Public Service
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Company

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December 19, 1985

Director of Nuclear Reactor Regulation
United States Nuclear Regulatory Commission
7920 Norfolk Avenue
Bethesda, Maryland 20814

Attention: Ms. Elinor Adensam, Director
Project Directorate 3
Division of BWR Licensing

Dear Ms. Adensam:

CONTROL ROOM HABITABILITY
HOPE CREEK GENERATING STATION
DOCKET NO. 50-354

Pursuant to discussions with NRC on Ocotber 30, 1985, concerning control room habitability, PSE&G hereby submits the attached response to each of the concerns identified.

We trust this information will resolve the ACRS open item related to loss of all control room ventilation.

Should you have any questions in this regard, please contact us.

Sincerely,

Attachment

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A00-

C D.H. Wagner
USNRC Licensing Project Manager

R.W. Borchardt
USNRC Senior Resident Inspector

ITEM 1· NRC TELECON - CONTROL ROOM HABITABILITY, OCTOBER 30, 1985

NRC Concern: "Indicate all assumptions used to develop the control room temperature rise curves provided in the 10/1/85 submittal, and describe analytical model used."

RESPONSE:

The transient ambient temperature analysis for Control Room 5510 and Electrical Equipment Room 5302 was completed by using the Bechtel Standard Computer Program ME204-Room Heat-up (RMHTUP). The program analyzes room ambient air heat-up generated by internal equipment and other heat sources, and indicates that without ventilation air, the room air temperature increases with time. The program is valid for any homogenous room enclosure material with a surface emissivity similar to that of concrete.

The analytical model and assumptions used in the program are as follows:

A. The room is modeled as an enclosed space bounded by the same thickness of walls, ceiling and floor. The various wall thicknesses were calculated to provide an equivalent thickness.

B. The different adjacent room temperatures were calculated to an equivalent temperature.

C. The room volume is corrected for the volume occupied by the equipment and likewise, the room area is corrected for the area covered by the equipment.

D. Only one half of the concrete wall thickness is considered as a heat sink for each room, the other half is for the adjacent room.

E. The air temperatures in the adjacent spaces/rooms is considered as remaining constant.

F. The heat generated within the subject room is considered as being constant.

G. Heat transfer between the space and the adjacent rooms is calculated based on the room ambient and wall temperature differences.

ITEM 2. NRC TELECON - CONTROL ROOM HABITABILITY, OCTOBER 30, 1985

NRC CONCERN: "Provide additional temperature rise curves for inside cabinets and panels, indicating delta T between ambient control room temperature and temperature inside cabinets and panels; indicate all assumptions used in developing the curves."

RESPONSE:

The actual operating temperature for the majority of the control room panels have been measured in the field. The attached control panel load summary provides a listing of all control room panels with their heat loads and their temperatures as measured in the field. These measurements have been analyzed to yield the minimum, maximum, and average temperature rise for two cases. The first case is the normal panel condition with the panel doors closed. The second case is with the panel doors open. The average temperature rise (delta T between inside panel and ambient) will remain constant for each panel provided the panel heat load does not change. In most cases the panel temperature rise is on the order of 10 to 15 degrees F or less.

Heat-up values for inside cabinets and panels is determined by adding the panel average temperature rise to the attached control room heat-up curve.

ITEM 3: NRC TELECON - CONTROL ROOM HABITABILITY, OCTOBER 30, 1985

NRC CONCERN: "Commit to development of emergency operating procedures and training in the use of these procedures, if such actions as opening doors and installing temporary fans will be utilized to mitigate the effects of loss of all ventilation to the control room."

RESPONSE:

The actions described in the response to Item 4, that is opening control panel doors, positioning portable fans in the control room boundary doors, and operating the control room exhaust fans if available, will be implemented via control room alarm response procedure OP-AR.ZZ-019. A malfunction or loss of control room supply ventilation is annunciated in the control room by the overhead annunciator alarm window 10C800-E5.B1. Operator training in the implementation of the above actions will be included in the first annual operator requalification training cycle.

ITEM 4: NRC TELECON - CONTROL ROOM HABITABILITY, OCTOBER 30, 1985

NRC CONCERN: "Assess the effectiveness of any alternate cooling method to be utilized."

RESPONSE:

The following actions will be taken to reduce the heat rise in the control room if a loss of all control room ventilation occurs:

1. The control room panel doors will be opened thus allowing additional cooling to the panels. While this does not reduce the control room heat load or change the room heatup curve, it does lower the average heat rise of each panel by an average of 3.8 degrees F (see the control panel load summary in the response to Item 2). In addition, the maximum (hot spot) temperature of each panel is lowered an average of 4.4 degrees F with hotter panels having a greater temperature reduction. This action will be taken within thirty minutes of the loss of all ventilation.

2. The control room boundary doors will be opened, and temporary portable fans will be placed in the door ways to induce cooling air from the service area corridor into the control room and allowing it to exit to the diesel and wing area of the auxiliary building.

   One fan will be positioned in double door #02 leading to corridor 3504 with the fan blowing into the control room from the service area corridor. The other fan will be placed in door #10C leading to corridor 5525 with the fan blowing into the corridor from the control room. In addition, the control room doors Nos. 09, 10A, and 10B will be opened. Approximately 6000 CFM cooling air from the service area ventilation system at approximately 80°F to help cool the control room will delay the time required to reach 104°F to at least 24 hours.

3. If the control room exhaust fans are operational (1AV-402 & 1BV-402), one of them will be started. This will induce an additional 2500 CFM of cooling air into the control room from adjacent spaces.

These actions will be implemented in control room alarm response procedure OP-AR.ZZ-019.

ITEM 5: NRC TELECON - CONTROL ROOM HABITABILITY, OCTOBER 30, 1985

NRC CONCERN: "Indicate whether it is expected that control room instrumentation will have been damaged as a result of the loss of all ventilation event. Will instrumentation have to be replaced after such an event?"

RESPONSE:

It is not expected that control room instruments will be damaged or that their accuracy will change by a temporary temperature excursion of the control room ambient to 104°F. Since the gathering of field data concentrated on panel hot spots, the delta T's found are considered the most conservative conditions that would exist. A review of the temperature design limits, the control room equipment and the field temperature data revealed that the worst case delta T existed with the Bailey control panels when the doors were closed. The functional temperature design limit for Bailey equipment is given as 140°F for a 24 hour period. Adding the worst case delta T of 18°F (ignoring 27°F as unrepresentative) to a control room ambient of 104°F yields 122°F which is the maximum temperature the Bailey equipment would see. Since 122°F is much less than the 140°F functional limit, it is highly unlikely that any damage will occur to the Bailey equipment. The design temperature limits of the remaining essential control room panels are: GE-120°F; NDT Intl.-135°F (8 hours); General Atomic-131°F & Rockwell-120°F (see the attached control panel load summary for internal temperature rise for the approximate panels).

ITEM 6: NRC TELECON - CONTROL ROOM HABITABILITY, OCTOBER 30, 1985

NRC CONCERN: "Verify that control room ventilation system is of sufficient capacity that when the ventilation system comes back on-line it will immediately begin to remove the heat built up and prevent any further temperature rise (i.e., must demonstrate that qualification temperature values are not exceeded due to the duration between the time ventilation is restored and the point where heat input is effectively removed)."

RESPONSE:

The control room ventilation system has sufficient capacity to prevent further temperature rise in the control room after it is restored. As seen from the attached control room heatup curve, the control room temperature six hours after loss of ventilation cooling is 102.8°F and the ambient air temperature rise gradient between six and eight hours after loss of ventilation cooling is about one degree F per hour. Within 15 minutes after the system is restored to full capacity, the control room ambient air temperature will fall to approximately 87°F. The air temperature will slowly drop to 76°F as the system removes the normal heat load plus the stored heat resulting from the room heatup event. Within 24 hours, the ventilation system will remove all stored heat and the control room conditions will be returned to normal.

ITEM 7: NRC TELECON - CONTROL ROOM HABITABILITY, OCTOBER 30, 1985

NRC CONCERN: "Account for temperature rise inside the cabinets (local hot spots)."

RESPONSE:

The field temperature measurements provide indication of any local panel hot spots. Each panel was visually reviewed prior to placement of thermocouples to establish potential hot spots. Thermocouples were then placed within close proximity of any potential hot spots such as transformers, power supplies, heavy duty relays, CRTs, lights, etc. to generate worst case conditions. The attached Sample Data Collection Sheet is an example of thermocouple placement in a panel. The maximum panel temperature difference is 34.3°F in panel 10C651B where the temperature sensors were placed near a CRT and a light bulb. The average temperature for this panel is 27.8°F. This value is considered a conservative indication of panel hot spots.

CONTROL PANEL LOAD SUMMARY

05-Dec-85 PAGE 1

NOTE 1

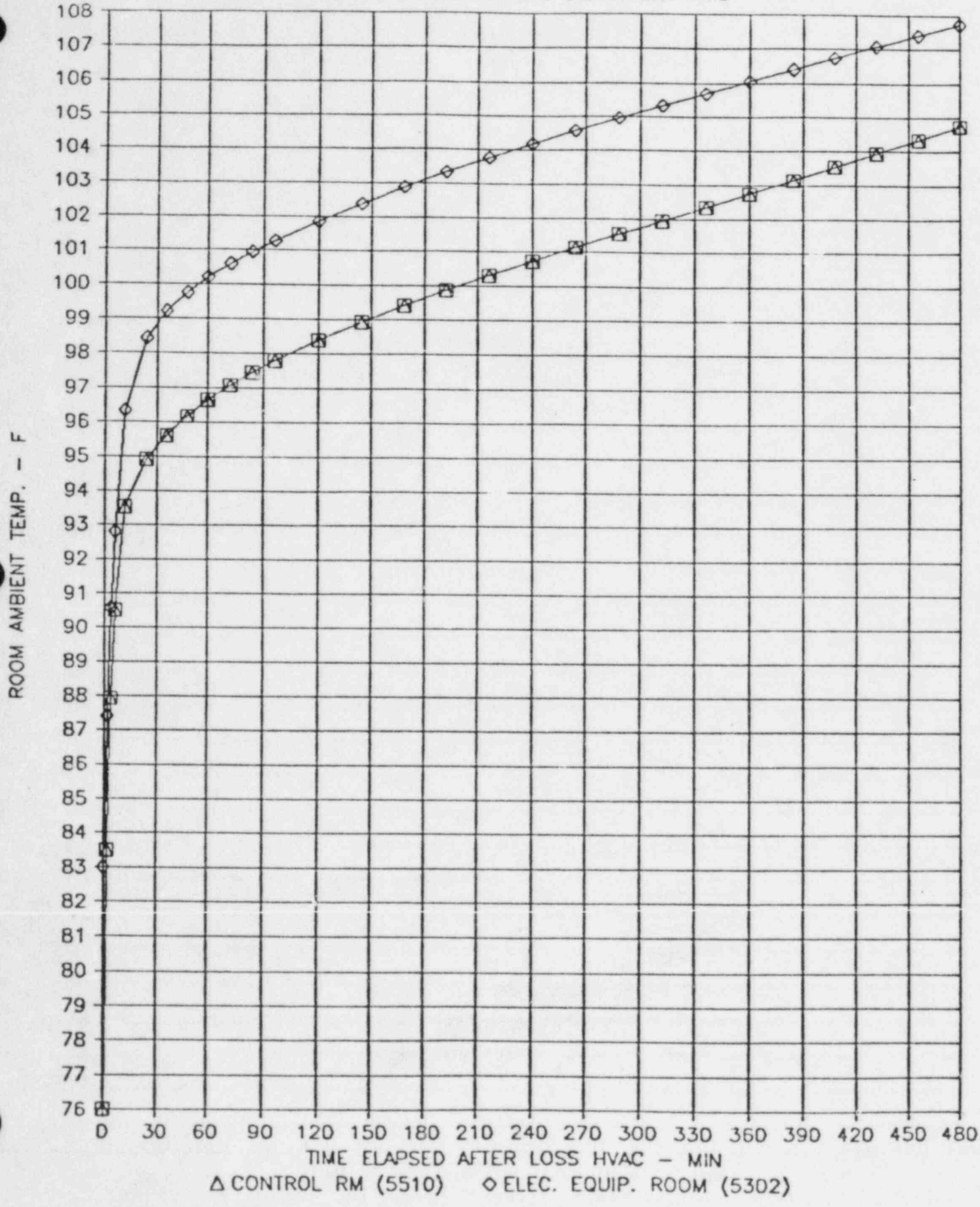
LOCATION	PANEL TAG #	DESCRIPTION	DIMENSIONS (FT) FRONT	SIDE	HEIGHT	VOLUME (FT3)	HEAT LOAD (WATTS)	HEAT DENSITY (BTUH /FT3)	PANEL TEMP DIFFERENCE (F) WITH DOORS CLOSED MIN	MAX	AVG	PANEL TEMP DIFFERENCE (F) WITH DOORS OPEN MIN	MAX	AVG	MAX TEMP REDUCTION DUE TO OPEN DOORS	AVG TEMP REDUCTION DUE TO OPEN DOORS	REMARKS
SHIFT SUP OFFICE	00C647	SHIFT SUPV COMM CONSOLE	8.00	3.00	4.00	96.00	160	5.69	NO FIELD TEMPERATURE DATA								TEMP'S EXPECTED TO BE LOW (LOW HEAT DENSITY)
5509	00C648	SHIFT SUPV MONITOR CONSOLE	8.00	4.40	4.00	140.80	350	8.48	NO FIELD TEMPERATURE DATA								TEMP'S EXPECTED TO BE LOW (LOW HEAT DENSITY)
MAIN CONTROL RM	10C604	CLASS 1E RAD MON INSTR CAB	4.50	3.00	7.50	101.25	2000	67.42	5.3	18.8	11.5	3.2	14.6	8.6	4.2	2.9	PANEL AVG
5510	10C604	* * * * * *							6.2	16.3	10.4	4.2	14.[illegible]	8.0			SECTION 1
GENERAL ATOMIC	10C604	* * * * * *							4.4	21.2	12.5	2.1	14.5	9.2			SECTIONS 2 & 3
	10C605	SRV MONITOR CAB	2.50	3.00	7.50	56.25	500	30.34	4.0	21.2	13.0	-0.1	11.1	5.5	10.1	7.5	
	10C607	TIP CONT & MONITOR CAB	4.00	3.00	7.50	90.00	700	26.54	-2.8	7.4	2.0	-4.4	4.2	-0.6	3.2	2.6	
NDT INTL	10C608	POWER RANGE NEUTRON MON	12.50	3.00	7.50	281.25	3600	43.69	0.8	21.1	8.9	-1.0	16.7	3.3	4.5	5.7	PANEL AVG
	10C608	* * * * *							0.5	19.5	8.4	0.7	14.4	4.9			SECTION A
	10C608	* * * * *							0.8	21.4	8.3	-1.6	11.5	2.1			SECTIONS B & C
	10C608	* * * * *							1.0	22.5	10.1	-2.0	24.1	2.8			SECTIONS D & E
GE	10C609	RPS PIV 1&3 LOGIC VERT BD	15.00	3.00	7.50	337.50	2775	28.06	7.0	13.1	9.9	1.8	7.2	4.6	5.9	5.2	PANEL AVG
	10C609	* * * * * * *							12.9	15.7	14.4	3.1	11.1	6.9			SECTIONS A-C
	10C609	* * * * * * *							8.9	22.4	14.7	4.8	10.7	7.9			SECTIONS D-E
	10C610	CONT ROD TEST INSTR CAB	2.00	3.00	7.50	45.00	200	15.17	-0.8	1.3	0.5	-2.6	-0.1	-0.9	1.4	1.4	
	10C611	RPS PIV 2&4 LOGIC VERT BD	15.00	3.00	7.50	337.50	2775	28.06	7.0	13.1	9.9	1.8	7.2	4.6	5.9	5.2	PANEL AVG (DATA TAKEN FROM PANEL 10C609)
	10C635	RAD MON A/B INSTR CAB	4.00	3.00	7.50	90.00	1000	37.92	0.1	9.8	4.5	-2.1	5.7	0.7	4.1	3.8	
	10C636	RAD MON C/D INSTR CAB	3.00	4.00	7.50	90.00	1000	37.92	2.7	10.6	6.7	-1.5	7.2	2.0	3.4	4.7	
	10C649	OPERATORS MONITOR CONSOLE	8.00	2.33	4.00	74.56	400	18.31	NO FIELD TEMPERATURE DATA								TEMP'S EXPECTED TO BE LOW (LOW HEAT DENSITY)
	10C650A	MAIN VERTICAL BOARDS	17.45	3.00	7.50	392.70	1596	13.87	-2.7	5.1	1.0	-3.7	4.1	0.2	1.0	0.8	
	10C650B	* * *	9.20	3.00	7.50	207.[illegible]8	850	14.01	0.0	16.7	4.3	-0.6	6.3	1.6	10.4	2.7	
	10C650C	* * *	20.79	3.00	7.50	467.70	3258	23.77	1.2	14.5	6.8	-0.5	12.3	4.8	2.3	1.9	PANEL AVG
	10C650C	* * *							1.0	14.5	7.7	-1.4	13.4	5.7			SECTIONS 1 & 2
	10C650C	* * *							2.1	15.2	7.7	0.5	12.4	5.1			SECTIONS 3 & 4
	10C650C	* * *							0.5	13.9	4.9	-0.6	11.0	3.7			SECTION 5
	10C650D	* * *	9.20	3.00	7.50	207.08	868	14.31	-1.1	7.1	2.2	-2.3	6.0	1.3	1.1	0.9	
	10C650E	* * *	17.45	3.00	7.50	392.70	897	7.80	-3.4	3.4	-0.9	-4.5	2.9	-1.7	0.5	0.8	PANEL AVG
BAILEY	10C650E	* * *							-3.3	3.6	-0.7	-5.4	3.0	-2.0			SECTIONS 1 & 2
	10C650E	* * *							-3.5	0.2	-1.9	-4.4	0.0	-2.9			SECTIONS 3
	10C650E	* * *							-3.5	6.4	0.0	-3.6	5.8	-0.2			SECTION 4
	10C651A	UNIT OPERATORS CONSOLE	14.25	5.08	3.50	253.37	1769	23.83	13.9	21.0	18.0	8.4	16.7	13.8	4.3	4.2	
	10C651B	* * *	2.5	5.08	3.50	44.45	326	25.03	21.6	34.3	27.8	14.2	28.1	21.2	6.2	6.6	POINTS NEAR HOT SPOTS (CRT & LIGHT BULB)
	10C651C	* * *	14	5.08	3.50	248.92	3049	41.80	7.4	16.6	12.5	4.3	10.5	7.4	6.1	5.1	
	10C651D	* * *	2.5	5.08	3.50	44.45	321	24.65	8.5	20.1	15.7	3.0	15.7	11.1	4.4	4.6	
	10C651E	* * *	14.24	5.08	3.50	253.19	1362	18.36	10.4	19.1	13.2	5.5	17.7	10.0	1.4	3.2	
	10C660	CONTROL RM DKP	7.00	3.00	3.50	73.50	517	24.01	NO FIELD TEMPERATURE DATA								EQUIP. IS NOT SAFETY RELATED
	10C671	FIRE PROTECTION STATUS CAB	7.33	2.25	7.50	123.69	2450	67.60	NO FIELD TEMPERATURE DATA								TEMP'S EXPECTED SIMILAR TO 10C604
	10C685	COMMUNICATIONS EQUIP CAB	6.00	[illegible].00	7.50	90.00	600	22.75	NO FIELD TEMPERATURE DATA								EQUIP. IS NOT SAFETY RELATED
	10C800A	OVERHEAD ANNUNCIATOR PANEL	17.45	[illegible]	2.33	137.45	255	6.33	NO FIELD TEMPERATURE DATA								TEMP'S EXPECTED TO BE LOW (LOW HEAT DENSITY)
	10C800B	* * *	9.20	[illegible].38	2.33	72.48	130	6.12	NO FIELD TEMPERATURE DATA								TEMP'S EXPECTED TO BE LOW (LOW HEAT DENSITY)
	10C800C	* * *	20.79	3.38	2.33	163.70	305	6.36	NO FIELD TEMPERATURE DATA								TEMP'S EXPECTED TO BE LOW (LOW HEAT DENSITY)
	10C800D	* * *	9.20	3.38	2.33	72.48	130	6.12	NO FIELD TEMPERATURE DATA								TEMP'S EXPECTED TO BE LOW (LOW HEAT DENSITY)
	10C800E	* * *	17.45	3.38	2.33	137.45	255	6.33	NO FIELD TEMPERATURE DATA								TEMP'S EXPECTED TO BE LOW (LOW HEAT DENSITY)
	10Z622	BOP COMP LINE PRINTER	3.00	3.00	4.17	37.53	689	62.66	NO FIELD TEMPERATURE DATA								EQUIP. IS NOT SAFETY RELATED
ROCKWELL	1AC633	POST LOCA H2 RECOMB A CNT	2.50	2.50	7.83	48.94	250	17.43	0.1	13.0	6.9	-2.2	6.7	2.3	6.3	4.6	
	1BC633	POST LOCA H2 RECOMB B CNT	2.50	2.50	7.83	48.94	250	17.43	0.1	13.0	6.9	-2.2	6.7	2.3	6.3	4.6	DATA TAKEN FROM PANEL 1AC633
TOTALS							33578 WATTS		-3.5 MIN	34.3 MAX	27.8 MAX AVG	-5.4 MIN	28.1 MAX	21.2 MAX AVG	4.4 MAX REDUC (AVERAGE)	3.8 AVG REDUC (AVERAGE)	THESE VALUES SUMMARIZE ALL PANELS
							114598 BTU/HR										
									-3.5	22.5	18	-5.4	24.1	13.8	4.3	3.6	THESE VALUES SUMMARIZE ALL PANELS EXCEPT PANEL 10C651B WHICH IS NOT CONSIDERED AVERAGE

NOTE 1 - DIFFERENCE BETWEEN THE CONTROL ROOM AMBIENT TEMP AND THE AVERAGE INTERNAL PANEL TEMPERATURE

CONTROL ROOM HEAT-UP CURVE

(ASSUMING NO OPERATOR ACTION TAKEN)

CONTROL & ELECTRICAL EQUIPMENT RMS



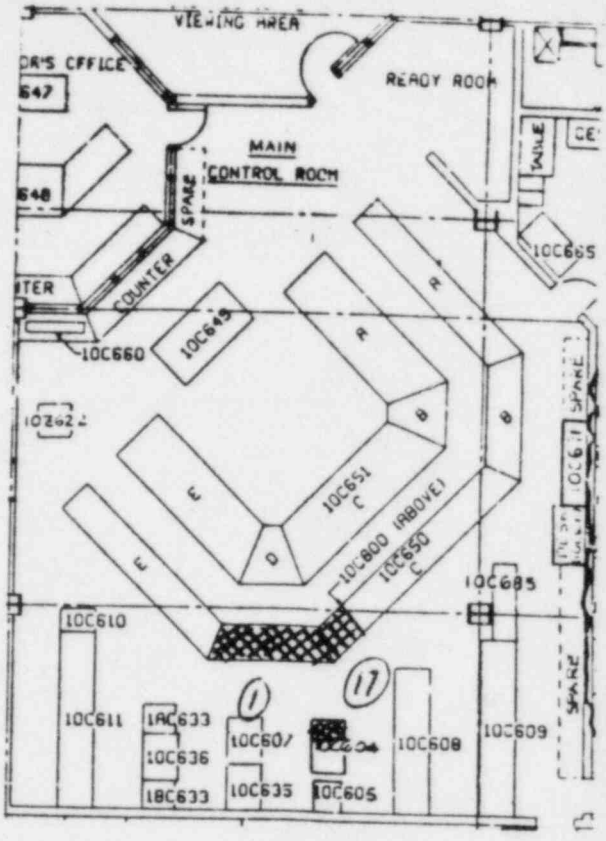
PANEL: 10C604 / 10C650C / 10C650D

	DOORS CLOSED	DOORS OPEN
TIME START:	17:52	18:04
TIME END:	18:04	18:16

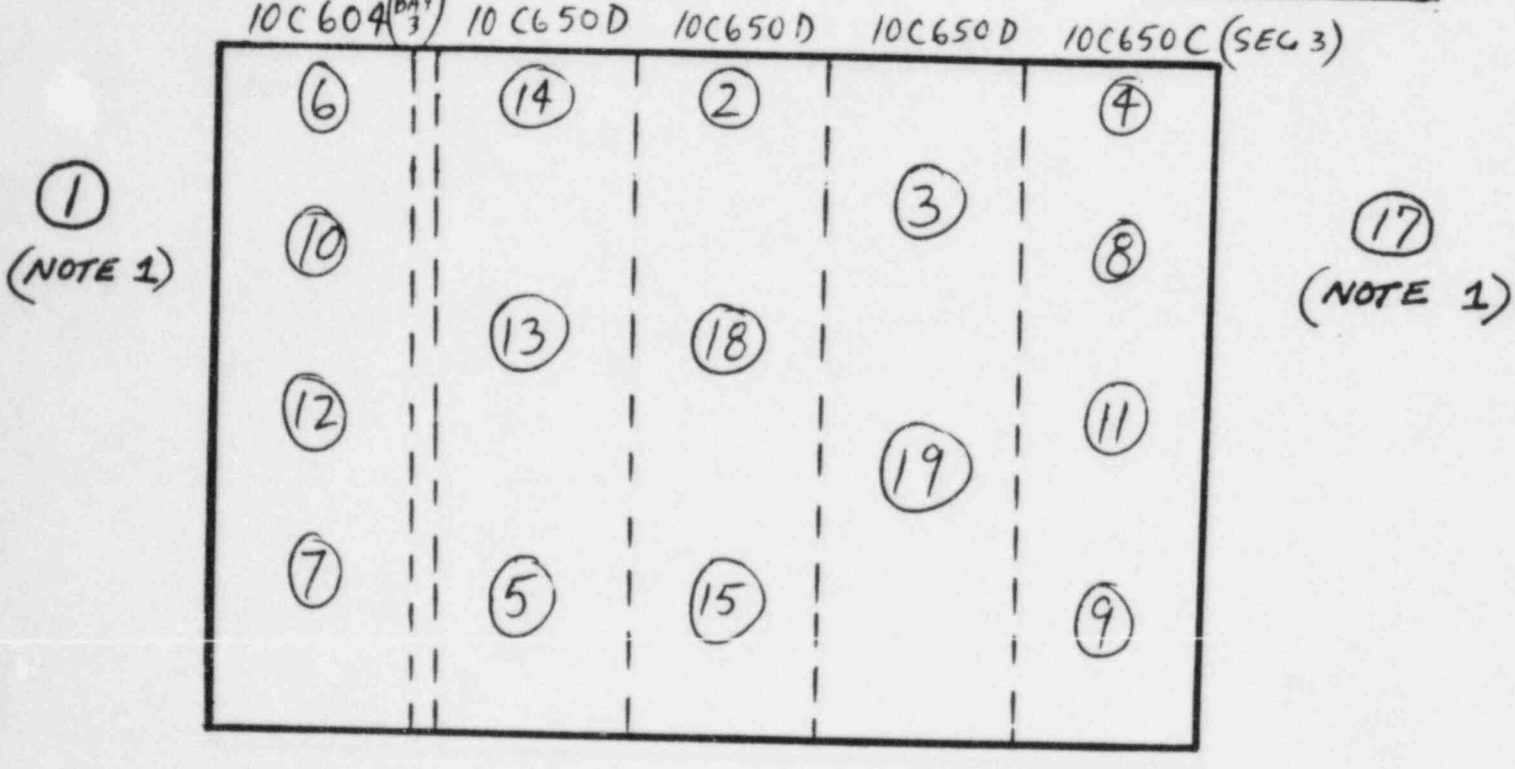
MGM
INITIALS

NOTES:

SAMPLE DATA COLLECTION SHEET



KEY PLAN:



REAR VIEW

○ - THERMOCOUPLE NUMBER (CORRELATE WITH CHART PAPER FOR TEMPERATURE READINGS)

NOTE 1- AMBIENT THERMOCOUPLES (SEE KEY PLAN FOR LOCATION)

ATTACHMENT A