Southern California Edison Company **INTERIM CALCULATION CHANGE NOTICE (ICCN)/ CALCULATION CHANGE NOTICE (CCN)**	CALC NO. M-73-116	~~ICCN NO./~~ PRELIM. CCN NO. N-1	PAGE 1	TOTAL NO. OF PAGES 328
	BASE CALC. REV. 1	UNIT 2/3	CCN CONVERSION: CCN NO. CCN- 1	CALC. REV. 1
	CALCULATION SUBJECT: ROOM TEMPERATURE RESPONSE DURING STATION BLACKOUT (SBO)			
CALCULATION CROSS-INDEX ☒ New/Updated Index Included ☐ Existing Index is Complete	ENGINEERING SYSTEM NUMBER/PRIMARY STATION SYSTEM DESIGNATOR 1510 & 1513 / GKA, GLB, GLF, GLH		Q-CLASS III	
1. BRIEF DESCRIPTION OF ICCN/CCN:	CONTROLLED PROGRAM OR DATABASE IN ACCORDANCE WITH NES&L 41-5-1 ☒ PROGRAM ☐ DATABASE	PROGRAM/DATABASE NAME(S) ☐ ALSO, LISTED BELOW PCFLUD	VERSION/RELEASE NO.(S) 3.7	

Reason for CCN:

The reasons for the CCN are:

1. To incorporate resolutions to Science Applications International Corporation (SAIC) Technical Evaluation Report (TER); Reference # 6.4.

2. The program which was used in revision 1 has limitation (one type of material heat sink), but the PCFLUD Program has the capability to handle different types of heat sink construction materials.

3. The temperature rise analyses were performed for the following:

   1. ESF Switchgear Room 302A
   2. Distribution Room 310B
   3. Computer Room 232
   4. Control Room Cabinet Area 229
   5. Control Room (228 and 240)

   However, the temperature rise analysis for the AFW Pump Room was accepted by the NRC. Therefore temperature rise for this room was not revised.

INITIATING DOCUMENT (DCP/MMP, FCN, OTHER) N/A Rev. ______

2. OTHER AFFECTED DOCUMENTS (CHECK AS APPLICABLE FOR CCN ONLY):

☐ YES ☒ NO OTHER AFFECTED DOCUMENTS EXIST AND ARE IDENTIFIED ON ATTACHED FORM 26-503.

3. APPROVAL: DISCIPLINE/ESC: N/M

PARVIZ TIGERI 51342
ORIGINATOR (Print name/initial) PAX

GS (Signature) 12/24/92

OTHER (Signature)

ILYA SHAFMAN / 51851
IRE (Print name/initial) PAX

Storm R. Yaddle 12/30/92
NES&L DM (Signature) Date

4. ASSIGNED SUPPLEMENT ALPHA DESIGNATOR: ______

CONVERSION TO CCN DATE 1/20/93

L Evans
SCE CDM-SONGS

SCE 26-122-1 REV. 9/91

CALCULATION CROSS-INDEX

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Calculation No. M 73-116 Sheet No. 2

Calc. rev. number and responsible supervisor initials and date	INPUTS These interfacing calculations and/or documents provide input to the subject calculation, and if revised may require revision of the subject calculation.		OUTPUTS Results and conclusion of the subject calculation are used in these interfacing calculations and/or documents.		Does the out-put interface calc/ document require revision?	Identify output interface calc/document CCN, DCN, TCN/Rev., FIDCN, or tracking number.
12/24/92	Calc/Document No.	Rev. No.	Calc/Document No.	Rev. No.	YES / NO	
	Calc # M-73-10	0	Document 90051	0	YES	LKC-91-427
	Calc # M-74-1	2	DBD-5027-140	0	YES	DBD-5027-140
	Calc. #E4C-105	0				
	DWG. 10101	27				
	DWG. 10102	12				
	DWG. 10119	26				
	DWG. 10114	9				
	DWG. 10121	39				
	DWG. 10132	13				
	DWG. 25131	5				
	DWG. 53000	13				

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Project or DCP/MMP SONGS 2/3 Calc No. M73-116

Subject Room Temperature Response During Station Blackout (SBO) Sheet No.

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
	PARVIZ TIGERI	10/15	[signature]	12/24/92					

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Project or DCP/MMP SONGS 2/3 Calc No. M73-116

Subject Room Temperature Response During Station Blackout (SBO) Sheet No.

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
	PARVIZ TIGERI	10/15	[illegible]	11/11/92					

Reason for CCN:

The reasons for the CCN are:

1. To incorporate resolution responses to Science Applications International Corporation (SAIC) Technical Evaluation Report (TER); Reference # 6.4.

2. Program which has been used in revision 1 has limitation (for one type of material heat sink), but the PCFLUD Program has the capability to handle different types of heat sink construction materials.

3. The temperature rise analysis performed for the following:

   1. ESF Switchgear Room 302A
   2. Distribution Room 310B
   3. Computer Room 232
   4. Control Room Cabinet Area 229
   5. Control Room (228 and 240)

   However, the temperature rise analysis for the AFW Pump Room was accepted by the NRC. Therefore temperature rise for this room was not revised.

1.0 Purpose

1.1 Purpose/Background

1.1.2 Purpose:

The purpose of this calculation is to determine the temperature rise in the following Dominate Areas of Concern (DACs) during Unit 2 Station Blackout (SBO):

A. Coping Duration of four hours were used for the following areas (Ref. # 6.19):

Switchgear Room (Room #302A), Unit 2
Computer Room (Room #232), Unit 2
Distribution Room (Room #310B), Unit 2
Control Room Cabinet Area (Room #229), Unit 2

B. Coping Duration of one hour was used for the following areas (see assumption 3.12):

Control Room Area (Rooms #228 and #240), Unit 2

1.1.3 Affected Documents:

The results of this calculation partially supersedes results of the Station Blackout calculation M-73-116, Revision 1. However, temperature rise analysis for the AFW-Pump Room was accepted by the NRC. Therefore, the data for the AFW Pump Room from Revision 1 will be used as valid information.

1.1.4 Background

Southern California Edison (SCE) provided the Station Blackout submittal to the U. S. Nuclear Regulatory Commission (NRC). The submittal was reviewed by the NRC Staff and Science Application International Corporation (SAIC) under contract with the NRC. As a result of the review, the NRC issued a Technical Evaluation Report (TER) SAIC-91/1252 to SCE in a letter dated February 6, 1992.

The TER identified several concerns with regards to the Methodology and Assumptions used in Station Blackout Calculation M73-116, Rev. 1. In summary, the TER recommended the licensee to reassess the temperature rise analyses for all control building rooms containing Station Blackout (SBO) equipment. The areas that require temperature rise reanalysis are the Switchgear Room, Distribution Room, Computer Room, Control Room, and Control Room Cabinet Area.

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Subject Room Temperature Response During Station Blackout (SBO) Sheet No.

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2.0 Results/Conclusions and Recommendation:

2.1 Results:

ROOM AMBIENT TEMPERATURES AFTER STATION BLACKOUT

ROOM NAME	Normal room temperature period to SBO (°F)	VOLUME (ft^3)	ROOM TEMP. AFTER 1 Hr. SBO (°F)	ROOM TEMP. AFTER 4 Hr. SBO (°F)
SWITCHGEAR ROOM 302A	95	24218.0	N/A	96.788
DISTRIBUTION ROOM 310B	95	4370.0	N/A	123.777
COMPUTER ROOM 232	72	17380.0	N/A	112.223
CONTROL ROOM CABINET AREA (ROOM 229)	75	57092.0	N/A	105.281
CONTROL ROOM (ROOMS #228 & #240)	75	24840.0	108.103	N/A

2.2 Conclusion:

Based upon result analyses, the four Distribution Rooms(310-A, B, C, and D) are the only rooms that are expected to have a temperature in excess of 120 °F(Room 310-B is one of the four similar rooms which have approximately the same heat load and configuration).

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Subject Room Temperature Response During Station Blackout (SBO) Sheet No. 7

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2	PARVIZ TIGERI	10/15	[illegible]	11/22/91					

2.3 **Recommendations:**

2.3.1 To reduce the temperature in the Distribution Rooms(310-A, 310-B, 310-C, and 310D) the actions should be taken as follows: (1) all Distribution room doors should be opened 30 minutes after SBO and temporary ventilation (min. 800 cfm capacity for each room) should be started to maintain Distribution Room temperature under 120 °F or (2) manually start ESF Switchgear Emergency A/C units one hour after SBO with chilled water as heat sink.

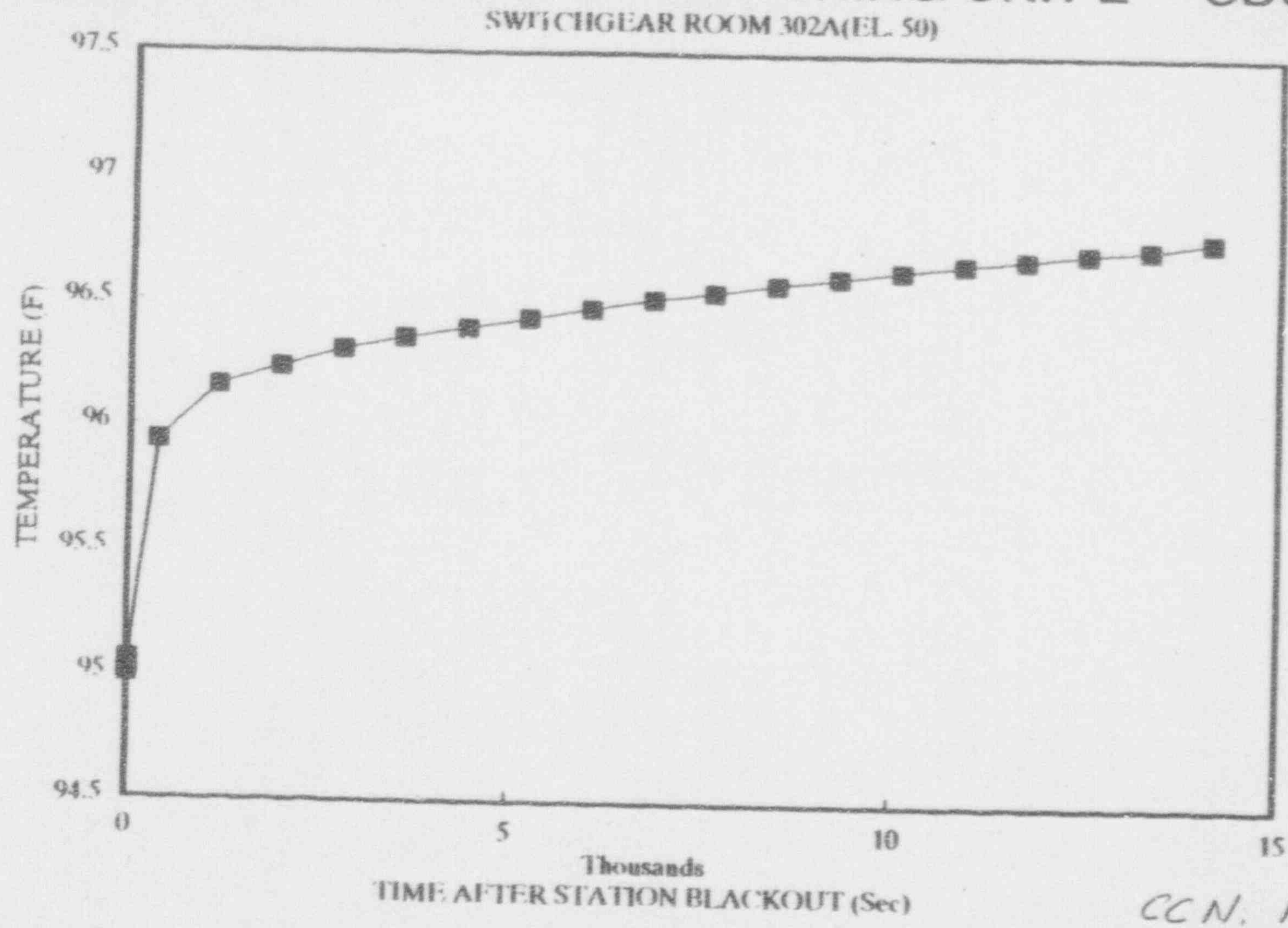
2.3.2 Open control room cabinet doors after 30 minutes of SBO (Ref. # 6.19)

2.3.3 The results of this analyses have no effect on Technical Specification of Surveillance Procedures.

2.3.4 Revise Administrative Procedures to maintain the normal temperature in each DAC at or below the values used in Section 4.1. (Ref. 6.22)

The resolution of these recommendations will be tracked by RCTS 9208020.001 PRY 12.30.92

TEMPERATURE RESPONSE DURING UNIT 2 – SBO



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CHECKED: [illegible]	DATE: 12/22/92
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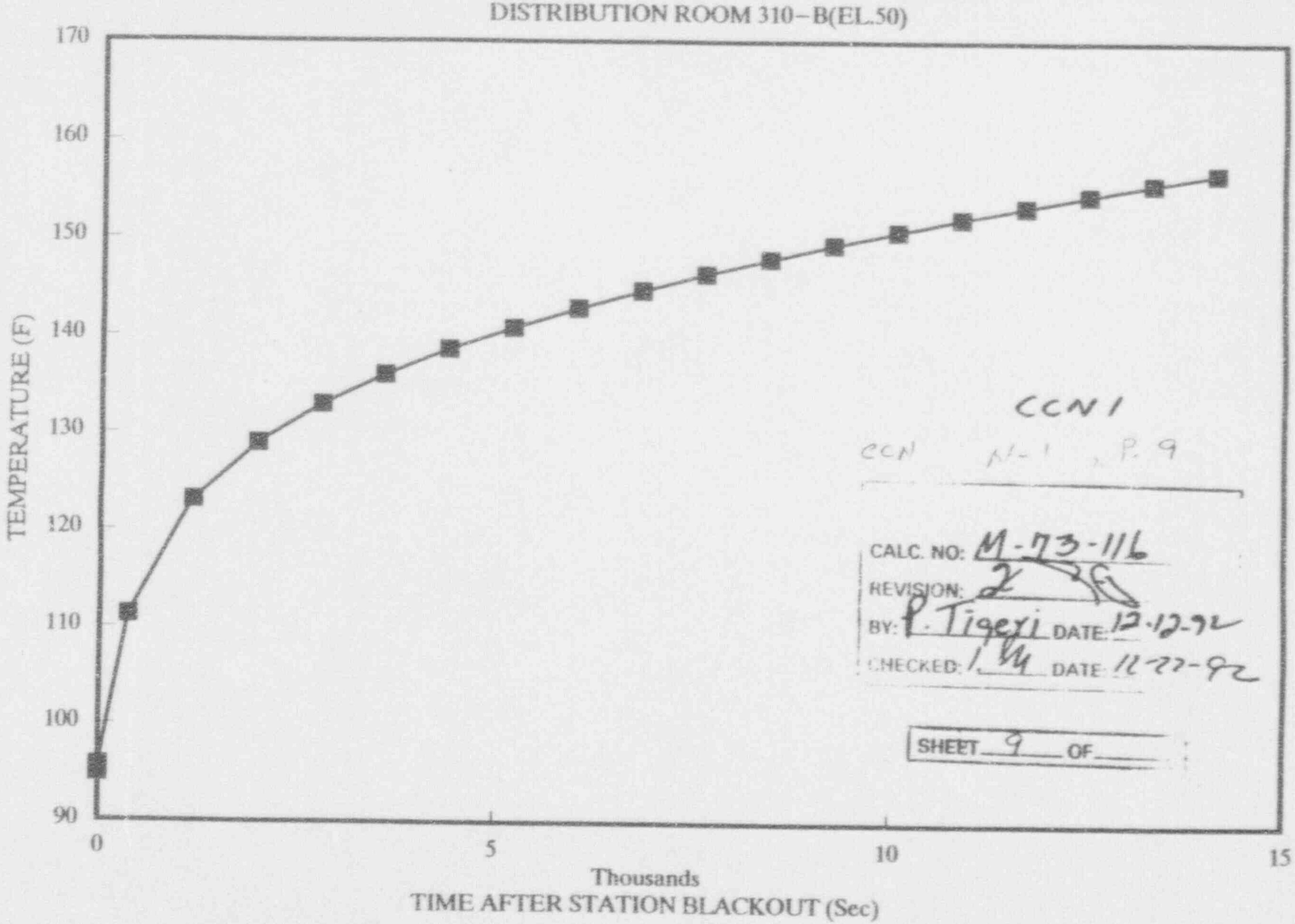
TEMPERATURE RESPONSE DURING UNIT 2 – SBO



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BY: P. Tigeri DATE: 12-12-92

CHECKED: I. M. DATE: 12-22-92

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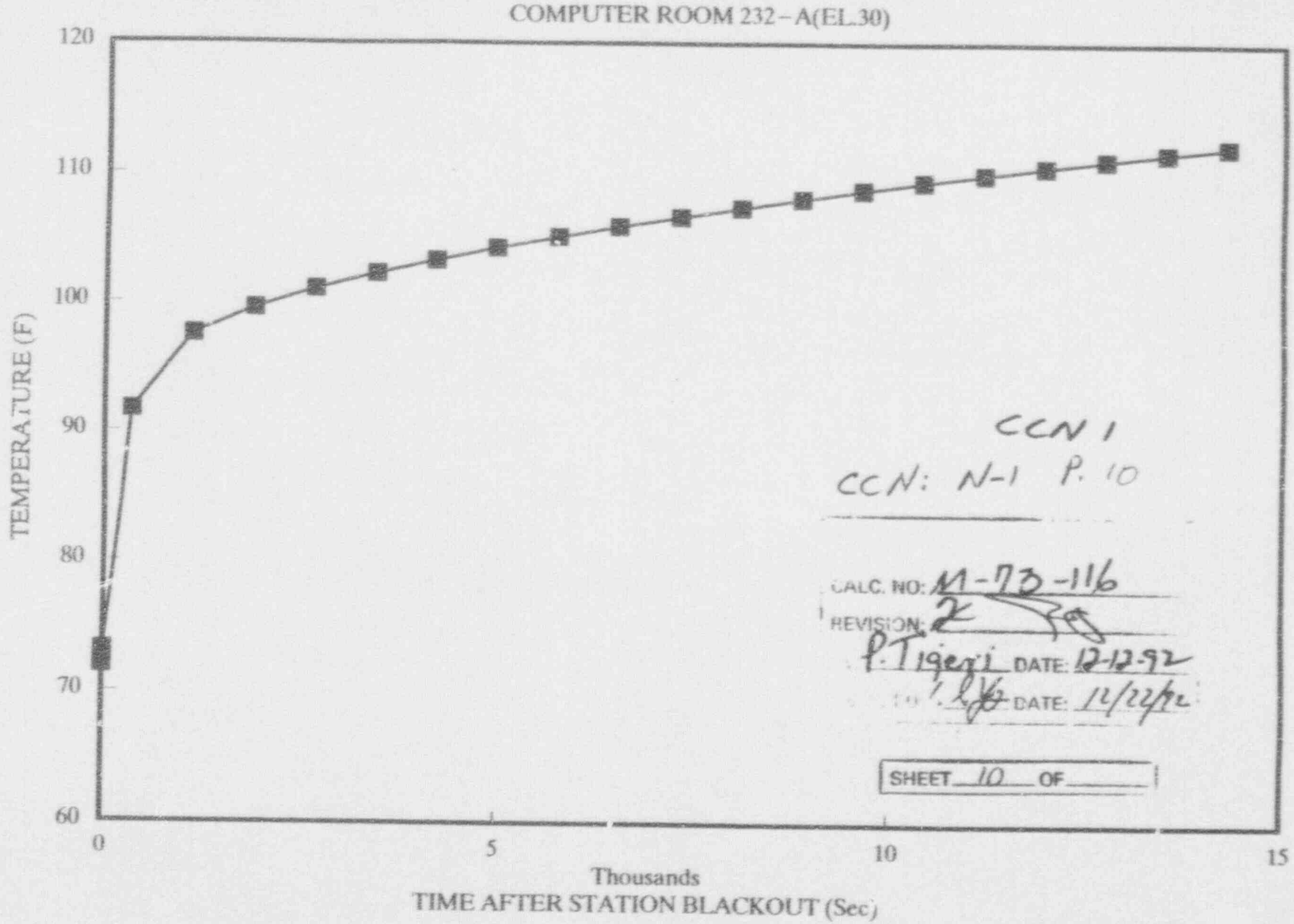
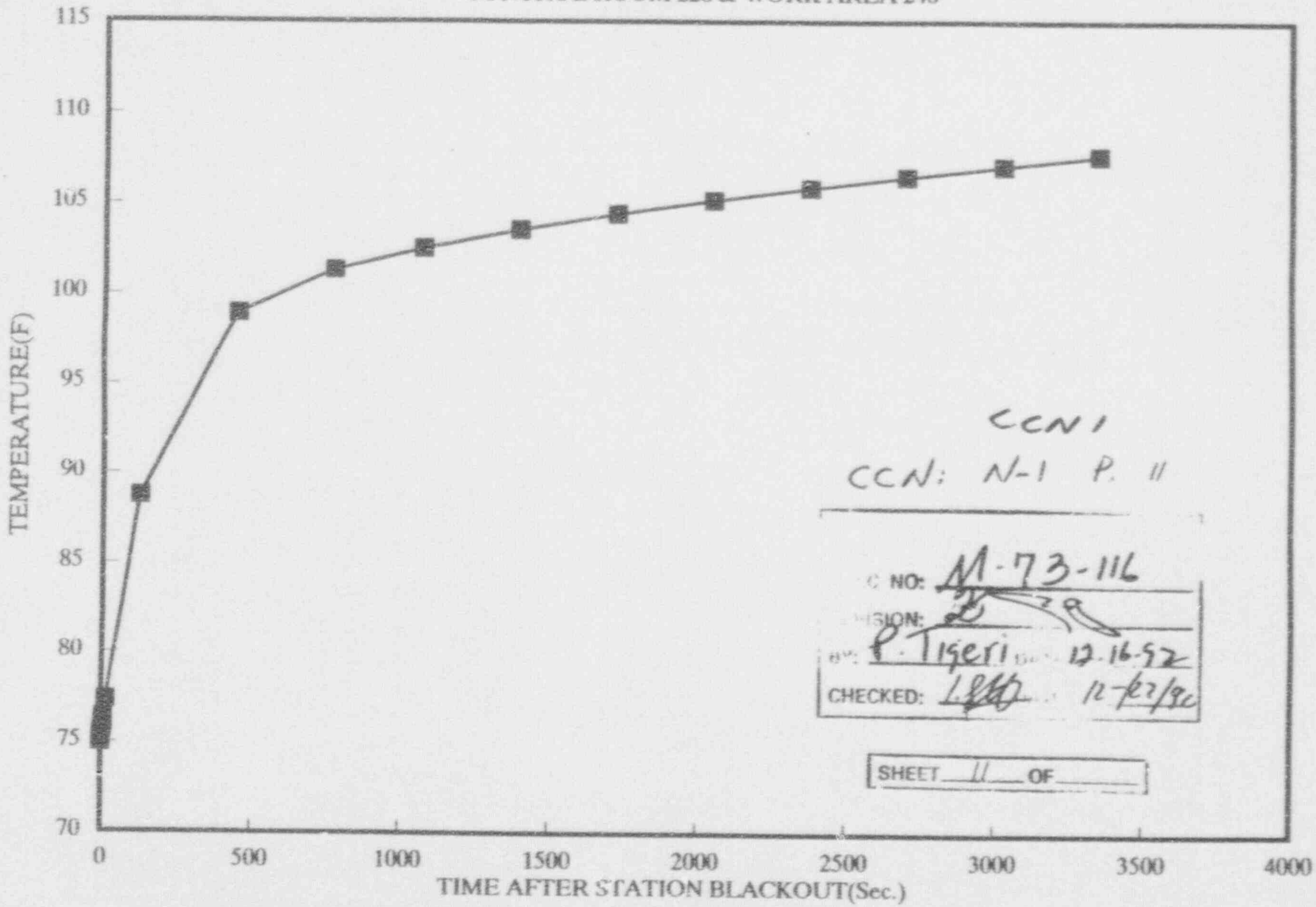
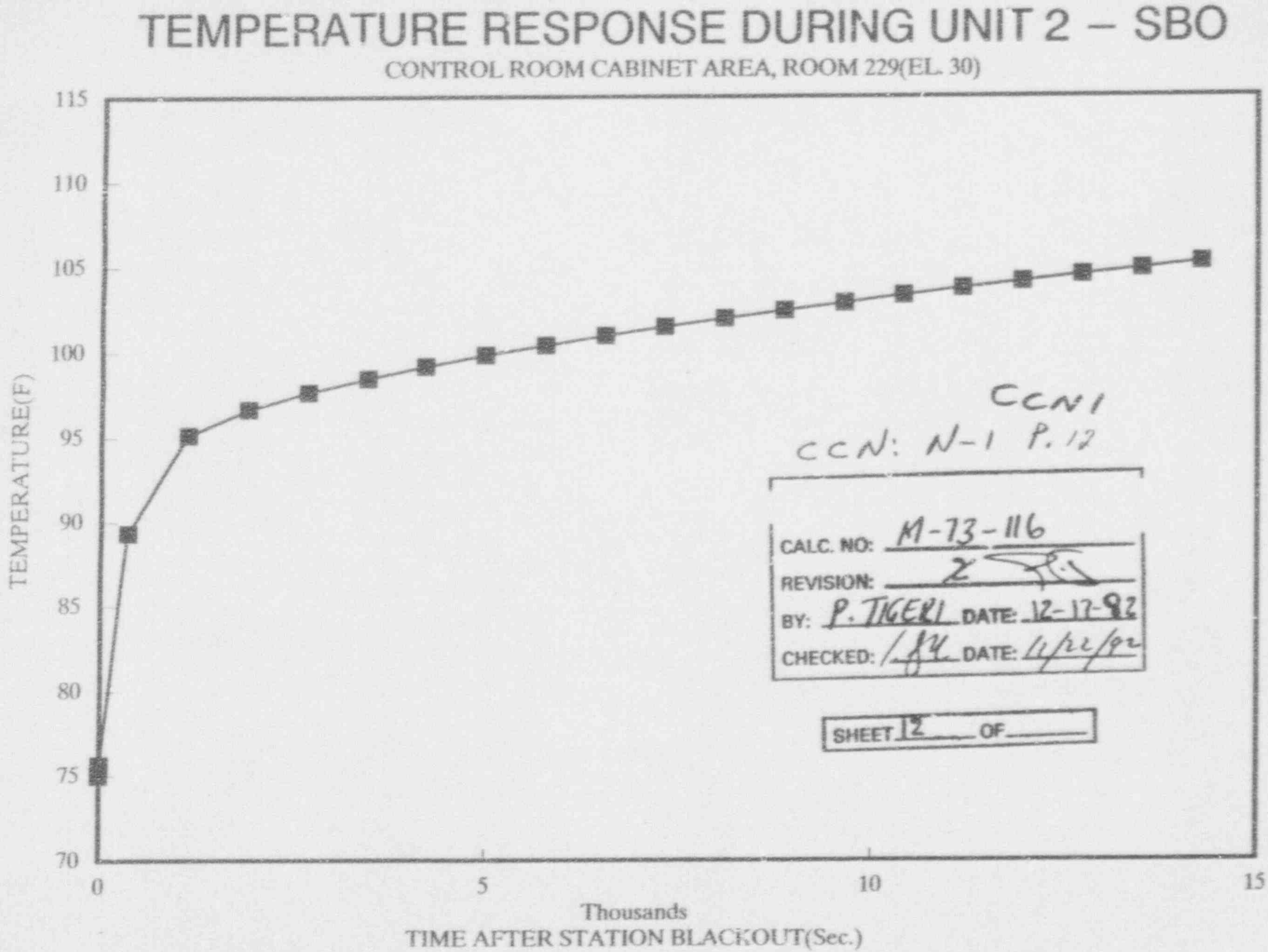
TEMPERATURE RESPONSE DURING UNIT 2 – SBO



TEMPERATURE RESPONSE DURING UNIT 2 – SBO

CONTROL ROOM 228 & WORK AREA 240





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BY: P. TIGERI DATE: 12-17-92

CHECKED: DATE: 12/22/92

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3.0 Assumptions:

3.1 All plant equipment are in their normal operating conditions prior to station blackout.

3.2 The initial temperature in each DAC and the initial temperature of the rooms (areas) surrounding the DAC is assumed to be equal to the maximum design/ambient temperature during normal plant operation.

Also, if the normal design temperature of the adjacent room is different from the normal design temperature of DAC at SBO initiation, the initial surface temperature of the common wall facing the DAC is the arithmetic average temperature of the two rooms.

The effect of increased temperatures in the rooms above and below the DACs was not considered because the Auxiliary Building floors are composed of approximately 12 inches of concrete on a metal deck. Since concrete is capable of storing large amounts of heat, the heat generated in the room below the DAC will be stored in the concrete rather than transferred to the DAC.

3.3 At SBO initiation, all AC powered heat sources on the blacked out unit, such as switchgear, electrical equipment and lighting in the rooms, are deenergized. The batteries in the ESF Battery Room provide emergency DC power to the equipment in the Distribution Room. However, the batteries produce negligible heat so it is conservatively assumed that the battery room temperature remains constant.

3.4 There are four Distribution and two Switchgear rooms. with same physical arrangements. One room from each group was analyzed as representative of the rest(Distribution Room #310B and Switchgear Room #302A were analyzed as the rooms with highest heat load).

3.5 The temperature in the adjacent Distribution Rooms #310A and 310C is expected to increase at the same rate as in Distribution Room #310B because the heat loads are approximately the same. Consequently, the partitions which separate the distribution rooms are not considered as heat sinks. Also this assumption applies to the partitions separating:(1) Control Room #228 and Cabinet Areas #227/228, and (2) Computer Room #232 and Control Room Cabinet Area #229. The analysis also assumes that the temperatures in the areas above the Distribution room (Corridor and Health Physics Area) remain constant through the SBO coping duration because their heat loads (i. e. emergency lights and a small number of computers) are negligible.

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3.0 Assumptions(continued):

3.6 The maximum design temperature of the rooms directly above the Control Room Area is 95°F. However, because the suspended ceiling above the Control Room Area is being used as a supply air plenum (design supply air temperature discharged to the plenum with low turbulence is 54°F (Ref 6.23)), it is assumed that the ceiling temperature is initially 75°F. It should be noted that 75°F is the maximum design temperature in the Control Room Area #228 during normal plant operation.

3.7 Heat is transferred in the room by convection and conduction only.

3.8 Heat transfer is in one direction only.

3.9 The doors are the same temperature as the walls. This is conservative because the door will likely have a lower temperature resistance than the wall.

3.10 Only the walls, ceiling, and room air are considered as a heat sink in heat transfer analyzes.

3.11 Heat loads from personnel and emergency lights are negligible for all rooms except the Control Room Area.

3.12 The emergency chillers are aligned to the Unit experiencing blackout and it will take one hour for operator action to switch the emergency chillers ESF buses from one Unit to the other by using available Kirk-Key locks and realigning CCW valves from the Train A chillers to the Train B chillers or visa versa. Therefore, the Control Room will only have a one hour Station Blackout coping duration. (Ref. 6.21)

3.13 Station Blackout will only occur at one Unit with the other Unit having at least one Diesel Generator available and running. Although, this calculation considers Unit 2 as the unit experiencing SBO and Unit 3 as the Mode 3 Unit, it bounds the opposite configuration. The basis for this assumption is that the areas/rooms addressed by this calculation for Unit 2 are the same for the Unit 3. The Unit 3 areas/rooms are adjacent to Unit 2 with similar equipment.((ESF & DC equipment) systems on the same elevation is a mirror image (ref 6.7).)

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3.0 Assumptions(continued):

3.14 Rear sides of the Control Room control panels face the Control Room Cabinet Area. Therefore, for Control Room Cabinet Area heat transfer analysis it was conservatively assumed that 50% of the heat loss from Control Room panels is dissipated to the Control Room Cabinet Area.

3.15 For Control Room Area (Room 228) heat transfer analysis it was conservatively assumed that 100% of the heat loss from control panels is dissipated to the Control Room Area.

3.16 The air gap between composite plaster wall is assumed to be 3.5 inches(the smallest air gap is four inches). This assumption is conservative because it will resulted in the smaller thermal conductivity of air and the higher room temperature.

3.17 All DAC room volumes are equal to that calculated in the Revision 0 of the subject calculation, because the rooms physical layout has not changed since the Rev. 0 issue.

3.18 The thermal conductivity of the air is equal to: h_{air}=1.47 Btu/hr-ft^2-°F (Ref.6.10). This value is conservatively used for all rooms and all heat sinks including ceiling. The technical justification for this assumption is provided in Appendices.

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4.0 **Design Input**

4.1 Normal Operating Design Temperatures Are: (Ref. # 6.21)

4.1.1	Distribution Rooms, El. 50 ft.	95°F	(Ref. # 6.3)
4.1.2	ESF Switchgear Rooms, El. 50 ft.	95°F	(Ref. # 6.3)
4.1.3	Computer Rooms , El. 30 ft.	72°F	(Ref. # 6.23)
4.1.4	Control Room Cabinet Area	75°F	(Ref. # 6.3)
4.1.5	Control Room Area(Rooms 228 & 240)	75°F	(Ref. # 6.3

4.2 Station blackout coping time for all Rooms above except Control Room Area is four hours (Ref. # 6.19).

4.3 Station blackout coping time for Control Room Area is one hour (see assumption 3.12).

4.4 Rooms Heat Load are:

4.4.1	Distribution Room 310B, El. 50 ft.	5.76 kW	(Ref. # 6.7)
4.4.2	Switchgear Room 302A, El. 50 ft.	1.92 kW	(Ref. # 6.7)
4.4.3	Computer Room 232, El. 30 ft.	27.94 kW	(Ref. # 6.7)
4.4.4	Control Room Cabinet Area 229, El. 30 ft.	51.67 kW	(Ref. # 6.7)
4.4.5	Control Room 228 El. 30 ft.	38.89 kW	(Ref. # 6.7)
4.4.6	Work Area Room 240 El. 30 ft.	13.25 kW	(Ref. # 6.7)
4.5.1	Heat per person in Control Area	400.0 BTU/hr	(Ref. # 6.11)
4.5.2	Total occupancy in Control Room Area	11	

The number of operators (nine plus 25%) is based on the Minimum Shift Crew Composition (Technical Specification, Table 6.2-1) with Unit 2 and Unit 3 both normally operating. This is the plant operating condition postulated at the SBO initiation. Per the referenced table, Control Room occupancy consists of one Shift Supervisor, one Senior Reactor Operator, three Reactor Operators, three Auxiliary Operators and one Shift Technical Advisor. Two people were added to account for personnel such as Nuclear Plant Operators and TSC personnel who may intermittently gain access to the Control Room. Because Units 2 & 3 are sharing a common Control Room, SCE's license was approved with one less Shift Supervisor, Senior Reactor Operator and Reactor Operator/Auxiliary Operator than two individual reactor units operating with a dedicated Control Room each.

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4.0) Design Input (continued)

4.6) Properties of Constriction Material Components:

Plaster Properties

ρ = 51.0	lbm/ft^3	(Ref. # 6.17)
Cp = 0.74	BTU/(lbm-°F)	(Ref. # 6.17)
K = 0.25	BTU/(hr-ft-°F)	(Ref. # 6.17)

Concrete Properties

ρ_e= 143.6	lbm/ft^3	(Ref. # 6.6)
Cpe= 0.21	BTU/(lbm-°F)	(Ref. # 6.6)
Ke= 1.04	BTU/(hr-ft-°F)	(Ref. # 6.2)

Insulation Properties

ρ_e= 36.0	lbm/ft^3	(Ref. # 6.11)
CP_e= 0.20	BTU/(lbm-°F)	(Ref. # 6.11)
K_e= 0.092	BTU/(hr-ft-°F)	(Ref. # 6.11)

Air Properties

ρ = 0.07	lbm/ft^3	(Ref. # 6.2)
C_p = 0.24	BTU/(lbm-°F)	(Ref. # 6.2)
K = 1.24	BTU/hr-ft-°F(for 3.5 inches and at 90°F)	(see section 8.8)
R = 0.85	ft^2-F-hr/BTU(for 3.5 inches and at 90°F)	(Ref. # 6.2)
h = 1.47	BTU/hr-ft^2-°F	(see section 9)
R = 0.81	ft^2-°F-hr/BTU (for 3.5 inches and at 95°F)	(see section 8.8)

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Subject Room Temperature Response During Station Blackout (SBO) Sheet No. 17

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1	PARVIZ TIGERI	10/15		11/10/92					

5.0 Methodology

Since normal ventilation is not available during station blackout (SBO), equipment needed to achieve and maintain safe shutdown in a blackout may be subject to elevated temperatures. Loss of ventilation concerns are thus limited to rooms housing these equipment. These rooms are labeled Dominant Areas of Concern (DAC) and are limited to areas that will have significant heat loads in SBO, and also contain safe shutdown equipment.

The temperature rise analyses were performed for the following DAC:

1. Switchgear Room 302A
2. Distribution Room 310B
3. Computer Room 232
4. Control Room Cabinet Area 229
5. Control Room (228 and 240)

The Control Room Cabinet Areas for the Units 2 and 3 are separated by a common open passway and heat generated in the Unit 3 Cabinet Area may affect the temperature rise in the Unit 2 Cabinet Area. Also heat generated in the Cable Riser Gallery Unit 3 (#224) during SBO may affect the adjacent Unit 3 Control Room Cabinet Area. Therefore, the temperature rise analyses were performed for these areas to evaluate overall impact of the heat generated in these rooms on the temperature rise in the Unit 2 Control Room and Control Room Cabinet Area.

The PCFLUD Program developed by BECHTEL CORP was used for the heat transfer analysis to calculate the ambient room temperature following loss of ventilation.

Prior to utilizing PCFLUD, a unique input data file was prepared which describes the actual DAC area physical geometry and thermodynamic conditions. The electrical heat load for each DAC area was calculated in Ref. # 6.7 and used as input. Also Thermal Conductivity(K) for air at 95 °F(see section # 8.8)

As a result of drawing reviews (Ref. # 6.8) and walkdowns, the walls, ceiling, floor, cabinets, cable trays, ductwork, and hangers were identified as the heat sinks. However NUMARC 87-00 (Ref. # 6.18) recommends that only the walls and ceiling be considered in the heat transfer analyses. Therefore the NUMARC recommendation was utilized.

Heat transfer by convection, conduction, and heat storage in the walls and ceiling were considered in this analysis.

Due to the fact that the subject program analyzed each heat sink as a uniform material, the physical properties for the plaster wall (which consists of two plaster boards and an air gap were input into the program as the combined effective physical property for this wall.

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The plaster wall effective values for the thermal conductivity, density and specific heat capacity (Ke, Pe, Cpe) were calculated as follows:

$$\rho e = \frac{M_1 + M_2 + M_3 + \ldots.}{V_1 + V_2 + V_3 + \ldots.} = \frac{Total\ Mass}{Total\ Volume}$$

Where

$$M_1 = V_1 X \rho_1$$

$$M_2 = V_2 X \rho_2$$

$$M_3 = V_3 X \rho_3$$

$$V_1 = A_1 X t_1$$

$$V_2 = A_2 X t_2$$

$$V_3 = A_3 X t_3$$

$$A = A_1 = A_2 = A_3 = Constant$$

$$\rho e = \frac{V_1 \rho 1 + V_2 P_2 + V_3 \rho_3 \ldots.}{V_1 + V_2 + V_3 + \ldots.}$$

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$$\rho e = \frac{A_1 X t_1 X \rho_1 + A_2 X t_2 X \rho_2 + A_3 X t_3 X \rho_3 + \ldots.}{A_1 x t_1 + A_2 X t_2 + A_3 X t_3 + \ldots.}$$

$$\rho e = \frac{A X (t_1 X \rho_1 + t_2 X \rho_2 + t_3 X \rho_3 + \ldots}{A X (t_1 + t_2 + t_3 + \ldots.}$$

$$\rho e = \frac{(t_1 X \rho_1 + t_2 X \rho_2 + t_3 X \rho_3)}{t_1 + t_2 + t_3 + \ldots.}$$

$$tT = t_1 + t_2 + t_3 + \ldots.$$

$$\rho e = \frac{t_1 X \rho_1 + t_2 X \rho_2 + t_3 X \rho_3 + \ldots.}{tT}$$

$$Cpe = \frac{\rho_1 X V_1 X Cp_1 + \rho_2 V_2 X Cp2 + \rho_3 X V_3 X Cp_3 + \ldots}{\rho_1 X V_1 + \rho_2 X V_2 + \rho_3 V_3 + \ldots.}$$

$$Cpe = \frac{\rho_1 X A_1 X t_1 X Cp_1 + \rho_2 X A_2 X t_2 X Cp_2 + \rho_3 X A_3 X t_3 X Cp_3 + \ldots.}{\rho_1 A_1 X t_1 + \rho_2 X A_2 X t_2 + \rho_3 X A_3 X t_3 + \ldots.}$$

$$Cpe = \frac{A X (\rho_1 X t_1 X Cp_1 + \rho_2 X t_2 X Cp_2 + \rho_3 X t_3 X Cp_3 + \ldots.}{A X (\rho_1 X t_1 + \rho_2 X t_2 + \rho_3 X t_3 + \ldots.}$$

$$Cpe = \frac{\rho_1 X t_1 X Cp_1 + \rho_2 X t_2 X Cp_2 + \rho_3 X t_3 X Cp_3 + \ldots.}{\rho_1 X t_1 + \rho_2 X t_2 + \rho_3 X t_3 + \ldots.}$$

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1	PARVIZ TIGERI	10/15	[illegible]	11/20					

$$\frac{Q}{A} = \frac{k}{\Delta X} X\ (Ti - To)$$

$$\frac{Q}{A} = \frac{K_1}{\Delta X_1} X\ (Ti - T_1) = \frac{K_2}{\Delta X_2} X\ (T_1 - T_2) = \frac{K_1}{\Delta X_1} X\ (T_2 - To)$$

$$\frac{Q}{A} = Ui\ X\ ATi = Uo\ X\ ATo$$

$$Uo = \frac{1}{\frac{1}{U_1} + \frac{1}{U_2} + \frac{1}{U_3} + \ldots}$$

$$Uo = \frac{1}{\frac{\Delta X_1}{K_1} + \frac{\Delta X_2}{K_2} + \frac{\Delta X_3}{K_3} + \ldots} = \frac{Ke}{\Delta X_T}$$

$$Ke = \frac{\Delta X_T}{\frac{\Delta X_1}{K_1} + \frac{\Delta X_2}{K_2} + \frac{\Delta X_3}{K} + \ldots}$$

The LOTUS 123 print-graph program was used to develop graphs of temperature response during SBO for each DAC.

The Mathcad Program was used for the Section 8 calculations.

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
	PARVIZ TIGERI	10/15	[illegible]	12/14/92					

6.0 References

6.1 (Delete)

6.2 Cooling and Heating Load Calculation Manual. ASHRAE GRP158

6.3 Calculation #M-73-10 Rev. 0, HVAC Aux. Bldg. General Data.

6.4 Reference letter from R. M. Rosenblum to NRC dated June 11, 1992; Subject: Docket Nos. 50-361 and 50-362, Response to Unit 2/3 SBO Safety Evaluation Report.

6.5 (Delete)

6.6 Calculation #M-74-1 Rev. 2, Radwaste Area Normal Cooling system - Heat Load Calculation.

6.7 Calculation #E4C-105 Revision 0.

6.8 Drawings for SONGS Units 2 & 3.

6.8.1 10101-27, Aux. Bldg Control Area Flr. Plan Elevation 30.
6.8.2 10102-12, Aux. Bldg. Control Area Flr. Plan Elevation 50.
6.8.3 10119-26, Aux. Bldg. Finish Schedule.
6.8.4 10114-9, Aux. Bldg. Control and Radwaste area.
6.8.5 10121-39, Aux. Bldg. Door Schedule.
6.8.6 10132-13, Aux. Bldg. Miscellaneous Details.
6.8.7 25131-5, Aux. Bldg. Control Area, Conc. Section & Details.
6.8.8 53000-13, Aux. Bldg. Main Control Room Panel Arrangement.

6.9 Fundamentals of Heat and Mass Transfer. Frank P. Incropera and David De Witt - 2_{nd} Edition.

6.10 ASHRAE Handbook - Fundamentals 1985.

6.11 ASHRAE Handbook - Equipment 1988.

6.12 National Gypsum Construction Guide 92 Edition.

6.13 Heat Transfer 5th Edition by J. P. Holman.

6.14 Principles of Heat Transfer 5th Edition 1986, by Frank Kreith & Mark S. Bohn.

6.15 ACI Manual of Concrete Practice Part 3, 1989.

6.16 Mechanical Engineering for Professional Engineering Examinations, 4th Edition by John D. Constance.

NES&L DEPARTMENT

CALCULATION SHEET

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Project or DCP/MMP SONGS 2/3 Calc No. M73-116

Subject Room Temperature Response During Station Blackout (SBO) Sheet No. 23

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
1	PARVIZ TIGERI	10/15	[signature]	11/2/92					

6.0 References(continued)

6.17 Heat Transfer by Shao Ti Hsu, 1st Edition 1963.

6.18 NUMARC 87-0. Guidelines and Technical bases for NUMARC initiatives addressing S. tion Blackout.

6.19 Document 90051 Rev. 0, Station Blackout Analysis, Units 2 & 3.

6.20 Document DBD-5027-140, revision 0.

6.21 Ref. Letter from T. Yackle to V. B. Fisher dated 08/28/92; subject impact on operating procedures by SONGS 2 and 3 SBO SER.

6.22 Ref. Letter from George Kalman (NRI) to Harold B. Ray (SCE) dated 06/06/92; subject SONGS, Unit 2 and 3 Station Blackout Analysis.

6.23 Calculation M 73-41 Rev.7 Aux. Bldg.-Heat Load calculation.

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
1	PARVIZ TIGERI	10/15	[illegible]	[illegible]					

7.0 Nomenclature

DAC	-dominant area of concern	
Dwg	-drawing	
h	-surface conductance	BTU/hr-ft^2-°F
hr	-Room height	ft
K	-thermal conductivity	BTU/hr-ft-°F
k_e	-Effective thermal conductivity	BTU/hr-ft-°F
L_c	-length along a heat flow Path (Concrete)	ft
L_e	-Length along East Wall	ft
L_n	-Length along North Wall	ft
L_p	-length along a heat flow path (Plaster wall)	ft
L_s	-Length along South Wall	ft
L_w	-Length along West Wall	ft
L_i	-Length along Wall(where i = 1 to 17)	ft
A	-area through which heat flows	ft^2
A_c	-Area of concrete	ft^2
A_{ce}	-Area of ceiling	ft^2
A_e	-Area of East wall	ft^2
A_p	-Area of plaster	ft^2
A_s	-Area of South wall	ft^2
A_T	-Total Area	ft^2
A_{net}	-Area	ft^2
A_w	-Area of West wall	ft^2
A_i	-Area of wall or ceiling(where i = 1 to 17)	ft^2
Cp_{air}	-specific heat of air at constant pressure	BTU/lbm-°F
Cp_p	-specific heat of Plaster at constant pressure	BTU/lbm-°F
C_{pe}	-Effective specific heat at constant pressure	BTU/lbm-°F

△

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
1	PARVIZ TIGERI	10/15		11/22/92					

7.0 Nomenclature (Continued)

Q	-Rate of heat generated/transferred	BTU/S or W
Q_T	-Total rate heat generated/transformed	BTU/S or Kw
Q_1	-Rate of heat generated/transferred	BTU/S or Kw
Q_2	-Rate of heat generated/transferred	BTU/S or Kw
Q_2cr	-Rate of heat generated/transferred	BTU/S or Kw
Q_3	-Rate of heat generated/transferred	BTU/S or Kw
Q_3cr	-Rate of heat generated/transferred	BTU/S or W
$Q_{23}cr$	-Rate of heat generated/transferred	BTU/S or W
cr	-Control panel	
R	-Thermal resistance	$°F\text{-hr-ft}^2/BTU$
S	-Second	time
t	-Thickness	ft
t_{air}	-Thickness of air	ft
t_{in}	-Thickness of insulation	ft
t_p	-Thickness of plaster	ft
t_T	-Total thickness	ft
U	-Heat transfer coefficient	$BTU/hr\text{-}ft^2\text{-}°F$
UFHA	-Updated Fire Hazards Analysis	
UFSAR	-Updated Final Safety Analysis Report	
V	-Volume	ft^3
w	-Wall	
ρ	-Density	lbm/ft^3
ρ_e	-Effective density	lbm/ft^3
T_1	-Room temperature	°F
T_o	-Surrounding surface temperature	°F
$\delta T = \Delta T$	-Temperature difference	°F
ΔX_T	-Total length increment	ft
ΔX	-Length increment	ft
U2	-Area of Unit 2 Control Room	ft^2

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Project or DCP/MMP SONGS 2/3 Calc No. M73-116

Subject Room Temperature Response During Station Blackout (SBO) Sheet No. 26

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
2	PARVIZ TIGERI	10/15	[illegible]	12/2/92					

8. CALCULATIONS:

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CALCULATION SHEET

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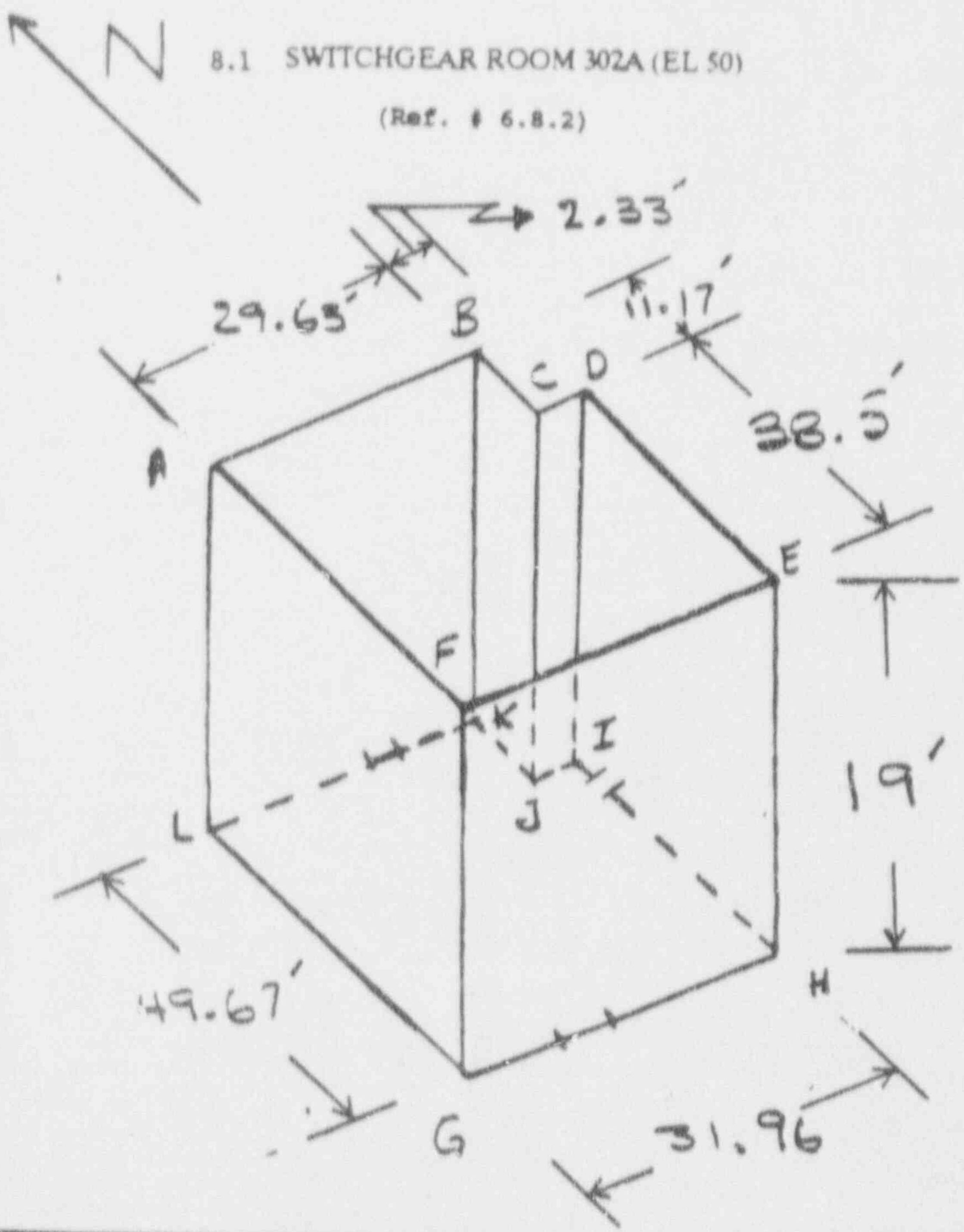
Subject Room Temperature Response During SBO Sheet No 27

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
7	. TIGERI	10-15-93		12/22/92					

8.1 SWITCHGEAR ROOM 302A (EL 50)

(Ref. # 6.8.2)



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Subject Room Temperature Response During Station Blackout (SBO) Sheet No. 28

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
1	PARVIZ TIGERI	10/15		12/17/92					

Input data summary used for the Switchgear Room 30?-A Temperature Rise Analysis.

Q = 1.82 BTU/S (Ref. #6.7)
V = 24,218 ft^3 (see assumption 3.17)

Heat Sink	K_e (BTU/hr-ft-°F)	ρ_e lbm/ft^3	Cp_e BTU/lb-°F	A (ft^2)	t (ft)	Ti (°F)
Plaster wall	0.508	18.572	0.739	2158.0	0.459	95
West wall Concrete	1.04	143.6	0.21	943.73	2.0	95
Ceiling Concrete	1.04	143.6	0.21	1561.0	1.0	95

See data below for reference to above table.

CALCULATION SHEET

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Project or DCP/MMP SONGS 2/3 Calc No. M73-116

CCN CONVERSION CCN NO. CCN - i

Subject Room Temperature Response During Station Blackout (SBO) Sheet No. 29

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
1	PARVIZ TIGERI	10/15	[illegible]	11/13/94					

CALCULATION FOR SWITCHGEAR ROOM 302-A; UNIT 2:

$GL := 49.67$	ft	(Ref. # 6.8.2)
$GH := 31.96$	ft	(Ref. # 6.8.2)
$DE := 38.5$	ft	(Ref. # 6.8.2)
$BC := 11.17$	ft	(Ref. # 6.8.2)
$AB := 29.63$	ft	(Ref. # 6.8.2)
$CD := 2.33$	ft	(Ref. # 6.8.2)
$hr := 19.0$	ft	(Ref. # 6.8.4)
$Q := 1920$	W	(Ref. # 6.7)

$$Q := Q \cdot \frac{3.4121}{3600}$$

$Q = 1.82$ BTU/S

CALCULATION OF WALLS AND CEILING AREA:

$An := GH \cdot hr$	$An = 607.24$	ft^2
$As := GH \cdot hr$	$As = 607.24$	ft^2
$Ae := GL \cdot hr$	$Ae = 943.73$	ft^2
$Aw := GL \cdot hr$	$Aw = 943.73$	ft^2

$Ace := AB \cdot BC + GH \cdot DE$

$Ace = 1.561 \cdot 10^{3}$ ft^2

NORTH, EAST AND SOUTH WALL ARE PLASTER WALLS WITH THE SAME THICKNESS AND AIR GAP.

$Ap := 607.24 + 607.24 + 943.73$

$Ap = 2.158 \cdot 10^{3}$ ft^2

WEST WALL AND CEILING ARE CONCRETE

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
1	PARVIZ TIGERI	10/15		11/24/92					

CALCULATION OF PROPERTIES FOR COMPOSITE WALL(PLASTER WALL)

$tp := 0.0833$ ft (Ref. # 6.8.2)

$tair := 0.292$ ft (Ref. # 6.2)

$tT := 2 \cdot tp + tair$

$tT = 0.459$ ft

$k_p := 0.25$ BTU/(hr-ft-F) (Ref. # 6.17)

$\rho_p := 51.0$ lbm/ft^3 (Ref. # 6.17)

$Cp_p := 0.74$ BTU/(lbm-F) (Ref. # 6.17)

$k_{air} := 1.24$ BTU/(hr-ft-F) (see section 8.8)

$\rho_{air} := 0.07$ lbm/ft^3 (Ref. # 6.2)

$Cp_{air} := 0.24$ BTU/(lbm-F) (Ref. # 6.2)

$$Ke := \left[\frac{tT}{2 \cdot \frac{tp}{k_p} + \frac{tair}{k_{air}}}\right]$$ $Ke = 0.508$ BTU/(hr-F)

$$\rho e := \frac{\left[2 \cdot tp \cdot \rho_p\right] + \left[tair \cdot \rho_{air}\right]}{tT}$$ $\rho e = 18.572$ lbm/ft^3

$$Cpe := \frac{\left[2 \cdot tp \cdot \rho_p \cdot Cp_p\right] + \left[tair \cdot \rho_{air} \cdot Cp_{air}\right]}{\left[2 \cdot tp \cdot \rho_p\right] + \left[tair \cdot \rho_{air}\right]}$$

$Cpe = 0.739$ BTU/(lbm-F)

SONGS 2 SWITCHGEAR ROOM 302A - SBO

```
 0.000
ROOM 302A
      14.7      24218.0         95    0.50    1.00
   0.0000    0.0000     0.0000 1 0
 0.0000              1.82
 21800               1.82
@EOF
   0.0000  0.0000
@EOF
 0  0    000.00    000.00    000.00    000.00      000.00 1
@EOF
 0    000.00    000.00    000.00    000.00 1
@EOF
@EOF
 0.0000       0.0000       0.0000
 1.e20        0.0000       0.0000
@EOF
 1               1.00
@EOF
 0.0000       14.70        95           0.50
 1.e20        14.70        95           0.50
@EOF
                              PLASTER WALL
3     2158.00        0.459          0.01  1.00
 1       0.00 1 6
 0.000              1.47
 1.E6               1.47
@EOF
  0        0.00
 0.000              1.47
 1.E6               1.47
@EOF
      0.508    18.572       0.739
WEST WALL(CONCRETE)
3      943.73          2.0          0.01  1.00
 1       0.00 1 1
 0.000              1.47
 1.E6               1.47
@EOF
       1.04      143.6        0.21
CEILING(CONCRETE)
3     1561.00          1.00         0.01  1.00
 1       0.00 1 1
 0.000              1.47
 1.E6               1.47
@EOF
       1.04      143.6        0.21
@EOF
 0 1 0 0 0 1 0 0 0 0
@EOF
       14400 1     0 0    1 0   25    1.E20    0.001  500
 0.01               1.0
 0.10               10.0
 1.0                20.0
```

CCN 1

CCN: N-1 P. 31

CALC. NO: M-73-116

REVISION: 2 2A

BY: P. Tigeri DATE: 12-16-92

CHECKED: [illegible] DATE: 12-22-92

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CCN 1
CCN: N-1, P.32

CALC. NO:	M-73-116
REVISION:	2
BY: P. Tigeri	DATE: 12-16-92
CHECKED:	DATE: 12-22-92

SHEET 32 OF

2

SONGS 2 SWITCHGEAR ROOM 302A - SBO

* * * PCFLUD 3.7 * * *

> Thermofluid Dynamics for a System of Interconnected Compartments <

MAP-120

[] [] []

Release Record

Date	Version	Description of Changes
3/25/85	1.00	Original PC version
8/25/86	2.00	Air-only version (SF)
1/06/87	3.00	Added SIGFLO routine
6/02/88	3.10	Modified for new compiler
2/06/90	3.61	61 Compartment version
5/21/91	3.7	Automatic zero reverse flow

CCN 1
CCN: N-1, P. 33

INPUT file name: b:r302a.inp

OUTPUT file name: b:r302a.OUT

PLOT file name: b:r302a.PLT

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SONGS 2 WITCHGEAR ROOM 302A - SBO

COMPARTMENT INITIAL CONDITIONS
==============================

Compartment	Description	Volume (ft**3)	Temperature (Degrees F)	Pressure (psia)	Rel. Humidity (Fraction)	Flow to Compartments (0 = Atmosphere)
0	Atmosphere		95.00	14.7000	.50	
1	ROOM 302A	2.4218E+04	95.00	14.7000	.50	

CCN 1
CCN: N-1 , P. 34

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SONGS 2 WITCHGEAR ROOM 302A - SBO

COMPARTMENT AUXILIARY CONDITIONS

Compartment	Compartment Desc.	Air Cooler Constant (BTU/sec-deg)	Air Cooler Temperatures Water (F)	Start (F)	Equipment Heat Load Options	Leakage Constants Rate(CFM)	@ Press.(in. H2O)
1	ROOM 302A	.000	.0	.0	1, 0	.00000	.0000

COMPARTMENT HEAT LOAD

Compartment 1

Time (seconds)	Heat Load (BTU/sec)
.00	1.82
28800.00	1.82

ecN 1
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SONGS 2 WITCHGEAR ROOM 302A - SBO

BLOWDOWN DATA

Time (sec)	Flowrate (lbm/sec)	Enthalpy (BTU/lbm)
.00000	.00000	.00000
1.00000E+20	.00000	.00000

SPLIT OF BLOWDOWN DATA

Compartment	Fraction of Blowdown
1	1.00000

ATMOSPHERIC DATA

Time (sec)	Temp(deg.F)	Pressure(psia)	Relative Humidity
.00000	95.000	14.700	.50000
1.00000E+20	95.000	14.700	.50000

CCN1
CCN: N-1, P. 36

CALC. NO. M-73-116
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SONGS 2 WITCHGEAR ROOM 302A - SLD

Heat Sink Number 1: PLASTER WALL

CONVECTIVE HEAT TRANSFER PARAMETERS

Slab Material	User-Defined
Slab Thickness	.459 ft
Surface Area	2158.00 ft**2
Thermal Conductivity	.508 BTU/hr-ft-deg. F
Density	18.572 lbm/ft**3
Thermal Diffusivity	.037 ft**2/hr
Heat Capacity	.739 BTU/lbm-deg. F
First Node Thickness	.01000 ft
Node Thickness Ratio	1.00
Number of Nodes	47
External Boundary Condition	Convective
External Heat Transfer Coefficient	Uchida
Outside Environment Index	0
Inside Environment Index	1
Interior Heat Transfer Coefficient	Uchida

TABLE OF EXTERNAL HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

TABLE OF INTERIOR HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

TABLE OF HEAT SINK MESH POINT COORDINATES (feet)

.000000	.010000	.020000	.030000	.040000	.050000	.060000	.070000	.080000	.090000

CCN 1
CCN: N-1, P. 37

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.100000	.110000	.120000	.130000	.140000	.150000	.160000	.170000	.180000	.190000
.200000	.210000	.220000	.230000	.240000	.250000	.260000	.270000	.280000	.290000
.300000	.310000	.320000	.330000	.340000	.350000	.360000	.370000	.380000	.390000
.400000	.410000	.420000	.430000	.440000	.450000	.459000			

CCN 1
CCN: N-1, P. 38

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SONGS 2 WITCHGEAR ROOM 302A - SBO

Heat Sink Number 2: WEST WALL(CONCRETE)

CONVECTIVE HEAT TRANSFER PARAMETERS

Slab Material	User-Defined
Slab Thickness	2.000 ft
Surface Area	943.73 ft**2
Thermal Conductivity	1.040 BTU/hr-ft-deg. F
Density	143.600 lbm/ft**3
Thermal Diffusivity	.034 ft**2/hr
Heat Capacity	.210 BTU/lbm-deg. F
First Node Thickness	.04082 ft
Node Thickness Ratio	1.00
Number of Nodes	50
External Boundary Condition	Adiabatic
Inside Environment Index	1
Interior Heat Transfer Coefficient	Uchida

TABLE OF INTERIOR HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

TABLE OF HEAT SINK MESH POINT COORDINATES (feet)

.000000	.040816	.081633	.122449	.163265	.204082	.244898	.285714	.326531	.367347
.408163	.448980	.489796	.530612	.571429	.612245	.653061	.693878	.734694	.775510
.816326	.857143	.897959	.938775	.979592	1.020408	1.061224	1.102041	1.142857	1.183673
1.224490	1.265306	1.306122	1.346938	1.387755	1.428571	1.469387	1.510204	1.551020	1.591836
1.632653	1.673469	1.714285	1.755102	1.795918	1.836734	1.877550	1.918367	1.959183	2.000000

CCN1
CCN' N-1, P. 39

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SONGS 2 WITCHGEAR ROOM 302A - SBO

Heat Sink Number 3: CEILING(CONCRETE)

CONVECTIVE HEAT TRANSFER PARAMETERS

Slab Material	User-Defined
Slab Thickness	1.000 ft
Surface Area	1561.00 ft**2
Thermal Conductivity	1.040 BTU/hr-ft-deg. F
Density	143.500 lbm/ft**3
Thermal Diffusivity	.034 ft**2/hr
Heat Capacity	.210 BTU/lbm-deg. F
First Node Thickness	.02041 ft
Node Thickness Ratio	1.00
Number of Nodes	50
External Boundary Condition	Adiabatic
Inside Environment Index	1
Interior Heat Transfer Coefficient	Uchida

TABLE OF INTERIOR HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

TABLE OF HEAT SINK MESH POINT COORDINATES (feet)

.000000	.020408	.040816	.061224	.081633	.102041	.122449	.142857	.163265	.183673
.204082	.224490	.244898	.265306	.285714	.306122	.326531	.346939	.367347	.387755
.408163	.428571	.448980	.469388	.489796	.510204	.530612	.551020	.571428	.591837
.612245	.632653	.653061	.673469	.693877	.714286	.734694	.755102	.775510	.795918
.816326	.836734	.857143	.877551	.897959	.918367	.938775	.959183	.979592	1.000000

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CCN: N-1, P. 40

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SONGS 2 WITCHGEAR ROOM 302A - SBO

AUXILIARY CONDITIONS SELECTED

Blowout Panels	OFF
Convective Heat Transfer	ON
Unit Air Coolers	OFF
Heating and Ventilation Flow	OFF
Compartment Leakage	OFF
Compartment Equipment Heat Loads	ON
Atmosphere Exhaust Fan	OFF
Blowdown Dropout	OFF
Zero Reverse Flow	OFF
8% Revaporization	OFF

PROBLEM CONTROL PARAMETERS

Problem Time Limit	14400.0 seconds
Flow Calculation Output/Frequency	OFF/ 0
Compartment Pressure Difference Output	OFF
Heat Sink Calculation Output/Frequency	ON/ 1
Extended Heatsink Output: Node Temperatures	ON
Restart Option	OFF
Number of Plot Points	25
SIGFLO Switch Time	1.000000E+20 seconds
SIGFLO Iteration Tolerance	.001000 psi
Maximum Number of Flow Iterations	500

CALCULATION/PRINT TIMES SELECTED

Calc. Time Step	Change Time	Print Interval	Change Time
1.000E-02	1.000E+00	3.600E+03	2.000E+04
1.000E-01	1.000E+01	0.000E+00	0.000E+00
1.000E+00	2.000E+01	0.000E+00	0.000E+00
1.000E+01	1.000E+02	0.000E+00	0.000E+00
3.000E+01	3.600E+04	0.000E+00	0.000E+00

CCN 1
CCN: N-1, P. 41

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SONGS 2 WITCHGEAR ROOM 302A - SBO

Time = 0 Hours 0 Minutes .00000 Seconds (.0000 Seconds) (Calc. Time Step = 1.000E-02 seconds)

----- Compartment ----	Temp. (Deg F)	S-Heat/ Quality	Rel. Hum.	-- Pressures (psia) -- Total	Air	Steam	K	Total Mass (lbm)	Frac. Air	Frac. Vapor	Heat Load	Total Energy (BTU)
0 Atmosphere	95.000		.50	14.700	14.292	.408	1.40		.9825	.0175		
1 ROOM 302A	95.000	21.3 S	.50	14.700	14.292	.408	1.40	1.7144870E+03	.9825	.0175	1.82	1.9240100E+05

Compartments Initial Energy	1.9240E+05 BTU	Compartments Initial Mass	1.7145E+03 lbm
Current Energy in Compartments	1.9240E+05 BTU	Current Mass in Compartments	1.7145E+03 lbm
Blowdown Enthalpy Added	0.0000E+00 BTU	Blowdown Mass Added	0.0000E+00 lbm
Irreversible Energy Loss	0.0000E+00 BTU	(Condens. + Dropout) Mass Loss	0.0000E+00 lbm
Energy Lost to Atmosphere	0.0000E+00 BTU	Mass Lost to Atmosphere	0.0000E+00 lbm
[Rate of Energy Loss to Atmosphere	0.0000E+00 BTU/sec]	[Rate of Mass Loss to Atmosphere	0.0000E+00 lbm/sec]
Absolute Energy Imbalance	0.0000E+00 BTU	Absolute Mass Imbalance	0.0000E+00 lbm
Relative Energy Imbalance	0.0000E+00 %	Relative Mass Imbalance	0.0000E+00 %

CCN 1
CCN: N-1, P.42

M-73-116
3 EA
P. Tigeri 12-16-92
I. [illegible] 12-22-92

SONGS 2 WITCHGEAR ROOM 302A - SBO

Time = 0 Hours 0 Minutes .00000 Seconds (.0000 Seconds) (Calc. Time Step = 1.000E-02 seconds)

Heat Sink Calculation Output

HS#	Comp	T	TSAT	TWALL	HCOND	HCONV	AREA	QCOND	QCONV	QSENS	QTOT	HS#
1 Left	1	95.000	73.729	95.004	.000	1.000	2158.0	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	1
1 Right	0	95.000	*******	95.002	.000	1.000	2158.0	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	1
2 Left	1	95.000	73.729	94.999	.000	1.000	943.7	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	2
3 Left	1	95.000	73.729	95.010	.000	1.000	1561.0	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	3

CCN 1
CCN: N-1, P. 43

M-93-116
~~2~~
P. Tigeri 12-16-92
I.M 12-22-92

SONGS 2 WITCHGEAR ROOM 302A - SBO

Time = 0 Hours 0 Minutes .00000 Seconds (.0000 Seconds) (Calc. Time Step = 1.000E-02 seconds)

Extended Heatsink Output: Node Temperatures

Heat Sink No. 1, PLASTER WALL

95.003750	95.003810	95.003880	95.003880	95.003880
95.003880	95.003880	95.003880	95.003810	95.003750
95.003690	95.003630	95.003570	95.003510	95.003450
95.003450	95.003450	95.003450	95.003450	95.003390
95.003330	95.003270	95.003200	95.003140	95.003020
95.002900	95.002840	95.002780	95.002720	95.002660
95.002590	95.002530	95.002470	95.002410	95.002350
95.002290	95.002230	95.002170	95.002040	95.001980
95.001920	95.001920	95.001920	95.001920	95.001860
95.001860	95.001800			

Heat Sink No. 2, WEST WALL(CONCRETE)

94.999110	94.999050	94.998990	94.998930	94.998870
94.998870	94.998870	94.998810	94.998810	94.998810
94.998810	94.998810	94.998750	94.998690	94.998690
94.998690	94.998690	94.998690	94.998690	94.998690
94.998690	94.998690	94.998750	94.998750	94.998750
94.998750	94.998750	94.998750	94.998750	94.998690
94.998630	94.998570	94.998500	94.998440	94.998380
94.998320	94.998260	94.998200	94.998140	94.998080
94.998080	94.998080	94.998080	94.998080	94.998020
94.997960	94.997960	94.997890	94.997830	94.997830

Heat Sink N 3, CEILING(CONCRETE)

95.009920	95.010160	95.010410	95.010590	95.010830
95.011080	95.011260	95.011440	95.011630	95.011810
95.011930	95.012050	95.012240	95.012360	95.012480
95.012600	95.012730	95.012850	95.012970	95.013090
95.013210	95.013340	95.013460	95.013580	95.013640
95.013760	95.013890	95.014010	95.014070	95.014190

CCN 1
CCN: N-1, P.44

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95.014310	95.014370	95.014500	95.014620	95.014680
95.014800	95.014860	95.014920	95.014980	95.015050
95.015110	95.015170	95.015170	95.015170	95.015170
95.015170	95.015170	95.015170	95.015170	95.015170

CCN 1
CCN: N-1, P 45

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P. Tiyeri 12-16-92
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SONGS 2 WITCHGEAR ROOM 302A - SBO

Time = 1 Hours 0 Minutes .00000 Seconds (3600.0000 Seconds) (Calc. Time Step = 3.000E+01 seconds)

----- Compartment ----	Temp. (Deg F)	S-Heat/ Quality	Rel. Hum.	-- Pressures (psia) -- Total	Air	Steam	X	Total Mass (lbm)	Frac. Air	Frac. Vapor	Heat Loss	Total Energy (BTU)
0 Atmosphere	95.000		.50	14.700	14.292	.408	1.40		.9825	.0175		
1 ROOM 302A	96.355	22.6 S	.48	14.736	14.326	.409	1.40	1.7144870E+03	.9825	.0175	1.42	1.9280840E+05

Compartments Initial Energy	1.9240E+05 BTU	Compartments Initial Mass	1.7145E+03 lbm
Current Energy in Compartments	1.9281E+05 BTU	Current Mass in Compartments	1.7145E+03 lbm
Blowdown Enthalpy Added	0.0000E+00 BTU	Blowdown Mass Added	0.0000E+00 lbm
Irreversible Energy Loss	-4.5262E+02 BTU	(Condens. + Dropout) Mass Loss	0.0000E+00 lbm
Energy Lost to Atmosphere	4.4765E+01 BTU	Mass Lost to Atmosphere	0.0000E+00 lbm
[Rate of Energy Loss to Atmosphere	3.9746E-02 BTU/sec]	[Rate of Mass Loss to Atmosphere	0.0000E+00 lbm/sec]
Absolute Energy Imbalance	-3.7331E-01 BTU	Absolute Mass Imbalance	0.0000E+00 lbm
Relative Energy Imbalance	-1.9362E-04 %	Relative Mass Imbalance	0.0000E+00 %

CCN 1
CCN: N-1 , P. 46

M-73-116
2 R0
P. Tigeri 12-16-92
1. [illegible] 12-22-92

SONGS 2 WITCHGEAR ROOM 302A - SBO

Time = 1 Hours 0 Minutes .00000 Seconds (3600.0000 Seconds) (Calc. Time Step = 3.000E+01 seconds)

Heat Sink Calculation Output

HS#	Comp	T	TSAT	TWALL	HCOND	HCONV	AREA	QCOND	QCONV	QSENS	QTOT	HS#
1 Left	1	96.355	73.802	95.530	.000	1.470	2158.0	0.000000E+00	-7.287619E-01	0.000000E+00	-7.287619E-01	1
1 Right	0	95.000	*******	95.046	.000	1.470	2158.0	0.000000E+00	3.974576E-02	0.000000E+00	3.974576E-02	1
2 Left	1	96.355	73.802	95.296	.000	1.470	943.7	0.000000E+00	-4.086653E-01	0.000000E+00	-4.086650E-01	2
3 Left	1	96.355	73.802	95.314	.000	1.470	1561.0	0.000000E+00	-6.642912E-01	0.000000E+00	-6.642912E-01	3

CCN 1
CCN: N-1, P. 47

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2 RE
P. Tigeri 12-16-92
1.MY 12-22-92

SONGS 2 WITCHGEAR ROOM 302A - SBO

Time = 1 Hours 0 Minutes .00000 Seconds (3600.0000 Seconds) (Calc. Time Step = 3.000E+01 seconds)

Extended Heatsink Output: Node Temperatures

Heat Sink No. 1, PLASTER WALL

95.530360	95.506810	95.483920	95.461700	95.440220
95.419460	95.399380	95.379970	95.361180	95.343110
95.325710	95.309050	95.293000	95.277560	95.262790
95.248690	95.235200	95.222320	95.209990	95.198210
95.186980	95.176360	95.166230	95.156590	95.147490
95.138820	95.130650	95.122960	95.115690	95.108860
95.102450	95.0964[illegible]	95.090790	95.085540	95.080660
95.076140	95.071930	95.068080	95.064480	95.061190
95.058200	95.055510	95.053070	95.050870	95.048920
95.047210	95.045930			

Heat Sink No. 2, WEST WALL(CONCRETE)

95.296110	95.239040	95.190090	95.148770	95.114350
95.086330	95.063930	95.046360	95.032750	95.022490
95.014920	95.009370	95.005400	95.002660	95.000700
94.999420	94.998630	94.998140	94.998020	94.998020
94.998020	94.998080	94.998260	94.998260	94.998260
94.998260	94.998260	94.998260	94.998260	94.998140
94.998080	94.998020	94.998020	94.998020	94.998020
94.998020	94.998020	94.998020	94.998020	94.998020
94.998020	94.998020	94.998020	94.998020	94.998020
94.998020	94.997960	94.997890	94.997830	94.997830

CCN 1
CCN: N-1, P. 48

Heat Sink No. 3, CEILING(CONCRETE)

95.314480	95.285490	95.258450	95.233370	95.210240
95.188930	95.169400	95.151580	95.135350	95.120760
95.107640	95.095920	95.085480	95.076200	95.068080
95.060940	95.054660	95.049220	95.044460	95.040440
95.036960	95.034030	95.031520	95.029450	95.027680
95.026210	95.024990	95.023960	95.023100	95.022430

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2 ~~RB~~
P. Tiyeri 12-16-92
I. Ly 12-21-92

95.021880	95.021390	95.021030	95.020720	95.020480
95.020230	95.020050	95.019670	95.019740	95.019620
95.019560	95.019440	95.019320	95.019260	95.019200
95.019130	95.019070	95.019010	95.018950	95.018950

CCN 1
CCN: N-1, P.49

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P. Tizezi 12-16-72
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SONGS 2 WITCHGEAR ROOM 302A - SBO

Time = 2 Hours 0 Minutes .00000 Seconds (7200.0000 Seconds) (Calc. Time Step = 3.000E+01 seconds)

----- Compartment ----	Temp. (Deg F)	S-Heat/ Quality	Rel. Hum.	-- Pressures (psia) -- Total	Air	Steam	K	Total Mass (lbm)	Frac. Air	Frac. Vapor	Heat Load	Total Energy (BTU)
0 Atmosphere	95.000		.50	14.700	14.292	.408	1.40		.9825	.0175		
1 ROOM 302A	96.535	22.7 S	.48	14.741	14.331	.410	1.40	1.7144870E+03	.9825	.0175	1.82	1.9286250E+05

Compartments Initial Energy	1.9240E+05 BTU	Compartments Initial Mass	1.7145E+03 lbm
Current Energy in Compartments	1.9286E+05 BTU	Current Mass in Compartments	1.7145E+03 lbm
Blowdown Enthalpy Added	0.0000E+00 BTU	Blowdown Mass Added	0.0000E+00 lbm
Irreversible Energy Loss	-8.1756E+02 BTU	(Condens. + Dropout) Mass Loss	0.0000E+00 lbm
Energy Lost to Atmosphere	3.5550E+02 BTU	Mass Lost to Atmosphere	0.0000E+00 lbm
[Rate of Energy Loss to Atmosphere	1.3505E-01 BTU/sec]	[Rate of Mass Loss to Atmosphere	0.0000E+00 lbm/sec]
Absolute Energy Imbalance	-5.1514E-01 BTU	Absolute Mass Imbalance	0.0000E+00 lbm
Relative Energy Imbalance	-2.6710E-04 %	Relative Mass Imbalance	0.0000E+00 %

CCN 1

CCN: N-1, P. 50

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P. Tigeri 12-16-92

12-22-92

SONGS 2 WITCHGEAR ROOM 302A - SBO

Time = 2 Hours 0 Minutes .00000 Seconds (7200.0000 Seconds) (Calc. Time Step = 3.000E+01 seconds)

Heat Sink Calculation Output

HS#	Comp	T	TSAT	TWALL	HCOND	HCONV	AREA	QCOND	QCONV	QSENS	QTOT	HS#
1 Left	1	96.535	73.811	95.743	.000	1.470	2158.0	0.000000E+00	-6.988046E-01	0.000000E+00	-6.988046E-01	1
1 Right	0	95.000	*******	95.154	.000	1.470	2158.0	0.000000E+00	1.350495E-01	0.000000E+00	1.350495E-01	1
2 Left	1	96.535	73.811	95.438	.000	1.470	943.7	0.000000E+00	-4.232476E-01	0.000000E+00	-4.232476E-01	2
3 Left	1	96.535	73.811	95.461	.000	1.470	1561.0	0.000000E+00	-6.851829E-01	0.000000E+00	-6.851829E-01	3

CCN 1
CCN: N-1, P. 51

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SONGS 2 WITCHGEAR ROOM 302A - SBO

Time = 2 Hours 0 Minutes .00000 Seconds (7200.0000 Seconds) (Calc. Time Step = 3.000E+01 seconds)

Extended Heatsink Output: Node Temperatures

Heat Sink No. 1, PLASTER WALL

95.743500	95.720790	95.[illegible]98580	95.676730	95.655430
95.634610	95.614350	95.594510	95.575100	95.556180
95.537750	95.[illegible]870	95.5[illegible]2410	95.485380	95.468840
95.452790	95.437160	95.42[illegible]970	95.407260	95.392970
95.379120	95.365690	95.352[illegible]90	95.340120	95.327970
95.31[illegible]250	95.304900	95.2939[illegible]0	95.283420	95.273280
95.263520	95.254120	95.24509[illegible]	95.236420	95.228120
95.220120	95.212550	95.20529[illegible]	95.198330	95.191680
95.185390	95.179410	95.17374[illegible]	95.168300	95.163180
95.158290	95.154140			

Heat Sink No. 2, WEST WALL(CONCRETE)

95.437710	95.377350	95.[illegible]22910	95.274260	95.231050
95.193020	95.159820	95.131200	95.106660	95.085850
95.068390	95.053860	9[illegible].041840	95.032010	95.024020
95.017670	95.012600	[illegible]5.008640	95.005520	95.003140
95.001370	95.000090	94.999180	94.998570	94.998380
94.998320	94.998260	94.998[illegible]60	94.998260	94.998140
94.998080	94.998020	94.998020	94.998020	94.998020
94.998020	94.998020	94.998020	94.998020	94.998020
94.998020	94.998020	94.998026	94.998020	94.998020
94.998020	94.997960	94.997890	94.997830	94.997830

Heat Sink No. 3, CEILING(CONCRETE)

95.461090	95.430940	95.402130	95.374790	95.348790
95.324190	95.300930	95.278960	95.258330	95.238980
95.220860	95.203950	95.188140	95.173430	95.159820
95.147250	95.135590	95.124850	95.115020	95.105990
95.097690	95.090120	95.083220	95.076930	95.071260
95.066130	95.061490	95.057340	95.053560	95.050260

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95.047270	95.044590	95.042210	95.040070	95.038180
95.036470	95.035060	95.033780	95.032680	95.031710
95.030910	95.030240	95.029630	95.029080	95.028660
95.028290	95.027980	95.027680	95.027500	95.027440

CCN 1

CCN: N-1, P. 53

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P. Tigeri 12-16-92

I. M 12-22-92

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SONGS 2 SWITCHGEAR ROOM 302A - SBO

Time = 3 Hours 0 Minutes .00000 Seconds (10800.0000 Seconds) (Calc. Time Step = 3.000E+01 seconds)

----- Compartment ----	Temp. (Deg F)	S-Heat/ Quality	Rel. Hum.	-- Pressures (psia) -- Total	Air	Steam	K	Total Mass (lbm)	Frac. Air	Frac. Vapor	Heat Load	Total Energy (BTU)
0 Atmosphere	95.000		.50	14.700	14.292	.408	1.40		.9825	.0175		
1 ROOM 302A	96.673	22.9 S	.48	14.744	14.335	.410	1.40	1.7144870E+03	.9825	.0175	1.82	1.9290390E+05

Compartments Initial Energy	1.9240E+05 BTU	Compartments Initial Mass	1.7145E+03 lbm
Current Energy in Compartments	1.9290E+05 BTU	Current Mass in Compartments	1.7145E+03 lbm
Blowdown Enthalpy Added	0.0000E+00 BTU	Blowdown Mass Added	0.0000E+00 lbm
Irreversible Energy Loss	-1.5074E+03 BTU	(Condens. + Dropout) Mass Loss	0.0000E+00 lbm
Energy Lost to Atmosphere	1.0038E+03 BTU	Mass Lost to Atmosphere	0.0000E+00 lbm
[Rate of Energy Loss to Atmosphere	2.2336E-01 BTU/sec]	[Rate of Mass Loss to Atmosphere	0.0000E+00 lbm/sec]
Absolute Energy Imbalance	-6.5393E-01 BTU	Absolute Mass Imbalance	0.0000E+00 lbm
Relative Energy Imbalance	-3.3899E-04 %	Relative Mass Imbalance	0.0000E+00 %

CCN 1

CCN: N-1, P. 54

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SONGS 2 WITCHGEAR ROOM 302A - SBO

Time = 3 Hours 0 Minutes .00000 Seconds (10800.0000 Seconds) (Calc. Time Step = 3.000E+01 seconds)

Heat Sink Calculation Output

HS#	Comp	T	TSAT	TWALL	HCOND	HCONV	AREA	QCOND	QCONV	QSENS	QTOT	HS#
1 Left	1	96.673	73.819	95.905	.000	1.470	2158.0	0.000000E+00	-6.774527E-01	0.000000E+00	-6.774527E-01	1
1 Right	0	95.000	*******	95.254	.000	1.470	2158.0	0.000000E+00	2.233615E-01	0.000000E+00	2.233615E-01	1
2 Left	1	96.673	73.819	95.549	.000	1.470	943.7	0.000000E+00	-4.333613E-01	0.000000E+00	-4.333613E-01	2
3 Left	1	96.673	73.819	95.578	.000	1.470	1561.0	0.000000E+00	-6.987215E-01	0.000000E+00	-6.987215E-01	3

CCN '
CCN: N-1, P. 55

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P. Tijeri 12-16-92
I. Sa 12-22-92

SONGS 2 WITCHGEAR ROOM 302A - SP?

Time = 3 Hours 0 Minutes .00000 Seconds (10800.0000 Seconds) (Calc. Time Step = 3.000E+01 seconds)

Extended Heatsink Output: Node Temperatures

Heat Sink No. 1, PLASTER W LL

95.905240	95.883150	95.861480	95.840120	95.819180
95.798550	95.778410	95.758580	95.739110	95.720000
95.701320	95.683070	95.665130	95.647550	95.630340
95.613560	95.597140	95.581090	95.565340	95.549960
95.534940	95.520290	95.505950	95.491970	95.478300
95.465000	95.452000	95.439300	95.426910	95.414830
95.403110	95.391690	95.380580	95.369780	95.359220
95.348970	95.339020	95.329380	95.319980	95.310820
95.301910	95.293240	95.284820	95.276640	95.268710
95.261020	95.254300			

Heat Sink No. 2, WEST WALL(CONCRETE)

95.549160	95.486790	95.429470	95.377110	95.329380
95.286040	95.247040	95.212130	95.181060	95.153590
95.129550	95.108490	95.090120	95.074310	95.060760
95.049220	95.039400	95.031160	95.024260	95.018650
95.013890	95.010100	95.006930	95.004360	95.002410
95.000890	94.999790	94.998990	94.998440	94.998140
94.998080	94.998020	94.998020	94.998020	94.998020
94.998020	94.998020	94.998020	94.998020	94.998020
94.998020	94.998020	94.998020	94.998020	94.998020
94.998020	94.997960	94.997890	94.997830	94.997830

Heat Sink No. 3, CEILING(CONCRETE)

95.577610	95.546660	95.516940	95.488310	95.460850
95.434600	95.409520	95.385470	95.362640	95.340850
95.320100	95.300450	95.281770	95.264130	95.247470
95.231720	95.216890	95.202910	95.189790	95.177580
95.166050	95.155300	95.145290	95.135890	95.127110
95.118990	95.111480	95.104520	95.098110	95.092190

CCN 1
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95.086760	95.081760	95.077120	95.072910	95.069060
95.065520	95.062350	95.059480	95.056920	95.054660
95.052640	95.050810	95.049220	95.047820	95.046720
95.045810	95.045070	95.044530	95.044160	95.044040

CCN 1

CCN: N-1, P. 57

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12-21-92

SONGS 2 WITCHGEAR ROOM 302A - SBO

Time = 4 Hours 0 Minutes .00000 Seconds (14400.0000 Seconds) (Calc. Time Step = 3.000E+01 seconds)

----- Compartment ----	Temp. (Deg F)	S-Heat/ Quality	Rel. Hum.	-- Pressures (psia) -- Total	Air	Steam	K	Total Mass (lbm)	Frac. Air	Frac. Vapor	Heat Load	Total Energy (BTU)
0 Atmosphere	95.000		.50	14.700	14.292	.408	1.40		.9825	.0175		
1 ROOM 302A	96.788	23.0 S	.47	14.747	14.338	.410	1.40	1.7144870E+03	.9825	.0175	1.82	1.9293860E+05

Compartments Initial Energy	1.9240E+05 BTU	Compartments Initial Mass	1.7145E+03 lbm
Current Energy in Compartments	1.9294E+05 BTU	Current Mass in Compartments	1.7145E+03 lbm
Blowdown Enthalpy Added	0.0000E+00 BTU	Blowdown Mass Added	0.0000E+00 lbm
Irreversible Energy Loss	-2.4816E+03 BTU	(Condens. + Dropout) Mass Loss	0.0000E+00 lbm
Energy Lost to Atmosphere	1.9433E+03 BTU	Mass Lost to Atmosphere	0.0000E+00 lbm
[Rate of Energy Loss to Atmosphere	2.9683E-01 BTU/sec]	[Rate of Mass Loss to Atmosphere	0.0000E+00 lbm/sec]
Absolute Energy Imbalance	-7.2937E-01 BTU	Absolute Mass Imbalance	0.0000E+00 lbm
Relative Energy Imbalance	-3.7803E-04 %	Relative Mass Imbalance	0.0000E+00 %

CCN 1
CCN: N-1, P. 58

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P. Ingeri 12-16-92
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SONGS 2 WITCHGEAR ROOM 302A - SBO

Time = 4 Hours 0 Minutes .00000 Seconds (14400.0000 Seconds) (Calc. Time Step = 3.000E+01 seconds)

Heat Sink Calculation Output

HS#	Comp	T	TSAT	TWALL	HCOND	HCONV	AREA	QCOND	QCONV	QSENS	QTOT	HS#
1 Left	1	96.788	73.825	96.037	.000	1.470	2158.0	0.000000E+00	-6.627162E-01	0.000000E+00	-6.627162E-01	1
1 Right	0	95.000	*******	95.337	.000	1.470	2158.0	0.000000E+00	2.968293E-01	0.000000E+00	2.968293E-01	1
2 Left	1	96.788	73.825	95.645	.000	1.470	943.7	0.000000E+00	-4.406526E-01	0.000000E+00	-4.406526E-01	2
3 Left	1	96.788	73.825	95.678	.000	1.470	1561.0	0.000000E+00	-7.077863E-01	0.000000E+00	-7.077863E-01	3

CCN 1

CCN: N-1, P.59

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P. Tigeri 12-16-92
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SONGS 2 WITCHGEAR ROOM 302A - SBO

Time = 4 Hours 0 Minutes .00000 Seconds (14400.0000 Seconds) (Calc. Time Step = 3.000E+01 seconds)

Extended Heatsink Output: Node Temperatures

Heat Sink No. 1, PLASTER WALL

96.036900	96.015290	95.993990	95.972930	95.952240
95.931850	95.911830	95.892060	95.872530	95.853360
95.834500	95.816010	95.797760	95.779820	95.762180
95.744840	95.727810	95.711030	95.694550	95.678380
95.662450	95.646820	95.631500	95.616420	95.601590
95.587070	95.572780	95.558750	95.544950	95.531460
95.518220	95.505220	95.492400	95.479890	95.467620
95.455540	95.443700	95.432100	95.420680	95.409450
95.398470	95.387660	95.377040	95.366670	95.356410
95.346340	95.337490			

Heat Sink No. 2, WEST WALL(CONCRETE)

95.645230	95.581450	95.522130	95.467190	95.416290
95.369600	95.326750	95.287690	95.252170	95.220120
95.191190	95.165310	95.142120	95.121490	95.103360
95.087370	95.073330	95.061070	95.050510	95.041410
95.033540	95.026890	95.021270	95.016510	95.012480
95.009060	95.006260	95.003940	95.001980	95.000460
94.999300	94.998570	94.998140	94.998020	94.998020
94.998020	94.998020	94.998020	94.998020	94.998020
94.998020	94.998020	94.998020	94.998020	94.998020
94.998020	94.997960	94.997890	94.997830	94.997830

Heat Sink No. 3, CEILING(CONCRETE)

95.678380	95.647000	95.616550	95.587130	95.558750
95.531400	95.505100	95.479710	95.455350	95.431920
95.409450	95.387970	95.367460	95.347870	95.329130
95.311310	95.294340	95.278170	95.262850	95.248320
95.234530	95.221530	95.209260	95.197660	95.186680
95.176420	95.166720	95.157620	95.149080	95.141080

CCN 1

CCN: N-1, P. 60

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95.133640	95.126680	95.120270	95.114290	95.108860
95.103790	95.099150	95.094940	95.091090	95.087620
95.084560	95.081820	95.079380	95.077300	95.075530
95.074070	95.072910	95.072050	95.071500	95.071260

CCN 1

CCN: N-1, P. 61

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SONGS 2 WITCHGEAR ROOM 302A - SBO

MAXIMUM AND MINIMUM PRESSURES AND TEMPERATURES

	Maximum				Minimum			
Compartment	(psia) Pressure	(sec) at Time	(deg. F) Temperature	(sec) at Time	(psia) Pressure	(sec) at Time	(deg. F) Temperature	(sec) at Time
1 ROOM 302A	14.7473	1.4400E+04	96.788	1.4400E+04	14.7000	1.0000E-02	95.000	.0000

685 Calculation cycles were performed

==> Execution time: 00:01:16.46

CCN 1
CCN: N-1, P. 62

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I. [illegible] 12-22-92

NES&L DEPARTMENT

CALCULATION SHEET

CCN NO	PRELIM. CCN NO. N-1	PAGE 63 OF
CCN CONVERSION	CCN NO. CCN-- 1	

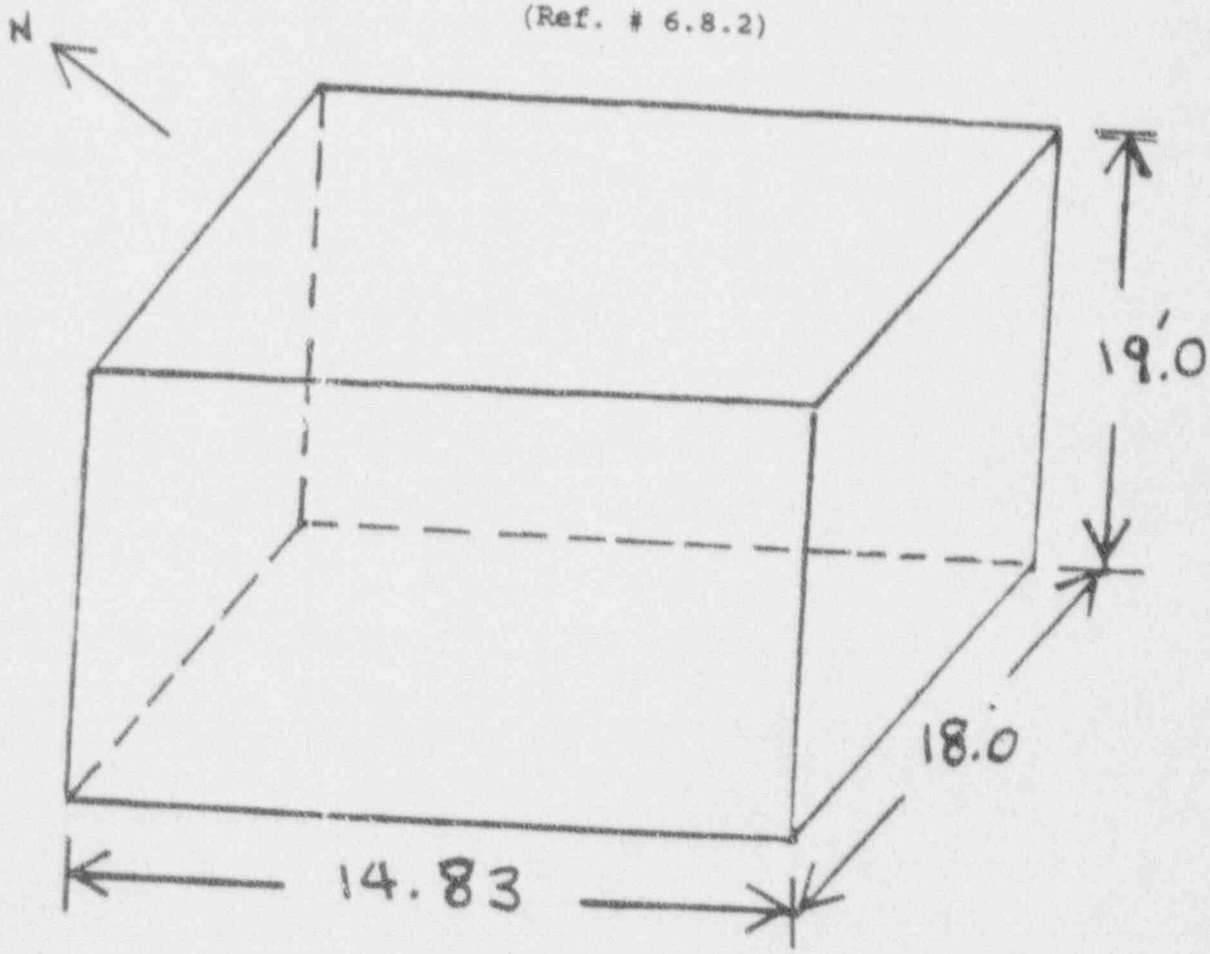
Project or DCP/MMP SONGS 2/3 Calc No. M73-116

Subject Room Temperature Response During SBO Sheet No. 63

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
2	P. TIGERI	10-15-92	[illegible]	12/22/92					

8.2 DISTRIBUTION ROOM 310B(EL. 50)

(Ref. # 6.8.2)



SCE 26-428 NEW 4/90

NES&L DEPARTMENT

CALCULATION SHEET

~~ICCN NO.~~ PRELIM. CCN NO. N-1	PAGE 64 OF
CCN CONVERSION CCN NO. CCN - 1	

Project or DCP/MMP SONGS 2/3   Calc No. M73-116

Subject Room Temperature Response During Station Blackout (SBO)   Sheet No. 64

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
1	PARVIZ TIGERI	10/15		11/21/92					

Input data summary used for Distribution Room 310B Temperature Rise Analysis

Q = 5.46 BTU/S (Ref. #6.7)
V = 4,370.0 ft^3 (see assumption 3.17)

Heat Sink	K_e BTU/hr-ft·F	ρ_e lbm/ft^3	Cp_e BTU/lbm-·F	A (ft^2)	t (ft)	Ti (·F)
North wall Plaster	0.508	18.572	0.739	342.0	0.459	95
South wall Plaster	0.567	15.337	0.738	342.0	0.417	95
Ceiling Concrete	1.04	143.6	0.21	266.94	1.00	95

See data below for reference to above table.

△

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
1	PARVIZ TIGERI	10/15							

CALCULATION OF DISTIRBUTION ROOM(ROOM 310-B); UNIT 2

$Ln := 18$	ft	(Ref. # 6.8.2)
$Le := 14.83$	ft	(Ref. # 6.8.2)
$Ls := 18$	ft	(Ref. # 6.8.2)
$Lw := 14.83$	ft	(Ref. # 6.8.2)
$K_p := 0.25$	BTU/(hr-ft-F)	(Ref. # 6.17)
$\rho_p := 51.0$	lbm/ft^3	(Ref. # 6.17)
$Cp_p := 0.74$	BTU/(lbm-F)	(Ref. # 6.17)
$K_{air} := 1.24$	BTU/(hr-ft-F)	(see section 8.8)
$\rho_{air} := 0.07$	BTU/ft^3	(Ref. # 6.2)
$Cp_{air} := 0.24$	BTU/(lbm-F)	(Ref. # 6.2)

△

CALCULATION SHEET

~~ICCN NO.~~ PRELIM. CCN NO. N-1	PAGE 66 OF

CCN CONVERSION
CCN NO. CCN - 1

Project or DCP/MMP SONGS 2/3 Calc No. M73-116

Subject Room Temperature Response During Station Blackout (SBO) Sheet No. 66

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
Z	PARVIZ TIGERI	10/15	[signature]	12/22/93					

CALCULATION OF WALL AND CEILING AREAS

$An := 18 \cdot 19$ ==>> $An = 342$ ft^2

$As := 18 \cdot 19$ ==>> $As = 342$ ft^2

$Ace := 14.83 \cdot 18$ ==>> $Ace = 266.94$ ft^2

HEAT LOAD(Q)

$Q := 5.76 \cdot 10^{3}$ W (Ref. # 6.7)

$Q := 5.76 \cdot 10^{3} \cdot \frac{3.4121}{3600}$ ==>> $Q = 5.459$ BTU/S

SCE 26-426 NEW 4/88

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
2	PARVIZ TIGERI	10/15		11/22/94					

FINDING Ke, ρe AND Cpe BASE ON METHODOLOGY :

FOR NORTH WALL(COMPOSITE WALL)

tp := 0.0833 ft (Ref. # 6.8.2)

tair := 0.292 ft (Ref. # 6.2)

tT := 2·tp + tair

tT = 0.459 ft

$$Ke := \frac{tT}{2\cdot\frac{tp}{K_p} + \frac{tair}{K_{air}}}$$

Ke = 0.508 BTU/(hr-ft-F)

$$\rho e := \frac{\left[2\cdot tp\cdot\rho_p\right] + \left[tair\cdot\rho_{air}\right]}{tT}$$

ρe = 18.572 lbm/ft^3

$$Cpe := \frac{\left[2\cdot tp\cdot\rho_p\cdot Cp_p\right] + \left[tair\cdot\rho_{air}\cdot Cp_{air}\right]}{\left[2\cdot tp\cdot\rho_p\right] + \left[tair\cdot\rho_{air}\right]}$$

Cpe = 0.739 BTU/(lbm-F)

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
1	PARVIZ TIGERI	10/15	[signature]	10/22/92					

FINDING Ke, ρe AND Cpe BASE ON METHODOLOGY
FOR SOUTH WALL(COMPOSITE WALL)

$tp := 0.0625$ ft (Ref. # 6.8.2)

$tair := 0.292$ ft (Ref. # 6.2)

$tT := 0.417$ ft

$$Ke := \frac{tT}{2 \cdot \frac{tp}{K_p} + \frac{tair}{K_{air}}}$$

$Ke = 0.567$ BTU/(hr-ft-F)

$$\rho e := \frac{\left[2 \cdot tp \cdot \rho_p\right] + \left[tair \cdot \rho_{air}\right]}{tT}$$

$\rho e = 15.337$ lbm/ft^3

$$Cpe := \frac{\left[2 \cdot tp \cdot \rho_p \cdot Cp_p\right] + \left[tair \cdot \rho_{air} \cdot Cp_{air}\right]}{\left[2 \cdot tp \cdot \rho_p\right] + \left[tair \cdot \rho_{air}\right]}$$

$Cpe = 0.738$ BTU/(lbm-F)

```
                SONGS 2     DISTRIBUTION ROOM 310B - SBO
 0.000
        ROOM 310B
      14.7      4370.0        95    0.50    1.00
   0.0000    0.0000    0.0000 1 0
 0.0000          5.46
 28800           5.46
@EOF
   0.0000  0.0000
@EOF
 0  0    000.00    000.00    000.00    000.00      000.00 1
@EOF
 0    000.00    000.00    000.00    000.00 1
@EOF
@EOF
 0.0000      0.0000      0.0000
 1.e20       0.0000      0.0000
@EOF
 1               1.00
@EOF
 0.0000      14.70       95          0.50
 1.e20       14.70       95          0.50
@EOF
                  NORTH WALL(PLASTER)
3       342.0      0.459        0.01  1.00
 1      0.00 1 4
 0.000           1.47
 1.E6            1.47
@EOF
  0       0.00
 0.000           1.47
 1.E6            1.47
@EOF
     0.508     18.572      0.739
                  SOUTH WALL(PLASTER)
3       342.0      0.417        0.01  1.00
 1      0.00 1 4
 0.000           1.47
 1.E6            1.47
@EOF
  0       0.00
 0.000           1.47
 1.E6            1.47
@EOF
     0.567     15.337      0.738
CEILING(CONCRETE)
3      266.94        1.00         0.01  1.00
 1      0.00 1 1
 0.000           1.47
 1.E6            1.47
@EOF
      1.04      143.6       0.21
@EOF
 0 1 0 0 0 1 0 0 0 0
@EOF
```

CCN 1
CCN: N-1, P. 69

CALC NO: M-73-116
REV: 2
BY: P. Tigeyi 12-12-92
CHECKED: [signature] 12/22/92
SHEET 69 OF

```
      14400 1     0 0    1 0   25    1.E20    0.001  500
 0.01             1.0
 0.10             10.0
 1.0              20.0
 10.0             100.0
 30.0             36000
@EOF
 3600             20000
@EOF
```

CCN 1

CCN: N-1, P. 70

M-73-116

BY: P. Tigetti DATE: 12.12.92

CHECKED: DATE: 11/22/92

SHEET 70

SONGS 2 DISTRIBUTION ROOM 310B - SBO

* * * PCFLUD 3.7 * * *

> Thermofluid Dynamics for a System of Interconnected Compartments <

MAP-120

[] [] []

Release Record

Date	Version	Description of Changes
3/25/85	1.00	Original PC version
8/25/86	2.00	Air-only version (SF)
1/06/87	3.00	Added SIGFLO routine
6/02/88	3.10	Modified for new compiler
2/06/90	3.61	61 Compartment version
5/21/91	3.7	Automatic zero reverse flow

CCN 1
CCN: N-1, P. 71

INPUT file name: b:r310b.inp

OUTPUT file name: b:r310b.OUT

PLOT file name: b:r310b.PLT

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12/23/92

SHEET 71

SONGS 2 DISTRIBUTION ROOM 310B - SBO

COMPARTMENT INITIAL CONDITIONS

Compartment	Description	Volume (ft**3)	Temperature (Degrees F)	Pressure (psia)	Rel. Humidity (Fraction)	Flow to Compartments (0 = Atmosphere)
0	Atmosphere		95.00	14.7000	.50	
1	ROOM 310B	4.3700E+03	95.00	14.7000	.50	

CCN 1
CCN: N-1 , P. 79

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SONGS 2 DISTRIBUTION ROOM 310B - SBO

COMPARTMENT AUXILIARY CONDITIONS

Compartment	Compartment Desc.	Air Cooler Constant (BTU/sec-deg)	Air Cooler Temperatures Water (F)	Start (F)	Equipment Heat Load Options	Leakage Constants Rate(CFM)	@ Press.(in. H2O)
1	ROOM 310B	.000	.0	.0	1, 0	.00000	.0000

COMPARTMENT HEAT LOAD

Compartment 1

Time (seconds)	Heat Load (BTU/sec)
.00	5.46
28800.00	5.46

CCN 1
CCN: N-1, P 73

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SONGS 2 DISTRIBUTION ROOM 310B - SBO

BLOWDOWN DATA

Time (sec)	Flowrate (lbm/sec)	Enthalpy (BTU/lbm)
.00000	.00000	.00000
1.00000E+20	.00000	.00000

SPLIT OF BLOWDOWN DATA

Compartment	Fraction of Blowdown
1	1.00000

ATMOSPHERIC DATA

Time (sec)	Temp(deg.F)	Pressure(psia)	Relative Humidity
.00000	95.000	14.700	.50000
1.00000E+20	95.000	14.700	.50000

CCN 1
CCN: N-1, P. 74

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SONGS 2 DISTRIBUTION ROOM 310B - SBO

Heat Sink Number 1: NORTH WALL(PLASTER)

CONVECTIVE HEAT TRANSFER PARAMETERS

Slab Material	User-Defined
Slab Thickness	.459 ft
Surface Area	342.00 ft**2
Thermal Conductivity	.508 BTU/hr-ft-deg. F
Density	18.572 lbm/ft**3
Thermal Diffusivity	.037 ft**2/hr
Heat Capacity	.739 BTU/lbm-deg. F
First Node Thickness	.01000 ft
Node Thickness Ratio	1.00
Number of Nodes	47
External Boundary Condition	Convective
External Heat Transfer Coefficient	Uchida
Outside Environment Index	0
Inside Environment Index	1
Interior Heat Transfer Coefficient	Uchida

TABLE OF EXTERNAL HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

CCN/
CCN: N-1, P.75

TABLE OF INTERIOR HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

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TABLE OF HEAT SINK MESH POINT COORDINATES (feet)

.000000	.010000	.020000	.030000	.040000	.050000	.060000	.070000	.080000	.090000

75

.100000	.110000	.120000	.130000	.140000	.150000	.160000	.170000	.180000	.190000
.200000	.210000	.220000	.230000	.240000	.250000	.260000	.270000	.280000	.290000
.300000	.310000	.320000	.330000	.340000	.350000	.360000	.370000	.380000	.390000
.400000	.410000	.420000	.430000	.440000	.450000	.459000			

CCN 1
CCN: N-1 , P 76

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SONGS 2 DISTRIBUTION ROOM 310B - SBO

Heat Sink Number 2: SOUTH WALL(PLASTER)

CONVECTIVE HEAT TRANSFER PARAMETERS

Slab Material	User-Defined
Slab Thickness	.417 ft
Surface Area	342.00 ft**2
Thermal Conductivity	.567 BTU/hr-ft-deg. F
Density	15.337 lbm/ft**3
Thermal Diffusivity	.050 ft**2/hr
Heat Capacity	.738 BTU/lbm-deg. F
First Node Thickness	01000 ft
Node Thickness Ratio	1.00
Number of Nodes	43
External Boundary Condition	Convective
External Heat Transfer Coefficient	Uchida
Outside Environment Index	0
Inside Environment Index	1
Interior Heat Transfer Coefficient	Uchida

TABLE OF EXTERNAL HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

TABLE OF INTERIOR HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

TABLE OF HEAT SINK MESH POINT COORDINATES (feet)

.000000	.010000	.020000	.030000	.040000	.050000	.060000	.070000	.080000	.090000

7

CCN1
CCN: N-1, P.77

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P. Tigeri
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.100000	.110000	.120000	.130000	.140000	.150000	.160000	.170000	.180000	.190000
.200000	.210000	.220000	.230000	.240000	.250000	.260000	.270000	.280000	.290000
.300000	.310000	.320000	.330000	.340000	.350000	.360000	.370000	.380000	.390000
.400000	.410000	.417000							

CCN 1

CCN: U-1, P.78

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3

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12/22/92

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SONGS 2 DISTRIBUTION ROOM 310B - SBO

Heat Sink Number 3: CEILING(CONCRETE)

CONVECTIVE HEAT TRANSFER PARAMETERS

Slab Material	User-Defined
Slab Thickness	1.000 ft
Surface Area	266.94 ft**2
Thermal Conductivity	1.040 BTU/hr-ft-deg. F
Density	143.600 lbm/ft**3
Thermal Diffusivity	.034 ft**2/hr
Heat Capacity	.210 BTU/lbm-deg. F
First Node Thickness	.02041 ft
Node Thickness Ratio	1.00
Number of Nodes	50
External Boundary Conditi n	Adiabatic
Inside Environment Index	1
Interior Heat Transfer Coefficient	Uchida

CCN 1

CCN: N-1 s P. 79

TABLE OF INTERIOR HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

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TABLE OF HEAT SINK MESH POINT COORDINATES (feet)

.000000	.020408	.040816	.061224	.081633	.102041	.122449	.142857	.163265	.183673
.204082	.224490	.244898	.265306	.285714	.306122	.326531	.346939	.367347	.387755
.408163	.428571	.448980	.469388	.489796	.510204	.530612	.551020	.571428	.591837
.612245	.632653	.653061	.673469	.693877	.714286	.734694	.755102	.775510	.795918
.816326	.836734	.857143	.877551	.897959	.918367	.938775	.959183	.979592	1.000000

SONGS 2 DISTRIBUTION ROOM 310B - SBO

AUXILIARY CONDITIONS SELECTED

Blowout Panels	OFF
Convective Heat Transfe	ON
Unit Air Coolers	OFF
Heating and Ventilati n Flow	OFF
Compartment Leakage	OFF
Compartment Equipment Heat Loads	ON
Atmosphere Exhaust Fan	OFF
Blowdown Dropout	OFF
Zero Reverse Flow	OFF
8% Revaporization	OFF

PROBLEM CONTROL PARAMETERS

Problem Time Limit	14400.0 seconds
Flow Calculation Output/Frequency	OFF/ 0
Compartment Pressure Difference Output	OFF
Heat Sink Calculation Output/Frequency	ON/ 1
Extended Heatsink Output: Node Temperatures	ON
Restart Option	OFF
Number of Plot Points	25
SIGFLO Switch Time	1.000000E+20 seconds
SIGFLO Iteration Tolerance	.001000 psi
Maximum Number of Flow Iterations	500

CALCULATION/PRINT TIMES SELECTED

Calc. Time Step	Change Time	Print Interval	Change Time
1.000E-02	1.000E+00	3.600E+03	2.000E+04
1.000E-01	1.000E+01	0.000E+00	0.000E+00
1.000E+00	2.000E+01	0.000E+00	0.000E+00
1.000E+01	1.000E+02	0.000E+00	0.000E+00
3.000E+01	3.600E+04	0.000E+00	0.000E+00

CCN 1

CCN: N-1 , P. 80

CALC. M-93-116
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P. Tigeri
12-12-92
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SHEET 80

SONGS 2 DISTRIBUTION ROOM 310B - SBO

Time = 0 Hours 0 Minutes .00000 Seconds (.0000 Seconds) (Calc. Time Step = 1.000E-02 seconds)

----- Compartment ----		Temp. (Deg F)	S-Heat/ Quality	Rel. Hum.	-- Pressures (psia) -- Total	Air	Steam	K	Total Mass (lbm)	Frac. Air	Frac. Vapor	Heat Load	Total Energy (BTU)
0	Atmosphere	95.000		.50	14.700	14.292	.408	1.40		.9825	.0175		
1	ROOM 310B	95.000	21.3 S	.50	14.700	14.292	.408	1.40	3.0936940E+02	.9825	.0175	5.46	3.4717660E+04

Compartments Initial Energy	3.4718E+04 BTU	Compartments Initial Mass	3.0937E+02 lbm
Current Energy in Compartments	3.4718E+04 BTU	Current Mass in Compartments	3.0937E+02 lbm
Blowdown Enthalpy Added	0.0000E+00 BTU	Blowdown Mass Added	0.0000E+00 lbm
Irreversible Energy Loss	0.0000E+00 BTU	(Condens. + Dropout) Mass Loss	0.0000E+00 lbm
Energy Lost to Atmosphere	0.0000E+00 BTU	Mass Lost to Atmosphere	0.0000E+00 lbm
[Rate of Energy Loss to Atmosphere	0.0000E+00 BTU/sec]	[Rate of Mass Loss to Atmosphere	0.0000E+00 lbm/sec]
Absolute Energy Imbalance	0.0000E+00 BTU	Absolute Mass Imbalance	0.0000E+00 lbm
Relative Energy Imbalance	0.0000E+00 %	Relative Mass Imbalance	0.0000E+00 %

CCN 1

CCN: N-1, P. 81

M-73-11L
2

P. Tijeri 12-12-92

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SONGS 2 DISTRIBUTION ROOM 310B - SBO

Time = 0 Hours 0 Minutes .00000 Seconds (.0000 Seconds) (Calc. Time Step = 1.000E-02 seconds)

Heat Sink Calculation Output

HS#	Comp	T	TSAT	TWALL	HCOND	HCONV	AREA	QCOND	QCONV	QSENS	QTOT	HS#
1 Left	1	95.000	73.729	95.004	.000	1.000	342.0	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	1
1 Right	0	95.000	*******	95.002	.000	1.000	342.0	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	1
2 Left	1	95.000	73.729	95.003	.000	1.000	342.0	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	2
2 Right	0	95.000	*******	95.002	.000	1.000	342.0	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	2
3 Left	1	95.000	73.729	95.010	.000	1.000	266.9	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	3

CCN 1
CCN: N-1 , P82

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P. Tigeri 12-12-92
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SONGS 2 DISTRIBUTION ROOM 310B - SBO

Time = 0 Hours 0 Minutes .00000 Seconds (.0000 Seconds) (Calc. Time Step = 1.000E-02 seconds)

Extended Heatsink Output: Node Temperatures

Heat Sink No. 1, NORTH WALL(PLASTER)

95.003750	95.003810	95.003880	95.003880	95.003880
95.003880	95.003880	95.003880	95.003810	95.003750
95.003690	95.003630	95.003570	95.003510	95.003450
95.003450	95.003450	95.003450	95.003450	95.003390
95.003330	95.003270	95.003200	95.003140	95.003020
95.002900	95.002840	95.002780	95.002720	95.002660
95.002590	95.002530	95.002470	95.002410	95.002350
95.002290	95.002230	95.002170	95.002040	95.001980
95.001920	95.001920	95.001920	95.001920	95.001860
95.001860	95.001800			

Heat Sink No. 2, SOUTH WALL(PLASTER)

95.002590	95.002660	95.002720	95.002780	95.002840
95.002900	95.002960	95.002960	95.002960	95.003020
95.003080	95.003140	95.003200	95.003270	95.003330
95.003390	95.003450	95.003450	95.003450	95.003450
95.003450	95.003450	95.003450	95.003450	95.003390
95.003330	95.003270	95.003200	95.003140	95.003080
95.003020	95.002960	95.002900	95.002840	95.002780
95.002660	95.002590	95.002470	95.002350	95.002230
95.002170	95.002110	95.002040		

Heat Sink No. 3, CEILING(CONCRETE)

95.009920	95.010160	95.010410	95.010590	95.010830
95.011080	95.011260	95.011440	95.011630	95.011810
95.011930	95.012050	95.012240	95.012360	95.012480
95.012600	95.012730	95.012850	95.012970	95.013090
95.013[illegible]10	95.013340	95.013460	95.013580	95.013640
95.013760	95.013890	95.014010	95.014070	95.014190
95.014310	95.014370	95.014500	95.014620	95.014680

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95.014800	95.014860	95.014920	95.014980	95.015050
95.015110	95.015170	95.015170	95.015170	95.015170
95.015170	95.015170	95.015170	95.015170	95.015170

CCN 1

CCN1 N-1, P. 84

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SONGS 2 DISTRIBUTION ROOM 310B - SBO

Time = 1 Hours 0 Minutes .00000 Seconds (3600.0000 Seconds) (Calc. Time Step = 3.000E+01 seconds)

----- Compartment ----	Temp. (Deg F)	S-Heat/ Quality	Rel. Hum.	-- Pressures (psia) -- Total	Air	Steam	K	Total Mass (lbm)	Frac. Air	Frac. Vapor	Heat Load	Total Energy (BTU)
0 Atmosphere	95.000		.50	14.700	14.292	.408	1.40		.9825	.0175		
1 ROOM 310B	116.090	41.3 S	.28	15.259	14.835	.424	1.40	3.0936940E+02	.9825	.0175	5.46	3.5861960E+04

Compartments Initial Energy	3.4718E+04 BTU	Compartments Initial Mass	3.0937E+02 lbm
Current Energy in Compartments	3.5862E+04 BTU	Current Mass in Compartments	3.0937E+02 lbm
Blowdown Enthalpy Added	0.0000E+00 BTU	Blowdown Mass Added	0.0000E+00 lbm
Irreversible Energy Loss	-1.4169E+03 BTU	(Condens. + Dropout) Mass Loss	0.0000E+00 lbm
Energy Lost to Atmosphere	2.7259E+02 BTU	Mass Lost to Atmosphere	0.0000E+00 lbm
[Rate of Energy Loss to Atmosphere	2.6146E-01 BTU/sec]	[Rate of Mass Loss to Atmosphere	0.0000E+00 lbm/sec]
Absolute Energy Imbalance	2.5940E-02 BTU	Absolute Mass Imbalance	0.0000E+00 lbm
Relative Energy Imbalance	7.2333E-05 %	Relative Mass Imbalance	0.0000E+00 %

CCN 1

CCN: N-1 , P. 85

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SONGS 2 DISTRIBUTION ROOM 310B - SBO

Time = 1 Hours 0 Minutes .00000 Seconds (3600.0000 Seconds) (Calc. Time Step = 3.000E+01 seconds)

Heat Sink Calculation Output

HS#	Comp	T	TSAT	TWALL	HCOND	HCONV	AREA	QCOND	QCONV	QSENS	QTOT	HS#
1 Left	1	116.090	74.838	103.088	.000	1.470	342.0	0.000000E+00	-1.820556E+00	0.000000E+00	-1.820556E+00	1
1 Right	0	95.000	*******	95.572	.000	1.470	342.0	0.000000E+C0	7.831447E-02	0.000000E+00	7.831447E-02	1
2 Left	1	116.090	74.838	103.339	.000	1.470	342.0	0.000000E+00	-1.785601E+00	0.000000E+00	-1.785601E+00	2
2 Right	0	95.000	*******	96.331	.000	1.470	342.0	0.000000E+00	1.831457E-01	0.000000E+00	1.831457E-01	2
3 Left	1	116.090	74.838	99.639	.000	1.470	266.9	0.000000E+00	-1.795588E+00	0.000000E+00	-1.795588E+00	3

CCN 1

CCN: N-1, P 86

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SONGS 2 DISTRIBUTION ROOM 310B - SBO

Time = 1 Hours 0 Minutes .00000 Seconds (3600.0000 Seconds) (Calc. Time Step = 3.000E+01 seconds)

Extended Heatsink Output: Node Temperatures

Heat Sink No. 1, NORTH WALL(PLASTER)

103.087800	102.717000	102.357400	102.008800	101.671400
101.344900	101.029600	100.725100	100.431500	100.148600
99.876430	9^.614780	99.363430	99.122340	98.891330
98.670200	98.458770	98.256870	98.064300	97.880830
97.706270	97.540370	97.382900	97.233670	97.092440
96.959010	96.833160	96.714570	96.603120	96.498500
96.400480	96.308930	96.223540	96.144130	96.073530
96.002470	95.939790	95.882290	95.829800	95.782140
95.739170	95.700650	95.666530	95.636630	95.610750
95.588840	95.572420			

Heat Sink No. 2, SOUTH WALL(PLASTER)

103.339400	103.013100	102.695300	102.386000	102.085300
101.793100	101.509400	101.234200	100.967400	100.709100
100.459100	100.217400	99.983980	99.758700	99.541530
99.332430	99.131260	98.937960	98.752470	98.574620
98.404330	98.241420	98.085910	97.937530	97.796300
97.662020	97.534520	97.413790	97.299650	97.191990
97.090670	96.995510	96.906460	96.823330	96.746000
96.674350	96.608250	96.547580	96.492220	96.442050
96.396880	96.356600	96.331270		

Heat Sink No. 3, CEILING(CONCRETE)

99.639509	99.181240	98.755040	98.360260	97.996190
97.661710	97.355740	97.077060	96.824430	96.596470
96.391630	96.208470	96.045440	95.901030	95.773710
95.661960	95.564420	95.479640	95.406400	95.343350
95.289400	95.243440	95.204440	95.171540	95.143950
95.120940	95.101840	95.086090	95.073090	95.062410
95.053740	95.046720	95.041110	95.036530	95.032930

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95.030060	95.027740	95.025910	95.024440	95.023350
95.022490	95.021820	95.021330	95.020900	95.020540
95.020230	95.020050	95.019870	95.019740	95.019680

CCN 1
CCN: N-1, F88

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P. Tigeri 12-12-92
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SONGS 2 DISTRIBUTION ROOM 310B - SBO

Time = 2 Hours 0 Minutes .00000 Seconds (7200.0000 Seconds) (Calc. Time Step = 3.000E+01 seconds)

	Compartment	Temp. (Deg F)	S-Heat/ Quality	Rel. Hum.	Pressures (psia) Total	Air	Steam	K	Total Mass (lbm)	Frac. Air	Frac. Vapor	Heat Load	Total Energy (BTU)
0	Atmosphere	95.000		.50	14.700	14.292	.408	1.40		.9825	.0175		
1	ROOM 310B	119.299	44.3 S	.26	15.344	14.918	.426	1.40	3.0936940E+02	.9825	.0175	5.46	3.6036090E+04

Compartments Initial Energy	3.4718E+04 BTU	Compartments Initial Mass	3.0937E+02 lbm
Current Energy in Compartments	3.6036E+04 BTU	Current Mass in Compartments	3.0937E+02 lbm
Blowdown Enthalpy Added	0.0000E+00 BTU	Blowdown Mass Added	0.0000E+00 lbm
Irreversible Energy Loss	-3.5027E+03 BTU	(Condens. + Dropout) Mass Loss	0.0000E+00 lbm
Energy Lost to Atmosphere	2.1843E+03 BTU	Mass Lost to Atmosphere	0.0000E+00 lbm
[Rate of Energy Loss to Atmosphere	8.0127E-01 BTU/sec]	[Rate of Mass Loss to Atmosphere	0.0000E+00 lbm/sec]
Absolute Energy Imbalance	3.4668E-02 BTU	Absolute Mass Imbalance	0.0000E+00 lbm
Relative Energy Imbalance	9.6203E-05 %	Relative Mass Imbalance	0.0000E+00 %

CCN 1

CCN: N-1, P.89

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P. Tigeri 12-12-92
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SONGS 2 DISTRIBUTION ROOM 310B - SBO

Time = 2 Hours 0 Minutes .00000 Seconds (7200.0000 Seconds) (Calc. Time Step = 3.000E+01 seconds)

Heat Sink Calculation Output

HS#	Comp	T	TSAT	TWALL	HCOND	HCONV	AREA	QCOND	QCONV	QSENS	QTOT	HS#
1 Left	1	119.299	75.003	106.493	.000	1.470	342.0	0.000000E+00	-1.791874E+00	0.000000E+00	-1.791874E+00	1
1 Right	0	95.000	*******	97.183	.000	1.470	342.0	0.000000E+00	3.029273E-01	0.000000E+00	3.029273E-01	1
2 Left	1	119.299	75.003	106.915	.000	1.470	342.0	0.000000E+00	-1.733087E+00	0.000000E+00	-1.733087E+00	2
2 Right	0	95.000	*******	98.585	.000	1.470	342.0	0.000000E+00	4.983384E-01	0.000000E+00	4.983384E-01	2
3 Left	1	119.299	75.003	101.944	.000	1.470	266.9	0.000000E+00	-1.893604E+00	0.000000E+00	-1.893604E+00	3

ECN 1
CCN: N-1, P. 90

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P. Tigeri 12-12.92
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SONGS 2 DISTRIBUTION ROOM 3108 - SBO

Time = 2 Hours 0 Minutes .00000 Seconds (7200.0000 Seconds) (Calc. Time Step = 3.000E+01 seconds)

Extended Heatsink Output: Node Temperatures

Heat Sink No. 1, NORTH WALL(PLASTER)

106.492600	106.126000	105.767200	105.416400	105.073500
104.738400	104.411400	104.092200	103.780800	103.477300
103.181600	102.893800	102.613600	102.341200	102.076500
101.819400	101.569800	101.327700	101.093000	100.865700
100.645700	100.432800	100.227100	100.028500	99.836820
99.652010	99.473970	99.302580	99.137850	98.979580
98.827730	98.682160	98.542760	98.409390	98.282070
98.160550	98.044770	97.934600	97.829990	97.730740
97.636750	97.547940	97.464140	97.385220	97.311070
97.241610	97.182950			

Heat Sink No. 2, SOUTH WALL(PLASTER)

106.914700	106.596600	106.284800	105.979000	105.679200
105.385600	105.098100	104.816600	104.541300	104.272100
104.008900	103.751700	103.500600	103.255600	103.016500
102.78[illegible]00	102.556200	102.335100	102.119700	101.910200
101.706500	101.508500	101.316100	101.129400	100.948200
100.772600	100.602400	100.437600	100.278000	100.123700
99.974640	99.830600	99.691560	99.557460	99.428190
99.303680	99.183870	99.068630	98.957860	98.851470
98.749360	98.651460	98.585420		

Heat Sink No. 3, CEILING(CONCRETE)

101.943800	101.455500	100.991100	100.550600	100.133400
99.739040	99.367160	99.017060	98.688200	98.379970
98.091710	97.822720	97.572240	97.339510	97.123750
96.924220	96.740080	96.570590	96.414890	96.272250
96.141820	96.022860	95.914640	95.816440	95.727570
95.647310	95.574980	95.509980	95.451750	95.399750
95.353360	95.312100	95.275540	95.243190	95.214690

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95.189610	95.167690	95.148530	95.131930	95.117520
95.105130	95.094640	95.085720	95.078280	95.072170
95.067350	95.063690	95.061070	95.059540	95.058990

CCN !
CCN: N-1, P. 92

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P. Tigeri 12-12-92
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SONGS 2 DISTRIBUTION ROOM 310B - SBO

Time = 3 Hours 0 Minutes .00000 Seconds (10800.0000 Seconds) (Calc. Time Step = 3.000E+01 seconds)

----- Compartment ----	Temp. (Deg F)	S-Heat/ Quality	Rel. Hum.	-- Pressures (psia) -- Total	Air	Steam	K	Total Mass (lbm)	Frac. Air	Frac. Vapor	Heat Load	Total Energy (BTU)
0 Atmosphere	95.000		.50	14.700	14.292	.408	1.40		.9825	.0175		
1 ROOM 310B	121.765	46.6 S	.24	15.409	14.981	.428	1.40	3.0936940E+02	.9825	.0175	5.46	3.6169870E+04

Compartments Initial Energy	3.4718E+04 BTU	Compartments Initial Mass	3.0937E+02 lbm
Current Energy in Compartments	3.6170E+04 BTU	Current Mass in Compartments	3.0937E+02 lbm
Blowdown Enthalpy Added	0.0000E+00 BTU	Blowdown Mass Added	0.0000E+00 lbm
Irreversible Energy Loss	-7.3820E+03 BTU	(Condens. + Dropout) Mass Loss	0.0000E+00 lbm
Energy Lost to Atmosphere	5.9298E+03 BTU	Mass Lost to Atmosphere	0.0000E+00 lbm
[Rate of Energy Loss to Atmosphere	1.2677E+00 BTU/sec]	[Rate of Mass Loss to Atmosphere	0.0000E+00 lbm/sec]
Absolute Energy Imbalance	4.6387E-02 BTU	Absolute Mass Imbalance	0.0000E+00 lbm
Relative Energy Imbalance	1.2825E-04 %	Relative Mass Imbalance	0.0000E+00 %

CCN 1

CCN: N-1 , P. 93

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CONTROL NO. 05931

CERTIFICATE OF AUTHENTICITY

CONTINUATION

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Southern California Edison

For the MATERIAL & ADMINISTRATIVE SERVICES - CDM/SONGS Department
San Onofre Nuclear Generating Station Design Calculations

This microform file is a complete record of the transaction herein recorded. The documents are arranged on this microform in the following manner:

- ( ) By month in Location and Work Order sequence
- ( ) Alphabetical order by ____
- (X) Numerical order by Design Cal. No.
- ( ) Order of Customer Service Store Number
- ( ) Order of Payroll Location Number
- ( ) Grievance File Number sequence
- ( ) Date order
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The above information is deemed necessary in compliance with the Federal Power Commission Order No. 450 - Regulations to govern the Preservation of Public Utilities and Licensees – issued March 14, 1972. This order has subsequently been approved by the Public Utilities Commission of the State of California on October 29, 1974.

1-20-93
DATE MICROFILMED

AWS BLDG., O-2-P, SONGS
LOCATION

CAMERA OPERATOR

Napoleon C. Vass
AUTHORIZED SIGNATURE
SUPERVISOR MICROGRAPHICS

SCE OSD 9-G REV 7/88

SONGS 2 DISTRIBUTION ROOM 310B - SBO

Time = 3 Hours 0 Minutes .00000 Seconds (10800.0000 Seconds) (Calc. Time Step = 3.000E+01 seconds)

Heat Sink Calculation Output

HS#	Comp	T	TSAT	TWALL	HCOND	HCONV	AREA	QCOND	QCONV	QSENS	QTOT	HS#
1 Left	1	121.765	75.130	109.131	.000	1.470	342.0	0.000000E+00	-1.767147E+00	0.000000E+00	-1.767147E+00	1
1 Right	0	95.000	*******	98.729	.000	1.470	342.0	0.000000E+00	5.190251E-01	0.000600E+00	5.190251E-01	1
2 Left	1	121.765	75.130	109.612	.000	1.470	342.0	0.000000E+00	-1.699939E+00	0.000000E+00	-1.699939E+00	2
2 Right	0	95.000	*******	100.374	.000	1.470	342.0	0.000000E+00	7.486413E-01	0.000000E+00	7.486413E-01	2
3 Left	1	121.765	75.130	103.801	.000	1.470	266.9	0.000000E+00	-1.959607E+00	0.000000E+00	-1.959607E+00	3

CCN 1
CCN: N-1, P.94

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SONGS 2 DISTRIBUTION ROOM 310B - SBO

Time = 3 Hours 0 Minutes .00000 Seconds (10800.0000 Seconds) (Calc. Time Step = 3.000E+01 seconds)

Extended Heatsink Output: Node Temperatures

Heat Sink No. 1, NORTH WALL(PLASTER)

109.130600	108.768200	108.412200	108.062600	107.719500
107.382800	107.052700	106.729000	106.411700	106.100700
105.796200	105.498200	105.206500	104.921100	104.642100
104.369300	104.102800	103.842400	103.588300	103.340200
103.098200	102.862300	102.632300	102.408200	102.190000
101.977500	101.770800	101.569700	101.374200	101.184200
100.999700	100.820500	100.646600	100.478000	100.314500
100.156000	100.002400	99.853730	99.709810	99.570530
99.435820	99.305570	99.179720	99.058140	98.940700
98.827300	98.728610			

Heat Sink No. 2, SOUTH WALL(PLASTER)

109.611800	109.299000	108.991100	108.687800	108.389300
108.095400	107.806300	107.521900	107.242200	106.967200
106.696800	106.431100	106.170100	105.913700	105.661900
105.414700	105.172100	104.934100	104.700500	104.471500
104.246900	104.026800	103.810900	103.599500	103.392200
103.189300	102.990500	102.795900	102.605300	102.418800
102.236200	102.057600	101.882800	101.711800	101.544500
101.381000	101.220900	101.064400	100.911400	100.761700
100.615400	100.472300	100.373900		

Heat Sink No. 3, CEILING(CONCRETE)

103.801200	103.293400	102.806000	102.338800	101.891500
101.463900	101.055600	100.666400	100.295700	99.943330
99.608730	99.291530	98.991180	98.707180	98.439120
98.186430	97.948580	97.725070	97.515290	97.318760
97.134860	96.963170	96.803130	96.654140	96.515660
96.387180	96.268160	96.158170	96.056730	95.963290
95.877470	95.798800	95.726840	95.661160	95.601410

CCN 1

CCN: N-1 , P. 95

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95.547270	95.498380	95.454380	95.414950	95.379850
95.348910	95.321810	95.298370	95.278410	95.261810
95.248320	95.237950	95.230560	95.226100	95.224640

CCN 1

CCN: N-1, P. 96

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SONGS 2 DISTRIBUTION ROOM 310B - SBO

Time = 4 Hours 0 Minutes .00000 Seconds (14400.0000 Seconds) (Calc. Time Step = 3.000E+01 seconds)

----- Compartment ----		Temp. (Deg F)	S-Heat/ Quality	Rel. Hum.	-- Pressures (psia) -- Total	Air	Steam	K	Total Mass (lbm)	Frac. Air	Frac. Vapor	Heat Load	Total Energy (BTU)
0	Atmosphere	95.000		.50	14.700	14.292	.408	1.40		.9825	.0175		
1	ROOM 310B	123.777	45.5 S	.23	15.463	15.033	.430	1.40	3.0936940E+02	.9825	.0175	5.46	3.6279050E+04

Compartments Initial Energy	3.4718E+04 BTU	Compartments Initial Mass	3.0937E+02 lbm
Current Energy in Compartments	3.6279E+04 BTU	Current Mass in Compartments	3.0937E+02 lbm
Blowdown Enthalpy Added	0.0000E+00 BTU	Blowdown Mass Added	0.0000E+00 lbm
Irreversible Energy Loss	-1.2753E+04 BTU	(Condens. + Dropout) Mass Loss	0.0000E+00 lbm
Energy Lost to Atmosphere	1.1192E+04 BTU	Mass Lost to Atmosphere	0.0000E+00 lbm
[Rate of Energy Loss to Atmosphere	1.6454E+00 BTU/sec]	[Rate of Mass Loss to Atmosphere	0.0000E+00 lbm/sec]
Absolute Energy Imbalance	2.8320E-02 BTU	Absolute Mass Imbalance	0.0000E+00 lbm
Relative Energy Imbalance	7.8062E-05 %	Relative Mass Imbalance	0.0000E+00 %

CCN 1
CCN: N-1, P. 97

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SONGS 2 DISTRIBUTION ROOM 310B - SBO

Time = 4 Hours 0 Minutes .00000 Seconds (14400.0000 Seconds) (Calc. Time Step = 3.000E+01 seconds)

Heat Sink Calculation Output

HS#	Comp	T	TSAT	TWALL	HCOND	HCONV	AREA	QCOND	QCONV	QSENS	QTOT	HS#
1 Left	1	123.777	75.233	111.303	.000	1.470	342.0	0.000000E+00	-1.744219E+00	0.000000E+00	-1.744219E+00	1
1 Right	0	95.000	*******	100.045	.000	1.470	342.0	0.000000E+00	7.031851E-01	0.000000E+00	7.031851E-01	1
2 Left	1	123.777	75.233	111.729	.000	1.470	342.0	0.000000E+00	-1.684733E+00	0.000000E+00	-1.684733E+00	2
2 Right	0	95.000	*******	101.757	.000	1.470	342.0	0.000000E+00	9.421943E-01	0.000000E+00	9.421943E-01	2
3 Left	1	123.777	75.233	105.409	.000	1.470	266.9	0.000000E+00	-2.003496E+00	0.000000E+00	-2.003496E+00	3

CCN 1
CCN: N-1, P 98

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SONGS 2 DISTRIBUTION ROOM 3108 - SBO

Time = 4 Hours 0 Minutes .00009 Seconds (14400.0000 Seconds) (Calc. Time Step = 3.000E+01 seconds)

Extended Heatsink Output: Node Temperatures

Heat Sink No. 1, NORTH WALL(PLASTER)

111.303500	110.945200	110.592200	110.244500	109.902200
109.565300	109.233700	108.907500	108.586600	108.271000
107.960800	107.656000	107.356400	107.062000	106.772900
106.489000	106.210400	105.936900	105.668500	105.405200
105.147000	104.893800	104.645500	104.402300	104.163800
103.930300	103.701400	103.477300	103.257900	103.043100
102.832900	102.627200	102.425900	102.228900	102.036200
101.847700	101.663400	101.483200	101.306900	101.134600
100.966100	100.801400	100.640300	100.482800	100.328800
100.178100	100.045400			

Heat Sink No. 2, SOUTH WALL(PLASTER)

111.728600	111.418100	111.111400	110.808300	110.509000
110.213400	109.921500	109.633300	109.348800	109.068000
108.790800	108.517300	108.247500	107.981200	107.718600
107.459600	107.204100	106.952300	106.703900	106.459100
106.217700	105.979700	105.745100	105.513900	105.286100
105.061500	104.840200	104.622100	104.407200	104.195400
103.986700	103.781000	103.578300	103.378600	103.181700
102.987700	102.796500	102.608000	102.422200	102.239000
102.058400	101.880200	101.757600		

Heat Sink No. 3, CEILING(CONCRETE)

105.408800	104.888200	104.385500	103.900600	103.433400
102.983900	102.551500	102.136200	101.737800	101.355900
100.990200	100.640400	100.306200	99.987340	99.683320
99.393890	99.118560	98.857030	98.608860	98.373690
98.151090	97.940700	97.742100	97.554840	97.378570
97.212860	97.057400	96.911710	96.775420	96.648220
96.529690	96.419530	96.317410	96.222870	96.135770

CCN1
CCN: N-1, P.99

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96.055760	95.982510	95.915740	95.855260	95.800870
95.752290	95.709320	95.671840	95.639620	95.612640
95.590670	95.573700	95.561550	95.554290	95.551850

CCN 1
CCN: N-1, P.100

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SONGS 2 DISTRIBUTION ROOM 310B - SBO

MAXIMUM AND MINIMUM PRESSURES AND TEMPERATURES

		Maximum				Minimum			
Compartment		(psia) Pressure	(sec) at Time	(deg. F) Temperature	(sec) at Time	(psia) Pressure	(sec) at Time	(deg. F) Temperature	(sec) at Time
1	ROOM 310B	15.4627	1.4400E+04	123.777	1.4400E+04	14.7000	1.0000E-02	95.000	.0000

685 Calculation cycles were performed

==> Execution time: 00:01:14.97

CCN1

CCN: N-1, P.101

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CALCULATION SHEET

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PRELIM. CCN NO.	N/-1
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CCN CONVERSION	
CCN NO. CCN-	

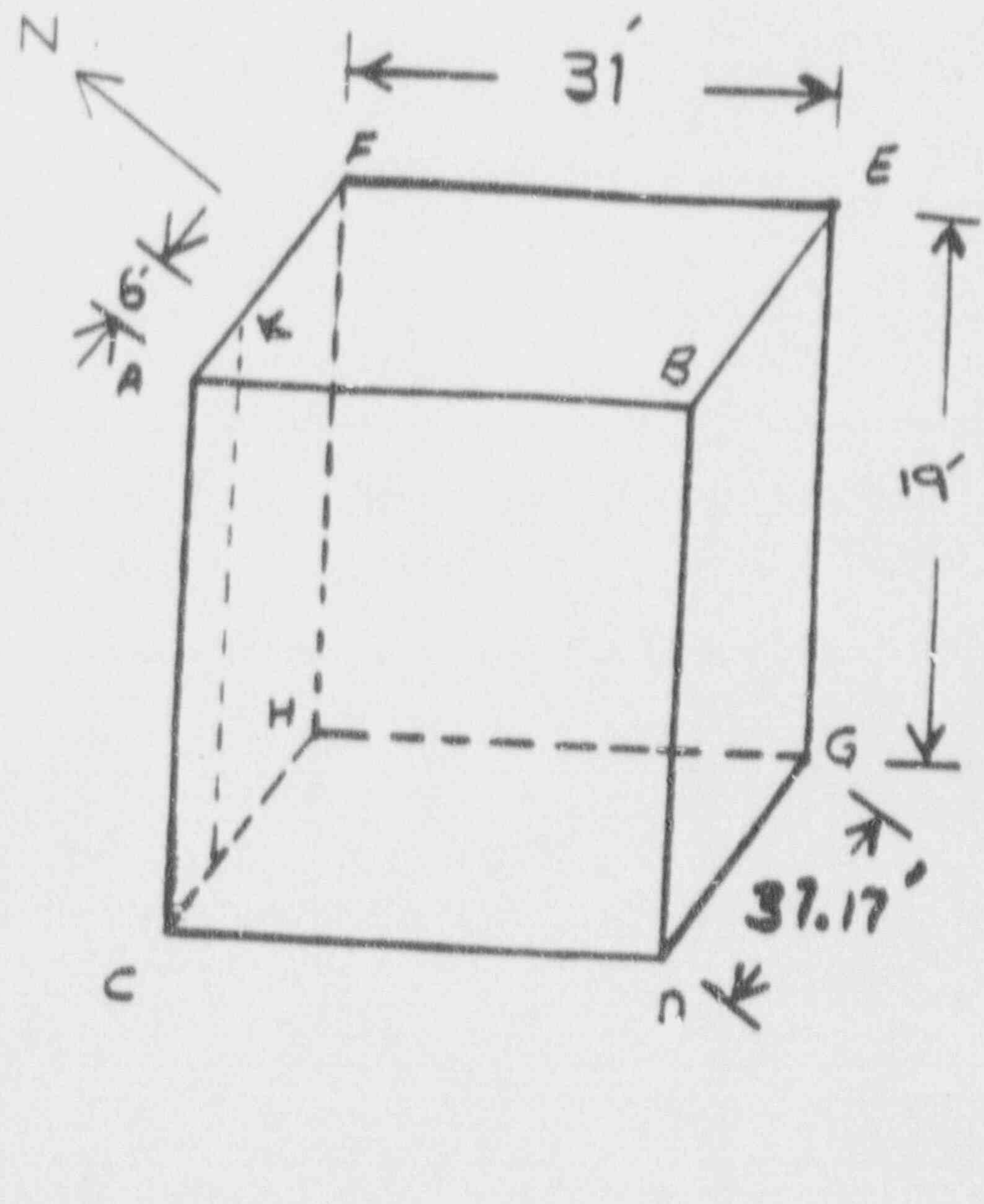
Project or DCP/MMP SONGS 2/3 Calc No. M73-116

Subject Room Temperature Response During SBO Sheet No. 102

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
2	P. TIGERI	10/15	[illegible]	11/2/92					

8.3 COMPUTER ROOM 232

(Ref. # 6.8.1)



8.3 Computer Room 232 Temperature Rise Analysis.

The results of the heat load analyses of Cabinet Area Room 229 (Section 8.5) and Computer Room 232 are as follow:

ROOM NAME	Normal room temperature period to SBO (°F)	ROOM TEMP. AFTER 4 Hr. SBO (°F)
COMPUTER ROOM 232	72	112.223
CONTROL ROOM CABINET AREA (ROOM 229)	75	105.281

Conclusion:

Based on the temperature rise analyses of the Computer Room 232 and the Cabinet Area Room 229 it can be concluded that the Computer Room heat load has no affect on the temperature rise in the Cabinet Area because the ambient temperature for both rooms after 4 hours of the SBO is below the design limit (120 °F).

Input data summary used for Computer Room 232 Temperature Rise Analysis.

Q = 26.48 BTU/S (Ref. #6.7)
V = 17,380 ft^3 (see assumption 3.17)

Heat Sink	K_e BTU/hr-ft·F	ρ_e lbm/ft^3	Cp_e BTU/lbm-°F	A (ft^2)	t (ft)	Ti (°F)
North wall Plaster	0.567	15.337	0.738	114.0	0.417	72
North wall Concrete	1.04	143.6	0.21	592.23	2.0	72
South wall Plaster	0.567	15.337	0.738	706.23	0.417	72
West wall Plaster	0.23	23.224	0.516	589.0	0.626	72
Ceiling Concrete	1.04	143.6	0.21	1152	1.00	72

See data below for the reference to the above table.

CALCULATION SHEET

~~ICCN NO.~~ PRELIM. CCN NO. N-1	PAGE 104 OF

Project or DCP/MMP SONGS 2/3 Calc No. M73-116

CCN CONVERSION
CCN NO. CCN - 1

Subject Room Temperature Response During Station Blackout (SBO) Sheet No. 104

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
0	PARVIZ TIGERI	10/15		12/17/92					

CALCULATION FOR COMPUTER ROOM 232; UNIT 2

EF := 31.0 ft (Ref. # 6.8.1)

BE := 37.17 ft (Ref. # 6.8.1)

AB := 31.0 ft (Ref. # 6.8.1)

KF := 31.17 ft (Ref. # 6.8.1)

AK := 6.0 ft (Ref. # 6.8.1)

hr := GE ▫

GE := 19.0 ft (Ref. # 6.8.4)

$Q := 27.94 \cdot 10^{3}$ W (Ref. # 6.7)

$Q := 27.94 \cdot 10.^{3} \cdot \frac{3.4121}{3600}$

Q = 26.482 BTU/S

CALCULATION OF THE WALLS(SOUTH, EAST, AND WEST) AREA

As := BE·GE As = 706.23 ft^2

Ae := AB·GE Ae = 589 ft^2

Aw := AB·GE Aw = 589 ft^2

AREA OF THE NORTH WALL

Ap := AK·GE Ap = 114 ft^2

Ac := KF·GE Ac = 592.23 ft^2

AREA OF THE CEILING

Ace := BE·AB

$Ace = 1.152 \cdot 10^{3}$ ft^2

CALCULATION SHEET

~~CCN NO.~~ PRELIM. CCN NO. N-1	PAGE 105 OF
CCN CONVERSION CCN NO. CCN - 1	

Project or DCP/MMP SONGS 2/3 Calc No. M73-116

Subject Room Temperature Response During Station Blackout (SBO) Sheet No. 105

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
2	PARVIZ TIGERI	10/15		11/22/94					

CALCULATION OF PROPERTIES FOR COMPOSITE WALL(PLASTER WALL)

NORTH WALL

$tp := 0.0625$ ft (Ref. # 6.8.1)

$tair := 0.292$ ft (Ref. # 6.2)

$tT := 2 \cdot tp + tair$

$tT = 0.417$ ft

$k_p := 0.25$ BTU/(hr-ft-F) (Ref. # 6.17)

$\rho_p := 51.0$ lbm/ft^3 (Ref. # 6.17)

$Cp_p := 0.74$ BTU/(lbm-F) (Ref. # 6.17)

$k_{air} := 1.24$ BTU/(hr-ft-F) (see section 8.8) △

$\rho_{air} := 0.07$ lbm/ft^3 (Ref. # 6.2)

$Cp_{air} := 0.24$ BTU/(lbm-F) (Ref. # 6.2)

$$Ke := \frac{tT}{2 \cdot \frac{tp}{k_p} + \frac{tair}{k_{air}}}$$ $Ke = 0.567$ BTU/(hr-ft-F)

$$\rho e := \frac{\left[2 \cdot tp \cdot \rho_p\right] + \left[tair \cdot \rho_{air}\right]}{tT}$$ $\rho e = 15.337$ lbm/ft^3

$$Cpe := \frac{\left[2 \cdot tp \cdot \rho_p \cdot Cp_p\right] + \left[tair \cdot \rho_{air} \cdot Cp_{air}\right]}{\left[2 \cdot tp \cdot \rho_p\right] + \left[tair \cdot \rho_{air}\right]}$$

$Cpe = 0.738$ BTU/(lbm-F)

CALCULATION SHEET

~~ICCN NO.~~ PRELIM. CCN NO. N-1	PAGE 106 OF

Project or DCP/MMP SONGS 2/3 Calc No. M73-116

CCN CONVERSION
CCN NO. CCN - 1

Subject Room Temperature Response During Station Blackout (SBO) Sheet No. 106

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
1	PARVIZ TIGERI	10/15		11/23/92					

SOUTH WALL

$tp := 0.0625$ ft (Ref. # 6.8.1)

$tair := 0.292$ ft (Ref. # 6.2)

$tT := 0.417$ ft

$$Ke := \frac{tT}{2\cdot\frac{tp}{k_p} + \frac{tair}{k_{air}}}$$

$Ke = 0.567$ BTU/(hr-ft-F)

$$\rho e := \frac{\left[2\cdot tp\cdot\rho_p\right] + \left[tair\cdot\rho_{air}\right]}{tT}$$

$\rho e = 15.337$ lbm/ft^3

$$Cpe := \frac{\left[2\cdot tp\cdot\rho_p\cdot Cp_p\right] + \left[tair\cdot\rho_{air}\cdot Cp_{air}\right]}{\left[2\cdot tp\cdot\rho_p\right] + \left[tair\cdot\rho_{air}\right]}$$

$Cpe = 0.738$ BTU/(lbm-F)

$\triangle$

CALCULATION SHEET

~~ICCN NO.~~/ PRELIM. CCN NO. N-1	PAGE 107 OF

CCN CONVERSION CCN NO. CCN - 1

Project or DCP/MMP SONGS 2/3 Calc No. M73-116

Subject Room Temperature Response During Station Blackout (SBO) Sheet No. 107

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
1	PARVIZ TIGERI	12/15		12/…					

WEST WALL

$tp := 0.0833$ ft (Ref. # 6.8.1)

$tair := 0.292$ ft (Ref. # 6.2)

$tin := 0.167$ ft

$tT := 2 \cdot tp + tair + tin$ ft

$tT = 0.626$ ft

$k_{in} := 0.092$ BTU/(hr-ft-F) (Ref. # 6.11)

$\rho_{in} := 36.0$ lbm/ft^3 (Ref. # 6.11)

$Cp_{in} := 0.2$ BTU/(lbm-F) (Ref. # 6.11)

$$Ke := \frac{tT}{2 \cdot \frac{tp}{k_p} + \frac{tair}{k_{air}} + \frac{tin}{k_{in}}}$$

$Ke = 0.23$ BTU/(hr-ft-F)

$$\rho e := \frac{\left[2 \cdot tp \cdot \rho_p\right] + \left[tair \cdot \rho_{air}\right] + \left[tin \cdot \rho_{in}\right]}{tT}$$

$\rho e = 23.224$ lbm/ft^3

$$Cpe := \frac{\left[2 \cdot tp \cdot \rho_p \cdot Cp_p\right] + \left[tair \cdot \rho_{air} \cdot Cp_{air}\right] + \left[tin \cdot \rho_{in} \cdot Cp_{in}\right]}{\left[2 \cdot tp \cdot \rho_p\right] + \left[tair \cdot \rho_{air}\right] + \left[tin \cdot \rho_{in}\right]}$$

$Cpe = 0.516$ BTU/(lbm-F)

```
SONGS UNITS 2 COMPUTER ROOM 232 - SBO
0.00
ROOM 232
14.7     17380.0     72.0    0.50    1.00
0.0000    0.0000    0.0000 1 0
0.0000         26.48
28800          26.48
@EOF
0.0000  0.0000
@EOF
0  0    000.00    000.00    000.00    000.00      000.00 1
@EOF
0    000.00    000.00    000.00    000.00 1
@EOF
0  0       1.00   0.60   0.60     0.00 0
@EOF
0.0000      0.0000      0.0000
1.0E6       0.0         0.0
@EOF
1               1.00
@EOF
0.0000      14.70       75          0.50
1.e20       14.70       75          0.50
@EOF
                NORTH WALL(PLASTER)
3      114.0       0.417        0.01  1.00
1         0 1 4
0.000           1.47
1.E6            1.47
@EOF
0          0
0.000           1.47
1.0E6           1.47
@EOF
     0.567    15.337      0.738
                NORTH WALL(CONCRETE)
3      592.23       2.00        0.01  1.00
1         0 1 4
0.000           1.47
1.E6            1.47
@EOF
0       0.00
0.000           1.47
1.E6            1.47
@EOF
     1.04     143.6      0.21
                WEST WALL(PLASTER)
3      589.0      0.626        0.01  1.00
1         0 1 4
0.000           1.47
1.E6            1.47
@EOF
0       0.00
0.000           1.47
1.E6            1.47
```

CCN 1
CCN: N-1, P.108

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Sheet 108

```
@EOF
      0.23     23.224      0.516
                    CEILING(CONCRETE)
3     1152.00        1.00        0.01  1.00
 1        0 1 1
 0.000          1.47
 1.E6           1.47
@EOF
      1.04      143.6       0.21
                  SOUTH WALL(PLASTER)
3      706.23       0.417       0.01  1.00
 1        0 1 4
 0.000          1.47
 1.E6           1.47
@EOF
  0       0.00
 0.000          1.47
 1.E6           1.47
@EOF
     0.567     15.337      0.738
@EOF
 0 1 0 0 0 1 0 0 0 0
@EOF
      14400 1    0 0    1 0   25    1.E20    0.001  500
 0.01           1.0
 0.10           10.0
 1.00           20.0
 10.00          100.0
 25.00          36000.0
@EOF
 3600.0         28800.0
@EOF
```

CCN 1
CCN: N-1, P. 109

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SONGS UNITS 2 COMPUTER ROOM 232 SBO

* * * PCFLUD 3.7 * * *

> Thermofluid Dynamics for a System of Interconnected Compartments <

MAP-120

[] [] []

Release Record

Date	Version	Description of Changes
3/25/85	1.00	Original PC version
8/25/86	2.00	Air-only version (SF)
1/06/87	3.00	Added SIGFLO routine
6/02/88	3.10	Modified for new compiler
2/06/90	3.61	61 Compartment version
5/21/91	3.7	Automatic zero reverse flow

CCN 1
CCN: N-1, P. 110

INPUT file name: b:r232.inp

OUTPUT file name: b:r232.OUT

PLOT file name: b:r232.PLT

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SONGS UNITS [illegible] OOM 232 - SBO

COMPARTMENT INITIAL CONDITIONS

Compartment	Description	Volume (ft**3)	Temperature (Degrees F)	Pressure (psia)	Rel. Humidity (Fraction)	Flow to Compartments (0 = Atmosphere)
0	Atmosphere		75.00	14.7000	.50	
1	ROOM 232	1.7380E+04	72.00	14.7000	.50	

CCN 1
CCN: N-1, P.111

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[illegible] 12-22-92
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SONGS UNITS 2 COMPUTER ROOM 232 - SBO

COMPARTMENT AUXILIARY CONDITIONS

Compartment	Compartment Desc.	Air Cooler Constant (BTU/sec-deg)	Air Cooler Temperatures Water (F)	Start (F)	Equipment Heat Load Options	Leakage Constants Rate(CFM)	@ Press.(in. H2O)
1	ROOM 232	.000	.0	.0	1, 0	.00000	.0000

COMPARTMENT HEAT LOAD

Compartment 1

Time (seconds)	Heat Load (BTU/sec)
.00	26.48
28800.00	26.48

CCN 1
CCN: N-1, P. 112

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SONGS UNITS 2 COMPUTER ROOM 232 - SBO

FLOW PATH DATA

Compartment From	Compartment To	Flow Area (ft**2)	Flow Coefficients Forward	Flow Coefficients Reverse	Set Pressure (psid)	Valve Setpoint Pressure (psid)	Valve Setpoint Temperature (F)
0	0	1.0	.600	.600	.0000		

CCN 1
CCN: N-1, P. 113

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SONGS UNITS 2 COMPUTER ROOM 232 - SBO

BLOWDOWN DATA

Time (sec)	Flowrate (lbm/sec)	Enthalpy (BTU/lbm)
.00000	.00000	.00000
1.00000E+06	.00000	.00000

SPLIT OF BLOWDOWN DATA

Compartment	Fraction of Blowdown
1	1.00000

ATMOSPHERIC DATA

Time (sec)	Temp(deg.F)	Pressure(psia)	Relative Humidity
.00000	75.000	14.700	.50000
1.00000E+20	75.000	14.700	.50000

CCN 1
CCN: N-1 , P. 114

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SONGS UNITS 2 COMPUTER ROOM 232 - SBO

Heat Sink Number 1: NORTH WALL(PLASTER)

CONVECTIVE HEAT TRANSFER PARAMETERS

Slab Material	User-Defined
Slab Thickness	.417 ft
Surface Area	114.00 ft**2
Thermal Conductivity	.567 BTU/hr-ft-deg. F
Density	15.337 lbm/ft**3
Thermal Diffusivity	.050 ft**2/hr
Heat Capacity	.738 BTU/lbm-deg. F
First Node Thickness	.01000 ft
Node Thickness Ratio	1.00
Number of Nodes	43
External Boundary Condition	Convective
External Heat Transfer Coefficient	Uchida
Outside Environment Index	0
Inside Environment Index	1
Interior Heat Transfer Coefficient	Uchida

CCN 1

CCN: N-1, P.115

TABLE OF EXTERNAL HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

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I.S. 1-27-92

TABLE OF INTERIOR HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

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TABLE OF HEAT SINK MESH POINT COORDINATES (feet)

.000000	.010000	.020000	.030000	.040000	.050000	.060000	.070000	.080000	.090000

.100000	.110000	.120000	.130000	.140000	.150000	.160000	.170000	.180000	.190000
.200000	.210000	.220000	.230000	.240000	.250000	.260000	.270000	.280000	.290000
.300000	.310000	.320000	.330000	.340000	.350000	.360000	.370000	.380000	.390000
.400000	.410000	.417000							

CCN1
CCN: N-1 , P. 116

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SONGS UNITS 2 COMPUTER ROOM 232 - SBO

Heat Sink Number 2: NORTH WALL(CONCRETE)

CONVECTIVE HEAT TRANSFER PARAMETERS

Slab Material	User-Defined
Slab Thickness	2.000 ft
Surface Area	592.23 ft**2
Thermal Conductivity	1.040 BTU/hr-ft-deg. F
Density	143.600 lbm/ft**3
Thermal Diffusivity	.034 ft**2/hr
Heat Capacity	.210 BTU/lbm-deg. F
First Node Thickness	.04082 ft
Node Thickness Ratio	1.00
Number of Nodes	50
External Boundary Condition	Convective
External Heat Transfer Coefficient	Uchida
Outside Environment Index	0
Inside Environment Index	1
Interior Heat Transfer Coefficient	Uchida

CCN 1
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TABLE OF EXTERNAL HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

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TABLE OF INTERIOR HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

TABLE OF HEAT SINK MESH POINT COORDINATES (feet)

.000000	.040816	.081633	.122449	.163265	.204082	.244898	.285714	.326531	.367347

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.408163	.448980	.489796	.530612	.571429	.612245	.653061	.693878	.734694	.775510
.816326	.857143	.897959	.938775	.979592	1.020408	1.061224	1.102041	1.142857	1.183673
1.224490	1.265306	1.306122	1.346938	1.387755	1.428571	1.469387	1.510204	1.551020	1.591836
1.632653	1.673469	1.714285	1.755102	1.795918	1.836734	1.877550	1.918367	1.959183	2.000000

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SONGS UNITS 2 COMPUTER ROOM 232 - SBO

Heat Sink Number 3: WEST WALL(PLASTER)

CONVECTIVE HEAT TRANSFER PARAMETERS

Slab Material	User-Defined
Slab Thickness	.626 ft
Surface Area	589.00 ft**2
Thermal Conductivity	.230 BTU/hr-ft-deg. F
Density	23.224 lbm/ft**3
Thermal Diffusivity	.019 ft**2/hr
Heat Capacity	.516 BTU/lbm-deg. F
First Node Thickness	.01278 ft
Node Thickness Ratio	1.00
Number of Nodes	50
External Boundary Condition	Convective
External Heat Transfer Coefficient	Uchida
Outside Environment Index	0
Inside Environment Index	1
Interior Heat Transfer Coefficient	Uchida

CCN 1
CCN: N-1, P. 119

TABLE OF EXTERNAL HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

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TABLE OF INTERIOR HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

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TABLE OF HEAT SINK MESH POINT COORDINATES (feet)

.000000	.012776	.025551	.038327	.051102	.063878	.076653	.089429	.102204	.114980	
	10									

.127755	.140531	.153306	.166082	.178857	.191633	.204408	.217184	.229959	.242735
.255510	.268286	.281061	.293837	.306612	.319388	.332163	.344939	.357714	.370490
.383265	.396041	.408816	.421592	.434367	.447143	.459918	.472694	.485469	.498245
.511020	.523796	.536571	.549347	.562122	.574898	.587673	.600449	.613224	.626000

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SONGS UNITS 2 COMPUTER ROOM 232 - SBO

Heat Sink Number 5: SOUTH WALL(PLASTER)

CONVECTIVE HEAT TRANSFER PARAMETERS

Slab Material	User-Defined
Slab Thickness	.417 ft
Surface Area	706.23 ft**2
Thermal Conductivity	.567 BTU/hr-ft-deg. F
Density	15.337 lbm/ft**3
Thermal Diffusivity	.050 ft**2/hr
Heat Capacity	.738 BTU/lbm-deg. F
First Node Thickness	.01000 ft
Node Thickness Ratio	1.00
Number of Nodes	43
External Boundary Condition	Convective
External Heat Transfer Coefficient	Uchida
Outside Environment Index	0
Inside Environment Index	1
Interior Heat Transfer Coefficient	Uchida

CCN/
CCN: N-1, P. 122

TABLE OF EXTERNAL HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

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TABLE OF INTERIOR HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

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TABLE OF HEAT SINK MESH POINT COORDINATES (feet)

.000000	.010000	.020000	.030000	.040000	.050000	.060000	.070000	.080000	.090000

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S. , UNITS 2 COMPUTER ROOM 2?? - SBO

Heat Sink Number 4: CEILING(CONCRETE)

CONVECTIVE HEAT TRANSFER PARAMETERS

Slab Material	User-Defined
Slab Thickness	1.000 ft
Surface Area	1152.00 ft**2
Thermal Conductivity	1.040 BTU/hr-ft-deg. F
Density	143.600 lbm/ft**3
Thermal Diffusivity	.034 ft**2/hr
Heat Capacity	.210 BTU/ibm-deg. F
First Node Thickness	.02041 ft
Node Thickness Ratio	1.00
Number of Nodes	50
External Boundary Condition	Adiabatic
Inside Environment Index	1
Interior Heat Transfer Coefficient	Uchida

CCN 1

CCN: N-1, P. 121

TABLE OF INTERIOR HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

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TABLE OF HEAT SINK MESH POINT COORDINATES (feet)

.000000	.020408	.040816	.061224	.081633	.102041	.122449	.142857	.163265	.183673
.204082	.224490	.244898	.265306	.285714	.306122	.326531	.346939	.367347	.387755
.408163	.428571	.448980	.469388	.489796	.510204	.530612	.551020	.571428	.591837
.612245	.632653	.653061	.673469	.693877	.714286	.734694	.755102	.775510	.795918
.816326	.836734	.857143	.877551	.897959	.918367	.938775	.959183	.979592	1.000000

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.100000	.110000	.120000	.130000	.140000	.150000	.160000	.170000	.180000	.190000
.200000	.210000	.220000	.230000	.240000	.250000	.260000	.270000	.280000	.290000
.300000	.310000	.320000	.330000	.340000	.350000	.360000	.370000	.380000	.390000
.400000	.410000	.417000							

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SONGS UNITS 2 COMPUTER ROOM 232 - SBO

AUXILIARY CONDITIONS SELECTED

Blowout Panels	OFF
Convective Heat Transfer	ON
Unit Air Coolers	OFF
Heating and Ventilation Flow	OFF
Compartment Leakage	OFF
Compartment Equipment Heat Loads	ON
Atmosphere Exhaust Fan	OFF
Blowdown Dropout	OFF
Zero Reverse Flow	OFF
8% Revaporization	OFF

PROBLEM CONTROL PARAMETERS

Problem Time Limit	14400.0 seconds
Flow Calculation Output/Frequency	OFF/ 0
Compartment Pressure Difference Output	OFF
Heat Sink Calculation Output/Frequency	ON/ 1
Extended Heatsink Output: Node Temperatures	ON
Restart Option	OFF
Number of Plot Points	25
SIGFLO Switch Time	1.000000E+20 seconds
SIGFLO Iteration Tolerance	.001000 psi
Maximum Number of Flow Iterations	500

CCN 1

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CALCULATION/PRINT TIMES SELECTED

Calc. Time Step	Change Time	Print Interval	Change Time
1.000E-02	1.000E+00	3.600E+03	2.880E+04
1.000E-01	1.000E+01	0.000E+00	0.000E+00
1.000E+00	2.000E+01	0.000E+00	0.000E+00
1.000E+01	1.000E+02	0.000E+00	0.000E+00
2.500E+01	3.600E+04	0.000E+00	0.000E+00

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SONGS UNITS 2 COMPUTER ROOM 232 - SBO

Time = 0 Hours 0 Minutes .00000 Seconds (.0000 Seconds) (Calc. Time Step = 1.000E-02 seconds)

----- Compartment ----	Temp. (Deg F)	S-Heat/ Quality	Rel. Hum.	-- Pressures (psia) -- Total	Air	Steam	K	Total Mass (lbm)	Frac. Air	Frac. Vapor	Heat Load	Total Energy (BTU)
0 Atmosphere	75.000		.50	14.700	14.485	.215	1.40		.9908	.0092		
1 ROOM 232	72.000	19.1 S	.50	14.700	14.505	.195	1.40	1.2907450E+03	.9917	.0083	26.48	1.2844980E+05

Compartments Initial Energy	1.2845E+05 BTU	Compartments Initial Mass	1.2907E+03 lbm
Current Energy in Compartments	1.2845E+05 BTU	Current Mass in Compartments	1.2907E+03 lbm
Blowdown Enthalpy Added	0.0000E+00 BTU	Blowdown Mass Added	0.0000E+00 lbm
Irreversible Energy Loss	0.0000E+00 BTU	(Condens. + Dropout) Mass Loss	0.0000E+00 lbm
Energy Lost to Atmosphere	0.0000E+00 BTU	Mass Lost to Atmosphere	0.0000E+00 lbm
[Rate of Energy Loss to Atmosphere	0.0000E+00 BTU/sec]	[Rate of Mass Loss to Atmosphere	0.0000E+00 lbm/sec]
Absolute Energy Imbalance	0.0000E+00 BTU	Absolute Mass Imbalance	0.0000E+00 lbm
Relative Energy Imbalance	0.0000E+00 %	Relative Mass Imbalance	0.0000E+00 %

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SONGS UNITS 2 COMPUTER ROOM 232 - SBO

Time = 0 Hours 0 Minutes .00000 Seconds (.0000 Seconds) (Calc. Time Step = 1.000E-02 seconds)

Heat Sink Calculation Output

HS#	Comp	T	TSAT	TWALL	HCOND	HCONV	AREA	QCOND	QCONV	QSENS	QTOT	HS#
1 Left	1	72.000	52.850	73.099	.000	1.000	114.0	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	1
1 Right	0	75.000	*******	73.905	.000	1.000	114.0	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	1
2 Left	1	72.000	52.850	72.764	.000	1.000	592.2	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	2
2 Right	0	75.000	*******	74.235	.000	1.000	592.2	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	2
3 Left	1	72.000	52.850	72.635	.000	1.000	589.0	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	3
3 Right	0	75.000	*******	74.365	.000	1.000	589.0	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	3
4 Left	1	72.000	52.850	72.010	.000	1.000	1152.0	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	4
5 Left	1	72.000	52.850	73.099	.000	1.000	706.2	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	5
5 Right	0	75.000	*******	73.905	.000	1.000	706.2	0.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00	5

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SONGS UNITS 2 COMPUTER ROOM 232 - SBO

Time = 0 Hours 0 Minutes .00000 Seconds (.0000 Seconds) (Calc. Time Step = 1.000E-02 seconds)

Extended Heatsink Output: Node Temperatures

Heat Sink No. 1, NORTH WALL(PLASTER)

73.099270	73.118620	73.138030	73.157380	73.176790
73.196200	73.215550	73.234890	73.254240	73.273650
73.293060	73.312470	73.331880	73.351290	73.370700
73.390110	73.409450	73.428800	73.448150	73.467500
73.486850	73.506200	73.525540	73.544890	73.564180
73.583470	73.602750	73.622040	73.641330	73.660610
73.679900	73.699190	73.718480	73.737760	73.757050
73.776280	73.795560	73.814790	73.834010	73.853240
73.872530	73.891750	73.905240		

CCN 1

CCN: N-1 , P.127

Heat Sink No. 2, NORTH WALL(CONCRETE)

72.764500	72.794460	72.824430	72.854400	72.884370
72.914400	72.944430	72.974460	73.004490	73.034520
73.064540	73.094570	73.124540	73.154510	73.184540
73.214570	73.244600	73.274630	73.304660	73.334690
73.364720	73.394740	73.424840	73.454860	73.484890
73.514920	73.544950	73.574980	73.605010	73.634980
73.664950	73.694920	73.724880	73.754850	73.784820
73.814790	73.844760	73.874730	73.904690	73.934660
73.964690	73.994720	74.024750	74.054780	74.084750
74.114720	74.144740	74.174710	74.204680	74.234710

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Heat Sink No. 3, WEST WALL(PLASTER)

72.634980	72.670260	72.705540	72.740810	72.776150
72.811490	72.846830	72.882170	72.917510	72.952850
72.988250	73.023650	73.059050	73.094390	73.129730
73.165070	73.200410	73.235750	73.271090	73.306430
73.341830	73.377170	73.412510	73.447850	73.483180
73.518460	73.553740	73.589020	73.624300	73 659580
73.694850	73.730130	73.765350	73.800570	73.835780

73.871000	73.906220	73.941440	73.976720	74.011990
74.047270	74.082550	74.117830	74.153110	74.188390
74.223660	74.258940	74.29425[illegible]	74.329560	74.364840

Heat Sink No. 4, CEILING(CONCRETE)

72.009610	72.009860	72.010040	72.010220	72.010410
72.010650	72.010830	72.011020	72.011200	72.011380
72.011510	72.011630	72.011750	72.011870	72.011990
72.012120	72.012180	72.012300	72.012420	72.012540
72.012660	72.012790	72.012910	72.013030	72.013090
72.013210	72.013340	72.013460	72.013520	72.013580
72.013700	72.013760	72.013890	72.013950	72.014010
72.014130	72.014190	72.014250	72.014310	72.014370
72.014430	72.014430	72.014430	72.014430	72.014430
72.014430	72.014430	72.014430	72.014430	72.014430

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P. Tigeri DATE: 12-12-92
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SONGS UNITS 2 COMPUTER ROOM 232 - SBO

Time = 0 Hours 0 Minutes .00000 Seconds (.0000 Seconds) (Calc. Time Step = 1.000E-02 seconds)

Extended Heatsink Output: Node Temperatures

Heat Sink No. 5, SOUTH WALL(PLASTER)

73.099270	73.118620	73.138030	73.157380	73.176790
73.196200	73.215550	73.234890	73.254240	73.273650
73.293060	73.312470	73.331880	73.351290	73.370700
73.390110	73.409450	73.428800	73.448150	73.467500
73.486850	73.506200	73.525540	73.544890	73.564180
73.583470	73.602750	73.622040	73.641330	73.660610
73.679900	73.699190	73.718480	73.737760	73.757050
73.776280	73.795560	73.814790	73.834010	73.853240
73.872530	73.891750	73.905240		

CCN 1

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SONGS UNITS 2 COMPUTER ROOM 232 - SBO

Time = 1 Hours 0 Minutes .00000 Seconds (3600.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

----- Compartment ----	Temp. (Deg F)	S-Heat/ Quality	Rel. Hum.	-- Pressures (psia) -- Total	Air	Steam	K	Total Mass (lbm)	Frac. Air	Frac. Vapor	Heat Load	Total Energy (BTU)
0 Atmosphere	75.000		.50	14.700	14.485	.215	1.40		.9908	.0092		
1 ROOM 232	102.483	48.1 S	.20	15.543	15.337	.206	1.40	1.2907450E+03	.9917	.0083	26.48	1.3529020E+05

Compartments Initial Energy	1.2845E+05 BTU	Compartments Initial Mass	1.2907E+03 lbm
Current Energy in Compartments	1.3529E+05 BTU	Current Mass in Compartments	1.2907E+03 lbm
Blowdown Enthalpy Added	0.0000E+00 BTU	Blowdown Mass Added	0.0000E+00 lbm
Irreversible Energy Loss	-5.2078E+03 BTU	(Condens. + Dropout) Mass Loss	0.0000E+00 lbm
Energy Lost to Atmosphere	-1.6323E+03 BTU	Mass Lost to Atmosphere	0.0000E+00 lbm
[Rate of Energy Loss to Atmosphere	4.4328E-03 BTU/sec]	[Rate of Mass Loss to Atmosphere	0.0000E+00 lbm/sec]
Absolute Energy Imbalance	2.8259E-01 BTU	Absolute Mass Imbalance	0.0000E+00 lbm
Relative Energy Imbalance	2.0888E-04 %	Relative Mass Imbalance	0.0000E+00 %

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SONGS UNITS 2 COMPUTER ROOM 232 - SBO

Time = 1 Hours 0 Minutes .00000 Seconds (3600.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

Heat Sink Calculation Output

HS#	Comp	T	TSAT	TWALL	HCOND	HCONV	AREA	QCOND	QCONV	QSENS	QTOT	HS#
1 Left	1	102.483	54.355	85.019	.000	1.470	114.0	0.000000E+00	-8.149433E-01	0.000000E+00	-8.149433E-01	1
1 Right	0	75.000	*******	75.918	.000	1.470	114.0	0.000000E+00	4.161770E-02	0.000000E+00	4.161770E-02	1
2 Left	1	102.483	54.355	79.384	.000	1.470	592.2	0.000000E+00	-5.592432E+00	0.000000E+00	-5.592432E+00	2
2 Right	0	75.000	*******	74.293	.000	1.470	592.2	0.000000E+00	-1.710385E-01	0.000000E+00	-1.710385E-01	2
3 Left	1	102.483	54.355	87.962	.000	1.470	589.0	0.000000E+00	-3.503783E+00	0.000000E+00	-3.503783E+00	3
3 Right	0	75.000	*******	74.485	.000	1.470	589.0	0.000000E+00	-1.239681E-01	0.000000E+00	-1.239681E-01	3
4 Left	1	102.483	54.355	78.696	.000	1.470	1152.0	0.000000E+00	-1.120240E+01	0.000000E+00	-1.120240E+01	4
5 Left	1	102.483	54.355	85.019	.000	1.470	706.2	0.000000E+00	-5.048573E+00	0.000000E+00	-5.048573E+00	5
5 Right	0	75.000	*******	75.918	.000	1.470	706.2	0.000000E+00	2.578216E-01	0.000000E+00	2.578216E-01	5

CCN'
CCN' N-1, P. 131

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SONGS UNITS 2 COMPUTER ROOM 232 - SBO

Time = 1 Hours 0 Minutes .00000 Seconds (3600.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

Extended Heatsink Output: Node Temperatures

Heat Sink No. 1, NORTH WALL(PLASTER)

85.018770	84.572050	84.137480	83.715060	33.304900
82.907010	82.521330	82.1[illegible]7800	81.786350	81.436980
81.099760	80.774510	80.461150	80.159580	79.869720
79.591520	79.324800	79.069490	78.825410	78.592440
78.370390	78.159150	77.958590	77.768520	77.588780
77.419160	77.259550	77.109710	76.969450	76.838650
76.717070	76.604580	76.500950	76.405980	76.319490
76.241300	76.171230	76.109160	76.054780	76.008030
75.968660	75.936430	75.918060		

Heat Sink No. 2, NORTH WALL(CONCRETE)

79.384430	78.144620	77.084630	76.194850	75.462190
74.871490	74.405550	74.046910	73.778170	73.582860
73.446320	73.355620	73.299900	73.270230	73.259490
73.262360	73.274380	73.292940	73.315640	73.341090
73.368380	73.396700	73.425690	73.455230	73.485020
73.515050	73.544950	73.574980	73.604890	73.634800
73.664890	73.694850	73.724700	73.754490	73.784790
73.814970	73.845370	73.876130	73.907070	73.938450
73.970120	74.002350	74.035370	74.069000	74.103670
74.139250	74.175930	74.213710	74.252840	74.292940

Heat Sink No. 3, WEST WALL(PLASTER)

87.961760	86.804600	85.705350	84.664640	83.682830
82.759740	81.895050	81.088040	80.337680	79.642730
79.001560	78.412450	77.873380	77.382350	76.937040
76.535000	76.173860	75.851040	75.564180	75.310700
75.088100	74.894010	74.726100	74.582000	74.459630
74.356900	74.272000	74.202970	74.148100	74.105930
74.075040	74.054170	74.042080	74.037570	74.039890

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74.048070	74.061370	74.079130	74.100740	74.125640
74.153530	74.183870	74.216400	74.250820	74.286830
74.324310	74.362950	74.402740	74.443510	74.485200

Heat Sink No. 4, CEILING(CONCRETE)

78.695590	78.032560	77.415500	76.843600	76.315890
75.830960	75.387300	74.983310	74.617030	74.286470
73.989530	73.724030	73.487760	73.278530	73.094210
72.932590	72.791530	72.669100	72.563320	72.472440
72.394680	72.328520	72.272550	72.225490	72.186000
72.153170	72.126010	72.103550	72.085170	72.070220
72.058070	72.048250	72.040370	72.034150	72.029210
72.025300	72.022250	72.019870	72.018100	72.016690
72.015720	72.014980	72.014370	72.014010	72.013760
72.013640	72.013700	72.013820	72.013890	72.013890

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SONGS UNITS 2 COMPUTER ROOM 232 - SBO

Time = 1 Hours 0 Minutes .00000 Seconds (3600.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

Extended Heatsink Output: Node Temperatures

Heat Sink No. 5, SOUTH WALL(PLASTER)

85.018770	84.572050	84.137480	83.715060	83.304900
82.907010	82.521330	82.147800	81.786350	81.436980
81.099760	80.774510	80.461150	80.159580	79.869720
79.591520	79.324800	79.069490	78.825410	78.592440
78.370390	78.159150	77.958590	77.768520	77.588780
77.419160	77.259550	77.109710	76.969450	76.838650
76.717070	76.604580	76.500950	76.405980	76.319490
76.241300	76.171230	76.109160	76.054780	76.008030
75.968660	75.936430	75.918060		

CCN1

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SONGS UNITS 2 COMPUTER ROOM 232 - SBO

Time = 2 Hours 0 Minutes .00000 Seconds (7200.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

----- Compartment ----	Temp. (Deg F)	S-Heat/ Quality	Rel. Hum.	-- Pressures (psia) -- Total	Air	Steam	K	Total Mass (lbm)	Frac. Air	Frac. Vapor	Heat Load	Total Energy (BTU)
0 Atmosphere	75.000		.50	14.700	14.485	.215	1.40		.9908	.0092		
1 ROOM 232	106.631	52.1 S	.18	15.657	15.450	.207	1.40	1.2907450E+03	.9917	.0083	26.48	1.3622090E+05

Compartments Initial Energy	1.2845E+05 BTU	Compartments Initial Mass	1.2907E+03 lbm
Current Energy in Compartments	1.3622E+05 BTU	Current Mass in Compartments	1.2907E+03 lbm
Blowdown Enthalpy Added	0.0000E+00 BTU	Blowdown Mass Added	0.0000E+00 lbm
Irreversible Energy Loss	-8.2631E+03 BTU	(Condens. + Dropout) Mass Loss	0.0000E+00 lbm
Energy Lost to Atmosphere	4.9221E+02 BTU	Mass Lost to Atmosphere	0.0000E+00 lbm
[Rate of Energy Loss to Atmosphere	1.1661E+00 BTU/sec]	[Rate of Mass Loss to Atmosphere	0.0000E+00 lbm/sec]
Absolute Energy Imbalance	2.2058E-01 BTU	Absolute Mass Imbalance	0.0000E+00 lbm
Relative Energy Imbalance	1.6193E-04 %	Relative Mass Imbalance	0.0000E+00 %

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SONGS UNITS 2 COMPUTER ROOM 232 - SBO

Time = 2 Hours 0 Minutes .00000 Seconds (7200.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

Heat Sink Calculation Output

HS#	Comp	T	TSAT	TWALL	HCOND	HCONV	AREA	QCOND	QCONV	QSENS	QTOT	HS#
1 Left	1	106.631	54.554	90.005	.000	1.470	114.0	0.000000E+00	-7.753115E-01	0.000000E+00	-7.753115E-01	1
1 Right	0	75.000	*******	79.160	.000	1.470	114.0	0.000000E+00	1.927177E-01	0.000000E+00	1.927177E-01	1
2 Left	1	106.631	54.554	82.606	.000	1.470	592.2	0.000000E+00	-5.814643E+00	0.000000E+00	-5.814643E+00	2
2 Right	0	75.000	*******	74.311	.000	1.470	592.2	0.000000E+00	-1.666105E-01	0.000000E+00	-1.666105E-01	2
3 Left	1	106.631	54.554	93.190	.000	1.470	589.0	0.000000E+00	-3.239758E+00	0.000000E+00	-3.239758E+00	3
3 Right	0	75.000	*******	74.779	.000	1.470	589.0	0.000000E+00	-5.390299E-02	0.000000E+00	-5.390299E-02	3
4 Left	1	106.631	54.554	81.926	.000	1.470	1152.0	0.000000E+00	-1.163017E+01	0.000000E+00	-1.163017E+01	4
5 Left	1	106.631	54.554	90.005	.000	1.470	706.2	0.000000E+00	-4.803055E+00	0.000000E+00	-4.803055E+00	5
5 Right	0	75.000	*******	79.160	.000	1.470	706.2	0.000000E+00	1.193886E+00	0.000000E+00	1.193886E+00	5

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SONGS UNITS 2 COMPUTER ROOM 232 - SBO

Time = 2 Hours 0 Minutes .00000 Seconds (7200.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

Extended Heatsink Output: Node Temperatures

Heat Sink No. 1, NORTH WALL(PLASTER)

90.004850	89.578030	89.159640	88.749660	88.348300
87.955410	87.571140	87.195340	86.828090	86.469330
86.119110	85.777500	85.444310	85.119660	84.803440
84.495640	84.196200	83.905240	83.622530	83.348050
83.081820	82.823700	82.573640	82.331570	82.097440
81.871120	81.652620	81.441740	81.238490	81.042760
80.854400	80.673310	80.499420	80.332550	80.172640
80.019560	79.873140	79.733310	79.599880	79.472810
79.351900	79.236970	79.160060		

Heat Sink No. 2, NORTH WALL(CONCRETE)

82.605870	81.287320	80.101100	79.043180	78.107880
77.288850	76.578700	75.969210	75.451810	75.017610
74.657620	74.363130	74.125890	73.937770	73.791720
73.680940	73.599460	73.542140	73.504360	73.482390
73.472930	73.473300	73.481170	73.494900	73.513090
73.534580	73.558380	73.584080	73.611110	73.639190
73.668000	73.697420	73.727390	73.757720	73.788420
73.819550	73.851040	73.883030	73.915370	73.948210
73.981600	74.015590	74.050080	74.085240	74.121120
74.157750	74.195040	74.233060	74.271820	74.311190

Heat Sink No. 3, WEST WALL(PLASTER)

93.190160	92.110810	91.068150	90.062530	89.094270
88.163480	87.270290	86.414760	85.596710	84.815890
84.071870	83.364350	82.692720	82.056490	81.454930
80.887300	80.352870	79.850680	79.379910	78.939540
78.528590	78.145030	77.790740	77.461760	77.157870
76.878020	76.621060	76.385890	76.171420	75.976590
75.800320	75.641570	75.499240	75.372410	75.260100

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75.161410	75.075410	75.001250	74.936140	74.885280
74.841950	74.807460	74.781160	74.762420	74.750700
74.745390	74.746060	74.752290	74.763520	74.779450

Heat Sink No. 4, CE[illegible]G(CONCRETE)

81.926480	81.230740	80.568510	79.939540	79.343350
78.779450	78.[illegible]7100	77.745760	77.274440	76.837370
76.418610	76.032260	75.672270	75.337680	75[illegible]370
74.740140	74.475010	74.230[illegible]	74.006560	[illegible]0950
73.612950	73.441500	73.285[illegible]	73.[illegible]43890	73.015720
72.899930	72.795680	72.7020[illegible]	72.618070	72.543060
72.476230	72.416780	72.364110	72.317600	72.276580
72.240630	72.209140	72.181670	72.157870	72.137360
72.119720	72.104770	72.092190	72.081760	72.073150
72.066440	72.061310	72.057770	72.055690	72.055020

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SONGS UNITS   COMPUTER ROOM 232 - SBO

Time = 2 Hours 0 Minutes .00000 Seconds (7200.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

Extended Heatsink Output: Node Temperatures

Heat Sink No. 5, SOUTH WALL(PLASTER)

90.004850	89.578030	89.159640	88.749660	88.348300
87.955410	87.571140	87.195340	86.828090	86.469330
86.119110	85.777500	85.444310	85.119660	84.803440
84.495640	84.196260	83.905240	83.622530	83.348050
83.081820	82.823700	82.573640	82.331570	82.097440
81.871120	81.652620	81.441740	81.238490	81.042760
80.854400	80.673310	80.499420	80.332550	80.172640
80.019560	79.873140	79.733310	79.599880	79.472810
79.351900	79.236970	79.169060		

CCN 1

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SONGS UNITS 2 COMPUTER ROOM 232 - SBO

Time = 3 Hours 0 Minutes .00000 Seconds (10800.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

----- Compartment ----	Temp. (Deg F)	S-Heat/ Quality	Rel. Hum.	-- Pressures (psia) -- Total	Air	Steam	* K	Total Mass (lbm)	Frac. Air	Frac. Vapor	Heat Load	Total Energy (BTU)
0 Atmosphere	75.000		.50	14.700	14.485	.215	1.40		.9908	.0092		
1 ROOM 232	109.718	55.0 S	.16	15.743	15.534	.208	1.40	1.2907450E+03	.9917	.0083	26.48	1.3691360E+05

Compartments Initial Energy	1.2845E+05 BTU	Compartments Initial Mass	1.2907E+03 lbm
Current Energy in Compartments	1.3691E+05 BTU	Current Mass in Compartments	1.2907E+03 lbm
Blowdown Enthalpy Added	0.0000E+00 BTU	Blowdown Mass Added	0.0000E+00 lbm
Irreversible Energy Loss	-1.5001E+04 BTU	(Condens. + Dropout) Mass Loss	0.0000E+00 lbm
Energy Lost to Atmosphere	6.5371E+03 BTU	Mass Lost to Atmosphere	0.0000E+00 lbm
[Rate of Energy Loss to Atmosphere	2.1693E+00 BTU/sec]	[Rate of Mass Loss to Atmosphere	0.0000E+00 lbm/sec]
Absolute Energy Imbalance	2.1436E-01 BTU	Absolute Mass Imbalance	0.0000E+00 lbm
Relative Energy Imbalance	1.5656E-04 %	Relative Mass Imbalance	0.0000E+00 %

CCN 1

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SONGS UNITS 2 COMPUTER ROOM 232 - SBO

Time = 3 Hours 0 Minutes .00000 Seconds (10800.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

Heat Sink Calculation Output

HS#	Comp	T	TSAT	TWALL	HCOND	HCONV	AREA	QCOND	QCNV	QSENS	QTOT	HS#
1 Left	1	109.718	54.702	93.661	.000	1.470	114.0	0.000000E+00	-7.484765E-01	0.000000E+00	-7.484765E-01	1
1 Right	0	75.000	*******	81.672	.000	1.470	114.0	0.000000E+00	3.098740E-01	0.000000E+00	3.098740E-01	1
2 Left	1	109.718	54.702	85.139	.000	1.470	592.2	0.000000E+00	-5.947867E+00	0.000000E+00	-5.947867E+00	2
2 Right	0	75.000	*******	74.323	.000	1.470	592.2	0.000000E+00	-1.637470E-01	0.000000E+00	-1.637470E-01	2
3 Left	1	109.718	54.702	96.897	.000	1.470	589.0	0.000000E+00	-3.088912E+00	0.000000E+00	-3.088912E+00	3
3 Right	0	75.000	*******	75.436	.000	1.470	539.0	0.000000E+00	1.034609E-01	0.000000E+00	1.034609E-01	3
4 Left	1	109.718	54.702	84.465	.000	1.470	1152.0	0.000000E+00	-1.188653E+01	0.000000E+00	-1.188653E+01	4
5 Left	1	[illegible]	54.702	93.661	.000	1.470	706.2	0.000000E+00	-4.636812E+00	0.000000E+00	-4.636812E+00	5
5 Right	0	75.000	*******	81.672	.000	1.470	706.2	0.000000E+00	1.919670E+00	0.000000E+00	1.919670E+00	5

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SONGS UNITS 2 COMPUTER ROOM 232 - SBO

Time = 3 Hours 0 Minutes .00000 Seconds (10800.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

Extended Heatsink Output: Node Temperatures

Heat Sink No. 1, NORTH WALL(PLASTER)

93.661100	93.248020	92.841340	92.441010	92.047150
91.659760	91.278780	90.904210	90.536100	90.174350
89.819060	89.470250	89.127780	88.791720	88.462010
88.138640	87.821560	87.510770	87.206270	86.907990
86.615810	86.329740	86.049770	85.775790	85.507780
85.245700	84.989410	84.738920	84.494110	84.254970
84.021390	83.793240	83.570530	83.353120	83.140960
82.933930	82.731900	82.534820	82.342620	82.155180
81.972380	81.794100	81.671970		

Heat Sink No. 2, NORTH WALL(CONCRETE)

85.138580	83.776640	82.525180	81.381680	80.342740
79.404690	78.563080	77.812770	77.148470	76.564300
76.054470	75.612880	75.233490	74.910430	74.637850
74.410310	74.222440	74.069490	73.946870	73.850190
73.776030	73.720860	73.681920	73.656400	73.641940
73.636750	73.639070	73.647550	73.660920	73.678310
73.698940	73.722260	73.747590	73.774630	73.803130
73.832670	73.863370	73.894870	73.927090	73.960050
73.993740	74.027980	74.062840	74.098300	74.134370
74.170930	74.208160	74.245940	74.284270	74.322970

Heat Sink No. 3, WEST WALL(PLASTER)

96.897490	95.864650	94.860020	93.883820	92.936310
92.017610	91.128020	90.267550	89.436130	88.633880
87.860500	87.115940	86.399930	85.712370	85.052830
84.421050	83.816740	83.239410	82.688690	82.163970
81.664890	81.190770	80.741120	80.315340	79.912810
79.532870	79.174840	78.838170	78.522060	78.225920
77.949010	77.690640	77.450100	77.226720	77.019740

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76.828520	76.652370	76.490570	76.342500	76.207430
76.084750	75.973790	75.873870	75.784520	75.705050
75.634860	75.573390	75.520050	75.474270	75.435520

Heat Sink No. 4, CEILING(CONCRETE)

84.465120	83.750700	83.064180	82.405430	81.774080
81.170010	80.592680	80.041720	79.516630	79.016940
78.542080	78.091400	77.664340	77.260280	76.878510
76.518400	76.179170	75.860140	75.560640	75.279820
75.017000	74.771390	74.542330	74.328950	74.130580
73.946500	.3.775970	73.618190	73.472630	73.338590
73.215360	73.102390	72.999050	72.904750	72.819000
72.741180	72.670930	72.607700	72.551120	72.500760
72.456330	72.417450	72.383880	72.355320	72.331510
72.312290	72.297580	72.287200	72.281040	72.278960

CCN 1

CCN: N-1, P. 143

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SONGS UNITS 2 COMPUTER ROOM 232 - SBO

Time = 3 Hours 0 Minutes .00000 Seconds (10800.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

Extended Heatsink Output: Node Temperatures

Heat Sink No. 5, SOUTH WALL(PLASTER)

93.661100	93.248020	92.841340	92.441010	92.047150
91.659760	91.278780	90.904210	90.536100	90.174350
89.819060	89.470250	89.127780	88.791720	88.462010
88.138640	87.821560	87.510770	87.206270	86.907990
86.615810	86.329740	86.049770	85.775790	85.507780
85.245700	84.989410	84.738920	84.494110	84.254970
84.021390	83.793240	83.570530	83.353120	83.140960
82.933930	82.731900	82.534820	82.342620	82.155180
81.972380	81.794100	81.671970		

CCN 1
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SONGS UNITS 2 COMPUTER ROOM 232 - SBO

Time = 4 Hours 0 Minutes .00000 Seconds (14400.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

Compartment		Temp. (Deg F)	S-Heat/ Quality	Rel. Hum.	Pressures (psia) Total	Air	Steam	K	Total Mass (lbm)	Frac. Air	Frac. Vapor	Heat Load	Total Energy (BTU)
0	Atmosphere	75.000		.50	14.700	14.485	.215	1.40		.9908	.0092		
1	ROOM 232	112.223	57.4 S	.15	15.812	15.603	.209	1.40	1.2907450E+03	.9917	.0083	26.48	1.3747590E+05

Compartments Initial Energy	1.2845E+05 BTU	Compartments Initial Mass	1.2907E+03 lbm
Current Energy in Compartments	1.3748E+05 BTU	Current Mass in Compartments	1.2907E+03 lbm
Blowdown Enthalpy Added	0.0000E+00 BTU	Blowdown Mass Added	0.0000E+00 lbm
Irreversible Energy Loss	-2.4907E+04 BTU	(Condens. + Dropout) Mass Loss	0.0000E+00 lbm
Energy Lost to Atmosphere	1.5881E+04 BTU	Mass Lost to Atmosphere	0.0000E+00 lbm
[Rate of Energy Loss to Atmosphere	3.0008E+00 BTU/sec]	[Rate of Mass Loss to Atmosphere	0.0000E+00 lbm/sec]
Absolute Energy Imbalance	2.0920E-01 BTU	Absolute Mass Imbalance	0.0000E+00 lbm
Relative Energy Imbalance	1.4562E-04 %	Relative Mass Imbalance	0.0000E+00 %

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SONGS UNITS 2 COMPUTER ROOM 232 - SBO

Time = 4 Hours 0 Minutes .00000 Seconds (14400.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

Heat Sink Calculation Output

HS#	Comp	T	TSAT	TWALL	HCOND	HCONV	AREA	QCOND	QCONV	QSENS	QTOT	HS#
1 Left	1	112.223	54.821	96.468	.000	1.470	114.0	0.000000E+00	-7.342080E-01	0.000000E+00	-7.342080E-01	1
1 Right	0	75.000	*******	83.566	.000	1.470	114.0	0.000000E+00	3.981980E-01	0.000000E+00	3.981980E-01	1
2 Left	1	112.223	54.821	87.297	.000	1.470	592.2	0.000000E+00	-6.031172E+00	0.000000E+00	-6.031172E+00	2
2 Right	0	75.000	*******	74.333	.000	1.470	592.2	0.000000E+00	-1.613854E-01	0.000000E+00	-1.613854E-01	2
3 Left	1	1.2.223	54.821	99.861	.000	1.470	589.0	0.000000E+00	-2.977685E+00	0.000000E+00	-2.977685E+00	3
3 Right	0	75.000	*******	76.241	.000	1.470	589.0	0.000000E+00	2.971123E-01	0.000000E+00	2.971123E-01	3
4 Left	1	112.223	54.821	86.630	.000	1.470	1152.0	0.000000E+00	-1.204590E+01	0.000000E+00	-1.204590E+01	4
5 Left	1	112.223	54.821	94.468	.000	1.470	706.2	0.000000E+00	-4.548419E+00	0.000000E+00	-4.548419E+00	5
5 Right	0	75.000	*******	8. 566	.000	1.470	706.2	0.000000E+00	2.466836E+00	0.000000E+00	2.466836E+00	5

CCN 1
CCN: N-1, P. 146

M-73-116
2 ~~1~~ 0
P. Tigeri 12-12-92
12-22-92

146 OF

SONGS UNITS 2 COMPUTER ROOM 232 - SBO

Time = 4 Hours 0 Minutes .00000 Seconds (14400.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

Extended Heatsink Output: Node Temperatures

Heat Sink No. 1, NORTH WALL(PLASTER)

96.468290	96.062290	95.661290	95.265230	94.874240
94.488250	94.107210	93.731170	93.360080	92.993870
92.632660	92.276460	91.925140	91.578700	91.237150
90.900480	90.568630	90.241670	89.919460	89.602020
89.289280	88.981170	88.677700	88.378810	88.084500
87.794710	87.509370	87.228360	86.951690	86.679350
86.411220	86.147250	85.887360	85.631560	85.379670
85.131740	84.887660	84.647310	84.410680	84.177580
83.948030	83.721890	83.565640		

Heat Sink No. 2, NORTH WALL(CONCRETE)

87.297450	85.908290	84.615810	83.418240	82.313260
81.298550	80.371000	79.527070	78.762970	78.074860
77.458160	76.908480	76.421360	75.992[illegible]20	75.616490
75.289640	75.[illegible]07480	74.765660	74.560090	74.387050
74.242890	74.124360	74.028290	73.[illegible]51930	73.892610
73.848110	73.816310	73.795500	73.783970	73.780240
73.783290	73.791900	73.805210	73.822360	73.842860
73.866120	73.891690	73.919220	73.948270	73.978910
74.010650	74.043430	74.077180	74.111790	74.147060
74.1[illegible]30[illegible]0	74.219640	74.256810	74.294530	74.332730

Heat Sink No. 3, WEST WALL(PLASTER)

99.861420	98.863560	97.888890	96.937770	96.010350
95.106720	94.227080	93.371610	92.540310	91.733250
90.950350	90.191560	89.4[illegible]760	88.746000	88.058990
87.395600	86.755710	86.139010	85.545260	84.974150
84.425510	83.898830	83.393890	82.910250	82.447540
82.005340	81.583220	81.180760	80.797450	80.432830
80.086400	79.757660	79.446080	79.151090	78.872220

CCN 1
CCN: N-1, P. 147

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78.608920	78.360570	78.126680	77.906710	77.700040
77.506200	77.324490	77.154450	76.995390	76.846830
76.708220	76.578890	76.458280	76.345920	76.241120

Heat Sink No. 4, CEILING(CONCRETE)

86.629730	85.903660	[illegible]5.201430	84.524380	83.871060
83.241730	82.635960	[illegible].953680	81.494420	80.957920
80.443760	79.951510	79.[illegible]	79.031160	78.602200
78.193390	77.804290	77.434360	77.083100	76.749970
76.434420	76.135890	75.854030	75.588170	75.337740
75.102200	74.881010	74.673610	74.479580	74.298370
74.129490	73.972380	73.826690	73.691930	73.567600
73.453340	73.348720	73.253450	73.167140	73.089450
73.020050	72.958770	72.905240	72.859340	72.820830
72.789520	72.765350	72.748200	72.73[illegible]950	72.734590

CCN 1
CCN: N-1, P. 148

M-73-116
[illegible]
12-22-92
148

SONGS UNITS 2 COMPUTER ROOM 232 - SBO

Time = 4 Hours 0 Minutes .00000 Seconds (14400.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

Extended Heatsink Output: Node Temperatures

Heat Sink No. 5, SOUTH WALL(PLASTER)

96.468290	96.062290	95.661290	95.265230	94.874240
94.488250	94.107210	93.731170	93.360080	92.993870
92.632660	92.276460	91.925140	91.578790	91.237150
90.900480	90.568630	90.241670	89.919460	89.602020
89.289280	88.981170	88.677700	88.378810	88.084500
87.794710	87.509370	87.228360	86.951690	86.679350
86.411220	86.147250	85.887360	85.631560	85.379670
85.131740	84.887660	84.647310	84.410680	84.177580
83.948030	83.721890	83.565640		

CCN 1
CCN: N-1, P. 149

12-17-92

149

SONGS UNITS 2 COMPUTER ROOM 232 - SBO

MAXIMUM AND MINIMUM PRESSURES AND TEMPERATURES

Compartment		Maximum (psia) Pressure	(sec) at Time	(deg. F) Temperature	(sec) at Time	Minimum (psia) Pressure	(sec) at Time	(deg. F) Temperature	(sec) at Time
1	ROOM 232	15.8121	1.4400E+04	112.223	1.4400E+04	14.7000	1.0000E-02	72.000	.0000

781 Calculation cycles were performed

==> Execution time: 00:01:54.03

CCN 1
CCN: N-1, P.150

12-22-92

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NES&L DEPARTMENT

CALLCULATION SHEET

~~CCN NO~~ PRELIM CCN NO N-1	PAGE 151
CCN CONVERSION CCN NO CCN- 1	

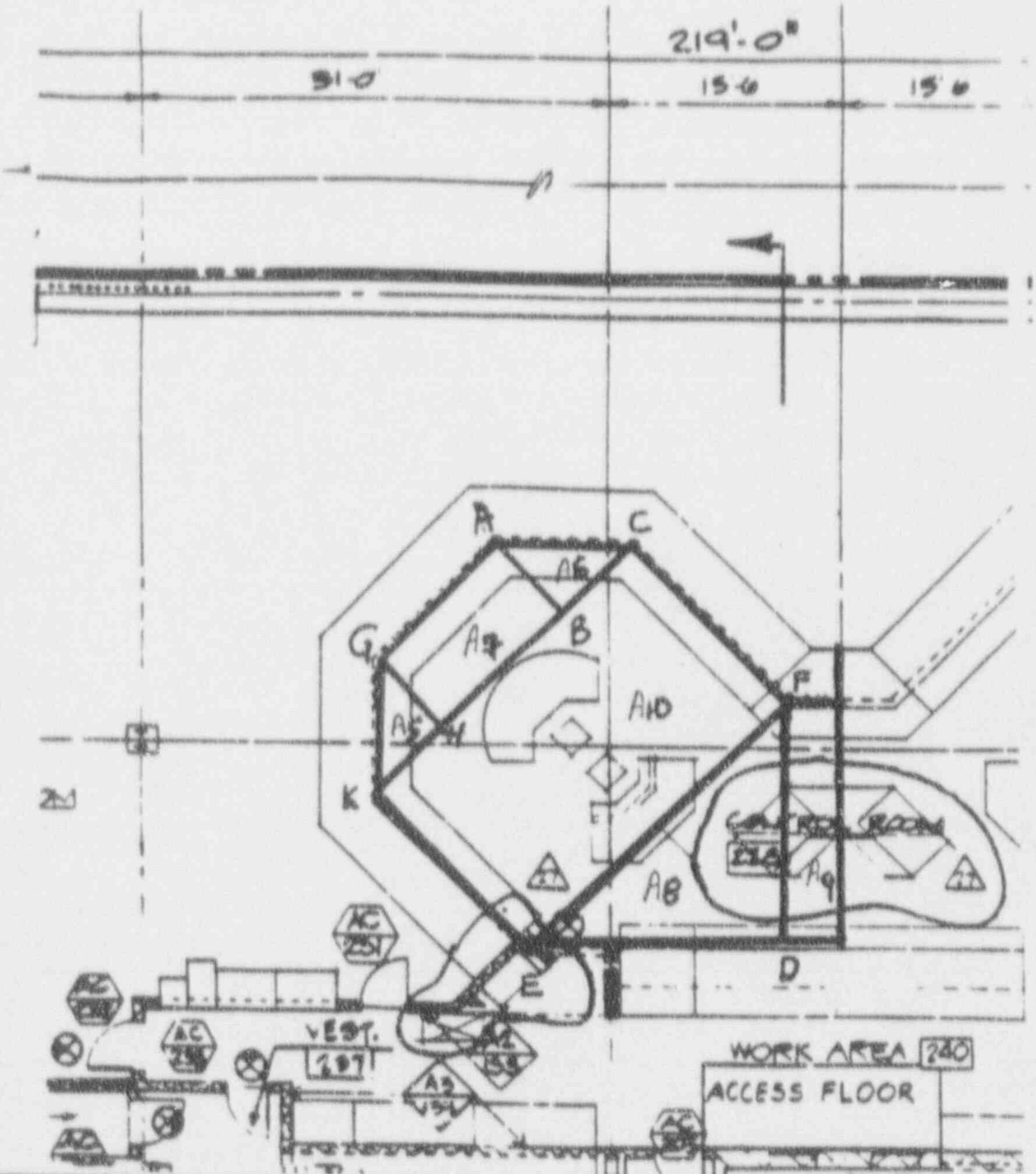
Project or DCP/MMP SONG 2/3 Calc No. M73-116

Subject Room Temperature Response During SBO Sheet No 151

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
2	PARVIZ TIGERI	10/15	[signature]	11/24/92					

8.4 CONTROL ROOM (228 & 240)

(Ref. # 6.8.1)



NES&L DEPARTMENT
CALCULATION SHEET

JOB/NOT PRELIM. CCN NO. N-1	PAGE 209 OF 309
CCN CONVERSION: CCN NO. CCN-- 1	

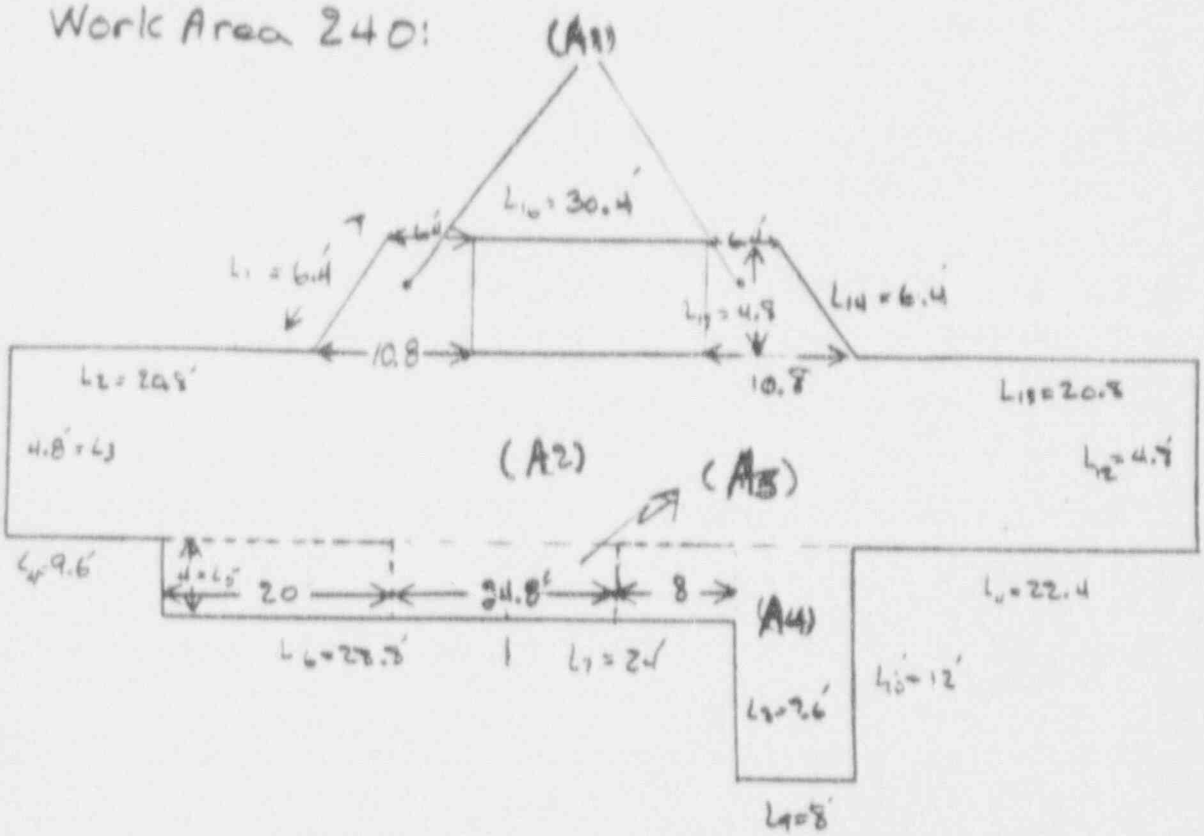
Project or DCP/MMP SONG 2/3 Calc No. M73-116

Subject Room Temperature Response During SBO Sheet No. 152

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
1	PARVIZ TIGERI	10/15	[illegible]	11/21/90					

REV. INDICATOR

Work Area 240:



NES&L DEPARTMENT
CALCULATION SHEET

~~ICCN NO./~~ PRELIM. CCN NO. N-1	PAGE 153 OF

CCN CONVERSION CCN NO. CCN - 1

Project or DCP/MMP SONGS 2/3 Calc No. M73-116

Subject Room Temperature Response During Station Blackout (SBO) Sheet No. 153

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
1	PARVIZ TIGERI	10/15	[illegible]	12/22/[illegible]					

Input data summary used for Control Rooms(228 & 240) Temperature Rise Analysis.

Q = 50.64 BTU/S (see section 8.4)
V = 24,840 ft^3 (see assumption 3.17)

Heat Sink	K_e BTU/hr-ft-°F	ρ_e lbm/ft^3	Cp_e BTU/lbm-°F	A (ft^2)	t (ft)	Ti (°F)
Plaster wall	0.567	15.337	0.738	3466.0	0.417	75
Ceiling Concrete	1.04	143.6	0.21	2058.0	1.00	75

See data below for reference to above table.

△

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
1	PARVIZ TIGERI	10/15	[illegible]	12/24/[illegible]					

CALCULATION OF WORK AREA(ROOM 240)

L1 := 6.4 ft (Ref. # 6.8.1)

L2 := 20.8 ft (Ref. # 6.8.1)

L3 := 4.8 ft (Ref. # 6.8.1)

L4 := 9.6 ft (Ref. # 6.8.1)

L5 := 4.0 ft (Ref. # 6.8.1)

L6 := 28.8 ft (Ref. # 6.8.1)

L7 := 24.0 ft (Ref. # 6.8.1)

L8 := 9.6 ft (Ref. # 6.8.1)

L9 := 8.0 ft (Ref. # 6.8.1)

L10 := 12.0 ft (Ref. # 6.8.1)

L11 := 22.4 ft (Ref. # 6.8.1)

L12 := 4.8 ft (Ref. # 6.8.1)

L13 := 20.8 ft (Ref. # 6.8.1)

L14 := 6.4 ft (Ref. # 6.8.1)

L15 := 51.2 ft (Ref. # 6.8.1)

L16 := 30.4 ft (Ref. # 6.8.1)

L17 := 4.8 ft (Ref. # 6.8.1)

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
	PARVIZ TIGERI	10/15		11/12/96					

hr := 19.0 ft (Ref. # 6.8.4)

CALCULATION OF TH[illegible]LS AREA(ROOM 240)

A1 := L1·hr	A1 = 121.6	ft^2
A2 := L2·hr	A2 = 395.2	ft^2
A3 := L3·hr	A3 = 91.2	ft^2
A4 := L4·hr	A4 = 182.4	ft^2
A5 := L5·hr	A5 = 76	ft^2
A6 := L6·hr	A6 = 547.2	ft^2
A7 := L7·hr	A7 = 456	ft^2
A8 := L8·hr	A8 = 182.4	ft^2
A9 := L9·hr	A9 = 152	ft^2
A10 := L10·hr	A10 = 228	ft^2
A11 := L11·hr	A11 = 425.6	ft^2
A12 := L12·hr	A12 = 91.2	ft^2
A13 := L13·hr	A13 = 395.2	ft^2
A14 := L14·hr	A14 = 121.6	ft^2

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
1	PARVIZ TIGERI	10/15		12/14/96					

TOTAL PLASTER WALL AREA

AT := A1 + A2 + A3 + A4 + A5 + A6 + A7 + A8 + A9 + A10 + A11 + A12 + A13 + A14

$AT = 3.466 \cdot 10^{3}$ ft^2

CALCULATION OF CEILING FOR WORK AREA(ROOM 240)

$A1 := \frac{1}{2} \cdot (10.8 + 6.4) \cdot 4.8 \cdot 2$ (Ref. # 6.8.4)

A1 = 82.56 ft^2

$A2 := (20.8 + 52 + 20.8) \cdot 4.8$ (Ref. # 6.8.4)

A2 = 449.28 ft^2

$A3 := 24.8 \cdot 4.0$ ft^2 (Ref. # 6.8.4)

A3 = 99.2 ft^2

$A4 := 8.0 \cdot 12$ ft^2 (Ref. # 6.8.4)

A4 = 96 ft^2

AREA OF WORK AREA (ROOM 240)

AT := A1 + A2 + A3 + A4

AT = 727.04 ft^2

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
1	PARVIZ TIGERI	10/15		12/16/96					

AREA OF THE CONTROL ROOM(ROOM 228)

$AB := 9 \cdot \sin\left[45 \cdot \frac{\pi}{180}\right]$

$AB = 6.364$ ft

$A5 := \frac{1}{2} \cdot \left[AB^2\right]$

$A5 = 20.25$ ft^2

$A6 := \frac{1}{2} \cdot \left[6.36^2\right]$

$A6 = 20.225$ ft^2

$A7 := 11 \cdot 6.36$

$A7 = 69.96$ ft^2

$FE := 6.36 + 6.36 + 11$

$FE = 23.72$ ft

$KE := 13 + 2$

$KE = 15$ ft

$$DE := 23.72 \cdot \sin\left[45 \cdot \frac{\pi}{180}\right]$$

DE = 16.773 ft

$$A8 := \frac{1}{2} \cdot \left[16.77^2\right]$$

A8 = 140.616 ft^2

CONTROL ROOM AREA, ROOM 228(CONTINUED)

A9 := 3.5·16.77

A9 = 58.695 ft^2

A10 := 15·23.72

A10 = 355.8 ft^2

TOTAL AREA OF CONTROL ROOM(ROOM 228)

AT := 2·(A5 + A6 + A7 + A8 + A9 + A10)

AT = $1.331 \cdot 10^3$ ft^2

TOTAL CEILING AREA OF CONTROL ROOM AND WORK AREA ROOM 240

A := 1331 + 727.0

A = $2.058 \cdot 10^3$ ft^2

△

PLASTER WALL

$tp := 0.0625$

$tair := 0.292$

$tT := 2 \cdot tp + tair$

$tT = 0.417$

$k_p := 0.25$ BTU/(hr-ft-F)

$\rho_p := 51.0$ lbm/ft^3

$Cp_p := 0.74$ BTU/(lbm-F)

$k_{air} := 1.24$ BTU/(hr-ft-F)

$\rho_{air} := 0.07$ lbm/ft^3

$Cp_{air} := 0.24$ BTU/(lbm-F)

$$ke := \frac{tT}{2 \cdot \frac{tp}{k_p} + \frac{tair}{k_{air}}}$$ $ke = 0.567$ BTU/(hr-ft-F)

$$\rho e := \frac{\left[2 \cdot tp \cdot \rho_p\right] + \left[tair \cdot \rho_{air}\right]}{tT}$$ $\rho e = 15.337$ lbm/ft^3

$$Cpe := \frac{\left[2 \cdot tp \cdot \rho_p \cdot Cp_p\right] + \left[tair \cdot \rho_{air} \cdot Cp_{air}\right]}{\left[2 \cdot tp \cdot \rho_p\right] + \left[tair \cdot \rho_{air}\right]}$$

$Cpe = 0.738$ BTU/(lbm-F)

△

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
1	PARVIZ TIGERI	10/15	[illegible]	[illegible]					

HEAT LOAD FROM ROOM 228 AND ROOM 240

$Q1 := 38.89 \cdot 10^{3}$ W (FOR ROOM 228) (Ref. # 6.7)

$Q := 400$ BTU/person (Ref. # 6.10)

$N := 11$ NUMBER OF PEOPLE IN CONTROL ROOM (SEE SECTION 4.5.2)

$Q2 := Q \cdot N$

$Q2 = 4.4 \cdot 10^{3}$ BTU/hr (HEAT LOAD FOR 11 PERSONS)

$Q2 := 4.4 \cdot \dfrac{10^{3}}{3.4121}$

$Q2 = 1.29 \cdot 10^{3}$ W

$Q3 := 13.25 \cdot 10^{3}$ W FOR ROOM 240 (Ref. # 6.7)

HEAT LOAD FOR CONTROL ROOM UNIT 2

$QT := Q1 + Q2 + Q3$

$QT = 5.343 \cdot 10^{4}$ W

$QT := QT \cdot \dfrac{3.4121}{3600}$

$QT = 50.641$ BTU/S

SONGS UNITS 2&3 CONTROL ROOM 228 & WORK AREA ROOM 240

```
 0.00
R228 & R240
      14.7     24840.0        75    0.50    1.00
    0.0000    0.0000    0.0000 1 0
 0.0             50.64
 28800           50.64
@EOF
    0.0000  0.0000
@EOF
 0  0    000.00    000.00    000.00    000.00      000.00 1
@EOF
 0    000.00    000.00    000.00    000.00 1
@EOF
  0  0       1.00   0.60   0.60     0.00 0
@EOF
 0.0000      0.0000      0.0000
 1.0E6       0.0         0.0
@EOF
 1               1.00
@EOF
 0.0000      14.70       75          0.50
 1.e20       14.70       75          0.50
@EOF
                         PLASTER WALL
3      3466.0       0.417        0.01  1.00
 1      0.00 1 4
 0.000           1.47
 1.E3            1.47
@EOF
  0      0.00
 0.000           1.47
 1.E3            1.47
@EOF
      0.567     15.337      0.738
                     CEILING(Concrete)
3     2058.00        1.00        0.01  1.00
 1      0.00 1 4
 0.000           1.47
 1.E3            1.47
@EOF
  0      0.00
 0.000           1.47
 1.E3            1.47
@EOF
       1.04      143.6       0.21
@EOF
 0 1 0 0 0 1 0 0 0 0
@EOF
      3600.0 1     0 0    2 0   25    1.E20    0.001  500
 0.01            1.0
 0.10            10.0
 1.00            20.0
 10.00           100.0
 25.00           36000.0
```

CCN 1

CCN: ... 161

CALC. NO: M-73-116

REVISION: ~~2~~ 20

BY: P. Tigeri DATE: 12-16-92

CHECKED: [initials] DATE: 12/22/92

SHEET 161 OF ____

@EOF
900.0 36000.0
@EOF

CCN 1
CCN: N-1 , P. 162

CALC. NO: M-73-116
REVISION: ~~2~~
BY: P. Tigeri 12-16-92
CHECKED BY: 12/22/92

SHEET 162 OF

SONGS UNITS 2&3 CONTROL ROOM 228 & WORK AREA ROOM 240

* * * PCFLUD 3.7 * * *

> Thermofluid Dynamics for a System of Interconnected Compartments <

MAP-120

[] [] []

Release Record

Date	Version	Description of Changes
3/25/85	1.00	Original PC version
8/25/86	2.00	Air-only version (SF)
1/06/87	3.00	Added SIGFLO routine
6/02/88	3.10	Modified for new compiler
2/06/90	3.61	61 Compartment version
5/21/91	3.7	Automatic zero reverse flow

CCN'
CCN: N-1, P 163

INPUT file name: b:r228&r240.inp

OUTPUT file name: b:r228&r240.OUT

PLOT file name: b:r228&r240.PLT

M-73-116

P.Tigeri DATE 12-16-92
12/22/92

SHEET 163 OF

SONGS UNITS 2&3 CONTROL ROOM 228 & WORK AREA ROOM 240

COMPARTMENT INITIAL CONDITIONS

Compartment	Description	Volume (ft**3)	Temperature (Degrees F)	Pressure (psia)	Rel. Humidity (Fraction)	Flow to Compartments (0 = Atmosphere)
0	Atmosphere		75.00	14.7000	.50	
1	R228 & R240	2.4840E+04	75.00	14.7000	.50	

CCN 1
CCN: N-1, P. 164

M-73-116

P. Tigeri 12-16-92
12/22/92

SHEET 164 OF

SONGS UNITS 2&3 CONTROL ROOM 228 & WORK AREA ROOM 240

COMPARTMENT AUXILIARY CONDITIONS

Compartment	Compartment Desc.	Air Cooler Constant (BTU/sec-deg)	Air Cooler Temperatures Water (F)	Start (F)	Equipment Heat Load Options	Leakage Constants Rate(CFM)	@ Press.(in. H2O)
1	R228 & R240	.000	.0	.0	1, 0	.00000	.0000

COMPARTMENT HEAT LOAD

Compartment 1

Time (seconds)	Heat Load (BTU/sec)
.00	50.64
28800.00	50.64

CCN 1
CCN: N-1 , P. 165

M-73-116
P. Tiger 12-16-92
12-21-92

SHEET 165 OF

SONGS UNITS 2&3 CONTROL ROOM 228 & WORK AREA ROOM 240

FLOW PATH DATA

Compartment From	Compartment To	Flow Area (ft**2)	Flow Coefficients Forward	Flow Coefficients Reverse	Set Pressure (psid)	Valve Setpoint Pressure (psid)	Valve Setpoint Temperature (F)
0	0	1.0	.600	.600	.0000		

CCN 1
CCN: N-1, P. 166

M-73-116
P. Tigeri 12-16-92
12-20-92

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SONGS UNITS 2&3 CONTROL ROOM 228 & WORK AREA ROOM 240

BLOWDOWN DATA

Time (sec)	Flowrate (lbm/sec)	Enthalpy (BTU/lbm)
.00000	.00000	.00000
1.00000E+06	.00000	.00000

SPLIT OF BLOWDOWN DATA

Compartment	Fraction of Blowdown
1	1.00000

ATMOSPHERIC DATA

Time (sec)	Temp(deg.F)	Pressure(psia)	Relative Humidity
.00000	75.000	14.700	.50[illegible]
1.00000E+20	75.000	14.700	.50000

CCN 1
CCN: N-1, P. 167

M-73-116
P. T[illegible] 12-16-92
[illegible] 11-22-92

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SONGS UNITS 2&3 CONTROL ROOM 228 & WORK AREA ROOM 240

Heat Sink Number 1: PLASTER WALL

CONVECTIVE HEAT TRANSFER PARAMETERS

Slab Material	User-Defined
Slab Thickness	.417 ft
Surface Area	3466.00 ft**2
Thermal Conductivity	.567 BTU/hr-ft-deg. F
Density	15.337 lbm/ft**3
Thermal Diffusivity	.050 ft**2/hr
Heat Capacity	.738 BTU/lbm-deg. F
First Node Thickness	.01000 ft
Node Thickness Ratio	1.00
Number of Nodes	43
External Boundary Condition	Convective
External Heat Transfer Coefficient	Uchida
Outside Environment Index	0
Inside Environment Index	1
Interior Heat Transfer Coefficient	Uchida

TABLE OF EXTERNAL HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1000.0	1.4700

CCN 1
CCN: N-1, P. 168

TABLE OF INTERIOR HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1000.0	1.4700

M-73-116
~~2~~ RJ
P. Tigeri 12-16-92
[illegible] 12-22-92

TABLE OF HEAT SINK MESH POINT COORDINATES (feet)

.000000	.010000	.020000	.030000	.040000	.050000	.060000	.070000	.080000	.090000

.100000	.110000	.120000	.130000	.140000	.150000	.160000	.170000	.180000	.190000
.200000	.210000	.220000	.230000	.240000	.250000	.260000	.270000	.280000	.290000
.300000	.310000	.320000	.330000	.340000	.350000	.360000	.370000	.380000	.390000
.400000	.410000	.417000							

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CCN 1
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SONGS UNITS 2&3 CONTROL ROOM 228 & WORK AREA ROOM 240

Heat Sink Number 2: CEILING(Concrete)

CONVECTIVE HEAT TRANSFER PARAMETERS

Slab Material	User-Defined
Slab Thickness	1.000 ft
Surface Area	2058.00 ft**2
Thermal Conductivity	1.040 BTU/hr-ft-deg. F
Density	143.600 lbm/ft**3
Thermal Diffusivity	.034 ft**2/hr
Heat Capacity	.210 BTU/lbm-deg. F
First Node Thickness	.02041 ft
Node Thickness Ratio	1.00
Number of Nodes	50
External Boundary Condition	Convective
External Heat Transfer Coefficient	Uchida
Outside Environment Index	0
Inside Environment Index	1
Interior Heat Transfer Coefficient	Uchida

TABLE OF EXTERNAL HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1000.0	1.4700

TABLE OF INTERIOR HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1000.0	1.4700

TABLE OF HEAT SINK MESH POINT COORDINATES (feet)

.000000	.020408	.040816	.061224	.081633	.102041	.122449	.142857	.163265	.183673

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.204082	.224490	.244898	.265306	.285714	.306122	.326531	.346939	.367347	.387755
.408163	.428571	.448980	.469388	.489796	.510204	.530612	.551020	.571428	.591837
.612245	.632653	.653061	.673469	.693877	.714286	.734694	.735102	.775510	.795918
.816326	.836734	.857143	.877551	.897959	.918367	.938775	.959183	.979592	1.000000

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SONGS UNITS 2&3 CONTROL ROOM 228 & WORK AREA ROOM 240

AUXILIARY CONDITIONS SELECTED

Blowout Panels	OFF
Convective Heat Transfer	ON
Unit Air Coolers	OFF
Heating and Ventilation Flow	OFF
Compartment Leakage	OFF
Compartment Equipment Heat Loads	ON
Atmosphere Exhaust Fan	OFF
Blowdown Dropout	OFF
Zero Reverse Flow	OFF
8% Revaporization	OFF

PROBLEM CONTROL PARAMETERS

Problem Time Limit	3600.00	seconds
Flow Calculation Output/Frequency		OFF/ 0
Compartment Pressure Difference Output		OFF
Heat Sink Calculation Output/Frequency		ON/ 2
Extended Heatsink Output: Node Temperatures		ON
Restart Option		OFF
Number of Plot Points		25
SIGFLO Switch Time		1.000000E+20 seconds
SIGFLO Iteration Tolerance		.001000 psi
Maximum Number of Flow Iterations		500

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CALCULATION/PRINT TIMES SELECTED

Calc. Time Step	Change Time	Print Interval	Change Time
1.000E-02	1.000E+00	9.000E+02	3.600E+04
1.000E-01	1.000E+01	0.000E+00	0.000E+00
1.000E+00	2.000E+01	0.000E+00	0.000E+00
1.000E+01	1.000E+02	0.000E+00	0.000E+00
2.500E+01	3.600E+04	0.000E+00	0.000E+00

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SONGS UNITS 2&3 CONTROL ROOM 228 & WORK AREA ROOM 240

Time = 0 Hours 0 Minutes .00000 Seconds (.0000 Seconds) (Calc. Time Step = 1.000E-02 seconds)

----- Compartment ----	Temp. (Deg F)	S-Heat/ Quality	Rel. Hum.	-- Pressures (psia) -- Total	Air	Steam	K	Total Mass (lbm)	Frac. Air	Frac. Vapor	Heat Load	Total Energy (BTU)
0 Atmosphere	75.000		.50	14.700	14.485	.215	1.40		.9908	.0092		
1 R228 & R240	75.000	19.4 S	.50	14.700	14.485	.215	1.40	1.8334430E+03	.9908	.0092	50.64	1.8493880E+05

Compartments Initial Energy	1.8494E+05 BTU	Compartments Initial Mass	1.8334E+03 lbm
Current Energy in Compartments	1.8494E+05 BTU	Current Mass in Compartments	1.8334E+03 lbm
Blowdown Enthalpy Added	0.0000E+00 BTU	Blowdown Mass Added	0.0000E+00 lbm
Irreversible Energy Loss	0.0000E+00 BTU	(Condens. + Dropout) Mass Loss	0.0000E+00 lbm
Energy Lost to Atmosphere	0.0000E+00 BTU	Mass Lost to Atmosphere	0.0000E+00 lbm
[Rate of Energy Loss to Atmosphere	0.0000E+00 BTU/sec]	[Rate of Mass Loss to Atmosphere	0.0000E+00 lbm/sec]
Absolute Energy Imbalance	0.0000E+00 BTU	Absolute Mass Imbalance	0.0000E+00 lbm
Relative Energy Imbalance	0.0000E+00 %	Relative Mass Imbalance	0.0000E+00 %

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SONGS UNITS 2&3 CONTROL ROOM 228 & WORK AREA ROOM 240

Time = 0 Hours 15 Minutes .00000 Seconds (900.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

----- Compartment ----	Temp. (Deg F)	S-Heat/ Quality	Rel. Hum.	-- Pressures (psia) -- Total	Air	Steam	K	Total Mass (lbm)	Frac. Air	Frac. Vapor	Heat Load	Total Energy (BTU)
0 Atmosphere	75.000		.50	14.700	14.485	.215	1.40		.9908	.0092		
1 R228 & R240	101.889	45.0 S	.22	15.439	15.213	.226	1.40	1.8334430E+03	.9908	.0092	50.64	1.9351660E+05

Compartments Initial Energy	1.8494E+05 BTU	Compartments Initial Mass	1.8334E+03 lbm
Current Energy in Compartments	1.9352E+05 BTU	Current Mass in Compartments	1.8334E+03 lbm
Blowdown Enthalpy Added	0.0000E+00 BTU	Blowdown Mass Added	0.0000E+00 lbm
Irreversible Energy Loss	-8.5883E+03 BTU	(Condens. + Dropout) Mass Loss	0.0000E+00 lbm
Energy Lost to Atmosphere	1.0013E+01 BTU	Mass Lost to Atmosphere	0.0000E+00 lbm
[Rate of Energy Loss to Atmosphere	4.2041E-02 BTU/sec]	[Rate of Mass Loss to Atmosphere	0.0000E+00 lbm/sec]
Absolute Energy Imbalance	-4.4641E-01 BTU	Absolute Mass Imbalance	0.0000E+00 lbm
Relative Energy Imbalance	-2.3069E-04 %	Relative Mass Imbalance	0.0000E+00 %

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SONGS UNITS 2&3 CONTROL ROOM 228 & WORK AREA ROOM 240

Time = 0 Hours 15 Minutes .00000 Seconds (900.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

Heat Sink Calculation Output

HS#	Comp	T	TSAT	TWALL	HCOND	HCONV	AREA	QCOND	QCONV	QSENS	QTOT	HS#
1 Left	1	101.889	56.913	81.252	.000	1.470	3466.0	0.000000E+0`	-2.935288E+01	0.000000E+00	-2.935288E+01	1
1 Right	0	75.000	*******	75.030	.000	1.470	3466.0	0.000000E+00	3.783533E-02	0.000000E+00	3.783533E-02	1
2 Left	1	101.889	56.913	78.166	.000	1.470	2058.0	0.000000E+00	-1.998411E+01	0.000000E+00	-1.998411E+01	2
2 Right	0	75.000	*******	75.005	.000	1.470	2058.0	0.000000E+00	4.205853E-03	0.000000E+00	4.205853E-03	2

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SONGS UNITS 2&3 CONTROL ROOM 228 & WORK AREA ROOM 240

Time = 0 Hours 15 Minutes .00000 Seconds (900.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

Extended Heatsink Output: Node Temperatures

Heat Sink No. 1, PLASTER WALL

81.252470	80.732330	80.241910	79.780980	79.349090
78.945770	78.570280	78.221830	77.899510	77.602260
77.329130	77.079010	76.850680	76.642850	76.454380
76.283970	76.130400	75.992460	75.868990	75.758820
75.660800	75.573880	75.497100	75.429410	75.369960
75.317960	75.272550	75.233120	75.198940	75.169400
75.144010	75.122220	75.103670	75.087920	75.074680
75.063630	75.054530	75.047090	75.041230	75.036710
75.033420	75.031280	75.030490		

Heat Sink No. 2, CEILING(Concrete)

78.165620	77.531280	76.993130	76.545070	76.179050
75.885650	75.654940	75.476960	75.342320	75.242220
75.169220	75.116910	75.080110	75.054720	75.037380
75.025790	75.018160	75.013280	75.010160	75.008210
75.006990	75.006320	75.005830	75.005580	75.005460
75.005400	75.005400	75.005400	75.005400	75.005400
75.005400	75.005400	75.005400	75.005400	75.005400
75.005400	75.005400	75.005400	75.005400	75.005400
75.005400	75.005400	75.005400	75.005400	75.005400
75.005280	75.005220	75.005100	75.005040	75.004970

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SONGS UNITS 2&3 CONTROL ROOM 228 & WORK AREA ROOM 240

Time = 0 Hours 30 Minutes .00000 Seconds (1800.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

----- Compartment ----	Temp. (Deg F)	S-Heat/ Quality	Rel. Hum.	-- Pressures (psia) -- Total	Air	Steam	K	Total Mass (lbm)	Frac. Air	Frac. Vapor	Heat Load	Total Energy (BTU)
0 Atmosphere	75.000		.50	14.700	14.485	.215	1.40		.9908	.0092		
1 R228 & R240	104.619	47.6 S	.21	15.514	15.287	.227	1.40	1.8334430E+03	.9908	.0092	50.64	1.9438780E+05

Compartments Initial Energy	1.8494E+05 BTU	Compartments Initial Mass	1.8334E+03 lbm
Current Energy in Compartments	1.9439E+05 BTU	Current Mass in Compartments	1.8334E+03 lbm
Blowdown Enthalpy Added	0.0000E+00 BTU	Blowdown Mass Added	0.0000E+00 lbm
Irreversible Energy Loss	-9.6748E+03 BTU	(Condens. + Dropout) Mass Loss	0.0000E+00 lbm
Energy Lost to Atmosphere	2.2531E+02 BTU	Mass Lost to Atmosphere	0.0000E+00 lbm
[Rate of Energy Loss to Atmosphere	5.6579E-01 BTU/sec]	[Rate of Mass Loss to Atmosphere	0.0000E+00 lbm/sec]
Absolute Energy Imbalance	-4.4829E-01 BTU	Absolute Mass Imbalance	0.0000E+00 lbm
Relative Energy Imbalance	-2.3062E-04 %	Relative Mass Imbalance	0.0000E+00 %

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SONGS UNITS 2&3 CONTROL ROOM 228 & WORK AREA ROOM 240

Time = 0 Hours 45 Minutes .00000 Seconds (2700.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

----- Compartment ----	Temp. (Deg F)	S-Heat/ Quality	Rel. Hum.	-- Pressures (psia) -- Total	Air	Steam	K	Total Mass (lbm)	Frac. Air	Frac. Vapor	Heat Load	Total Energy (BTU)
0 Atmosphere	75.000		.50	14.700	14.485	.215	1.40		.9908	.0092		
1 R228 & R240	106.529	49.4 S	.23	15.567	15.339	.228	1.40	1.8334430E+03	.9908	.0092	50.64	1.9499710E+05

Compartments Initial Energy	1.8494E+05 BTU	Compartments Initial Mass	1.8334E+03 lbm
Current Energy in Compartments	1.9500E+05 BTU	Current Mass in Compartments	1.8334E+03 lbm
Blowdown Enthalpy Added	0.0000E+00 BTU	Blowdown Mass Added	0.0000E+00 lbm
Irreversible Energy Loss	-1.1230E+04 BTU	(Condens. + Dropout) Mass Loss	0.0000E+00 lbm
Energy Lost to Atmosphere	1.1712E+03 BTU	Mass Lost to Atmosphere	0.0000E+00 lbm
[Rate of Energy Loss to Atmosphere	1.6251E+00 BTU/sec]	[Rate of Mass Loss to Atmosphere	0.0000E+00 lbm/sec]
Absolute Energy Imbalance	-4.4275E-01 BTU	Absolute Mass Imbalance	0.0000E+00 lbm
Relative Energy Imbalance	-2.2705E-04 %	Relative Mass Imbalance	0.0000E+00 %

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SONGS UNITS 2&3 CONTROL ROOM 228 & WORK AREA ROOM 240

Time = 0 Hours 45 Minutes .00000 Seconds (2700.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

Heat Sink Calculation Output

HS#	Comp	T	TSAT	TWALL	HCOND	HCONV	AREA	QCOND	QCONV	QSENS	QTOT	HS#
1 Left	1	106.529	57.139	86.313	.000	1.470	3466.0	0.000000E+00	-2.868834E+01	0.000000E+00	-2.868834E+01	1
1 Right	0	75.000	*******	76.169	.000	1.470	3466.0	0.000000E+00	1.621045E+00	0.000000E+00	1.621045E+00	1
2 Left	1	106.529	57.139	81.158	.000	1.470	2058.0	0.000000E+00	-2.134840E+01	0.000000E+00	-2.134840E+01	2
2 Right	0	75.000	*******	75.005	.000	1.470	2058.0	0.000000E+00	4.051981E-03	0.000000E+00	4.051981E-03	2

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SONGS UNITS 2&3 CONTROL ROOM 228 & WORK AREA ROOM 240

Time = 0 Hours 45 Minutes .00000 Seconds (2700.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

Extended Heatsink Output: Node Temperatures

Heat Sink No. 1, PLASTER WALL

86.312530	85.796050	85.295010	84.809360	84.339290
83.884430	83.444980	83.020720	82.611600	82.217440
81.838230	81.473790	81.123930	80.788420	80.467070
80.159700	79.866000	79.585850	79.318940	79.065030
78.823820	78.595060	78.378450	78.173680	77.980440
77.798490	77.627530	77.467250	77.317350	77.177580
77.047640	76.927220	76.816130	76.714020	76.620700
76.535860	76.459260	76.390660	76.329860	76.276640
76.230800	76.192110	76.169220		

Heat Sink No. 2, CEILI[illegible](Concrete)

81.158480	80.455470	79.809230	79.218600	78.681790
78.196750	77.761020	77.371980	77.026760	76.722260
76.455350	76.222930	76.021820	75.848970	75.701320
75.576020	75.470430	75.382050	75.308500	75.247710
75.197850	75.157260	75.124360	75.097990	75.076870
75.060150	75.046970	75.036650	75.028720	75.022610
75.017910	75.014430	75.011750	75.009800	75.008330
75.007290	75.006620	75.006070	75.005770	75.005520
75.005460	75.005400	75.005400	75.005400	75.005400
75.005280	75.005220	75.005100	75.004970	75.004850

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SONGS UNITS 2&3 CONTROL ROOM 228 & WORK AREA ROOM 240

Time = 1 Hours 0 Minutes .00000 Seconds (3600.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

----- Compartment ----	Temp. (Deg F)	S-Heat/ Quality	Rel. Hum.	-- Pressures (psia) -- Total	Air	Steam	K	Total Mass (lbm)	Frac. Air	Frac. Vapor	Heat Load	Total Energy (BTU)
0 Atmosphere	75.000		.50	14.700	14.485	.215	1.40		.9908	.0092		
1 R228 & R240	108.103	50.9 S	.19	15.610	15.382	.229	1.40	1.8334430E+03	.9908	.0092	50.64	1.9549920E+05

Compartments Initial Energy	1.8494E+05 BTU	Compartments Initial Mass	1.8334E+03 lbm
Current Energy in Compartments	1.9550E+05 BTU	Current Mass in Compartments	1.8334E+03 lbm
Blowdown Enthalpy Added	0.0000E+00 BTU	Blowdown Mass Added	0.0000E+00 lbm
Irreversible Energy Loss	-1.3746E+04 BTU	(Condens. + Dropout) Mass Loss	0.0000E+00 lbm
Energy Lost to Atmosphere	3.1851E+03 BTU	Mass Lost to Atmosphere	0.0000E+00 lbm
[Rate of Energy Loss to Atmosphere	2.9030E+00 BTU/sec]	[Rate of Mass Loss to Atmosphere	0.0000E+00 lbm/sec]
Absolute Energy Imbalance	-4.8291E-01 BTU	Absolute Mass Imbalance	0.0000E+00 lbm
Relative Energy Imbalance	-2.4701E-04 %	Relative Mass Imbalance	0.0000E+00 %

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SONGS UNITS 2&3 CONTROL ROOM 228 & WORK AREA ROOM 240

MAXIMUM AND MINIMUM PRESSURES AND TEMPERATURES

Compartment	Maximum				Minimum			
	(psia) Pressure	(sec) at Time	(deg. F) Temperature	(sec) at Time	(psia) Pressure	(sec) at Time	(deg. F) Temperature	(sec) at Time
1 R228 & R240	15.6101	3600.	108.103	3600.	14.7000	1.0000E-02	75.000	.0000

349 Calculation cycles were performed

==> Execution time: 00:00:38.78

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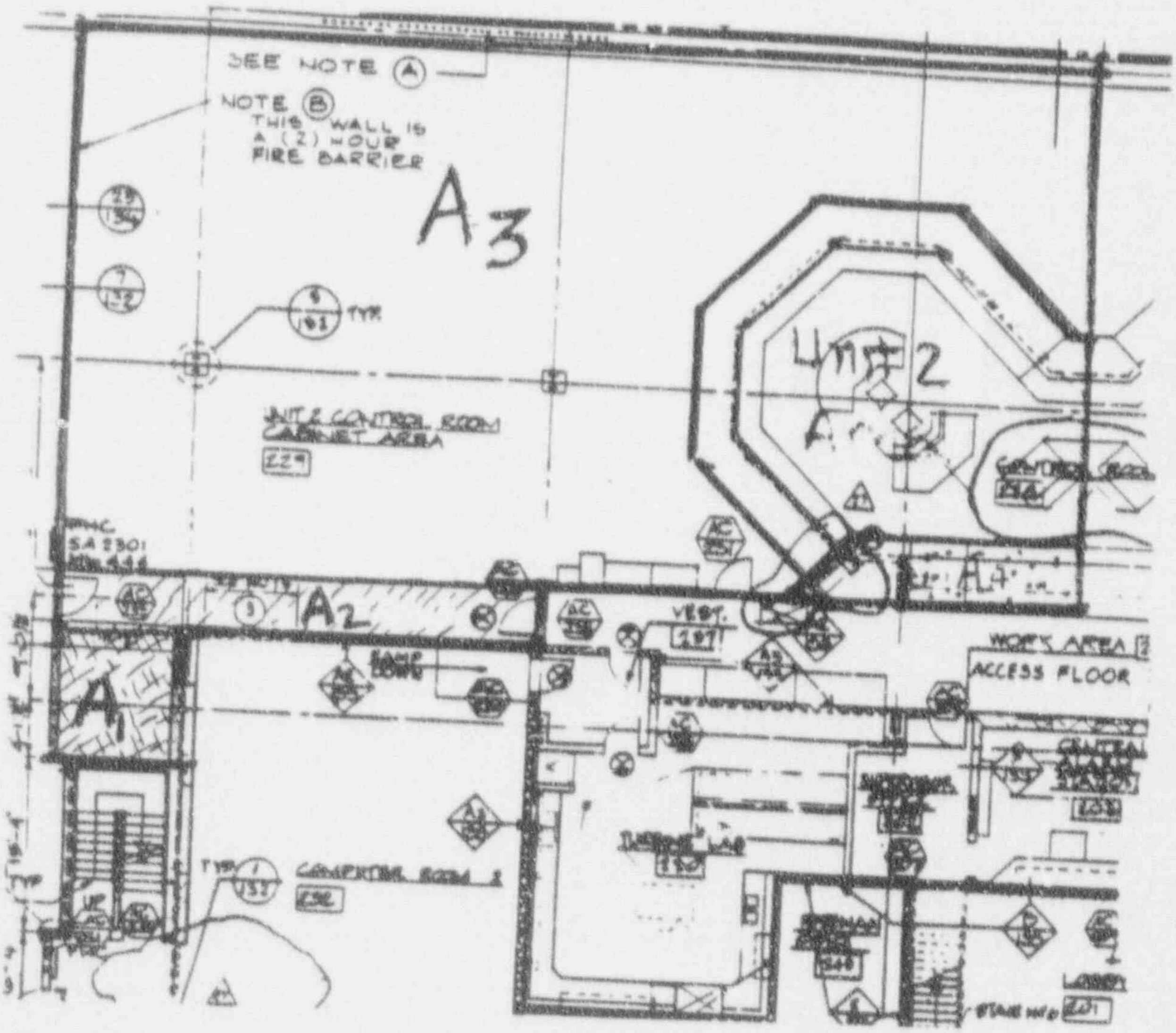
8.5 CONTROL ROOM CABINET AREA, ROOM 229(EL.30)

(Ref. # 6.8.1)



REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
1	PARVIZ TIGERI	10/15							

8.5 Control Room Cabinet Area # 229

The results of the heat load analyses of Cabinet Area Room 229 and Cabinet Area Room 227(Ref.# 6.7) are as follow:

Name	Heat Load (kw)
Control Cabinet Area Room 227	51.71
Control Cabinet Area Room 229	51.67

Conclusion:

Based on the heat load review of the Cabinet Area Room 227(Unit 3) and the Cabinet Area Room 229(Unit 2) it can be concluded that the temperature rise in the none blackout Unit 3 Cabinet Area Room does not affect the Unit 2 Cabinet Area.

Input data summary used for Control Room Cabinet Area(Room 229) Temperature Rise Analysis.

Q_{total} = 54.41 BTU/S (see section 8.5)

V= 57092.0 ft^3 (see assumption 3.17)

Heat Sink	K_e BTU/hr-ft-°F	ρ_e lbm/ft^3	Cp_e BTU/lbm-°F	A (ft^2)	t (ft)	Ti (°F)
North wall Plaster	0.509	18.556	0.739	1196	0.459	75
East wall Concrete	1.04	143.6	0.21	1685	2.5	75
South wall Plaster	0.567	15.337	0.738	91.2	0.417	75
South wall Concrete	1.04	143.6	0.21	237.5	2.00	75
West wall Plaster	0.567	15.337	0.738	589	0.417	75
Ceiling Concrete	1.04	143.6	0.21	3723	1.00	75

See data below for reference to the above table.

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
1	PARVIZ TIGERI	10/15							

CALCULATION OF CABINET AREA (ROOM 229) UNIT 2

$Ls := 62.96$ ft (Ref. # 6.8.1)

$Le := 88.67$ ft (Ref. # 6.8.1)

$Lw := 31.00$ ft (Ref. # 6.8.1)

$hr := 19.00$ ft (Ref. # 6.8.4)

CALCULATION OF THE CEILING CABINET AREA (ROOM 229); UNIT 2 AND UNIT 3 CABINET AREA ARE THE SAME.

$A1 := 11.167 \cdot 12.5$

$A1 = 139.588$ ft^2

$A2 := 42.17 \cdot 4.8$

$A2 = 202.416$ ft^2

$A3 := 46.92 \cdot 88.67$

$A3 = 4.16 \cdot 10^{3}$ ft^2

$U2 := 665.54$ ft^2

$A4 := \frac{1}{2} \cdot (21.6 + 26) \cdot 4.8$

$A4 = 114.24$ ft^2

$Anet := A3 - (U2 + A4)$

$Anet = 3.381 \cdot 10^{3}$ ft^2

$Ace := A1 + A2 + Anet$

$Ace = 3.723 \cdot 10^{3}$ ft^2

CALCULATION OF WALLS AREA(FOR CABINET AREA ROOM 229 UNIT 2)

CALCULATION OF AREAS; FOR NORTH, EAST, AND WEST WALLS

$An := Ls \cdot hr$

$An = 1.196 \cdot 10^{3}$ ft^2

$Ae := Le \cdot hr$

$Ae = 1.685 \cdot 10^{3}$ ft^2

$Aw := Lw \cdot hr$

$Aw = 589$ ft^2

CALCULATION OF AREA; FOR SOUTH WALL

$Lc := 12.5$ ft (Ref. # 6.8.1)

$Ac := Lc \cdot hr$

$Ac = 237.5$ ft^2

$Lp := 4.8$ ft (Ref. # 6.8.1)

$Ap := Lp \cdot hr$

$Ap = 91.2$ ft^2

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
1	PARVIZ TIGERI	10/15		11/23/					

CALCULATION OF PROPERTIES(Ke, ρe, AND Cpe) FOR COMPOSITE WALLS

NORTH WALL

$tp := 0.0833$	ft	(Ref. # 6.8.1)
$tair := 0.292$	ft	(Ref. # 6.2)
$tT := 2 \cdot tp + tair$		
$tT := 0.459$	ft	
$k_p := 0.25$	BTU/(hr-ft-F)	(Ref. # 6.17)
$\rho_p := 51.0$	lbm/ft^3	(Ref. # 6.17)
$Cp_p := 0.74$	BTU/(lbm-F)	(Ref. # 6.17)
$k_{air} := 1.24$	BTU/(hr-ft-F)	(see section 8.8)
$\rho_{air} := 0.07$	lbm/ft^3	(Ref. # 6.2)
$Cp_{air} := 0.24$	BTU/(lbm-F)	(Ref. # 6.2)

$$Ke := \frac{tT}{2 \cdot \frac{tp}{k_p} + \frac{tair}{k_{air}}} \implies Ke = 0.509 \quad \text{BTU/(hr-ft-F)}$$

$$\rho e := \frac{\left[2 \cdot tp \cdot \rho_p\right] + \left[tair \cdot \rho_{air}\right]}{tT} \qquad \rho e = 18.556 \quad \text{lbm/ft}^3$$

$$Cpe := \frac{\left[2 \cdot tp \cdot \rho_p \cdot Cp_p\right] + \left[tair \cdot \rho_{air} \cdot Cp_{air}\right]}{\left[2 \cdot tp \cdot \rho_p\right] + \left[tair \cdot \rho_{air}\right]}$$

$Cpe = 0.739$ BTU/(lbm-F)

CALCULATION SHEET

~~ICCN NO./~~ PRELIM. CCN NO. N-1	PAGE 187 OF
CCN CONVERSION CCN NO. CCN - 1	

Project or DCP/MMP SONGS 2/3 Calc No. M73-116

Subject Room Temperature Response During Station Blackout (SBO) Sheet No. 188

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
1	PARVIZ TIGERI	10/15	[illegible]	[illegible]					

SOUTH WALL

$tp := 0.0625$ ft (Ref. # 6.8.1)

$tair := 0.292$ ft (Ref. # 6.2)

$tT := 2 \cdot tp + tair$

$tT = 0.417$ ft

$$Ke := \frac{tT}{\left[2 \cdot \frac{tp}{k_p} + \frac{tair}{k_{air}}\right]}$$

$Ke = 0.567$ BTU/(hr-ft-F)

$$\rho e := \frac{\left[2 \cdot tp \cdot \rho_p\right] + \left[tair \cdot \rho_{air}\right]}{tT}$$

$\rho e = 15.337$ lbm/ft^3

$$Cpe := \frac{\left[2 \cdot tp \cdot \rho_p \cdot Cp_p\right] + \left[tair \cdot \rho_{air} \cdot Cp_{air}\right]}{\left[2 \cdot tp \cdot \rho_p\right] + \left[tair \cdot \rho_{air}\right]}$$

$Cpe = 0.738$ BTU/(lbm-F)

CALCULATION SHEET

~~ICCN NO.~~ PRELIM. CCN NO. N-1	PAGE 189 OF

Project or DCP/MMP SONGS 2/3 Calc No. M73-116

CCN CONVERSION
CCN NO. CCN - 1

Subject Room Temperature Response During Station Blackout (SBO) Sheet No. 189

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
1	PARVIZ TIGERI	10/15	[illegible]	14/15					

WEST WALL

$tp := 0.0625$ ft (Ref. # 6.8.1)

$tair := 0.292$ ft (Ref. # 6.2)

$tT := 2 \cdot tp + tair$

$tT = 0.417$ ft

$$Ke := \frac{tT}{\left[2 \cdot \frac{tp}{k_p} + \frac{tair}{k_{air}}\right]}$$

$Ke = 0.567$ BTU/(hr-ft-F)

$$\rho e := \frac{\left[2 \cdot tp \cdot \rho_p\right] + \left[tair \cdot \rho_{air}\right]}{tT}$$

$\rho e = 15.337$ lbm/ft^3

$$Cpe := \frac{\left[2 \cdot tp \cdot \rho_p \cdot Cp_p\right] + \left[tair \cdot \rho_{air} \cdot Cp_{air}\right]}{\left[2 \cdot tp \cdot \rho_p\right] + \left[tair \cdot \rho_{air}\right]}$$

$Cpe = 0.738$ BTU/(lbm-F)

CONTROL NO. 05931

CERTIFICATE OF AUTHENTICITY

CONTINUATION

This is to certify that the microphotographic images appearing in this microform are direct and facsimile reproductions of the original records of the Southern California Edison Company and were microfilmed in the regular course of business. The microfilming has been performed according to established routine Company Policy for systems utilization and/or maintenance and preservation of records through the storage of such microforms in protected locations.

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Southern California Edison

For the MATERIAL & ADMINISTRATIVE SERVICES - CDM/SONGS Department
San Onofre Nuclear Generating Station Design Calculations

This microform file is a complete record of the transaction herein recorded. The documents are arranged on this microform in the following manner:

- ( ) By month in Location and Work Order sequence
- ( ) Alphabetical order by
- (X) Numerical order by Design Cal.No.
- ( ) Order of Customer Service Store Number
- ( ) Order of Payroll Location Number
- ( ) Grievance File Number sequence
- ( ) Date order
- ( ) Other

The hardcopy documents used to create this microform have been authorized for destruction after verification of correctness and acceptability of the microfilming.

It is further certified that on the date specified below, the micrographic images appearing on this microform were made at a reduction ratio of 29 :1 under my direction and control.

The above information is deemed necessary in compliance with the Federal Power Commission Order No. 450 - Regulations to govern the Preservation of Public Utilities and Licensees – issued March 14, 1972. This order has subsequently been approved by the Public Utilities Commission of the State of California on October 29, 1974.

1-20-93
DATE MICROFILMED

CAMERA OPERATOR

AWS BLDG., D-2-P, SONGS
LOCATION

Napoleon C. Vass
AUTHORIZED SIGNATURE
SUPERVISOR MICROGRAPHICS

SCE 050 1-0 REV 7/88

CALCULATION SHEET

~~ICCN NO./~~ PRELIM. CCN NO. N-1	PAGE 190 OF

Project or DCP/MMP SONGS 2/3 **Calc No.** M73-116

CCN CONVERSION CCN NO. CCN - 1

Subject Room Temperature Response During Station Blackout (SBO) **Sheet No.** 190

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
1	PARVIZ TIGERI	10/15	[signature]	12/24/96					

CALCULATION OF HEAT LOAD FOR CABINET AREA(ROOM 229); UNIT 2

Q2cr057 := 2431.04 W (Ref. # 6.7)

Q2cr056 := 2249.2 W (Ref. # 6.7)

Q2cr058 := 712.46 W (Ref. # 6.7)

Q2cr050 := 576.32 W (Ref. # 6.7)

Q2cr051 := 292.96 W (Ref. # 6.7)

Q2cr052 := 912.23 W (Ref. # 6.7)

Q2cr053 := 1042.41 W (Ref. # 6.7)

Q2cr054 := 1609.4 W (Ref. # 6.7)

Q2cr064 := 708.0 W (Ref. # 6.7)

Q23cr061 := 1861.03 W (Ref. # 6.7)

Q23cr061 IS FOR UNIT 2 AND 3 THEREFORE HEAT LOAD FOR UINT 3 (Q) IS

$$Q := \frac{Q23cr06\_}{2}$$

Q = 930.515 W

TOTAL HEAT LOAD THAT, CONTRIBUTING HEAT TO THE CONTROL ROOM CABINET AREA(ROOM 229) UNIT 2 IS

$$Q2 := Q2cr057 + Q2cr056 + Q2cr058 + Q2cr050 + Q2cr051 + Q2cr052 + Q2cr053 + Q2cr054 + Q2cr064 + Q$$

$Q2 = 1.146 \cdot 10^{4}$ W

50% OF THIS LEAT LOAD (Q2) TRANSFER TO CABINET AREA(ROOM 229)

$$Q\% := 50 \cdot \frac{Q2}{100}$$

$Q\% = 5.732 \cdot 10^{3}$ W

CALCULATION SHEET

~~ICCN NO.~~ PRELIM. CCN NO. N-1	PAGE 191 OF

Project or DCP/MMP SONGS 2/3 Calc No. M73-116

CCN CONVERSION CCN NO. CCN - 1

Subject Room Temperature Response During Station Blackout (SBO) Sheet No. 191

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
X	PARVIZ TIGERI	10/15	[illegible]	11/21/9[illegible]					

THEREFORE CABINET AREA(ROOM 229) UNIT 2, HEAT LOAD IS

$Q := 51670$ W (Ref. # 6.7)

$QT := Q + Q\%$

$QT = 5.74 \cdot 10^{4}$ W

$QT := QT \cdot \frac{3.4121}{3600}$

$QT = 54.406$ BTU/S

SCE 26-428 NEW 4/90

SONGS UNITS 2 CONTROL ROOM CABINET 229

```
 0.00
ROOM 229
      14.7      57092.0         75     0.50     1.00
    0.0000     0.0000     0.0000 1 0
 0.0000            54.41
 28800             54.41
@EOF
    0.0000  0.0000
@EOF
 0  0    000.00     000.00     000.00     000.00       000.00 1
@EOF
 0    000.00     000.00     000.00     000.00 1
@EOF
  0  0        1.00    0.60    0.60      0.00 0
@EOF
 0.0000       0.0000        0.0000
 1.0E6        0.0           0.0
@EOF
 1                 1.00
@EOF
 0.0000       14.70         75            0.50
 1.e20        14.70         75            0.50
@EOF
NORTH WALL(PLASTER)
3      1196.0        0.459          0.01  1.00
 1       0.00 1 4
 0.000             1.47
 1.E6              1.47
@EOF
  0        0.00
 0.0000            1.47
 1.E6              1.47
@EOF
      0.509    18.556       0.739
EAST WALL(CONCRETE)
3         1685          2.5         0.01  1.00
 1       0.00 1 4
 0.000             1.47
 1.E6              1.47
@EOF
  0        0.00
 0.000             1.47
 1.E6              1.47
@EOF
        1.04     143.6        0.21
SOUTH WALL(PLASTER)
3         91.2        0.417         0.01  1.00
 1       0.00 1 4
 0.000             1.47
 1.E6              1.47
@EOF
  0        0.00
 0.000             1.47
 1.E6              1.47
```

CCN1
CCN: N-1, P.192

CALC. NO: M-73-116
REVISION: 2 ~~3~~
BY: P. TIGERI DATE: 12-17-92
CHECKED: WJ DATE: 12/22/92

SHEET 192 OF ____

```
@EOF
      0.567      15.337       0.738
SOUTH WALL(CONCRETE)
3      237.51          2.00         (.01  1.00
 1       0.00 1 4
 0.000              1.47
 1.E6               1.47
@EOF
  0        0.00
 0.000              1.47
 1.E3               1.47
@EOF
       1.04      143.6        0.21
WEST WALL(PLASTER)
3         595         0.417         0.01  1.00
 1       0.00 1 4
 0.000              1.47
 1.E6               1.47
@EOF
  0        0.00
 0.000              1.47
 1.E6               1.47
@EOF
      0.567      15.337       0.738
CEILING(CONC    E)
3     3723.0          1.00          0.01  1.00
 1       0.00 . 1
 0.000              1.47
 1.E6               1.47
@EOF
       1.04      143.6        0.21
@EOF
 0 1 0 0 0 1 0 0 0 0
@EOF
       14400 1     0 0    2 0   25    1.E20    0.001  500
 0.01               1.0
 0.10               10.0
 1.00               20.0
 10.00              100.0
 25.00              36000.0
@EOF
 3600               14400
@EOF
```

CCN! CCN: N-1, P. 193

CALC. NO: M-73-116
REVISION: 2
BY: P.TKGERL DATE: 12-17-92
CHECKED: [illegible] DATE: 12/22/92

SHEET 193 OF

SONGS UNITS 2 CONTROL ROOM CABINET 229

* * * PCFLUD 3.7 * * *

) Thermofluid Dynamics for a System of Interconnected Compartments (

NAP-120

[][][]

Release Record

Date	Version	Description of Changes
3/25/85	1.00	Original PC version
8/25/86	2.00	Air-only version (SP)
1/06/87	3.00	Added SIGFLO routine
6/02/88	3.10	Modified for new compiler
2/06/90	3.61	61 Compartment version
5/21/91	3.7	Automatic zero reverse flow

CCN: N-1, P. 194
CCN1

INPUT file name: b:rr-229.inp

OUTPUT file name: b:rr-229.OUT

PLOT file name: b:rr-229 PLT

CALC. NO: M-73-116
REVISION: 2
BY: P. TIGERI DATE: 12-17-92
CHECKED: [illegible] DATE: 12/22/92

SHEET 194 OF

SONGS UNITS 2 CONTROL ROOM CABINET 229

COMPARTMENT INITIAL CONDITIONS

Compartment	Description	Volume (ft**3)	Temperature (Degrees F)	Pressure (psia)	Rel. Humidity (Fraction)	Flow to Compartments (0 = Atmosphere)
0	Atmosphere		75.00	14.7000	.50	
1	ROOM 229	5.7092E+04	75.00	14.7000	.50	

CCN1
CCN: N-1, P. 195

CALC. NO: M-73-116
REVISION: 2
BY: P. TIGERI DATE: 12-17-92
CHECKED BY: [illegible] DATE: 12/21/92

SHEET 195 OF ____

SONGS UNITS 2 CONTROL ROOM CABINET 229

COMPARTMENT AUXILIARY CONDITIONS

Compartment	Compartment Desc.	Air Cooler Constant (BTU/sec-deg)	Air Cooler Temperatures Water (F)	Start (F)	Equipment Heat Load Options	Leakage Constants Rate(CFM)	@ Press.(in. H2O)
1	ROOM 229	.000	.0	.0	1, 0	.00000	.0000

COMPARTMENT HEAT LOAD

Compartment 1

Time (seconds)	Heat Load (BTU/sec)
.00	54.41
28800.00	54.41

CCN1
CCN: N-1, P. 196

CALC. NO: M-73-116
REVISION: 2
P. TIGERI DATE: 12-17-92
DATE: 12/22/92

SHEET 196 OF

SONGS UNITS 2 CONTROL ROOM CABINET 229

FLOW PATH DATA

Compartment From	Compartment To	Flow Area (ft**2)	Flow Coefficients Forward	Flow Coefficients Reverse	Set Pressure (psid)	Valve Setpoint Pressure (psid)	Valve Setpoint Temperature (F)
0	0	1.0	.600	.600	.0000		

CCN1
CCN: N-1, P 197

CALC. NO: M-73-116
2
P. TIGERI DATE: 12-17-92
[illegible] 12/22/92

SHEET 197 OF ____

SONGS UNITS 2 CONTROL ROOM CABINET 229

BLOWDOWN DATA

Time (sec)	Flowrate (lbm/sec)	Enthalpy (BTU/lbm)
.00000	.00000	.00000
1.00000E+06	.00000	.00000

SPLIT OF BLOWDOWN DATA

Compartment	Fraction of Blowdown
1	1.00000

ATMOSPHERIC DATA

Time (sec)	Temp(deg.F)	Pressure(psia)	Relative Humidity
.00000	75.000	14.700	.50000
1.00000E+20	75.000	14.700	.50000

CCN 1
CCN: N-1, P. 198

CALC. NO: M-73-116
REVISION: 2
P. TIGGRI DATE: 12-17-92
DATE: 12/22/92

SHEET 198 OF

CCN1
CCN: N-1, P 199

CALC. NO: 17-73-116
REVISION: 2
BY: P. TIGERI DATE: 12-17-92
CHECKED: [illegible] DATE: 12/22/92

SHEET 199 OF

SONGS UNITS 2 CONTROL ROOM CABINET 229

Heat Sink Number 1: NORTH WALL(PLASTER)

CONVECTIVE HEAT TRANSFER PARAMETERS

Slab Material	User-Defined
Slab Thickness	.459 ft
Surface Area	1196.00 ft**2
Thermal Conductivity	.509 BTU/hr-ft-deg. F
Density	18.556 lbm/ft**3
Thermal Diffusivity	.037 ft**2/hr
Heat Capacity	.739 BTU/lbm-deg. F
First Node Thickness	.01000 ft
Node Thickness Ratio	1.00
Number of Nodes	47
External Boundary Condition	Convective
External Heat Transfer Coefficient	Uchida
Outside Environment Index	0
Inside Environment Index	1
Interior Heat Transfer Coefficient	Uchida

TABLE OF EXTERNAL HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

TABLE OF INTERIOR HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

TABLE OF HEAT SINK MESH POINT COORDINATES (feet)

.000000	.010000	.020000	.030000	.040000	.050000	.060000	.070000	.080000	.090000

.100000	.110000	.120000	.130000	.140000	.150000	.160000	.170000	.180000	.190000
.200000	.210000	.220000	.230000	.240000	.250000	.260000	.270000	.280000	.290000
.300000	.310000	.320000	.330000	.340000	.350000	.360000	.370000	.380000	.390000
.400000	.410000	.420000	.430000	.440000	.450000	.459000			

CCN 1
CCN: N-1, P. 200

CALC. NO: M-75-116

REVISION: 2

P. TIGER 12-17-92

12/22/92

SHEET 200 OF

SONGS UNITS 2 CONTROL ROOM CABINET 229

Heat Sink Number 2: EAST WALL(CONCRETE)

CONVECTIVE HEAT TRANSFER PARAMETERS

Slab Material	User-Defined
Slab Thickness	2.500 ft
Surface Area	1685.00 ft**2
Thermal Conductivity	1.040 BTU/hr-ft-deg. F
Density	143.600 lbm/ft**3
Thermal Diffusivity	.034 ft**2/hr
Heat Capacity	.210 BTU/lbm-deg. F
First Node Thickness	.05102 ft
Node Thickness Ratio	1.00
Number of Nodes	50
External Boundary Condition	Convective
External Heat Transfer Coefficient	Uchida
Outside Environment Index	0
Inside Environment Index	1
Interior Heat Transfer Coefficient	Uchida

CCN 1
CCN: N-1, P. 201

CALC. NO: M-73-116
REVISION: 2
P. TIGERI DATE: 12-17-92
[initials] DATE: 12/22/92

SHEET 201 OF

TABLE OF EXTERNAL HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

TABLE OF INTERIOR HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

TABLE OF HEAT SINK MESH POINT COORDINATES (feet)

.000000	.051020	.102041	.153061	.204082	.255102	.306122	.357143	.408163	.459184

.510204	.561224	.612245	.663265	.714286	.765306	.816326	.867347	.918367	.969388
1.020408	1.071428	1.122449	1.173469	1.224489	1.275510	1.326530	1.377551	1.428571	1.479591
1.530612	1.581632	1.632653	1.683673	1.734693	1.785714	1.836734	1.887754	1.938775	1.989795
2.040816	2.091836	2.142856	2.193877	2.244897	2.295918	2.346938	2.397958	2.448979	2.500000

CCN1
CCN: M-1, P. 202

M-73-116
2

P. TIGERI 12-17-92
[illegible] 12/22/92

SHEET 202 OF

SONGS UNITS 2 CONTROL ROOM CABINET 229

Heat Sink Number 3: SOUTH WALL(PLASTER)

CONVECTIVE HEAT TRANSFER PARAMETERS

Slab Material	User-Defined
Slab Thickness	.417 ft
Surface Area	91.20 ft**2
Thermal Conductivity	.567 BTU/hr-ft-deg. F
Density	15.337 lbm/ft**3
Thermal Diffusivity	.050 ft**2/hr
Heat Capacity	.738 BTU/lbm-deg. F
First Node Thickness	.01000 ft
Node Thickness Ratio	1.00
Number of Nodes	43
External Boundary Condition	Convective
External Heat Transfer Coefficient	Uchida
Outside Environment Index	9
Inside Environment Index	1
Interior Heat Transfer Coefficient	Uchida

CCN 1
CCN: N-1, P. 203

M-73-116
2
P. TIGERI 12-17-92
12/22/92

SHEET 203 OF

TABLE OF EXTERNAL HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

TABLE OF INTERIOR HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

TABLE OF HEAT SINK MESH POINT COORDINATES (feet)

.000000	.010000	.020000	.030000	.040000	.050000	.060000	.070000	.080000	.090000

.100000	.110000	.120000	.130000	.140000	.150000	.160000	.170000	.180000	.190000
.200000	.210000	.220000	.230000	.240000	.250000	.260000	.270000	.280000	.290000
.300000	.310000	.320000	.330000	.340000	.350000	.360000	.370000	.380000	.390000
.400000	.410000	.417000							

CCN 1
CCN: N-1, P 204

M-73-116
2
P.TIGERI 12-17-92
12/22/92

SHEET 204 OF

SONGS UNITS 2 CONTROL ROOM CABINET 229

Heat Sink Number 4: SOUTH WALL(CONCRETE)

CONVECTIVE HEAT TRANSFER PARAMETERS

Slab Material	User-Defined
Slab Thickness	2.000 ft
Surface Area	237.51 ft**2
Thermal Conductivity	1.040 BTU/hr-ft-deg. F
Density	143.600 lbm/ft**3
Thermal Diffusivity	.034 ft**2/hr
Heat Capacity	.210 BTU/lbm-deg. F
First Node Thickness	.04082 ft
Node Thickness Ratio	1.00
Number of Nodes	50
External Boundary Condition	Convective
External Heat Transfer Coefficient	Uchida
Outside Environment Index	0
Inside Environment Index	1
Interior Heat Transfer Coefficient	Uchida

CCN 1
CCN: N-1, P. 205

M-73-116
2
P.TIGERI 12-17-92
12/22/92

SHEET 205 OF

TABLE OF EXTERNAL HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1000.0	1.4700

TABLE OF INTERIOR HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

TABLE OF HEAT SINK MESH POINT COORDINATES (feet)

.000000 .040816 .081633 .122449 .163265 .204082 .244898 .285714 .326531 .367347

12

.408163	.448980	.489796	.530612	.571429	.612245	.653061	.693878	.734694	.775[illegible]
.816326	.857143	.897959	.938775	.979592	1.020408	1.061224	1.102041	1.142857	1.183673
1.224490	1.265306	1.306122	1.346938	1.387755	1.428571	1.469387	1.510204	1.551020	1.591836
1.632653	1.673469	1.714285	1.755102	1.795918	1.836734	1.877550	1.918367	1.959183	2.000000

CCN 1

CCN: N-1, P. 206

CALC. NO. M-73-116

~~2~~

P. TIGER 12-17-92

12/22/92

SHEET 206 OF

SONGS UNITS 2 CONTROL ROOM CABINET 229

Heat Sink Number 5: WEST WALL(PLASTER)

CONVECTIVE HEAT TRANSFER PARAMETERS

Slab Material	User-Defined
Slab Thickness	.417 ft
Surface Area	595.00 ft**2
Thermal Conductivity	.567 BTU/hr-ft-deg. F
Density	15.337 lbm/ft**3
Thermal Diffusivity	.050 ft**2/hr
Heat Capacity	.738 BTU/lbm-deg. F
First Node Thickness	.01000 ft
Node Thickness Ratio	1.00
Number of Nodes	43
External Boundary Condition	Convective
External Heat Transfer Coefficient	Uchida
Outside Environment Index	0
Inside Environment Index	1
Interior Heat Transfer Coefficient	Uchida

CCN 1
CCN: N-1, P.207

M-73-116
2
P.TIGERI 12-17-92
12/17/92

SHEET 207 OF

TABLE OF EXTERNAL HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

TABLE OF INTERIOR HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

TABLE OF HEAT SINK MESH POINT COORDINATES (feet)

.000000	.010000	.020000	.030000	.040000	.050000	.060000	.070000	.080000	.090000

.100000	.110000	.120000	.130000	.140000	.150000	.160000	.170000	.180000	.190000
.200000	.210000	.220000	.230000	.240000	.250000	.260000	.270000	.280000	.290000
.300000	.310000	.320000	.330000	.340000	.350000	.360000	.370000	.380000	.390000
.400000	.410000	.417000							

CCN 1
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CALC. NO: M-73-116
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L. [illegible] 17/12/92

SHEET 208 OF

SONGS UNITS 2 CONTROL ROOM CABINET 229

Heat Sink Number 6: CEILING(CONCRETE)

CONVECTIVE HEAT TRANSFER PARAMETERS
====================================

Slab Material	User-Defined
Slab Thickness	1.000 ft
Surface Area	3723.00 ft**2
Thermal Conductivity	1.040 BTU/hr-ft-deg. F
Density	143.600 lbm/ft**3
Thermal Diffusivity	.034 ft**2/hr
Heat Capacity	.210 BTU/lbm-deg. F
First Node Thickness	.02041 ft
Node Thickness Ratio	1.00
Number of Nodes	50
External Boundary Condition	Adiabatic
Inside Environment Index	1
Interior Heat Transfer Coefficient	Uchida

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CCN 1

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[illegible] 12/22/92

TABLE OF INTERIOR HEAT TRANSFER COEFFICIENTS
===

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

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TABLE OF HEAT SINK MESH POINT COORDINATES (feet)
===

.000000	.020408	.040816	.061224	.081633	.102041	.122449	.142857	.163265	.183673
.204082	.224490	.244898	.265306	.285714	.306122	.326531	.346939	.367347	.387755
.408163	.428571	.448980	.469388	.489796	.510204	.530612	.551020	.571428	.591837
.612245	.632653	.653061	.673469	.693877	.714286	.734694	.755102	.775510	.795918
.816326	.836734	.857143	.877551	.897959	.918367	.938775	.959183	.979592	1.000000

BONUS UNITS 2 CONTROL ROOM CABINET 229

AUXILIARY CONDITIONS SELECTED

Blowout Panels	OFF
Convective Heat Transfer	ON
Unit Air Coolers	OFF
Heating and Ventilation Flow	OFF
Compartment Leakage	OFF
Compartment Equipment Heat Loads	ON
Atmosphere Exhaust Fan	OFF
Blowdown Dropout	OFF
Zero Reverse Flow	OFF
HX Revaporization	OFF

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SHEET 210

PROBLEM CONTROL PARAMETERS

Problem Time Limit	14400.0	seconds
Flow Calculation Output/Frequency		OFF/ 0
Compartment Pressure Difference Output		OFF
Heat Sink Calculation Output/Frequency		ON/ 2
Extended Heatsink Output: Node Temperatures		ON
Restart Option		OFF
Number of Plot Points		25
SIGFLO Switch Time	1.000000E+20	seconds
SIGFLO Iteration Tolerance	.001000	psi
Maximum Number of Flow Iterations		500

CALCULATION/PRINT TIMES SELECTED

Calc. Time Step	Change Time	Print Interval	Change Time
1.000E-02	1.000E+00	3.600E+03	1.440E+04
1.000E-01	1.000E+01	3.600E+03	1.800E+04
1.000E+00	2.000E+01	0.000E+00	0.000E+00
1.000E+01	1.000E+02	0.000E+00	0.000E+00
2.500E+01	3.600E+04	0.300E+00	0.000E+00

SONGS UNITS 2 CONTROL ROOM CABINET 229

Time = 0 Hours 0 Minutes .00000 Seconds (.0000 Seconds) (Calc. Time Step = 1.000E-02 seconds)

----- Compartment ----	Temp. (Deg F)	S-Heat/ Quality	Rel. Hum.	Pressures (psia) -- Total	Air	Steam	K	Total Mass (lbm)	Frac. Air	Frac. Vapor	Heat Load	Total Energy (BTU)
0 Atmosphere	75.000		.50	14.700	14.485	.215	1.40		.9908	.0092		
1 ROOM 229	75.000	19.4 S	.50	14.700	14.485	.215	1.40	4.2139670E+03	.9908	.0092	54.41	4.2506140E+05

Compartments Initial Energy	4.2506E+05 BTU	Compartments Initial Mass	4.2140E+03 lbm
Current Energy in Compartments	4.2506E+05 BTU	Current Mass in Compartments	4.2140E+03 lbm
Blowdown Enthalpy Added	0.0000E+00 BTU	Blowdown Mass Added	0.0000E+00 lbm
Irreversible Energy Loss	0.0000E+00 BTU	(Condens. + Dropout) Mass Loss	0.0000E+00 lbm
Energy Lost to Atmosphere	0.0000E+00 BTU	Mass Lost to Atmosphere	0.0000E+00 lbm
[Rate of Energy Loss to Atmosphere	0.0000E+00 BTU/sec]	[Rate of Mass Loss to Atmosphere	0.0000E+00 lbm/sec]

Absolute Energy Imbalance	0.0000E+00 BTU	Absolute Mass Imbalance	0.0000E+00 lbm
Relative Energy Imbalance	0.0000E+00 %	Relative Mass Imbalance	0.0000E+00 %

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SONGS UNITS 2 CONTROL ROOM CABINET 229

Time = 1 Hours 0 Minutes .00000 Seconds (3600.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

----- Compartment ----	Temp. (Deg F)	S-Heat/ Quality	Rel. Hum.	-- Pressures (psia) -- Total	Air	Steam	K	Total Mass (lbm)	Frac. Air	Frac. Vapor	Heat Load	Total Energy (BTU)
0 Atmosphere	75.000		.50	14.700	14.485	.215	1.40		.9908	.0092		
1 ROOM 229	98.643	41.9 S	.25	15.350	15.125	.225	1.40	4.2139670E+03	.9908	.0092	54.41	4.4239650E+05

Compartments Initial Energy	4.2506E+05 BTU	Compartments Initial Mass	4.2140E+03 lbm
Current Energy in Compartments	4.4240E+05 BTU	Current Mass in Compartments	4.2140E+03 lbm
Blowdown Enthalpy Added	0.0000E+00 BTU	Blowdown Mass Added	0.0000E+06 lbm
Irreversible Energy Loss	-1.8035E+04 BTU	(Condens. + Dropout) Mass Loss	0.0000E+00 lbm
Energy Lost to Atmosphere	6.9860E+02 BTU	Mass Lost to Atmosphere	0.0000E+00 lbm
[Rate of Energy Loss to Atmosphere	7.0736E-01 BTU/sec]	[Rate of Mass Loss to Atmosphere	0.0000E+00 lbm/sec]

Absolute Energy Imbalance	-1.2003E+00 BTU	Absolute Mass Imbalance	0.0000E+00 lbm
Relative Energy Imbalance	-2.7132E-04 %	Relative Mass Imbalance	0.0000E+00 %

CCN: CCN 1 N-1, P. 212

CALC. NO: M-73-116
CHECKED: ? PG
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I M 11/11/92

SHEET 212 OF

SONGS UNITS 2 CONTROL ROOM CABINET 229

Time = 1 Hours 0 Minutes .00000 Seconds (3600.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

Heat Sink Calculation Output

HS#	Comp	T	TSAT	TWALL	HCOND	HCONV	AREA	QCOND	QCONV	QSENS	QTOT	HS#
1 Left	1	98.643	56.754	84.089	.000	1.470	1196.0	0.000000E+00	-7.122779E+00	0.000000E+00	-7.122779E+00	1
1 Right	0	75.000	*******	75.630	.000	1.470	1196.0	0.000000E+00	3.021888E-01	0.000000E+00	3.021888E-01	1
2 Left	1	98.643	56.754	80.183	.000	1.470	1685.0	0.000000E+00	-1.271500E+01	0.000000E+00	-1.271500E+01	2
2 Right	0	75.000	*******	75.001	.000	1.470	1685.0	0.000000E+00	7.559052E-04	0.000000E+00	7.559052E-04	2
3 Left	1	98.643	56.754	84.357	.000	1.470	91.2	0.000000E+00	-5.331884E-01	0.000000E+00	-5.331884E-01	3
3 Right	0	75.000	*******	76.462	.000	1.470	91.2	0.000000E+00	5.375752E-02	0.000000E+00	5.375752E-02	3
4 Left	1	98.643	56.754	80.188	.000	1.470	237.5	0.000000E+00	-1.791757E+00	0.000000E+00	-1.791757E+00	4
4 Right	0	75.000	*******	74.999	.000	1.470	237.5	0.000000E+00	-6.511327E-05	0.000000E+00	-6.511327E-05	4
5 Left	1	98.643	56.754	84.357	.000	1.470	595.0	0.000000E+00	-3.478587E+00	0.000000E+00	-3.478587E+00	5
5 Right	0	75.000	*******	76.462	.000	1.470	595.0	0.000000E+00	3.507207E-01	0.000000E+00	3.507207E-01	5
6 Left	1	98.643	56.754	80.203	.000	1.470	3723.0	0.000000E+00	-2.806311E+01	0.000000E+00	-2.806311E+01	6

CCN!
CCN; N-1 , P. 213

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SHEET 213 OF

SONGS UNITS 2 CONTROL ROOM CABINET 229

Time = 1 Hours 0 Minutes .00000 Seconds (3600.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

CCN 1
CCN: N-1, P. 214

Extended Heatsink Output: Node Temperatures

CALC. NO: M-73-116
REVISION: 2
BY: P. TIGER DATE: 12-17-92
CHECKED: DATE: 12/21/92

214

Heat Sink No. 1, NORTH WALL(PLASTER)

84.088650	83.674290	83.271880	82.881500	82.503200
82.136990	81.782810	81.440580	81.110320	80.791960
80.485440	80.190460	79.907070	79.635100	79.374300
79.124600	78.885770	78.657620	78.439970	78.232570
78.035190	77.847630	77.669590	77.500890	77.341220
77.190400	77.048130	76.914150	76.788240	76.670070
76.559480	76.456150	76.359830	76.270360	76.187410
76.110810	76.040310	75.975680	75.916780	75.863310
75.815220	75.772190	75.734100	75.700780	75.672090
75.647860	75.629790			

Heat Sink No. 2, EAST WALL(CONCRETE)

80.183260	78.963470	77.959200	77.155000	76.529750
76.057950	75.712430	75.407250	75.298550	75.185880
75.112880	75.067050	75.039150	75.022490	75.013030
75.007600	75.004550	75.002900	75.001860	75.001190
75.000890	75.000700	75.000700	75.000700	75.000700
75.000700	75.000700	75.000700	75.001010	75.001500
75.001500	75.001500	75.001500	75.001680	75.001680
75.001680	75.001680	75.001680	75.001680	75.001680
75.001680	75.001680	75.001680	75.001680	75.001500
75.001190	75.001130	75.001190	75.001250	75.001130

Heat Sink No. 3, SOUTH WALL(PLASTER)

84.356900	83.991120	83.634610	83.287380	82.949490
82.621000	82.301850	81.991970	81.691440	81.400180
81.118260	80.845610	80.582120	80.327790	80.082550
79.846340	79.618990	79.400480	79.190700	78.989590
78.796970	78.612760	78.436860	78.269130	78.109410
77.957610	77.813630	77.677220	77.548370	77.426850

77.312590	77.205350	77.105070	77.011570	76.924650
76.844270	76.770230	76.702420	76.640660	76.584810
76.534700	76.490200	76.462310		

Heat Sink No. 4, SOUTH WALL(CONCRETE)

80.188260	79.194790	78.340480	77.618560	77.019500
76.531770	76.142180	75.836940	75.602570	75.426120
75.295930	75.201810	75.135100	75.088780	75.057100
75.036100	75.022250	75.013400	75.007840	75.004360
75.002170	75.000890	75.000150	74.999850	74.999790
74.999850	74.999850	74.999850	74.999850	74.999850
74.999850	74.999790	74.999730	74.999660	74.999600
74.999540	74.999480	74.999420	74.999420	74.999420
74.999420	74.999420	74.999420	74.999420	74.999420
74.999420	74.999420	74.999420	74.999420	74.999360

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SONGS UNITS 2 CONTROL ROOM CABINET 229

Time = 1 Hours 0 Minutes .00000 Seconds (3600.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

Extended Heatsink Output: Node Temperatures

Heat Sink No. 5, WEST WALL(PLASTER)

84.356900	83.991120	83.624610	83.287380	82.949490
82.621000	82.301850	81.991970	81.691440	81.400180
81.118260	80.845610	80.582120	80.327790	80.082550
79.846240	79.618990	79.400480	79.190700	78.989590
78.796970	78.612760	78.436860	78.269130	78.109410
77.957610	77.813630	77.677220	77.548370	77.426850
77.312590	77.205350	77.105070	77.011570	76.924650
76.844270	76.770230	76.702420	76.640660	76.584810
76.534700	76.490200	75.462210		

Heat Sink No. 6, CEILING(CONCRETE)

80.203280	79.689000	79.209870	78.765470	78.355130
77.977810	77.632540	77.317960	77.032810	76.775360
76.544100	76.337430	76.153590	75.990880	75.847560
75.722020	75.612520	75.517610	75.435700	75.365390
75.305330	75.254300	75.211210	75.174960	75.144620
75.119420	75.098540	75.081450	75.067410	75.056060
75.046840	75.039460	75.033540	75.028900	75.025180
75.022310	75.020110	75.018450	75.017240	75.016330
75.015660	75.015230	75.014660	75.014740	75.014740
75.014800	75.014800	75.014920	75.014980	75.015050

CCN 1
CCN: N-1, P. 216

CALC. NO. M-73-11C
REVISION 2
BY P. TIGER DATE 12-17-92
CHECKED [signature] 12/21/92

SHEET 216 OF

SONGS UNITS 2 CONTROL ROOM CABINET 229

Time = 2 Hours 0 Minutes .00000 Seconds (7200.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

----- Compartment ----	Temp. (Deg F)	S-Heat/ Quality	Rel. Hum.	-- Pressures (psia) -- Total	Air	Steam	K	Total Mass (lbm)	Frac. Air	Frac. Vapor	Heat Load	Total Energy (BTU)
0 Atmosphere	75.000		.50	14.700	14.485	.215	1.40		.9908	.0092		
1 ROOM 229	161.448	44.6 S	.23	15.427	15.201	.226	1.40	4.2139670E+03	.9908	.0092	54.41	4.4445360E+05

Compartments Initial Energy	4.2506E+05 BTU	Compartments Initial Mass	4.2140E+03 lbm
Current Energy in Compartments	4.4445E+05 BTU	Current Mass in Compartments	4.2140E+03 lbm
Blowdown Enthalpy Added	0.0000E+00 BTU	Blowdown Mass Added	0.0000E+00 lbm
Irreversible Energy Loss	-2.5496E+04 BTU	(Condens. + Dropout) Mass Loss	0.0000E+00 lbm
Energy Lost to Atmosphere	.1022E+03 BTU	Mass Lost to Atmosphere	0.0000E+00 lbm
[Rate of Energy Loss to Atmosphere	2.2963E+00 BTU/sec]	[Rate of Mass Loss to Atmosphere	0.0000E+00 lbm/sec]

Absolute Energy Imbalance	-1.2656E+00 BTU	Absolute Mass Imbalance	0.0000E+00 lbm
Relative Energy Imbalance	-2.8476E-04 %	Relative Mass Imbalance	0.0000E+00 %

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SHEET 217 OF

SONGS UNITS 2 CONTROL ROOM CABINET 229

Time = 3 Hours 0 Minutes .00000 Seconds (10800.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

----- Compartment ----	Temp. (Deg F)	S-Heat/ Quality	Rel. Hum.	-- Pressures (psia) -- Total	Air	Steam	K	Total Mass (lbm)	Frac. Air	Frac. Vapor	Heat Load	Total Energy (BTU)
0 Atmosphere	75.000		.50	14.700	14.485	.215	1.40		.9908	.0092		
1 ROOM 229	103.549	46.6 S	.21	15.485	15.258	.227	1.40	4.2139670E+03	.9908	.0092	54.41	4.4599400E+05

Compartments Initial Energy	4.2506E+05 BTU	Compartments Initial Mass	4.2140E+03 lbm
Current Energy in Compartments	4.4599E+05 BTU	Current Mass in Compartments	4.2140E+03 lbm
Blowdown Enthalpy Added	0.0000E+00 BTU	Blowdown Mass Added	0.0000E+00 lbm
Irreversible Energy Loss	-3.7814E+04 BTU	(Condens. + Dropout) Mass Loss	0.0000E+30 lbm
Energy Lost to Atmosphere	1.6880E+04 BTU	Mass Lost to Atmosphere	0.0000E+00 lbm
[Rate of Energy Loss to Atmosphere	3.6487E+00 BTU/sec]	[Rate of Mass Loss to Atmosphere	0.0000E+00 lbm/sec]

Absolute Energy Imbalance	-1.1914E+00 BTU	Absolute Mass Imbalance	0.0000E+00 lbm
Relative Energy Imbalance	-2.6714E-04 %	Relative Mass Imbalance	0.0000E+00 %

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SONGS UNITS 2 CONTROL ROOM CABINET 229

Time = 3 Hours 0 Minutes .00000 Seconds (10800.0000 Seconds) (Calc. Time Step = 3.500E+01 seconds)

Heat Sink Calculation Output

HS#	Comp	T	TSAT	TWALL	HCOND	HCONV	AREA	QCOND	QCONV	QSENS	QTOT	HS#
1 Left	1	103.549	56.994	90.263	.000	1.470	1196.0	0.000000E+00	-6.496433E+00	0.000000E+00	-6.496432E+00	1
1 Right	0	75.000	*******	79.122	.000	1.470	1196.0	0.000000E+00	2.007746E+00	0.000000E+00	2.007746E+00	1
2 Left	1	103.549	56.994	84.499	.000	1.470	1685.0	0.000000E+00	-1.311542E+01	0.000000E+00	-1.311542E+01	2
2 Right	0	75.000	*******	75.001	.000	1.470	1685.0	0.000000E+00	7.559052E-04	0.000000E+00	7.559052E-04	2
3 Left	1	103.549	56.994	90.751	.000	1.470	91.2	0.000000E+00	-4.772102E-01	0.000000E+00	-4.772102E-01	3
3 Right	0	75.000	*******	80.865	.000	1.470	91.2	0.000000E+00	2.180008E-01	0.000000E+00	2.180008E-01	3
4 Left	1	103.549	56.994	84.499	.000	1.470	237.5	0.000000E+00	-1.848666E+00	0.000000E+00	-1.848666E+00	4
4 Right	0	75.000	*******	74.999	.000	1.470	237.5	0.000000E+00	-6.511327E-05	0.000000E+00	-6.511327E-05	4
5 Left	1	103.549	56.994	90.751	.000	1.470	595.0	0.000000E+00	-3.113378E+00	0.000000E+00	-3.113378E+00	5
5 Right	0	75.000	*******	80.865	.000	1.470	595.0	0.000000E+00	1.422264E+00	0.000000E+00	1.422264E+00	5
6 Left	1	103.549	56.994	84.502	.000	1.470	3723.0	0.000000E+00	-2.897456E+01	0.000000E+00	-2.897456E+01	6

CCN: CCN N-1, P. 219

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SONGS UNITS 2 CONTROL ROOM CABINET 229

Time = 3 Hours 0 Minutes .00000 Seconds (10800.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

CCN 1
CCN: N-1, P 220

Extended Heatsink Output: Node Temperatures

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11/22/92

220

Heat Sink No. 1, NORTH WALL(PLASTER)

90.263030	89.882420	89.508090	89.140170	88.778590
88.423430	88.074620	87.732210	87.396270	87.066740
86.743680	86.427030	86.116730	85.812900	85.515410
85.224330	84.939610	84.661220	84.389190	84.123380
83.863860	83.610500	83.363310	83.122220	82.887740
82.658230	82.435210	82.218110	82.006810	81.801300
81.601470	81.407260	81.218600	81.035370	80.8575[illegible]
80.685030	80.517730	80.355560	80.198390	80.046170
79.898770	79.756130	79.618070	79.484530	79.355440
79.230560	79.121800			

Heat Sink No. 2, EAST WALL(CONCRETE)

84.499110	83.189910	82.008150	80.950590	80.012790
79.188320	78.470310	77.850920	77.321810	76.874300
76.499480	76.188750	75.933810	75.726840	75.560460
75.428130	75.324130	75.243070	75.180690	75.133150
75.097320	75.070530	75.050750	75.036290	75.025790
75.018280	75.012910	75.009060	75.006440	75.004550
75.003080	75.002170	75.001740	75.001680	75.001680
75.001680	75.001680	75.001680	75.001680	75.001680
75.001680	75.001680	75.001680	75.001680	75.001500
75.001190	75.001130	75.001190	75.001250	75.001130

Heat Sink No. 3, SOUTH WALL(PLASTER)

90.750760	90.421230	90.096410	89.776210	89.460720
89.149930	88.843900	88.542570	88.245880	87.953890
87.666560	87.384190	87.106350	86.833220	86.564790
86.301060	86.041900	85.787450	85.537570	85.292330
85.051610	84.815400	84.583710	84.356480	84.133700
83.915250	83.701140	83.491360	83.285800	83.084440

82.887180	82.694000	82.504850	82.319670	82.138400
81.960910	81.787200	81.617160	81.450780	81.287930
81.128510	80.972500	80.865260		

Heat Sink No. 4, SOUTH WALL(CONCRETE)

84.499360	83.441800	82.466090	81.570890	80.753690
80.012360	79.343660	78.744110	78.209690	77.736240
77.319610	76.954930	76.638280	76.364780	76.130220
75.930270	75.761020	75.618620	75.499850	75.401280
75.320160	75.253750	75.199800	75.156400	75.121430
75.093600	75.071620	75.054410	75.040990	75.030550
75.022550	75.016390	75.011810	75.008270	75.005520
75.003390	75.001860	75.000640	74.999910	74.999480
74.999420	74.999420	74.999420	74.999420	74.999420
74.999420	74.999420	74.999420	74.999420	74.999530

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SONGS UNITS 2 CONTROL ROOM CABINET 229

Time = 3 Hours 0 Minutes .00000 Seconds (10800.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

Extended Heatsink Output: Node Temperatures

Heat Sink No. 5, WEST WALL(PLASTER)

90.750760	90.421230	90.096410	89.776210	89.460720
89.149930	88.843900	88.542570	88.245880	87.953890
87.666660	87.384190	87.106350	86.833220	86.564790
86.301060	86.041900	85.787450	85.537570	85.292330
85.051610	84.815400	84.583710	84.356480	84.133700
83.915250	83.701140	83.491360	83.285800	83.084440
82.887180	82.694000	82.504850	82.319670	82.138400
81.960910	81.787200	81.617160	81.450780	81.287930
81.128510	80.972500	80.865260		

Heat Sink No. 6, CEILING(CONCRETE)

84.501680	83.962490	83.443880	82.945710	82.467800
82.010160	81.572360	81.154270	80.755460	80.375580
80.014250	79.671110	79.345670	79.037570	78.746190
78.471160	78.211880	77.967930	77.738680	77.523650
77.322380	77.133940	76.958220	76.794530	76.642240
76.500820	76.369780	76.248500	76.136510	76.033360
75.938510	75.851530	75.771940	75.699250	75.633210
75.573270	75.519130	75.470370	75.426730	75.387910
75.353610	75.323640	75.297700	75.275670	75.257350
75.242580	75.231170	75.223110	75.218350	75.216770

CCN: CCN N-1, P. 222

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SONGS UNITS 2 CONTROL ROOM CABINET 229

Time = 4 Hours 0 Minutes .00000 Seconds (14400.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

----- Compartment ----	Temp. (Deg F)	S-Heat/ Quality	Rel. Hum.	-- Pressures (psia) -- Total	Air	Steam	K	Total Mass (lbm)	Frac. Air	Frac. Vapor	Heat Load	Total Energy (BTU)
0 Atmosphere	75.000		.50	14.700	14.485	.215	1.40		.9908	.0092		
1 ROOM 229	105.281	48.2 S	.20	15.532	15.305	.227	1.40	4.2139670E+03	.9908	.0092	54.41	4.4[illegible]6370E+05

Compartments Initial Energy	4.250[illegible]E+05 BTU	Compartments Initial Mass	4.2140E+03 lbm
Current Energy in Compartments	4.4726E+05 BTU	Current Mass in Compartments	4.2140E+03 lbm
Blowdown Enthalpy Added	0.0000E+00 BTU	Blowdown Mass Added	0.0000E+00 lbm
Irreversible Energy Loss	-5.4200E+04 BTU	(Condens. + Dropout) Mass Loss	0.0000E+00 lbm
Energy Lost to Atmosphere	3.1996E+04 BTU	Mass Lost to Atmosphere	0.0000E+00 lbm
[Rate of Energy Loss to Atmosphere	4.7137E+00 BTU/sec]	[Rate of Mass Loss to Atmosphere	0.0000E+00 lbm/sec]

Absolute Energy Imbalance	-1.3164E+00 BTU	Absolute Mass Imbalance	0.0000E+00 lbm
Relative Energy Imbalance	-2.9432E-04 %	Relative Mass Imbalance	0.0000E+00 %

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SHEET 223

SONGS UNITS 2 CONTROL ROOM CABINET 229

MAXIMUM AND MINIMUM PRESSURES AND TEMPERATURES

	Maximum				Minimum			
Compartment	(psia) Pressure	(sec) at Time	(deg. F) Temperature	(sec) at Time	(psia) Pressure	(sec) at Time	(deg. F) Temperature	(sec) at Time
1 ROOM 229	15.5325	1.4400E+04	105.281	1.4400E+04	14.7000	1.0000E-02	75.000	.0000

781 Calculation cycles were performed

==> Execution time: 00:02:01.34

CCN 1
CCN: N-1 ? 224

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NES&L DEPARTMENT
CALCULATION SHEET

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CCN CONVERSION CCN NO. CCN - 1	

Project or DCP/MMP SONGS 2/3 Calc No. M73-116

Subject Room Temperature Response During Station Blackout (SBO) Sheet No. 225

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
~~0~~ 1	PARVIZ TIGERI	10/15	[signature]	12/12/98					

8.6 Control Room Cabinet Area # 227

The results of the temperature rise analyses of Cabinet Area Room 227 and Cable Riser Gallery Room 224(Section 8.7) are as follow:

Name	Temperaturer 1hr SBO [°F]
Control Cabinet Area Room 227	98.656
Cable Riser Gallery Room 224	98.765

Conclusion:

Based on the temperature rise review of the Cabinet Room 227 and the Cable Riser Gallery Room 224 it can be concluded that the temperature change in room 224 does not affect the temperature rise in room 227.

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CALCULATION SHEET

~~CCN NO.~~ PRELIM. CCN NO. N-1	PAGE 226 OF
	CCN CONVERSION: CCN NO. CCN-- 1

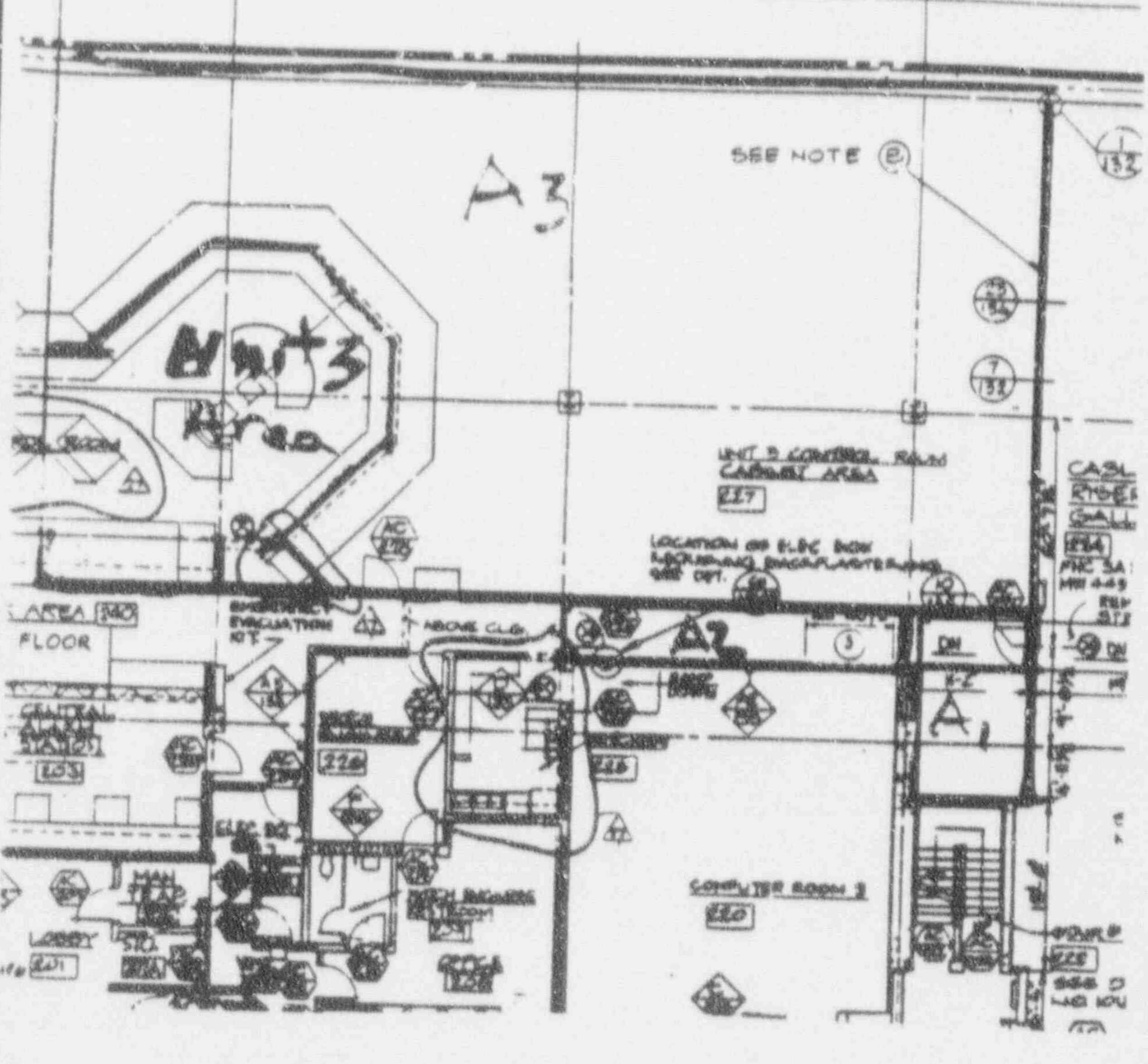
Project or DCP/MMP SONGS 2/3 Calc No. M73-116

Subject Room Temperature Response During SBO Sheet No. 226

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
	P. TIGERI	11/19/92	[illegible]	12/22/92					

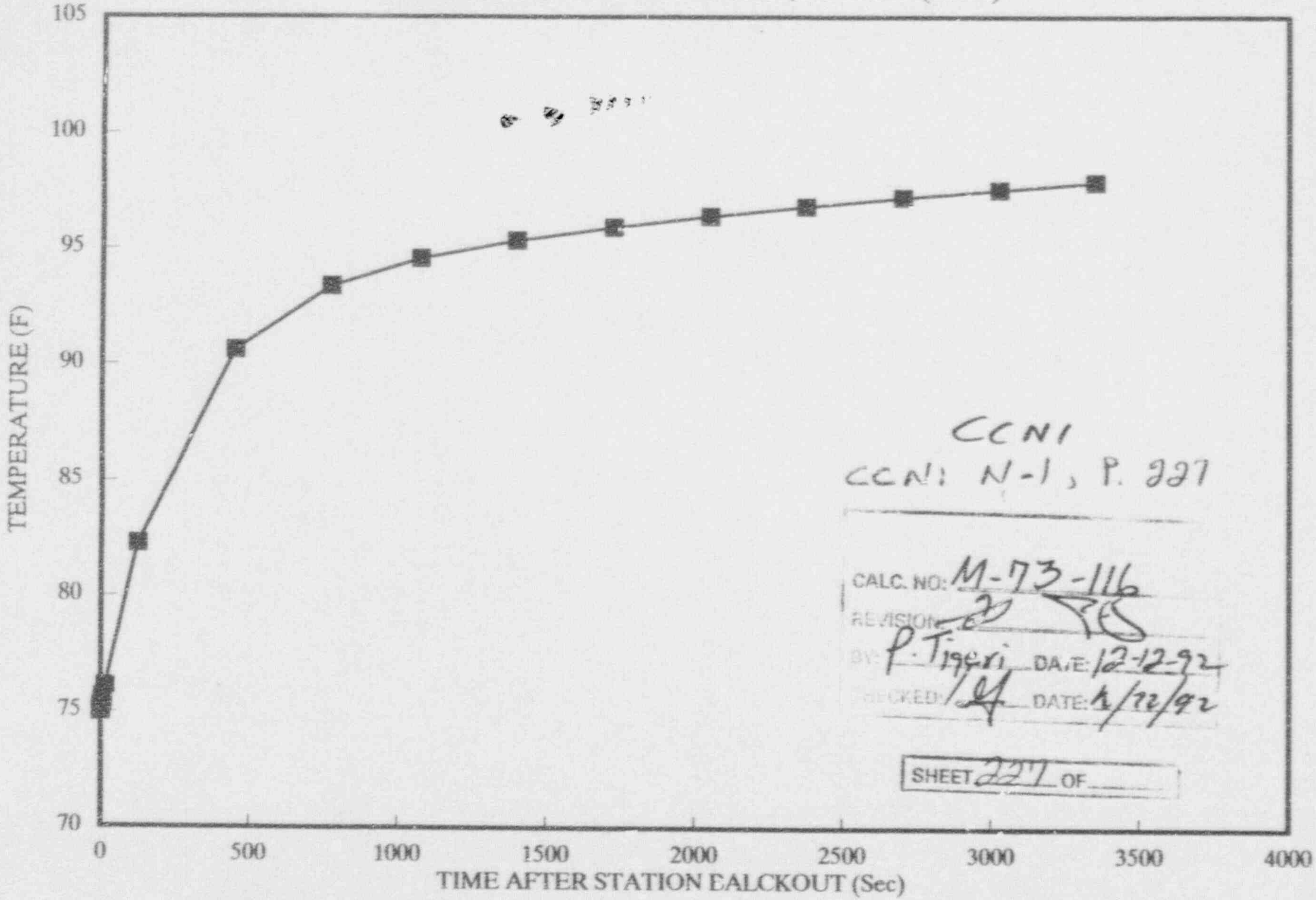
8.6 CONTROL ROOM CAB..NET AREA, ROOM 227(EL.30)

(Ref. # 6.8.1)



TEMPERATURE RESPONSE DURING UNIT 2 SBO

CONTROL ROOM CABINET AREA, ROOM 227(EL.30)



CCN1

CCN1: N-1, P. 227

CALC. NO: M-73-116

REVISION: 2 TS

BY: P. Tigeri DATE: 12-12-92

CHECKED: DATE: 12/22/92

SHEET 227 OF

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CALCULATION SHEET

~~ICCN NO.~~/ PRELIM. CCN NO. N-1	PAGE 228 OF

CCN CONVERSION
CCN NO. CCN - 1

Project or DCP/MMP SONGS 2/3 Calc No. M73-116

Subject Room Temperature Response During Station Blackout (SBO) Sheet No. 228

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
1	PARVIZ TIGERI	10/15							

Input data summary used for Control Cabinet area(Room 227) Temperature Rise Analysis.

$Q = 54.44$ BTU/S (see section 8.6)

$V = 57092.0\ ft^3$ (see assumption 3.17)

Heat Sink	K_e BTU/hr-ft-°F	ρ_e lbm/ft^3	Cp_e BTU/lbm-°F	A (ft^2)	t (ft)	Ti (°F)
South Wall Plaster	0.509	18.556	0.739	1196	0.459	75
East Wall Concrete	1.04	143.6	0.21	1685	2.5	75
North Wall Plaster	0.567	15.337	0.738	91.2	0.417	75
North Wall Concrete	1.04	143.6	0.21	237.5	2.00	75
West Wall Plaster	0.567	15.337	0.738	595	0.417	75
Ceiling Concrete	1.04	143.6	0.21	3723	1.00	75

See data below for reference to above table.

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
1	PARVIZ TIGERI	10/15	[illegible]	11/21/94					

CALCULATION OF CABINET AREA (ROOM 227) UNIT 3

Ls := 62.96 ft (Ref. # 6.8.1)

Le := 88.67 ft (Ref. # 6.8.1)

Lw := 31.00 ft (Ref. # 6.8.1)

hr := 19.00 ft (Ref. # 6.8.4)

CALCULATION OF THE CEILING(PLEASE SEE UNIT 2 CALCULATION OF CABINET AREA ROOM 229 OF THIS CALC.; UNIT 2 AND UNIT 3 CABINET AREA ARE THE SAME.)

$A1 := 11.167 \cdot 12.5$

$A1 = 139.588$ ft^2

$A2 := 42.17 \cdot 4.8$

$A2 = 202.416$ ft^2

$A3 := 46.92 \cdot 88.67$

$A3 = 4.16 \cdot 10^{3}$ ft^2

$U2 := 665.54$ ft^2 (Ref. UNIT 2 CEILING AREA OF THIS CALC.; UNIT 2 AND UNIT 3 FLOOR AREA ARE THE SAME.)

$A4 := \frac{1}{2} \cdot (21.6 + 26) \cdot 4.8$

$A4 = 114.24$ ft^2

$Anet := A3 - (U2 + A4)$

$Anet = 3.381 \cdot 10^{3}$ ft^2

$Ace := A1 + A2 + Anet$

$Ace = 3.723 \cdot 10^{3}$ ft^2

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
1	PARVIZ TIFERI	10/15		12/12/96					

CALCULATION OF WALLS AREA(FOR CABINET AREA ROOM 227 UNIT 3)

CALCULATION OF AREAS; FOR SOUTH, EAST, AND WEST WALLS

$As := Ls \cdot hr$

$As = 1.196 \cdot 10^{3}$ ft^2

$Ae := Le \cdot hr$

$Ae = 1.685 \cdot 10^{3}$ ft^2

$Aw := Lw \cdot hr$

$Aw = 589$ ft^2

CALCULATION OF AREA; FOR NORTH WALL

$Lc := 12.5$ ft (Ref. # 6.8.1)

$Ac := Lc \cdot hr$

$Ac = 237.5$ ft^2

$Lp := 4.8$ ft (Ref. # 6.8.1)

$Ap := Lp \cdot hr$

$Ap = 91.2$ ft^2

CALCULATION OF PROPERTIES(Ke, ρe, AND Cpe) FOR COMPOSITE WALLS

SOUTH WALL

$tp := 0.0833$	ft	(Ref. # 6.8.1)
$tair := 0.292$	ft	(Ref. # 6.2)

$tT := 2 \cdot tp + tair$

$tT := 0.459$ ft

$k_p := 0.25$	BTU/(hr-ft-F)	(Ref. # 6.17)
$\rho_p := 51.0$	lbm/ft^3	(Ref. # 6.17)
$Cp_p := 0.74$	BTU/(lbm-F)	(Ref. # 6.17)
$k_{air} := 1.24$	BTU/(hr-ft-F)	(Ref. PG. # 8)
$\rho_{air} := 0.07$	lbm/ft^3	(Ref. # 6.2)
$Cp_{air} := 0.24$	BTU/(lbm-F)	(Ref. # 6.2)

$$Ke := \frac{tT}{2 \cdot \frac{tp}{k_p} + \frac{tair}{k_{air}}} \quad ===>> \quad Ke = 0.509 \quad \text{BTU/(hr-ft-F)}$$

$$\rho e := \frac{\left[2 \cdot tp \cdot \rho_p\right] + \left[tair \cdot \rho_{air}\right]}{tT} \qquad \rho e = 18.556 \quad \text{lbm/ft^3}$$

$$Cpe := \frac{\left[2 \cdot tp \cdot \rho_p \cdot Cp_p\right] + \left[tair \cdot \rho_{air} \cdot Cp_{air}\right]}{\left[2 \cdot tp \cdot \rho_p\right] + \left[tair \cdot \rho_{air}\right]}$$

$Cpe = 0.739$ BTU/(lbm-F)

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
1	PARVIZ TIGERI	10/15	[illegible]	12/2/[illegible]					

NORTH WALL

$tp := 0.0625$ ft (Ref. # 6.8.1)

$tair := 0.292$ ft (Ref. # 6.2)

$tT := 2 \cdot tp + tair$

$tT = 0.417$ ft

$$Ke := \frac{tT}{\left[2 \cdot \frac{tp}{k_p} + \frac{tair}{k_{air}}\right]}$$

$Ke = 0.567$ BTU/(hr-ft-F)

$$\rho e := \frac{\left[2 \cdot tp \cdot \rho_p\right] + \left[tair \cdot \rho_{air}\right]}{tT}$$

$\rho e = 15.337$ lbm/ft^3

$$Cpe := \frac{\left[2 \cdot tp \cdot \rho_p \cdot Cp_p\right] + \left[tair \cdot \rho_{air} \cdot Cp_{air}\right]}{\left[2 \cdot tp \cdot \rho_p\right] + \left[tair \cdot \rho_{air}\right]}$$

$Cpe = 0.738$ BTU/(lbm-F)

CALCULATION SHEET

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Project or DCP/MMP SONGS 2/3 Calc No. M73-116

CCN CONVERSION
CCN NO. CCN - 1

Subject Room Temperature Response During Station Blackout (SBO) Sheet No. 233

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
1	PARVIZ TIGERI	10/15	[illegible]	11/21/95					

WEST WALL

$tp := 0.0625$ ft (Ref. # 6.8.1)

$tair := 0.292$ ft (Ref. # 6.6)

$tT := 2 \cdot tp + tair$

$tT = 0.417$ ft

$$Ke := \frac{tT}{\left[2 \cdot \frac{tp}{k_p} + \frac{tair}{k_{air}}\right]}$$

$Ke = 0.567$ BTU/(hr-ft-F)

$$\rho e := \frac{\left[2 \cdot tp \cdot \rho_p\right] + \left[tair \cdot \rho_{air}\right]}{tT}$$

$\rho e = 15.337$ lbm/ft^3

$$Cpe := \frac{\left[2 \cdot tp \cdot \rho_p \cdot Cp_p\right] + \left[tair \cdot \rho_{air} \cdot Cp_{air}\right]}{\left[2 \cdot tp \cdot \rho_p\right] + \left[tair \cdot \rho_{air}\right]}$$

$Cpe = 0.738$ BTU/(lbm-F)

△

CALCULATION SHEET

~~ICCN NO./~~ PRELIM. CCN NO. N-1	PAGE 234 OF

Project or DCP/MMP SONGS 2/3 Calc No. M73-116

CCN CONVERSION
CCN NO. CCN - 1

Subject Room Temperature Response During Station Blackout (SBO) Sheet No. 234

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
1	PARVIZ TIGERI	10/15							

CALCULATION OF HEAT LOAD FOR CABINET AREA(ROOM 227)

Q3cr057 := 2431.04 W (Ref. # 6.7)

Q3cr056 := 2249.2 W (Ref. # 6.7)

Q3cr058 := 712.46 W (Ref. # 6.7)

Q3cr050 := 576.32 W (Ref. # 6.7)

Q3cr051 := 292.96 W (Ref. # 6.7)

Q3cr052 := 912.23 W (Ref. # 6.7)

Q3cr053 := 1042.41 W (Ref. # 6.7)

Q3cr054 := 1609.4 W (Ref. # 6.7)

Q3cr064 := 708.0 W (Ref. # 6.7)

Q23cr061 := 1861.03 W (Ref. # 6.7)

Q23cr061 IS FOR UNIT 2 AND 3 THEREFORE HEAT LOAD FOR UINT 3 (Q) IS

$$Q := \frac{Q23cr061}{2}$$

$Q = 930.515$ W

TOTAL HEAT LOAD THAT, CONTRIBUTING HEAT TO THE CONTROL ROOM CABINET AREA(ROOM 227) UNIT 3 IS

$$Q3 := Q3cr057 + Q3cr056 + Q3cr058 + Q3cr050 + Q3cr051 + Q3cr052 + Q3cr053 + Q3cr054 + Q3cr064 + Q$$

$Q3 = 1.146 \cdot 10^{4}$ W

50% OF THIS LEAT LOAD (Q3) TRANSFER TO CABINET AREA(ROOM 227)

$$Q\% := 50 \cdot \frac{Q3}{100}$$

$Q\% = 5.732 \cdot 10^{3}$ W

CALCULATION OF HEAT LOAD FOR CABINET AREA(ROOM 227)

Q3cr057 := 2431.04	W	(Ref. # 6.7)
Q3cr056 := 2249.2	W	(Ref. # 6.7)
Q3cr058 := 712.46	W	(Ref. # 6.7)
Q3cr050 := 576.32	W	(Ref. # 6.7)
Q3cr051 := 292.96	W	(Ref. # 6.7)
Q3cr052 := 912.23	W	(Ref. # 6.7)
Q3cr053 := 1042.41	W	(Ref. # 6.7)
Q3cr054 := 1609.4	W	(Ref. # 6.7)
Q3cr064 := 708.0	W	(Ref. # 6.7)
Q23cr061 := 1861.03	W	(Ref. # 6.7)

Q23cr061 IS FOR UNIT 2 AND 3 THEREFORE HEAT LOAD FOR UINT 3 (Q) IS

$$Q := \frac{Q23cr061}{2}$$

$Q = 930.515$ W

TOTAL HEAT LOAD THAT, CONTRIBUTING HEAT TO THE CONTROL ROOM CABINET AREA(ROOM 227) UNIT 3 IS

$$Q3 := Q3cr057 + Q3cr056 + Q3cr058 + Q3cr050 + Q3cr051 + Q3cr052 + Q3cr053 + Q3cr054 + Q3cr064 + Q$$

$Q3 = 1.146 \cdot 10^{4}$ W

50% OF THIS LEAT LOAD (Q3) TRANSFER TO CABINET AREA(ROOM 227)

$$Q\% := 50 \cdot \frac{Q3}{100}$$

$Q\% = 5.732 \cdot 10^{3}$ W

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
1	PARVIZ TIGERI	10/15	[illegible]	[illegible]					

THEREFORE CABINET AREA(ROOM 227) UNIT 3, HEAT LOAD IS

$Q := 51710$ W (Ref. # 6.7)

$QT := Q + Q\%$

$QT = 5.744 \cdot 10^{4}$ W

$QT := QT \cdot \dfrac{3.4121}{3600}$

$QT = 54.444$ BTU/S

△

SONGS UNITS 3 CONTROL ROOM CABINET AREA(ROOM 227)

```
 0.00
ROOM 227
      14.7     57092.0        75    0.50    1.00
    0.0000    0.0000    0.0000 1 0
 0.0000            54.44
 28800             54.44
@EOF
    0.0000  0.0000
@EOF
 0  0    000.00    000.00    000.00    000.00      000.00 1
@EOF
 0    000.00    000.00    000.00    000.00 1
@EOF
  0  0       1.00   0.60   0.60     0.00 0
@EOF
 0.0000      0.0000      0.0000
 1.0E6       0.0         0.0
@EOF
 1               1.00
@EOF
 0.0000      14.70       75           0.50
 1.e20       14.70       75           0.50
@EOF
SOUTH WALL(PLASTER)
3        1196       0.459        0.01  1.00
 1      0.00 1 4
 0.000             1.47
 1.E6              1.47
@EOF
  0       0.00
 0.0000            1.47
 1.E6              1.47
@EOF
      0.509     18.556      0.739
EAST WALL(CONCRETE)
3        1685         2.5        0.01  1.00
 1      0.00 1 4
 0.000             1.47
 1.E6              1.47
@EOF
  0       0.00
 0.000             1.47
 1.E6              1.47
@EOF
       1.04      143.6       0.21
                    NORTH WALL(PLASTER)
3        91.2       0.417        0.01  1.00
 1      0.00 1 4
 0.000             1.47
 1.E6              1.47
@EOF
  0       0.00
 0.000             1.47
 1.E6              1.47
```

CCN1

CCN: N-1 & P. 237

CALC. NO: M-73-116

REVISION: 3

BY: P. Tigeri DATE: 12-16-92

CHECKED: [illegible] DATE: 12-22-92

SHEET 237 OF

```
@EOF
      0.567     15.337      0.738
NORTH WALL(CONCRETE)
3      237.50         2.00        0.01  1.00
 1      0.00 1 4
 0.000            1.47
 1.E6             1.47
@EOF
  0       0.00
 0.000            1.47
 1.E3             1.47
@EOF
       1.04      143.6       0.21
                  WEST WALL(PLASTER)
3      595.0        0.417       0.01  1.00
 1      0.00 1 4
 0.000            1.47
 1.E6             1.47
@EOF
  0       0.00
 0.000            1.47
 1.E6             1.47
@EOF
      0.567     15.337      0.738
                   CEILING(CONCRETE)
3     3723.00        1.00        0.01  1.00
 1      0.00 1 1
 0.000            1.47
 1.E6             1.47
@EOF
       1.04      143.6       0.21
@EOF
 0 1 0 0 0 1 0 0 0 0
@EOF
      3600.0 1     0 0    2 0   25    1.E20    0.001  500
 0.01            1.0
 0.10            10.0
 1.00            20.0
 10.00           100.0
 25.00           36000.0
@EOF
 900.0           36000.0
@EOF
```


CCN 1

CCN: N-1 + P 238

CALC. NO: M-73-116

REVISION: 2

BY: P. Tigeri DATE: 12-16-92

CHECKED: [illegible] DATE: 12-22-92

SHEET 238 OF

SONGS UNITS 3 CONTROL ROOM CABINET AREA(ROOM 227)

* * * PCFLUD 3.7 * * *

> Thermofluid Dynamics for a System of Interconnected Compartments <

MAP-120

[] [] []

Release Record

Date	Version	Description of Changes
3/25/85	1.00	Original PC version
8/25/86	2.00	Air-only version (SF)
1/06/87	3.00	Added SIGFLO routine
6/02/88	3.10	Modified for new compiler
2/06/90	3.61	61 Compartment version
5/21/91	3.7	Automatic zero reverse flow

INPUT file name: b:r227.inp

OUTPUT file name: b:r227.OUT

PLOT file name: b:r227.PLT

CCN 1
CCN: N-1, P 239

CALC. NO: M-73-116
REVISION: 2
BY: P. Tigen DATE: 12-16-92
CHECKED: [illegible] DATE: 12-22-92

1

SHEET 231 OF

SONGS UNITS 3 CONTROL ROOM CABINET AREA(ROOM 227)

COMPARTMENT INITIAL CONDITIONS

Compartment	Description	Volume (ft**3)	Temperature (Degrees F)	Pressure (psia)	Rel. Humidity (Fraction)	Flow to Compartments (0 = Atmosphere)
0	Atmosphere		75.00	14.7000	.50	
1	ROOM 227	5.7092E+04	75.00	14.7000	.50	

CCN 1
CCN: N-1, P. 240

CALC. NO: M-73-116
REVISION: 2
BY: P. Tiseri DATE: 12-16-92
CHECKED: LY DATE: 12-27-92

SHEET 240 OF

SONGS UNITS 3 CONTROL ROOM CABINET AREA(ROOM 227)

COMPARTMENT AUXILIARY CONDITIONS

Compartment	Compartment Desc.	Air Cooler Constant (BTU/sec-deg)	Air Cooler Temperatures Water (F)	Start (F)	Equipment Heat Load Options	Leakage Constants Rate(CFM)	@ Press.(in. H2O)
1	ROOM 227	.000	.0	.0	1, 0	.00000	.0000

COMPARTMENT HEAT LOAD

Compartment 1

Time (seconds)	Heat Load (BTU/sec)
.00	54.44
28800.00	54.44

CCN!
CCN! N-1, P. 241

CALC. NO: M-73-116
REVISION: 2 ~~2~~ 6
BY: P. Tigeri DATE: 12-16-92
CHECKED: [illegible] DATE: 12-22-92

SHEET 241 OF ____

SONGS UNITS 3 CONTROL ROOM CABINET AREA(ROOM 227)

FLOW PATH DATA

Compartment From	Compartment To	Flow Area (ft**2)	Flow Coefficients Forward	Flow Coefficients Reverse	Set Pressure (psid)	Valve Setpoint Pressure (psid)	Valve Setpoint Temperature (F)
0	0	1.0	.600	.600	.0000		

CCN 1

CCN: N-1, P. 242

CALC. NO: M-73-116
REVISION: 2
BY: P. Tigeri DATE: 12-16-92
CHECKED: LM DATE: 12-22-92

SHEET 242 OF

SONGS UNITS 3 CO\ :OL ROOM CABINET AREA(ROOM 227)

BLOWDOWN DATA

Time (sec)	Flowrate (lbm/sec)	Enthalpy (BTU/lbm)
.00000	.00000	.00000
1.00000E+06	.00000	.00000

SPLIT OF BLOWDOWN DATA

Compartment	Fraction of Blowdown
1	1.00000

ATMOSPHERIC DATA

Time (sec)	Temp(deg.F)	Pressure(psia)	Relative Humidity
.00000	75.000	14.700	.50000
1.00000E+20	75.000	14.700	.50000

CCN 1
CCN: N-1, P. 243

CALC. NO: M-73-116
REVISION: ~~2~~ 3
BY: P. ligeri DATE: 12-16-92
CHECKED: [illegible] DATE: 12-22-92

SHEET 243 OF

SONGS UNITS 3 CONTROL ROOM CABINET AREA(ROOM 227)

Heat Sink Number 1: SOUTH WALL(PLASTER)

CONVECTIVE HEAT TRANSFER PARAMETERS

Slab Material	User-Defined
Slab Thickness	.459 ft
Surface Area	1196.00 ft**2
Thermal Conductivity	.509 BTU/hr-ft-deg. F
Density	18.556 lbm/ft**3
Thermal Diffusivity	.037 ft**2/hr
Heat Capacity	.739 BTU/lbm-deg. F
First Node Thickness	.01000 ft
Node Thickness Ratio	1.00
Number of Nodes	47
External Boundary Condition	Convective
External Heat Transfer Coefficient	Uchida
Outside Environment Index	0
Inside Environment Index	1
Interior Heat Transfer Coefficient	Uchida

TABLE OF EXTERNAL HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

TABLE OF INTERIOR HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

TABLE OF HEAT SINK MESH POINT COORDINATES (feet)

.000000	.010000	.020000	.030000	.040000	.050000	.060000	.070000	.080000	.090000

CCN 1
CCN: N-1, P. 244

CALC. NO: M-73-116
REVISION: 2
BY: P. Tigeri DATE: 12-16-92
CHECKED: [illegible] DATE: 12-22-92

SHEET 244 OF ____

.100000	.110000	.120000	.130000	.140000	.150000	.160000	.170000	.180000	.190000
.200000	.210000	.220000	.230000	.240000	.250000	.260000	.270000	.280000	.290000
.300000	.310000	.320000	.330000	.340000	.350000	.360000	.370000	.380000	.390000
.400000	.410000	.420000	.430000	.440000	.450000	.459000			

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CCN 1
CCN: N-1, P 2-15

CALC. NO: M-73-111
REVISION: ~~2~~ 3
BY: P. Tigeri DATE: 2-16-92
CHECKED: LG DATE: 12-21-92

SHEET 295 OF ____

SONGS UNITS 3 CONTROL ROOM CABINET AREA(ROOM 227)

Heat Sink Number 2: EAST WALL(CONCRETE)

CONVECTIVE HEAT TRANSFER PARAMETERS

Slab Material	User-Defined
Slab Thickness	2.500 ft
Surface Area	1685.00 ft**2
Thermal Conductivity	1.040 BTU/hr-ft-deg. F
Density	143.600 lbm/ft**3
Thermal Diffusivity	.034 ft**2/hr
Heat Capacity	.210 BTU/lbm-deg. F
First Node Thickness	.05102 ft
Node Thickness Ratio	1.00
Number of Nodes	50
External Boundary Condition	Convective
External Heat Transfer Coefficient	Uchida
Outside Environment Index	0
Inside Environment Index	1
Interior Heat Transfer Coefficient	Uchida

TABLE OF EXTERNAL HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

TABLE OF INTERIOR HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

TABLE OF HEAT SINK MESH POINT COORDINATES (feet)

.000000	.051020	.102041	.153061	.204082	.255102	.306122	.357143	.408163	.459184

8

CCN 1
CCN: N-1, P. 246

CALC. NO: M-73-116
REVISION: 2
BY: P. Tigeri DATE 12-16-92
CHECKED: LY DATE 12-22-92

SHEET 246 OF

.510204	.561224	.612245	.663265	.714286	.765306	.816326	.867347	.918367	.969388
1.020408	1.071428	1.122449	1.173469	1.224489	1.275510	1.326530	1.377551	1.428571	1.479591
1.530612	1.581632	1.632653	1.683673	1.734693	1.785714	1.836734	1.887754	1.938775	1.989795
2.040816	2.091836	2.142856	2.193877	2.244897	2.295918	2.346938	2.397958	2.448979	2.500000

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CCN 1
CCN: N-1, P. 247

CALC. NO: M-73-116
REVISION: ~~2~~ 2
BY: P. Tisari DATE: 12-16-92
CHECKED: [illegible] DATE: 12-22-92

SONGS UNITS 3 CONTROL ROOM CABINET AREA(ROOM 227)

Heat Sink Number 3: NORTH WALL(PLASTER)

CONVECTIVE HEAT TRANSFER PARAMETERS

Slab Material	User-Defined
Slab Thickness	.417 ft
Surface Area	91.20 ft**2
Thermal Conductivity	.567 BTU/hr-ft-deg. F
Density	15.337 lbm/ft**3
Thermal Diffusivity	.050 ft**2/hr
Heat Capacity	.738 BTU/lbm-deg. F
First Node Thickness	.01000 ft
Node Thickness Ratio	1.00
Number of Nodes	43
External Boundary Condition	Convective
External Heat Transfer Coefficient	Uchida
Outside Environment Index	0
Inside Environment Index	1
Interior Heat Transfer Coefficient	Uchida

TABLE OF EXTERNAL HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

TABLE OF INTERIOR HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

TABLE OF HEAT SINK MESH POINT COORDINATES (feet)

.000000	.010000	.020000	.030000	.040000	.050000	.060000	.070000	.080000	.090000

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CCN 1
CCN: N-1, P. 248

CALC. NO: M-73-116
REVISION: 2
BY: P. Tigeri DATE 12-16-92
CHECKED: LMJ DATE 12-22-92

SHEET 248 OF

.100000	.110000	.120000	.130000	.140000	.150000	.160000	.170000	.180000	.190000
.200000	.210000	.220000	.230000	.240000	.250000	.260000	.270000	.280000	.290000
.300000	.310000	.320000	.330000	.340000	.350000	.360000	.370000	.380000	.390000
.400000	.410000	.417000							

CCN 1
CCN: N-1, P. 249

CALC. NO: M-73-116
REVISION: 2
BY: P. Tigeri DATE: 12-16-92
CHECKED: [illegible] DATE: 12-22-92

SONGS UNITS 3 CONTROL ROOM CABINET AREA(ROOM 227)

Heat Sink Number 4: NORTH WALL(CONCRETE)

CONVECTIVE HEAT TRANSFER PARAMETERS

Slab Material	User-Defined
Slab Thickness	2.000 ft
Surface Area	237.50 ft**2
Thermal Conductivity	1.040 BTU/hr-ft-deg. F
Density	143.600 lbm/ft**3
Thermal Diffusivity	.034 ft**2/hr
Heat Capacity	.210 BTU/lbm-deg. F
First Node Thickness	.04082 ft
Node Thickness Ratio	1.00
Number of Nodes	50
External Boundary Condition	Convective
External Heat Transfer Coefficient	Uchida
Outside Environment Index	0
Inside Environment Index	1
Interior Heat Transfer Coefficient	Uchida

TABLE OF EXTERNAL HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00900	1.4700
1000.0	1.4700

TABLE OF INTERIOR HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

TABLE OF HEAT SINK MESH POINT COORDINATES (feet)

.000000	.040816	.081633	.122449	.163265	.204082	.244898	.285714	.326531	.367347

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CCN 1
CCN: N-1 , P. 250

CALC. NO: M-73-116
REVISION: 2
BY: P. Tigeri DATE: 12-16-92
CHECKED: LH 12-22-92

SHEET 250 OF

.408163	.448980	.489796	.530612	.571429	.612245	.653061	.693878	.734694	.775510
.816326	.857143	.897959	.938775	.979592	1.020408	1.061224	1.102041	1.142857	1.183673
1.224490	1.265306	1.306122	1.346938	1.387755	1.428571	1.469387	1.510204	1.551020	1.591836
1.632653	1.673469	1.714285	1.755102	1.795918	1.836734	1.877550	1.918367	1.959183	2.000000

CCN 1

CCN: N-1, P. 951

CALC. NO: M-73-116

REVISION: 2

BY: P. Tigeri DATE: 12-16-92

CHECKED: [illegible] DATE: 12-22-92

SHEET 251

SONGS UNITS 3 CONTROL ROOM CABINET AREA(ROOM 227)

Heat Sink Number 5: WEST WALL(PLASTER)

CONVECTIVE HEAT TRANSFER PARAMETERS

Slab Material	User-Defined
Slab Thickness	.417 ft
Surface Area	595.00 ft**2
Thermal Conductivity	.567 BTU/hr-ft-deg. F
Density	15.337 lbm/ft**3
Thermal Diffusivity	.050 ft**2/hr
Heat Capacity	.738 BTU/lbm-deg. F
First Node Thickness	.01000 ft
Node Thickness Ratio	1.00
Number of Nodes	43
External Boundary Condition	Convective
External Heat Transfer Coefficient	Uchida
Outside Environment Index	0
Inside Environment Index	1
Interior Heat Transfer Coefficient	Uchida

TABLE OF EXTERNAL HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

TABLE OF INTERIOR HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

TABLE OF HEAT SINK MESH POINT COORDINATES (feet)

.000000 .010000 .020000 .030000 .040000 .050000 .060000 .070000 .080000 .090000

14

CCN1
CCN: N-1, P 252

CALC NO. M-73-116
P. Tigeri 12-16-92
12-22-92

252

.100000	.110000	.120000	.130000	.140000	.150000	.160000	.170000	.180000	.190000
.200000	.210000	.220000	.230000	.240000	.250000	.260000	.270000	.280000	.290000
.300000	.310000	.320000	.330000	.340000	.350000	.360000	.370000	.380000	.390000
.400000	.410000	.417000							

CCN 1
CCN: N-1, P. 253

CALC. NO. M-73-116
P. Tigeri DATE 12-16-92
DATE 12-22-92

SHEET 253

SONGS UNITS 3 CONTROL ROOM CABINET AREA(ROOM 227)

Heat Sink Number 6: CEILING(CONCRETE)

CONVECTIVE HEAT TRANSFER PARAMETERS

Slab Material	User-Defined
Slab Thickness	1.000 ft
Surface Area	3723.00 ft**2
Thermal Conductivity	1.040 BTU/hr-ft-deg. F
Density	143.600 lbm/ft**3
Thermal Diffusivity	.034 ft**2/hr
Heat Capacity	.210 BTU/lbm-deg. F
First Node Thickness	.02041 ft
Node Thickness Ratio	1.00
Number of Nodes	50
External Boundary Condition	Adiabatic
Inside Environment Index	1
Interior Heat Transfer Coefficient	Uchida

TABLE OF INTERIOR HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

CCN 1
CCN: N-1, P. 254

TABLE OF HEAT SINK MESH POINT COORDINATES (feet)

.000000	.020408	.040816	.061224	.081633	.102041	.122449	.142857	.163265	.183673
.204082	.224490	.244898	.265306	.285714	.306122	.326531	.346939	.367347	.387755
.408163	.428571	.448980	.469388	.489796	.510204	.530612	.551020	.571428	.591837
.612245	.632653	.653061	.673469	.693877	.714286	.734694	.755102	.775510	.795918
.816326	.836734	.857143	.877551	.897959	.918367	.938775	.959183	.979592	1.000000

CALC NO: M-73-116
REVISION: 2 RJ
BY: P. Tigeri DATE: 12-16-92
CHECKED: TA DATE: 12/12/92

SHEET 254

SONGS UNITS 3 CONTROL ROOM CABINET AREA(ROOM 227)

AUXILIARY CONDITIONS SELECTED

Blowout Panels	OFF
Convective Heat Transfer	ON
Unit Air Coolers	OFF
Heating and Ventilation Flow	OFF
Compartment Leakage	OFF
Compartment Equipment Heat Loads	ON
Atmosphere Exhaust Fan	OFF
Blowdown Dropout	OFF
Zero Reverse Flow	OFF
8% Revaporization	OFF

PROBLEM CONTROL PARAMETERS

Problem Time Limit	3600.00 seconds
Flow Calculation Output/Frequency	OFF/ 0
Compartment Pressure Difference Output	OFF
Heat Sink Calculation Output/Frequency	ON/ 2
Extended Heatsink Output: Node Temperatures	ON
Restart Option	OFF
Number of Plot Points	25
SIGFLO Switch Time	1.000000E+20 seconds
SIGFLO Iteration Tolerance	.001000 psi
Maximum Number of Flow Iterations	500

CALCULATION/PRINT TIMES SELECTED

Calc. Time Step	Change Time	Print Interval	Change Time
1.000E-02	1.000E+00	9.000E+02	3.600E+04
1.000E-01	1.000E+01	0.000E+00	0.000E+00
1.000E+00	2.000E+01	0.000E+00	0.000E+00
1.000E+01	1.000E+02	0.000E+00	0.000E+00
2.500E+01	3.600E+04	0.000E+00	0.000E+00

CCN 1
CCN: N-1, P. 255

CALC. NO: M-73-116
REVISION: 2
BY: P. Tigeri DATE: 12-16-92
CHECKED: I.M DATE: 12-22-92

SONGS UNITS 3 CONTROL ROOM CABINET AREA(ROOM 227)

Time = 0 Hours 0 Minutes .00000 Seconds (.0000 Seconds) (Calc. Time Step = 1.000E-02 seconds)

----- Compartment ----	Temp. (Deg F)	S-Heat/ Quality	Rel. Hum.	-- Pressures (psia) -- Total	Air	Steam	K	Total Mass (lbm)	Frac. Air	Frac. Vapor	Heat Load	Total Energy (BTU)
0 Atmosphere	75.000		.50	14.700	14.485	.215	1.40		.9908	.0092		
1 ROOM 227	75.000	19.4 S	.50	14.700	14.485	.215	1.40	4.2139670E+03	.9908	.0092	54.44	4.2506140E+05

Compartments Initial Energy	4.2506E+05 BTU	Compartments Initial Mass	4.2140E+03 lbm
Current Energy in Compartments	4.2506E+05 BTU	Current Mass in Compartments	4.2140E+03 lbm
Blowdown Enthalpy Added	0.0000E+00 BTU	Blowdown Mass Added	0.0000E+00 lbm
Irreversible Energy Loss	0.0000E+00 BTU	(Condens. + Dropout) Mass Loss	0.0000E+00 lbm
Energy Lost to Atmosphere	0.0000E+00 BTU	Mass Lost to Atmosphere	0.0000E+00 lbm
[Rate of Energy Loss to Atmosphere	0.0000E+00 BTU/sec]	[Rate of Mass Loss to Atmosphere	0.0000E+00 lbm/sec]
Absolute Energy Imbalance	0.0000E+00 BTU	Absolute Mass Imbalance	0.0000E+00 lbm
Relative Energy Imbalance	0.0000E+00 %	Relative Mass Imbalance	0.0000E+00 %

CCN 1

CCN: N-1 , P. 256

CALC. NO: M-73-116 R0

2

P. Tigeri DATE 12-16-92

I.G. 12-22-92

SHEET 256 OF

SONGS UNITS 3 CONTROL ROOM CABINET AREA(ROOM 227)

Time = 0 Hours 15 Minutes .00000 Seconds (900.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

----- Compartment ----	Temp. (Deg F)	S-Heat/ Quality	Rel. Hum.	-- Pressures (psia) -- Total	Air	Steam	K	Total Mass (lbm)	Frac. Air	Frac. Vapor	Heat Load	Total Energy (BTU)
0 Atmosphere	75.000		.50	14.700	14.485	.215	1.40		.9908	.0092		
1 ROOM 227	94.400	37.9 S	.28	15.233	15.010	.223	1.40	4.2139670E+03	.9908	.0092	54.44	4.3928560E+05

Compartments Initial Energy	4.2506E+05 BTU	Compartments Initial Mass	4.2140E+03 lbm
Current Energy in Compartments	4.3929E+05 BTU	Current Mass in Compartments	4.2140E+03 lbm
Blowdown Enthalpy Added	0.0000E+00 BTU	Blowdown Mass Added	0.0000E+00 lbm
Irreversible Energy Loss	-1.4226E+04 BTU	(Condens. + Dropout) Mass Loss	0.0000E+00 lbm
Energy Lost to Atmosphere	9.8518E-01 BTU	Mass Lost to Atmosphere	0.0000E+00 lbm
[Rate of Energy Loss to Atmosphere	5.7374E-03 BTU/sec]	[Rate of Mass Loss to Atmosphere	0.0000E+00 lbm/sec]
Absolute Energy Imbalance	-1.2062E+00 BTU	Absolute Mass Imbalance	0.0000E+00 lbm
Relative Energy Imbalance	-2.7459E-04 %	Relative Mass Imbalance	0.0000E+00 %

CCN 1
CCN: N-1, P. 257

C.NO: M-73-116
P. Tigeri DATE: 12-16-92
DATE: 12-22-92

SHEET 257 OF

SONGS UNITS 3 CONTROL ROOM CABINET AREA(ROOM 227)

Time = 0 Hours 15 Minutes .00000 Seconds (900.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

Heat Sink Calculation Output

HS#	Comp	T	TSAT	TWALL	HCOND	HCONV	AREA	QCOND	QCONV	QSENS	QTOT	HS#
1 Left	1	94.400	56.545	79.186	.000	1.470	1196.0	0.000000E+00	-7.469142E+00	0.000000E+00	-7.469142E+00	1
1 Right	0	75.000	*******	75.002	.000	1.470	1196.0	0.000000E+00	6.855733E-04	0.000000E+00	6.855733E-04	1
2 Left	1	94.400	56.545	77.137	.000	1.470	1685.0	0.000000E+00	-1.190966E+01	0.000000E+00	-1.190966E+01	2
2 Right	0	75.000	*******	75.001	.000	1.470	1685.0	0.000000E+00	7.559052E-04	0.000000E+00	7.559052E-04	2
3 Left	1	94.400	56.545	79.333	.000	1.470	91.2	0.000000E+00	-5.641687E-01	0.000000E+00	-5.641687E-01	3
3 Right	0	75.000	*******	75.018	.000	1.470	91.2	0.000000E+00	5.796020E-04	0.000000E+00	5.796020E-04	3
4 Left	1	94.400	56.545	77.155	.000	1.470	237.5	0.000000E+00	-1.676815E+00	0.000000E+00	-1.676815E+00	4
4 Right	0	75.000	*******	74.999	.000	1.470	237.5	0.000000E+00	-6.511053E-05	0.000000E+00	-6.511053E-05	4
5 Left	1	94.400	56.545	79.333	.000	1.470	595.0	0.000000E+00	-3.680706E+00	0.000000E+00	-3.680706E+00	5
5 Right	0	75.000	*******	75.018	.000	1.470	595.0	0.000000E+00	3.781395E-03	0.000000E+00	3.781395E-03	5
6 Left	1	94.400	56.545	77.191	.000	1.470	3723.0	0.000000E+00	-2.623084E+01	0.000000E+00	-2.623084E+01	6

CCN1
CCN: N-1, P. 258

M-73-116
P. Tigeri 12-16-92
12-22-92

SHEET 258

SONGS UNITS 3 CONTROL ROOM CABINET AREA(ROOM 227)

Time = 0 Hours 15 Minutes .00000 Seconds (900.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

Extended Heatsink Output: Node Temperatures

Heat Sink No. 1, SOUTH WALL(PLASTER)

79.186370	78.762540	78.769480	78.006620	77.673190
77.368070	77.090060	76.837920	76.610320	76.405730
76.222630	76.059420	75.914580	75.786650	75.674100
75.575590	75.489650	75.415010	75.350490	75.294950
75.247280	75.206570	75.171970	75.142610	75.117890
75.097080	75.079680	75.065220	75.053190	75.043240
75.035000	75.028230	75.022740	75.018280	75.014680
75.011750	75.009430	75.007540	75.006010	75.004850
75.003940	75.003200	75.002660	75.002290	75.001980
75.001800	75.001740			

Heat Sink No. 2, EAST WALL(CONCRETE)

77.136870	76.143340	75.557950	75.249540	75.103420
75.040310	75.015290	75.006130	75.003020	75.001980
75.001740	75.001740	75.001740	75.001620	75.001560
75.001560	75.001560	75.001500	75.001250	75.001070
75.000890	75.000760	75.000760	75.000760	75.000760
75.000760	75.000760	75.000820	75.001070	75.001430
75.001430	75.001430	75.001560	75.001620	75.001740
75.001740	75.001740	75.001740	75.001740	75.001740
75.001740	75.001740	75.001740	75.001620	75.001560
75.001250	75.001070	75.001130	75.001250	75.001130

Heat Sink No. 3, NORTH WALL(PLASTER)

79.333160	78.954380	78.599210	78.267180	77.957860
77.670620	77.404750	77.159520	76.933990	76.727330
76.538540	76.366670	76.210660	76.069550	75.942350
75.828030	75.725560	75.634060	75.552640	75.480380
75.416470	75.360140	75.310580	75.267180	75.229280
75.196260	75.167570	75.142790	75.121370	75.103000

CCN! CCN 1 N-1, P. 259

CALC. NO: M-73-116
REVISION: ~~2~~ 3
BY: P. Tigeri DATE: 12-16-92
CHECKED: i.ely DATE: 12-22-92

75.087250	75.073820	75.062410	75.052760	75.044710
75.037990	75.032440	75.027920	75.024320	75.021580
75.019620	75.018340	75.017850		

Heat Sink No. 4, NORTH WALL(CONCRETE)

77.155490	76.319980	75.760100	75.411960	75.210300
75.101350	75.046110	75.019810	75.007970	75.002840
75.000700	74.999910	74.999600	74.999540	74.999540
74.999540	74.999540	74.999540	74.999540	74.999540
74.999540	74.999600	74.999600	74.999660	74.999790
74.999850	74.999850	74.999850	74.999850	74.999850
74.999350	74.999790	74.999730	74.999660	74.999600
74.999540	74.999480	74.999420	74.999420	74.999420
74.999420	74.999420	74.999420	74.999420	74.999420
74.999420	74.999420	74.999420	74.999420	74.999360

CCN 1
CCN: N-1, P. 260

CALC. NO: M-73-116
REVISION: 2
BY: P. Tigeri DATE: 12-16-92
CHECKED: LG DATE: 12/22/92

SONGS UNITS 3 CONTROL ROOM CABINET AREA(ROOM 227)

Time = 0 Hours 15 Minutes .00000 Seconds (900.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

Extended Heatsink Output: Node Temperatures

Heat Sink No. 5, WEST WALL(PLASTER)

79.333160	78.954380	78.599210	78.267180	77.957860
77.670620	77.404750	77.159520	76.933990	76.727330
76.538540	76.366670	76.210660	76.069550	75.942350
75.828030	75.725560	75.634060	75.552640	75.480380
75.416470	75.360140	75.310580	75.267180	75.229280
75.196260	75.167570	75.142790	75.121370	75.103000
75.087250	75.073820	75.062410	75.052760	75.044710
75.037990	75.032440	75.027920	75.024320	75.021580
75.019620	75.018340	75.017850		

Heat Sink No. 6, CEILING(CONCRETE)

77.190700	76.733550	76.350860	76.036650	75.783600
75.583710	75.428740	75.311000	75.223110	75.158720
75.112340	75.079500	75.056730	75.041230	75.030850
75.024080	75.019680	75.016880	75.015170	75.014190
75.013700	75.013460	75.013400	75.013400	75.013580
75.013700	75.013820	75.013950	75.014070	75.014130
75.014190	75.014250	75.014250	75.014250	75.014250
75.014250	75.014250	75.014250	75.014250	75.014250
75.014250	75.014310	75.014370	75.014500	75.014680
75.014800	75.014860	75.014860	75.014920	75.014980

CCN 1
CCN: N-1, P. 261

CALC. NO: M-73-116
REVISION 2
BY P. Tigeri DATE 12-16-92
CHECKED LLY DATE 12/22/92

SHEET 261 OF

SONGS UNITS 3 CONTROL ROOM CABIEET AREA(ROOM 227)

Time = 0 Hours 30 Minutes .00000 Seconds (1800.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

----- Compartment ----	Temp. (Deg F)	S-Heat/ Quality	Rel. Hum.	-- Pressures (psia) -- Total	Air	Steam	K	Total Mass (lbm)	Frac. Air	Frac. Vapor	Heat Load	Total Energy (BTU)
0 Atmosphere	75.000		.50	14.700	14.485	.215	1.40		.9908	.0092		
1 ROOM 227	96.514	39.9 S	.26	15.291	15.068	.224	1.40	4.2139670E+03	.9908	.0092	54.44	4.4083550E+05

Compartments Initial Energy	4.2506E+05 BTU	Compartments Initial Mass	4.2140E+03 lbm
Current Energy in Compartments	4.4084E+05 BTU	Current Mass in Compartments	4.2140E+03 lbm
Blowdown Enthalpy Added	0.0000E+00 BTU	Blowdown Mass Added	0.0000E+00 lbm
Irreversible Energy Loss	-1.5812E+04 BTU	(Condens. + Dropout) Mass Loss	0.0000E+00 lbm
Energy Lost to Atmosphere	3.7008E+01 BTU	Mass Lost to Atmosphere	0.0000E+00 lbm
[Rate of Energy Loss to Atmosphere	1.0309E-01 BTU/sec]	[Rate of Mass Loss to Atmosphere	0.0000E+00 lbm/sec]
Absolute Energy Imbalance	-1.2758E+00 BTU	Absolute Mass Imbalance	0.0000E+00 lbm
Relative Energy Imbalance	-2.8940E-04 %	Relative Mass Imbalance	0.0000E+00 %

CCN 1
CCN: N-1, P.262

CALC NO. M-73-116
P. Tigeri DATE 12-16-92
12/22/92

SHEET 262 OF

SONGS UNITS 3 CONTROL ROOM CABINET AREA(ROOM 227)

Time = 0 Hours 45 Minutes .00000 Seconds (2700.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

----- Compartment ----	Temp. (Deg F)	S-Heat/ Quality	Rel. Hum.	-- Pressures (psia) -- Total	Air	Steam	K	Total Mass (lbm)	Frac. Air	Frac. Vapor	Heat Load	Total Energy (BTU)
0 Atmosphere	75.000		.50	14.700	14.485	.215	1.40		.9908	.0092		
1 ROOM 227	97.710	41.0 S	.25	15.324	15.100	.224	1.40	4.2139670E+03	.9908	.0092	54.44	4.4171230E+05

Compartments Initial Energy	4.2506E+05 BTU	Compartments Initial Mass	4.2140E+03 lbm
Current Energy in Compartments	4.4171E+05 BTU	Current Mass in Compartments	4.2140E+03 lbm
Blowdown Enthalpy Added	0.0000E+00 BTU	Blowdown Mass Added	0.0000E+00 lbm
Irreversible Energy Loss	-1.6882E+04 BTU	(Condens. + Dropout) Mass Loss	0.0000E+00 lbm
Energy Lost to Atmosphere	2.3003E+02 BTU	Mass Lost to Atmosphere	0.0000E+00 lbm
[Rate of Energy Loss to Atmosphere	3.5533E-01 BTU/sec]	[Rate of Mass Loss to Atmosphere	0.0000E+00 lbm/sec]
Absolute Energy Imbalance	-1.2727E+00 BTU	Absolute Mass Imbalance	0.0000E+00 lbm
Relative Energy Imbalance	-2.8812E-04 %	Relative Mass Imbalance	0.0000E+00 %

CCN 1
CCN: N-1, P. 263

CALC. NO: M-73-116
REVISION: 2
BY: P. Tigeri DATE: 12-16-92
CHECKED: [illegible] DATE: 12/22/92

SHEET 263 OF ____

SONGS UNITS 3 CONTROL ROOM CABINET AREA(ROOM 227)

Time = 0 Hours 45 Minutes .00000 Seconds (2700.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

Heat Sink Calculation Output

HS#	Comp	T	TSAT	TWALL	HCOND	HCONV	AREA	QCOND	QCONV	QSENS	QTOT	HS#
1 Left	1	97.710	56.708	82.886	.000	1.470	1196.0	0.000000E+00	-7.257718E+00	0.000000E+00	-7.257718E+00	1
1 Right	0	75.000	*******	75.280	.000	1.470	1196.0	0.000000E+00	1.327926E-01	0.000000E+00	1.327926E-01	1
2 Left	1	97.710	56.708	79.394	.000	1.470	1685.0	0.000000E+00	-1.261837E+01	0.000000E+00	-1.261837E+01	2
2 Right	0	75.000	*******	75.001	.000	1.470	1685.0	0.000000E+00	7.559052E-04	0.000000E+00	7.559052E-04	2
3 Left	1	97.710	56.708	83.118	.000	1.470	91.2	0.000000E+00	-5.448259E-01	0.000000E+00	-5.448259E-01	3
3 Right	0	75.000	*******	75.809	.000	1.470	91.2	0.000000E+00	2.948470E-02	0.000000E+00	2.948470E-02	3
4 Left	1	97.710	56.708	79.401	.000	1.470	237.5	0.000000E+00	-1.777872E+00	0.000000E+00	-1.777872E+00	4
4 Right	0	75.000	*******	74.999	.000	1.470	237.5	0.000000E+00	-6.511053E-05	0.000000E+00	-6.511053E-05	4
5 Left	1	97.710	56.708	83.118	.000	1.470	595.0	0.000000E+00	-3.554511E+00	0.000000E+00	-3.554511E+00	5
5 Right	0	75.000	*******	75.809	.000	1.470	595.0	0.000000E+00	1.923618E-01	0.000000E+00	1.923618E-01	5
6 Left	1	97.710	56.708	79.519	.000	1.470	3723.0	0.000000E+00	-2.784200E+01	0.000000E+00	-2.784200E+01	6

CCN 1
CCN: N-1 , P 264

C. NO: M-73-116
REVISION: 2
P. Tiyeri DATE: 12-16-92
DATE: 12/22/92

SHEET: 264 OF

SONGS UNITS 3 CONTROL ROOM CABINET AREA(ROOM 227)

Time = 0 Hours 45 Minutes .00000 Seconds (2700.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

Extended Heatsink Output: Node Temperatures

Heat Sink No. 1, SOUTH WALL(PLASTER)

82.885530	82.464570	82.058010	81.665860	81.288740
80.925080	80.576200	80.241610	79.921170	79.614650
79.321990	79.042880	78.777130	78.524510	78.284640
78.057280	77.842130	77.638760	77.446930	77.266270
77.096340	76.936800	76.787260	76.647310	76.516630
76.394810	76.281400	76.176060	76.078400	75.988130
75.904820	75.828160	75.757780	75.693390	75.634610
75.581270	75.532930	75.489470	75.450530	75.415920
75.385470	75.358920	75.336090	75.316860	75.301060
75.288540	75.280000			

Heat Sink No. 2, EAST WALL(CONCRETE)

79.394070	78.202970	77.260040	76.541960	76.016510
75.647250	75.397980	75.236600	75.136140	75.076020
75.041350	75.022190	75.011990	75.006620	75.004000
75.002590	75.001920	75.001500	75.001250	75.001070
75.000890	75.000760	75.000760	75.000760	75.000760
75.000760	75.000760	75.000820	75.001070	75.001430
75.001430	75.001430	75.001560	75.001620	75.001740
75.001740	75.001740	75.001740	75.001740	75.001740
75.001740	75.001740	75.001740	75.001620	75.001560
75.001250	75.001070	75.001130	75.001250	75.001130

Heat Sink No. 3, NORTH WALL(PLASTER)

83.117520	82.744660	82.382780	82.031890	81.692110
81.363370	81.045680	80.738920	80.443080	80.158050
79.883880	79.620450	79.367580	79.125150	78.892970
78.670990	78.458950	78.256810	78.064300	77.881260
77.707430	77.542630	77.386750	77.239470	77.100560
76.969880	76.847200	76.732270	76.624910	76.[illegible]24870

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CCN 1
CC N: N-1, P. 2.5

CALC. NO: M-73-116
REVISION: 2
BY: P. Tijeri DATE: 12-16-92
CHECKED: LY DATE: 12/22/92

SHEET: 265 OF ____

76.431980	76.345980	76.266690	76.193940	76.127470
76.067170	76.012850	75.964320	75.921420	75.883940
75.851780	75.824740	75.838870		

Heat Sink No. 4, NORTH WALL(CONCRETE)

79.401030	78.427640	77.615020	76.952670	76.426060
76.018340	75.710660	75.484470	75.322660	75.209750
75.133150	75.082430	75.049840	75.029390	75.016820
75.009190	75.004790	75.002290	75.000820	75.000030
74.999660	74.999600	74.999600	74.999660	74.999790
74.999850	74.999850	74.999850	74.999850	74.999850
74.999850	74.999790	74.999730	74.999660	74.999600
74.999540	74.999480	74.999420	74.999420	74.999420
74.999420	74.999420	74.999420	74.999420	74.999420
74.999420	74.999420	74.999420	74.999420	74.999360

CCN'
CCN: N-1, P. 266

CALC. NO: M-73-116
REVISION: 3
BY: P. Tiseri DATE: 12-16-92
CHECKED: LY DATE: 12/22/92

SHEET 266 OF ____

SONGS UNITS 3 CONTROL ROOM CABINET AREA(ROOM 227)

Time = 0 Hours 45 Minutes .00000 Seconds (2700.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

Extended Heatsink Output: Node Temperatures

Heat Sink No. 5, WEST WALL(PLASTER)

83.117520	82.744660	82.382780	82.031890	81.692110
81.363370	81.045680	80.738920	80.443080	80.158050
79.883880	79.620450	79.367580	79.125150	78.892970
78.670990	78.458950	78.256810	78.064300	77.881260
77.707430	77.542630	77.386750	77.239470	77.100560
76.969880	76.847200	76.732270	76.624910	76.524870
76.431980	76.345980	76.266690	76.193940	76.127470
76.067170	76.012850	75.964320	75.921420	75.883940
75.851780	75.824740	75.808870		

Heat Sink No. 6, CEILING(CONCRETE)

79.419040	78.911960	78.445710	78.019440	77.632110
77.282440	76.968540	76.688690	76.440770	76.222500
76.031590	75.865750	75.722630	75.599950	75.495510
75.407200	75.333040	75.271150	75.219880	75.177760
75.143340	75.115390	75.092930	75.074980	75.060760
75.049530	75.040740	75.033910	75.028660	75.024690
75.021700	75.019440	75.017790	75.016630	75.015780
75.015170	75.014740	75.014500	75.014310	75.014250
75.014250	75.014310	75.014370	75.014500	75.014680
75.014800	75.014860	75.014860	75.014920	75.014980

CCN 1
CCN! N-1, P. 267

CALC. NO: M-73-116
REVISION: 2
BY: P. Tigeri DATE: 12-16-92
CHECKED: DATE: 12/22/92

SHEET 267 OF

SONGS UNITS 3 CONTROL ROOM CABINET AREA(ROOM 227)

Time = 1 Hours 0 Minutes .00000 Seconds (3600.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

----- Compartment ----	Temp. (Deg F)	S-Heat/ Quality	Rel. Hum.	-- Pressures (psia) -- Total	Air	Steam	K	Total Mass (lbm)	Frac. Air	Frac. Vapor	Heat Load	Total Energy (BTU)
0 Atmosphere	75.000		.50	14.700	14.485	.215	1.40		.9908	.0092		
1 ROOM 227	98.656	41.9 S	.25	15.350	15.126	.225	1.40	4.2139670E+03	.9908	.0092	54.44	4.4240600E+05

Compartments Initial Energy	4.2506E+05 BTU	Compartments Initial Mass	4.2140E+03 lbm
Current Energy in Compartments	4.4241E+05 BTU	Current Mass in Compartments	4.2140E+03 lbm
Blowdown Enthalpy Added	0.0000E+00 BTU	Blowdown Mass Added	0.0000E+00 lbm
Irreversible Energy Loss	-1.8045E+04 BTU	(Condens. + Dropout) Mass Loss	0.0000E+00 lbm
Energy Lost to Atmosphere	6.9893E+02 BTU	Mass Lost to Atmosphere	0.0000E+00 lbm
[Rate of Energy Loss to Atmosphere	7.0769E-01 BTU/sec]	[Rate of Mass Loss to Atmosphere	0.0000E+00 lbm/sec]
Absolute Energy Imbalance	-1.1974E+00 BTU	Absolute Mass Imbalance	0.0000E+00 lbm
Relative Energy Imbalance	-2.7065E-04 %	Relative Mass Imbalance	0.0000E+00 %

CCN 1
CCN: N-1, P.268

CALC. NO: M-73-116
REVISION: 2
P. Tiseri 12-16-92
LM 12/24/92

SHEET 268 OF

SONGS UNITS 3 CONTROL ROOM CABINET AREA(ROOM 227)

MAXIMUM AND MINIMUM PRESSURES AND TEMPERATURES

Compartment	Maximum (psia) Pressure	(sec) at Time	(deg. F) Temperature	(sec) at Time	Minimum (psia) Pressure	(sec) at Time	(deg. F) Temperature	(sec) at Time
1 ROOM 227	15.3504	3600.	98.656	3600.	14.7000	1.0000E-02	75.000	.0000

349 Calculation cycles were performed

==> Execution time: 00:01:10.53

CCN1
CCN: N-1, P. 969

CALC. NO: M-73-116
REVISION: ~~3~~ 3A
BY: P. Tijeri DATE: 12-16-92
CHECKED: LY DATE: 12/22/92

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NES&L DEPARTMENT

CALCULATION SHEET

PRELIM CCN NO. N-1	PAGE 270 OF	
	CCN CONVERSION: 1	CCN NO. CCN--

Project or DCP/MMP SONGS 2/3 Calc No. M73-116

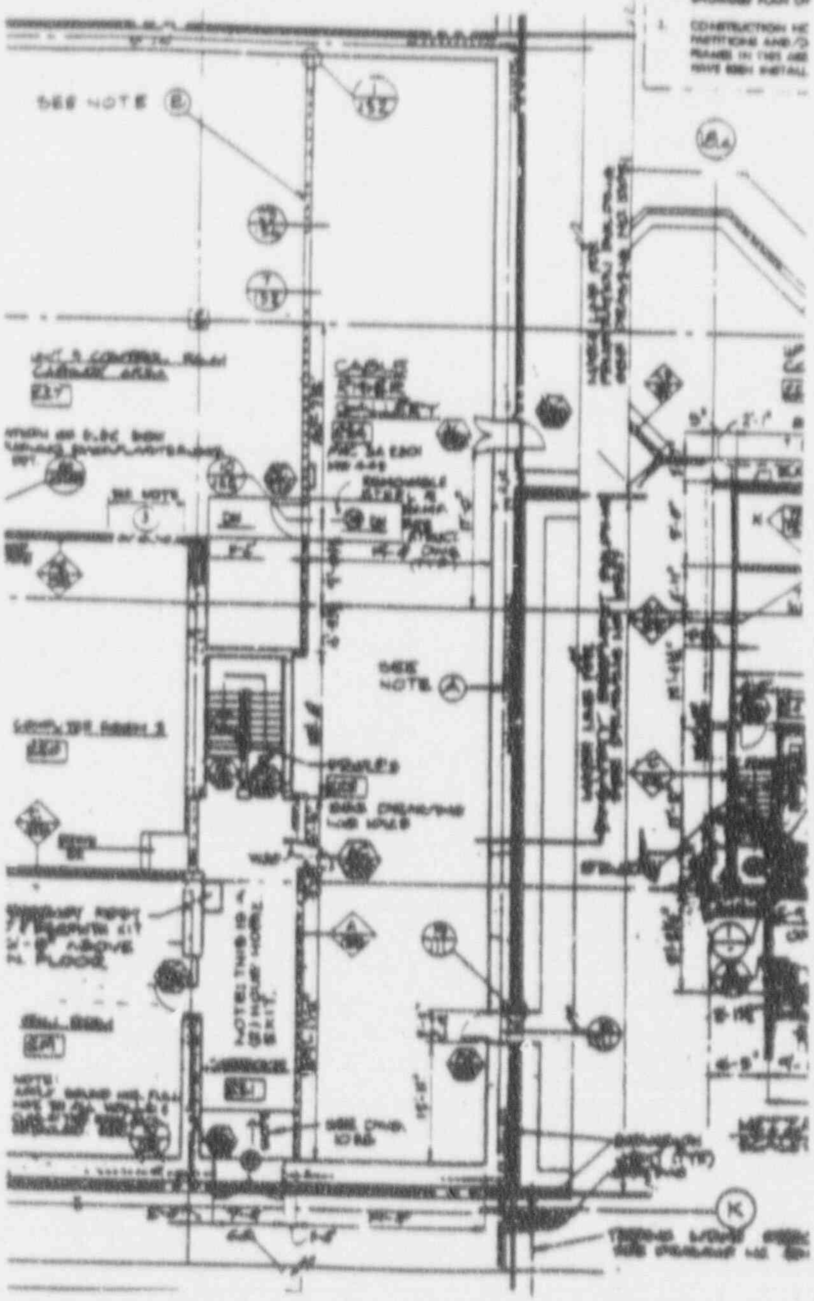
Subject Room Temperature Response During SBO Sheet No. 270

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
2	P. TIGERI	10/15	[illegible]	12/22/92					

8.7 Cable Riser Gallery Room 224

(Ref. # 6.8.1)

N



NES&L DEPARTMENT

CALCULATION SHEET

~~ICCN NO./~~ PRELIM. CCN NO. N-1	PAGE 271 OF

CCN CONVERSION CCN NO. CCN - 1

Project or DCP/MMP SONGS 2/3 Calc No. M73-116

Subject Room Temperature Response During Station Blackout (SBO) Sheet No. 271

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
1	PARVIZ TIGERI	10/15	[illegible]	1/26/91					

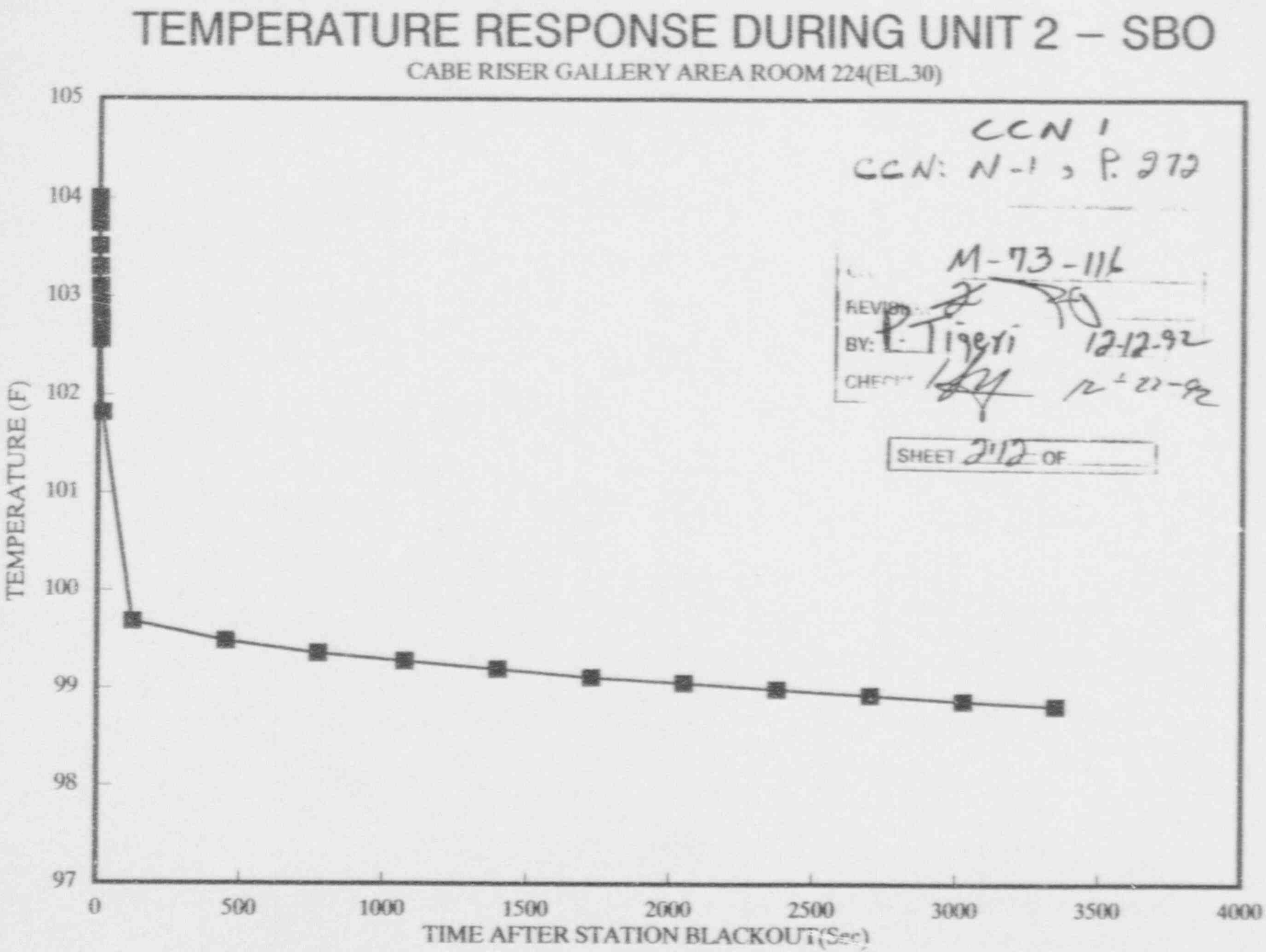
Input data summary used for Cable Riser Gallery (Room 224) Temperature Rise Analysis.

Q = 3.35 BTU/S (Ref. # 6.7)
V = 13768.48 ft^3 (see section 8.7)

Table of Data and Results

HEAT SINK	K_e BTU/hr-ft-°F	ρ_e lbm/ft^3	Cp_e BTU/lbm-°F	A (ft^2)	t (ft)	Ti (°F)	To
East Wall Concrete	1.04	143.6	0.21	1179	2.50	104	81
West Wall Concrete	1.04	143.6	0.21	1179	2.50	104	81
North Wall Concrete	1.04	143.6	0.21	1322	1.00	104	81
North Wall Plaster	0.508	18.572	0.739	5801	0.459	104	81
South Wall Concrete	1.04	143.6	0.21	7122	2.50	104	81
Ceiling Concrete	1.04	143.6	0.21	2257	1.00	104	81

See data below reference to above table.


TEMPERATURE RESPONSE DURING UNIT 2 - SBO
CABE RISER GALLERY AREA ROOM 224(EL.30)
TEMPERATURE (F)
105
104
103
102
101
100
99
98
97
0
500
1000
1500
2000
2500
3000
3500
4000
TIME AFTER STATION BLACKOUT(Sec)
CCN 1
CCN: N-1, P. 272
M-73-116
REVISION
BY: P. Tigeri 12-12-92
CHECK 12-22-92
SHEET 212 OF

NES&L DEPARTMENT

CALCULATION SHEET

ICCN NO./ PRELIM. CCN NO. N-1	PAGE 273 OF

Project or DCP/MMP SONGS 2/3 Calc No. M73-116

CCN CONVERSION
CCN NO. CCN - 1

Subject Room Temperature Response During Station Blackout (SBO) Sheet No. 273

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
	PARVIZ TIGERI	10/15							

CALCULATION OF CABLE RISER GALLERY(ROOM 224) UNIT 3

$Ls := 116.75$ ft (Ref. # 6.8.1)

$Le := 19.33$ ft (Ref. # 6.8.1)

$Lw := 19.33$ ft (Ref. # 6.8.1)

FOR NORTH WALL

$Lc := 21.67$ ft (Ref. # 6.8.1)

$Lp := 95.1$ ft (Ref. # 6.8.1)

$hr := 61$ ft (Ref. # 6.8.1)

CALCULATION OF WALLS AREA

$As := Ls \cdot hr$

$As = 7.122 \cdot 10^{3}$ ft^2

$Ae := Le \cdot hr$

$Ae = 1.179 \cdot 10^{3}$ ft^2

$Aw := Lw \cdot hr$

$Aw = 1.179 \cdot 10^{3}$ ft^2

CALCULATION SHEET

CCN NO./PRELIM. CCN NO.	PAGE	OF
~~CCN NO.~~ N-1	274	

CCN CONVERSION CCN NO. CCN - 1

Project or DCP/MMP SONGS 2/3 Calc No. M73-116

Subject Room Temperature Response During Station Blackout (SBO) Sheet No. 274

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
1	...IZ TIGERI	10/15		12/24/96					

AREA OF NORTH WALL

$Ac := Lc \cdot hr$

$Ac = 1.322 \cdot 10^{3}$ ft^2

$Ap := Lp \cdot hr$

$Ap = 5.801 \cdot 10^{3}$ ft^2

AREA OF CEILING

$Ace := Ls \cdot Le$

$Ace = 2.257 \cdot 10^{3}$ ft^2

VOLUME OF ROOM 224

$V_T := Ace \cdot hr$

$V_T = 1.377 \cdot 10^{5}$ ft^3

ASSUMING 10% OF TOTAL VOLUME FOR EQUIPMENT

$$V_{net} := V_T - 10 \cdot \frac{V_T}{100}$$

$V_{net} = 1.239 \cdot 10^{5}$ ft^3

$Q := 3.53 \cdot 10^{3}$ W (Ref. # 6.7)

$$Q := 3.53 \cdot 10^{3} \cdot \frac{3.4121}{3600}$$

$Q = 3.346$ BTU/S

$\triangle$

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
1	PARVIZ TIGERI	10/15	[illegible]	11/11/96					

FINDING Ke, ρe, AND Cpe BASE ON METHODOLOGY

FOR NORTH WALL(COMPOSITE WALL)

$tp := 0.0833$	ft	(Ref. # 6.8.2)
$tair := 0.292$	ft	(Ref. # 6.2)
$tT := 2 \cdot tp + tair$		
$tT = 0.459$	ft	
$k_p := 0.25$	BTU/(hr-ft-F)	(Ref. # 6.17)
$\rho_p := 51.0$	lbm/ft^3	(Ref. # 6.17)
$Cp_p := 0.74$	BTU/(lbm-F)	(Ref. # 6.17)
$k_{air} := 1.24$	BTU/(hr-ft-F)	(see section 8.8)
$\rho_{air} := 0.07$	lbm/ft^3	(Ref. # 6.2)
$Cp_{air} := 0.24$	BTU/(lbm-F)	(Ref. # 6.2)

△

CALCULATION SHEET

~~ICCN NO./~~ PRELIM. CCN NO. N-1	PAGE 276 OF

Project or DCP/MMP SONGS 2/3 Calc No. M73-116

CCN CONVERSION CCN NO. CCN - 1

Subject Room Temperature Response During Station Blackout (SBO) Sheet No. 276

REV	ORIGINATOR	DATE	IRE	DATE	REV	ORIGINATOR	DATE	IRE	DATE
	PARVIZ TIGERI	10/15	[illegible]	11/14/92					

$$ke := \frac{tT}{2 \cdot \frac{tp}{k_p} + \frac{tair}{k_{air}}}$$

$ke = 0.508$ BTU/(hr-ft-F)

$$\rho e := \frac{\left[2 \cdot tp \cdot \rho_p\right] + \left[tair \cdot \rho_{air}\right]}{tT}$$

$\rho e = 18.572$ lbm/ft^3

$$Cpe := \frac{\left[2 \cdot tp \cdot \rho_p \cdot Cp_p\right] + \left[tair \cdot \rho_{air} \cdot Cp_{air}\right]}{2 \cdot tp \cdot \rho_p + tair \cdot \rho_{air}}$$

$Cpe = 0.739$ ====>> BTU/(lbm-F)

SCE 26-426 NEW 4/90

SONGS UNITS 2 CABLE RISER CALLERY ROOM 224

```
0.00
      ROOM 224
    14.7    13768.48      104    0.50    1.00
   0.0000    0.0000    0.0000 1 0
 0.0000           3.35
 28800            3.35
@EOF
   0.0000  0.0000
@EOF
 0  0    000.00    000.00    000.00    000.00     000.00 1
@EOF
 0    000.00    000.00    000.00    000.00 1
@EOF
  0  0       1.00   0.60   0.60    0.00 0
@EOF
 0.0000     0.0000     0.0000
 1.0E6      0.0        0.0
@EOF
 1               1.00
@EOF
 0.0000     14.70      85        0.50
 1.e20      14.70      85        0.50
@EOF
               NORTH WALL(PLASTER)
3       5801       0.459       0.01  1.00
 1      0.00 1 4
 0.000           1.47
 1.E6            1.47
@EOF
  0       0.00
 0.0000          1.47
 1.E6            1.47
@EOF
      0         18.572     0.739
               EAST WALL(CONCRETE)
3       1179        2.5        0.01  1.00
 1      0.00 1 4
 0.000           1.47
 1.E6            1.47
@EOF
 0        0.00
 0.000           1.47
 1.E6            1.47
@EOF
      1.04      143.6      0.21
              SOUTH WALL(CONCRETE)
3       7122        2.5        0.01  1.00
 1      0.00 1 4
 0.000           1.47
 1.E6            1.47
@EOF
 0        0.00
 0.000           1.47
 1.E6            1.47
```

CCN 1

CCN: N-1, P. 277

CALC. NO: M-73-116

REVISION: ~~2~~ 3

BY: P. Tigezi DATE: 12-12-92

CHECKED: [illegible] DATE: 12-22-92

SHEET 277 OF ____

```
@EOF
       1.04      143.6       0.21
                  WEST WALL (CONCRETE)
3        1179        2.5          0.01  1.00
 1      0.00 1 4
 0.000            1.47
 1.E6             1.47
@EOF
  0       0.00
 0.000            1.47
 1.E3             1.47
@EOF
       1.04      143.6       0.21
                 NORTH WALL (CONCRETE)
3        1322        1.00         0.01  1.00
 1      0.00 1 4
 0.000            1.47
 1.E6             1.47
@EOF
  0       0.00
 0.000            1.47
 1.E6             1.47
@EOF
       1.04      143.6       0.21
CEILING(CONCRETE)
3        2257        1.00         0.01  1.00
 1      0.00 1 1
 0.000            1.47
 1.E6             1.47
@EOF
       1.04      143.6       0.21
@EOF
 0 1 0 0 0 1 0 0 0 0
@EOF
      3600.0 1    0 0    2 0   25    1.E20    0.001  500
 0.01             1.0
 0.10             10.0
 1.00             20.0
 10.00            100.0
 25.00            36000.0
@EOF
 900.0            36000.0
@EOF
```

CCN 1

CCN: N-1 , P. 278

CALC. NO: M-73-116

REVISION: 2 PG

BY: P. Tigiri DATE: 12-12-92

CHECKED: [illegible] DATE: 12-12-92

SHEET 278 OF ______

SONGS UNITS 2 CABLE RISER GALLERY ROOM 224

* * * PCFLUD 3.7 * * *

> Thermofluid Dynamics for a System of Interconnected Compartments <

MAP-120

[] [] []

Release Record

Date	Version	Description of Changes
3/25/85	1.00	Original PC version
8/25/86	2.00	Air-only version (SF)
1/06/87	3.00	Added SIGFLO routine
6/02/88	3.10	Modified for new compiler
2/06/90	3.61	61 Compartment version
5/21/91	3.7	Automatic zero reverse flow

INPUT file name: b:r224.inp

OUTPUT file name: b:r224.OUT

PLOT file name: b:r224.PLT

CCN 1
CCN: N-1, P. 979

CALC. NO: M-73-116
REVISION: 2
BY: P. Tigeri DATE: 12-12-92
CHECKED: DATE: 12-12-92

SHEET 214 OF ___

SONGS UNITS 2 CABLE RISER GALLERY ROOM 224

COMPARTMENT INITIAL CONDITIONS

Compartment	Description	Volume (ft**3)	Temperature (Degrees F)	Pressure (psie)	Rel. Humidity (Fraction)	Flow to Compartments (0 = Atmosphere)
0	Atmosphere		85.00	14.7000	.50	
1	ROOM 224	1.3768E+04	104.00	14.7000	.50	

CCN1
CCN: N-1, P. 280

CALC. NO: M-73-116
REVISION: 2 3
BY: P. Tigeri DATE: 12-12-92
CHECKED: [illegible] DATE: 12-22-92

SHEET 280 OF ____

SONGS UNITS 2 CABLE RISER GALLERY ROOM 224

COMPARTMENT AUXILIARY CONDITIONS

Compartment	Compartment Desc.	Air Cooler Constant (BTU/sec-deg)	Air Cooler Temperatures Water (F)	Start (F)	Equipment Heat Load Options	Leakage Constants Rate(CFM)	@ Press.(in. H2O)
1	ROOM 224	.000	.0	.0	1, 0	.00000	.0000

COMPARTMENT HEAT LOAD

Compartment 1

Time (seconds)	Heat Load (BTU/sec)
.00	3.35
28800.00	3.35

CCN '
CCN: N-1, P. 281

CALC NO: M-73-116
2
P. Tigeri DATE 12-12-92
[illegible] DATE 12-22-92

SHEET 281 OF ____

SONGS UNITS 2 CABLE RISER GALLERY ROOM 224

FLOW PATH DATA

Compartment From	Compartment To	Flow Area (ft**2)	Flow Coefficients Forward	Flow Coefficients Reverse	Set Pressure (psid)	Valve Setpoint Pressure (psid)	Valve Setpoint Temperature (F)
0	0	1.0	.600	.600	.0000		

CCN 1
CCN: N-1, P. 282

CALC. NO: M-73-116
REVISION: 2
P. Tigeri DATE 12-12-92
DATE 12-22-92

SHEET 282 OF ____

SONGS UNITS 2 CABLE RISER GALLERY ROOM 224

BLOWDOWN DATA

Time (sec)	Flowrate (lbm/sec)	Enthalpy (BTU/lbm)
.00000	.00000	.00000
1.00000E+06	.00000	.00000

SPLIT OF BLOWDOWN DATA

Compartment	Fraction of Blowdown
1	1.00000

ATMOSPHERIC DATA

Time (sec)	Temp(deg.F)	Pressure(psia)	Relative Humidity
.00000	85.000	14.700	.50000
1.00000E+20	85.000	14.700	.50000

CCN 1
CCN: N-1, P 283

M-73-116
2 8
P. Tiger DATE 12-12-92
[illegible] DATE 12-22-92

SHEET 283 OF ____

SONGS UNITS 2 CABLE RISER GALLERY ROOM 224

Heat Sink Number 1: NORTH WALL(PLASTER)

CONVECTIVE HEAT TRANSFER PARAMETERS

Slab Material	User-Defined
Slab Thickness	.459 ft
Surface Area	5801.00 ft**2
Thermal Conductivity	.508 BTU/hr-ft-deg. F
Density	18.572 lbm/ft**3
Thermal Diffusivity	.037 ft**2/hr
Heat Capacity	.739 BTU/lbm-deg. F
First Node Thickness	.01000 ft
Node Thickness Ratio	1.00
Number of Nodes	47
External Boundary Condition	Convective
External Heat Transfer Coefficient	Uchida
Outside Environment Index	0
Inside Environment Index	1
Interior Heat Transfer Coefficient	Uchida

CCN 1
CCN: N-1, P. 284

TABLE OF EXTERNAL HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

CALC. NO: M-73-116
REVISION 2
BY: P. Tigeri DATE: 12-12-92
CHECKED: [illegible] DATE: 12-22-92

TABLE OF INTERIOR HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

SHEET 284 OF

TABLE OF HEAT SINK MESH POINT COORDINATES (feet)

.000000	.010000	.020000	.030000	.040000	.050000	.060000	.070000	.080000	.090000

.100000	.110000	.120000	.130000	.140000	.150000	.160000	.170000	.180000	.190000
.200000	.210000	.220000	.230000	.240000	.250000	.260000	.270000	.280000	.290000
.300000	.310000	.320000	.330000	.340000	.350000	.360000	.370000	.380000	.390000
.400000	.410000	.420000	.430000	.440000	.450000	.459000			

CCN 1
CCN: N-1, P 285

CALC. NO: M-73-116
REVISION: ~~2~~ RO
BY: P. Tijeri DATE: 12-12-92
CHECKED: [illegible] DATE: 12-22-92

SHEET 285

7

CONTROL NO. 05931

CERTIFICATE OF AUTHENTICITY

CONTINUATION

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SCE Southern California Edison

For the MATERIAL & ADMINISTRATIVE SERVICES - CDM/SONGS Department
San Onofre Nuclear Generating Station Design Calculations

This microform file is a complete record of the transaction herein recorded. The documents are arranged on this microform in the following manner:

- ( ) By month in Location and Work Order sequence
- ( ) Alphabetical order by ______
- (X) Numerical order by Design Cal.No.
- ( ) Order of Customer Service Store Number
- ( ) Order of Payroll Location Number
- ( ) Grievance File Number sequence
- ( ) Date order
- ( ) Other ______

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The above information is deemed necessary in compliance with the Federal Power Commission Order No. 450 - Regulations to govern the Preservation of Public Utilities and Licensees – issued March 14, 1972. This order has subsequently been approved by the Public Utilities Commission of the State of California on October 29, 1974.

1-20-93
DATE MICROFILMED

CAMERA OPERATOR

AWS BLDG., D-2-P, SONGS
LOCATION

AUTHORIZED SIGNATURE
SUPERVISOR MICROGRAPHICS

SCE OSD 1-G REV 7/88

SONGS UNITS 2 CABLE RISER GALLERY ROOM 224

Heat Sink Number 2: EAST WALL(CONCRETE)

CONVECTIVE HEAT TRANSFER PARAMETERS

Slab Material	User-Defined
Slab Thickness	2.500 ft
Surface Area	1179.00 ft**2
Thermal Conductivity	1.040 BTU/hr-ft-deg. F
Density	143.600 lbm/ft**3
Thermal Diffusivity	.034 ft**2/hr
Heat Capacity	.210 BTU/lbm-deg. F
First Node Thickness	.05102 ft
Node Thickness Ratio	1.00
Number of Nodes	50
External Boundary Condition	Convective
External Heat Transfer Coefficient	Uchida
Outside Environment Index	0
Inside Environment Index	1
Interior Heat Transfer Coefficient	Uchida

CCN 1

CCN: N-1 , P. 286

CALC. NO: M-83-116
REVISION 2
BY P. Tigeri DATE 12-12-92
1 [illegible] 12-22-92

SHEET 286 OF

TABLE OF EXTERNAL HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

TABLE OF INTERIOR HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

TABLE OF HEAT SINK MESH POINT COORDINATES (feet)

.000000	.051020	.102041	.153061	.204082	.255102	.306122	.357143	.408163	.459184

.510204	.561224	.612245	.663265	.714286	.765306	.816326	.867347	.918367	.969388
1.020408	1.071428	1.122449	1.173469	1.224489	1.275510	1.326530	1.377551	1.428571	1.479591
1.530612	1.581632	1.632653	1.683673	1.734693	1.785714	1.836734	1.887754	1.938775	1.989795
2.040816	2.091836	2.142856	2.1[illegible]3877	2.244897	2.295918	2.346938	2.397958	2.448979	2.500000

CCN 1

CCN: N-1 , P. 287

CALC. NO: M-73-116

REVISION: ~~2~~

BY: P. Tigeri DATE: 12-12-92

CHECKED: / Mg DATE: 12-22-92

SONGS UNITS 2 CABLE RISER GALLERY ROOM 224

Heat Sink Number 3: SOUTH WALL(CONCRETE)

CCN 1

CCN: N-1 , P. 288

CALC. NO: M-73-116

REV. NO: 2

P. Tigeri DATE: 12-12-92

DATE: 12-22-92

SHEET 288 OF

CONVECTIVE HEAT TRANSFER PARAMETERS

Slab Material	User-Defined
Slab Thickness	2.500 ft
Surface Area	7122.00 ft**2
Thermal Conductivity	1.040 BTU/hr-ft-deg. F
Density	143.600 lbm/ft**3
Thermal Diffusivity	.034 ft**2/hr
Heat Capacity	.210 BTU/lbm-deg. F
First Node Thickness	.05102 ft
Node Thickness Ratio	1.00
Number of Nodes	50
External Boundary Condition	Convective
External Heat Transfer Coefficient	Uchida
Outside Environment Index	0
Inside Environment Index	1
Interior Heat Transfer Coefficient	Uchida

TABLE OF EXTERNAL HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

TABLE OF INTERIOR HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

TABLE OF HEAT SINK MESH POINT COORDINATES (feet)

.000000	.051020	.102041	.153061	.204082	.255102	.306122	.357143	.408163	.459184

10

.510204	.561224	.612245	.663265	.714286	.765306	.816326	.867347	.918367	.969388
1.020408	1.071428	1.122449	1.173469	1.224489	1.275510	1.326530	1.377551	1.428571	1.479591
1.530612	1.581632	1.632653	1.683673	1.734693	1.785714	1.836734	1.887754	1.958775	1.989795
2.040816	2.091836	2.142856	2.193877	2.244897	2.295918	2.346938	2.397958	2.448979	2.500000

CCN 1

CCN: N-1 , P. 289

CALC NO: M-73-116
REV: 2
BY: P. Tijori DATE: 12-12-92
CHECKED: I. K. DATE: 12-12-92

289

SONGS UNITS 2 CABLE RISER GALLERY ROOM 224

Heat Sink Number 4: WEST WALL (CONCRETE)

CONVECTIVE HEAT TRANSFER PARAMETERS

Slab Material	User-Defined
Slab Thickness	2.500 ft
Surface Area	1179.00 ft**2
Thermal Conductivity	1.040 BTU/hr-ft-deg. F
Density	143.600 lbm/ft**3
Thermal Diffusivity	.034 ft**2/hr
Heat Capacity	.210 BTU/lbm-deg. F
First Node Thickness	.05102 ft
Node Thickness Ratio	1.00
Number of Nodes	50
External Boundary Condition	Convective
External Heat Transfer Coefficient	Uchida
Outside Environment Index	0
Inside Environment Index	1
Interior Heat Transfer Coefficient	Uchida

CCN 1

CCN: N-1, P. 290

M-73-116
2
P. Tiseri DATE: 12-12-92
I. A DATE: 12-22-92

TABLE OF EXTERNAL HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1000.0	1.4700

TABLE OF INTERIOR HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

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TABLE OF HEAT SINK MESH POINT COORDINATES (feet)

.000000	.051020	.102041	.153061	.204082	.255102	.306122	.357143	.408163	.459184

.510204	.561224	.612245	.663265	.714286	.765306	.816326	.867347	.918367	.969388
[illegible]	1.071428	1.122449	1.173469	1.224489	1.275510	1.326530	1.377551	1.428571	1.479591
[illegible]	1.581632	1.632653	1.683673	1.734693	1.785714	1.836734	1.887754	1.938775	1.989795
2.040816	2.091836	2.142856	2.193877	2.244897	2.295918	2.346938	2.397958	2.448979	2.500000

CCN 1
CCN: N-1, P. 291

CALC. NO: M-73-116
REVISION: 2 ~~3~~
BY: P. Tigeri DATE 12-12-92
CHECKED: [signature] DATE: 12-22-92

SHEET 291 OF ____

SONGS UNITS 2 CABLE RISER GALLERY ROOM 224

Heat Sink Number 5: NORTH WALL (CONCRETE)

CONVECTIVE HEAT TRANSFER PARAMETERS

Slab Material	User-Defined
Slab Thickness	1.000 ft
Surface Area	1322.00 ft**2
Thermal Conductivity	1.040 BTU/hr-ft-deg. F
Density	143.600 lbm/ft**3
Thermal Diffusivity	.034 ft**2/hr
Heat Capacity	.210 BTU/lbm-deg. F
First Node Thickness	.02041 ft
Node Thickness Ratio	1.00
Number of Nodes	50
External Boundary Condition	Convective
External Heat Transfer Coefficient	Uchida
Outside Environment Index	0
Inside Environment Index	1
Interior Heat Transfer Coefficient	Uchida

CCN 1
CCN: N-1, P. 292

CALC. NO: M-93-116
REVISION: 2
P. Tigeri DATE: 12-12-92
[illegible] DATE: 12-22-92

SHEET 292 OF

TABLE OF EXTERNAL HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

TABLE OF INTERIOR HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

TABLE OF HEAT SINK MESH POINT COORDINATES (feet)

.000000	.020408	.040816	.061224	.081633	.102041	.122449	.142857	.163265	.183673

.204082	.224490	.244898	.265306	.285714	.306122	.326531	.346939	.367347	.387755
.408163	.428571	.448980	.469388	.489796	.510204	.530612	.551020	.571428	.591837
.612245	.632653	.653061	.673469	.693877	.714286	.734694	.755102	.775510	.795918
.816326	.836734	.857143	.877551	.897959	.918367	.938775	.959183	.979592	1.000000

CCN 1

CCN: N-1 , P. 293

CALC. NO: M-73-116

REV: ~~2~~ 2

BY: P. Tigeri 12-12-92

CHECKED: 1. [illegible] 12-21-92

SH. 293

SONGS UNITS 2 CABLE RISER GALLERY ROOM 224

Heat Sink Number 6: CEILING(CONCRETE)

CCN 1

CCN: N-1, P. 294

CALC NO: M-~~83~~-116

REVISION ~~2~~ 10

P. Tigeri 12-12-92

M 12-22-92

SHEET 294 OF

CONVECTIVE HEAT TRANSFER PARAMETERS

Slab Material	User-Defined
Slab Thickness	1.000 ft
Surface Area	2257.00 ft**2
Thermal Conductivity	1.040 BTU/hr ft-deg. F
Density	143.600 lbm/ft**3
Thermal Diffusivity	.034 ft**2/hr
Heat Capacity	.210 BTU/lbm-deg. F
First Node Thickness	.02041 ft
Node Thickness Ratio	1.00
Number of Nodes	50
External Boundary Condition	Adiabatic
Inside Environment Index	1
Interior Heat Transfer Coefficient	Uchida

TABLE OF INTERIOR HEAT TRANSFER COEFFICIENTS

Temperature Difference (Degrees F)	Heat Transfer Coefficient (BTU/hr/ft**2/F)
.00000	1.4700
1.00000E+06	1.4700

TABLE OF HEAT SINK MESH POINT COORDINATES (feet)

.000000	.020408	.040816	.061224	.081633	.102041	.122449	.142857	.163265	.183673
.204082	.224490	.244898	.265306	.285714	.306122	.326531	.346939	.367347	.387755
.408163	.428571	.448980	.469388	.489796	.510204	.530612	.551020	.571428	.591837
.612245	.632653	.653061	.673469	.693877	.714286	.734694	.755102	.775510	.795918
.816326	.836734	.857143	.877551	.897959	.918367	.938775	.959183	.979592	1.000000

SONGS UNITS 2 CABLE RISER GALLERY ROOM 224

CCN 1

CCN: N-1, P. 295

CALC. NO: M-73-116
REVISION: ~~2~~ 2G
BY: P. Ligeri DATE: 12-12-92
I.A. 12-22-92

SHEET 295 OF

AUXILIARY CONDITIONS SELECTED

Blowout Panels	OFF
Convective Heat Transfer	ON
Unit Air Coolers	OFF
Heating and Ventilation Flow	OFF
Compartment Leakage	OFF
Compartment Equipment Heat Loads	ON
Atmosphere Exhaust Fan	OFF
Blowdown Dropout	OFF
Zero Reverse Flow	OFF
8% Revaporization	OFF

PROBLEM CONTROL PARAMETERS

Problem Time Limit	3600.00 seconds
Flow Calculation Output/Frequency	OFF/ 0
Compartment Pressure Difference Output	OFF
Heat Sink Calculation Output/Frequency	ON/ 2
Extended Heatsink Output: Node Temperatures	ON
Restart Option	OFF
Number of Plot Points	25
SIGFLO Switch Time	1.000000E+20 seconds
SIGFLO Iteration Tolerance	.001000 psi
Maximum Number of Flow Iterations	500

CALCULATION/PRINT TIMES SELECTED

Calc. Time Step	Change Time	Print Interval	Change Time
1.000E-02	1.000E+00	9.000E+02	3.600E+04
1.000E-01	1.000E+01	0.000E+00	0.000E+00
1.000E+00	2.000E+01	0.000E+00	0.000E+00
1.000E+01	1.000E+02	0.000E+00	0.000E+00
2.500E+01	3.600E+04	0.000E+00	0.000E+00

SONGS UNITS 2 CABLE RISER GALLERY ROOM 224

Time = 0 Hours 0 Minutes .00000 Seconds (.0000 Seconds) (Calc. Time Step = 1.000E-02 seconds)

	----- Compartment ----	Temp. (Deg F)	S-Heat/ Quality	Rel. Hum.	-- Pressures (psia) -- Total	Air	Steam	K	Total Mass (lbm)	Frac. Air	Frac. Vapor	Heat Load	Total Energy (BTU)
0	Atmosphere	85.000		.50	14.700	14.402	.298	1.40		.9873	.0127		
1	ROOM 224	104.000	22.1 S	.50	14.700	14.164	.536	1.39	9.5598620E+02	.9770	.0230	3.35	1.1381560E+05

Compartments Initial Energy	1.1382E+05 BTU	Compartments Initial Mass	9.5599E+02 lbm
Current Energy in Compartments	1.1382E+05 BTU	Current Mass in Compartments	9.5599E+02 lbm
Blowdown Enthalpy Added	0.0000E+00 BTU	Blowdown Mass Added	0.0000E+00 lbm
Irreversible Energy Loss	0.0000E+00 BTU	(Condens. + Dropout) Mass Loss	0.0000E+00 lbm
Energy Lost to Atmosphere	0.0000E+00 BTU	Mass Lost to Atmosphere	0.0000E+00 lbm
[Rate of Energy Loss to Atmosphere	0.0000E+00 BTU/sec]	[Rate of Mass Loss to Atmosphere	0.0000E+00 lbm/sec]
Absolute Energy Imbalance	0.0000E+00 BTU	Absolute Mass Imbalance	0.0000E+00 lbm
Relative Energy Imbalance	0.0000E+00 %	Relative Mass Imbalance	0.0000E+00 %

CCN/
CCN: N-1 , P. 296

CALC NO: M-73-116
2
P. Tigeri 12-12-92
I.A 12-22-92

SHEET 296 OF

SONGS UNITS 2 CABLE RISER GALLERY ROOM 224

Time = 0 Hours 15 Minutes .00000 Seconds (900.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

----- Compartment -----		Temp. (Deg F)	S-Heat/ Quality	Rel. Hum.	-- Pressures (psia) -- Total	Air	Steam	K	Total Mass (lbm)	Frac. Air	Frac. Vapor	Heat Load	Total Energy (BTU)
0	Atmosphere	85.000		.50	14.700	14.402	.298	1.40		.9873	.0127		
1	ROOM 224	99.330	17.7 S	.57	14.578	14.046	.532	1.39	9.5598620E+02	.9770	.0230	3.35	1.1302840E+05

Compartments Initial Energy	1.1382E+05 BTU	Compartments Initial Mass	9.5599E+02 lbm
Current Energy in Compartments	1.1303E+05 BTU	Current Mass in Compartments	9.5599E+02 lbm
Blowdown Enthalpy Added	0.0000E+00 BTU	Blowdown Mass Added	0.0000E+00 lbm
Irreversible Energy Loss	-3.0059E+04 BTU	(Condens. + Dropout) Mass Loss	0.0000E+00 lbm
Energy Lost to Atmosphere	3.0846E+04 BTU	Mass Lost to Atmosphere	0.0000E+00 lbm
[Rate of Energy Loss to Atmosphere	3.3600E+01 BTU/sec]	[Rate of Mass Loss to Atmosphere	0.0000E+00 lbm/sec]
Absolute Energy Imbalance	-3.5156E-02 BTU	Absolute Mass Imbalance	0.0000E+00 lbm
Relative Energy Imbalance	-3.1104E-05 %	Relative Mass Imbalance	0.0000E+00 %

CCN 1
CCN: N-1, P. 297

CALC. NO: M-73-116
REVISION: 2
P. Tigeri DATE 12-12-92
CHECKED: L.H. 12-21-92
SHEET 297

SONGS UNITS 2 CABLE RISER GALLERY ROOM 224

Time = 0 Hours 15 Minutes .00000 Seconds (900.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

Heat Sink Calculation Output

HS#	Comp	T	TSAT	TWALL	HCOND	HCONV	AREA	QCOND	QCONV	QSENS	QTOT	HS#
1 Left	1	99.330	81.655	96.846	.000	1.470	5801.0	0.000000E+00	-5.863590E+00	0.000000E+00	-5.863590E+00	1
1 Right	0	85.000	*******	91.018	.000	1.470	5801.0	0.000000E+00	1.426970E+01	0.000000E+00	1.426970E+01	1
2 Left	1	99.330	81.655	99.275	.000	1.470	1179.0	0.000000E+00	-2.330139E-02	0.000000E+00	-2.330139E-02	2
2 Right	0	85.000	*******	89.134	.000	1.470	1179.0	0.000000E+00	1.991197E+00	0.000000E+00	1.991197E+00	2
3 Left	1	99.330	81.655	99.275	.000	1.470	7122.0	0.000000E+00	-1.407570E-01	0.000000E+00	-1.407570E-01	3
3 Right	0	85.000	*******	89.134	.000	1.470	7122.0	0.000000E+00	1.202825E+01	0.000000E+00	1.202825E+01	3
4 Left	1	99.330	81.655	99.275	.000	1.470	1179.0	0.000000E+00	-2.330139E-02	0.000000E+00	-2.330139E-02	4
4 Right	0	85.000	*******	89.134	.000	1.470	1179.0	0.000000E+00	1.991197E+00	0.000000E+00	1.991197E+00	4
5 Left	1	99.330	81.655	97.260	.000	1.470	1322.0	0.000000E+00	-1.114327E+00	0.000000E+00	-1.114327E+00	5
5 Right	0	85.000	*******	91.146	.000	1.470	1322.0	0.000000E+00	3.319754E+00	0.000000E+00	3.319754E+00	5
6 Left	1	99.330	81.655	103.408	.000	1.470	2257.0	0.000000E+00	3.766422E+00	0.000000E+00	3.766422E+00	6

CCN 1
CCN: N-1 , P. 298

CALC. NO: M-73-116
REVISION: ~~2~~ 3
BY: P. Tigeri DATE: 12-12-92
CHECKED: [illegible] 12-21-92

298

SONGS UNITS 2 CABLE RISER GALLERY ROOM 224

Time = 0 Hours 15 Minutes .00000 Seconds (900.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

Extended Heatsink Output: Node Temperatures

Heat Sink No. 1, NORTH WALL(PLASTER)

96.845610	96.772060	96.695100	96.614780	96.531160
96.444310	96.354220	96.261020	96.164760	96.065580
95.963650	95.859040	95.751860	95.642300	95.530360
95.416350	95.300200	95.182160	95.062290	94.940640
94.817350	94.692410	94.565950	94.437900	94.308380
94.177400	94.044890	93.910920	93.775360	93.638210
93.499360	93.358860	93.216520	93.072360	92.926300
92.778170	92.628020	92.475740	92.321200	92.164400
92.005280	91.843840	91.680020	91.513820	91.345250
91.174290	91.018460			

Heat Sink No. 2, EAST WALL(CONCRETE)

99.274930	99.237150	99.137730	98.991120	98.813570
98.617830	98.413060	98.204070	97.993740	97.782930
97.571870	97.360260	97.148280	96.936130	96.723850
96.512180	96.300690	96.089140	95.877900	95.666530
95.454680	95.242650	95.030550	94.818880	94.607150
94.395600	94.184480	93.972990	93.761380	93.549220
93.337490	93.126010	92.914580	92.702970	92.491360
92.279630	92.067900	91.856050	91.644380	91.432830
91.221100	91.009430	90.797150	90.584080	90.369050
90.149570	89.921970	89.680690	89.419530	89.133760

Heat Sink No. 3, SOUTH WALL(CONCRETE)

99.274930	99.237150	99.137730	98.991120	98.813570
98.617830	98.413060	98.204070	97.993740	97.782930
97.571870	97.360260	97.148280	96.936130	96.723850
96.512180	96.300690	96.089140	95.877900	95.666530
95.454680	95.242650	95.030550	94.818880	94.607150
94.395600	94.184480	93.972990	93.761380	93.549220

CCN 1
CCN: N-1, P. 299

CALC. NO: M-73-116
REVISION: ~~2~~
P. Tigeri DATE 12-12-92
L. A 11-22-92

SHEET 299 OF ____

93.337490	93.126010	92.914580	92.702970	92.491360
92.279630	92.067900	91.856050	91.644380	91.432830
91.221100	91.009430	90.797150	90.584080	90.369050
90.149570	89.921970	89.680690	89.419530	89.133760

Heat Sink No. 4, WEST WALL (CONCRETE)

99.274930	99.237150	99.137730	98.991120	98.813570
98.617830	98.413060	98.204070	97.993740	97.782930
97.571870	97.360260	97.148280	96.936130	96.723850
96.512180	96.300690	96.089140	95.877900	95.666530
95.454680	95.242650	95.030550	94.818880	94.607150
94.395600	94.184480	93.972990	93.761380	93.549220
93.337490	93.126010	92.914580	92.702970	92.491360
92.279630	92.067900	91.856050	91.644380	91.432830
91.221100	91.009430	90.797150	90.584080	90.369050
90.149570	89.921970	89.680690	89.419530	89.133760

CCN 1
CCN: N-1 , P.300

CALC. NO: M-73-116
2 ~~2~~A
P. Tigeri 12-12-92
L. [illegible] 12-22-92
SHEET 300

SONGS UNITS 2 CABLE RISER GALLERY ROOM 224

Time = 0 Hours 15 Minutes .00000 Seconds (900.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

Extended Heatsink Output: Node Temperatures

Heat Sink No. 5, NORTH WALL (CONCRETE)

97.260160	97.196010	97.123260	97.042450	96.954070
96.858980	96.757840	96.651580	96.540990	96.426730
96.309540	96.190030	96.068820	95.946200	95.822600
95.698330	95.573460	95.448270	95.322850	95.197170
95.071440	94.945650	94.819790	94.693940	94.568080
94.442230	94.316310	94.190340	94.064420	93.938390
93.812290	93.686070	93.559720	93.433140	93.306180
93.178740	93.050690	92.921660	92.791410	92.659640
92.525850	92.389680	92.250340	92.107390	91.960420
91.808620	91.651700	91.489110	91.320710	91.146390

Heat Sink No. 6, LEILING(CONCRETE)

103.407900	103.518200	103.613900	103.695600	103.764400
103.821100	103.867000	103.903600	103.932200	103.954200
103.970700	103.983000	103.992000	103.998400	104.003000
104.006100	104.008300	104.009900	104.010800	104.011600
104.012100	104.012400	104.012700	104.912900	104.013100
104.013300	104.013500	104.013600	104.013800	104.013800
104.013900	104.013900	104.014000	104.014100	104.014100
104.014200	104.014300	1F-.014400	104.014500	104.014500
104.014600	104.014600	104.014600	104.014600	104.014600
104.014700	104.014700	104.014700	104.014900	104.914900

CCN 1
CCN: N-1, P. 301

CALC NO. M-73-116
P. Tigeri 12-12-92
12-22-92

SHEET 301 OF ___

SONGS UNITS 2 CABLE RISER GALLERY ROOM 224

Time = 0 Hours 30 Minutes .00000 Seconds (1800.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

----- Compartment ----	Temp. (Deg F)	S-Heat/ Quality	Rel. Hum.	-- Pressures (psia) -- Total	Air	Steam	K	Total Mass (lbm)	Frac. Air	Frac. Vapor	Heat Load	Total Energy (BTU)
0 Atmosphere	85.000		.50	14.700	14.402	.298	1.40		.9873	.0127		
1 ROOM 224	99.113	17.5 S	.57	14.572	14.041	.531	1.39	9.5598620E+02	.9770	.0230	3.35	1.1299190E+05

Compartments Initial Energy	1.1382E+05 BTU	Compartments Initial Mass	9.5599E+02 lbm
Current Energy in Compartments	1.1299E+05 BTU	Current Mass in Compartments	9.5599E+02 lbm
Blowdown Enthalpy Added	0.0000E+00 BTU	Blowdown Mass Added	0.0000E+00 lbm
Irreversible Energy Loss	-5.9933E+04 BTU	(Condens. + Dropout) Mass Loss	0.0000E+00 lbm
Energy Lost to Atmosphere	6.0757E+04 BTU	Mass Lost to Atmosphere	0.0000E+00 lbm
[Rate of Energy Loss to Atmosphere	3.2896E+01 BTU/sec]	[Rate of Mass Loss to Atmosphere	0.0000E+00 lbm/sec]
Absolute Energy Imbalance	-2.7344E-02 BTU	Absolute Mass Imbalance	0.0000E+00 lbm
Relative Energy Imbalance	-2.4200E-05 %	Relative Mass Imbalance	0.0000E+00 %

CCN 1
CCN: N-1, P. 302

CALC. NO: M-73-116
REVISION: 2
BY: P. Tigeri 12-12-92
12-21-92

SHEET 302

SONGS UNITS 2 CABLE RISER GALLERY ROOM 224

Time = 0 Hours 45 Minutes .00000 Seconds (2700.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

----- Compartment ----	Temp. (Deg F)	S-Heat/ Quality	Rel. Hum.	-- Pressures (psia) -- Total	Air	Steam	K	Total Mass (lbm)	Frac. Air	Frac. Vapor	Heat Load	Total Energy (BTU)
0 Atmosphere	85.000		.50	14.700	14.402	.298	1.40		.9873	.0127		
1 ROOM 224	98.943	17.3 S	.58	14.568	14.037	.531	1.39	9.5598620E+02	.9770	.0230	3.35	1.1296330E+05

Compartments Initial Energy	1.1382E+05 BTU	Compartments Initial Mass	9.5599E+02 lbm
Current Energy in Compartments	1.1296E+05 BTU	Current Mass in Compartments	9.5599E+02 lbm
Blowdown Enthalpy Added	0.0000E+00 BTU	Blowdown Mass Added	0.0000E+00 lbm
Irreversible Energy Loss	-8.9270E+04 BTU	(Condens. + Dropout) Mass Loss	0.0000E+00 lbm
Energy Lost to Atmosphere	9.0123E+04 BTU	Mass Lost to Atmosphere	0.0000E+00 lbm
[Rate of Energy Loss to Atmosphere	3.2361E+01 BTU/sec]	[Rate of Mass Loss to Atmosphere	0.0000E+00 lbm/sec]
Absolute Energy Imbalance	7.8125E-03 BTU	Absolute Mass Imbalance	0.0000E+00 lbm
Relative Energy Imbalance	6.9160E-06 %	Relative Mass Imbalance	0.0000E+00 %

CCN 1

CCN: N-1, P. 303

CALC. NO: M-73-116
REVISION: 2
BY: P. Tigeri DATE: 12-12-92
CHECKED: [illegible] DATE: 12-22-92
SHEET 303

SONGS UNITS 2 CABLE RISER GALLERY ROOM 224

Time = 0 Hours 45 Minutes .00000 Seconds (2700.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

Heat Sink Calculation Output

HS#	Comp	T	TSAT	TWALL	HCOND	HCONV	AREA	QCOND	QCONV	QSENS	QTOT	HS#
1 Left	1	98.943	81.634	96.373	.000	1.470	5801.0	0.000000E+00	-6.073804E+00	0.000000E+00	-6.073804E+00	1
1 Right	0	85.300	*******	90.719	.000	1.470	5801.0	0.000000E+00	1.355535E+01	0.000000E+00	1.355535E+01	1
2 Left	1	98.943	81.634	98.948	.000	1.470	1179.0	0.000000E+00	4.084355E-03	0.000000E+00	4.084355E-03	2
2 Right	0	85.000	*******	89.023	.000	1.470	1179.0	0.000000E+00	1.937219E+00	0.000000E+00	1.937219E+00	2
3 Left	1	98.943	81.634	98.948	.000	1.470	7122.0	0.000000E+00	2.467242E-02	0.000000E+00	2.467242E-02	3
3 Right	0	85.000	*******	89.023	.000	1.470	7122.0	0.000000E+00	1.170218E+01	0.000000E+00	1.170218E+01	3
4 Left	1	98.943	81.634	98.948	.000	1.470	1179.0	0.000000E+00	4.084355E-03	0.000000E+00	4.084355E-03	4
4 Right	0	85.000	*******	89.023	.000	1.470	1179.0	0.000000E+00	1.937219E+00	0.000000E+00	1.937219E+00	4
5 Left	1	98.943	81.634	96.987	.000	1.470	1322.0	0.000000E+00	-1.054296E+00	0.000000E+00	-1.054296E+00	5
5 Right	0	85.000	*******	90.981	.000	1.470	1322.0	0.000000E+00	3.229411E+00	0.000000E+00	3.229411E+00	5
6 Left	1	98.943	81.634	102.971	.000	1.470	2257.0	0.000000E+00	3.716415E+00	0.000000E+00	3.716415E+00	6

CCN 1
CCN: N-1, P. 304

CALC. NO: M-73-116
REVISION:
BY: P. Tiseri DATE 12-[illegible]-92
CHECKED: DATE 12-22-92

304

SONGS UNITS 2 CABLE RISER GALLERY ROOM 224

Time = 0 Hours 45 Minutes .00000 Seconds (2700.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

Extended Heatsink Output: Node Temperatures

Heat Sink No. 1, NORTH WALL(PLASTER)

96.373080	96.297640	96.219940	96.139980	96.057830
95.973420	95.886750	95.797820	95.706530	95.613190
95.517490	95.419590	95.319430	95.217070	95.112460
95.005650	94.896640	94.785490	94.672150	94.556670
94.439060	94.319310	94.197480	94.073520	93.947540
93.819490	93.689420	93.557340	93.423310	93.287320
93.149440	93.009610	92.867890	92.724330	92.578950
92.431730	92.282750	92.132050	91.979580	91.825470
91.669710	91.512360	91.353420	91.192900	91.030910
90.867400	90.719020			

Heat Sink No. 2, EAST WALL(CONCRETE)

98.947720	98.928380	98.871000	98.778960	98.656830
98.509610	98.342620	98.160680	97.967990	97.768100
97.563390	97.355740	97.146210	96.935460	96.724210
96.512420	96.300810	96.089140	95.877900	95.666530
95.454680	95.242650	95.030550	94.818880	94.607150
94.395600	94.184480	93.972990	93.761380	93.549410
93.337620	93.126010	92.914580	92.702970	92.491360
92.279630	92.067840	91.855740	91.642970	91.429470
91.214750	90.998080	90.778230	90.553800	90.323460
90.085360	89.837550	89.578460	89.306920	89.022800

Heat Sink No. 3, SOUTH WALL(CONCRETE)

98.947720	98.928380	98.871000	98.778960	98.656830
98.509610	98.342620	98.160680	97.967990	97.768100
97.563390	97.355740	97.146210	96.935460	96.724210
96.512420	96.300810	96.089140	95.877900	95.666530
95.454680	95.242650	95.030550	94.818880	94.607150
94.395600	94.184480	93.972990	93.761380	93.549410

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REVISION: 2
P. Tigeri DATE: 12-12-92
CHECKED: DATE: 12-22-92

93.337620	93.126010	92.914580	92.702970	92.491360
92.279630	92.067840	91.855740	91.642970	91.429470
91.214750	90.998080	90.778230	90.553800	90.323460
90.085360	89.837550	89.578460	89.306920	89.022800

Heat Sink No. 4, WEST WALL (CONCRETE)

98.947720	98.928380	98.871000	98.778960	98.656830
98.509610	98.342620	98.160680	97.967990	97.768100
97.563390	97.355740	97.146210	96.935460	96.724210
96.512420	96.300810	96.089140	95.877900	95.666530
95.454680	95.242650	95.030550	94.818880	94.607150
94.395600	94.184480	93.972990	93.761380	93.549410
93.337620	93.126010	92.914580	92.702970	92.491360
92.279630	92.067840	91.855740	91.642970	91.429470
91.214750	90.998080	90.778230	90.553800	90.323460
90.085360	89.837550	89.578460	89.306920	89.022800

CCN 1
CCN: N-1, P. 306

CALC. NO: M-73-116
2
P. Tigeri 12-12-92
12-22-92
306

SONGS UNITS 2 CABLE RISER GALLERY ROOM 224

Time = 0 Hours 45 Minutes .00000 Seconds (2700.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

Extended Heatsink Output: Node Temperatures

Heat Sink No. 5, NORTH WALL (CONCRETE)

96.986720	96.927580	96.863130	96.793490	96.718900
96.639620	96.555760	96.467680	96.375520	96.279450
96.179840	96.076930	95.971040	95.862400	95.751310
95.637970	95.522670	95.405610	95.287020	95.167080
95.045870	94.923680	94.800510	94.676480	94.551670
94.426060	94.299710	94.172580	94.044710	93.915990
93.786410	93.655790	93.524140	93.391270	93.256990
93.121250	92.983860	92.844700	92.703580	92.560270
92.414640	92.266630	92.115940	91.962550	91.806300
91.647130	91.485020	91.319920	91.151820	90.980740

Heat Sink No. 6, CEILING(CONCRETE)

102.970700	103.082700	103.186400	103.282000	103.369700
103.449600	103.522100	103.587500	103.646100	103.698200
103.744300	103.784900	103.820300	103.851100	103.877700
103.900500	103.919800	103.936200	103.950000	103.961600
103.971200	103.979000	103.985500	103.990800	103.995100
103.998500	104.001300	104.003500	104.005300	104.006700
104.007700	104.008600	104.009300	104.009900	104.010300
104.010700	104.011000	104.011300	104.011500	104.011700
104.011900	104.012100	104.012200	104.012400	104.012500
104.012700	104.012800	104.012900	104.013000	104.013000

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P. Tiperi DATE: 12-12-92
DATE: 12-22-92

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SONGS UNITS 2 CABLE RISER GALLERY ROOM 224

Time = 1 Hours 0 Minutes .00000 Seconds (3600.0000 Seconds) (Calc. Time Step = 2.500E+01 seconds)

	----- Compartment ----	Temp. (Deg F)	S-Heat/ Quality	Rel. Hum.	-- Pressures (psia) -- Total	Air	Steam	K	Total Mass (lbm)	Frac. Air	Frac. Vapor	Heat Load	Total Energy (BTU)
0	Atmosphere	85.000		.50	14.700	14.402	.298	1.40		.9873	.0127		
1	ROOM 224	98.795	17.2 S	.58	14.564	14.033	.531	1.39	9.5598620E+02	.9770	.0230	3.35	1.1293830E+05

Compartments Initial Energy	1.1382E+05 BTU	Compartments Initial Mass	9.5599E+02 lbm
Current Energy in Compartments	[illegible]E+05 BTU	Current Mass in Compartments	9.5599E+02 lbm
Blowdown Enthalpy Added	0.0000E+00 BTU	Blowdown Mass Added	0.0000E+00 lbm
Irreversible Energy Loss	-1.1816E+05 BTU	(Condens. + Dropout) Mass Loss	0.0000E+00 lbm
Energy Lost to Atmosphere	1.1904E+05 BTU	Mass Lost to Atmosphere	0.0000E+00 lbm
[Rate of Energy Loss to Atmosphere	3.1895E+01 BTU/sec]	[Rate of Mass Loss to Atmosphere	0.0000E+00 lbm/sec]
Absolute Energy Imbalance	0.0000E+00 BTU	Absolute Mass Imbalance	0.0000E+00 lbm
Relative Energy Imbalance	0.00u0E+00 %	Relative Mass Imbalance	0.0000E+00 %

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LA 12-22-92

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SONGS UNITS 2 CABLE RISER GALLERY ROOM 224

MAXIMUM AND MINIMUM PRESSURES AND TEMPERATURES

		Maximum				Minimum			
Compartment		(psia) Pressure	(sec) at Time	(deg. F) Temperature	(sec) at Time	(psia) Pressure	(sec) at Time	(deg. F) Temperature	(sec) at Time
1	ROOM 224	14.7000	.0000	104.000	1.0000E-02	14.5642	3600.	98.795	3600.

349 Calculation cycles were performed

==> Execution time: 00:01:12.94

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8.8 Calculations:

Thermal conductivity of air and temporary fan capacity for the Distribution Rooms.

8.8.1 CALCULATION OF THERMAL CONDUCTIVITY(K) FOR AIR AT 95 deg F

1. FOR $X_{air} := 3.5$ in AND $T_{air} := 90$ F

$R_{air} := 0.85$ (hr.ft^2.F)/BTU (Ref. # 6.2)

2. FOR $X_{air} := 3.5$ in AND $T_{air} := 95$ F

$$R1_{air} := 0.85 \cdot \frac{90}{95} \qquad R1_{air} = 0.805 \quad \text{(hr.ft^2.F)/BTU}$$

$$K_{air} := \frac{1}{R1_{air}} \qquad K_{air} = 1.242 \quad \text{BTU/(hr.ft.F)}$$

$\triangle$

8.8.2 Distribution Room Temperature Fan Capacity:

Calculating "cfm" needed to maintain temperature in the Distribution Rooms Unit 2 under 120 deg F.

$$cfm := \frac{Q}{1.08 \cdot \delta T}$$

Where
Q is total heat load (BTU/hr)
δT = Ti - To
Ti is room temperature(deg F)
To is outside room temperature(deg F)

$Q := 5.76 \cdot 10^{3}$ W (Ref. # 6.7)

$Q := 5.76 \cdot 10^{3} \cdot 3.4121$

$Q = 1.965 \cdot 10^{4}$ BTU/hr

$Ti := 120$ F

$To := 95$ F assuming that Corridor ambient temperature remains at 95 F during SBO. This assumption is conservative because of:

1. Range of Corridor ambient temperature is between 65 F to 95 F.

2. Corridor has several components such as walls, ceiling, ductwork, cable riser, piping, and structural supports that can be credited as heat sinks.

3. Corridor heat load is small(negligible).

$\delta T := Ti - To$

$$cfm := \frac{Q}{1.08 \cdot \delta T} \quad ====>> \quad cfm = 727.915$$

or ====> cfm := 800

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9.0 APPENDICES

Analysis
Thermal conductivity of air
Technical justification

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1. Purpose:

The purpose of this calculation is to determine the combined radiation/convection heat transfer coefficient for the Distribution Room walls and ceiling. The Distribution Room was evaluated because the final calculated temperature (123.8 °F) is higher than the limit(120 °F). Any reduction in the heat transfer coefficient will reduce the heat rejected from the room and subsequently increase the room temperature and will require earlier operator actions to maintain the temperature within design limit.

Background:

Natural Convection Heat Transfer Coefficients for h_{air} are affected by surface orientation(Vertical or horizontal), air properties, system geometry, and air to surface temperature difference. Depending on these parameters the value of h_{air} could range from 0.1 to 10.0 Btu/hr-ft^2-°F. For this calculation heat transfer coefficient h = 1.47 Btu/hr-ft^2-°F(Ref. #6.3), used in order to determine the temperature rise for DACs for SONGS 2. This value is widely used in the engineering industry for the heat transfer analysis(Ref. # 2). In order to validate this heat transfer coefficient, the evaluation below is performed.

2. Results/Conclusions/Recommendations

The surface heat transfer coefficients, for the U2 Distribution Rooms are:

North Wall 1.67 Btu/hr $ft^2 \cdot F$ (U2, U3 South Wall)
Ceiling 1.80 Btu/hr. $ft^2 \cdot F$

Conclusion

The heat transfer coefficient h = 1.47 Btu/hr $ft^2 \cdot F$ used in this calculation is conservative value since it results in a higher room temperature than the value arrived at by calculation (1.67 and 1.80).

Recommendations

None.

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3. Assumptions

3.1 The temperature of the radiating surface (panels, cabinets) is 20°F higher than the surrounding air temperature since there is no forced convection in the room.

3.2 The radiating surfaces are painted grey.

3.3 The temperature difference between the room air and the wall is approximately 13°F. This is based on the results of the Distribution Room heat rise analysis (section 8.2) for the north wall and checked with an independent spread sheet program (See Independent Review). This value is constant from six to ten minutes into SBO and assumed constant for the total SBO coping duration.

3.4 The modes of heat transfer in the Distribution Room are free convection and radiation.

3.5 The ceiling and wall temperatures are assumed to be the same.

3.6 Heat is transferred through the North wall (Unit 2), Unit 3 South wall and the ceiling only. The East and West Walls are considered Adiabatic since the Distribution Rooms are located next to each other.

3.7 The door is assumed to be the same temperature as the walls. This is conservative since the door will likely have a lower transmission coefficient that the wall and consequently a lower temperature.

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2	PARVIZ TIGERI	12/15							

4. Design Input

   1. Room Dimensions (310, A,B,C,D,E,F,G,H)
      (For reference see Section 8.2)

   2. Emmissivity of the equipment located in the distribution room is .9 since the equipment is assumed to be painted. (Ref. 1)

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5. Methodology.

Two modes of heat transmission have been considered in this analysis- Free Convection and Radiation. The methods and equations used are consistent with that specified in Reference 1.

Prior to SBO initiation, the room air temperature and the wall temperature are assumed to be the same. Consequently, the heat transfer coefficient is initially low because it is a function of the difference in temperature between the room air and the wall. Most of the equipment generated heat is removed from the room by the ventilation system. Immediately after SBO initiation, the ventilation system is not available, therefore the change in temperature with respect to time (dT/dt) is high. The convection heat transfer coefficient increases because the temperature difference between the air and wall increases and several minutes into the event, $dT_{air}/dt = dT_{wall}/dt$. At this point and through the event duration, the heat transfer coefficient stabilizes because the difference between the air temperature and the wall temperature is approaching constant values. The evaluation that was performed calculates the steady state heat transfer coefficient for both radiation and convection (thermal conductivity):

A) Convection

Formulas (Ref. 1)

$$\bar{h}_{conv} = \frac{\overline{Nu}_L \cdot K}{L} \qquad \overline{Nu}_L = \left[0.825 + \frac{.387 x\, [Ra_L]^{1/6}}{[1+(.492/Pr)^{9/16}]^{8/27}}\right]^2$$

$$Ra_L = \frac{g\beta\,(T_s - T_\infty)\,L^3}{\nu\alpha} \qquad \beta = \frac{1}{T_f}$$

$$T_f = \frac{T_s + T_\infty}{2}$$

Where:

h_{conv} -Average convection heat transfer coefficient ($W/M^2 \cdot K$)
Nu - Nusselt Number averaged over the length of the surface.
K - Thermal conductivity of Air ($W/m \cdot K$)\
L - Length of the surface - wall height (m)
Ra_L - Reynolds number

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Pr - Prandtl Number
g - Acceleration due to gravity (ft/sec^2)
β - Expansion coefficient (1/°K)
T_s - Wall surface temperature (°K)
T_∞ - Air Temperature (°K)
γ - Kinematic viscosity (m^2/s)
α - thermal diffusivity ((m^2/s)
T_f - bulk fluid (air) temperature at the wall surface (°K)

5.1 Radiation

Formulas

$$Q = \epsilon A\sigma(T_E^4 - Tw^4) \qquad Q = \bar{h}_{rad}A(T_E - T_w)$$

$$\bar{h}_{rad} = \frac{\epsilon\sigma(T_E^4 - Tw^4)}{(T_E - T_w)}$$

Where:

Q = Heat transferred by Radiation (Watts)
ϵ = Emissivity
A = Area (m^2)
σ = Stefan - Boltzmann Const.
T_E = Equipment temperature (°K)
T_w = Wall Temperature (°K)
$\bar{h}_{rad}$ = Radiation heat transfer coefficient

5.2 Convection - ceiling

Formulas:

Lower surface of a cooled plate

$$\bar{h}_{conv} = \frac{\overline{Nu}_L \times K}{L} \quad \overline{Nu}_L = 0.15[Ra_L]^{1/3} \quad 10^7 < Ra_L < 10^{11}$$

$$Ra_L = \frac{g\beta(T_c - T_\infty)L^3}{\nu\alpha} \quad L = \frac{A_s}{P}$$

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Where:

As = Surface Area of Ceiling (m^2)
L = Characteristic Length (m)
P = Perimeter of Ceiling (m)
T_c = Ceiling Temperature (°K)
All other terms defined in Section 5.A

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1	PARVIZ TIGERI	12/15		12/18/9?					

6. References:

1. De Witt, David P. and Frank P. Incropera, "Introduction to Heat Transfer," John Wiley & Songs, New York, 1985.

2. Calculation #N-4090-4 Rev 1, Thermal Response of Auxiliary Bldg. Control Area Room 302A on Station Blackout.

3. 1985 ASHRAE Fundamentals Handbook.

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7. Nomenclature

Nomenclature for the subject calculation is defined in the Section 5 - Methodology

8.0 Calculation:

8.1 Convection - vertical surface.

Given:

$K := 0.0156$ BTU/hr-ft-deg F $K := 0.02698$ W/m-deg K

$L := 18.75$ ft $L := 5.715$ m

$Pr := 0.72$ $Pr := 0.72$

$g := 32.2$ ft/s^2 $g := 9.81$ m/s^2

$Ts := 111.729$ deg F $Ts := 317.44$ deg K

$T\infty := 118.4$ deg F $T\infty := 324.13$ deg K

$v := 0.186 \cdot 10^{-3}$ ft^2/s $v := 1.73 \cdot 10^{-5}$ m^2/s

$\alpha := 25.58 \cdot 10^{-6}$ m^2/s

$$T_f := \frac{324.13 + 317.44}{2}$$

$T_f = 320.785$ deg K

$$\beta := \frac{1}{T_f}$$

$\beta = 0.003$ 1/deg K

$$Ra_L := \frac{9.81 \cdot 3.1 \cdot 10^{-3} \cdot (324.13 - 317.44) \cdot 5.715^3}{1.728 \cdot 10^{-5} \cdot \alpha}$$

$$Ra_L = 8.591 \cdot 10^{10}$$

$$Nu_L := \left[0.825 + \left[0.387 \cdot \frac{Ra_L^{\frac{1}{6}}}{\left[1 + \left[\frac{0.492}{0.72}\right]^{\frac{9}{16}}\right]^{\frac{8}{27}}}\right]\right]^2$$

$$Nu_L = 501.657$$

$k := 0.02698$ W/m-deg K

$L := 5.715$ m

$$h_{conv} := Nu_L \cdot \frac{k}{L}$$

$h_{conv} = 2.368$ W/m^2-deg K

8.2 Radiacion

GIVEN:

$E := 0.9$

$\sigma := 5.67 \cdot 10^{-8}$

$T_E := 143.77$ deg F $\qquad T_E := 335.26$ deg K

$T_W := 111.729$ deg F $\qquad T_W := 317.44$ deg K

$$h_{rad} := \frac{0.9 \cdot \left[\sigma \cdot \left[335.26^4 - 317.44^4\right]\right]}{335.26 - 317.44}$$

$h_{rad} = 7.1$ W/m^2-deg K

$h_{Total} := h_{conv} + h_{rad}$

$h_{Total} = 9.468$ W/m^2-deg K

$h_{Total} := h_{Total} \cdot 0.17612$ BTU/hr-ft^2-deg F

$h_{Total} = 1.668$ BTU/hr-ft^2-deg F

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8.3 Convection - Ceiling

GIVEN:

CEILING DIMENTIONS

L := 17.375	ft	L := 5.3	m
W := 14.52	ft	W := 4.43	m
$v := 0.186 \cdot 10^{-3}$	ft^2/s	$v := 1.73 \cdot 10^{-5}$	m^2/s
K := 0.0156	BTU/hr-ft-F	K := 0.02698	W/m-deg

m^2

L := 5.3 m

W := 4.43 m

A := L·W m^2

P := 2·5.3 + 2·4.43

WHERE
"A" IS SURFACE AREA OF CEILING
"P" IS PERIMETER OF CEILING

$$L := \frac{A}{P}$$

L = 1.207 m

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$$Ra_L := \frac{9.81 \cdot 3.1 \cdot 10^{-3} \cdot (324.13 - 317.44) \cdot 1.207^3}{1.728 \cdot 10^{-5} \cdot \alpha}$$

$$Ra_L = 8.093 \cdot 10^8$$

$$Nu_L := 0.15 \cdot Ra_L^{\frac{1}{3}}$$

$$Nu_L = 139.788$$

$$h_{conv} := Nu_L \cdot \frac{0.02698}{L}$$

$h_{conv} = 3.126$ W/m^2-deg K

SINCE "h" IS INDEPENDENT OF DIRECTION:

$$h_{Total} := h_{conv} + h_{rad}$$

$h_{Total} = 10.226$ W/m^2-deg K

$$h_{Total} := h_{Total} \cdot 0.17612$$

$h_{Total} = 1.801$ BTU/hr-ft^2-deg F