



ENGINEERING DEPARTMENT

**CALCULATION SHEET**SUBJECT: Room Temperature Response During  
Station BlackoutCALC NO. M-73-116 REV. 1J.O.NO. 6711 MADE BY: I. Shlafman DATE: 5-4-90 CHECKED BY: [Signature] DATE: 5-23-90Table of Contents  
Section

Page

1. Purpose	3
2. Results/Conclusion	4
3. Assumptions	11
4. Methodology	13
5. Design Input	14
6. References	15
7. Nomenclature	16
8. Calculation	
8.1 General Equations	17
8.2 Switchgear Room 302A	21
8.3 Distribution Room 310B	33
8.4 Computer Room 232	45
8.5 AFW Pump Room	58
8.6 Control Room Cabinet Area 229	70
8.7 Control Room 228	77

Attachments: 84

1. Size of computer room cabinets
2. Letter from A.P. Grande to A.D. Sistos, Subject: Station Blackout Scenario. Electrical Heat Loads. SONGS 1,2 & 3 dated 4/10/89
3. E-mail from T.Ramos to Ilya Shlafman, subject : Station Blackout- Lighting Load for DAC Rooms Units 2/3.

ENGINEERING DEPARTMENT

**CALCULATION SHEET**SUBJECT: Room Temperature Response During  
Station BlackoutCALC NO. M-73-116 REV. 1J.O. NO. 6711 MADE BY: I. Shlafman DATE: 5-4-90 CHECKED BY: [Signature] DATE: 5-23-90**1. Purpose**

The purpose of this calculation is to determine the temperature rise in the following areas during Unit 2 blackout:

**a) Station Blackout Coping Duration of four hours:**

Switchgear Rooms (Room #302A was used)  
Computer Room (Room #232)  
AFW Pump Room  
Distribution Rooms (Room #310B was used)

**b) Station Blackout Coping Duration of one hour:**

Control Room Cabinet Area (Room #229)  
Control Room Area (Room #228)

**Reason for revision:** The reasons for the revision 1 are as follows:

- 1) Charging pump room, which was analyzed in rev.0, is completely deleted from Station Blackout analyses in rev.1.
- 2) The coping duration for Control Room Blackout was reduced from 4 hours to 1 hour.
- 3) The additional conservatism (only floor and walls were used in rev.1 as the heat sinks per NUMARC 87-00 recommendation) was added in rev.1 calculation. Almost every room was effected by these changes.

Therefore, in order to avoid numerous deletions and additions in the process of revising calc., the new calculation rev.1 was developed which completely supersedes rev.0.

ENGINEERING DEPARTMENT

**CALCULATION SHEET**SUBJECT: Room Temperature Response During  
Station BlackoutCALC NO. M-73-116 REV. 1J.O. NO. 6711 MADE BY: I. Shlafman DATE: 5-4-90 CHECKED BY: [Signature] DATE: 5-23-90**2.0 Results/Conclusion**

The results of these analyses are summarized in Table 1 below:

**Table 1**Room Ambient Temperature After Station Blackout  
Coping durations of 1 and 4 hours

Room Name	Initial Temp. F	Time after SBO	
		1hr	4 hrs
1. Switchgear Rm.	95		96.8
2. Distribution Rm.	95		118.5
3. Computer Rm.	72		163.9
4. AFW Pump Rm	104		107.4
5. Control Rm. Cab. Area	75	111.1	
6. Control Room Area	75	114.6	

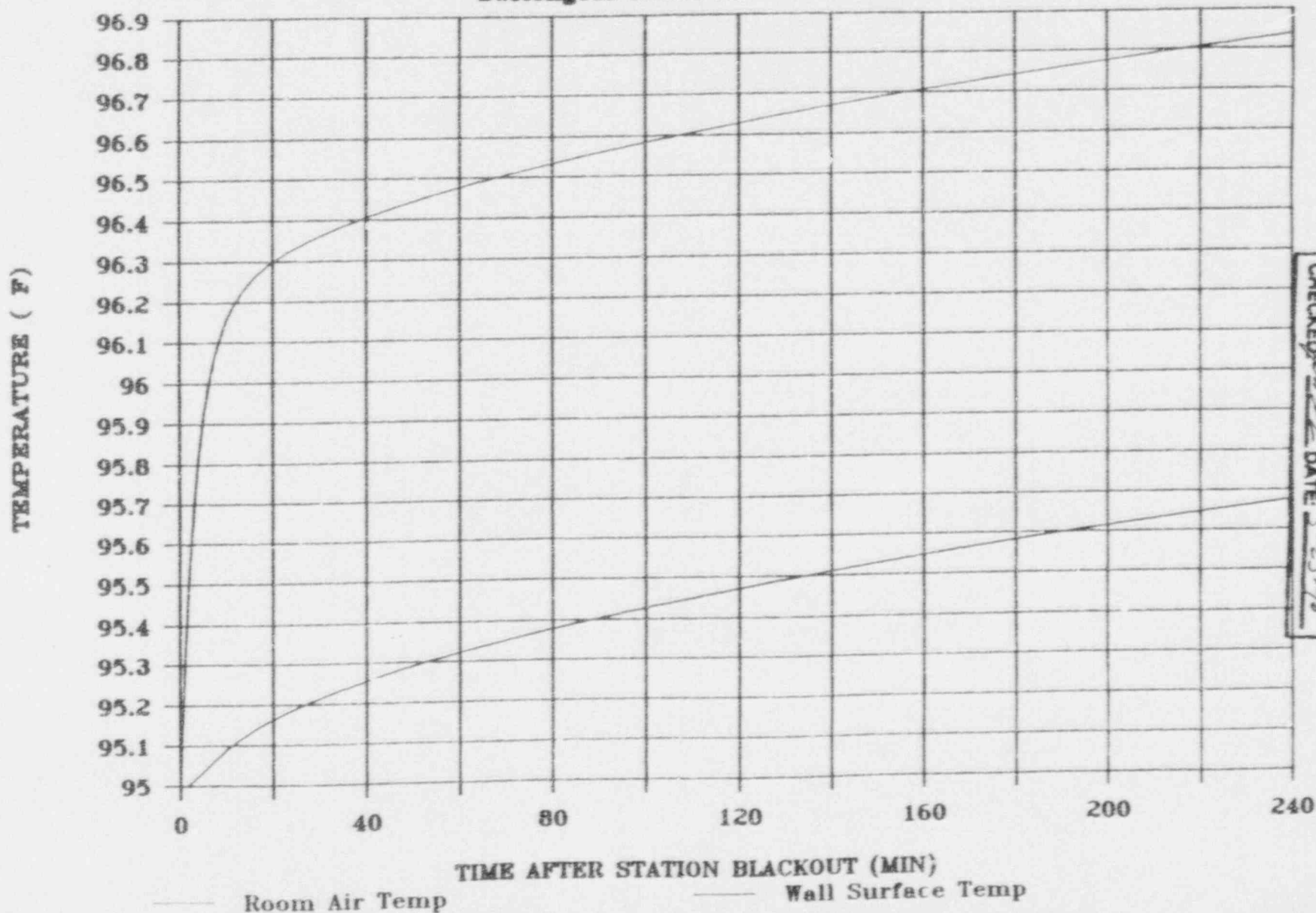
Graphs on pages 5 thru 10 show the air temperature as function of time for the above subject rooms.

The results of this analyses have no effect on Technical Specifications or Surveillance Procedures.



# TEMP. RESPONSE DURING UNIT 2/3 BLACKOUT

Switchgear Room El. 50 Unit 2/3

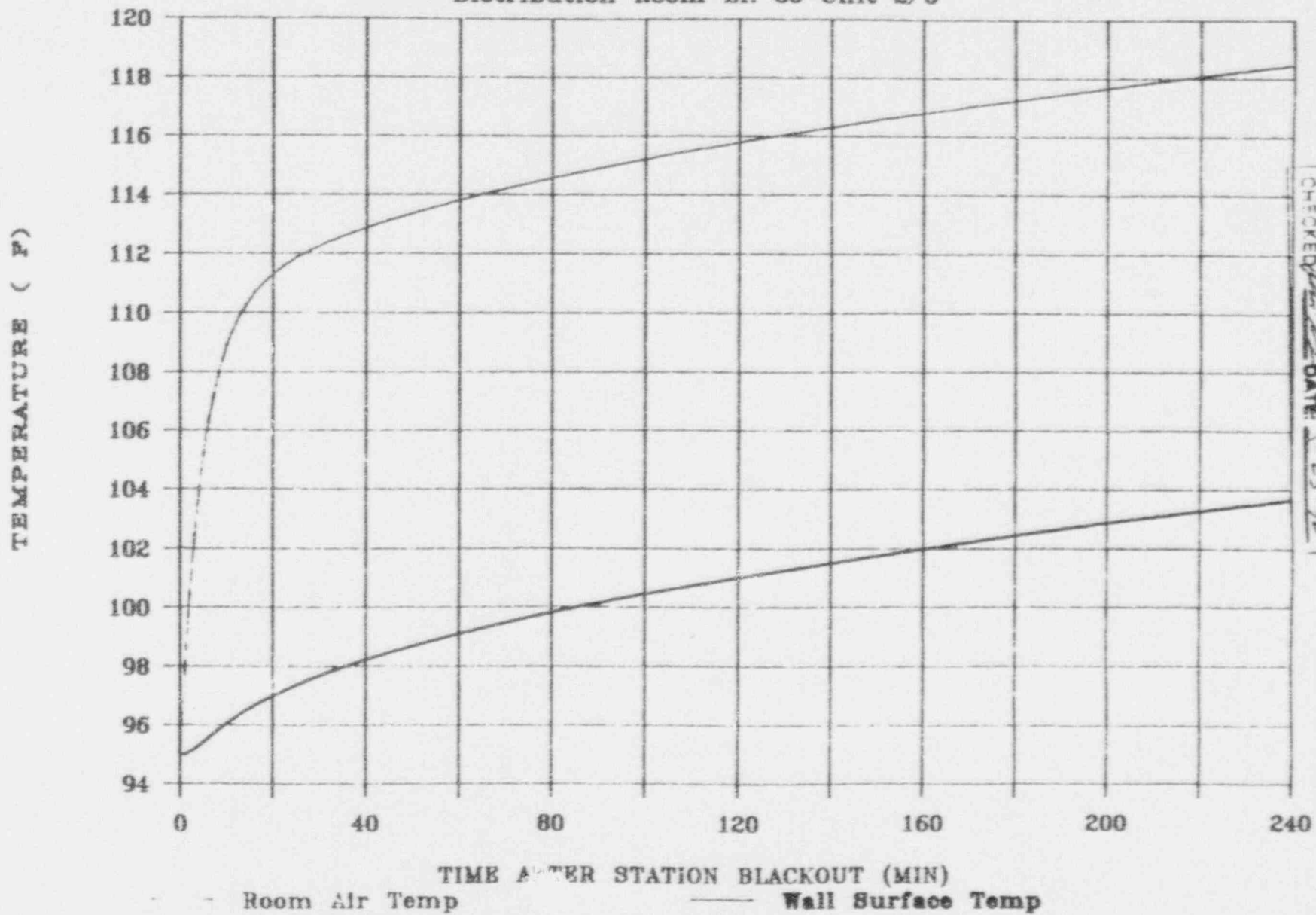


CALC. NO. M-13-116  
 REVISION 1  
 BY: I. S. H. M. M. DATE: 5/1/90  
 CHECKED: [Signature] DATE: 5-23-90

SHEET 31-3 OF 33

# TEMP. RESPONSE DURING UNIT 2/3 BLACKOUT

Distribution Room Bl. 50 Unit 2/3

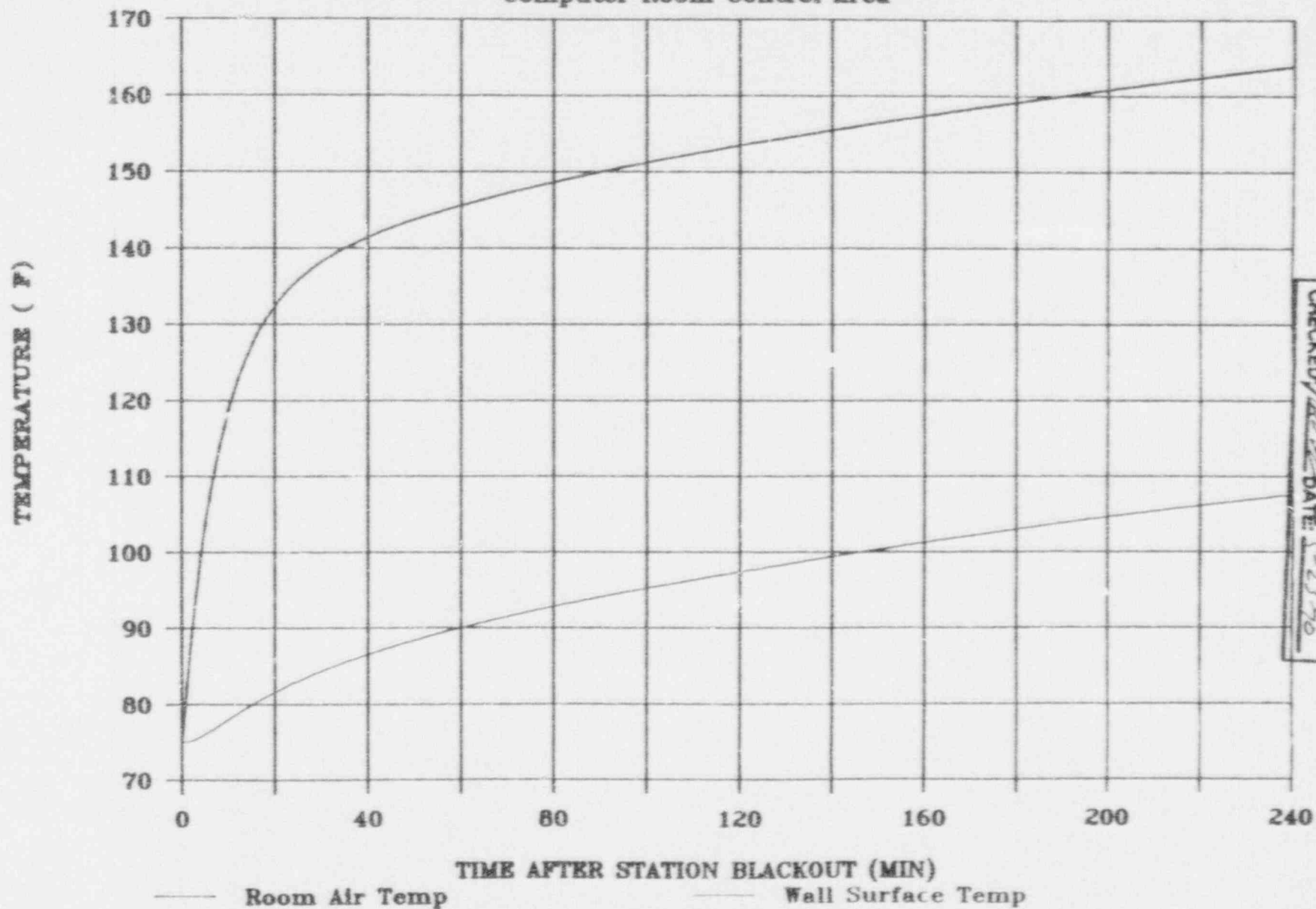


CALL NO: H-3-11  
REVISION: 1  
BY: J. SHUEY DATE: 5/7/90  
CHECKED: *[Signature]* DATE: 5-23-90

CWE 11

# TEMP. RESPONSE DURING UNIT 2/3 BLACKOUT

Computer Room Control Area

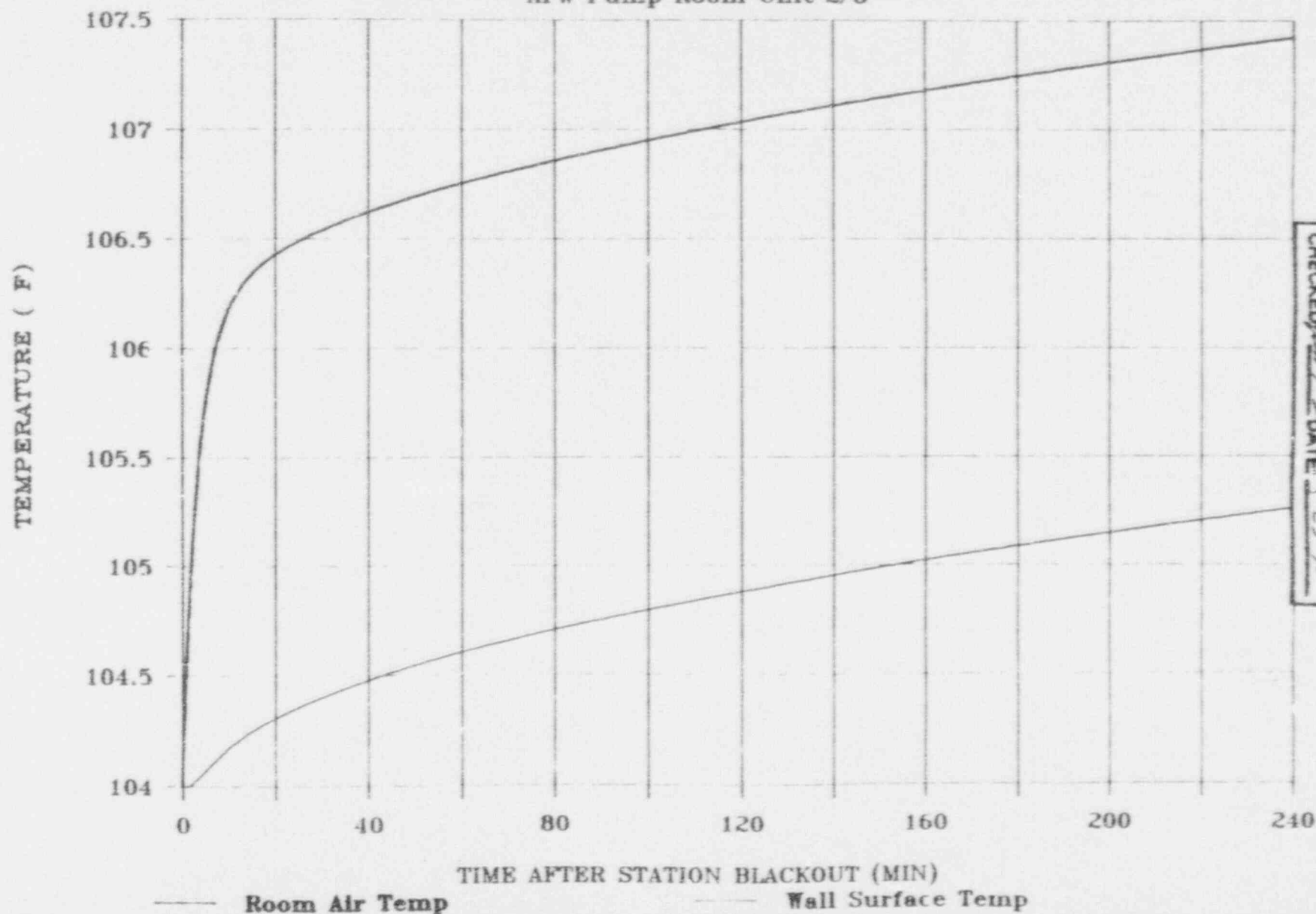


CALC NO: M-72-116  
REVISION: 1  
BY: J. Sullivan DATE: 5/1/90  
CHECKED: AS DATE: 5-23-90

SHEET 21-1 OF 14

# TEMP. RESPONSE DURING UNIT 2/3 BLACKOUT

AFW Pump Room Unit 2/3

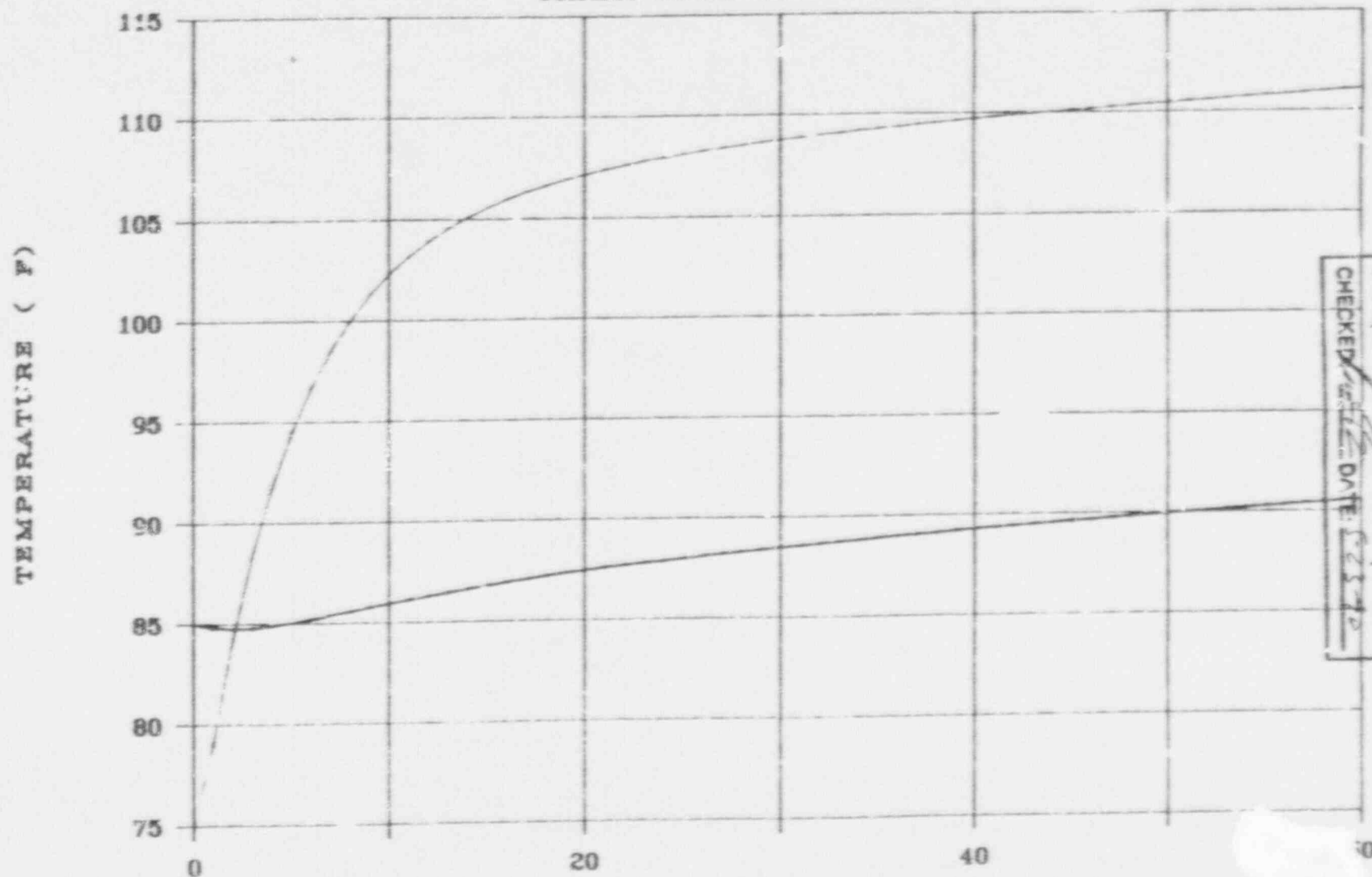


CALC NO: M-73-116  
REVISION: 1  
BY: I. SUGARMAN DATE: 5/1/90  
CHECKED: [Signature] DATE: 5-23-90

SHEET E1-8 OF 84

# TEMP. RESPONSE DURING UNIT 2/3 BLACKOUT

Control Room Cabinet Area



CALC. NO: M-73-116  
 REVISION: 1  
 BY: J. S. M. M. DATE: 5/1/10  
 CHECKED: [Signature] DATE: 5/23/10

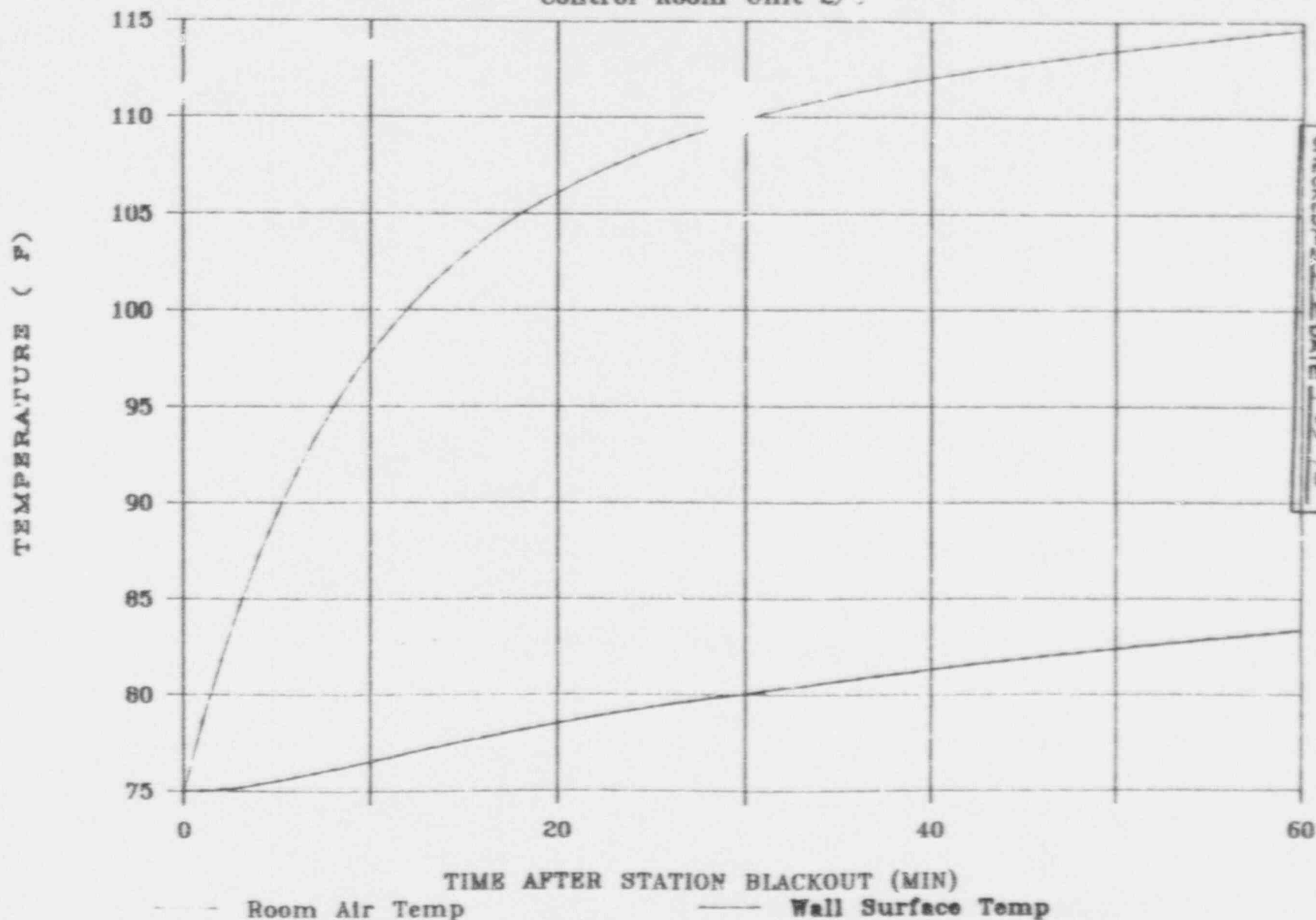
SHEET 11 OF 24

- Room Air Temp  
 — Wall Surface Temp



# TEMP. RESPONSE DURING UNIT 2/3 BLACKOUT

Control Room Unit 2/3



CALC. NO: M-13-116  
 REVISION: 1  
 BY: J. Sullivan DATE: 5/1/90  
 CHECKED: [Signature] DATE: 5-23-90

SHEET R-10 OF 54

ENGINEERING DEPARTMENT

**CALCULATION SHEET**SUBJECT: Room Temperature Response During  
Station BlackoutCALC NO. M-73-116 REV. 1J.O. NO. 6711 MADE BY: I. Shlafman DATE: 5-4-90 CHECKED BY: [Signature] DATE: 6-16-90**3. Assumptions:**

The following assumptions were made in the calculations:

- .1 All plant equipments are in their normal operating conditions prior to station blackout.
- .2 Charges for batteries are not operating. Batteries are supplying power to users.
- .3 Heat transfer is due to convection and conduction through the walls and ceiling in one direction.
- .4 Air temperature in surrounding rooms is not changed.
- .5 For this analysis Distribution Room #310b and Switchgear Room #302A were analyzed as the rooms with highest heat load (ref. Attachment 2).
- .6 Due to the fact that no personnel expected in areas of concern but Control Room and emergency lighting load is relatively insignificant in these areas of concern (see Att.3), it was assumed that heat loads from personnel and emergency lights are negligible for all rooms except Control Room Area.
- .7 The emergency chillers are aligned to the Unit experiencing blackout and it will take 1 hour for the operator action to switch emergency chillers ESF buses from one Unit to the other by using available Kirk-Key interlocks and realign CCW valves from the train A chillers to the train B chillers or visa versa. Therefore the Control Room and Control Room Cabinet Area will only have a one hour Station Blackout coping duration.
- .8 The Station Blackout will only occur at one Unit with the other Unit having at least one Diesel Generator available and running.
- .9 The only walls, ceiling and room air are considered as a heat sink in heat transfer analyses.
- .10 Rear sides of the Control Room control panels are facing Control Room Cabinet Area. Therefore for Control Room Cabinet Area heat transfer analysis it was conservatively assumed that 50% of the heat losses from Control Room panels are dissipated to Control Room Cabinet Area.

ENGINEERING DEPARTMENT

## CALCULATION SHEET

SUBJECT: Room Temperature Response During  
Station BlackoutCALC NO. M-73-116 REV. 1J.O. NO. 6711 MADE BY: I. Shlafman DATE: 5-4-90 CHECKED BY: [Signature] DATE: 5-23-90

## 3. Assumptions (cont'd)

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

ENGINEERING DEPARTMENT

**CALCULATION SHEET**Room Temperature Response During  
Station Blackout

SUBJECT:

CALC NO. M-73-116 REV. 1J.O. NO. 6711 MADE BY: I. Shlafman DATE: 5-4-90 CHECKED BY: [Signature] DATE: 5-23-90**4.0 Methodology**

The finite difference method was developed for transient - heat transfer analyses and used to evaluate the ambient room temperature and wall temperature within concrete slab. Convection, conduction and heat storage in the concrete slab were considered in the analyses.

As result of drawings review (ref.10) and walkdowns, the walls, ceiling, floor, cabinets, cable trays, ductwork and hangers support were identified as the heat sinks. However per NUMARC 87-00 (ref.14) recommendations the only walls and ceiling are considered in heat transfer analyses.

The heat transfer equations were entered into LOTUS 1-2-3 program to perform temperature response analyses for various rooms during station blackout.

The output results from LOTUS program were verified by performing sample calculations for each analyzed room and compare results between manual calculation and computer output.

The LOTUS "Printgraph" program was used to develop graphs- "Temperature Response During Station Blackout" for rooms listed under Table 1 Section 2.

## DESIGN INPUT SHEET

☒ Design Requirements  
☐ Design Input Change

 PAGE 01  
 RI-A 84

DESIGN CALCULATION

DC M - 73-6

SUBJECT TEMP. RISE IN COMPARTMENTS DURING A <sup>blackout</sup> STRIKE		PROJECT SONOS 243
QUALITY CLASS I	SEISMIC CLASS N/A	SPECIFICATION REFERENCE

Design Input: NORMAL OPERATING DESIGN TEMPERATURES ARE:

- 1) DISTRIBUTION ROOMS, ON SOFT - 95°F (REF UFSAR TABLE 9.4.4)
- 2) SWITCHGEAR ROOMS, ON SOFT - 95°F
- 3) COMPUTER ROOMS ON 30 FT - 72°F
- 4) CONTROL ROOM CABINET AREA - 75°F
- 5) CONTROL AREA - 75°F
- 6) CHARGING PUMP ROOMS - 104°F
- 7) AFW PUMP ROOM - 104°F

STATION BLACKOUT TIME FOR ALL ROOMS ABOVE EXCEPT 4 &amp; 5 IS 4 HR.

STATION BLACKOUT TIME FOR ROOMS 4 &amp; 5 IS 1 HR.

HEAT LOADS FOR SUBJECT ROOMS, EXCEPT COMPUTER ROOM, WERE TAKEN FROM ATTACHMENT 2.

HEAT LOAD FOR THE COMPUTER ROOM WAS TAKEN FROM CALC M-73-6 AS MORE REALISTIC.

RESPONSIBLE ENGINEER 1. [Signature]	DATE 5/7/99	INDEPENDENT REVIEW ENGINEER [Signature]	DATE 5-23-99	GROUP CHIEF [Signature]	DATE 6/11
--	----------------	--	-----------------	----------------------------	--------------



ENGINEERING DEPARTMENT

**CALCULATION SHEET**Room Temperature Response During  
Station Blackout

SUBJECT:

CALC NO. M-73-116 REV. 1J.O. NO. 6711 MADE BY: I. Shlafman DATE: 5-4-90 CHECKED BY: [Signature] DATE: 5-21-90

## 6.0 References

1. Calculation # N-4090-4 rev 1, Thermal Response of Auxiliary Bldg. Control Area Rooms 229 and 310B on Station Blackout.
2. Calculation # N-4090-4 rev 1, Thermal Response of Auxiliary Bldg. Control Area Room 302A on Station Blackout.
3. Calculation # M-74-06 rev.1, AFW Pump Room Heat Load Calculation.
4. Calculation # M-73-51 rev.1, El 50'-00" Battery Room Heat Load Calculation.
5. Calculation # M-73-64 rev.0, ESF Battery Room H2 Buildup.
6. Calculation # M-74-1 rev.2, Radwaste Area Normal Cooling System -Heat Load Calculation.
7. Cooling and Heating Load Calculation Manual. ASHRAE GRP158
8. Calculation # M-73-10 rev.0, HVAC Aux. Bldg. General Data.
9. Calculation # M-73-41 rev.7, Control Room Complex-Heat Load Calculation.
10. Drawings for SONGS Units 2 & 3.
  - .1 10101-27, Aux. Bldg Control Area Flr. Plan El. 3 '00"
  - .2 10119-26, Aux. Bldg. Finish Schedule
  - .3 10121-39, Aux. Bldg. Door Schedule
  - .4 53000-12, Main Control Room Panel Arrangement
  - .5 35648-3, Control Bldg. Equipment Arrangement
  - .6 41341-8, HVAC Plan El 50'-00"
  - .7 41342-10, HVAC Plan Area CA-7 El 30'-00"
  - .8 41357-10, HVAC Plan Area CA-9 El 30'-00"
  - .9 41350-9, HVAC Plan Area CA-8 El 30'-00"
  - .10 41365-10, HVAC Plan Area CA-10 El 30'-00"
11. Fundamentals of Heat and Mass Transfer. Frank P. Inclopera and David De Witt- 2<sup>nd</sup> Edition
12. ASHRAE Handbook-Fundamentals 1985
13. ASHRAE Handbook-Equipment 1988
14. NUMARC 87-00 Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors.

ENGINEERING DEPARTMENT

**CALCULATION SHEET**SUBJECT: Room Temperature Response During  
Station BlackoutCALC NO. M-73-116 REV. 1J.O. NO. 6711 MADE BY: I. Shlafman DATE: 5-4-90 CHECKED BY: [Signature] DATE: 5-23-90

## 7.0 Nomenclature

A	- area through which heat flows	square feet
V	- volume	cubic feet
L	- length along a heat flow path	feet
k	- thermal conductivity	Btu/hr-ft-deg F
h	- surface conductance	Btu/hr-ft <sup>2</sup> -deg F
Q	- rate of heat generated/transferred	Btu/hr or Kw
U	- heat transfer coefficient	Btu/hr-ft <sup>2</sup> -deg F
R	- thermal resistance	deg F/Btu-hr-ft <sup>2</sup>
j	- interior node number	
F <sub>0</sub>	- Fourier number	
Bio	- Biot number	
T <sub>air</sub>	- air temperature	deg F
T <sub>0</sub>	- surrounding surface temperature	deg F
i	- time	minute
Δi	- time gradient	minute
c <sub>p</sub>	- specific heat at constant pressure	Btu/lb mass-deg F
m	- mass	lb
Δt	- temperature difference	deg F
Δx	- length increment	ft
ρ	- density	lb/ cubic ft
Dwg		drawing
UFSAR	Updated Final Safety Analysis Report	
UFHA	Updated Fire Hazards Analysis	

ENGINEERING DEPARTMENT

**CALCULATION SHEET**SUBJECT: Room Temperature Response During  
Station BlackoutCALC NO. M-73-116 REV. 1J.O. NO. 6711 MADE BY: L. Shlafman DATE: 5-4-90 CHECKED BY: [Signature] DATE: 5-23-90

## 8.0 Calculation

## 8.1 General Equations:

- a. Assume initially, that during the first minute after SBO event all heat generated by the electrical equipments, lights and people is absorbed by the room air, where:

$$Q_{ai} = \rho_{air} C_{p, air} V_{air} \Delta T$$

$$\text{where: } \Delta T = T_{air,i} - T_{air,i-1}$$

$$\text{Let: } F_1 = Q_{ai} \quad \text{for } i = 1 \text{ minute}$$

$$T_{air,i=1 \text{ min.}} = F_1 / \rho_{air} C_{p, air} V_{air} + T_{air,i=0} \quad (\text{Equation No.1})$$

- b. Assume that heat energy transferred to the envelope (partitions) by natural convection will take effect two minutes after SBO event. The following equation will be used to calculate the room temperature at  $i \geq 2$  minutes:

$$Q_{ai} - h_{air} A_{ai} (T_{air,i-1} - T_{o,i-1}) = \rho_{air} C_{p, air} V_{air} \Delta T$$

To simplify the calculation, let:

$$F_2 = \rho_{air} C_{p, air} V_{air} \quad \text{and} \quad F_3 = h_{air} A_{ai}$$

Therefore:

$$T_{air,i=2} = [F_1 - F_3 (T_{air,i-1} - T_{o,i-1})] / F_2 + T_{air,i-1} \quad (\text{Equation 2})$$

ENGINEERING DEPARTMENT

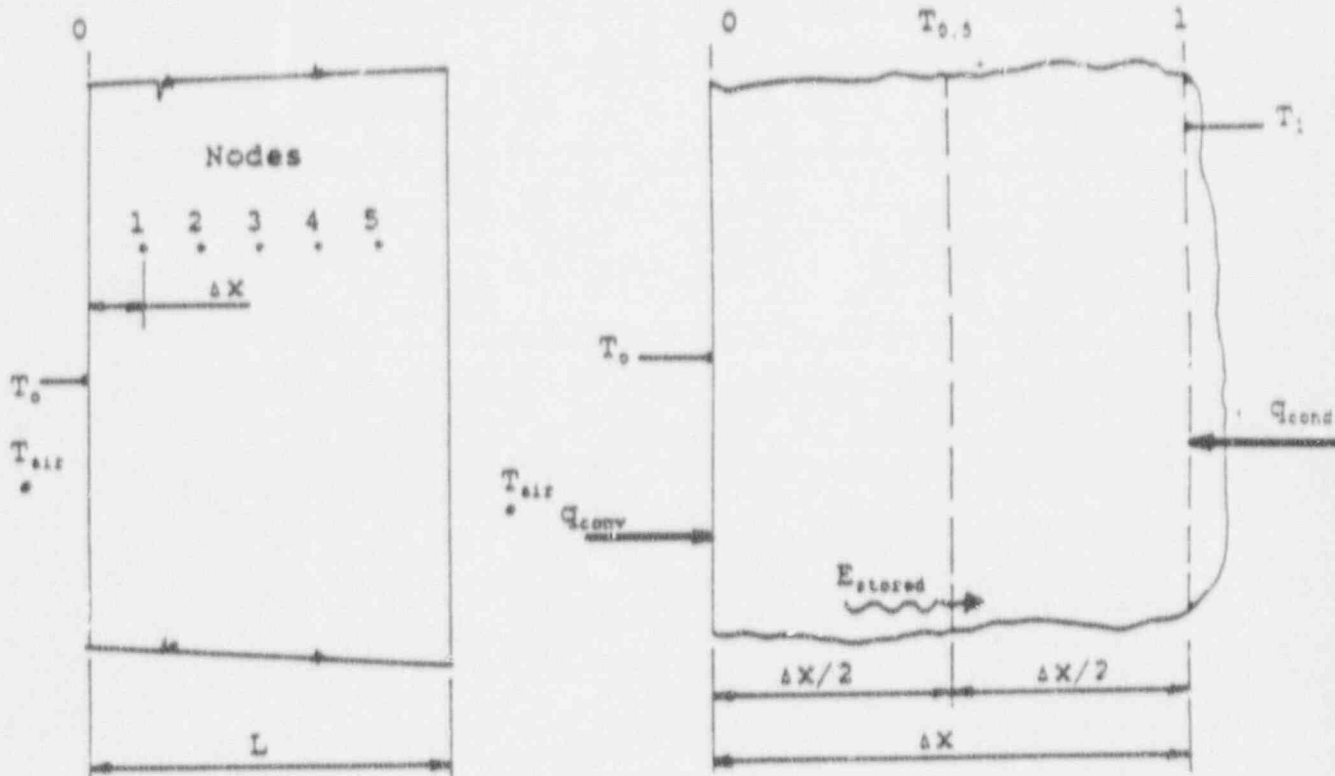
**CALCULATION SHEET**

SUBJECT: Room Temperature Response During Station Blackout

CALC NO. M-73-116 REV. 1J.O. NO. 6711 MADE BY: I. Shlafman DATE: 5-4-90 CHECKED BY: [Signature] DATE: 5-23-90

c. Transient heat flow through the partition.

To define the temperature  $T_{0.1}$  at different times after SBO event, the finite difference method was applied (ref. 11, section 5.8.1). The concrete slab is divided into equal finite slices of thickness  $\Delta x$  apart and separated by "nodes".



Analyzing the first Node, 0 to 1 and considering a heat balance, the adjacent half slice gives:

$$hA(T_{air, i-1} - T_{0, i-1}) - kA(T_{0, i-1} - T_{1, i-1})/\Delta x =$$

$$(A\Delta x)(\rho_{conc}C_p)_{conc}(T_{0.5, i} - T_{0.5, i-1})/2\Delta t$$

For approximation, the temperature at Node 0.5 is replaced by that at the surface;  $T_{0.5} = T_{0.1}$

$$T_{0, i} = 2\Delta t/\rho_{conc}C_p)_{conc}\Delta x[h(T_{air, i-1} - T_{0, i-1}) - k/\Delta x(T_{0, i-1} - T_{1, i-1})] + T_{0, i-1}$$

ENGINEERING DEPARTMENT

**CALCULATION SHEET**SUBJECT: Room Temperature Response During Station BlackoutCALC NO. M-73-116 REV. 1J.O. NO. 6711 MADE BY: I. Shlafman DATE: 5-4-90 CHECKED BY: [Signature] DATE: 5-23-90

Designating the dimensionless modulus:

$$Bio = h\Delta x/k; \quad F_o = \alpha \Delta t / \Delta x^2 \quad \text{where } \alpha = k/\rho c \text{ and:}$$

$$2h\Delta t / \rho c \Delta x = 2BioF_o; \quad 2\Delta t k / \rho c \Delta x^2 = 2F_o$$

$$T_{o,i} = 2F_o(BioT_{air,i-1} + T_{1,i-1}) + (1 - 2BioF_o - 2F_o)(T_{o,i-1})$$

(Equation No. 3)

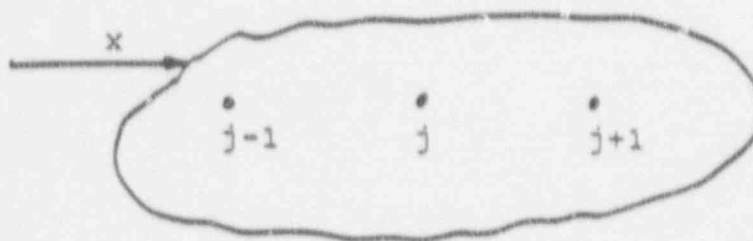
To retain stability of the solution to the above equation, it is required that  $[1 - 2BioF_o - 2F_o]$  be greater than or equal to zero.

$$1 - 2BioF_o - 2F_o \geq 0$$

$$F_o (1 + Bio) \leq 1/2$$

$$F_o \leq \frac{1}{2(1 + Bio)} \quad (\text{Equation 4})$$

d. Interior Nodes:



Energy Equation, assuming one dimensional heat transfer:

$$1/\alpha \times dT/dt = d^2 T/dx^2$$

$$d^2 T/dx^2 \approx [dT/dx_{j+\Delta x} - dT/dx_{j-\Delta x}]/\Delta x \quad (\text{ref. 11 pg. 144})$$

$$dT/dx_{j+\Delta x} \approx (T_{j+1} - T_j)/\Delta x; \quad dT/dx_{j-\Delta x} \approx (T_j - T_{j-1})/\Delta x$$

Substituting:

equation  $d^2 T/dx^2 \approx (T_{j+1} - 2T_j + T_{j-1})/\Delta x^2$ , then the energy

becomes:



## ENGINEERING DEPARTMENT

## CALCULATION SHEET

SUBJECT: Room Temperature Response During  
Station Blackout

CALC NO. M-73-116 REV. 1

J.O.NO. 6711 MADE BY: I. Shlafman DATE: 5-4-90 CHECKED BY: [Signature] DATE: 5-23-90

$$(1/\alpha)(T_{j,i} - T_{j,i-1})/\Delta i = (T_{j+1,i-1} + T_{j-1,i-1} - 2T_{j,i-1})/\Delta x^2$$

Therefore:

$$T_{j,i} = \alpha \Delta i / \Delta x^2 (T_{j+1,i-1} + T_{j-1,i-1} - 2T_{j,i-1}) + T_{j,i-1}$$

$$T_{j,i} = F_o(T_{j+1,i-1} + T_{j-1,i-1}) + (1 - 2F_o)T_{j,i-1}$$

Let  $F_s = 1 - 2F_o$ , Then

$$T_{j,i} = F_o(T_{j+1,i-1} + T_{j-1,i-1}) + F_s(T_{j,i-1}) \quad (\text{Equation 5})$$

Equations 1, 2, 3 and 5 were entered into the LOTUS program and the results are tabulated in the computer printouts.

## General Thermal Properties:

## ■ concrete

$$C_{p \text{ conc.}} = 0.21 \text{ Btu/lb F (ref.6)}$$

$$\rho_{\text{conc.}} = 143.58 \text{ lb/ft}^3 \quad (\text{ref.6})$$

$$k_{\text{conc.}} = 1.04 \text{ Btu/hr ft F (ref.7)}$$

## ■ air

$$C_{p \text{ air}} = 0.24 \text{ Btu/lb F (ref.7)}$$

$$\rho_{\text{air}} = 0.07 \text{ lb/ft}^3 \quad (\text{ref.7})$$

$$h_{\text{air}} = 1.47 \text{ Btu/hr ft}^2 \text{ F (ref.7)}$$

ENGINEERING DEPARTMENT

**CALCULATION SHEET**SUBJECT: Room Temperature Response During  
Station BlackoutCALC NO. M-73-116 REV. 1J.O. NO. 6711 MADE BY: I. Shlafman DATE: 5-4-90 CHECKED BY: [Signature] DATE: 52370**8.2 SWITCHGEAR ROOM #302****Room Heat Transfer Area:****Walls Areas:**

a) 3/4" gypsum plaster wall (east and south)

$$A = (32 + 49 + 1.7) \times 18.75 = 1551 \text{ ft}^2$$

b) 1" gypsum plaster wall (north)

$$A = 18.75 \times 30.3 = 568.1 \text{ ft}^2$$

c) 1 ft concrete wall (west)

$$A = 49 \times 18.75 = 919 \text{ ft}^2$$

$$A_{\text{WALL TOTAL}} = 1551 + 568 + 919 = 3038 \text{ ft}^2$$

**Ceiling Area:**

$$A_{\text{CEILING}} = (49 \times 32) - (11.5 \times 1.5) = 1548 \text{ ft}^2$$

Area for fireproofing beam equal 364 ft<sup>2</sup> (ref. 2)

$$A_{\text{HEAT TRANSFER CEIL.}} = 1548 - 364 = 1184 \text{ ft}^2$$

$$A_{\text{TOTAL HEAT TRANSFER}} = 1184 + 3038 = 4222 \text{ ft}^2$$

**Room Volume:**

$$\text{Volume of empty room} = 1548 \text{ ft}^2 \times 18.75 \text{ ft} = 29,026 \text{ ft}^3 \text{ (ref. 2)}$$

Volume of electrical cabinets, hanger supports, cable trays  
and a/c ducts equal to 4808 ft<sup>3</sup> (ref 2)

$$V_{\text{NET VOLUME}} = 29026 - 4808 = 24,218 \text{ ft}^3$$

Initial room ambient temperature = 95 deg F

Initial wall temperature = 95 deg F

Concrete wall and slab thickness: For conservative approach,  
assuming that east, south and north walls are concrete and  
thickness is equal to  $L = 1 \text{ ft}$ .**Heat Gain:**

$$Q_{\text{ELECT.}} = 2119 \text{ wt} \times 3.413 \text{ Btu/hr wt} = 7232 \text{ Btu/hr} \quad (\text{Ref. Att. 2})$$

ENGINEERING DEPARTMENT

**CALCULATION SHEET**SUBJECT: Room Temperature Response During Station BlackoutCALC NO. M-73-116 REV. 1J.O. NO. 6711 MADE BY: I. Shlafman DATE: 5-4-90 CHECKED BY: [Signature] DATE: 5-23-90Sample CalculationFrom Equations 1 and 2, at  $i = 1$  minute

$$T_{air,i+1} = F_1/F_2 + T_{air,i+0} \quad \text{where: (ref. Eq. 1 pg.17)}$$

$$F_1 = Q_{\Delta i} = 7232/60 = 120.53 \text{ Btu/min, and}$$

$$F_2 = \rho_{air} V_{air} C_{pair} = (0.07)(24218)(0.24) = 406.9 \text{ Btu/deg F}$$

$$T_{air,i+1} = 120.53/406.9 + 95 = 95.3 \text{ deg F}$$

At  $i = 2$  minutes:

$$T_{air,i+2} = [F_1 - F_3(T_{air,i+1} - T_0)]/F_2 + T_{air,i+1} \quad (\text{ref. Eq. 2 pg.17})$$

$$\text{where: } F_3 = h_{air} A_{\Delta i} = 1.47 \times 4222 \times 1/60 = 103.43 \text{ Btu/deg F}$$

$$T_{air,i+2} = [120.53 - 103.43(95.3 - 95)]/406.9 + 95.3 = 95.52 \text{ deg F}$$

$$B_1 = h_{air} x/k = 1.47 \times 0.0833/1.04 = 0.117 \text{ say } 0.12$$

$$F_0 = k \Delta t / pc \Delta x^2 = (1.04 \times 1/60) / 143.58 \times 0.21 \times 0.0833^2 = 0.0828$$

Stability criterion requires that the coefficient for  $T_{0,i+1}$  in equation 3 be greater than or equal to zero

$$1 - 2B_1F_0 - 2F_0 \geq 0 \text{ or (ref. pg. 19)}$$

$$F_0 (1 + B_1) \leq 1/2 \text{ or } F_0 \leq 1/2 (1/1 + 0.12) \leq 0.45$$

$$\text{or } \alpha \Delta t / \Delta x^2 \leq 0.45 ; \quad \alpha = k/pc$$

$$\Delta t \leq 0.45 \times \Delta x^2 / \alpha \text{ or } \Delta t \leq 0.45 \times 0.0833^2 \times 143.58 \times 0.21 / 1.04$$

$$\Delta t \leq 0.0905 \text{ hr (5.4 min) ,}$$

therefore,  $\Delta t = 1$  minute satisfies the stability criterion.

To calculate the wall temperature and interior "node" temperature we used equations 3 and 5 from general calculations.

$$i=2 \text{ min, } T_{0,2} = 2 \times 0.0828 [0.12 \times 95.3 + 95] + [1 - 2 \times 0.0828 \times 0.12 - 2 \times 0.0828] \times 95 = 95.01 \text{ F}$$

ENGINEERING DEPARTMENT

## CALCULATION SHEET

Room Temperature Response During  
Station Blackout

SUBJECT:

CALC NO. M-73-116 REV. 1J.O. NO. 6711 MADE BY: I. Shlafman DATE: 5-4-90 CHECKED BY: [Signature] DATE: 5-23-90

from equation 5,  $F_4 = 1 - 2F_0 = 1 - 2 \times 0.0828 = 0.8344$

$$T_{1,2} = 0.0828 \times (95 + 95) + 0.08344 \times 95 = 95 \text{ F}$$

$$T_{2,2} = 0.0828 \times (95 + 95) + 0.08344 \times 95 = 95 \text{ F ETC...}$$

For this iterative calculations, the equations 1,2,3 and 5 were entered into LOTUS program and the results are tabulated on pages 24 thru 32.











CALC. NO: M-73-116  
REVISION: 1  
BY: D. SHILFMAN DATE: 5/6/90  
CHECKED: [Signature] DATE: 5-23-90

1.200E+02	9.663E+01	9.547E+01	9.535E+01	9.525E+01	9.517E+01	9.511E+01	9.507E+01	9.505E+01	9.503E+01	9.502E+01	9.501E+01	9.500E+01
1.210E+02	9.663E+01	9.547E+01	9.535E+01	9.525E+01	9.517E+01	9.512E+01	9.507E+01	9.505E+01	9.503E+01	9.502E+01	9.501E+01	9.500E+01
1.220E+02	9.663E+01	9.548E+01	9.535E+01	9.525E+01	9.518E+01	9.512E+01	9.508E+01	9.505E+01	9.503E+01	9.502E+01	9.501E+01	9.500E+01
1.230E+02	9.664E+01	9.548E+01	9.535E+01	9.525E+01	9.513E+01	9.512E+01	9.508E+01	9.505E+01	9.503E+01	9.502E+01	9.501E+01	9.501E+01
1.240E+02	9.664E+01	9.548E+01	9.536E+01	9.526E+01	9.518E+01	9.512E+01	9.508E+01	9.505E+01	9.503E+01	9.502E+01	9.501E+01	9.501E+01
1.250E+02	9.664E+01	9.548E+01	9.536E+01	9.526E+01	9.518E+01	9.512E+01	9.508E+01	9.505E+01	9.503E+01	9.502E+01	9.501E+01	9.501E+01
1.260E+02	9.664E+01	9.548E+01	9.536E+01	9.526E+01	9.518E+01	9.512E+01	9.508E+01	9.505E+01	9.503E+01	9.502E+01	9.501E+01	9.501E+01
1.270E+02	9.664E+01	9.549E+01	9.536E+01	9.526E+01	9.518E+01	9.512E+01	9.508E+01	9.505E+01	9.503E+01	9.502E+01	9.501E+01	9.501E+01
1.280E+02	9.665E+01	9.549E+01	9.536E+01	9.526E+01	9.519E+01	9.513E+01	9.508E+01	9.505E+01	9.503E+01	9.502E+01	9.501E+01	9.501E+01
1.290E+02	9.665E+01	9.549E+01	9.537E+01	9.527E+01	9.519E+01	9.513E+01	9.508E+01	9.505E+01	9.503E+01	9.502E+01	9.501E+01	9.501E+01
1.300E+02	9.665E+01	9.549E+01	9.537E+01	9.527E+01	9.519E+01	9.513E+01	9.508E+01	9.505E+01	9.503E+01	9.502E+01	9.501E+01	9.501E+01
1.310E+02	9.665E+01	9.549E+01	9.537E+01	9.527E+01	9.519E+01	9.513E+01	9.509E+01	9.505E+01	9.503E+01	9.502E+01	9.501E+01	9.501E+01
1.320E+02	9.665E+01	9.550E+01	9.537E+01	9.527E+01	9.519E+01	9.513E+01	9.509E+01	9.506E+01	9.503E+01	9.502E+01	9.501E+01	9.501E+01
1.330E+02	9.666E+01	9.550E+01	9.537E+01	9.527E+01	9.519E+01	9.513E+01	9.509E+01	9.506E+01	9.503E+01	9.502E+01	9.501E+01	9.501E+01





SHEET B - 30 OF 84

CALC. NO: M-73-116

REVISION:

NO. 1 SHIPMA DATE: 5/6/90

CHECKED [Signature] DATE: 5-23-90

SWITCHGEAR ROOM EL.50 UNIT 2/3

[illegible]



CALC. NO. M-73-116  
REVISION: 1  
BY: I. SHAFMAN DATE: 5/16/90  
CHECKED: [Signature] DATE: 5-23-90

[illegible]

2.330E+02	9.603E+01	9.567E+01	9.554E+01	9.543E+01	9.534E+01	9.526E+01	9.520E+01	9.515E+01	9.511E+01	9.508E+01	9.506E+01	9.504E+01
2.340E+02	9.603E+01	9.567E+01	9.554E+01	9.543E+01	9.534E+01	9.526E+01	9.520E+01	9.515E+01	9.511E+01	9.508E+01	9.506E+01	9.504E+01
2.350E+02	9.603E+01	9.567E+01	9.554E+01	9.543E+01	9.534E+01	9.526E+01	9.520E+01	9.515E+01	9.511E+01	9.508E+01	9.506E+01	9.504E+01
2.360E+02	9.603E+01	9.567E+01	9.554E+01	9.543E+01	9.534E+01	9.526E+01	9.520E+01	9.515E+01	9.511E+01	9.508E+01	9.506E+01	9.504E+01
2.370E+02	9.603E+01	9.567E+01	9.554E+01	9.544E+01	9.534E+01	9.526E+01	9.520E+01	9.515E+01	9.511E+01	9.508E+01	9.506E+01	9.504E+01
2.380E+02	9.603E+01	9.567E+01	9.555E+01	9.544E+01	9.534E+01	9.526E+01	9.520E+01	9.515E+01	9.511E+01	9.508E+01	9.506E+01	9.504E+01
2.390E+02	9.604E+01	9.568E+01	9.555E+01	9.544E+01	9.534E+01	9.527E+01	9.520E+01	9.515E+01	9.511E+01	9.508E+01	9.506E+01	9.504E+01
2.400E+02	9.604E+01	9.568E+01	9.555E+01	9.544E+01	9.535E+01	9.527E+01	9.520E+01	9.515E+01	9.511E+01	9.508E+01	9.506E+01	9.504E+01

CALC. NO:	M-73-116
REVISION:	1
BY:	J. SHARMA DATE: 5/1/90
CHECKED:	DATE: 5-23-90

SHEET 11 OF 84

ENGINEERING DEPARTMENT

**CALCULATION SHEET**Room Temperature Response During  
Station Blackout

SUBJECT:

CALC NO. M-73-116 REV. 1J.O. NO. 6711 MADE BY: I. Shlafman DATE: 5-4-90 CHECKED BY: [Signature] DATE: 5-23-908.3 Distribution Room (310B)

## Room Heat Transfer Area

## Wall

a) 3/4" plaster wall (north)

$$A_{\text{north wall}} = 18(W) \times 19 = 342 \text{ ft}^2$$

## Ceiling

a) 1' concrete

$$A_{\text{cell}} = 18 \times 14.88 = 276 \text{ ft}^2$$

$$A_{\text{total heat transfer area}} = 342 + 276 = 609 \text{ ft}^2$$

## Room Volume (ref.1)

$$V_{\text{total room}} = 14.52 \times 17.375 \times 18.75 = 4730 \text{ ft}^3$$

$$V_{\text{elect. cab}} + V_{\text{tray}} + V_{\text{duct}} + V_{\text{hanger}} = 207 + 18 + 125 + 8 = 358 \text{ ft}^3 \text{ (ref1)}$$

$$V_{\text{net room}} = 4730 - 358 = 4372 \text{ ft}^3$$

Initial temperature = 95 deg F

Initial wall temperature = 95 deg F

Concrete wall and slab thickness: For conservative approach, assuming that north wall is concrete and thickness is equal to  $L = 1 \text{ ft}$ .

Heat Gain:

$$Q_{\text{ELECT.}} = 3914 \text{ wt} \times 3.413 \text{ Btu/hr wt} = 13359 \text{ Btu/hr} \quad (\text{Ref. Att. 2})$$

Sample CalculationFrom Equations 1 and 2, at  $i = 1$  minute

$$T_{\text{air}, i=1} = F_1/F_2 + T_{\text{air}, i=0} \quad \text{where:}$$

$$F_1 = Q_{\text{ai}} = 13359/60 = 222.65 \text{ Btu/min say } 222.7 \text{ Btu/min}$$

$$F_2 = \rho_{\text{air}} V_{\text{air}} C_{\text{p air}} = (0.07)(4372)(0.24) = 73.4 \text{ Btu/deg F}$$

$$T_{\text{air}, i=1} = 222.7/73.4 + 95 = 98.03 \text{ deg F}$$

At  $i = 2$  minutes:

$$T_{\text{air}, i=2} = [F_1 - F_1(T_{\text{air}, i=1} - T_0)]/F_2 + T_{\text{air}, i=1} \quad \text{where}$$

ENGINEERING DEPARTMENT

**CALCULATION SHEET**SUBJECT: Room Temperature Response During  
Station BlackoutCALC NO. M-73-116 REV. 1J.O.NO. 6711 MADE BY: I. Shlafman DATE: 5-4-90 CHECKED BY: [Signature] DATE: 5-23-90

$$F_3 = h_{s,ir} A \Delta i = 1.47 \times 609 \times 1/60 = 14.9 \text{ Btu/deg F}$$

$$T_{air, is2} = [222.7 - 14.9(98.03 - 95)] / 406.9 + 98.03 = 100.44 \text{ deg F}$$

$$B_1 = h \Delta x / k = 1.47 \times 0.0833 / 1.04 = 0.117 \text{ say } 0.12$$

$$F_0 = k \Delta t / pc \Delta x^2 = (1.04 \times 1/60) / 143.58 \times 0.21 \times 0.0833^2 = 0.0828$$

Stability criterion requires that the coefficient for  $T_{0,j-1}$  in equation 3 be greater than or equal to zero

$$1 - 2B_1F_0 - 2F_0 \geq 0 \text{ or}$$

$$F_0 (1 + B_1) \leq 1/2 \text{ or } F_0 \leq 1/2 (1/1 + 0.12) \leq 0.45$$

$$\text{or } \Delta t / \Delta x^2 \leq 0.45 ; \quad \alpha = k / pc$$

$$\Delta t \leq .045 \times \Delta x^2 / \alpha \text{ or } \Delta t \leq 0.45 \times 0.0833^2 \times 143.58 \times 0.21 / 1.04$$

$$\Delta t \leq 0.0905 \text{ hr (5.4 min) ,}$$

therefore,  $\Delta t = 1$  minute satisfies the stability criterion.

To calculate the wall temperature and interior "node" temperature we used equations 3 and 5 from general calculations.

$$i=2 \text{ min, } T_{0,2} = 2 \times 0.0828 [0.12 \times 98.03 + 95] + [1 - 2 \times 0.0828 \times 0.12 - 2 \times 0.0828] \times 95 = 95.06$$

$$F \text{ from equation 5, } F_4 = 1 - 2F_0 = 1 - 2 \times 0.0828 = 0.8344$$

$$T_{1,2} = 0.0828 \times (95 + 95) + 0.8344 \times 95 = 95 \text{ F}$$

$$T_{2,2} = 0.0828 \times (95 + 95) + 0.8344 \times 95 = 95 \text{ F ETC...}$$

For this iterative calculations, the equations 1,2,3 and 5 were entered into LOTUS program and the results are tabulated on pages 35 thru 44.



CHECKED 10/14/92 DATE 11-28-90

SHEET 21-36 OF 84

DISTRIBUTION ROOM EL. 50 UNIT 2/5

[illegible]



CHECKED: James L. Galt DATE: 5-23-90

SHEET 21-37 OF 84

DISTRIBUTION ROOM EL. 50 UNIT 2/3

1.123E+01	9.769E+01	9.557E+01	9.521E+01	9.507E+01	9.502E+01	9.500E+01	9.500E+01	9.500E+01
1.123E+01	9.774E+01	9.560E+01	9.523E+01	9.508E+01	9.502E+01	9.500E+01	9.500E+01	9.500E+01
1.124E+02	9.780E+01	9.563E+01	9.525E+01	9.508E+01	9.502E+01	9.500E+01	9.500E+01	9.500E+01
1.125E+02	9.785E+01	9.567E+01	9.526E+01	9.509E+01	9.503E+01	9.500E+01	9.500E+01	9.500E+01
1.125E+02	9.790E+01	9.570E+01	9.528E+01	9.510E+01	9.503E+01	9.500E+01	9.500E+01	9.500E+01
1.126E+02	9.795E+01	9.573E+01	9.530E+01	9.511E+01	9.504E+01	9.500E+01	9.500E+01	9.500E+01
1.127E+02	9.802E+01	9.577E+01	9.532E+01	9.512E+01	9.504E+01	9.500E+01	9.500E+01	9.500E+01
1.127E+02	9.807E+01	9.580E+01	9.534E+01	9.513E+01	9.504E+01	9.500E+01	9.500E+01	9.500E+01
1.128E+02	9.813E+01	9.583E+01	9.535E+01	9.514E+01	9.505E+01	9.500E+01	9.500E+01	9.500E+01
1.128E+02	9.818E+01	9.586E+01	9.538E+01	9.515E+01	9.505E+01	9.500E+01	9.500E+01	9.500E+01
1.129E+02	9.823E+01	9.589E+01	9.540E+01	9.516E+01	9.506E+01	9.500E+01	9.500E+01	9.500E+01
1.129E+02	9.828E+01	9.592E+01	9.543E+01	9.517E+01	9.506E+01	9.500E+01	9.500E+01	9.500E+01
1.130E+02	9.833E+01	9.595E+01	9.545E+01	9.519E+01	9.507E+01	9.500E+01	9.500E+01	9.500E+01
1.130E+02	9.837E+01	9.598E+01	9.547E+01	9.520E+01	9.508E+01	9.500E+01	9.500E+01	9.500E+01
1.131E+02	9.842E+01	9.601E+01	9.549E+01	9.521E+01	9.508E+01	9.500E+01	9.500E+01	9.500E+01
1.131E+02	9.846E+01	9.604E+01	9.551E+01	9.522E+01	9.509E+01	9.500E+01	9.500E+01	9.500E+01
1.132E+02	9.851E+01	9.607E+01	9.553E+01	9.524E+01	9.509E+01	9.500E+01	9.500E+01	9.500E+01
1.132E+02	9.856E+01	9.610E+01	9.556E+01	9.525E+01	9.510E+01	9.500E+01	9.500E+01	9.500E+01
1.133E+02	9.860E+01	9.613E+01	9.558E+01	9.526E+01	9.511E+01	9.500E+01	9.500E+01	9.500E+01
1.133E+02	9.864E+01	9.616E+01	9.560E+01	9.527E+01	9.511E+01	9.500E+01	9.500E+01	9.500E+01
1.134E+02	9.869E+01	9.623E+01	9.562E+01	9.529E+01	9.512E+01	9.500E+01	9.500E+01	9.500E+01
1.134E+02	9.873E+01	9.626E+01	9.564E+01	9.530E+01	9.513E+01	9.500E+01	9.500E+01	9.500E+01
1.135E+02	9.877E+01	9.629E+01	9.567E+01	9.532E+01	9.514E+01	9.500E+01	9.500E+01	9.500E+01
1.135E+02	9.882E+01	9.633E+01	9.569E+01	9.533E+01	9.515E+01	9.500E+01	9.500E+01	9.500E+01
1.136E+02	9.886E+01	9.636E+01	9.571E+01	9.534E+01	9.515E+01	9.500E+01	9.500E+01	9.500E+01
1.136E+02	9.890E+01	9.639E+01	9.573E+01	9.536E+01	9.516E+01	9.500E+01	9.500E+01	9.500E+01
1.137E+02	9.894E+01	9.642E+01	9.576E+01	9.537E+01	9.517E+01	9.500E+01	9.500E+01	9.500E+01

CALC NO: M-13-116REVISION: 1BY: J. SHAW DATE: 5/4/90CHECKED: [Signature] DATE: 5-23-90

DISTRIBUTION ROOM FL. 50 UNIT 2/3

SHEET 21 OF 84

5.700E+01	1.137E+02	9.898E+01	9.749E+01	9.645E+01	9.578E+01	9.539E+01	9.518E+01	9.508E+01	9.503E+01	9.501E+01	9.500E+01	9.500E+01
5.800E+01	1.137E+02	9.902E+01	9.753E+01	9.649E+01	9.580E+01	9.540E+01	9.519E+01	9.508E+01	9.503E+01	9.501E+01	9.500E+01	9.500E+01
5.900E+01	1.138E+02	9.906E+01	9.756E+01	9.651E+01	9.583E+01	9.542E+01	9.520E+01	9.509E+01	9.503E+01	9.501E+01	9.500E+01	9.500E+01
6.000E+01	1.139E+02	9.910E+01	9.760E+01	9.654E+01	9.585E+01	9.543E+01	9.521E+01	9.509E+01	9.504E+01	9.501E+01	9.500E+01	9.500E+01
6.100E+01	1.139E+02	9.914E+01	9.764E+01	9.657E+01	9.587E+01	9.545E+01	9.522E+01	9.510E+01	9.504E+01	9.502E+01	9.501E+01	9.500E+01
6.200E+01	1.139E+02	9.918E+01	9.767E+01	9.660E+01	9.589E+01	9.547E+01	9.522E+01	9.510E+01	9.504E+01	9.502E+01	9.501E+01	9.500E+01
6.300E+01	1.139E+02	9.921E+01	9.771E+01	9.663E+01	9.592E+01	9.548E+01	9.523E+01	9.511E+01	9.504E+01	9.502E+01	9.501E+01	9.500E+01
6.400E+01	1.140E+02	9.925E+01	9.774E+01	9.666E+01	9.594E+01	9.550E+01	9.524E+01	9.511E+01	9.505E+01	9.502E+01	9.501E+01	9.500E+01
6.500E+01	1.140E+02	9.929E+01	9.778E+01	9.669E+01	9.596E+01	9.551E+01	9.525E+01	9.512E+01	9.505E+01	9.502E+01	9.501E+01	9.500E+01
6.600E+01	1.141E+02	9.933E+01	9.781E+01	9.672E+01	9.599E+01	9.553E+01	9.526E+01	9.512E+01	9.505E+01	9.502E+01	9.501E+01	9.500E+01
6.700E+01	1.141E+02	9.936E+01	9.785E+01	9.675E+01	9.601E+01	9.555E+01	9.527E+01	9.513E+01	9.506E+01	9.502E+01	9.501E+01	9.500E+01
6.800E+01	1.141E+02	9.940E+01	9.788E+01	9.678E+01	9.603E+01	9.556E+01	9.528E+01	9.514E+01	9.506E+01	9.502E+01	9.501E+01	9.500E+01
6.900E+01	1.142E+02	9.944E+01	9.792E+01	9.681E+01	9.605E+01	9.558E+01	9.530E+01	9.514E+01	9.506E+01	9.503E+01	9.501E+01	9.500E+01
7.000E+01	1.142E+02	9.947E+01	9.795E+01	9.684E+01	9.608E+01	9.559E+01	9.531E+01	9.515E+01	9.507E+01	9.503E+01	9.501E+01	9.500E+01
7.100E+01	1.142E+02	9.951E+01	9.798E+01	9.687E+01	9.610E+01	9.561E+01	9.532E+01	9.515E+01	9.507E+01	9.503E+01	9.501E+01	9.500E+01
7.200E+01	1.143E+02	9.954E+01	9.802E+01	9.690E+01	9.612E+01	9.563E+01	9.533E+01	9.516E+01	9.507E+01	9.503E+01	9.501E+01	9.500E+01
7.300E+01	1.143E+02	9.958E+01	9.805E+01	9.693E+01	9.615E+01	9.564E+01	9.534E+01	9.517E+01	9.508E+01	9.503E+01	9.501E+01	9.500E+01
7.400E+01	1.144E+02	9.961E+01	9.808E+01	9.695E+01	9.617E+01	9.566E+01	9.535E+01	9.517E+01	9.509E+01	9.504E+01	9.502E+01	9.501E+01
7.500E+01	1.144E+02	9.965E+01	9.812E+01	9.698E+01	9.619E+01	9.568E+01	9.536E+01	9.518E+01	9.509E+01	9.504E+01	9.502E+01	9.501E+01
7.600E+01	1.144E+02	9.968E+01	9.815E+01	9.701E+01	9.621E+01	9.569E+01	9.537E+01	9.519E+01	9.509E+01	9.504E+01	9.502E+01	9.501E+01
7.700E+01	1.145E+02	9.972E+01	9.818E+01	9.704E+01	9.624E+01	9.571E+01	9.538E+01	9.519E+01	9.509E+01	9.504E+01	9.502E+01	9.501E+01
7.800E+01	1.145E+02	9.975E+01	9.821E+01	9.707E+01	9.626E+01	9.573E+01	9.539E+01	9.520E+01	9.510E+01	9.504E+01	9.502E+01	9.501E+01
7.900E+01	1.145E+02	9.978E+01	9.825E+01	9.710E+01	9.628E+01	9.574E+01	9.541E+01	9.521E+01	9.510E+01	9.505E+01	9.502E+01	9.501E+01
8.000E+01	1.146E+02	9.982E+01	9.828E+01	9.712E+01	9.631E+01	9.576E+01	9.542E+01	9.522E+01	9.511E+01	9.505E+01	9.502E+01	9.501E+01
8.100E+01	1.146E+02	9.985E+01	9.831E+01	9.715E+01	9.633E+01	9.578E+01	9.543E+01	9.522E+01	9.511E+01	9.505E+01	9.502E+01	9.501E+01
8.200E+01	1.146E+02	9.988E+01	9.834E+01	9.718E+01	9.635E+01	9.579E+01	9.544E+01	9.523E+01	9.511E+01	9.505E+01	9.502E+01	9.501E+01
8.300E+01	1.147E+02	9.992E+01	9.837E+01	9.721E+01	9.637E+01	9.581E+01	9.545E+01	9.524E+01	9.512E+01	9.506E+01	9.503E+01	9.501E+01

CALC. NO: 14-13-116

REVISION: 1

BY: I. SHUMATE DATE: 5/6/90

CHECKED: [Signature] DATE: 5-23-90

DISTRIBUTION FROM EL. 50 UNIT 2/3

SHEET 31-39 OF 84

8.400E+01	1.147E+02	9.995E+01	9.840E+01	9.723E+01	9.640E+01	9.583E+01	9.546E+01	9.525E+01	9.512E+01	9.506E+01	9.503E+01	9.501E+01
8.500E+01	1.147E+02	9.998E+01	9.844E+01	9.726E+01	9.642E+01	9.584E+01	9.548E+01	9.525E+01	9.513E+01	9.506E+01	9.503E+01	9.501E+01
8.600E+01	1.148E+02	1.000E+02	9.847E+01	9.729E+01	9.644E+01	9.586E+01	9.549E+01	9.526E+01	9.513E+01	9.506E+01	9.503E+01	9.501E+01
8.700E+01	1.148E+02	1.000E+02	9.850E+01	9.732E+01	9.646E+01	9.589E+01	9.550E+01	9.527E+01	9.514E+01	9.507E+01	9.503E+01	9.501E+01
8.800E+01	1.148E+02	1.001E+02	9.853E+01	9.734E+01	9.648E+01	9.590E+01	9.551E+01	9.528E+01	9.514E+01	9.507E+01	9.503E+01	9.501E+01
8.900E+01	1.149E+02	1.001E+02	9.856E+01	9.737E+01	9.651E+01	9.591E+01	9.552E+01	9.529E+01	9.515E+01	9.507E+01	9.503E+01	9.502E+01
9.000E+01	1.149E+02	1.001E+02	9.859E+01	9.740E+01	9.653E+01	9.593E+01	9.554E+01	9.530E+01	9.515E+01	9.508E+01	9.504E+01	9.502E+01
9.100E+01	1.149E+02	1.002E+02	9.862E+01	9.742E+01	9.655E+01	9.595E+01	9.555E+01	9.530E+01	9.516E+01	9.508E+01	9.504E+01	9.502E+01
9.200E+01	1.150E+02	1.002E+02	9.865E+01	9.745E+01	9.657E+01	9.596E+01	9.556E+01	9.531E+01	9.516E+01	9.509E+01	9.504E+01	9.502E+01
9.300E+01	1.150E+02	1.002E+02	9.868E+01	9.748E+01	9.660E+01	9.598E+01	9.557E+01	9.532E+01	9.517E+01	9.509E+01	9.504E+01	9.502E+01
9.400E+01	1.150E+02	1.003E+02	9.871E+01	9.750E+01	9.662E+01	9.600E+01	9.559E+01	9.533E+01	9.518E+01	9.509E+01	9.504E+01	9.502E+01
9.500E+01	1.151E+02	1.003E+02	9.874E+01	9.753E+01	9.664E+01	9.602E+01	9.560E+01	9.534E+01	9.518E+01	9.509E+01	9.504E+01	9.502E+01
9.600E+01	1.151E+02	1.003E+02	9.876E+01	9.756E+01	9.666E+01	9.603E+01	9.561E+01	9.535E+01	9.519E+01	9.510E+01	9.505E+01	9.502E+01
9.700E+01	1.151E+02	1.004E+02	9.879E+01	9.758E+01	9.668E+01	9.605E+01	9.563E+01	9.536E+01	9.519E+01	9.510E+01	9.505E+01	9.502E+01
9.800E+01	1.152E+02	1.004E+02	9.882E+01	9.761E+01	9.671E+01	9.607E+01	9.564E+01	9.536E+01	9.520E+01	9.511E+01	9.505E+01	9.503E+01
9.900E+01	1.152E+02	1.004E+02	9.885E+01	9.763E+01	9.673E+01	9.608E+01	9.565E+01	9.538E+01	9.521E+01	9.511E+01	9.506E+01	9.503E+01
1.000E+02	1.152E+02	1.004E+02	9.888E+01	9.766E+01	9.675E+01	9.610E+01	9.566E+01	9.539E+01	9.522E+01	9.511E+01	9.506E+01	9.503E+01
1.010E+02	1.152E+02	1.005E+02	9.891E+01	9.768E+01	9.677E+01	9.612E+01	9.568E+01	9.540E+01	9.522E+01	9.512E+01	9.506E+01	9.503E+01
1.020E+02	1.153E+02	1.005E+02	9.894E+01	9.771E+01	9.679E+01	9.614E+01	9.569E+01	9.541E+01	9.523E+01	9.512E+01	9.506E+01	9.503E+01
1.030E+02	1.153E+02	1.005E+02	9.896E+01	9.774E+01	9.681E+01	9.615E+01	9.570E+01	9.541E+01	9.523E+01	9.513E+01	9.506E+01	9.503E+01
1.040E+02	1.153E+02	1.006E+02	9.899E+01	9.776E+01	9.684E+01	9.617E+01	9.572E+01	9.542E+01	9.523E+01	9.513E+01	9.507E+01	9.503E+01
1.050E+02	1.154E+02	1.006E+02	9.902E+01	9.779E+01	9.686E+01	9.619E+01	9.573E+01	9.543E+01	9.524E+01	9.513E+01	9.507E+01	9.503E+01
1.060E+02	1.154E+02	1.006E+02	9.905E+01	9.781E+01	9.688E+01	9.621E+01	9.574E+01	9.544E+01	9.525E+01	9.513E+01	9.507E+01	9.504E+01
1.070E+02	1.154E+02	1.006E+02	9.907E+01	9.784E+01	9.690E+01	9.622E+01	9.576E+01	9.545E+01	9.525E+01	9.514E+01	9.507E+01	9.504E+01
1.080E+02	1.155E+02	1.007E+02	9.910E+01	9.786E+01	9.692E+01	9.624E+01	9.577E+01	9.546E+01	9.526E+01	9.514E+01	9.507E+01	9.504E+01
1.090E+02	1.155E+02	1.007E+02	9.913E+01	9.789E+01	9.694E+01	9.626E+01	9.578E+01	9.547E+01	9.527E+01	9.515E+01	9.508E+01	9.504E+01
1.100E+02	1.155E+02	1.007E+02	9.916E+01	9.791E+01	9.696E+01	9.628E+01	9.580E+01	9.548E+01	9.527E+01	9.515E+01	9.508E+01	9.504E+01



CALC. NO: M-73-116REVISION: 1BY: J. SALASMAN DATE: 5/6/90CHECKED: 10/2/90 DATE: 5-23-90

DISTRIBUTION ROOM EL.50 UNIT 2/3

SHEET PI-40 OF 84

1.110E+02	1.155E+02	1.008E+02	9.918E+01	9.794E+01	9.699E+01	9.629E+01	9.581E+01	9.549E+01	9.528E+01	9.515E+01	9.508E+01	9.504E+01
1.120E+02	1.156E+02	1.008E+02	9.921E+01	9.796E+01	9.701E+01	9.631E+01	9.582E+01	9.550E+01	9.529E+01	9.516E+01	9.508E+01	9.504E+01
1.130E+02	1.156E+02	1.008E+02	9.924E+01	9.799E+01	9.703E+01	9.633E+01	9.584E+01	9.550E+01	9.529E+01	9.516E+01	9.509E+01	9.505E+01
1.140E+02	1.156E+02	1.008E+02	9.926E+01	9.801E+01	9.705E+01	9.634E+01	9.585E+01	9.551E+01	9.530E+01	9.517E+01	9.509E+01	9.505E+01
1.150E+02	1.157E+02	1.009E+02	9.929E+01	9.803E+01	9.707E+01	9.636E+01	9.586E+01	9.552E+01	9.531E+01	9.517E+01	9.509E+01	9.505E+01
1.160E+02	1.157E+02	1.009E+02	9.932E+01	9.806E+01	9.709E+01	9.638E+01	9.588E+01	9.553E+01	9.531E+01	9.518E+01	9.510E+01	9.505E+01
1.170E+02	1.157E+02	1.009E+02	9.934E+01	9.808E+01	9.711E+01	9.640E+01	9.589E+01	9.554E+01	9.532E+01	9.518E+01	9.510E+01	9.505E+01
1.180E+02	1.157E+02	1.009E+02	9.937E+01	9.811E+01	9.713E+01	9.641E+01	9.590E+01	9.555E+01	9.533E+01	9.519E+01	9.510E+01	9.505E+01
1.190E+02	1.158E+02	1.010E+02	9.940E+01	9.813E+01	9.715E+01	9.643E+01	9.592E+01	9.556E+01	9.533E+01	9.519E+01	9.510E+01	9.506E+01
1.200E+02	1.158E+02	1.010E+02	9.942E+01	9.815E+01	9.718E+01	9.645E+01	9.593E+01	9.557E+01	9.534E+01	9.520E+01	9.511E+01	9.506E+01
1.210E+02	1.158E+02	1.010E+02	9.945E+01	9.818E+01	9.720E+01	9.647E+01	9.594E+01	9.558E+01	9.535E+01	9.520E+01	9.511E+01	9.506E+01
1.220E+02	1.158E+02	1.011E+02	9.947E+01	9.820E+01	9.722E+01	9.648E+01	9.596E+01	9.559E+01	9.536E+01	9.521E+01	9.511E+01	9.506E+01
1.230E+02	1.159E+02	1.011E+02	9.950E+01	9.823E+01	9.724E+01	9.650E+01	9.597E+01	9.560E+01	9.536E+01	9.521E+01	9.512E+01	9.506E+01
1.240E+02	1.159E+02	1.011E+02	9.953E+01	9.825E+01	9.726E+01	9.652E+01	9.598E+01	9.562E+01	9.537E+01	9.522E+01	9.512E+01	9.507E+01
1.250E+02	1.159E+02	1.011E+02	9.955E+01	9.827E+01	9.728E+01	9.653E+01	9.600E+01	9.563E+01	9.538E+01	9.522E+01	9.512E+01	9.507E+01
1.260E+02	1.160E+02	1.012E+02	9.958E+01	9.830E+01	9.730E+01	9.655E+01	9.601E+01	9.564E+01	9.539E+01	9.523E+01	9.513E+01	9.507E+01
1.270E+02	1.160E+02	1.012E+02	9.960E+01	9.832E+01	9.732E+01	9.657E+01	9.602E+01	9.565E+01	9.539E+01	9.523E+01	9.513E+01	9.507E+01
1.280E+02	1.160E+02	1.012E+02	9.963E+01	9.834E+01	9.734E+01	9.659E+01	9.604E+01	9.566E+01	9.540E+01	9.524E+01	9.513E+01	9.507E+01
1.290E+02	1.160E+02	1.012E+02	9.965E+01	9.837E+01	9.736E+01	9.660E+01	9.605E+01	9.567E+01	9.541E+01	9.524E+01	9.514E+01	9.508E+01
1.300E+02	1.161E+02	1.013E+02	9.968E+01	9.839E+01	9.738E+01	9.662E+01	9.607E+01	9.568E+01	9.542E+01	9.525E+01	9.514E+01	9.508E+01
1.310E+02	1.161E+02	1.013E+02	9.970E+01	9.841E+01	9.740E+01	9.664E+01	9.608E+01	9.569E+01	9.542E+01	9.525E+01	9.514E+01	9.508E+01
1.320E+02	1.161E+02	1.013E+02	9.973E+01	9.844E+01	9.742E+01	9.665E+01	9.609E+01	9.570E+01	9.543E+01	9.526E+01	9.515E+01	9.508E+01
1.330E+02	1.161E+02	1.013E+02	9.975E+01	9.846E+01	9.744E+01	9.667E+01	9.611E+01	9.571E+01	9.544E+01	9.526E+01	9.515E+01	9.509E+01
1.340E+02	1.162E+02	1.014E+02	9.978E+01	9.848E+01	9.746E+01	9.669E+01	9.612E+01	9.572E+01	9.545E+01	9.527E+01	9.516E+01	9.509E+01
1.350E+02	1.162E+02	1.014E+02	9.980E+01	9.850E+01	9.748E+01	9.671E+01	9.613E+01	9.573E+01	9.545E+01	9.527E+01	9.516E+01	9.509E+01
1.360E+02	1.162E+02	1.014E+02	9.982E+01	9.853E+01	9.750E+01	9.672E+01	9.615E+01	9.574E+01	9.546E+01	9.528E+01	9.516E+01	9.509E+01
1.370E+02	1.162E+02	1.014E+02	9.985E+01	9.855E+01	9.752E+01	9.674E+01	9.616E+01	9.575E+01	9.547E+01	9.528E+01	9.517E+01	9.510E+01

CALC. NO: M-13-116

REVISION: 1

BY: J. S. H. CHAN DATE: 5/16/90

CHECKED: *[Signature]* DATE: 5-23-90

SHEET 31-41 OF 89

1.380E+02	1.163E+02	1.015E+02	9.987E+01	9.857E+01	9.754E+01	9.676E+01	9.618E+01	9.576E+01	9.546E+01	9.529E+01	9.517E+01	9.510E+01
1.390E+02	1.163E+02	1.015E+02	9.990E+01	9.859E+01	9.756E+01	9.677E+01	9.619E+01	9.577E+01	9.549E+01	9.530E+01	9.517E+01	9.510E+01
1.400E+02	1.163E+02	1.015E+02	9.992E+01	9.862E+01	9.758E+01	9.679E+01	9.620E+01	9.578E+01	9.549E+01	9.530E+01	9.518E+01	9.510E+01
1.410E+02	1.163E+02	1.015E+02	9.995E+01	9.864E+01	9.760E+01	9.681E+01	9.622E+01	9.579E+01	9.550E+01	9.531E+01	9.518E+01	9.511E+01
1.420E+02	1.164E+02	1.016E+02	9.997E+01	9.866E+01	9.762E+01	9.683E+01	9.623E+01	9.581E+01	9.551E+01	9.531E+01	9.519E+01	9.511E+01
1.430E+02	1.164E+02	1.016E+02	9.999E+01	9.868E+01	9.764E+01	9.684E+01	9.625E+01	9.582E+01	9.552E+01	9.532E+01	9.519E+01	9.511E+01
1.440E+02	1.164E+02	1.016E+02	1.000E+02	9.871E+01	9.766E+01	9.686E+01	9.626E+01	9.583E+01	9.553E+01	9.532E+01	9.519E+01	9.512E+01
1.450E+02	1.164E+02	1.016E+02	1.000E+02	9.873E+01	9.768E+01	9.688E+01	9.627E+01	9.584E+01	9.553E+01	9.533E+01	9.520E+01	9.512E+01
1.460E+02	1.165E+02	1.017E+02	1.001E+02	9.875E+01	9.770E+01	9.689E+01	9.629E+01	9.585E+01	9.554E+01	9.534E+01	9.520E+01	9.512E+01
1.470E+02	1.165E+02	1.017E+02	1.001E+02	9.877E+01	9.772E+01	9.691E+01	9.630E+01	9.586E+01	9.555E+01	9.534E+01	9.521E+01	9.512E+01
1.480E+02	1.165E+02	1.017E+02	1.001E+02	9.879E+01	9.774E+01	9.693E+01	9.631E+01	9.587E+01	9.556E+01	9.535E+01	9.521E+01	9.513E+01
1.490E+02	1.165E+02	1.017E+02	1.001E+02	9.882E+01	9.776E+01	9.694E+01	9.633E+01	9.588E+01	9.557E+01	9.535E+01	9.522E+01	9.513E+01
1.500E+02	1.166E+02	1.018E+02	1.002E+02	9.884E+01	9.778E+01	9.696E+01	9.634E+01	9.589E+01	9.558E+01	9.536E+01	9.522E+01	9.513E+01
1.510E+02	1.166E+02	1.018E+02	1.002E+02	9.886E+01	9.780E+01	9.698E+01	9.636E+01	9.590E+01	9.559E+01	9.537E+01	9.522E+01	9.514E+01
1.520E+02	1.166E+02	1.018E+02	1.002E+02	9.888E+01	9.782E+01	9.699E+01	9.637E+01	9.591E+01	9.559E+01	9.537E+01	9.523E+01	9.514E+01
1.530E+02	1.166E+02	1.018E+02	1.002E+02	9.890E+01	9.784E+01	9.701E+01	9.638E+01	9.593E+01	9.560E+01	9.538E+01	9.523E+01	9.514E+01
1.540E+02	1.167E+02	1.019E+02	1.003E+02	9.892E+01	9.786E+01	9.703E+01	9.640E+01	9.594E+01	9.561E+01	9.539E+01	9.524E+01	9.515E+01
1.550E+02	1.167E+02	1.019E+02	1.003E+02	9.895E+01	9.788E+01	9.704E+01	9.641E+01	9.595E+01	9.562E+01	9.539E+01	9.524E+01	9.515E+01
1.560E+02	1.167E+02	1.019E+02	1.003E+02	9.897E+01	9.790E+01	9.706E+01	9.643E+01	9.596E+01	9.563E+01	9.540E+01	9.525E+01	9.515E+01
1.570E+02	1.167E+02	1.019E+02	1.003E+02	9.899E+01	9.792E+01	9.708E+01	9.644E+01	9.597E+01	9.564E+01	9.540E+01	9.525E+01	9.516E+01
1.580E+02	1.168E+02	1.019E+02	1.003E+02	9.901E+01	9.794E+01	9.709E+01	9.645E+01	9.598E+01	9.564E+01	9.541E+01	9.526E+01	9.516E+01
1.590E+02	1.168E+02	1.020E+02	1.004E+02	9.903E+01	9.796E+01	9.711E+01	9.647E+01	9.599E+01	9.565E+01	9.541E+01	9.526E+01	9.516E+01
1.600E+02	1.168E+02	1.020E+02	1.004E+02	9.905E+01	9.798E+01	9.713E+01	9.648E+01	9.600E+01	9.566E+01	9.542E+01	9.527E+01	9.517E+01
1.610E+02	1.168E+02	1.020E+02	1.004E+02	9.907E+01	9.799E+01	9.714E+01	9.650E+01	9.601E+01	9.567E+01	9.543E+01	9.527E+01	9.517E+01
1.620E+02	1.168E+02	1.020E+02	1.004E+02	9.910E+01	9.801E+01	9.716E+01	9.651E+01	9.603E+01	9.568E+01	9.544E+01	9.528E+01	9.517E+01
1.630E+02	1.169E+02	1.021E+02	1.005E+02	9.912E+01	9.803E+01	9.718E+01	9.652E+01	9.604E+01	9.569E+01	9.544E+01	9.528E+01	9.518E+01
1.640E+02	1.169E+02	1.021E+02	1.005E+02	9.914E+01	9.805E+01	9.719E+01	9.654E+01	9.605E+01	9.570E+01	9.545E+01	9.529E+01	9.518E+01

CALC. NO: M-13-116

REVISION: 1

BY: S. SALAS MRM DATE: 5/6/90

CHECKED: [Signature] DATE: 5-23-90

DISTRIBUTION ROOM EL. 50 UNIT 2/3

SHEET 1-42 OF 84

1.650E+02	1.169E+02	1.021E+02	1.005E+02	9.916E+01	9.807E+01	9.721E+01	9.655E+01	9.606E+01	9.571E+01	9.546E+01	9.524	9.518E+01
1.660E+02	1.169E+02	1.021E+02	1.005E+02	9.918E+01	9.809E+01	9.723E+01	9.657E+01	9.607E+01	9.571E+01	9.546E+01	9.524	9.519E+01
1.670E+02	1.170E+02	1.022E+02	1.005E+02	9.920E+01	9.811E+01	9.724E+01	9.658E+01	9.608E+01	9.572E+01	9.547E+01	9.524	9.519E+01
1.680E+02	1.170E+02	1.022E+02	1.006E+02	9.922E+01	9.813E+01	9.726E+01	9.659E+01	9.609E+01	9.573E+01	9.548E+01	9.531E+01	9.519E+01
1.690E+02	1.170E+02	1.022E+02	1.006E+02	9.924E+01	9.815E+01	9.728E+01	9.661E+01	9.612E+01	9.574E+01	9.548E+01	9.531E+01	9.520E+01
1.700E+02	1.170E+02	1.022E+02	1.006E+02	9.926E+01	9.816E+01	9.729E+01	9.662E+01	9.612E+01	9.575E+01	9.549E+01	9.532E+01	9.520E+01
1.710E+02	1.171E+02	1.022E+02	1.006E+02	9.928E+01	9.818E+01	9.731E+01	9.663E+01	9.613E+01	9.576E+01	9.550E+01	9.532E+01	9.521E+01
1.720E+02	1.171E+02	1.023E+02	1.007E+02	9.930E+01	9.820E+01	9.733E+01	9.665E+01	9.614E+01	9.577E+01	9.551E+01	9.533E+01	9.521E+01
1.730E+02	1.171E+02	1.023E+02	1.007E+02	9.932E+01	9.822E+01	9.734E+01	9.666E+01	9.615E+01	9.578E+01	9.551E+01	9.533E+01	9.521E+01
1.740E+02	1.171E+02	1.023E+02	1.007E+02	9.934E+01	9.824E+01	9.736E+01	9.668E+01	9.616E+01	9.579E+01	9.552E+01	9.534E+01	9.521E+01
1.750E+02	1.171E+02	1.023E+02	1.007E+02	9.936E+01	9.826E+01	9.738E+01	9.669E+01	9.617E+01	9.579E+01	9.553E+01	9.534E+01	9.522E+01
1.760E+02	1.172E+02	1.024E+02	1.007E+02	9.938E+01	9.828E+01	9.739E+01	9.670E+01	9.619E+01	9.580E+01	9.553E+01	9.535E+01	9.523E+01
1.770E+02	1.172E+02	1.024E+02	1.008E+02	9.941E+01	9.829E+01	9.741E+01	9.672E+01	9.620E+01	9.581E+01	9.554E+01	9.535E+01	9.523E+01
1.780E+02	1.172E+02	1.024E+02	1.008E+02	9.943E+01	9.831E+01	9.742E+01	9.673E+01	9.621E+01	9.582E+01	9.555E+01	9.536E+01	9.523E+01
1.790E+02	1.172E+02	1.024E+02	1.008E+02	9.945E+01	9.833E+01	9.744E+01	9.675E+01	9.622E+01	9.583E+01	9.555E+01	9.536E+01	9.524E+01
1.800E+02	1.173E+02	1.024E+02	1.008E+02	9.947E+01	9.835E+01	9.746E+01	9.676E+01	9.623E+01	9.584E+01	9.556E+01	9.537E+01	9.524E+01
1.810E+02	1.173E+02	1.025E+02	1.008E+02	9.949E+01	9.837E+01	9.747E+01	9.677E+01	9.624E+01	9.585E+01	9.557E+01	9.537E+01	9.525E+01
1.820E+02	1.173E+02	1.025E+02	1.009E+02	9.951E+01	9.839E+01	9.749E+01	9.679E+01	9.625E+01	9.586E+01	9.558E+01	9.538E+01	9.525E+01
1.830E+02	1.173E+02	1.025E+02	1.009E+02	9.953E+01	9.841E+01	9.751E+01	9.680E+01	9.627E+01	9.587E+01	9.559E+01	9.539E+01	9.526E+01
1.840E+02	1.173E+02	1.025E+02	1.009E+02	9.955E+01	9.842E+01	9.752E+01	9.682E+01	9.628E+01	9.588E+01	9.559E+01	9.539E+01	9.526E+01
1.850E+02	1.174E+02	1.025E+02	1.009E+02	9.957E+01	9.844E+01	9.754E+01	9.683E+01	9.629E+01	9.589E+01	9.560E+01	9.540E+01	9.526E+01
1.860E+02	1.174E+02	1.026E+02	1.010E+02	9.959E+01	9.846E+01	9.755E+01	9.684E+01	9.630E+01	9.590E+01	9.560E+01	9.540E+01	9.527E+01
1.870E+02	1.174E+02	1.026E+02	1.010E+02	9.961E+01	9.848E+01	9.757E+01	9.686E+01	9.631E+01	9.591E+01	9.561E+01	9.541E+01	9.527E+01
1.880E+02	1.174E+02	1.026E+02	1.010E+02	9.963E+01	9.850E+01	9.759E+01	9.687E+01	9.632E+01	9.591E+01	9.562E+01	9.541E+01	9.528E+01
1.890E+02	1.174E+02	1.026E+02	1.010E+02	9.964E+01	9.851E+01	9.760E+01	9.688E+01	9.633E+01	9.592E+01	9.563E+01	9.542E+01	9.528E+01
1.900E+02	1.175E+02	1.027E+02	1.010E+02	9.966E+01	9.853E+01	9.762E+01	9.690E+01	9.635E+01	9.593E+01	9.563E+01	9.543E+01	9.529E+01
1.910E+02	1.175E+02	1.027E+02	1.011E+02	9.968E+01	9.855E+01	9.763E+01	9.691E+01	9.636E+01	9.594E+01	9.564E+01	9.543E+01	9.529E+01



CALC. NO: M-13-116  
 REVISION: 1  
 BY: J. SALAS DATE: 5/6/90  
 CHECKED: [Signature] DATE: 5/23/90

DISTRIBUTION ROOM EL. 50 UNIT 2/-

SHEET R-1-43 OF 84

1.920E+02	1.175E+02	1.027E+02	1.011E+02	9.970E+01	9.857E+01	9.765E+01	9.695E+01	9.637E+01	9.595E+01	9.565E+01	9.544E+01	9.530E+01
1.930E+02	1.175E+02	1.027E+02	1.011E+02	9.972E+01	9.859E+01	9.767E+01	9.694E+01	9.630E+01	9.596E+01	9.566E+01	9.544E+01	9.530E+01
1.940E+02	1.176E+02	1.027E+02	1.011E+02	9.974E+01	9.860E+01	9.768E+01	9.695E+01	9.639E+01	9.597E+01	9.566E+01	9.545E+01	9.530E+01
1.950E+02	1.176E+02	1.028E+02	1.011E+02	9.976E+01	9.862E+01	9.770E+01	9.697E+01	9.640E+01	9.598E+01	9.567E+01	9.545E+01	9.531E+01
1.960E+02	1.176E+02	1.028E+02	1.012E+02	9.978E+01	9.864E+01	9.771E+01	9.698E+01	9.642E+01	9.599E+01	9.568E+01	9.546E+01	9.531E+01
1.970E+02	1.176E+02	1.028E+02	1.012E+02	9.980E+01	9.866E+01	9.773E+01	9.700E+01	9.643E+01	9.600E+01	9.569E+01	9.547E+01	9.532E+01
1.980E+02	1.176E+02	1.028E+02	1.012E+02	9.982E+01	9.868E+01	9.775E+01	9.701E+01	9.644E+01	9.601E+01	9.569E+01	9.547E+01	9.532E+01
1.990E+02	1.177E+02	1.028E+02	1.012E+02	9.984E+01	9.869E+01	9.776E+01	9.702E+01	9.645E+01	9.602E+01	9.570E+01	9.548E+01	9.533E+01
2.000E+02	1.177E+02	1.029E+02	1.012E+02	9.986E+01	9.871E+01	9.778E+01	9.704E+01	9.646E+01	9.603E+01	9.571E+01	9.548E+01	9.533E+01
2.010E+02	1.177E+02	1.029E+02	1.013E+02	9.988E+01	9.873E+01	9.779E+01	9.705E+01	9.647E+01	9.604E+01	9.572E+01	9.549E+01	9.534E+01
2.020E+02	1.177E+02	1.029E+02	1.013E+02	9.990E+01	9.875E+01	9.781E+01	9.706E+01	9.649E+01	9.605E+01	9.573E+01	9.550E+01	9.534E+01
2.030E+02	1.177E+02	1.029E+02	1.013E+02	9.992E+01	9.876E+01	9.783E+01	9.708E+01	9.650E+01	9.606E+01	9.573E+01	9.550E+01	9.535E+01
2.040E+02	1.178E+02	1.029E+02	1.013E+02	9.994E+01	9.878E+01	9.784E+01	9.709E+01	9.651E+01	9.607E+01	9.574E+01	9.551E+01	9.535E+01
2.050E+02	1.178E+02	1.030E+02	1.014E+02	9.995E+01	9.880E+01	9.786E+01	9.711E+01	9.652E+01	9.608E+01	9.575E+01	9.552E+01	9.536E+01
2.060E+02	1.178E+02	1.030E+02	1.014E+02	9.997E+01	9.882E+01	9.787E+01	9.713E+01	9.653E+01	9.609E+01	9.576E+01	9.552E+01	9.536E+01
2.070E+02	1.178E+02	1.030E+02	1.014E+02	9.999E+01	9.885E+01	9.790E+01	9.715E+01	9.654E+01	9.610E+01	9.577E+01	9.553E+01	9.537E+01
2.080E+02	1.179E+02	1.030E+02	1.014E+02	1.000E+02	9.887E+01	9.792E+01	9.716E+01	9.656E+01	9.611E+01	9.578E+01	9.554E+01	9.538E+01
2.090E+02	1.179E+02	1.031E+02	1.014E+02	1.000E+02	9.889E+01	9.795E+01	9.717E+01	9.658E+01	9.612E+01	9.579E+01	9.555E+01	9.539E+01
2.100E+02	1.179E+02	1.031E+02	1.015E+02	1.001E+02	9.890E+01	9.797E+01	9.720E+01	9.659E+01	9.613E+01	9.580E+01	9.555E+01	9.539E+01
2.110E+02	1.179E+02	1.031E+02	1.015E+02	1.001E+02	9.892E+01	9.799E+01	9.722E+01	9.660E+01	9.614E+01	9.580E+01	9.556E+01	9.539E+01
2.120E+02	1.179E+02	1.031E+02	1.015E+02	1.001E+02	9.894E+01	9.800E+01	9.723E+01	9.661E+01	9.615E+01	9.581E+01	9.557E+01	9.540E+01
2.130E+02	1.180E+02	1.031E+02	1.015E+02	1.001E+02	9.896E+01	9.800E+01	9.723E+01	9.663E+01	9.616E+01	9.582E+01	9.557E+01	9.540E+01
2.140E+02	1.180E+02	1.032E+02	1.015E+02	1.001E+02	9.897E+01	9.801E+01	9.724E+01	9.664E+01	9.617E+01	9.583E+01	9.558E+01	9.541E+01
2.150E+02	1.180E+02	1.032E+02	1.016E+02	1.002E+02	9.899E+01	9.801E+01	9.726E+01	9.665E+01	9.618E+01	9.584E+01	9.559E+01	9.542E+01
2.160E+02	1.180E+02	1.032E+02	1.016E+02	1.002E+02	9.901E+01	9.805E+01	9.727E+01	9.666E+01	9.619E+01	9.584E+01	9.559E+01	9.542E+01
2.170E+02	1.180E+02	1.032E+02	1.016E+02	1.002E+02	9.903E+01	9.806E+01	9.728E+01	9.667E+01	9.620E+01	9.585E+01	9.560E+01	9.543E+01
2.180E+02	1.180E+02	1.032E+02	1.016E+02	1.002E+02								

CALC. NO: 14-13-116  
 REVISION: 1  
 BY: S. K. RAY DATE: 5/1/90  
 CHECKED: S. K. RAY DATE: 5-23-90

SHEET 11-44 OF 84

DISTRIBUTION ROOM EL. 50 UNIT 2/3

2.190E+02	1.181E+02	1.032E+02	1.016E+02	1.002E+02	9.904E+01	9.808E+01	9.730E+01	9.668E+01	9.621E+01	9.586E+01	9.561E+01	9.543E+01
2.200E+02	1.181E+02	1.033E+02	1.016E+02	1.002E+02	9.906E+01	9.809E+01	9.731E+01	9.670E+01	9.622E+01	9.587E+01	9.561E+01	9.544E+01
2.210E+02	1.181E+02	1.033E+02	1.017E+02	1.003E+02	9.908E+01	9.811E+01	9.733E+01	9.671E+01	9.623E+01	9.588E+01	9.562E+01	9.544E+01
2.220E+02	1.181E+02	1.033E+02	1.017E+02	1.003E+02	9.909E+01	9.812E+01	9.734E+01	9.672E+01	9.624E+01	9.589E+01	9.563E+01	9.545E+01
2.230E+02	1.181E+02	1.033E+02	1.017E+02	1.003E+02	9.911E+01	9.814E+01	9.735E+01	9.673E+01	9.625E+01	9.590E+01	9.564E+01	9.545E+01
2.240E+02	1.182E+02	1.033E+02	1.017E+02	1.003E+02	9.913E+01	9.815E+01	9.737E+01	9.674E+01	9.626E+01	9.590E+01	9.564E+01	9.546E+01
2.250E+02	1.182E+02	1.034E+02	1.017E+02	1.003E+02	9.915E+01	9.817E+01	9.738E+01	9.675E+01	9.627E+01	9.591E+01	9.565E+01	9.546E+01
2.260E+02	1.182E+02	1.034E+02	1.017E+02	1.003E+02	9.916E+01	9.818E+01	9.739E+01	9.677E+01	9.628E+01	9.592E+01	9.565E+01	9.547E+01
2.270E+02	1.182E+02	1.034E+02	1.018E+02	1.004E+02	9.918E+01	9.820E+01	9.741E+01	9.678E+01	9.629E+01	9.593E+01	9.566E+01	9.548E+01
2.280E+02	1.182E+02	1.034E+02	1.018E+02	1.004E+02	9.920E+01	9.822E+01	9.742E+01	9.679E+01	9.630E+01	9.593E+01	9.567E+01	9.548E+01
2.290E+02	1.183E+02	1.034E+02	1.018E+02	1.004E+02	9.921E+01	9.823E+01	9.743E+01	9.680E+01	9.631E+01	9.594E+01	9.567E+01	9.549E+01
2.300E+02	1.183E+02	1.035E+02	1.018E+02	1.004E+02	9.923E+01	9.825E+01	9.745E+01	9.681E+01	9.632E+01	9.595E+01	9.568E+01	9.549E+01
2.310E+02	1.183E+02	1.035E+02	1.018E+02	1.004E+02	9.925E+01	9.826E+01	9.746E+01	9.682E+01	9.633E+01	9.596E+01	9.569E+01	9.550E+01
2.320E+02	1.183E+02	1.035E+02	1.018E+02	1.005E+02	9.926E+01	9.828E+01	9.748E+01	9.684E+01	9.634E+01	9.597E+01	9.569E+01	9.550E+01
2.330E+02	1.183E+02	1.035E+02	1.019E+02	1.005E+02	9.928E+01	9.829E+01	9.749E+01	9.685E+01	9.635E+01	9.598E+01	9.570E+01	9.551E+01
2.340E+02	1.184E+02	1.035E+02	1.019E+02	1.005E+02	9.930E+01	9.831E+01	9.750E+01	9.686E+01	9.636E+01	9.598E+01	9.571E+01	9.552E+01
2.350E+02	1.184E+02	1.035E+02	1.019E+02	1.005E+02	9.931E+01	9.832E+01	9.752E+01	9.687E+01	9.637E+01	9.599E+01	9.571E+01	9.552E+01
2.360E+02	1.184E+02	1.036E+02	1.019E+02	1.005E+02	9.933E+01	9.834E+01	9.753E+01	9.688E+01	9.638E+01	9.600E+01	9.572E+01	9.553E+01
2.370E+02	1.184E+02	1.036E+02	1.020E+02	1.006E+02	9.935E+01	9.835E+01	9.754E+01	9.690E+01	9.639E+01	9.601E+01	9.573E+01	9.553E+01
2.380E+02	1.184E+02	1.036E+02	1.020E+02	1.006E+02	9.936E+01	9.837E+01	9.756E+01	9.691E+01	9.640E+01	9.602E+01	9.574E+01	9.554E+01
2.390E+02	1.185E+02	1.036E+02	1.020E+02	1.006E+02	9.938E+01	9.838E+01	9.757E+01	9.692E+01	9.641E+01	9.603E+01	9.574E+01	9.555E+01
2.400E+02	1.185E+02	1.036E+02	1.020E+02	1.006E+02	9.940E+01	9.840E+01	9.758E+01	9.693E+01	9.642E+01	9.603E+01	9.575E+01	9.555E+01

ENGINEERING DEPARTMENT

## CALCULATION SHEET

Room Temperature Response During  
Station Blackout

SUBJECT:

CALC NO. M-73-116 REV. 1

J.O. NO. 6711 MADE BY: I. Shlafman DATE: 5-4-90 CHECKED BY: [Signature] DATE: 5-23-90

8.4 Computer Room EL 30'-00" (Room 232)

Room Heat Transfer Area:

Wall (ref 9 pg.17A)

a) 3/4" plaster wall (west)

$$A_{\text{west wall}} = 290 \text{ ft}^2$$

b) 2 ft concrete wall (north)

$$A_{\text{north wall}} = 230 \text{ ft}^2$$

Ceiling

a) 1 ft concrete slab

$$A_{\text{ceiling}} = 1025 \text{ ft}^2$$

$$A_{\text{total}} = 290 + 230 + 1025 = 1545 \text{ ft}^2$$

Room Volume (ref.9)

$$V_{\text{total room}} = 19285 \text{ ft}^3 \text{ (included suspended ceiling and raised floor volumes)}$$

$$V_{\text{cabinets}} = 1519 \text{ ft}^3 \text{ (ref. Att.1)}$$

Assume 2% of total volume are taken by beams, suspended ceiling and raised floor structures.

$$V_{\text{net room}} = (19285 \times 0.98) - 1519 = 17380 \text{ ft}^3$$

Initial temperature = 72 deg F (Reference 9)

$$\text{Wall average temp., } T_{\text{wall avg.}} = (T_{\text{air, in}} + T_{\text{outside}}) / 2 \text{ (ref.14)}$$

$$T_{\text{wall avg.}} = (72 + 75) / 2 = 73.5 \text{ F} \approx 75.0 \text{ F}$$

Concrete wall and slab thickness: For conservative approach, assuming that west wall is concrete and thickness is equal to  $L = 1 \text{ ft}$ .

Heat Gain:

$$Q_{\text{ELECT}} = 37.86 \text{ kw} \times 3413 \text{ Btu/hr kw} = 129212 \text{ Btu/hr (Ref. Att. 9)}$$

## ENGINEERING DEPARTMENT

## CALCULATION SHEET

SUBJECT: Room Temperature Response During  
Station Blackout

CALC NO. M-73-116 REV. 1

J.O. NO. 5711 MADE BY: I. Shlafman DATE: 5-4-90 CHECKED BY: [Signature] DATE: 5-23-90

Sample Calculation

From Equations 1 and 2, at  $i = 1$  minute

$$T_{air,i=1} = F_1/F_2 + T_{air,i=0} \quad \text{where:}$$

$$F_1 = Q_{\Delta i} = 129212/60 = 2153.5 \text{ Btu/min say } 2154 \text{ Btu/min}$$

$$F_2 = \rho_{air} V_{air} C_{p,air} = (0.07)(17380)(0.24) = 292 \text{ Btu/deg F}$$

$$T_{air,i=1} = 2154/292 + 72 = 79.37 \text{ deg F}$$

At  $i = 2$  minutes:

$$T_{air,i=2} = [F_1 - F_3(T_{air,i=1} - T_0)]/F_2 + T_{air,i=1}, \text{ where}$$

$$F_3 = h_{air} A_{\Delta i} = 1.47 \times 1545 \times 1/60 = 37.85 \text{ Btu/deg F}$$

$$T_{air,i=2} = [2154 - 37.85(79.37 - 75)]/292 + 79.37 = 86.18 \text{ deg F}$$

$$B_1 = h \alpha x / k = 1.47 \times 0.0833 / 1.04 = 0.117 \approx 0.12$$

$$F_0 = k \alpha t / \rho c \alpha x^2 = (1.04 \times 1/60) / 143.58 \times 0.21 \times 0.0833^2 = 0.0828$$

Stability criterion requires that the coefficient for  $T_{0,i-1}$  in equation 3 be greater than or equal to zero

$$1 - 2B_1F_0 - 2F_0 \geq 0 \text{ or}$$

$$F_0 (1 + B_1) \leq 1/2 \text{ or } F_0 \leq 1/2 (1/1 + 0.12) \leq 0.45$$

$$\text{or } \alpha t / \alpha x^2 \leq 0.45 ; \quad \alpha = k / \rho c$$

$$t \leq .045 \times \alpha x^2 / \alpha \text{ or } t \leq 0.45 \times 0.0833^2 \times 143.58 \times 0.21 / 1.04$$

$$t \leq 0.0905 \text{ hr (5.4 min) ,}$$

therefore,  $t=1$  minute satisfies the stability criterion.

To calculate the wall temperature and interior "node" temperature we used equations 3 and 5 from general calculations.

$$i=2 \text{ min, } T_{0,2} = 2 \times 0.0828[0.12 \times 79.37 + 75] + [1 - 2 \times 0.0828 \times 0.12 - 2 \times 0.0828] \times 75 = 75 \text{ F}$$

$$\text{from equation 5, } F_1 = 1 - 2F_0 = 1 - 2 \times 0.0828 = 0.8344$$

ENGINEERING DEPARTMENT

**CALCULATION SHEET**SUBJECT: Room Temperature Response During  
Station BlackoutCALC NO. M-73-116 REV. 1J.O.NO. 6711 MADE BY: I. Shlafman DATE: 5-4-90 CHECKED BY: [Signature] DATE: 5-25-90

$$T_{1,2} = 0.0828 \times (75 + 75) + 0.08344 \times 75 = 75 \text{ F}$$

$$T_{2,2} = 0.0828 \times (75 + 75) + 0.08344 \times 75 = 75 \text{ F ETC...}$$

For this iterative calculations, the equations 1,2,3 and 5 were entered into LOTUS program and the results are tabulated on pages thru .







CALC. NO: N-73-116

REVISION: 1

BY: J. SHAFMAN DATE: 5/17/90

CHECKED: J. SHAFMAN DATE: 5/23/90

COMPUTER ROOM UNIT 2/3

3.000E+00	9.211E+01	7.525E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
4.000E+00	9.730E+01	7.554E+01	7.502E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
5.000E+00	1.019E+02	7.587E+01	7.506E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
6.000E+00	1.059E+02	7.625E+01	7.512E+01	7.501E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
7.000E+00	1.094E+02	7.664E+01	7.521E+01	7.502E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
8.000E+00	1.125E+02	7.704E+01	7.531E+01	7.503E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
9.000E+00	1.153E+02	7.744E+01	7.543E+01	7.505E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
1.000E+01	1.178E+02	7.785E+01	7.556E+01	7.508E+01	7.501E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
1.100E+01	1.200E+02	7.825E+01	7.571E+01	7.511E+01	7.501E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
1.200E+01	1.219E+02	7.864E+01	7.587E+01	7.515E+01	7.502E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
1.300E+01	1.237E+02	7.903E+01	7.604E+01	7.520E+01	7.503E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
1.400E+01	1.253E+02	7.941E+01	7.622E+01	7.526E+01	7.504E+01	7.501E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
1.500E+01	1.267E+02	7.977E+01	7.640E+01	7.532E+01	7.506E+01	7.501E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
1.600E+01	1.280E+02	8.013E+01	7.659E+01	7.539E+01	7.507E+01	7.501E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
1.700E+01	1.292E+02	8.048E+01	7.679E+01	7.546E+01	7.510E+01	7.502E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
1.800E+01	1.302E+02	8.082E+01	7.698E+01	7.554E+01	7.512E+01	7.502E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
1.900E+01	1.312E+02	8.115E+01	7.718E+01	7.563E+01	7.515E+01	7.503E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
2.000E+01	1.321E+02	8.147E+01	7.738E+01	7.571E+01	7.518E+01	7.504E+01	7.501E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
2.100E+01	1.329E+02	8.178E+01	7.758E+01	7.581E+01	7.521E+01	7.504E+01	7.501E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
2.200E+01	1.336E+02	8.208E+01	7.778E+01	7.590E+01	7.524E+01	7.506E+01	7.501E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
2.300E+01	1.343E+02	8.237E+01	7.798E+01	7.601E+01	7.528E+01	7.507E+01	7.501E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
2.400E+01	1.350E+02	8.266E+01	7.818E+01	7.611E+01	7.533E+01	7.508E+01	7.502E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
2.500E+01	1.356E+02	8.294E+01	7.838E+01	7.622E+01	7.537E+01	7.510E+01	7.502E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
2.600E+01	1.361E+02	8.321E+01	7.858E+01	7.632E+01	7.542E+01	7.511E+01	7.503E+01	7.501E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
2.700E+01	1.366E+02	8.347E+01	7.878E+01	7.644E+01	7.547E+01	7.513E+01	7.503E+01	7.501E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
2.800E+01	1.371E+02	8.373E+01	7.897E+01	7.655E+01	7.552E+01	7.515E+01	7.504E+01	7.501E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
2.900E+01	1.376E+02	8.399E+01	7.916E+01	7.666E+01	7.557E+01	7.517E+01	7.504E+01	7.501E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01

SHEET 21-50 OF 89

CALC. NO: M 73-116  
 REVISION: 1  
 BY: I. SHUKLA MAU DATE: 5/17/90  
 CHECKED: [Signature] DATE: 5-23-90

COMPUTER ROOM UNIT 2/3

3.000E+01	1.360E+02	8.423E+01	7.936E+01	7.676E+01	7.563E+01	7.519E+01	7.505E+01	7.501E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
3.100E+01	1.384E+02	8.447E+01	7.955E+01	7.690E+01	7.569E+01	7.522E+01	7.506E+01	7.501E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
3.200E+01	1.388E+02	8.471E+01	7.974E+01	7.702E+01	7.575E+01	7.524E+01	7.507E+01	7.502E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
3.300E+01	1.392E+02	8.494E+01	7.992E+01	7.714E+01	7.581E+01	7.527E+01	7.508E+01	7.502E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
3.400E+01	1.395E+02	8.517E+01	8.011E+01	7.726E+01	7.588E+01	7.530E+01	7.509E+01	7.502E+01	7.501E+01	7.500E+01	7.500E+01	7.500E+01
3.500E+01	1.398E+02	8.539E+01	8.029E+01	7.738E+01	7.595E+01	7.533E+01	7.510E+01	7.503E+01	7.501E+01	7.500E+01	7.500E+01	7.500E+01
3.600E+01	1.402E+02	8.561E+01	8.047E+01	7.750E+01	7.601E+01	7.536E+01	7.512E+01	7.503E+01	7.501E+01	7.500E+01	7.500E+01	7.500E+01
3.700E+01	1.405E+02	8.582E+01	8.065E+01	7.763E+01	7.608E+01	7.540E+01	7.513E+01	7.504E+01	7.501E+01	7.500E+01	7.500E+01	7.500E+01
3.800E+01	1.407E+02	8.603E+01	8.083E+01	7.775E+01	7.615E+01	7.543E+01	7.514E+01	7.504E+01	7.501E+01	7.500E+01	7.500E+01	7.500E+01
3.900E+01	1.410E+02	8.624E+01	8.100E+01	7.787E+01	7.623E+01	7.547E+01	7.516E+01	7.505E+01	7.501E+01	7.500E+01	7.500E+01	7.500E+01
4.000E+01	1.413E+02	8.644E+01	8.118E+01	7.799E+01	7.630E+01	7.550E+01	7.518E+01	7.505E+01	7.502E+01	7.500E+01	7.500E+01	7.500E+01
4.100E+01	1.416E+02	8.664E+01	8.135E+01	7.812E+01	7.637E+01	7.554E+01	7.519E+01	7.506E+01	7.502E+01	7.500E+01	7.500E+01	7.500E+01
4.200E+01	1.418E+02	8.683E+01	8.152E+01	7.824E+01	7.645E+01	7.558E+01	7.521E+01	7.507E+01	7.502E+01	7.501E+01	7.500E+01	7.500E+01
4.300E+01	1.421E+02	8.703E+01	8.169E+01	7.836E+01	7.653E+01	7.562E+01	7.523E+01	7.508E+01	7.502E+01	7.501E+01	7.500E+01	7.500E+01
4.400E+01	1.423E+02	8.722E+01	8.185E+01	7.849E+01	7.660E+01	7.567E+01	7.525E+01	7.508E+01	7.503E+01	7.501E+01	7.500E+01	7.500E+01
4.500E+01	1.425E+02	8.740E+01	8.202E+01	7.861E+01	7.668E+01	7.571E+01	7.527E+01	7.509E+01	7.503E+01	7.501E+01	7.500E+01	7.500E+01
4.600E+01	1.428E+02	8.759E+01	8.218E+01	7.873E+01	7.676E+01	7.575E+01	7.529E+01	7.510E+01	7.503E+01	7.501E+01	7.500E+01	7.500E+01
4.700E+01	1.430E+02	8.777E+01	8.234E+01	7.885E+01	7.684E+01	7.580E+01	7.531E+01	7.511E+01	7.504E+01	7.501E+01	7.500E+01	7.500E+01
4.800E+01	1.432E+02	8.795E+01	8.250E+01	7.898E+01	7.692E+01	7.584E+01	7.534E+01	7.512E+01	7.504E+01	7.501E+01	7.500E+01	7.500E+01
4.900E+01	1.434E+02	8.812E+01	8.266E+01	7.910E+01	7.700E+01	7.589E+01	7.536E+01	7.513E+01	7.505E+01	7.501E+01	7.500E+01	7.500E+01
5.000E+01	1.436E+02	8.830E+01	8.282E+01	7.922E+01	7.708E+01	7.594E+01	7.539E+01	7.515E+01	7.505E+01	7.502E+01	7.500E+01	7.500E+01
5.100E+01	1.438E+02	8.847E+01	8.298E+01	7.934E+01	7.717E+01	7.599E+01	7.541E+01	7.516E+01	7.506E+01	7.502E+01	7.501E+01	7.500E+01
5.200E+01	1.440E+02	8.864E+01	8.313E+01	7.946E+01	7.725E+01	7.604E+01	7.544E+01	7.517E+01	7.506E+01	7.502E+01	7.501E+01	7.500E+01
5.300E+01	1.442E+02	8.881E+01	8.328E+01	7.958E+01	7.733E+01	7.609E+01	7.547E+01	7.518E+01	7.507E+01	7.502E+01	7.501E+01	7.500E+01
5.400E+01	1.444E+02	8.897E+01	8.343E+01	7.970E+01	7.742E+01	7.614E+01	7.549E+01	7.520E+01	7.507E+01	7.502E+01	7.501E+01	7.500E+01
5.500E+01	1.446E+02	8.914E+01	8.358E+01	7.982E+01	7.750E+01	7.619E+01	7.552E+01	7.521E+01	7.508E+01	7.503E+01	7.501E+01	7.500E+01
5.600E+01	1.448E+02	8.930E+01	8.373E+01	7.994E+01	7.758E+01	7.625E+01	7.555E+01	7.523E+01	7.509E+01	7.503E+01	7.501E+01	7.500E+01

SHEET 21 OF 84

CALC. NO: M 73-116

REVISION: 1

BY: J. Sullivan DATE: 5/17/90

CHECKED: J. Sullivan DATE: 5-23-90

COMPUTER ROOM UNIT 2/3

5.700E+01	1.450E+02	8.946E+01	8.388E+01	8.006E+01	7.767E+01	7.630E+01	7.558E+01	7.524E+01	7.509E+01	7.503E+01	7.501E+01	7.500E+01
5.800E+01	1.451E+02	8.962E+01	8.402E+01	8.018E+01	7.775E+01	7.635E+01	7.561E+01	7.526E+01	7.510E+01	7.504E+01	7.501E+01	7.500E+01
5.900E+01	1.453E+02	8.977E+01	8.417E+01	8.030E+01	7.784E+01	7.641E+01	7.565E+01	7.527E+01	7.511E+01	7.504E+01	7.501E+01	7.500E+01
6.000E+01	1.455E+02	8.993E+01	8.431E+01	8.041E+01	7.792E+01	7.646E+01	7.568E+01	7.529E+01	7.512E+01	7.504E+01	7.501E+01	7.500E+01
6.100E+01	1.457E+02	9.008E+01	8.445E+01	8.053E+01	7.801E+01	7.652E+01	7.571E+01	7.531E+01	7.512E+01	7.505E+01	7.502E+01	7.501E+01
6.200E+01	1.458E+02	9.024E+01	8.460E+01	8.065E+01	7.809E+01	7.658E+01	7.574E+01	7.533E+01	7.513E+01	7.505E+01	7.502E+01	7.501E+01
6.300E+01	1.460E+02	9.039E+01	8.474E+01	8.076E+01	7.818E+01	7.663E+01	7.578E+01	7.535E+01	7.514E+01	7.505E+01	7.502E+01	7.501E+01
6.400E+01	1.461E+02	9.054E+01	8.487E+01	8.088E+01	7.826E+01	7.669E+01	7.581E+01	7.536E+01	7.515E+01	7.506E+01	7.502E+01	7.501E+01
6.500E+01	1.463E+02	9.068E+01	8.501E+01	8.099E+01	7.835E+01	7.675E+01	7.585E+01	7.538E+01	7.516E+01	7.506E+01	7.502E+01	7.501E+01
6.600E+01	1.465E+02	9.083E+01	8.515E+01	8.111E+01	7.844E+01	7.681E+01	7.588E+01	7.540E+01	7.517E+01	7.507E+01	7.503E+01	7.501E+01
6.700E+01	1.467E+02	9.097E+01	8.528E+01	8.122E+01	7.852E+01	7.686E+01	7.592E+01	7.542E+01	7.518E+01	7.507E+01	7.503E+01	7.501E+01
6.800E+01	1.468E+02	9.112E+01	8.542E+01	8.133E+01	7.861E+01	7.692E+01	7.596E+01	7.545E+01	7.519E+01	7.508E+01	7.503E+01	7.501E+01
6.900E+01	1.470E+02	9.126E+01	8.555E+01	8.144E+01	7.869E+01	7.698E+01	7.600E+01	7.547E+01	7.520E+01	7.508E+01	7.503E+01	7.501E+01
7.000E+01	1.471E+02	9.140E+01	8.568E+01	8.156E+01	7.878E+01	7.704E+01	7.603E+01	7.549E+01	7.522E+01	7.509E+01	7.503E+01	7.501E+01
7.100E+01	1.473E+02	9.154E+01	8.582E+01	8.167E+01	7.887E+01	7.710E+01	7.607E+01	7.551E+01	7.523E+01	7.510E+01	7.504E+01	7.501E+01
7.200E+01	1.474E+02	9.168E+01	8.595E+01	8.178E+01	7.895E+01	7.716E+01	7.611E+01	7.553E+01	7.524E+01	7.510E+01	7.504E+01	7.502E+01
7.300E+01	1.476E+02	9.182E+01	8.608E+01	8.189E+01	7.904E+01	7.722E+01	7.615E+01	7.556E+01	7.525E+01	7.511E+01	7.504E+01	7.502E+01
7.400E+01	1.477E+02	9.195E+01	8.621E+01	8.200E+01	7.912E+01	7.729E+01	7.619E+01	7.558E+01	7.527E+01	7.511E+01	7.505E+01	7.502E+01
7.500E+01	1.479E+02	9.209E+01	8.633E+01	8.211E+01	7.921E+01	7.735E+01	7.623E+01	7.561E+01	7.528E+01	7.512E+01	7.505E+01	7.502E+01
7.600E+01	1.480E+02	9.222E+01	8.646E+01	8.222E+01	7.930E+01	7.741E+01	7.627E+01	7.563E+01	7.529E+01	7.513E+01	7.505E+01	7.502E+01
7.700E+01	1.482E+02	9.236E+01	8.659E+01	8.233E+01	7.938E+01	7.747E+01	7.631E+01	7.566E+01	7.531E+01	7.514E+01	7.506E+01	7.502E+01
7.800E+01	1.483E+02	9.249E+01	8.671E+01	8.244E+01	7.947E+01	7.753E+01	7.635E+01	7.568E+01	7.532E+01	7.514E+01	7.506E+01	7.502E+01
7.900E+01	1.484E+02	9.262E+01	8.684E+01	8.255E+01	7.955E+01	7.760E+01	7.640E+01	7.571E+01	7.534E+01	7.515E+01	7.506E+01	7.503E+01
8.000E+01	1.486E+02	9.275E+01	8.696E+01	8.265E+01	7.964E+01	7.766E+01	7.644E+01	7.573E+01	7.535E+01	7.516E+01	7.507E+01	7.503E+01
8.100E+01	1.487E+02	9.288E+01	8.708E+01	8.276E+01	7.972E+01	7.772E+01	7.648E+01	7.576E+01	7.537E+01	7.517E+01	7.507E+01	7.503E+01
8.200E+01	1.489E+02	9.301E+01	8.721E+01	8.287E+01	7.981E+01	7.778E+01	7.652E+01	7.579E+01	7.538E+01	7.518E+01	7.508E+01	7.503E+01
8.300E+01	1.490E+02	9.314E+01	8.733E+01	8.297E+01	7.990E+01	7.785E+01	7.657E+01	7.582E+01	7.540E+01	7.519E+01	7.508E+01	7.503E+01

**SHEET 81-52 OF**

CALC. NO: M-13-116  
 REVISION: 1  
 BY: D. Sullivan DATE: 5/17/90  
 CHECKED: [Signature] DATE: 5-23-90

COMPUTER ROOM UNIT 2/3

8.400E+01	1.491E+02	9.327E+01	8.745E+01	8.308E+01	7.998E+01	7.791E+01	7.661E+01	7.584E+01	7.542E+01	7.520E+01	7.509E+01	7.504E+01
8.500E+01	1.493E+02	9.339E+01	6.757E+01	8.318E+01	8.007E+01	7.798E+01	7.666E+01	7.587E+01	7.543E+01	7.520E+01	7.509E+01	7.504E+01
8.600E+01	1.494E+02	9.352E+01	8.769E+01	8.329E+01	8.015E+01	7.804E+01	7.670E+01	7.590E+01	7.545E+01	7.521E+01	7.510E+01	7.504E+01
8.700E+01	1.495E+02	9.364E+01	8.781E+01	8.339E+01	8.024E+01	7.810E+01	7.674E+01	7.593E+01	7.547E+01	7.522E+01	7.510E+01	7.504E+01
8.800E+01	1.497E+02	9.376E+01	8.792E+01	8.350E+01	8.032E+01	7.817E+01	7.679E+01	7.596E+01	7.549E+01	7.523E+01	7.511E+01	7.505E+01
8.900E+01	1.498E+02	9.389E+01	8.804E+01	8.360E+01	8.041E+01	7.823E+01	7.683E+01	7.599E+01	7.550E+01	7.524E+01	7.511E+01	7.505E+01
9.000E+01	1.499E+02	9.401E+01	8.816E+01	8.370E+01	8.049E+01	7.830E+01	7.688E+01	7.602E+01	7.552E+01	7.526E+01	7.512E+01	7.505E+01
9.100E+01	1.500E+02	9.413E+01	8.827E+01	8.381E+01	8.057E+01	7.836E+01	7.693E+01	7.605E+01	7.554E+01	7.527E+01	7.512E+01	7.506E+01
9.200E+01	1.502E+02	9.425E+01	8.839E+01	8.391E+01	8.066E+01	7.842E+01	7.697E+01	7.608E+01	7.556E+01	7.528E+01	7.513E+01	7.506E+01
9.300E+01	1.503E+02	9.437E+01	8.850E+01	8.401E+01	8.074E+01	7.849E+01	7.702E+01	7.611E+01	7.558E+01	7.529E+01	7.514E+01	7.506E+01
9.400E+01	1.504E+02	9.449E+01	8.862E+01	8.411E+01	8.083E+01	7.855E+01	7.706E+01	7.614E+01	7.560E+01	7.530E+01	7.514E+01	7.506E+01
9.500E+01	1.505E+02	9.461E+01	8.873E+01	8.421E+01	8.091E+01	7.862E+01	7.711E+01	7.617E+01	7.562E+01	7.531E+01	7.515E+01	7.507E+01
9.600E+01	1.507E+02	9.473E+01	8.884E+01	8.431E+01	8.099E+01	7.868E+01	7.716E+01	7.621E+01	7.564E+01	7.532E+01	7.516E+01	7.507E+01
9.700E+01	1.508E+02	9.484E+01	8.895E+01	8.441E+01	8.108E+01	7.875E+01	7.721E+01	7.624E+01	7.566E+01	7.534E+01	7.516E+01	7.508E+01
9.800E+01	1.509E+02	9.496E+01	8.907E+01	8.451E+01	8.116E+01	7.881E+01	7.725E+01	7.627E+01	7.568E+01	7.535E+01	7.517E+01	7.508E+01
9.900E+01	1.510E+02	9.507E+01	8.918E+01	8.461E+01	8.124E+01	7.888E+01	7.730E+01	7.630E+01	7.570E+01	7.536E+01	7.518E+01	7.509E+01
1.000E+02	1.512E+02	9.519E+01	8.929E+01	8.471E+01	8.133E+01	7.894E+01	7.735E+01	7.634E+01	7.572E+01	7.537E+01	7.518E+01	7.509E+01
1.010E+02	1.513E+02	9.530E+01	8.940E+01	8.481E+01	8.141E+01	7.901E+01	7.740E+01	7.637E+01	7.575E+01	7.539E+01	7.519E+01	7.509E+01
1.020E+02	1.514E+02	9.542E+01	8.951E+01	8.491E+01	8.149E+01	7.907E+01	7.745E+01	7.640E+01	7.577E+01	7.540E+01	7.520E+01	7.510E+01
1.030E+02	1.515E+02	9.553E+01	8.961E+01	8.501E+01	8.158E+01	7.914E+01	7.749E+01	7.644E+01	7.579E+01	7.541E+01	7.521E+01	7.510E+01
1.040E+02	1.516E+02	9.564E+01	8.972E+01	8.510E+01	8.166E+01	7.921E+01	7.754E+01	7.647E+01	7.581E+01	7.543E+01	7.522E+01	7.511E+01
1.050E+02	1.517E+02	9.575E+01	8.983E+01	8.520E+01	8.174E+01	7.927E+01	7.759E+01	7.650E+01	7.584E+01	7.544E+01	7.522E+01	7.511E+01
1.060E+02	1.519E+02	9.587E+01	8.994E+01	8.530E+01	8.182E+01	7.934E+01	7.764E+01	7.654E+01	7.586E+01	7.546E+01	7.523E+01	7.511E+01
1.070E+02	1.520E+02	9.598E+01	9.004E+01	8.539E+01	8.190E+01	7.940E+01	7.769E+01	7.657E+01	7.588E+01	7.547E+01	7.524E+01	7.512E+01
1.080E+02	1.521E+02	9.609E+01	9.015E+01	8.549E+01	8.199E+01	7.947E+01	7.774E+01	7.661E+01	7.590E+01	7.549E+01	7.525E+01	7.512E+01
1.090E+02	1.522E+02	9.620E+01	9.026E+01	8.559E+01	8.207E+01	7.953E+01	7.779E+01	7.664E+01	7.593E+01	7.550E+01	7.526E+01	7.513E+01
1.100E+02	1.523E+02	9.630E+01	9.036E+01	8.568E+01	8.215E+01	7.960E+01	7.784E+01	7.668E+01	7.595E+01	7.552E+01	7.527E+01	7.514E+01



CALC. NO:

M-73-116

REVISION:

1

BY: T. SHIN

DATE: 5/1/90

CHECKED: *[Signature]*

DATE: 5-23-90

COMPUTER ROOM UNIT 2/3

1.110E+02	1.524E+02	9.641E+01	9.047E+01	8.578E+01	8.223E+01	7.964E+01	7.789E+01	7.672E+01	7.598E+01	7.553E+01	7.528E+01	7.514E+01
1.120E+02	1.526E+02	9.652E+01	9.057E+01	8.587E+01	8.231E+01	7.973E+01	7.794E+01	7.675E+01	7.630E+01	7.555E+01	7.529E+01	7.515E+01
1.130E+02	1.527E+02	9.663E+01	9.067E+01	8.596E+01	8.239E+01	7.979E+01	7.799E+01	7.677E+01	7.630E+01	7.556E+01	7.530E+01	7.515E+01
1.140E+02	1.528E+02	9.673E+01	9.078E+01	8.606E+01	8.247E+01	7.986E+01	7.804E+01	7.682E+01	7.605E+01	7.558E+01	7.531E+01	7.516E+01
1.150E+02	1.529E+02	9.684E+01	9.088E+01	8.615E+01	8.255E+01	7.993E+01	7.809E+01	7.686E+01	7.608E+01	7.560E+01	7.532E+01	7.516E+01
1.160E+02	1.530E+02	9.695E+01	9.098E+01	8.625E+01	8.263E+01	7.999E+01	7.814E+01	7.690E+01	7.610E+01	7.561E+01	7.533E+01	7.517E+01
1.170E+02	1.531E+02	9.705E+01	9.108E+01	8.634E+01	8.271E+01	8.006E+01	7.819E+01	7.693E+01	7.613E+01	7.563E+01	7.534E+01	7.518E+01
1.180E+02	1.532E+02	9.716E+01	9.118E+01	8.643E+01	8.279E+01	8.012E+01	7.824E+01	7.697E+01	7.615E+01	7.565E+01	7.535E+01	7.518E+01
1.190E+02	1.533E+02	9.726E+01	9.129E+01	8.652E+01	8.287E+01	8.019E+01	7.829E+01	7.701E+01	7.618E+01	7.566E+01	7.536E+01	7.519E+01
1.200E+02	1.534E+02	9.737E+01	9.139E+01	8.662E+01	8.295E+01	8.025E+01	7.834E+01	7.705E+01	7.620E+01	7.568E+01	7.537E+01	7.520E+01
1.210E+02	1.535E+02	9.747E+01	9.149E+01	8.671E+01	8.303E+01	8.032E+01	7.839E+01	7.708E+01	7.623E+01	7.570E+01	7.538E+01	7.520E+01
1.220E+02	1.536E+02	9.757E+01	9.159E+01	8.680E+01	8.311E+01	8.038E+01	7.844E+01	7.712E+01	7.626E+01	7.572E+01	7.539E+01	7.521E+01
1.230E+02	1.538E+02	9.767E+01	9.168E+01	8.689E+01	8.319E+01	8.045E+01	7.849E+01	7.716E+01	7.630E+01	7.574E+01	7.541E+01	7.522E+01
1.240E+02	1.539E+02	9.778E+01	9.178E+01	8.698E+01	8.327E+01	8.051E+01	7.855E+01	7.720E+01	7.631E+01	7.575E+01	7.542E+01	7.523E+01
1.250E+02	1.540E+02	9.788E+01	9.188E+01	8.707E+01	8.335E+01	8.058E+01	7.860E+01	7.724E+01	7.634E+01	7.577E+01	7.543E+01	7.523E+01
1.260E+02	1.541E+02	9.798E+01	9.198E+01	8.716E+01	8.343E+01	8.064E+01	7.865E+01	7.727E+01	7.637E+01	7.578E+01	7.544E+01	7.524E+01
1.270E+02	1.542E+02	9.805E+01	9.208E+01	8.725E+01	8.351E+01	8.071E+01	7.870E+01	7.731E+01	7.639E+01	7.581E+01	7.545E+01	7.525E+01
1.280E+02	1.543E+02	9.818E+01	9.218E+01	8.734E+01	8.359E+01	8.077E+01	7.875E+01	7.735E+01	7.642E+01	7.583E+01	7.547E+01	7.526E+01
1.290E+02	1.544E+02	9.828E+01	9.227E+01	8.743E+01	8.366E+01	8.084E+01	7.880E+01	7.739E+01	7.645E+01	7.585E+01	7.548E+01	7.526E+01
1.300E+02	1.545E+02	9.838E+01	9.237E+01	8.752E+01	8.374E+01	8.090E+01	7.885E+01	7.743E+01	7.648E+01	7.587E+01	7.549E+01	7.527E+01
1.310E+02	1.546E+02	9.848E+01	9.246E+01	8.761E+01	8.382E+01	8.097E+01	7.891E+01	7.747E+01	7.651E+01	7.589E+01	7.550E+01	7.528E+01
1.320E+02	1.547E+02	9.858E+01	9.256E+01	8.770E+01	8.390E+01	8.104E+01	7.896E+01	7.751E+01	7.653E+01	7.591E+01	7.552E+01	7.529E+01
1.330E+02	1.548E+02	9.867E+01	9.266E+01	8.778E+01	8.397E+01	8.110E+01	7.901E+01	7.755E+01	7.656E+01	7.593E+01	7.553E+01	7.530E+01
1.340E+02	1.549E+02	9.877E+01	9.275E+01	8.787E+01	8.405E+01	8.116E+01	7.906E+01	7.759E+01	7.659E+01	7.595E+01	7.554E+01	7.531E+01
1.350E+02	1.550E+02	9.887E+01	9.285E+01	8.796E+01	8.413E+01	8.123E+01	7.911E+01	7.763E+01	7.662E+01	7.597E+01	7.556E+01	7.532E+01
1.360E+02	1.551E+02	9.897E+01	9.294E+01	8.805E+01	8.421E+01	8.129E+01	7.917E+01	7.767E+01	7.665E+01	7.599E+01	7.557E+01	7.533E+01
1.370E+02	1.552E+02	9.906E+01	9.303E+01	8.813E+01	8.428E+01	8.136E+01	7.922E+01	7.771E+01	7.668E+01	7.601E+01	7.559E+01	7.533E+01



SHEET 11-54 OF 64

CALC. NO: M-73-116  
REVISION: 1  
BY: J. Sullivan DATE: 5/17/90  
CHECKED: J. J. DATE: 5/23/90

COMPUTER ROOM UNIT 2/3

1.330E+02	1.553E+02	9.916E+01	9.313E+01	8.436E+01	8.142E+01	7.927E+01	7.775E+01	7.671E+01	7.603E+01	7.534E+01
1.390E+02	1.584E+02	9.926E+01	9.322E+01	8.444E+01	8.149E+01	7.932E+01	7.779E+01	7.674E+01	7.605E+01	7.535E+01
1.400E+02	1.555E+02	9.935E+01	9.331E+01	8.451E+01	8.155E+01	7.937E+01	7.783E+01	7.677E+01	7.607E+01	7.536E+01
1.410E+02	1.556E+02	9.945E+01	9.341E+01	8.459E+01	8.162E+01	7.943E+01	7.787E+01	7.680E+01	7.609E+01	7.537E+01
1.420E+02	1.557E+02	9.954E+01	9.350E+01	8.467E+01	8.168E+01	7.948E+01	7.791E+01	7.683E+01	7.611E+01	7.538E+01
1.430E+02	1.558E+02	9.963E+01	9.359E+01	8.475E+01	8.175E+01	7.953E+01	7.795E+01	7.686E+01	7.613E+01	7.539E+01
1.440E+02	1.559E+02	9.973E+01	9.368E+01	8.482E+01	8.181E+01	7.958E+01	7.799E+01	7.689E+01	7.616E+01	7.540E+01
1.450E+02	1.560E+02	9.982E+01	9.377E+01	8.489E+01	8.188E+01	7.963E+01	7.803E+01	7.692E+01	7.618E+01	7.541E+01
1.460E+02	1.561E+02	9.992E+01	9.386E+01	8.497E+01	8.194E+01	7.968E+01	7.807E+01	7.695E+01	7.620E+01	7.542E+01
1.470E+02	1.562E+02	1.000E+02	9.395E+01	8.504E+01	8.200E+01	7.974E+01	7.811E+01	7.698E+01	7.622E+01	7.543E+01
1.480E+02	1.563E+02	1.001E+02	9.404E+01	8.512E+01	8.207E+01	7.979E+01	7.815E+01	7.701E+01	7.624E+01	7.545E+01
1.490E+02	1.564E+02	1.002E+02	9.413E+01	8.519E+01	8.213E+01	7.985E+01	7.819E+01	7.704E+01	7.627E+01	7.546E+01
1.500E+02	1.565E+02	1.003E+02	9.422E+01	8.527E+01	8.220E+01	7.990E+01	7.824E+01	7.707E+01	7.629E+01	7.547E+01
1.510E+02	1.565E+02	1.004E+02	9.431E+01	8.534E+01	8.226E+01	7.995E+01	7.828E+01	7.710E+01	7.631E+01	7.548E+01
1.520E+02	1.566E+02	1.005E+02	9.440E+01	8.542E+01	8.232E+01	8.000E+01	7.832E+01	7.714E+01	7.633E+01	7.549E+01
1.530E+02	1.567E+02	1.006E+02	9.449E+01	8.549E+01	8.239E+01	8.006E+01	7.836E+01	7.717E+01	7.636E+01	7.550E+01
1.540E+02	1.568E+02	1.007E+02	9.458E+01	8.557E+01	8.245E+01	8.011E+01	7.840E+01	7.720E+01	7.638E+01	7.551E+01
1.550E+02	1.569E+02	1.007E+02	9.467E+01	8.564E+01	8.252E+01	8.016E+01	7.844E+01	7.723E+01	7.640E+01	7.553E+01
1.560E+02	1.570E+02	1.008E+02	9.476E+01	8.571E+01	8.259E+01	8.021E+01	7.849E+01	7.726E+01	7.643E+01	7.554E+01
1.570E+02	1.571E+02	1.009E+02	9.484E+01	8.579E+01	8.266E+01	8.027E+01	7.853E+01	7.730E+01	7.645E+01	7.555E+01
1.580E+02	1.572E+02	1.010E+02	9.493E+01	8.586E+01	8.271E+01	8.032E+01	7.857E+01	7.733E+01	7.648E+01	7.556E+01
1.590E+02	1.573E+02	1.011E+02	9.502E+01	8.593E+01	8.277E+01	8.037E+01	7.861E+01	7.736E+01	7.650E+01	7.557E+01
1.600E+02	1.574E+02	1.012E+02	9.510E+01	8.601E+01	8.283E+01	8.043E+01	7.865E+01	7.739E+01	7.652E+01	7.559E+01
1.610E+02	1.575E+02	1.013E+02	9.519E+01	8.608E+01	8.290E+01	8.048E+01	7.870E+01	7.742E+01	7.655E+01	7.560E+01
1.620E+02	1.576E+02	1.014E+02	9.528E+01	8.615E+01	8.296E+01	8.053E+01	7.874E+01	7.746E+01	7.657E+01	7.561E+01
1.630E+02	1.577E+02	1.015E+02	9.536E+01	8.623E+01	8.302E+01	8.058E+01	7.878E+01	7.749E+01	7.660E+01	7.562E+01
1.640E+02	1.577E+02	1.015E+02	9.545E+01	8.630E+01	8.309E+01	8.064E+01	7.882E+01	7.752E+01	7.662E+01	7.564E+01

CALC. NO: M-73-116  
 REVISION: 1  
 BY: J. SHAW DATE: 5/17/90  
 CHECKED: DATE: 5-23-90

1.650E+02	1.578E+02	1.016E+02	9.553E+01	9.047E+01	8.637E+01	8.315E+01	8.069E+01	7.887E+01	7.756E+01	7.665E+01	7.604E+01	7.565E+01
1.660E+02	1.579E+02	1.017E+02	9.562E+01	9.055E+01	8.644E+01	8.321E+01	8.074E+01	7.891E+01	7.759E+01	7.667E+01	7.606E+01	7.566E+01
1.670E+02	1.580E+02	1.018E+02	9.570E+01	9.063E+01	8.652E+01	8.328E+01	8.079E+01	7.895E+01	7.762E+01	7.670E+01	7.608E+01	7.568E+01
1.680E+02	1.581E+02	1.019E+02	9.579E+01	9.071E+01	8.659E+01	8.334E+01	8.085E+01	7.899E+01	7.766E+01	7.672E+01	7.609E+01	7.569E+01
1.690E+02	1.582E+02	1.020E+02	9.587E+01	9.079E+01	8.666E+01	8.340E+01	8.090E+01	7.904E+01	7.769E+01	7.675E+01	7.611E+01	7.571E+01
1.700E+02	1.583E+02	1.021E+02	9.596E+01	9.087E+01	8.673E+01	8.346E+01	8.095E+01	7.908E+01	7.772E+01	7.677E+01	7.613E+01	7.572E+01
1.710E+02	1.584E+02	1.021E+02	9.604E+01	9.095E+01	8.680E+01	8.353E+01	8.101E+01	7.912E+01	7.776E+01	7.680E+01	7.615E+01	7.573E+01
1.720E+02	1.585E+02	1.022E+02	9.613E+01	9.103E+01	8.688E+01	8.359E+01	8.106E+01	7.916E+01	7.779E+01	7.682E+01	7.617E+01	7.575E+01
1.730E+02	1.585E+02	1.023E+02	9.621E+01	9.110E+01	8.695E+01	8.365E+01	8.111E+01	7.921E+01	7.782E+01	7.685E+01	7.619E+01	7.576E+01
1.740E+02	1.586E+02	1.024E+02	9.629E+01	9.118E+01	8.702E+01	8.371E+01	8.116E+01	7.925E+01	7.786E+01	7.688E+01	7.621E+01	7.578E+01
1.750E+02	1.587E+02	1.025E+02	9.637E+01	9.126E+01	8.709E+01	8.379E+01	8.122E+01	7.929E+01	7.789E+01	7.690E+01	7.623E+01	7.579E+01
1.760E+02	1.588E+02	1.026E+02	9.646E+01	9.134E+01	8.716E+01	8.384E+01	8.127E+01	7.934E+01	7.793E+01	7.693E+01	7.625E+01	7.581E+01
1.770E+02	1.589E+02	1.027E+02	9.654E+01	9.142E+01	8.723E+01	8.390E+01	8.132E+01	7.938E+01	7.796E+01	7.695E+01	7.627E+01	7.582E+01
1.780E+02	1.590E+02	1.027E+02	9.662E+01	9.149E+01	8.730E+01	8.396E+01	8.137E+01	7.942E+01	7.799E+01	7.698E+01	7.629E+01	7.584E+01
1.790E+02	1.591E+02	1.028E+02	9.670E+01	9.157E+01	8.737E+01	8.403E+01	8.143E+01	7.947E+01	7.803E+01	7.701E+01	7.631E+01	7.585E+01
1.800E+02	1.591E+02	1.029E+02	9.679E+01	9.165E+01	8.744E+01	8.409E+01	8.148E+01	7.951E+01	7.806E+01	7.703E+01	7.633E+01	7.587E+01
1.810E+02	1.592E+02	1.030E+02	9.687E+01	9.173E+01	8.751E+01	8.415E+01	8.153E+01	7.955E+01	7.810E+01	7.706E+01	7.635E+01	7.588E+01
1.820E+02	1.593E+02	1.031E+02	9.695E+01	9.180E+01	8.758E+01	8.421E+01	8.159E+01	7.960E+01	7.813E+01	7.709E+01	7.637E+01	7.590E+01
1.830E+02	1.594E+02	1.032E+02	9.703E+01	9.188E+01	8.765E+01	8.427E+01	8.164E+01	7.964E+01	7.817E+01	7.711E+01	7.639E+01	7.591E+01
1.840E+02	1.595E+02	1.032E+02	9.711E+01	9.196E+01	8.772E+01	8.434E+01	8.169E+01	7.968E+01	7.820E+01	7.714E+01	7.641E+01	7.593E+01
1.850E+02	1.596E+02	1.033E+02	9.719E+01	9.203E+01	8.779E+01	8.440E+01	8.174E+01	7.973E+01	7.824E+01	7.717E+01	7.643E+01	7.594E+01
1.860E+02	1.596E+02	1.033E+02	9.727E+01	9.211E+01	8.786E+01	8.446E+01	8.180E+01	7.977E+01	7.827E+01	7.720E+01	7.645E+01	7.596E+01
1.870E+02	1.597E+02	1.035E+02	9.735E+01	9.218E+01	8.793E+01	8.452E+01	8.185E+01	7.981E+01	7.831E+01	7.722E+01	7.647E+01	7.598E+01
1.880E+02	1.598E+02	1.036E+02	9.743E+01	9.226E+01	8.800E+01	8.458E+01	8.190E+01	7.986E+01	7.834E+01	7.725E+01	7.649E+01	7.599E+01
1.890E+02	1.599E+02	1.036E+02	9.751E+01	9.234E+01	8.807E+01	8.464E+01	8.195E+01	7.990E+01	7.838E+01	7.728E+01	7.651E+01	7.601E+01
1.900E+02	1.600E+02	1.037E+02	9.759E+01	9.241E+01	8.814E+01	8.470E+01	8.201E+01	7.995E+01	7.841E+01	7.731E+01	7.654E+01	7.603E+01
1.910E+02	1.601E+02	1.038E+02	9.767E+01	9.249E+01	8.821E+01	8.477E+01	8.206E+01	7.999E+01	7.845E+01	7.733E+01	7.656E+01	7.604E+01

PROPERTY OF 84

CALC. NO: M-1316  
 REVISION: 1  
 BY: J. S. H. J. M. DATE: 5-23-70  
 CHECKED: DATE: 5-23-70

COMPUTER ROOM UNIT 2/3

1.920E+02	1.601E+02	1.039E+02	9.775E+01	9.256E+01	8.828E+01	8.483E+01	8.211E+01	8.003E+01	7.848E+01	7.736E+01	7.658E+01	7.606E+01
1.930E+02	1.602E+02	1.040E+02	9.783E+01	9.264E+01	8.835E+01	8.489E+01	8.216E+01	8.008E+01	7.852E+01	7.739E+01	7.660E+01	7.608E+01
1.940E+02	1.603E+02	1.041E+02	9.791E+01	9.271E+01	8.842E+01	8.495E+01	8.222E+01	8.012E+01	7.855E+01	7.742E+01	7.662E+01	7.609E+01
1.950E+02	1.604E+02	1.041E+02	9.799E+01	9.279E+01	8.848E+01	8.501E+01	8.227E+01	8.016E+01	7.859E+01	7.745E+01	7.665E+01	7.611E+01
1.960E+02	1.605E+02	1.042E+02	9.806E+01	9.286E+01	8.855E+01	8.507E+01	8.232E+01	8.021E+01	7.863E+01	7.747E+01	7.667E+01	7.613E+01
1.970E+02	1.606E+02	1.043E+02	9.814E+01	9.293E+01	8.862E+01	8.513E+01	8.237E+01	8.025E+01	7.869E+01	7.750E+01	7.669E+01	7.615E+01
1.980E+02	1.606E+02	1.044E+02	9.822E+01	9.301E+01	8.869E+01	8.519E+01	8.243E+01	8.030E+01	7.870E+01	7.753E+01	7.671E+01	7.616E+01
1.990E+02	1.607E+02	1.044E+02	9.830E+01	9.308E+01	8.876E+01	8.525E+01	8.248E+01	8.034E+01	7.873E+01	7.756E+01	7.673E+01	7.618E+01
2.000E+02	1.608E+02	1.045E+02	9.837E+01	9.316E+01	8.883E+01	8.531E+01	8.253E+01	8.036E+01	7.877E+01	7.759E+01	7.676E+01	7.620E+01
2.010E+02	1.609E+02	1.046E+02	9.845E+01	9.323E+01	8.889E+01	8.537E+01	8.258E+01	8.043E+01	7.880E+01	7.762E+01	7.678E+01	7.622E+01
2.020E+02	1.610E+02	1.047E+02	9.853E+01	9.330E+01	8.896E+01	8.543E+01	8.264E+01	8.047E+01	7.884E+01	7.765E+01	7.680E+01	7.624E+01
2.030E+02	1.610E+02	1.048E+02	9.861E+01	9.338E+01	8.903E+01	8.549E+01	8.269E+01	8.052E+01	7.888E+01	7.768E+01	7.683E+01	7.625E+01
2.040E+02	1.611E+02	1.048E+02	9.868E+01	9.345E+01	8.910E+01	8.555E+01	8.274E+01	8.056E+01	7.891E+01	7.770E+01	7.685E+01	7.627E+01
2.050E+02	1.612E+02	1.049E+02	9.876E+01	9.352E+01	8.916E+01	8.561E+01	8.279E+01	8.060E+01	7.895E+01	7.773E+01	7.687E+01	7.629E+01
2.060E+02	1.613E+02	1.050E+02	9.884E+01	9.359E+01	8.923E+01	8.568E+01	8.285E+01	8.065E+01	7.899E+01	7.776E+01	7.690E+01	7.631E+01
2.070E+02	1.614E+02	1.051E+02	9.891E+01	9.367E+01	8.930E+01	8.574E+01	8.290E+01	8.069E+01	7.902E+01	7.779E+01	7.692E+01	7.633E+01
2.080E+02	1.614E+02	1.052E+02	9.899E+01	9.374E+01	8.936E+01	8.580E+01	8.295E+01	8.074E+01	7.906E+01	7.782E+01	7.694E+01	7.635E+01
2.090E+02	1.615E+02	1.052E+02	9.906E+01	9.381E+01	8.943E+01	8.586E+01	8.300E+01	8.078E+01	7.910E+01	7.785E+01	7.697E+01	7.637E+01
2.100E+02	1.616E+02	1.053E+02	9.914E+01	9.388E+01	8.950E+01	8.592E+01	8.306E+01	8.083E+01	7.913E+01	7.788E+01	7.699E+01	7.639E+01
2.110E+02	1.617E+02	1.054E+02	9.921E+01	9.396E+01	8.956E+01	8.597E+01	8.311E+01	8.087E+01	7.917E+01	7.791E+01	7.701E+01	7.641E+01
2.120E+02	1.618E+02	1.055E+02	9.929E+01	9.403E+01	8.963E+01	8.603E+01	8.316E+01	8.091E+01	7.921E+01	7.794E+01	7.704E+01	7.642E+01
2.130E+02	1.618E+02	1.055E+02	9.936E+01	9.410E+01	8.970E+01	8.609E+01	8.321E+01	8.096E+01	7.924E+01	7.797E+01	7.706E+01	7.644E+01
2.140E+02	1.619E+02	1.056E+02	9.944E+01	9.417E+01	8.976E+01	8.615E+01	8.326E+01	8.100E+01	7.928E+01	7.800E+01	7.709E+01	7.646E+01
2.150E+02	1.620E+02	1.057E+02	9.951E+01	9.424E+01	8.983E+01	8.621E+01	8.332E+01	8.105E+01	7.932E+01	7.803E+01	7.711E+01	7.648E+01
2.160E+02	1.621E+02	1.058E+02	9.959E+01	9.431E+01	8.989E+01	8.627E+01	8.337E+01	8.109E+01	7.935E+01	7.806E+01	7.713E+01	7.650E+01
2.170E+02	1.621E+02	1.058E+02	9.966E+01	9.438E+01	8.996E+01	8.633E+01	8.342E+01	8.114E+01	7.939E+01	7.809E+01	7.716E+01	7.652E+01
2.180E+02	1.622E+02	1.059E+02	9.974E+01	9.445E+01	9.003E+01	8.639E+01	8.347E+01	8.118E+01	7.943E+01	7.812E+01	7.718E+01	7.654E+01

SHEET 01-01 OF 89

CALC. NO: M-13-116

REVISION: 1

BY: J. S. M. M. DATE: 5-23-70

CHECKED: J. S. M. DATE: 5-23-70

COMPUTER ROOM UNIT 2/3

2. 190E+02	1. 623E+02	1. 060E+02	9. 981E+01	9. 453E+01	9. 009E+01	8. 645E+01	8. 352E+01	8. 123E+01	7. 946E+01	7. 815E+01	7. 721E+01	7. 656E+01
2. 200E+02	1. 624E+02	1. 061E+02	9. 989E+01	9. 460E+01	9. 016E+01	8. 651E+01	8. 358E+01	8. 127E+01	7. 950E+01	7. 818E+01	7. 723E+01	7. 658E+01
2. 210E+02	1. 624E+02	1. 061E+02	9. 996E+01	9. 467E+01	9. 022E+01	8. 657E+01	8. 363E+01	8. 131E+01	7. 954E+01	7. 821E+01	7. 726E+01	7. 660E+01
2. 220E+02	1. 625E+02	1. 062E+02	1. 000E+02	9. 474E+01	9. 029E+01	8. 663E+01	8. 368E+01	8. 136E+01	7. 958E+01	7. 824E+01	7. 728E+01	7. 663E+01
2. 230E+02	1. 626E+02	1. 063E+02	1. 001E+02	9. 481E+01	9. 035E+01	8. 669E+01	8. 373E+01	8. 140E+01	7. 961E+01	7. 827E+01	7. 731E+01	7. 665E+01
2. 240E+02	1. 627E+02	1. 064E+02	1. 002E+02	9. 488E+01	9. 042E+01	8. 675E+01	8. 378E+01	8. 145E+01	7. 965E+01	7. 831E+01	7. 735E+01	7. 667E+01
2. 250E+02	1. 627E+02	1. 064E+02	1. 003E+02	9. 495E+01	9. 048E+01	8. 680E+01	8. 384E+01	8. 149E+01	7. 969E+01	7. 834E+01	7. 736E+01	7. 669E+01
2. 260E+02	1. 628E+02	1. 065E+02	1. 003E+02	9. 502E+01	9. 055E+01	8. 686E+01	8. 389E+01	8. 154E+01	7. 973E+01	7. 837E+01	7. 738E+01	7. 671E+01
2. 270E+02	1. 629E+02	1. 066E+02	1. 004E+02	9. 509E+01	9. 061E+01	8. 692E+01	8. 394E+01	8. 158E+01	7. 976E+01	7. 840E+01	7. 741E+01	7. 673E+01
2. 280E+02	1. 630E+02	1. 067E+02	1. 005E+02	9. 516E+01	9. 068E+01	8. 698E+01	8. 399E+01	8. 163E+01	7. 980E+01	7. 843E+01	7. 743E+01	7. 675E+01
2. 290E+02	1. 630E+02	1. 067E+02	1. 005E+02	9. 522E+01	9. 074E+01	8. 704E+01	8. 404E+01	8. 167E+01	7. 984E+01	7. 846E+01	7. 746E+01	7. 677E+01
2. 300E+02	1. 631E+02	1. 068E+02	1. 006E+02	9. 529E+01	9. 081E+01	8. 710E+01	8. 409E+01	8. 172E+01	7. 988E+01	7. 849E+01	7. 749E+01	7. 679E+01
2. 310E+02	1. 632E+02	1. 069E+02	1. 007E+02	9. 536E+01	9. 087E+01	8. 716E+01	8. 415E+01	8. 176E+01	7. 991E+01	7. 852E+01	7. 751E+01	7. 682E+01
2. 320E+02	1. 633E+02	1. 070E+02	1. 008E+02	9. 543E+01	9. 094E+01	8. 721E+01	8. 420E+01	8. 180E+01	7. 995E+01	7. 855E+01	7. 754E+01	7. 684E+01
2. 330E+02	1. 633E+02	1. 070E+02	1. 008E+02	9. 550E+01	9. 100E+01	8. 727E+01	8. 425E+01	8. 185E+01	7. 999E+01	7. 859E+01	7. 756E+01	7. 686E+01
2. 340E+02	1. 634E+02	1. 071E+02	1. 009E+02	9. 557E+01	9. 106E+01	8. 733E+01	8. 430E+01	8. 189E+01	8. 003E+01	7. 862E+01	7. 759E+01	7. 688E+01
2. 350E+02	1. 635E+02	1. 072E+02	1. 010E+02	9. 564E+01	9. 113E+01	8. 739E+01	8. 435E+01	8. 194E+01	8. 006E+01	7. 865E+01	7. 762E+01	7. 690E+01
2. 360E+02	1. 636E+02	1. 072E+02	1. 010E+02	9. 571E+01	9. 119E+01	8. 745E+01	8. 440E+01	8. 198E+01	8. 010E+01	7. 868E+01	7. 764E+01	7. 692E+01
2. 370E+02	1. 636E+02	1. 073E+02	1. 011E+02	9. 577E+01	9. 126E+01	8. 751E+01	8. 446E+01	8. 203E+01	8. 014E+01	7. 871E+01	7. 767E+01	7. 695E+01
2. 380E+02	1. 637E+02	1. 074E+02	1. 012E+02	9. 584E+01	9. 132E+01	8. 756E+01	8. 451E+01	8. 207E+01	8. 018E+01	7. 874E+01	7. 770E+01	7. 697E+01
2. 390E+02	1. 638E+02	1. 075E+02	1. 013E+02	9. 591E+01	9. 138E+01	8. 762E+01	8. 456E+01	8. 212E+01	8. 022E+01	7. 878E+01	7. 772E+01	7. 699E+01
2. 400E+02	1. 639E+02	1. 075E+02	1. 013E+02	9. 598E+01	9. 145E+01	8. 768E+01	8. 461E+01	8. 216E+01	8. 025E+01	7. 881E+01	7. 775E+01	7. 701E+01

ENGINEERING DEPARTMENT

**CALCULATION SHEET**SUBJECT: Room Temperature Response During  
Station BlackoutCALC NO. M-73-116 REV. 1J.O. NO. 6711 MADE BY: L. Shlafman DATE: 5-4-90 CHECKED BY: [Signature] DATE: 5-23-90**8.5 AUXILIARY FEED WATER PUMP ROOM**

Room Heat Transfer Area (ref.3)

Walls Areas (concrete wall):

$$A_{\text{SOUTH WALL}} = 903 \text{ ft}^2$$

$$A_{\text{NORTH WALL}} = 903 \text{ ft}^2$$

$$A_{\text{EAST \& WEST WALL}} = 378 \text{ ft}^2$$

Ceiling (concrete slab):

$$A_{\text{CEILING}} = 1715 \text{ ft}^2$$

$$A_{\text{TOTAL}} = (903 \times 2) + (378 \times 2) + 1715 = 4277 \text{ ft}^2$$

Room Volume:

$$\text{Volume of empty room} = 64.5 \times 27 \times 14 = 24381 \text{ ft}^3 \text{ (ref.3)}$$

Assume that volume of equipment, pipe and hanger supports  
equal to 5% of total volume

$$V_{\text{NET VOLUME}} = 24381 \times 0.95 = 23162 \text{ ft}^3$$

Initial room ambient temperature = 104 deg F (ref.3)

Conservatively assume that initial wall ambient temperature = 104 F

Heat Gain (ref. 3 pg 15c):

Total heat dissipated to the room is equal to

$$Q_{\text{total}} = 13635 \text{ Btu/hr}$$

Sample CalculationFrom Equations 1 and 2, at  $i = 1$  minute

$$T_{\text{air}, i=1} = F_1/F_2 + T_{\text{air}, i=0} \quad \text{where:}$$

$$F_1 = Q_{\text{di}} = 13635/60 = 227.25 \text{ Btu/min, and}$$

$$F_2 = \rho_a \cdot V_{\text{air}} C_{\text{pair}} = (0.07)(23162)(0.24) = 389.12 \text{ Btu/deg F}$$



ENGINEERING DEPARTMENT

**CALCULATION SHEET**SUBJECT: Room Temperature Response During  
Station BlackoutCALC NO. M-73-116 REV. 1J.O.NO. 6711 MADE BY: I. Shlafman DATE: 5-4-90 CHECKED BY: [Signature] DATE: 5-23-90

$$T_{air,i=1} = 22.25 / 389.12 + 104 = 104.6 \text{ deg F}$$

At  $i = 2$  minutes:

$$T_{air,i=2} = [F_1 - F_3(T_{air,i=1} - T_0)] / F_2 + T_{air,i=1}, \text{ where}$$

$$F_3 = h_{air} A \Delta t = 1.47 \times 4277 \times 1/60 = 142.57 \text{ Btu/deg F}$$

$$T_{air,i=2} = [227.25 - 142.57(104.6 - 104)] / 389.12 + 104.6 = 105 \text{ deg F}$$

$$B_1 = h \cdot x / k = 1.47 \times 0.0833 / 1.04 = 0.117 \approx 0.12$$

$$F_0 = k \cdot t / pc \cdot x^2 = (1.04 \times 1/60) / 143.58 \times 0.21 \times 0.0833^2 = 0.0828$$

Stability criterion requires that the coefficient for  $T_{0,i-1}$  in equation 3 be greater than or equal to zero

$$1 - 2B_1F_0 - 2F_0 \geq 0 \text{ or}$$

$$F_0 (1 + B_1) \leq 1/2 \text{ or } F_0 \leq 1/2 (1/1 + 0.12) \leq 0.45$$

$$\text{or } \alpha \cdot t / x^2 \leq 0.45 ; \quad \alpha = k / pc$$

$$\Delta t \leq .045 \times x^2 / \alpha \text{ or } \Delta t \leq 0.45 \times 0.0833^2 \times 143.58 \times 0.21 / 1.04$$

$$\Delta t \leq 0.0105 \text{ hr (5.4 min) ,}$$

therefore,  $\Delta t = 1$  minute satisfies the stability criterion.

To calculate the wall temperature and interior "node" temperature we used equations 3 and 5 from general calculations.

$$i=2 \text{ min, } T_{0,2} = 2 \times 0.0828 [0.12 \times 104.6 + 104] + [1 - 2 \times 0.0828 \times 0.12 - 2 \times 0.0828] \times 104 = 104 \text{ F}$$

$$\text{from equation 5, } F_4 = 1 - 2F_0 = 1 - 2 \times 0.0828 = 0.8344$$

$$T_{1,2} = 0.0828 \times (104 + 104) + 0.8344 \times 104 = 104 \text{ F}$$

$$T_{2,2} = 0.0828 \times (104 + 104) + 0.8344 \times 104 = 104 \text{ F}$$

ETC...

For this iterative calculations, the equations 1,2,3 and 5 were entered into LOTUS program and the results are tabulated on pages 60 thru 69.

[illegible]

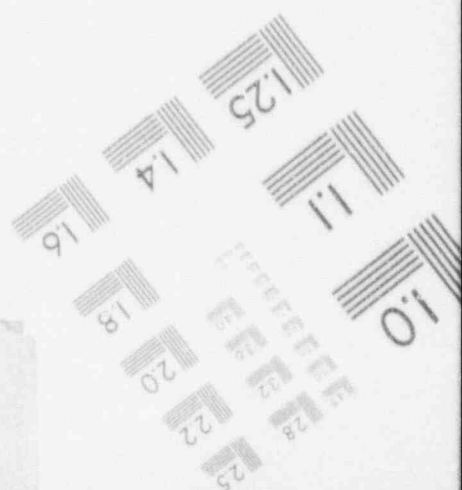
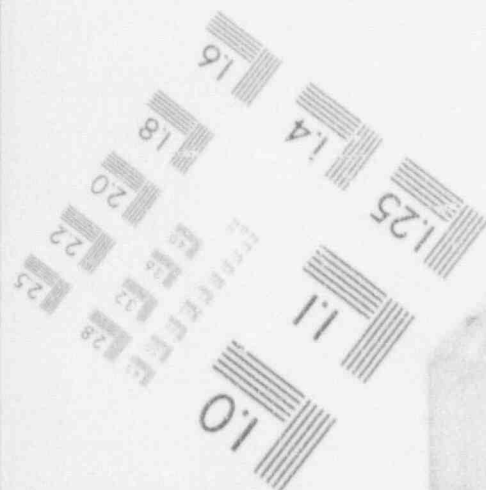
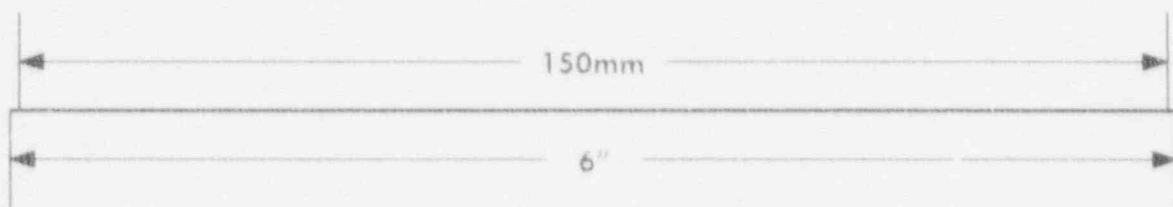
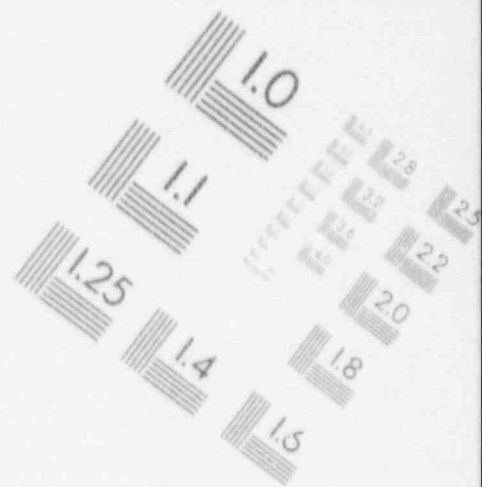
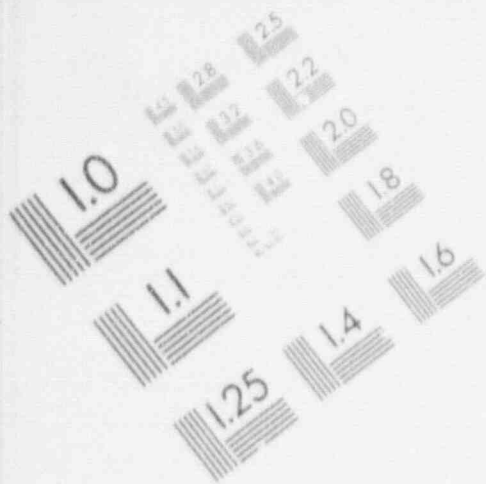
CHECKED [Signature] DATE: 5-23-90

SHEET 21-61 OF 84

[illegible]

# 1

## IMAGE EVALUATION TEST TARGET (MT-3)



CHECKED for S DATE 5-23-90

SHEET 12 OF 24

AFW PUMP ROOM UNIT 2/3

[illegible]



CHECKED Page 42 DATE: 5-23-90

SHEET 59 OF 68

[illegible]

M-73-110

PL-1

ATA-1 next 2

## UNIT2 LOAD

Table 9

Black Unit HVAC Rest Load

Room #228	Heat Dissipation	Uncorrected Load (VA)	Corrected Load in (VA)
Breaker #	Tag #		
Y0104	2CR52/53	40.00	20.71
Y0105	2CR56	40.00	20.71
Y0106	2CR57	90.00	46.61
Y0107	2CR58	10.00	5.16
Y0115	2CR65	690.00	357.52
Y0122	2/3CR63	60.00	31.07
Y0205	2CR56	40.00	19.02
Y0207	2CR58	10.00	4.76
Y0215	2CR66	690.00	328.15
Y0206	2/3CR53	40.00	19.02
Y0206	2CR57	90.00	42.80
Y0222	2/3CR63	60.00	28.53
Y0305	2CR56	40.00	17.53
Y0317	2/3CR63	30.00	13.15
Y0306	2CR52/53	40.00	17.53
Y0306	2CR57	20.00	8.77
Y0405	2CR56	40.00	20.14
Y0417	2/3CR63	30.00	15.10
Y0406	2CR52/53	40.00	20.14
Y0406	2CR57	20.00	10.07
200612-07	2L-235	420.00	286.00
200612-02	2CR58	450.00	306.57
200611-19	2CR54	1500.00	1028.57
200611-21	2CR52	1500.00	1028.57
200611-02	2CR57	1500.00	1028.57
200611-04	2CR58	1500.00	1028.57
05P484	05P484	4200.00	4200.00
2/30072-12	2/3UJ180918	10.00 A	557.85
	TOTAL	13200.00 VA	10515.03 VA

M-73-1  
R-1  
ATC Lin. 4 2

Table 9 cont.

Room # 22x Heat Dissipation

Breaker #	Tag #	Load (VA)	Corrected Load in (VA)
Y0102	2L-032	2700.00	1398.20
Y0103	2L-121, (2L-124)	1000.00	317.85
Y0109	2L-034	1200.00	621.42
Y0111	2L-091 #1	1340.00	642.14
Y0113	2L-091 #3	970.00	502.32
Y0119	2L-188	500.00	258.93
Y0123	2L-422	500.00	258.93
Y0110	2L-054	1520.00	787.14
Y0112	2L-091 #2	915.00	473.84
Y0114	2L-091 #4	1800.00	932.14
Y0116	2L-103	640.00	341.78
Y0118	2/3L-104	120.00	62.14
Y0124	2L-071-5F	400.00	310.71
Y0126	2L-491A	1955.00	1012.40
Y0209	2L-034	1200.00	570.70
Y0211	2L-091 #1	2140.00	1017.74
Y0213	2L-091 #3	1370.00	746.66
Y0219	2L-188	500.00	237.79
Y0223	2L-422	500.00	237.79
Y0210	2L-034	1200.00	570.70
Y0216	2L-103	640.00	313.88
Y0218	2/3L-104	120.00	57.07
Y0224	2L-071-5R	400.00	285.35
Y0203	2L-125, (2L-123)	1000.00	475.58
Y0202	2L-032 #2	3096.00	1472.39
Y0210	2L-035	320.00	152.19
Y0212	2L-091 #2	1540.00	741.90
Y0214	2L-091 #4	1800.00	856.04
Y0226	2L491B	1955.00	929.76
Y0302	2L-032 #2	4298.00	1843.71
Y0303	2L-129	940.00	319.14
Y0309	2L-035	1200.00	525.93
Y0311	2L-091 #1	2140.00	937.91
Y0313	2L-091 #3	1540.00	683.71
Y0315	2L-071-5R	100.00	43.83
Y0310	2L-035	1200.00	525.93
Y0312	2L-091 #2	1540.00	683.71
Y0314	2L-091 #4	1800.00	788.90
Y0316	2L-103	180.00	78.89

PAGE 10 of 25

M-73.112

R-1

Attachment 2

Table 9 cont.

Y0402	ZL-032 42	4298.00	2163.86
Y0403	ZL-133	500.00	251.73
Y0409	ZL-035	1200.00	604.15
Y0411	ZL-091 81	1240.00	624.29
Y0413	ZL-091 83	970.00	488.35
Y0415	ZL-071-58	100.00	50.35
Y0410	ZL-035	1200.00	604.15
Y0412	ZL-091 82	915.00	460.66
Y0414	ZL-091 84	1800.00	906.23
D1P104	ZL-71-3P	1355.00	1355.00
D2P104	ZL-71-3R	1355.00	1355.00
D3P102	ZL-71-5R	29.00	29.00
D4P102	ZL-71-5R	29.00	29.00
200611-12	ZL-168	100.00	100.00
200611-14	ZL-017-3	2900.00	2500.00
200612-01	ZL-160	500.00	342.86
200612-04	ZL-044	550.00	377.14
200612-05	ZL-168	500.00	342.86
200612-06	ZL-144	500.00	342.86
200612-08	ZL-017	2900.00	1714.29
200612-13	W3388	800.00	548.57
200612-14	ZL-158-8	2000.00	1371.43
200612-16	ZL-014	2000.00	1371.43
200612-18	ZL-015	1500.00	1028.57
200612-20	ZL-152	500.00	342.86
200612-26	ZL-071-1R	200.00	137.14
20065-01	ZL-137	500.00	256.41
20065-03	ZL-141	500.00	256.41
20065-05	ZL-145	500.00	256.41
20065-06	W3388	800.00	410.26
20065-07	ZL-149	500.00	256.41
20065-08	2/3L-090	330.00	169.23
20065-14	2/3L-104	480.00	246.15
20065-15	2/3L-027	500.00	256.41
20065-16	ZL-120	1000.00	512.82
20065-17	ZL-046	600.00	307.69
20065-18	ZL-049	600.00	307.69
20065-24	ZL-043	550.00	282.05
20065-26	ZL-071	2000.00	1025.64
20065-28	ZL-158-8	2000.00	1025.64
20065-30	ZL-152	500.00	256.41
D5P473	ZL-155	0.00	0.00
D5P477	ZL-71	0.00	0.00
D5P489	ZL-2	1000.00	1000.00
D5P474	ZL-40	8812.50	8812.50
D5P478	ZL-154	0.00	0.00
D5P480	ZL-17	483.30	483.30

11

Table 9 cont.

1448 11 of 25

36

M-73-115

1-1

App. 13.1.1 2

DSP484	2L-F3	4200.00	4200.00
2/38072-15	2L-238	10.00 A	597.85
280612-29	L183A	0.00	
	TOTAL	103437.80	63470.19 VA



M-73-

Rev 1

ATA 27.1 + =

Table 9 cont.

Room # 101 Heat Dissipation

Breaker #	Tag #	Load (VA)	Corrected Load In (VA)
Y0125	2/3L-378	300.00	155.56
Y0221	2/3L-378	300.00	142.67
	TOTAL	600.00	298.03

Electrical Tunnels Heat Dissipation

Breaker #	Tag #	Load (VA)	Corrected Load In (VA)
Y0127	ZXT-8031-1	100.00	51.79
Y0227	ZXT-8031-2	100.00	47.56
Y0327	ZXT-8031-3	100.00	43.83
Y0427	ZXT-8031-4	100.00	50.35
	TOTAL	400.00	193.53

Room # 311 Heat Dissipation

Breaker #	Tag #	Load (VA)	Corrected Load In (VA)
Y0108	2L-042	10.00	5.18
Y0208	2L-042	10.00	4.76
Y0308	2L-042	30.00	13.15
Y0408	2L-042	30.00	15.10
20065-23	2L-042	270.00	270.00
200612-23	2L-042	282.00	282.00
	TOTAL	632.00	590.19

Page 13 on 25 3 2

11 73

101

101010101

Table 9 cont.

Room # 3108 Heat Dissipation

Breaker #	Tag #	Load (VA)
Y0307	ZHV-9377	*(RANDOM)
20302	9003	*(ENDOTHERMIC)
20304	2Y003	2894.12
20305	2Y006	1050.00
	TOTAL	3944.12

Room # 308A Heat Dissipation

Breaker #	Tag #	Load (VA)
D1P101	2A04	125.00
D1P102	2B04	180.00
D1P106	2L-344	903.00
	TOTAL	1216.00

Diesel Building Heat Dissipation

Breaker #	Tag #	Load (VA)
D1P111	2L-160	3500.00
D2P111	2L-161	3500.00
	TOTAL	7000.00

Room # 310A Heat Dissipation

Breaker #	Tag #	Load (VA)
20102	9001	*(ENDOTHERMIC)
20104	Y001	3261.13
	TOTAL	3261.13

M-73 / 6

P-1

Attachment 2

Table 9 cont.

Room # 3100 Heat Dissipation

Breaker #	Tag #	Load (VA)
2D202	8002	*(ENDOTHERMIC) 3459.64
2D204	Y002	
	TOTAL	3459.64

Room # 302A Heat Dissipation

Breaker #	Tag #	Load (VA)
02P101	2A06	125.00
02P102	2B06	188.00
02P103	ZL-421	903.00
02P104	ZL-345	903.00
	TOTAL	2119.00

Room # 310C Heat Dissipation

Breaker #	Tag #	Load (VA)
2D402	8003	*(ENDOTHERMIC) 2325.33 1050.00
2D404	Y004	
2D405	Y007	
	TOTAL	3375.33

M-73 116

Rev 1

ATL Limit 2

Table 9 cont.

Room #236		Heat Dissipation			
Breaker #	Tag #	Load (VA)	Corrected Load in (VA)		
200612-03	2L-037	1375.00	1060.71		
200612-09	2L-036	1375.00	1060.71		
200612-10	2L-038	2682.00	2045.83		
200612-12	2L-039	2680.00	2221.71		
200612-22	2L-033	36.00	27.77		
20065-09	2L-036	1375.00	793.27		
20065-10	2L-036	1375.00	793.27		
20065-11	2L-037	2680.00	1661.54		
20065-12	2L-039				
Total		13948.00	9666.82		

Red Waste		Heat Dissipation			
Breaker #	Tag #	Load (VA)	Corrected Load in (VA)		
200612-17	FT210Y	234.00	180.91		
20065-22	2L-033	36.00	27.77		
05P345	2/3L-3	0.00	0.00		
05P346	2/3L-5	1000.00	1000.00		
05P347	2/3L-22	0.00	0.00		
05P348	2/3L-263	0.00	0.00		
05P350	2/3L-166	0.00	0.00		
05P350	2/3L-21	0.00	0.00		
05P351	2LP15	0.00	0.00		
05P352	2LP8	3007.81	3007.81		
05P353	2/3L-130	0.00	0.00		
05P354	2LP12	30007.00	30007.00		
05P355	2/3L185	0.00	0.00		
05P357	2/3L186	0.00	0.00		
05P360	2LP1	3007.81	3007.81		
Total		37292.82	37223.90		

Page 16 of 25

M. 73-116

P. 1

Appendix 2

Table 9 cont.

9' Control Building		Heat Dissipation	
Breaker #	Tag #	Load (VA)	
200612-17	2/3JA9782A	36.00	
200612-25	2/3JA9782A	36.00	
05P343	2L-70	0.00	
05P344	2L-70	0.00	
05P356	L0101	0.00	
05P471	2L-70	483.30	
05P479	2L-76	0.00	
05P481	2L-70	483.30	
05P482	2/3L074	0.00	
05P483	2/3L-224	25.00	
05P490	2/3L-224	483.30	
05P491	2L-70	483.30	
05P492	L0201	483.30	
05P493	2L-73	25.00	
05P494	2L-73	25.00	
05P495	2L-73	25.00	
05P496	2L-73	25.00	
Total		2613.90	

Containment		Heat Dissipation	
Breaker #	Tag #	Load (VA)	
05P109	2LP11	4293.68	
05P118	2LP16	6079.53	
05P108	2LP6	4293.68	
200612-21	T8ZT801	0	
200612-20	T8ZT811	0	
Total		14590.89	



M-73 - 116  
Rev 1  
Attachment 2

Table 9 cont.

70' Control Building Heat Dissipation

Breaker #	Tag #	Load (VA)	Corrected Load in (VA)
200612-25	FEI-9283	0.00	0.00
20065-27	2/3L 4P4	2080.00	2080.00
20065-29	NONE	0.00	0.00
DSP111	2816	0.00	0.00
DSP112	2A08	0.00	0.00
DSP114	2819	0.00	0.00
DSP362	810	0.00	0.00
DSP472	2A09	0.00	0.00
DSP488	2LP9	4200.00	4200.00
2/38072-1	213L-433	20.00 A	1115.70
2/38072-4	2/3HV9665A48	10.00 A	557.85
2/38072-9	2/3L406A88	30.00 A	1673.59
2/38072-10	2/3L-441A88	18.00 A	836.78
Total			10463.88

50' Control Building Heat Dissipation

Breaker #	Tag #	Load (VA)
DSP475	2ALP03	0.00
DSP487	2LP13	4200.00
Total		4200.00

M-73 11.

R-1

Am-Lines 1 2

Table 9 cont.

Turbine Building		Heat Dissipation
Breaker #	Tag #	Load (VA)
280611-02	2L-009	2250.00
280611-04	7827819	100.00
280611-05	2L-104	10.00
280611-06	2L-006	280.00
280611-07	2L-108	10.00
280611-08	2L-012	10.00
280611-09	2L-159	10.00
280611-10	2L-016	400.00
280611-11	2L195	200.00
280611-13	2L239	250.00
280611-15	2L510	10.00
280611-16	2L-004	500.00
05P117	2818	0.00
05P221	2A05	0.00
05P222	2803	0.00
05P223	2807	0.00
05P224	2811	0.00
05P225	2812	0.00
05P226	2813	0.00
05P231	2XFDW6 327, P327	80.35
05P228	2XFD403	80.35
05P229	2L-8	80.35
05P230	2XFD404, P076	80.35
05P227	2814	0.00
05P232	2XFS427819	80.35
05P233	2XFDW6326	80.35
05P234	A-U	80.35
05P476	HPVTK006	0.00
05P487	2/3LD47	1375.00
05P488	2L-094	0.00
05P489	H8WBC1, HPVTK009	0.00
05P4A0	2-L239	0.00
05P4A2	2A07	0.00
2Y007	2Y010	1900.00
2Y012	2Y012	15000.00
Total		22447.45

M-73-16  
Rev 1

Final Report

Table 9 cont.

Penetration Building		Heat Dissipation
Breaker #	Tag #	Load (VA)
DSP101	2A01 #1	0.00
DSP102	2B01	0.00
DSP103	2B02	0.00
DSP104	2B09	0.00
DSP105	2A02 #1	0.00
DSP107	2LP9	4255.68
DSP113	2B06	0.00
DSP116	2LP10	3667.73
DSP115	2L-316	0.00
DSP106	NONE	0.00
DSP341	2/3L-383	0.00
DSP343	2/3L-383	0.00
DSP358	NONE	0.00
YD217	RIT 7897-1	100.00
Total		6003.41

Saftey Equipment Building		Heat Dissipation
Breaker #	Tag #	Load (VA)
DSP110	2A08	4255.68
DSP361	NONE	601.56
DSP488	2LP2	4200.00
DSP486	2LP7	4200.00
Total		26514.80

39

M-73-  
Rev 1  
A-A-1-1 + 2

Table 9 cont.

Room #248		Heat Dissipation		
Breaker #	Tag #	Load (VA)	Corrected Load in (VA)	
29071-1	2L052	20.00	1093.12	
29071-2	2L051	40.00	2186.23	
29071-3	2L056	5.00	273.28	
29071-4	2L053	10.00	546.56	
29071-5	2L058	20.00	1093.12	
29071-6	2L057	10.00	546.56	
29071-7	2UJ1-00510	5.00	273.28	
29071-8	2L054	5.00	273.28	
29071-10	2/2L424	2.00	109.31	
29071-12	2UJ1-0051A	5.00	273.28	
29071-13	2UJ1-0051C	60.00	3279.35	
29071-14	2UJ1-0051B	5.00	273.28	
29071-15	2XR2C000051	10.00	546.56	
29071-17	2XC3JX5411	10.00	546.56	
2/39072-3	0XR2C2T824	10.00	546.56	
Total			11860.32	

Room #232		Heat Dissipation		
Breaker #	Tag #	Load (VA)		
2Y005	20060	30009.32		
2906908	20063	10500.00		
Total		40509.32		

Room #307#		Heat Dissipation		
Breaker #	Tag #	Load (VA)		
20507	2Y005	3000.00		
Total		3000.00		

M. 73-110

Rev 1

Attachment 2

Room #107

West Disipation

Breaker #

Tag #

Load (VA)

D701

ZY011

1500.00

Total

1500.00



M. 73 1.6

Rev 1

Attachment 2

Table 9 cont.

## Inverter Load Heat Dissipation (Unfactored)

Room #	Inverter Loads (Total by room)						Total
	Y001	Y002	Y003	Y004	Y006	Y007	
228.00	930.00	930.00	130.00	130.00			2120.00
229.00	19480.00	16221.00	14536.00	12223.00			60662.00
101.00	300.00	300.00					600.00
U1	100.00	100.00	100.00	100.00			400.00
311.00	10.00	10.00	30.00	30.00			80.00
CA		100.00					100.00
3108			2864.12		1050.00		3914.12
310C						1050.00	
TOTAL	17020.00	19661.00	17662.12	12663.00	1050.00	1050	67876.12

M-73-16  
 Rev 1  
 Appendix 2

Table 9 cont.

## Inverter Heat Dissipation Load Factor

	Y001	Y002	Y003	Y004	Y006**	Y007**
Total Unfactored Load in (VA)	17020.00	19661.00	17662.12	12485.00	1250.00	1250.00
Inverter Voltage (Volts)	105.00	105.00	105.00	105.00	105.00	105.00
Inverter Current (Amps)	115.00	122.00	101.00	82.00	10.00	10.00
Inverter Power Usage in (VA)	12075.00	12810.00	10605.00	8610.00	1050.00	1050.00
Inverter Efficiency *	0.73	0.73	0.73	0.73	0.00	0.00
Corrected Inverter Load in (VA)	8813.87	9350.36	7740.86	6286.67	0.00	0.00
Inverter Load Correction Value	0.52	0.48	0.44	0.50	1.00	1.00
Inverter Heat Dissipation (VA)	3261.13	3459.64	2866.12	2325.33	1050.00	1050.00

\* Inverter Efficiency Calculated as per 8023-955-2-1 paragraph 4.4.2.4

\*\* The only loads on these inverters is random therefore all of there steady state current is converted into heat.

M. 73-1-6

Rev 1

ATA Line A 2

Table 9 cont.

Inverter Loads (Total by room)							
Room #	Y001	Y002	Y003	Y004	Y006	Y007	Total
228.00	481.60	642.29	56.96	65.43			1046.32
229.00	8119.94	8668.53	6271.65	4153.77			29310.90
101.00	195.34	142.67					298.03
U1	51.79	47.56	43.83	30.38			193.52
311.00	5.18	4.76	13.15	15.10			38.19
04		0.00					0.00
308A							1216.00
302A							2119.00
310A	3261.13						3261.13
310C				2325.33		1090.00	3375.33
310D		3459.64					3459.64
Diesel							7000.00
310B			2864.12		1050.00		3914.12
TOTAL	12075.00	12762.44	9349.72	8610.00	1050.00	1090.00	44897.17

M-73-116

Rev 1

Attachment 2

Table 9 cont.

## Heat Dissipation Summation Totals

Room #	
228	10515.03
229	63470.19
101	298.03
Electrical Tunnels	193.52
311	590.19
308A	1216.00
302A	2119.00
310A	3261.13
310C	3375.33
310D	3459.64
Diesel	7000.00
310B	3914.12
236	9664.82
Rad waste	37223.90
9' Control Building	2613.50
Containment Building	14590.89
70' Control Building	10463.88
50' Control Building	4200.00
Turbine Building	22467.45
Penetration Building	8003.41
Safety Equipment Building	278602.04
248	11860.32
232	40509.32
307A	3000.00
107	1500.00

55587.6

- 2 1/2 1/2 8 1/2

[13] From: TONEE RAMOS at NESL4 3/15/90 3:09PM (1772 bytes: 30 ln)  
To: ILYA SHLAFMAN at NESL3, AMBROSIO MATIONG  
cc: RICK ALLEN at NESL3, DENNIS EVANS at NESL3, ALLEN THIEL, HARRY GURJALA,  
TONEE RAMOS, ALAN KANEKO  
Subject: STATION BLACKOUT- LIGHTING LOAD FOR DAC ROOMS UNITS 2/3

----- Message Contents -----

Ilya,

Please see below revised info on SBO lighting loads based on additional info gathered on the 3/14/90 meeting. Data shown are for "The first 90 minutes/After the first 90 minutes". Data for the control room area are for Units 2 & 3 and is based on the most desirable alternative of cross-tieing Unit 2 & 3 lighting panels 2LP35 and 3LP35 within the first hour.

Tonee 3/15/90

ALLEN,

IN ORDER TO COMPLETE THE CALCULATION FOR LOSS OF VENTILATION IN THE DAC (DOMINANT AREAS OF CONCERN) DURING UNIT 2 BLACKOUT, I NEED TO KNOW LIGHTING LOAD FOR THE FOLLOWING AREAS:

1. Control Room Area, Unit 2/3 - 5000 watts / 4850 watts
2. Control Room Cabinet Area (Unit 2 only) - 422W/72W
3. Battery Room EL.50 - None
4. 125 VDC Distribution Room EL.50 - 24watts / 24 watts each  
for Rooms 2A, 2B, 2C, & 2D
5. ESF Switchgear Room - 244W/144W each for Rms. 2A & 2B

PLEASE PROVIDE THE REQUESTED INFO NOT LATER THAN 3/12/90 TO MAINTAIN BLACKOUT SCHEDULE.

IF YOU HAVE ANY QUESTIONS, PLEASE CALL ME AT PAX 51331.

ILYA



CHECKED h<sup>u</sup>ll DATE: 5-23-70

AFW PLUMB ROOM UNIT 2/3

SHEET 21-64 of 84

1.069E+02	1.047E+02	1.045E+02	1.043E+02	1.041E+02	1.039E+02	1.037E+02	1.035E+02	1.033E+02	1.031E+02	1.029E+02	1.027E+02	1.025E+02	1.023E+02	1.021E+02	1.019E+02	1.017E+02	1.015E+02	1.013E+02	1.011E+02	1.009E+02	1.007E+02	1.005E+02	1.003E+02	1.001E+02	9.99E+01	9.97E+01	9.95E+01	9.93E+01	9.91E+01	9.89E+01	9.87E+01	9.85E+01	9.83E+01	9.81E+01	9.79E+01	9.77E+01	9.75E+01	9.73E+01	9.71E+01	9.69E+01	9.67E+01	9.65E+01	9.63E+01	9.61E+01	9.59E+01	9.57E+01	9.55E+01	9.53E+01	9.51E+01	9.49E+01	9.47E+01	9.45E+01	9.43E+01	9.41E+01	9.39E+01	9.37E+01	9.35E+01	9.33E+01	9.31E+01	9.29E+01	9.27E+01	9.25E+01	9.23E+01	9.21E+01	9.19E+01	9.17E+01	9.15E+01	9.13E+01	9.11E+01	9.09E+01	9.07E+01	9.05E+01	9.03E+01	9.01E+01	8.99E+01	8.97E+01	8.95E+01	8.93E+01	8.91E+01	8.89E+01	8.87E+01	8.85E+01	8.83E+01	8.81E+01	8.79E+01	8.77E+01	8.75E+01	8.73E+01	8.71E+01	8.69E+01	8.67E+01	8.65E+01	8.63E+01	8.61E+01	8.59E+01	8.57E+01	8.55E+01	8.53E+01	8.51E+01	8.49E+01	8.47E+01	8.45E+01	8.43E+01	8.41E+01	8.39E+01	8.37E+01	8.35E+01	8.33E+01	8.31E+01	8.29E+01	8.27E+01	8.25E+01	8.23E+01	8.21E+01	8.19E+01	8.17E+01	8.15E+01	8.13E+01	8.11E+01	8.09E+01	8.07E+01	8.05E+01	8.03E+01	8.01E+01	7.99E+01	7.97E+01	7.95E+01	7.93E+01	7.91E+01	7.89E+01	7.87E+01	7.85E+01	7.83E+01	7.81E+01	7.79E+01	7.77E+01	7.75E+01	7.73E+01	7.71E+01	7.69E+01	7.67E+01	7.65E+01	7.63E+01	7.61E+01	7.59E+01	7.57E+01	7.55E+01	7.53E+01	7.51E+01	7.49E+01	7.47E+01	7.45E+01	7.43E+01	7.41E+01	7.39E+01	7.37E+01	7.35E+01	7.33E+01	7.31E+01	7.29E+01	7.27E+01	7.25E+01	7.23E+01	7.21E+01	7.19E+01	7.17E+01	7.15E+01	7.13E+01	7.11E+01	7.09E+01	7.07E+01	7.05E+01	7.03E+01	7.01E+01	6.99E+01	6.97E+01	6.95E+01	6.93E+01	6.91E+01	6.89E+01	6.87E+01	6.85E+01	6.83E+01	6.81E+01	6.79E+01	6.77E+01	6.75E+01	6.73E+01	6.71E+01	6.69E+01	6.67E+01	6.65E+01	6.63E+01	6.61E+01	6.59E+01	6.57E+01	6.55E+01	6.53E+01	6.51E+01	6.49E+01	6.47E+01	6.45E+01	6.43E+01	6.41E+01	6.39E+01	6.37E+01	6.35E+01	6.33E+01	6.31E+01	6.29E+01	6.27E+01	6.25E+01	6.23E+01	6.21E+01	6.19E+01	6.17E+01	6.15E+01	6.13E+01	6.11E+01	6.09E+01	6.07E+01	6.05E+01	6.03E+01	6.01E+01	5.99E+01	5.97E+01	5.95E+01	5.93E+01	5.91E+01	5.89E+01	5.87E+01	5.85E+01	5.83E+01	5.81E+01	5.79E+01	5.77E+01	5.75E+01	5.73E+01	5.71E+01	5.69E+01	5.67E+01	5.65E+01	5.63E+01	5.61E+01	5.59E+01	5.57E+01	5.55E+01	5.53E+01	5.51E+01	5.49E+01	5.47E+01	5.45E+01	5.43E+01	5.41E+01	5.39E+01	5.37E+01	5.35E+01	5.33E+01	5.31E+01	5.29E+01	5.27E+01	5.25E+01	5.23E+01	5.21E+01	5.19E+01	5.17E+01	5.15E+01	5.13E+01	5.11E+01	5.09E+01	5.07E+01	5.05E+01	5.03E+01	5.01E+01	4.99E+01	4.97E+01	4.95E+01	4.93E+01	4.91E+01	4.89E+01	4.87E+01	4.85E+01	4.83E+01	4.81E+01	4.79E+01	4.77E+01	4.75E+01	4.73E+01	4.71E+01	4.69E+01	4.67E+01	4.65E+01	4.63E+01	4.61E+01	4.59E+01	4.57E+01	4.55E+01	4.53E+01	4.51E+01	4.49E+01	4.47E+01	4.45E+01	4.43E+01	4.41E+01	4.39E+01	4.37E+01	4.35E+01	4.33E+01	4.31E+01	4.29E+01	4.27E+01	4.25E+01	4.23E+01	4.21E+01	4.19E+01	4.17E+01	4.15E+01	4.13E+01	4.11E+01	4.09E+01	4.07E+01	4.05E+01	4.03E+01	4.01E+01	3.99E+01	3.97E+01	3.95E+01	3.93E+01	3.91E+01	3.89E+01	3.87E+01	3.85E+01	3.83E+01	3.81E+01	3.79E+01	3.77E+01	3.75E+01	3.73E+01	3.71E+01	3.69E+01	3.67E+01	3.65E+01	3.63E+01	3.61E+01	3.59E+01	3.57E+01	3.55E+01	3.53E+01	3.51E+01	3.49E+01	3.47E+01	3.45E+01	3.43E+01	3.41E+01	3.39E+01	3.37E+01	3.35E+01	3.33E+01	3.31E+01	3.29E+01	3.27E+01	3.25E+01	3.23E+01	3.21E+01	3.19E+01	3.17E+01	3.15E+01	3.13E+01	3.11E+01	3.09E+01	3.07E+01	3.05E+01	3.03E+01	3.01E+01	2.99E+01	2.97E+01	2.95E+01	2.93E+01	2.91E+01	2.89E+01	2.87E+01	2.85E+01	2.83E+01	2.81E+01	2.79E+01	2.77E+01	2.75E+01	2.73E+01	2.71E+01	2.69E+01	2.67E+01	2.65E+01	2.63E+01	2.61E+01	2.59E+01	2.57E+01	2.55E+01	2.53E+01	2.51E+01	2.49E+01	2.47E+01	2.45E+01	2.43E+01	2.41E+01	2.39E+01	2.37E+01	2.35E+01	2.33E+01	2.31E+01	2.29E+01	2.27E+01	2.25E+01	2.23E+01	2.21E+01	2.19E+01	2.17E+01	2.15E+01	2.13E+01	2.11E+01	2.09E+01	2.07E+01	2.05E+01	2.03E+01	2.01E+01	1.99E+01	1.97E+01	1.95E+01	1.93E+01	1.91E+01	1.89E+01	1.87E+01	1.85E+01	1.83E+01	1.81E+01	1.79E+01	1.77E+01	1.75E+01	1.73E+01	1.71E+01	1.69E+01	1.67E+01	1.65E+01	1.63E+01	1.61E+01	1.59E+01	1.57E+01	1.55E+01	1.53E+01	1.51E+01	1.49E+01	1.47E+01	1.45E+01	1.43E+01	1.41E+01	1.39E+01	1.37E+01	1.35E+01	1.33E+01	1.31E+01	1.29E+01	1.27E+01	1.25E+01	1.23E+01	1.21E+01	1.19E+01	1.17E+01	1.15E+01	1.13E+01	1.11E+01	1.09E+01	1.07E+01	1.05E+01	1.03E+01	1.01E+01	9.99E+00	9.97E+00	9.95E+00	9.93E+00	9.91E+00	9.89E+00	9.87E+00	9.85E+00	9.83E+00	9.81E+00	9.79E+00	9.77E+00	9.75E+00	9.73E+00	9.71E+00	9.69E+00	9.67E+00	9.65E+00	9.63E+00	9.61E+00	9.59E+00	9.57E+00	9.55E+00	9.53E+00	9.51E+00	9.49E+00	9.47E+00	9.45E+00	9.43E+00	9.41E+00	9.39E+00	9.37E+00	9.35E+00	9.33E+00	9.31E+00	9.29E+00	9.27E+00	9.25E+00	9.23E+00	9.21E+00	9.19E+00	9.17E+00	9.15E+00	9.13E+00	9.11E+00	9.09E+00	9.07E+00	9.05E+00	9.03E+00	9.01E+00	8.99E+00	8.97E+00	8.95E+00	8.93E+00	8.91E+00	8.89E+00	8.87E+00	8.85E+00	8.83E+00	8.81E+00	8.79E+00	8.77E+00	8.75E+00	8.73E+00	8.71E+00	8.69E+00	8.67E+00	8.65E+00	8.63E+00	8.61E+00	8.59E+00	8.57E+00	8.55E+00	8.53E+00	8.51E+00	8.49E+00	8.47E+00	8.45E+00	8.43E+00	8.41E+00	8.39E+00	8.37E+00	8.35E+00	8.33E+00	8.31E+00	8.29E+00	8.27E+00	8.25E+00	8.23E+00	8.21E+00	8.19E+00	8.17E+00	8.15E+00	8.13E+00	8.11E+00	8.09E+00	8.07E+00	8.05E+00	8.03E+00	8.01E+00	7.99E+00	7.97E+00	7.95E+00	7.93E+00	7.91E+00	7.89E+00	7.87E+00	7.85E+00	7.83E+00	7.81E+00	7.79E+00	7.77E+00	7.75E+00	7.73E+00	7.71E+00	7.69E+00	7.67E+00	7.65E+00	7.63E+00	7.61E+00	7.59E+00	7.57E+00	7.55E+00	7.53E+00	7.51E+00	7.49E+00	7.47E+00	7.45E+00	7.43E+00	7.41E+00	7.39E+00	7.37E+00	7.35E+00	7.33E+00	7.31E+00	7.29E+00	7.27E+00	7.25E+00	7.23E+00	7.21E+00	7.19E+00	7.17E+00	7.15E+00	7.13E+00	7.11E+00	7.09E+00	7.07E+00	7.05E+00	7.03E+00	7.01E+00	6.99E+00	6.97E+00	6.95E+00	6.93E+00	6.91E+00	6.89E+00	6.87E+00	6.85E+00	6.83E+00	6.81E+00	6.79E+00	6.77E+00	6.75E+00	6.73E+00	6.71E+00	6.69E+00	6.67E+00	6.65E+00	6.63E+00	6.61E+00	6.59E+00	6.57E+00	6.55E+00	6.53E+00	6.51E+00	6.49E+00	6.47E+00	6.45E+00	6.43E+00	6.41E+00	6.39E+00	6.37E+00	6.35E+00	6.33E+00	6.31E+00	6.29E+00	6.27E+00	6.25E+00	6.23E+00	6.21E+00	6.19E+00	6.17E+00	6.15E+00	6.13E+00	6.11E+00	6.09E+00	6.07E+00	6.05E+00	6.03E+00	6.01E+00	5.99E+00	5.97E+00	5.95E+00	5.93E+00	5.91E+00	5.89E+00	5.87E+00	5.85E+00	5.83E+00	5.81E+00	5.79E+00	5.77E+00	5.75E+00	5.73E+00	5.71E+00	5.69E+00	5.67E+00	5.65E+00	5.63E+00	5.61E+00	5.59E+00	5.57E+00	5.55E+00	5.53E+00	5.51E+00	5.49E+00	5.47E+00	5.45E+00	5.43E+00	5.41E+00	5.39E+00	5.37E+00	5.35E+00	5.33E+00	5.31E+00	5.29E+00	5.27E+00	5.25E+00	5.23E+00	5.21E+00	5.19E+00	5.17E+00	5.15E+00	5.13E+00	5.11E+00	5.09E+00	5.07E+00	5.05E+00	5.03E+00	5.01E+00	4.99E+00	4.97E+00	4.95E+00	4.93E+00	4.91E+00	4.89E+00	4.87E+00	4.85E+00	4.83E+00	4.81E+00	4.79E+00	4.77E+00	4.75E+00	4.73E+00	4.71E+00	4.69E+00	4.67E+00	4.65E+00	4.63E+00	4.61E+00	4.59E+00	4.57E+00	4.55E+00	4.53E+00	4.51E+00	4.49E+00	4.47E+00	4.45E+00	4.43E+00	4.41E+00	4.39E+00	4.37E+00	4.35E+00	4.33E+00	4.31E+00	4.29E+00	4.27E+00	4.25E+00	4.23E+00	4.21E+00	4.19E+00	4.17E+00	4.15E+00	4.13E+00	4.11E+00	4.09E+00	4.07E+00	4.05E+00	4.03E+00	4.01E+00	3.99E+00	3.97E+00	3.95E+00	3.93E+00	3.91E+00	3.89E+00	3.87E+00	3.85E+00	3.83E+00	3.81E+00	3.79E+00	3.77E+00	3.75E+00	3.73E+00	3.71E+00	3.69E+00	3.67E+00	3.65E+00	3.63E+00	3.61E+00	3.59E+00	3.57E+00	3.55E+00	3.53E+00	3.51E+00	3.49E+00	3.47E+00	3.45E+00	3.43E+00	3.41E+00	3.39E+00	3.37E+00	3.35E+00	3.33E+00	3.31E+00	3.29E+00	3.27E+00	3.25E+00	3.23E+00	3.21E+00	3.19E+00	3.17E+00	3.15E+00	3.13E+00	3.11E+00	3.09E+00	3.07E+00	3.05E+00	3.03E+00	3.01E+00	2.99E+00	2.97E+00	2.95E+00	2.93E+00	2.91E+00	2.89E+00	2.87E+00	2.85E+00	2.83E+00	2.81E+00	2.79E+00	2.77E+00	2.75E+00	2.73E+00	2.71E+00	2.69E+00	2.67E+00	2.65E+00	2.63E+00	2.61E+00	2.59E+00	2.57E+00	2.55E+00	2.53E+00	2.51E+00	2.49E+00	2.47E+00	2.45E+00	2.43E+00	2.41E+00	2.39E+00	2.37E+00	2.35E+00	2.33E+00	2.31E+00	2.29E+00	2.27E+00	2.25E+00	2.23E+00	2.21E+00	2.19E+00	2.17E+00	2.15E+00	2.13E+00	2.11E+00	2.09E+00	2.07E+00	2.05E+00	2.03E+00	2.01E+00	1.99E+00	1.97E+00	1.95E+00	1.93E+00	1.91E+00	1.89E+00	1.87E+00	1.85E+00	1.83E+00	1.81E+00	1.79E+00	1.77E+00	1.75E+00	1.73E+00	1.71E+00	1.69E+00	1.67E+00	1.65E+00	1.63E+00	1.61E+00	1.59E+00	1.57E+00	1.55E+00	1.53E+00	1.51E+00	1.49E+00	1.47E+00	1.45E+00	1.43E+00	1.41E+00	1.39E+00	1.37E+00	1.35E+00	1.33E+00	1.31E+00	1.29E+00	1.27E+00	1.25E+00	1.23E+00	1.21E+00	1.19E+00	1.17E+00	1.15E+00	1.13E+00	1.11E+00	1.09E+00	1.07E+00	1.05E+00	1.03E+00	1.01E+00	9.99E-01	9.97E-01	9.95E-01	9.93E-01	9.91E-01	9.89E-01	9.87E-01	9.85E-01	9.83E-01	9.81E-01	9.79E-01	9.77E-01	9.75E-01	9.73E-01	9.71E-01	9.69E-01	9.67E-01	9.65E-01	9.63E-01	9.61E-01	9.59E-01	9.57E-01	9.55E-01	9.53E-01	9.51E-01	9.4
-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	-----











CALC. NO: M-13-116  
REVISION: 1  
3: I. S. GUATEMALA DATE: 5/1/90  
CHECKED: [Signature] DATE: 5-23-90

Sheet RI-69 of 84

[illegible]

## ENGINEERING DEPARTMENT

## CALCULATION SHEET

SUBJECT: Room Temperature Response During  
Station Blackout

CALC NO. M-73-116 REV. 1

J.O. NO. 6711 MADE BY: I. Shlafman DATE: 5-4-90 CHECKED BY: [Signature] DATE: 5-23-90

## 8.6 CONTROL ROOM CABINET AREA (ROOM #229)

Room Heat Transfer Area (ref.1)

Walls Areas :

East wall- 2.5 ft concrete ;  $A_{\text{East wall}} = 1650 \text{ ft}^2$   $U_{E.W.} = .235 (\text{ref.9})$ North wall-1" gypsum plaster;  $A_{\text{North wall}} = 1137.4 \text{ ft}^2$   $U_{N.W.} = .25$  see belowWest wall- 3/4 " gypsum plaster;  $A_{\text{West wall}} = 536 \text{ ft}^2$   $U_{W.W.} = .27 "$ South wall- 3/4 " gypsum plaster;  $A_{\text{South wall}} = 676.91 \text{ ft}^2$   $U_{S.W.} = .27 "$ 

Ceiling (concrete slab):

1 ft concrete -  $A_{\text{Ceiling}} = 3611.3 \text{ ft}^2$   $U_{\text{CEIL.}} = .36 (\text{Ref.9})$  $A_{\text{TOTAL}} = 1650 + 1137.4 + 536 + 676.9 + 3611.3 = 7611 \text{ ft}^2$ 

"U" factors for:

3/4" (1") gypsum plaster with 6" air space:

	$R_1$	$R_2$
1. Inside film	0.68	
2. Gypsum plaster 3/4"(1")	0.64	(0.90)
3. Non-reflect air space	1.014.	
4. Gypsum plaster 3/4 (1")	0.64	(0.90)
5. Inside film	0.68	
	-----	
	3.65	(4.17)

 $U = 1/R$ ;  $U_1 = 1/3.65 = 0.27 \text{ BTU/hr ft}^2 \text{ F}$  $U_2 = 1/4.17 = 0.23 \text{ Btu/hr ft}^2 \text{ F}$ 

Due to the fact that walls and floor composition are different, it is required to determine the equivalent thickness of concrete:

 $A_{E.W.} U_{E.W.} = 1650 \times 0.235 = 388$  $A_{N.W.} U_{N.W.} = 1137 \times 0.25 = 284$  $A_{S.W.} U_{S.W.} = 677 \times 0.27 = 183$  $A_{W.W.} U_{W.W.} = 536 \times .27 = 145$  $A_{\text{CEIL.}} U_{\text{CEIL.}} = 3611 \times 0.36 = 1300$ -----  
 $AU_{\text{TOTAL}} = 2300$

ENGINEERING DEPARTMENT

**CALCULATION SHEET**Room Temperature Response During  
Station Blackout

SUBJECT:

CALC NO. M-73-116 REV. 1J.O.NO. 6711 MADE BY: I. Schlafman DATE: 5-4-90 CHECKED BY: [Signature] DATE: 5-23-90

$$U_{EQ} = AU_{TOTAL}/A_{TOTAL} = 2300/7611 = .302 \text{ SAY } 0.3 \text{ Btu/hr F ft}^2$$

$$U_{EQ} = [R_{INSIDE} + R_{EQ \text{ CONC.}} + R_{INSIDE}]^{-1} = [0.68 + R_{EQ \text{ CONC.}} + 0.68]^{-1} = 0.30$$

$$R_{EQ \text{ CONC.}} = 1/0.3 - 0.68 - 0.68 = 1.95 ; K_{EQ \text{ CONC.}} = 1/R_{EQ \text{ CONC.}} = 0.51 \text{ Btu/hr F ft}^2$$

$$K_{CONC.} = 1.04 \text{ Btu/hr F ft}^2 ; t_{EQ} = K_{CONC.}/K_{EQ \text{ CONC.}} = 1.04/0.51 = 2.02 \text{ ft}$$

Room Volume (ref.1) :

$$V_{CABLE \text{ TRAYS}} = 197.2 \text{ ft}^3$$

$$V_{HANGER \text{ SUP.}} = 109 \text{ ft}^3$$

$$V_{A/C \text{ DUCT}} = 3341.1 \text{ ft}^3$$

$$V_{EL. \text{ CABIN.}} = 7898.7 \text{ ft}^3$$

$$V_{TOTAL} = \text{-----}$$

$$V_{ROOM} = 68638 \text{ ft}^3$$

$$V_{NET \text{ VOLUME}} = 68638 - 11456 = 57092 \text{ ft}^3$$

Heat Gain :

Total heat dissipated to the room is equal to :

$$Q_{TOTAL} = Q_{CABINET \text{ AREA}} + Q_{CTR. \text{ RM PANEL}/2} \text{ (assumption 3.10)}$$

$$Q_{TOTAL} = (63470.19 \text{ wt} + 10000 \text{ wt}/2) \times 3.413 \text{ Btu/hr wt} = \\ = 233688.11 \text{ Btu/hr (ref. Atth.2)}$$

Initial room ambient temperature = 75 deg F;

$$\text{Wall average temp., } T_{wall \text{ avrg.}} = (T_{air, in} + T_{outside})/2$$

$$T_{wall \text{ avrg.}} = (75 + 95)/2 = 85 \text{ F}$$

Sample CalculationFrom Equations 1 and 2, at  $i = 1$  minute

## CALCULATION SHEET

Room Temperature Response During  
Station Blackout

SUBJECT:

CALC NO. M-73-116 REV. 1

J.O. NO. 8711 MADE BY: I. Shlafman DATE: 5-4-90 CHECKED BY: DATE: 5-23-90

$$T_{air,i=1} = F_1/F_2 + T_{air,i=0} \quad \text{where:}$$

$$F_1 = Q_{\Delta i} = 233688/60 = 3894.8 \text{ Btu/min, and}$$

$$F_2 = \rho_{air} V_{air} C_{p,air} = (0.07)(57092)(0.24) = 959.14 \text{ Btu/deg F}$$

$$T_{air,i=1} = 3894.8/959.14 + 75 = 79.06 \text{ deg F}$$

At  $i = 2$  minutes:

$$T_{air,i=2} = [F_1 - F_3(T_{air,i=1} - T_0)]/F_2 + T_{air,i=1} \quad \text{where}$$

$$F_3 = h_{air} A_{\Delta i} = 1.47 \times 7611 \times 1/60 = 186.5 \text{ Btu/deg F}$$

$$T_{air,i=2} = [3894.8 - 186.5(79.06 - 85)]/959.14 + 79.06 = 84.27 \text{ deg F}$$

$$B_1 = h \Delta x / k = 1.47 \times 0.0833 / 1.04 = 0.117 \text{ say } 0.12$$

$$F_0 = k \Delta t / \rho c \Delta x^2 = (1.04 \times 1/60) / 143.58 \times 0.21 \times 0.0833^2 = 0.0828$$

Stability criterion requires that the coefficient for  $T_{0,i=1}$  in equation be greater than or equal to zero

$$1 - 2B_1 F_0 - 2F_0 \geq 0 \text{ or}$$

$$F_0 (1 + B_1) \leq 1/2 \text{ or } F_0 \leq 1/2 (1/1 + 0.12) \leq 0.45$$

$$\text{or } \alpha \Delta t / \Delta x^2 \leq 0.45 ; \quad \alpha = k / \rho c$$

$$\Delta t \leq 0.45 \times \Delta x^2 / \alpha \text{ or } \Delta t \leq 0.45 \times 0.0833^2 \times 143.58 \times 0.21 / 1.04$$

$$\Delta t \leq 0.0905 \text{ hr (5.4 min) ,}$$

therefore,  $\Delta t = 1$  minute satisfies the stability criterion.

To calculate the wall temperature and interior "node" temperature we use equations 3 and 5 from general calculations.

$$i=2 \text{ min, } T_{0,2} = 2 \times 0.0828 [0.12 \times 79.06 + 85] + [1 - 2 \times 0.0828 \times 0.12 - 2 \times 0.0828] \times 85 = 84.73$$

$$\text{from equation 5, } F_4 = 1 - 2F_0 = 1 - 2 \times 0.0828 = 0.8344$$

$$T_{1,2} = 0.0828 \times (85 + 84.81) + 0.8344 \times 85 = 84.98 \text{ F}$$

$$T_{2,2} = 0.0828 \times (85 + 85) + 0.8344 \times 85 = 85 \text{ F ETC...}$$

For this iterative calculations, the equations 1,2,3 and 5 were entered into LOTUS program and the results are tabulated on pages 73 thru 76.

CALC. NO: M-73-116  
REVISION: 1  
BY: I. SHULMAN DATE: 5/7/90  
CHECKED: [Signature] DATE: 5-23-90

SHEET 21-73 OF 84

[illegible]

CALC. NO:

M-73-116

REVISION:

BY: J. Sullivan DATE: 5/1/90

CHECKED: J. Sullivan

DATE: 5-23-90

CONTROL ROOM CABINET AREA UNIT 2/3

RI-74 OF 84

3.000E+00	8.839E+01	8.476E+01	8.496E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01
4.000E+00	9.175E+01	8.486E+01	8.495E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01
5.000E+00	9.447E+01	8.501E+01	8.495E+01	8.499E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01
6.000E+00	9.669E+01	8.519E+01	8.496E+01	8.499E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01
7.000E+00	9.852E+01	8.537E+01	8.498E+01	8.499E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01
8.000E+00	1.000E+02	8.556E+01	8.501E+01	8.499E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01
9.000E+00	1.013E+02	8.575E+01	8.505E+01	8.499E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01
1.000E+01	1.023E+02	8.594E+01	8.511E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01
1.100E+01	1.032E+02	8.612E+01	8.517E+01	8.501E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01
1.200E+01	1.039E+02	8.630E+01	8.523E+01	8.502E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01
1.300E+01	1.046E+02	8.646E+01	8.530E+01	8.503E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01
1.400E+01	1.051E+02	8.662E+01	8.538E+01	8.505E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01
1.500E+01	1.056E+02	8.678E+01	8.545E+01	8.508E+01	8.501E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01
1.600E+01	1.060E+02	8.693E+01	8.553E+01	8.510E+01	8.501E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01
1.700E+01	1.063E+02	8.707E+01	8.561E+01	8.513E+01	8.502E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01
1.800E+01	1.067E+02	8.720E+01	8.569E+01	8.516E+01	8.503E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01
1.900E+01	1.069E+02	8.733E+01	8.577E+01	8.519E+01	8.503E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01
2.000E+01	1.072E+02	8.746E+01	8.585E+01	8.523E+01	8.505E+01	8.501E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01
2.100E+01	1.074E+02	8.757E+01	8.593E+01	8.526E+01	8.506E+01	8.501E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01
2.200E+01	1.076E+02	8.769E+01	8.601E+01	8.530E+01	8.507E+01	8.501E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01
2.300E+01	1.078E+02	8.780E+01	8.609E+01	8.534E+01	8.508E+01	8.502E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01
2.400E+01	1.080E+02	8.791E+01	8.617E+01	8.538E+01	8.510E+01	8.502E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01
2.500E+01	1.081E+02	8.801E+01	8.625E+01	8.543E+01	8.512E+01	8.503E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01
2.600E+01	1.083E+02	8.811E+01	8.633E+01	8.547E+01	8.514E+01	8.503E+01	8.501E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01
2.700E+01	1.084E+02	8.821E+01	8.641E+01	8.551E+01	8.515E+01	8.504E+01	8.501E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01
2.800E+01	1.086E+02	8.831E+01	8.648E+01	8.556E+01	8.517E+01	8.505E+01	8.501E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01
2.900E+01	1.087E+02	8.840E+01	8.656E+01	8.560E+01	8.520E+01	8.505E+01	8.501E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01	8.500E+01



CALC. NO: M-73-116  
 REVISION: 1  
 BY: T. SHAFER DATE: 5/1/90  
 CHECKED: DATE: 5-23-90

CONTROL ROOM CABINET AREA UNIT 2/3

11-75 OF 84

3.000E+01	1.000E+02	8.649E+01	8.663E+01	8.565E+01	8.522E+01	8.506E+01	8.501E+01	8.500E+01	8.500E+01	8.500E+01
3.100E+01	1.000E+02	8.850E+01	8.670E+01	8.569E+01	8.524E+01	8.507E+01	8.502E+01	8.500E+01	8.500E+01	8.500E+01
3.200E+01	1.000E+02	8.866E+01	8.677E+01	8.574E+01	8.526E+01	8.508E+01	8.502E+01	8.500E+01	8.500E+01	8.500E+01
3.300E+01	1.091E+02	8.875E+01	8.684E+01	8.579E+01	8.529E+01	8.509E+01	8.502E+01	8.500E+01	8.500E+01	8.500E+01
3.400E+01	1.092E+02	8.883E+01	8.691E+01	8.583E+01	8.531E+01	8.510E+01	8.503E+01	8.500E+01	8.500E+01	8.500E+01
3.500E+01	1.093E+02	8.891E+01	8.698E+01	8.588E+01	8.534E+01	8.511E+01	8.503E+01	8.500E+01	8.500E+01	8.500E+01
3.600E+01	1.094E+02	8.899E+01	8.705E+01	8.592E+01	8.536E+01	8.512E+01	8.504E+01	8.500E+01	8.500E+01	8.500E+01
3.700E+01	1.095E+02	8.907E+01	8.712E+01	8.597E+01	8.539E+01	8.514E+01	8.504E+01	8.500E+01	8.500E+01	8.500E+01
3.800E+01	1.096E+02	8.914E+01	8.718E+01	8.602E+01	8.542E+01	8.515E+01	8.505E+01	8.500E+01	8.500E+01	8.500E+01
3.900E+01	1.097E+02	8.922E+01	8.725E+01	8.607E+01	8.545E+01	8.516E+01	8.505E+01	8.500E+01	8.500E+01	8.500E+01
4.000E+01	1.098E+02	8.929E+01	8.731E+01	8.611E+01	8.547E+01	8.518E+01	8.506E+01	8.500E+01	8.500E+01	8.500E+01
4.100E+01	1.099E+02	8.936E+01	8.738E+01	8.616E+01	8.550E+01	8.519E+01	8.507E+01	8.500E+01	8.500E+01	8.500E+01
4.200E+01	1.099E+02	8.943E+01	8.744E+01	8.621E+01	8.553E+01	8.521E+01	8.507E+01	8.500E+01	8.500E+01	8.500E+01
4.300E+01	1.100E+02	8.950E+01	8.750E+01	8.625E+01	8.556E+01	8.522E+01	8.508E+01	8.500E+01	8.500E+01	8.500E+01
4.400E+01	1.101E+02	8.957E+01	8.757E+01	8.630E+01	8.559E+01	8.524E+01	8.509E+01	8.500E+01	8.500E+01	8.500E+01
4.500E+01	1.101E+02	8.964E+01	8.763E+01	8.634E+01	8.562E+01	8.526E+01	8.509E+01	8.500E+01	8.500E+01	8.500E+01
4.600E+01	1.102E+02	8.971E+01	8.769E+01	8.639E+01	8.565E+01	8.527E+01	8.510E+01	8.500E+01	8.500E+01	8.500E+01
4.700E+01	1.103E+02	8.977E+01	8.775E+01	8.644E+01	8.568E+01	8.529E+01	8.511E+01	8.500E+01	8.500E+01	8.500E+01
4.800E+01	1.104E+02	8.984E+01	8.781E+01	8.648E+01	8.571E+01	8.531E+01	8.512E+01	8.500E+01	8.500E+01	8.500E+01
4.900E+01	1.104E+02	8.990E+01	8.786E+01	8.653E+01	8.574E+01	8.532E+01	8.513E+01	8.500E+01	8.500E+01	8.500E+01
5.000E+01	1.105E+02	8.996E+01	8.792E+01	8.657E+01	8.577E+01	8.534E+01	8.514E+01	8.500E+01	8.500E+01	8.500E+01
5.100E+01	1.106E+02	9.003E+01	8.798E+01	8.662E+01	8.580E+01	8.536E+01	8.515E+01	8.500E+01	8.500E+01	8.500E+01
5.200E+01	1.106E+02	9.009E+01	8.804E+01	8.666E+01	8.583E+01	8.538E+01	8.516E+01	8.500E+01	8.500E+01	8.500E+01
5.300E+01	1.107E+02	9.015E+01	8.809E+01	8.671E+01	8.586E+01	8.540E+01	8.517E+01	8.500E+01	8.500E+01	8.500E+01
5.400E+01	1.108E+02	9.021E+01	8.815E+01	8.675E+01	8.590E+01	8.542E+01	8.518E+01	8.500E+01	8.500E+01	8.500E+01
5.500E+01	1.108E+02	9.027E+01	8.820E+01	8.680E+01	8.593E+01	8.544E+01	8.519E+01	8.500E+01	8.500E+01	8.500E+01
5.600E+01	1.109E+02	9.033E+01	8.826E+01	8.684E+01	8.596E+01	8.546E+01	8.520E+01	8.500E+01	8.500E+01	8.500E+01

CALC. NO:	M-73-116
REVISION:	1
BY: E. S. L. W. H. M. DATE:	5/1/90
CHECKED: <i>[Signature]</i> DATE:	5-23-90

CONTROL ROOM CABINET AREA UNIT 2/3

SHEET R1-76 OF R4

5.700E+01	1.110E+02	9.030E+01	8.831E+01	8.680E+01	8.590E+01	8.540E+01	8.521E+01	8.500E+01	8.503E+01	8.501E+01	8.500E+01
5.800E+01	1.110E+02	9.044E+01	8.837E+01	8.693E+01	8.602E+01	8.550E+01	8.522E+01	8.500E+01	8.503E+01	8.501E+01	8.500E+01
5.900E+01	1.111E+02	9.050E+01	8.842E+01	8.697E+01	8.605E+01	8.552E+01	8.524E+01	8.510E+01	8.504E+01	8.501E+01	8.500E+01
6.000E+01	1.111E+02	9.056E+01	8.847E+01	8.702E+01	8.609E+01	8.554E+01	8.525E+01	8.510E+01	8.504E+01	8.501E+01	8.500E+01

ENGINEERING DEPARTMENT

**CALCULATION SHEET**SUBJECT: Room Temperature Response During  
Station BlackoutCALC NO. M-73-116 REV. 1J.O.NO. 6711 MADE BY: I. Shlafman DATE: 5-4-90 CHECKED BY: [Signature] DATE: 5-23-90**8.7 CONTROL ROOM UNIT 2/3****Room Heat Transfer Area****Ceiling:**

$$A_{\text{UNIT 2\&3 CTR.RM.CEILING}} = 1300 \text{ ft}^2 \text{ (ref.9)}$$

$$A_{\text{CTR.RM.CORRD.}} = 300 \text{ ft}^2 \times 2 = 600 \text{ ft}^2 \text{ (ref. )}$$

$$A_{\text{TOTAL}} = 1300 + 600 = 1900 \text{ ft}^2$$

**Room Volume:**

Volume of Control Room including suspended ceiling:

$$V_{\text{CTR.RM}} = 1300 \times 18 = 23400 \text{ ft}^3$$

Volume of Control Room Corridor

$$V_{\text{CTR.RM.CORRD.UNIT 2\&3}} = 600 \times 7 = 4200 \text{ ft}^3$$

$$V_{\text{TOTAL VOLUME}} = 23400 + 4200 = 27600 \text{ ft}^3$$

Assume that volume of electrical cabinets, cable trays and a/c ducts equal to 10% of total volume, therefore the total net volume is equal to:

$$V_{\text{NET VOLUME}} = 27600 \times 0.9 = 24840 \text{ ft}^3$$

**Heat Gain:**

$$Q_{\text{people}} = 250 \text{ Btu/hr person} \times 4 \text{ people} = 1000 \text{ Btu/hr (ref. 12)}$$

$$Q_{\text{lights}} = 5000 \text{ wt} \times 3.413 \text{ Btu/hr wt} = 17065 \text{ Btu/hr (ref. Atth 3)}$$

$$Q_{\text{elect.}} = 10515.03 \text{ wt} \times 3.413 \text{ Btu/hr wt} \times 2 =$$

$$= 71775.4 \text{ Btu/hr (ref.Att. 2 for Unit 2\&3 sides)}$$

$$Q_{\text{total}} = 1000 + 17065 + 71775 = 89840 \text{ say } 90000 \text{ Btu/hr}$$

Initial room ambient temperature = 75 deg F

Initial ceiling surface temperature = 75 deg F

**CALCULATION SHEET**Room Temperature Response During  
Station Blackout

SUBJECT:

CALC NO. M-73-116 REV. 1D.NO. 6711 MADE BY: I. Shlafman DATE: 5-4-90 CHECKED BY: [Signature] DATE: 5-23-90Sample CalculationFrom Equations 1 and 2, at  $i = 1$  minute

$$T_{air,i=1} = F_1/F_2 + T_{air,i=0} \quad \text{where:}$$

$$F_1 = Q_{a1} = 90000/60 = 1500 \text{ Btu/min, and}$$

$$F_2 = \rho_{air} V_{air} C_{p,air} = (0.07)(24840)(0.24) = 417.31 \text{ Btu/deg F}$$

$$T_{air,i=1} = 1500/417.31 + 75 = 78.59 \text{ deg F}$$

At  $i = 2$  minutes:

$$T_{air,i=2} = [F_1 - F_3(T_{air,i=1} - T_0)]/F_2 + T_{air,i=1} \quad \text{where}$$

$$F_3 = h_{air} A_{d1} = 1.47 \times 1900 \times 1/60 = 46.55 \text{ Btu/deg F}$$

$$T_{air,i=2} = [598.66 - 26.78(78.59 - 75)]/417.31 + 78.59 = 81.8 \text{ deg F}$$

$$B_1 = h \cdot x/k = 1.47 \times 0.0833/1.04 = 0.117 \approx 0.12$$

$$F_0 = k \cdot t / \rho c \cdot x^2 = (1.04 \times 1/60) / 143.58 \times 0.21 \times 0.0833^2 = 0.0828$$

Stability criterion requires that the coefficient for  $T_{0,i-1}$  in equation be greater than or equal to zero

$$1 - 2B_1F_0 - 2F_0 \geq 0 \quad \text{or}$$

$$F_0(1 + B_1) \leq 1/2 \quad \text{or} \quad F_0 \leq 1/2(1/1 + 0.12) \leq 0.45$$

$$\text{or } \alpha \cdot t / x^2 \leq 0.45; \quad \alpha = k/\rho c$$

$$\alpha \cdot t \leq 0.45 \times x^2 / \alpha \quad \text{or} \quad \alpha \cdot t \leq 0.45 \times 0.0833^2 \times 143.58 \times 0.21 / 1.04$$

$$\alpha \cdot t \leq 0.0905 \text{ hr (5.4 min) ,}$$

therefore,  $\alpha \cdot t = 1$  minute satisfies the stability criterion.

To calculate the wall temperature and interior "node" temperature we use equations 3 and 5 from general calculations.

$$i=2 \text{ min, } T_{0,2} = 2 \times 0.0828[0.12 \times 78.59 + 75] + [1 - 2 \times 0.0828 \times 0.12 - 2 \times 0.0828] \times 75 = 75.07 \text{ F}$$

$$\text{from equation 5, } F_4 = 1 - 2F_0 = 1 - 2 \times 0.0828 = 0.8344$$

$$T_{1,2} = 0.0828 \times (75 + 75) + 0.8344 \times 75 = 75 \text{ F}$$

ENGINEERING DEPARTMENT

## CALCULATION SHEET

SUBJECT: Room Temperature Response During  
Station BlackoutCALC NO. M-73-116 REV. 1J.O. NO. 6711 MADE BY: I. Shlafman DATE: 5-4-90 CHECKED BY: [Signature] DATE: 5-23-90

$$T_{2,2} = 0.0828 \times (75 + 75) + 0.08344 \times 75 = 75 \text{ F ETC...}$$

For this iterative calculations, the equations 1, 2, 3 and 5 were entered into LOTUS program and the results are tabulated on pages 80 thru 83.

CALC. NO: M-73-116  
REVISION: 1  
BY: I. SHAFER DATE: 5/7/90  
CHECKED: [Signature] DATE: 5-23-90

SHEET 21-80 OF 84

[illegible]





CALC. NO: M-73-116  
 REVISION: 1  
 BY: J. CHASEMAN DATE: 5/7/90  
 CHECKED: [Signature] DATE: 5-23-90

CONTROL ROOM UNIT 2&3

SHEET 81-82 OF 84

3.000E+01	1.099E+02	8.007E+01	7.738E+01	7.597E+01	7.534E+01	7.511E+01	7.503E+01	7.501E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
3.100E+01	1.102E+02	8.020E+01	7.748E+01	7.604E+01	7.538E+01	7.512E+01	7.503E+01	7.501E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
3.200E+01	1.105E+02	8.034E+01	7.759E+01	7.610E+01	7.541E+01	7.513E+01	7.504E+01	7.501E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
3.300E+01	1.107E+02	8.047E+01	7.769E+01	7.617E+01	7.544E+01	7.515E+01	7.504E+01	7.501E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
3.400E+01	1.109E+02	8.060E+01	7.780E+01	7.623E+01	7.548E+01	7.516E+01	7.505E+01	7.501E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
3.500E+01	1.111E+02	8.073E+01	7.790E+01	7.630E+01	7.552E+01	7.518E+01	7.506E+01	7.502E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
3.600E+01	1.113E+02	8.085E+01	7.800E+01	7.637E+01	7.555E+01	7.520E+01	7.506E+01	7.502E+01	7.500E+01	7.500E+01	7.500E+01	7.500E+01
3.700E+01	1.115E+02	8.097E+01	7.810E+01	7.644E+01	7.559E+01	7.522E+01	7.507E+01	7.502E+01	7.501E+01	7.500E+01	7.500E+01	7.500E+01
3.800E+01	1.117E+02	8.109E+01	7.820E+01	7.650E+01	7.563E+01	7.524E+01	7.508E+01	7.502E+01	7.501E+01	7.500E+01	7.500E+01	7.500E+01
3.900E+01	1.119E+02	8.121E+01	7.830E+01	7.657E+01	7.567E+01	7.526E+01	7.509E+01	7.503E+01	7.501E+01	7.500E+01	7.500E+01	7.500E+01
4.000E+01	1.121E+02	8.133E+01	7.840E+01	7.664E+01	7.571E+01	7.528E+01	7.510E+01	7.503E+01	7.501E+01	7.500E+01	7.500E+01	7.500E+01
4.100E+01	1.122E+02	8.144E+01	7.850E+01	7.671E+01	7.575E+01	7.530E+01	7.511E+01	7.503E+01	7.501E+01	7.500E+01	7.500E+01	7.500E+01
4.200E+01	1.124E+02	8.156E+01	7.859E+01	7.678E+01	7.579E+01	7.532E+01	7.512E+01	7.504E+01	7.501E+01	7.500E+01	7.500E+01	7.500E+01
4.300E+01	1.125E+02	8.167E+01	7.869E+01	7.685E+01	7.584E+01	7.534E+01	7.513E+01	7.504E+01	7.501E+01	7.500E+01	7.500E+01	7.500E+01
4.400E+01	1.127E+02	8.177E+01	7.878E+01	7.691E+01	7.588E+01	7.536E+01	7.514E+01	7.505E+01	7.501E+01	7.500E+01	7.500E+01	7.500E+01
4.500E+01	1.128E+02	8.188E+01	7.887E+01	7.698E+01	7.592E+01	7.539E+01	7.515E+01	7.505E+01	7.502E+01	7.500E+01	7.500E+01	7.500E+01
4.600E+01	1.130E+02	8.199E+01	7.897E+01	7.705E+01	7.596E+01	7.541E+01	7.516E+01	7.506E+01	7.502E+01	7.501E+01	7.500E+01	7.500E+01
4.700E+01	1.131E+02	8.209E+01	7.906E+01	7.712E+01	7.601E+01	7.544E+01	7.517E+01	7.506E+01	7.502E+01	7.501E+01	7.500E+01	7.500E+01
4.800E+01	1.133E+02	8.219E+01	7.915E+01	7.719E+01	7.605E+01	7.546E+01	7.518E+01	7.507E+01	7.502E+01	7.501E+01	7.500E+01	7.500E+01
4.900E+01	1.134E+02	8.230E+01	7.924E+01	7.725E+01	7.610E+01	7.549E+01	7.520E+01	7.507E+01	7.502E+01	7.501E+01	7.500E+01	7.500E+01
5.000E+01	1.135E+02	8.240E+01	7.933E+01	7.733E+01	7.614E+01	7.551E+01	7.521E+01	7.508E+01	7.503E+01	7.501E+01	7.500E+01	7.500E+01
5.100E+01	1.136E+02	8.250E+01	7.942E+01	7.739E+01	7.619E+01	7.554E+01	7.523E+01	7.509E+01	7.503E+01	7.501E+01	7.500E+01	7.500E+01
5.200E+01	1.138E+02	8.259E+01	7.950E+01	7.746E+01	7.624E+01	7.557E+01	7.524E+01	7.509E+01	7.503E+01	7.501E+01	7.500E+01	7.500E+01
5.300E+01	1.139E+02	8.269E+01	7.959E+01	7.753E+01	7.628E+01	7.560E+01	7.526E+01	7.510E+01	7.504E+01	7.501E+01	7.500E+01	7.500E+01
5.400E+01	1.140E+02	8.278E+01	7.968E+01	7.760E+01	7.633E+01	7.563E+01	7.527E+01	7.511E+01	7.504E+01	7.501E+01	7.500E+01	7.500E+01
5.500E+01	1.141E+02	8.288E+01	7.976E+01	7.766E+01	7.638E+01	7.565E+01	7.529E+01	7.512E+01	7.504E+01	7.501E+01	7.500E+01	7.500E+01
5.600E+01	1.142E+02	8.297E+01	7.985E+01	7.773E+01	7.642E+01	7.568E+01	7.530E+01	7.512E+01	7.505E+01	7.502E+01	7.501E+01	7.500E+01

CALC. NO:	M-13-116
REVISION:	1
BY:	J. SHAFER DATE 5/17/90
CHECKED:	J. SHAFER DATE 5-23-90

CONTROL ROOM UNIT 283

SHEET 11-83 OF 84

5. 700E+01	1. 143E+02	8. 306E+01	7. 993E+01	7. 780E+01	7. 647E+01	7. 571E+01	7. 532E+01	7. 513E+01	7. 505E+01	7. 502E+01	7. 501E+01	7. 500E+01
5. 800E+01	1. 144E+02	8. 315E+01	8. 001E+01	7. 786E+01	7. 652E+01	7. 574E+01	7. 534E+01	7. 514E+01	7. 505E+01	7. 502E+01	7. 501E+01	7. 500E+01
5. 900E+01	1. 145E+02	8. 324E+01	8. 009E+01	7. 793E+01	7. 656E+01	7. 577E+01	7. 535E+01	7. 515E+01	7. 506E+01	7. 502E+01	7. 501E+01	7. 500E+01
6. 000E+01	1. 146E+02	8. 333E+01	8. 018E+01	7. 800E+01	7. 661E+01	7. 580E+01	7. 537E+01	7. 516E+01	7. 506E+01	7. 502E+01	7. 501E+01	7. 500E+01

ENGINEERING DEPARTMENT

**CALCULATION SHEET**SUBJECT: Room Temperature Response During  
Station BlackoutCALC NO. M-73-116 REV. 1J.O.NO. 6711 MADE BY: I. Shlafman DATE: 5-4-89 CHECKED BY: [Signature] DATE: 5-23-90**Attachments:**

1. Size of computer room cabinets
2. Letter from A.P. Grande to A.D. Sistos, Subject: Station Blackout Scenario. Electrical Heat Loads. SONGS 1,2 & 3 dated 4/10/89
3. E-mail from T.Ramos to Ilya Shlafman, subject : Station Blackout Lighting Load for DAC Rooms Units 2/3.

28208

28463

ADD

15%

AS TEMPORARY

CABINET

(TOD CARTE ETC)

ATTACHMENT 1

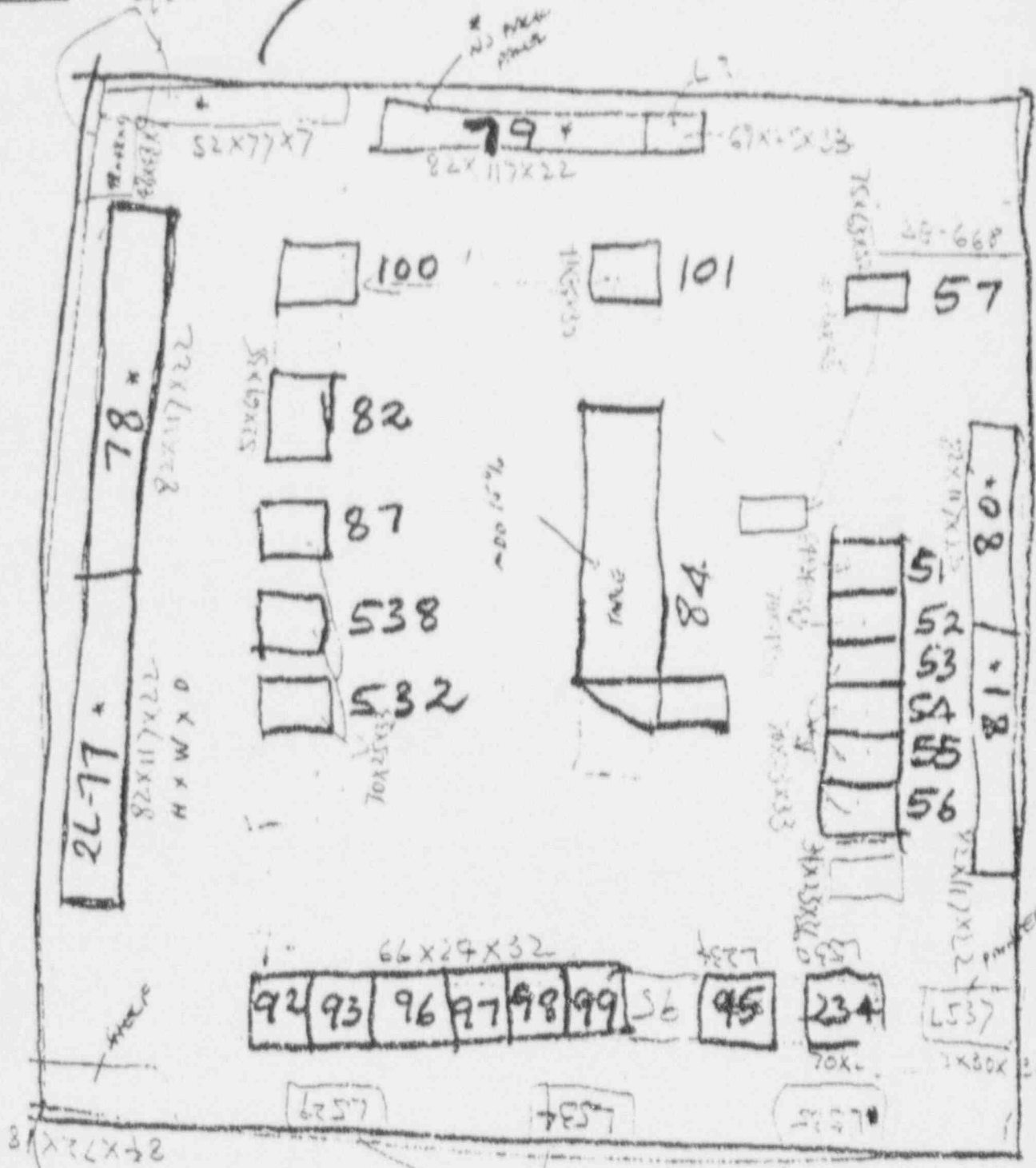
2/3L295

COMPUTER ROOM

PAGE 1 OF 1

M-73-116

Rev 1



FROM: SALES JAIN  
PAX: 28515

TO

ANDY NGAN PAX 86356

FAX: 86249

M - 73-116

Rev 1

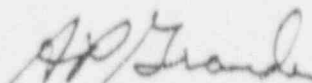
April 10, 1989

A. D. SISTOS

SUBJECT: Station Blackout Scenario  
Electrical Equipment Heat Loads  
San Onofre Nuclear Generating Station, Units 1, 2&3

In response to your request of February 22, 1989, attached are the tabulations of heat loads for DC powered electrical equipment under station blackout conditions by area for Unit 1 (Table 8) and Unit 2 (Table 9). DC and inverter electrical loads were directly converted to heat. For distribution panels, the heat dissipation for each panel load was allocated in proportion to its circuit breaker rating.

Preliminary copies of this data were provided to F. D. Santa Ana on March 13, 1989. If you have any questions, please call me at PAX 28483.



A. P. GRANDE

APGrande:0620g

cc: M. L. Merlo  
A. T. Kaneko  
M. A. Wharton  
B. Carlise  
D. L. Evans  
A. J. Thiel  
CDM Files



M-73-115

R-1

Ark-Lant 2

Table B

## Block Unit 1 HVAC Heat Load

Control Room	Heat Dissipation
Breaker #	Load (VA)
72-119	525.00
72-121	575.00
72-122	262.50
72-123	687.50
72-128	12.50
72-130	350.00
72-134	262.50
72-211	900.00
72-215	250.00
72-220	63.50
72-222	2962.50
72-223	3337.50
72-224	2075.00
72-104	2175.00
72-111	537.50
8-1101	202.50
8-1102	202.50
8-1103	202.50
8-1104	202.50
8-1105	202.50
8-1106	202.50
8-1107	202.50
8-1108	202.50
8-1109	202.50
8-1110	202.50
8-1111	202.50
8-1112	202.50
8-1113	202.50
8-1114	202.50
8-1115	202.50
8-1116	202.50

M-72-110

Rev 1

Attachment 2

Table 8 cont.

8-1201	313.20
8-1202	313.20
8-1203	313.20
8-1204	313.20
8-1205	313.20
8-1206	313.20
8-1207	313.20
8-1208	313.20
8-1209	313.20
8-1210	313.20
8-1211	313.20
8-1212	313.20
8-1213	313.20
8-1214	313.20
8-1215	313.20
8-1216	313.20
8-1301	181.20
8-1302	181.20
8-1303	181.20
8-1305	181.20
8-1306	181.20
8-1312	181.20
8-1314	181.20
8-1307	181.20
8-1308	181.20
8-1309	181.20
8-1310	181.20
8-1313	181.20
8-1315	181.20
8-1324	181.20
8-1401	308.40
8-1402	308.40
8-1403	308.40
8-1404	308.40
8-1405	308.40
8-1406	308.40
8-1407	308.40
8-1408	308.40
8-1409	308.40
8-1410	308.40
8-1411	308.40
8-1412	308.40
8-1413	308.40
8-1414	308.40
8-1415	308.40
8-1416	308.40

M-73-116  
R-1  
Attachment 2

Table 8 cont.

8-2901	230.85
8-2903	230.85
8-2904	230.85
8-2905	230.85
8-2906	230.85
8-2907	230.85
8-2908	230.85
8-2909	230.85
8-2924	230.85
8-3009	230.85
8-3024	230.85
Total	33256.75

M-73-112  
 Rev 1  
 Attachment 2

Table B cont.

## Diesel Generator #1 Heat Dissipation

Breaker #	Load (VA)
72-117	3425.00
72-118	512.50
72-126	350.00
Total	4287.50

## Diesel Generator #2 Heat Dissipation

Breaker #	Load (VA)
72-206	3425.00

## 4160 V Heat Dissipation

Breaker #	Load (VA)
72-127	112.50
72-206	237.50
72-218	237.50
72-102	1987.50
72-103	400.00
72-110	1150.00
72-112	175.00
72-131	642.50
8-3311	181.20
8-3312	181.20
8-3314	181.20
8-1417	308.40
Total	5796.50

M-73-1  
Rev 1  
Attachment 2

Table 8 cont.

Breaker Heat Dissipation

Breaker #	Load (VA)
72-120	7900.00
8-1304	181.20
Total	8081.20

Reducts Heat Dissipation

Breaker #	Load (VA)
72-129	237.00

Exciter Heat Dissipation

Breaker #	Load (VA)
72-138	14500.00

Turbine Heat Dissipation

Breaker #	Load (VA)
72-139	26500.00

Containment Heat Dissipation

Breaker #	Load (VA)
72-141	4790.00
8-1401	308.40
Total	5098.40

M-73 10

R-1

Attachment 2

Table 8 cont.

480V Heat Disipation

Breaker #	Load (VA)
72-204	112.50
72-205	112.50
72-217	495.00
72-221	37.50
8-3001	230.85
8-3002	230.85
8-3003	730.85
8-3004	240.85
Total	1640.90

005 Heat Disipation

Breaker #	Load (VA)
72-109	337.50

Battery No. 1 Heat Disipation

Breaker #	Load (VA)
72-135	375.00
72-136	580.00
72-137	377.50
Total	1332.50