ATTACHMENT 5

CONTROL BUILDING ROOM LOCATIONS AND P&ID EXCERPTS

#### CONTROL BUILDING ROOM LOCATIONS





#### CONTROL BUILDING ROOM LOCATIONS

CONTROL BLDG & COMMUNICATION CORRIDOR 3301 ESF SWITCHGEAR RM (NO.1) 3302 ESF SWITCHGEAR RM (NO.2) 3303 CORRIDOR 3304 COMMUNICATION CORRIDOR-GENERAL FL. AREA 3401 CORRIDOR (HO.I) 3402 CORRIDOR (NO.3) 3403 NON- VITAL AC SWER & TRANS ROOM 3404 SWITCHBOARD RM (NO.4) 3405 BATTERY RM (NO. 4) 3406 CORRIDOR (NO.2) 3407 BATTERY RM (NO.1) 3408 SWITCHBOARD RM (NO.I) 3409 NON-VITAL AC SWER & TRANS ROOM 3410 SWITCHBOARD RM (NO.2) 3411 BATTERY AM (NO.2) 3412 EMERGENCY SHOWER & EYEWASH AREA 3413 BATTERY RM (NO. 3) 3414 SWITCHBOARD RM (NO. 3) 3415 ACCESS CONTROL & ELEC. EQUIP. A/C UNITS RM. (HO. 1) 3416 ACCESS CONTROL & ELEC. EQUIP. A/C UNITS RM. (HO. 2) 3305, 3306, 3418 & 3419 ELEC CHASE



#### EXCERPT FROM P&ID M-22GK03 (FSAR FIGURE 9.4-1 SHEET 3)



### EXCERPT FROM P&ID M-22GK03 (FSAR FIGURE 9.4-1 SHEET 3)



## EXCERPT FROM P&ID M-22GK04 (FSAR FIGURE 9.4-1 SHEET 4)

# ATTACHMENT 6

CALCULATION GK-19, REVISION 0, ADDENDUM 3, "2016' AUXILIARY BUILDING BATTERY AND SWITCHBOARD ROOM GOTHIC TEMPERATURE ANALYSIS"

Calculation: GK-19	, Rev. 0 Add. 3	3
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Title: 2016' Aux. Building Battery and SWBD room GOTHIC temperature analysis

• Description: This calculation will model the temperatures of the 2016' Aux. Building Battery and SWBD rooms using the GOTHIC modeling software. This analysis will include the effects of impaired air conditioning and a range of time delays in opening the room doors.

Responsible Engineer:	Kurt Linsenbardt PIN#70901 Name (printed)	See electronic signature Signature	6/29/2011
Reviewing Engineer:	Thomas Carr PIN#990 Name (printed)	See electronic signature Signature	6/29/2011
Supervising Engineer			
Approval:	Jim Little PIN#3557	See electronic signature	6/29/2011
	Name (printed)	Signature	

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2016' Aux. Building Battery and SWBD room GOTHIC		GK-19, Rev	v. 0 Add. 3	3	
	temperature analysis	PREPARED BY:	REVIEW	ED B	SY:
		Kurt Linsenbardt	Tom Carr	•	

#### 1.0 <u>PURPOSE</u>

• This calculation will model the temperatures of the 2016' Aux. Building Battery and SWBD rooms using the GOTHIC modeling software. This analysis will include the effects of the loss of one train of Class 1E air conditioning, and a time delay in opening the room doors. This will show how effectively the alternate train rooms are cooled by the airflow through the doors and, ultimately, the other train of Class 1E A/C.

# 2.0 <u>METHODOLOGY</u>

The methodology used in this calculation will treat each room as a single lumped volume using two one directional flow paths for each major vent path. The thermal hydraulics modeled between and within the lumped volumes will be those integrated into the GOTHIC 7.2a software package. The 2000' ESF Switchgear rooms are also included in the model due to the potential impact of their heat loads.

# 3.0 ASSUMPTIONS

- 1. The doorways between the 2016' Battery and SWBD rooms, and the doors leading out to the 2016' hallways are opened simultaneously and instantaneously after a given duration into the event. As long as Operations has all of the doors opened by the point the model specifies, the model will be conservative. This is due to the fact that having some of the doors opened early will give extra cooling to the rooms.
- 2. The models were run with the doors opening at one and two hour intervals from the start of the accident, and then at two hour intervals from four to eight hours, and then one last run with them opening at the 12 hour mark. These were chosen to allow Operations adequate time to respond in the event of an A/C train failure, while still assuming that they would be able to respond within one shift of the failure.
- 3. All air and concrete are assumed to start at 80°F.

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- 4. HVAC flow to the area is assumed to be at a constant air temperature of 80°F.
- 5. The surrounding environment on the other side of the concrete walls is assumed to stay at 80°F for the duration of the 30 day run.
- 6. A 14.7 psia pressure boundary is included to prevent the levels from pressurizing. This is conservative, as the calculation is only concerned with the room temperatures, and not the room pressures. Due to it being a 30 day run, modeling it as an airtight volume would cause issues with pressure transients in the GOTHIC modeling software.
- All concrete is considered to be homogenous, with properties (such as density) not varying with temperature. As the temperatures only change by ~50°F, the difference in material properties with temperature is negligible.
- 8. Heat transfer through the closed doors is omitted. After the doors are opened at the six hour mark, they would no longer act as thermal conductors, and the GOTHIC program does not allow conductors to disappear in this fashion. As the temperature increases occur due to the heat sources inside the rooms, by removing a way for heat to escape the room, this will result in a conservative temperature.
- 9. No fire protection systems were modeled for the sensitivity runs. Due to the maximum temperatures remaining below the actuation temperatures of the fire dampers it is unnecessary to include them in the model.
- 10. It is assumed that the height of the ceilings in all rooms is 14 1/3 ft. This represents 16 feet nominal between floors, minus the assumed concrete floor thickness of one foot, minus an additional factor of conservation to represent room equipment taking up space in the room. This is conservative due to the fact that minimizing volume limits the mass of air in the room and increases the effects of heat addition on room temperature.
- 11. Only one door in a set of double doors will be blocked open. This is conservative in reducing the available airflow, and is consistent with past operator instructions.

2016' Aux. Building Battery and SWBD room GOTHIC temperature analysis

- 12. No thermal conductors other than structural concrete are included. This is conservative as the additional conductors would only serve as heatsinks and would remove heat from the atmosphere.
- 13. No credit is taken for any non-HVAC airflow from the floors (aside from the pressure boundaries). This is conservative as omitting the potential flow from the stairwells reduces the amount of buoyancy driven flow available to cool the areas.
- 14. Floors and ceilings are modeled as one foot concrete, and external walls are modeled as two foot thick concrete as estimated from floor layout drawings (Reference 1).
- 15. Each doorway and transfer grill flowpath was given an exit loss coefficient of 2.8 to account for the flow restriction of the path geometry. This is based off of discussion with the makers of GOTHIC. Omitting the exit loss coefficient would allow the airflows to reach unrealistic speeds and would cause greater than normal cooling.

# 4.0 **DESIGN INPUTS**

The room dimensions in Table 1 were taken from the Control Building floor layout drawing (Reference 1). The heat loads in Table 2 were taken from GK-10, the previous SWBD room heatup calculation (Reference 2) and the HVAC parameters in Table 3 were found in the Control Building HVAC drawing (Reference 3&4).

The door parameters in Table 4 were found on the Door Schedule drawing (Reference 5). The control building HVAC drawings show a grate in-between the SWBD rooms and their respective Battery rooms. The M-2H3411 drawing (Ref. 4) gives the dimensions of the grates as 12"x12". Similarly, the M-2H3311 HVAC drawing (Ref. 3) indicates the presence of two 24"x24" transfer grills between the two ESF Switchgear rooms.

All internal walls are modeled as 8 inch thick concrete (Note 2, Ref. 1).

In order to properly model the interaction between the two trains Corridor 1 (Room #3401) was divided into north and south halves, as shown in Figure 1. The T junction between Corridor 2 (Room #3406) was modeled by dividing the intersection into a three different flowpaths, one between the N-S halves of Corridor 1, and one from each half of

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Corridor 1 into Corridor 2. This allows the airflow to flow between all three different hallways.

	Width	Length
Rooms	(ft)	(ft)
SWBD 1	18.7	22.7
SWBD 2	18.5	19.7
-SWBD 2 E. Chase	6.0	4.0
SWBD 3	18.7	19.7
-SWBD 3 E. Chase	8.2	4.0
SWBD 4	18.5	22.7
Battery 1	12.7	20.7
Battery 2	12.8	21.0
-Battery 2 notch	8.4	4.7
Battery 3	12.7	21.0
+Battery 3 S. Alcove	4.2	4.7
+Battery 3 N. Alcove	2.1	3.3
Battery 4	12.8	20.7
Corridor 1N	57.3	6.7
Corridor 1S	31.3	6.7
+Corridor 1S Alcove	4.3	6.4
Corridor 2	12.0	37.0
ESF 1	50.5	66.0
-ESF Elec. Chase 1	6.0	4.0
-ESF Elec. Chase 2	13.0	13.0
ESF 2	48.5	66.0
-ESF Duct Chase	12.9	4.7
-ESF Elec. Chase 1	6.0	4.0
-ESF Elec. Chase 2	13.0	13.0
-2000' SW Stairwell	15.3	25.0

 Table 1: Room Parameters

+ means the volume is an addition to the parent room

- means the notch is removed from the parent room

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2016' Aux. Building Battery and SWBD room GOTHIC temperature analysis

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Rooms	DC Load (watts)	
SWBD 1&4	13811	
SWBD 2&3	2928	
Battery 1&4	301	
Battery 2&3	161	
ESF 1	28968	
ESF 2	27988	
Table 2. DC heat loads		

Table 2: DC heat loads

Booms	Air In	Air Out			
	(CFM)	(CFM)			
SWBD 1&4	2100	2100			
SWBD 2&3	2000	2000			
Battery 1&4	300	300			
Battery 2&3	200	200			
ESF A&B	6900	6900			
<b>T</b> 11 0					

Table 3: HVAC flowrates

Door (nominal)	W (ft)	H (ft)
3'-8.5"	3.33	7.17
4'-4.5"	4.00	7.17
5'-4.5"	5.00	7.17
6'-8.5"	6.00	8.00

Table 4: Door parameters

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Figure 1 – 2016' Floor layout – Red lines indicate the split corridor flowpaths, Blue lines indicate the flowpaths that come into play when the doors are opened

# 5.0 <u>CALCULATION</u>

#### 5.1 Areas

Wall areas were calculated by multiplying the various length and width room parameters located in Table 1 by the room height. Areas of the floors and ceilings were found by multiplying the length and width parameters together directly. The areas of the small additional nooks and notches were added or subtracted as dictated by the floorplan, as were the areas of the doors in respect to the wall area. Due to the simple nature of the calculations, and the repetitive nature of then, only the results are shown in Table 5. The areas of the walls, floors, and ceilings were then added into the GOTHIC model as Thermal Conductors, with their thickness determined by their location and orientation, as discussed above.

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#### For the floor area of Battery Room 1

Area = Width \* Length  
Length = 
$$12\frac{2}{3}ft$$
  
Width =  $20\frac{2}{3}ft$   
Area =  $20\frac{2}{3}*12\frac{2}{3}$   
Area =  $261.78ft^2$ 

Equation 1

	Ceiling&Floor	Walls
Room	(ft^2)	(ft^2)
SWBD 1	423.11	1103.67
SWBD 2	339.83	1052.31
SWBD 3	334.44	1046.33
SWBD 4	419.33	1120.39
Battery 1	261.78	907.78
Battery 2	230.42	922.11
Battery 3	292.51	1097.65
Battery 4	265.22	912.56
Corridor 1N	382.22	1710.44
Corridor 1S	236.51	1220.72
Corridor 2	444.00	1137.11
ESF 1	3140.00	3243.67
ESF 2	2566.70	3186.33

Table 5 – Room Areas

#### 5.2 Volumes

The volumes of the rooms and corridors were calculated by multiplying the areas of the floors by the assumed height of the rooms (14 1/3 ft). This method was chosen due to the irregular nature of the 2016' room layouts. Floor areas were taken from Table 5, and the resulting volumes can be found in Table 6. These volumes were then added into the GOTHIC model as Control Volumes. The Hydraulic Diameters of the rooms are

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calculated by taking four times the volume of the room and then dividing it by the surface area of the room.

Volume = Length \* Width \* Height  $Length = 12\frac{2}{3} ft$   $Width = 20\frac{2}{3} ft$   $Height = 14\frac{1}{3} ft$   $Volume = 20\frac{2}{3} * 12\frac{2}{3} * 14\frac{1}{3}$   $Volume = 3752.15 ft^{3}$ 

Equation 2

		Hyd.
	Volume	Diam.
Rooms	ft^3	ft
SWBD 1	6064.59	11.94
SWBD 2	4870.94	10.98
SWBD 3	4793.70	10.85
SWBD 4	6010.44	11.91
Battery 1	3752.15	10.15
Battery 2	3302.64	9.23
Battery 3	4192.69	9.69
Battery 4	3801.52	10.20
Corridor 1N	5478.52	8.75
Corridor 1S	3390.03	7.92
Corridor 2	6364.00	12.00
ESF 1	47773.00	19.86
ESF 2	45881.00	21.81

Table 6 - Room Volumes & Hydraulic Diameters

### 5.3 Flowpaths

The area of each flowpath (Table 7) was found by multiplying the width and height of the opening. The dimensions of the doors were taken from Table 4, and the grill dimensions were taken from the HVAC drawings (as discussed in Section 4.0). Each flowpath was then divided into a top and a bottom half before being added into the GOTHIC model. This is due to the fact that GOTHIC only allows flow to travel one way in a flowpath at a time. By dividing the flowpath into top and bottom halves, it allows GOTHIC to model

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two-way flow through the opening. This allows it to properly model the buoyancy driven cooling flow through the rooms, with the hot air rising and flowing out the top half of the opening, and the cold air sinking and flowing in through the bottom half. Hydraulic Diameter is calculated as four times the area divided by the perimeter.

	Width	Height	Area	Area/2	Hyd. Diam.
Flowpaths	ft	ft	ft^2	ft^2	ft
3'-8.5"					
Door	3.33	7.17	23.89	11.94	4.55
4'-4.5"					
Door	4.00	7.17	28.67	14.33	5.13
5'-4.5"					
Door	2.50	7.17	17.92	8.96	3.71
6'-8.5"					
Door	6.00	8.00	48.00	24.00	6.86
Transfer					
Grill	0.83	0.83	0.69	0.35	0.83
Corridor 1	6.67	14.33	95.56	47.78	9.10
Corridor 2	12.00	14.33	172.00	86.00	13.06

Table 7 – Flowpath Dimensions & Hydraulic Diameters

#### 6.0 **IMPACT ASSESSMENT**

The analysis will potentially affect the PRA and EQ analysis of the equipment located in the 2016' Battery and SWBD rooms. The analysis of the margin available in these rooms is beyond the scope of this calculation.

The blocking opening of doors from these volumes into areas with no heat sources or inactive heat sources is allowable under this calculation, due to the fact that the additional airspace and heat sinks will assist in absorbing the heat from the modeled heat loads. This will only serve to decrease the temperature of the Battery and SWBD rooms, thus increasing the margin available.

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# 7.0 <u>CONCLUSION</u>

Due to the number of different rooms and run conditions, only the limiting room temperatures will be given. The run results for the sensitivity analysis can be found in Table 8, with the limiting room temperature profiles in Figures 2-5. Additional cases of greater severity were run for the doors remaining closed with both one train and no trains of A/C, along with a run with the A/C disabled but the doors opened at one hour. The room temperatures for these runs can be found in Table 9.

The rooms with the working A/C systems show little heatup due to the large amount of airflow and the battery rooms have less than ten percent of the heat load of the SWBD rooms, so the limiting room temperatures in these models are always a SWBD room on the train with the failed A/C.

Due to the rapid decrease in the failed A/C room temperatures after the opening of the doorways, it is acceptable to interpolate the peak room temperatures for opening the doors between the modeled doors opening times.

Doors	A	В	А	В		
open	HVAC	HVAC	HVAC	HVAC		
at time	ESFAS	ESFAS	Normal	Normal		
2 hr	130.676	126.964	122.267	119.139		
4 hr	130.677	128.559	122.267	120.887		
6 hr	130.677	130.65	122.268	122.562		
8 hr	132.183	132.628	123.814	124.163		
12 hr	135.578	136.307	126.778	127.142		

Active Trains of HVAC

Table 8 - Sensitivity Run results

AC	Doors	24 hr max (°F)	30 day max (°F)
None	Open at 1hr	115.0	154.1
None	Closed	145.7	191.9
A Train	Closed	144.4	183.0
B Train	Closed	145.3	185.1

Table 9 – Alternate Severe Parameter Run results

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2016' Aux. Building Battery and SWBD room GOTHIC temperature analysis











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Figure 4b: Limiting temperatures (log scale time) with A Train HVAC and normal loads

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### 8.0 <u>REFERENCES</u>

- 1. A-2325 Rev. 3, "Control/Diesel Gen Bldg/Comm Corr EL 2000 & 2016 Floor Plans"
- GK-10 Rev. 1, "Switchboard Room Temperature Rise. Determine Action to be Taken to Maintain All DC Switchboard, Battery & ESF Switchgear Rooms Below 104 Deg F. When One 1E A/C Unit is Inoperable."
- 3. M-2H3311 Rev. 3, "Heating Ventilating & Air Cond. Control Building EL 2000'-0" Area 1"
- 4. M-2H3411 Rev. 4, "Heating Ventilating & Air Cond. Control Building EL 2016'-0" Area 1"
- 5. A-2908 Rev. 24, "Door Schedule"

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# 9.0 ATTACHMENTS

Attachment 1 – Excel file of GOTHIC outputs Attachment 2 – Zipped GOTHIC models



Attachment <u>3</u> – GOTHIC Model Control Volumes

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# 2016' Aux. Building Battery and SWBD room GOTHIC temperature analysis

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f         Description         A         Co         B         Co Type         (t:2)         T.(F)         Ot           1         4 internal         5         1         6         1         1         27.333         80.         X           3         1         1         100         1         1         27.333         80.         X           3         1         1         100         1         1         27.333         80.         X           3         1         1         100         1         1         27.2333         80.         X           5         4-22         B         6         1         1         1         27.2538         80.         X           1         1         1         1         1         1         1         27.2538         80.         X           1	Cond		Vol	ĦТ	Vol	HT	Cond	S. A.	Init.		
1       4       internal       5       1       6       1       1       272.333       80. X         1	#	Description	A	Со	в	Со	Type	(ft2)	T.(F)	Or	
2 2 internal 7 1 i 8 1 1 1 200.677 40. X 4 3 internal 12 1 11 1 1 1 277.111 80. X 6 4-2 B 6 1 8 1 1 1 277.111 80. X 6 4-2 B 6 1 8 1 1 1 133.944 80. X 8 1-3 B 10 1 12 1 1 1 183.944 80. X 8 1-3 B 10 1 12 1 1 1 183.944 80. X 8 1-3 B 10 1 12 1 1 1 183.944 80. X 10 2 to C2 6 1 4 1 1 227.338 80. X 11 to C2 10 1 4 1 1 227.338 80. X 12 3 to C2 12 1 4 1 1 227.338 80. X 12 3 to C2 12 1 2 1 4 1 1 277.111 80. X 13 4sy to C1 5 1 2 1 1 183.944 80. X 14 4g to C1 6 1 2 1 1 183.944 80. X 15 1sy to C1 1 6 1 2 1 1 1 183.944 80. X 15 1sy to C1 1 6 1 2 1 1 1 183.944 80. X 16 4st to C1 6 1 2 1 1 1 183.944 80. X 17 4st to C1 10 1 4 1 1 277.111 80. X 18 to C1 1 6 1 2 1 1 1 13.944 80. X 19 13y to C1 1 6 1 2 1 1 1 13.944 80. X 21 28 to Out 1 7 1 1 1 1 2 234.894 80. X 21 28 to Out 1 7 1 1 1 1 2 234.894 80. X 21 28 to Out 1 1 1 1 1 2 12.197 80. X 22 5 Cl to Out 1 2 1 1 1 2 2 112.197 80. X 23 62 to Out 1 3 1 1 2 2 364.894 80. X 24 Cl X to Out 1 1 1 1 1 2 2 112.197 80. X 25 Cl N to Out 1 1 1 1 1 2 2 112.197 80. X 25 Cl N to Out 1 3 1 1 2 2 364.894 80. X 27 Cl W Ceiling 3 3 1 2 2 2 386.222 80. X 27 Cl W Ceiling 3 3 1 2 2 2 386.222 80. X 28 fc Cl S Out 4 1 1 1 2 2 2 336.894 80. X 29 48 to Out 3 1 1 2 2 336.894 80. X 21 28 to Out 4 1 1 1 2 2 2 386.894 80. X 21 28 to Out 4 1 1 1 2 2 2 362.222 80. X 23 Cl Cl Cl Cling 3 3 1 2 2 2 386.232 80. X 23 Cl Cl Cling 4 3 1 2 2 386.232 80. X 23 Cl Cl Cling 5 3 1 2 2 2 386.232 80. X 23 Cl Cling 5 3 1 2 2 2 380.831 80. X 23 Cl Cling 5 3 1 2 2 2 380.834 80. X 23 Cl Cling 5 3 1 2 2 2 380.834 80. X 23 Cl Cling 5 3 1 2 2 2 380.834 80. X 23 Cl Cling 5 3 1 2 2 2 380.834 80. X 24 25 Cling 5 3 1 2 2 2 380.834 80. X 25 Cling 6 3 1 2 2 2 380.834 80. X 26 Cling 6 3 1 2 2 2 380.834 80. X 27 Clin Ceiling 3 3 1 2 2 2 380.834 80. X 28 S Cling 5 3 1 2 2 2 380.834 80. X 29 48 Ceiling 5 3 1 2 2 2 380.834 80. X 31 22 Ceiling 5 3 1 2 2 2 380.834 80. X 31 22 Ceiling 5 3 1 2 2 2 380.417 80. X 31 22 Ceiling 5 3 1 2 2 2 380.417 80. X 32 31 22 Ceiling 5 3 1 2 2 2 380.417 80. X 33 13	1	4 internal	5	1	6	1	1	272 333	80	x	
<pre>3   Internal 9 1 1 10 1 1 1 272.33 50 0.0 X 6 4-2 SW 6 1 6 1 6 1 1 133.944 80. X 7 1-3 SW 9 1 1 11 1 2238.894 80. X 9 4 to C2 6 1 4 1 1 272.338 80. X 9 4 to C2 6 1 4 1 1 272.338 80. X 10 2 to C2 8 1 4 1 1 272.338 80. X 11 1 to C2 10 1 4 1 1 272.338 80. X 12 3 to C2 12 1 4 1 1 272.338 80. X 13 45W to C1 5 1 2 1 1 138.624 80. X 15 15W to C1 5 1 2 1 1 1 28.894 80. X 15 15W to C1 5 1 1 2 1 1 1 28.894 80. X 15 15W to C1 9 1 3 1 1 1 2 28.894 80. X 15 15W to C1 5 1 1 2 1 1 1 28.894 80. X 17 45W to Out 5 1 1 1 1 2 28.894 80. X 18 25W to C1 4 1 1 2 27.338 80. X 19 45W to C1 5 1 1 2 1 1 1 38.625 80. X 17 45W to Out 5 1 1 1 1 2 28.694 80. X 15 15W to Out 5 1 1 1 1 2 28.694 80. X 15 15W to Out 5 1 1 1 1 2 28.694 80. X 15 15W to Out 5 1 1 1 1 2 28.694 80. X 15 15W to Out 5 1 1 1 1 2 28.694 80. X 15 15W to Out 5 1 1 1 1 2 28.694 80. X 15 15W to Out 5 1 1 1 1 2 28.694 80. X 12 25W to Out 5 1 1 1 1 2 28.694 80. X 12 25W to Out 1 5 1 1 1 2 28.694 80. X 12 25W to Out 4 1 1 1 1 2 28.694 80. X 12 25W to Out 5 1 1 1 1 2 28.694 80. X 12 25W to Out 5 1 1 1 1 2 28.694 80. X 12 25W to Out 3 1 1 1 1 2 28.694 80. X 13 45W to Out 5 1 1 1 2 2 23.519 80. X 13 5W to Out 4 1 1 1 1 2 2 23.619 80. X 13 6W to Out 3 1 1 1 2 2 23.619 80. X 14 C3 Ku to Out 3 1 1 1 1 2 2 23.619 80. X 15 15W to Out 3 1 1 1 2 2 23.619 80. X 15 15W to Out 3 1 1 1 2 2 23.619 80. X 15 15W to Out 3 1 1 1 2 2 23.619 80. X 15 15W to Out 3 1 1 1 2 2 23.619 80. X 15 15W to Out 3 1 1 1 2 2 23.619 80. X 15 15W to Out 3 1 1 1 2 2 23.619 80. X 15 15W to Out 3 1 1 1 2 2 2 352.220 80. X 15 15W to Out 3 1 1 1 2 2 2 352.220 80. X 15 15W to Out 3 1 1 1 2 2 2 353.619 80. X 15 15W to Out 3 1 1 1 2 2 2 353.619 80. X 15 15W to Out 3 1 1 1 2 2 2 353.619 80. X 15 15W to Out 3 1 1 1 2 2 2 353.619 80. X 15 15W to Out 3 1 1 1 2 2 2 353.618 80. X 15 15W to Out 3 1 1 1 2 2 2 353.818 80. X 15 15W to Out 3 1 1 1 2 2 2 353.818 80. X 15 15W to Out 3 1 1 1 2 2 2 353.818 80. X 15 15W to Out 3 1 1 2 2 2 353.80. X 15 15W to Out 3 1 1 2 2 2 353.80. X</pre>	2	2 internal	7	1	Ř	1î	ī	200.667	80.	x	
4       3       112       1       11       1       277.11       600       ×         6       4-25       5       1       7       1       1       247.25       800       ×         7       1-35       9       1       11       1       1238.894       800       ×         8       1-35       0       1       12       1       1       1238.894       800       ×         10       2 to C2       6       1       4       1       1272.338       800       ×         10       2 to C2       6       1       4       1       1272.338       800       ×         13       48       to C2       1       1       1238.694       800       ×         13       48       to C1       6       1       2       1       138.662       800       ×         15       15       15       1<	3	l internal	9	1	10	lī	ī	272.333	80.	x	║╴┎╴┽╺┥┽╫┟╶╫╬┍╴──╶┽╶╴╱╞┦═┡┥┽╺┟╱╕╢╵
6       4-2       b       6       1       7       1       1       247/25       60.       ×         7       1-3       W       9       1       11       1       283.944       80.       ×         9       4 to C2       6       1       4       1       1       228.984       80.       ×         10       2 to C2       8       1       4       1       1       227.338       80.       ×         112       1 to C2       10       1       4       1       1       277.111       80.       ×         12       3 458 to C1       6       1       2       1       1       386.63       ×         15       15 to C1       6       1       2       1       1       386.94       80.       ×         16       15 to C1       10       1       3       1       1       238.19       80.       ×         19       15 to C1       10       1       3       1       1       2       281.94       80.       ×       ×         16       15 to C1       10       1       1       2       281.94       80. <td< td=""><td>4</td><td>3 internal</td><td>12</td><td>1</td><td>11</td><td>lî</td><td>ĩ</td><td>277.111</td><td>80.</td><td>x</td><td></td></td<>	4	3 internal	12	1	11	lî	ĩ	277.111	80.	x	
6       -2-2 B       6       1       8       1       1       180.944       600. X         8       1-3 B       10       1       12       1       1       138.944       800. X         9       4 to C2       6       1       4       1       1       127.338       80. X         10       2 to C2       8       1       4       1       1       272.338       80. X         10       2 to C2       8       1       4       1       1       272.338       80. X         12       3 to C2       12       1       4       1       272.338       80. X         13       450 to C1       6       1       2       1       139.6625       80. X         14       48 to C1       6       1       2       1       139.662       80. X         16       18 to C1       1       1       1       23.994       80. X       X         19       150 to Out       1       1       1       23.994       80. X       X         20       150 to Out       1       1       1       2.23.6194       80. X       X         21       21	5	4-2 SW	5	1	7	1	1	247.25	80.	x	
7       1-3 SW       9       1       11       1       12 38, 994       60.       X         9       4 to C2       6       1       4       1       12 27, 238       80.       X         10       1 co C2       8       1       4       1       12 27, 238       80.       X         11       1 co C2       10       1       4       1       12 27, 238       80.       X         12       3 co C2       12       1       4       1       12 277, 111       80.       X         13       350 to C1       6       1       2       1       1383.944       80.       X         14       4B to C1       6       1       2       23.539       80.       X         15       15W to Out       5       1       1       12 283.539       80.       X         150 to Out       9       1       1       1       234.694       80.       X         12       20 bout       1       1       1       234.694       80.       X         12       20 bout       1       1       1       224.149       80.       X         22 bout	6	4-2 B	6	1	8	1	1	183.944	80.	x	
8        -3.8       10       1        12       1       1        12,9,944       80.       X         10       2 to C2       8       1       4       1       1        22,2,178       80.       X         11       1 to C2       10       1       4       1       1        27,2,388       80.       X         12       3 to C2       10       1       4       1       1        27,2,378       80.       X         13       45W to C1       5       1       2       1       1       338.625       80.       X         15       15W to C1       5       1       2       1       1       18.894       80.       X         16       15 to C1       9       1       1       12       281.894       80.       X         19       15W to Out       5       1       1       1       2       281.894       80.       X         21       28 to Out       8       1       1       1       2       212.18       80.       X         22       28 to Out       1       1       2       22.65.14       80.       X         28 </td <td>7</td> <td>1-3 SW</td> <td>9</td> <td>1</td> <td>11</td> <td>1</td> <td>1</td> <td>238.894</td> <td>80.</td> <td>x</td> <td></td>	7	1-3 SW	9	1	11	1	1	238.894	80.	x	
9       4       10       1       1       12       210       210       22       66       1       4       1       1       210       211       11       12       211       210       211       211       211       211       211       211       211       210       210       210<	8	1-3 B	10	1	12	1	1	183.944	80.	x	
10 2 to C2 8 8 1 4 4 1 1 1 20.217 80. X 11 1 to C2 100 1 4 1 1 1 272.336 80. X 13 45W to C1 5 1 2 1 1 1 336.655 80. X 14 4B to C1 6 1 2 1 1 1 183.944 80. X 15 15W to C1 9 1 3 1 1 23.944 80. X 16 1B to C1 10 1 3 1 1 1 23.944 80. X 17 45W to Out 5 1 1 1 2 281.994 80. X 18 25W to Out 7 1 1 1 2 281.994 80. X 19 15W to Out 9 1 1 1 2 284.994 80. X 19 15W to Out 9 1 1 1 2 284.994 80. X 20 55W to Out 1 1 1 1 2 284.994 80. X 21 28 to Out 8 1 1 1 2 284.994 80. X 22 38 to Out 12 1 1 1 2 284.994 80. X 22 38 to Out 12 1 1 1 2 284.994 80. X 23 C2 to Out 4 1 1 1 2 284.994 80. X 25 C1N to Out 3 1 1 1 2 297.33 80. X 25 C1N to Out 3 1 1 2 2 236.91 80. X 27 C1N Ceiling 3 3 1 2 2 2 365.222 80. X 28 C2 ceiling 7 3 1 2 2 2 368.83 80. X 29 45 Ceiling 7 3 1 2 2 2 442.11 80. X 29 45 Ceiling 7 3 1 2 2 2 339.833 80. X 29 45 Ceiling 7 3 1 2 2 2 339.833 80. X 29 45 Ceiling 7 3 1 2 2 2 339.833 80. X 29 45 Ceiling 7 3 1 2 2 2 339.833 80. X 29 45 Ceiling 7 3 1 2 2 2 339.833 80. X 29 45 Ceiling 7 3 1 2 2 2 339.833 80. X 30 48 Ceiling 8 3 1 2 2 2 442.11 80. X 31 12 2 2 16.778 80. X 32 38 Ceiling 7 3 1 2 2 2 339.833 80. X 33 13 Ceiling 10 3 1 2 2 2 339.833 80. X 34 1B Ceiling 10 3 1 2 2 2 334.444 80. X 35 33 Ceiling 11 3 1 2 2 2 334.444 80. X 36 41 B Ceiling 10 3 1 2 2 2 334.444 80. X 37 C1N Ceiling 10 3 1 2 2 2 334.444 80. X 38 35 33 Ceiling 11 3 1 2 2 2 334.444 80. X 39 45 Deiling 10 3 1 2 2 2 260.778 80. X 30 45 Deiling 10 3 1 2 2 2 260.778 80. X 31 5 Ceiling 10 3 1 2 2 2 260.778 80. X 32 35 Ceiling 11 3 1 2 2 2 260.778 80. X 33 Ceiling 11 3 1 2 2 2 260.778 80. X 34 1B Ceiling 10 3 1 2 2 2 260.778 80. X 35 33 Ceiling 11 3 1 2 2 2 260.778 80. X 35 33 Ceiling 11 3 1 2 2 2 260.778 80. X 35 31 Ceiling 10 3 1 2 2 2 260.778 80. X 35 31 Ceiling 11 3 1 2 2 2 260.778 80. X 35 31 Ceiling 11 3 1 2 2 2 260.778 80. X 35 31 Ceiling 11 3 1 2 2 2 260.778 80. X 35 31 Ceiling 11 3 1 2 2 2 260.778 80. X 35 31 Ceiling 11 3 1 2 2 2 260.778 80. X 35 31 Ceiling 11 3 1 2 2 2 260.778 80. X 35 31 Ceiling 11 3 1 2 2 2 2	9	4 to C2	6	1	4	1	1	272.338	80.	x	
11       1       1       0       272.338       80. X         12       3       45W to C1       5       1       2       1       1       336.625       80. X         14       4B to C1       6       1       2       1       1       338.625       80. X         15       15W to C1       6       1       2       1       1       138.544       80. X         16       1B to C1       10       1       3       1       1       238.194       80. X         17       4SW to Out       5       1       1       1       238.199       80. X         18       2SW to Out       7       1       1       1       238.494       80. X         21       2B to Out       1       1       1       238.494       80. X         22       2B to Out       1       1       1       2       244.194       80. X         23       C2 to Out       1       1       1       2       244.194       80. X         23       C2 to Out       1       1       1       2       236.14       80. X         24       C1N co Iut       3       1       <	10	2 to C2	8	1	4	1	1	210.217	80.	X	╢──── <del>╽╔╔╔┋╗</del> ╴┽╶╡┾╲╲╴┝╱╴╪ <i>╞╴╌╴╸</i> ╡╸┿ <u>┙╴</u> ║╽
12       3       to C2       12       1       4       1       1       277.111       80.       X         13       450 to C1       5       1       2       1       1       336.55       80.       X         15       1550 to C1       9       1       3       1       1238.594       80.       X         16       15 to C1       9       1       3       1       1238.594       80.       X         17       450 to Out       5       1       1       1       233.519       80.       X         18       250 to Out       7       1       1       2324.894       80.       X         19       150 to Out       9       1       1       1       236.694       80.       X         21       28 to Out       1       1       1       2       261.694       80.       X         22       36 to Out       1       1       1       2       284.694       80.       X         22       10       1       1       2       286.14       80.       X       X         22       12       1       1       1       2	11	1 to C2	10	1	4	1	1	272.338	80.	X	
13       45W       to C1       5       1       2       1       1       1338.625       80.       X         14       45W       to C1       6       1       2       1       183.944       80.       X         15       15W       to C1       9       1       3       1       1       283.625       80.       X         16       1E to C1       10       1       3       1       1       283.694       80.       X         18       25W       to Out       7       1       1       2       231.894       80.       X         20       35W       to Out       7       1       1       2       244.494       80.       X         21       22 to Out       1       1       2       231.474       80.       X         23       35 to Out       1       1       2       236.514       80.       X         23       35       1       2       2       364.222       80.       X         24       15       1       1       2       236.514       80.       X         26       C1S colling       3       1 <th< td=""><td>12</td><td>3 to C2</td><td>12</td><td>1</td><td>4</td><td>1</td><td>1</td><td>277.111</td><td>80.</td><td>х</td><td></td></th<>	12	3 to C2	12	1	4	1	1	277.111	80.	х	
14       4b to Cl       6       1       2       1       1       183.944       80.       X         15       15W to Cl       9       1       3       1       1       238.844       80.       X         17       45W to Out       5       1       1       1       238.844       80.       X         18       25W to Out       5       1       1       1       235.519       80.       X         19       15W to Out       9       1       1       12       232.4894       80.       X         21       25 to Out       8       1       1       12       244.149       80.       X         22       238 to Out       8       1       1       12       2112.137       80.       X         23       C2 to Out       4       1       1       2       236.514       80.       X         24       C1S to Out       3       1       2       2       236.514       80.       X         25       C1N to Out       3       1       2       2       380.80       X         26       C22 celling       4       3       1       2 <td>13</td> <td>4SW to Cl</td> <td>5</td> <td>1</td> <td>2</td> <td>1</td> <td>1</td> <td>338.625</td> <td>80.</td> <td>X</td> <td></td>	13	4SW to Cl	5	1	2	1	1	338.625	80.	X	
15       15W to Cl       9       1       3       1       1       238.894       80.       X         16       18 to Cl       10       1       3       1       1       238.894       80.       X         17       45W to Out       5       1       1       1       181.56       80.       X         18       25W to Out       7       1       1       12       248.894       80.       X         20       35W to Out       9       1       1       2       284.894       80.       X         21       28 to Out       11       1       2       284.994       80.       X         22       38 to Out       12       1       1       2       286.0       X         23       C2 to Out       4       1       1       2       12.873       80.       X         24       C1S to Out       3       1       2       2       380.222       80.       X         26       C1N Ceiling       3       1       2       2       380.38       80.       X         31       1       2       2       38.9383       80.       X     <	14	4B to Cl	6	1	2	1	1	183.944	80.	x	
16       18 to c1       10       1       3       1       1       181.56       80.       X         17       450 to Out       5       1       1       1       2       238.519       80.       X         19       150 to Out       7       1       1       1       2       238.519       80.       X         19       150 to Out       9       1       1       1       2       238.894       80.       X         21       28 to Out       8       1       1       2       248.894       80.       X         22       238 to Out       8       1       1       2       244.149       80.       X         23       25 to Out       4       1       1       2       12.187       80.       X         24       C1S to Out       3       1       2       2       285.222       80.       X         26       C1N to Out       3       1       2       2       280.       X         27       C1N Celling       3       1       2       2       280.       X         22       245.611ng       6       1       2       2	15	1SW to Cl	9	1	3	1	1	238.894	80.	x	
17       45W to Out       5       1       1       1       2       233.519       80.       X         18       25W to Out       7       1       1       1       2       281.894       80.       X         20       35W to Out       9       1       1       1       2       281.894       80.       X         21       25 to Out       8       1       1       1       2       281.4149       80.       X         22       38 to Out       12       1       1       2       12.816.94       80.       X         21       25 to Out       12       1       1       2       280.514       80.       X         23       25 colling       3       1       2       2       380.522       80.       X         26       C1N Celling       3       1       2       2       380.3       80.       X         29       45 celling       5       1       2       2       280.53       80.       X         31       12       2       280.538       80.       X       X       X       X         29       45 celling       6	16	1B to Cl	10	1	3	1	1	181.56	80.	x	
18       2200 to Out       7       1       1       1       2       28.1.894       80.       X         19       1500 to Out       1       1       1       2       28.4.894       80.       X         21       25 to Out       8       1       1       1       2       24.894       80.       X         22       25 to Out       8       1       1       1       2       24.4.49       80.       X         23       25 to Out       4       1       1       2       12.1.167       80.       X         23       25 to Out       4       1       1       2       917.33       80.       X         24       C1S to Out       3       1       1       2       2       286.042       80.       X         26       C1S Ceiling       3       1       2       2       286.222       80.       X         28       C2 Ceiling       4       3       1       2       2       480.       X         31       1       2       2       480.       X       80.       X       X         29       4S       Ciling       6	17	4SW to Out	5	1	1	1	2	233.519	80.	х	
19       15W to Out       9       1       1       1       2       324.894       80.       X         20       Byt to Out       11       1       1       2       324.894       80.       X         21       28 to Out       11       1       1       2       28.694       80.       X         22       38 to Out       12       1       1       2       21.2877       80.       X         23       C2 to Out       4       1       1       2       12.1877       80.       X         24       C1S to Out       2       1       1       1       2       12.733       80.       X         25       C1N to Out       3       1       1       2       982.222       80.       X         26       C1S Ceiling       3       1       2       2       280.222       80.       X         29       4S Ceiling       5       3       1       2       2       26.222       80.       X         31       25       Ceiling       7       3       2       2       239.833       80.       X         31       25       2 <t< td=""><td>18</td><td>2SW to Out</td><td>7</td><td>1</td><td>1</td><td>1</td><td>2</td><td>281.894</td><td>80.</td><td>х</td><td></td></t<>	18	2SW to Out	7	1	1	1	2	281.894	80.	х	
20       350 to Out       11       1       1       1       2       281.894       80. X         21       28 to Out       8       1       1       2       244.149       80. X         23       25 to Out       12       1       1       1       2       244.149       80. X         23       25 to Out       12       1       1       1       2       112.187       80. X         24       CLS to Out       2       1       1       1       2       112.373       80. X         25       CLN to Out       3       1       1       2       29.45.514       80. X         26       CLS Celling       3       1       2       2       382.222       80. X         26       CLN Celling       3       1       2       2       444. 80. X       80. X         29       45       Celling       6       3       1       2       2       265.222       80. X       X         31       15       2       2       39.438       80. X       X       X       X       X         35       35       Celling       9       3       1       2	19	1SW to Out	9	1	1	1	2	324.894	80.	Х	
21       22       38       to Out       8       1       1       1       2       244.149       80.       X         22       38       to Out       12       1       1       1       2       112.187       80.       X         23       C2 to Out       4       1       1       12       112.373       80.       X         24       C1S to Out       2       1       1       12       636.042       80.       X         25       CLN to Out       3       1       2       22       365.14       80.       X         26       CLS Ceiling       3       1       2       2       365.222       80.       X         28       C2 Ceiling       5       3       1       2       2       265.222       80.       X         30       48       Ceiling       7       3       1       2       2       426.322       80.       X         31       25       Ceiling       8       1       2       2       30.444       80.       X         31       13       1       2       2       26.1778       80.       X       10	20	3SW to Out	11	1	1	1	2	281.894	80.	х	
22       38 to Out       12       1       1       1       2       112.173       80.       X         23       C2 to Out       4       1       1       1       2       112.373       80.       X         23       C2 to Out       2       1       1       1       2       112.373       80.       X         25       C1N to Out       3       1       1       2       965.042       80.       X         26       C1S to Out       3       1       1       2       965.042       80.       X         26       C1N Celling       3       1       2       2       382.222       80.       X         27       C1N Celling       3       1       2       2       444.       80.       X         28       C21 Celling       5       3       1       2       2       38.03       X         30       4B       Celling       6       1       2       2       261.778       80.       X         31       15       Celling       1       1       2       2       364.444       80.       X         35       35       Cell	21	2B to Out	8	1	1	1	2	244.149	80.	х	
23 C2 to Out 4 1 1 1 1 2 (12.373 80. X 24 C1S to Out 2 1 1 1 1 2 (36.042 80. X 25 C1N to Out 3 1 1 1 2 (2917.33 80. X 26 C1S Ceiling 3 3 1 2 2 (286.514 80. X 27 C1N Ceiling 4 3 1 2 2 (286.222 80. X 28 C2 Ceiling 4 3 1 2 2 (265.222 80. X 29 45 Ceiling 6 3 1 2 2 (265.222 80. X 31 25 Ceiling 7 3 1 2 2 (265.222 80. X 31 25 Ceiling 7 3 1 2 2 (265.222 80. X 31 25 Ceiling 8 3 1 2 2 (265.222 80. X 31 25 Ceiling 9 3 1 2 2 (265.222 80. X 31 25 Ceiling 9 3 1 2 2 (265.222 80. X 33 15 Ceiling 9 3 1 2 2 (265.222 80. X 34 16 Ceiling 9 3 1 2 2 (265.222 80. X 35 35 Ceiling 11 3 1 2 2 (265.222 80. X 35 35 Ceiling 9 3 1 2 2 (265.222 80. X 36 48 Ceiling 9 3 1 2 2 (265.222 80. X 36 48 Ceiling 9 3 1 2 2 (265.222 80. X 36 48 Ceiling 9 3 1 2 2 (265.222 80. X 36 48 Ceiling 9 3 1 2 2 (265.222 80. X 36 48 Ceiling 9 3 1 2 2 (265.222 80. X 37 4 16 Ceiling 9 3 1 2 2 (265.778 80. X 38 5 35 Ceiling 11 3 1 2 2 (265.778 80. X 36 5 35 Ceiling 11 3 1 2 2 (265.778 80. X 36 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	22	3B to Out	12	1	1	1	2	112.187	80.	х	
24       CLS to Out       2       1       1       1       2       636.042       80.       X         25       CLN to Out       3       1       1       2       97.33       80.       X         26       CLS Ceiling       2       3       1       2       22.236.514       80.       X         27       CLN Ceiling       3       3       1       2       2       365.222       80.       X         28       C2C ceiling       4       3       1       2       2       444.       80.       X         29       48       Ceiling       5       3       1       2       2       449.833       80.       X         30       48       Ceiling       7       3       1       2       2       26.222       80.       X         31       25       Ceiling       8       3       1       2       2       230.417       80.       X         35       35       Ceiling       11       3       1       2       2       233.444       80.       X         36       Sceiling       11       3       1       2       2       <	23	C2 to Out	4	1	1	1	2	112.373	80.	х	
25       CLN to Out       3       1       1       1       2       917.33       80.       X         26       CLN to Out       3       1       1       2       917.33       80.       X         27       CLN to Out       3       1       2       2       917.33       80.       X         26       CLN to Ceiling       3       1       2       2       386.514       80.       X         28       C2 Ceiling       4       3       1       2       2       382.222       80.       X         29       45       Ceiling       5       3       1       2       444.       80.       X         30       45       Ceiling       6       3       1       2       2       265.222       80.       X         31       12       2       28.98.33       80.       X       X       X       X         31       15       Ceiling       8       3       1       2       2       334.444       80.       X         35       35       Ceiling       11       3       1       2       2       344.444       80.       X <td>24</td> <td>C1S to Out</td> <td>2</td> <td>1</td> <td>1</td> <td>1</td> <td>2</td> <td>636.042</td> <td>80.</td> <td>х</td> <td></td>	24	C1S to Out	2	1	1	1	2	636.042	80.	х	
26       ClS Celling       2       3       1       2       2       236.514       80. X         27       ClN Celling       3       3       1       2       2       382.222       80. X         28       C2 Ceiling       4       3       1       2       2       382.222       80. X         29       45       Ceiling       5       3       1       2       2       444. 80. X         30       48       Ceiling       6       3       1       2       2       444. 80. X         30       48       Ceiling       6       3       1       2       2       45.222       80. X         31       45       Ceiling       7       3       1       2       2       35.33       80. X         31       15       Ceiling       9       1       2       2       26.778       80. X       X         34       18       Ceiling       10       3       1       2       2       26.778       80. X       X         35       35       Ceiling       11       3       1       2       2       34.444       80. X       X </td <td>25</td> <td>C1N to Out</td> <td>3</td> <td>1</td> <td>1</td> <td>1</td> <td>2</td> <td>917.33</td> <td>80.</td> <td>х</td> <td></td>	25	C1N to Out	3	1	1	1	2	917.33	80.	х	
27       CLN Celling       3       3       1       2       2       382.222       80.       X         28       C2 Celling       4       3       1       2       2       444.       80.       X         29       45       Celling       5       3       1       2       2       444.       80.       X         30       4B       Celling       6       3       1       2       2       419.333       80.       X         31       25       Celling       7       3       1       2       2       255.222       80.       X         31       25       Celling       8       3       1       2       2       230.833       80.       X         31       15       Celling       9       3       1       2       2       230.417       80.       X         34       1B       Celling       11       3       1       2       2       34.444       80.       X         35       35       Celling       11       3       1       2       2       34.444       80.       X	26	ClS Ceiling	2	3	1	2	2	236.514	80.	х	
28       C2       Ceiling       4       3       1       2       2       444.       60.       X         29       45       Ceiling       5       3       1       2       2       444.       60.       X         30       48       Ceiling       6       3       1       2       2       444.       80.       X         31       25       Ceiling       6       3       1       2       2       265.222       80.       X         32       25       Ceiling       8       3       1       2       2       338.80.       X         32       25       Ceiling       8       3       1       2       2       423.111       80.       X         33       15       Ceiling       9       3       1       2       2       261.778       80.       X         35       35       Ceiling       11       3       1       2       2       34.444       80.       X         35       35       Ceiling       11       3       1       2       2       34.444       80.       X         35       35       Ceiling </td <td>27</td> <td>ClN Ceiling</td> <td>3</td> <td>3</td> <td>1</td> <td>2</td> <td>2</td> <td>382.222</td> <td>80.</td> <td>x</td> <td></td>	27	ClN Ceiling	3	3	1	2	2	382.222	80.	x	
29       43       Ceiling       5       3       1       2       2       449       Ceiling       5       3       1       2       2       449       Ceiling       6       3       1       2       2       249       28       Ceiling       6       3       1       2       2       265       222       80       X         31       25       Ceiling       7       3       1       2       2       230       48       Ceiling       7       3       1       2       2       230       417       80       X       X       33       35       Ceiling       10       3       1       2       2       230       34       444       80       X       34       18       Ceiling       11       3       1       2       2       34       444       80       X       44       46       46       46       46       46       46 <td>28</td> <td>C2 Ceiling</td> <td>4</td> <td>3</td> <td>1</td> <td>2</td> <td>2</td> <td>444.</td> <td>80.</td> <td>x</td> <td></td>	28	C2 Ceiling	4	3	1	2	2	444.	80.	x	
30       48       Ceiling       6       3       1       2       2       265.222       60.       X         31       25       Ceiling       7       3       1       2       2       30.833       80.       X         32       28       Ceiling       8       3       1       2       2       30.833       80.       X         33       15       Ceiling       9       3       1       2       2       423.111       80.       X         34       16       Ceiling       10       3       1       2       2       334.444       80.       X         35       35       Ceiling       11       3       1       2       2       334.444       80.       X	29	45 Ceiling	5	3	1	2	2	419.333	80.	X	
31       225       Ceiling       7       3       1       2       2       339.833       80.       X         32       285       Ceiling       9       3       1       2       2       230.417       80.       X         33       15       Ceiling       9       3       1       2       2       243.0147       80.       X         34       18       Ceiling       10       3       1       2       2       261.778       80.       X         35       35       Ceiling       11       3       1       2       2       261.778       80.       X         4       18       Ceiling       11       3       1       2       2       334.444       80.       X         35       35       Ceiling       11       3       1       2       334.444       80.       X         4       4       4       4       4       80.       X       4	30	4B Ceiling	6	3	1	2	2	265.222	80.	X	
32       22       22       12       23       13       13       12       2       23       13       13       13       13       12       2       2       23       111       80.       X         34       18       Ceiling       10       3       1       2       2       26       178       80.       X         35       35       Ceiling       11       3       1       2       2       23       34.444       80.       X         35       35       Ceiling       11       3       1       2       2       33.4444       80.       X         95       35       Ceiling       11       3       1       2       2       33.4444       80.       X         96       97       98	31	25 Ceiling	7	3	1	2	2	339.833	80.	X	
33       18       Ceiling       9       3       1       2       2       425.111       80.       X         34       18       Ceiling       10       3       1       2       2       261.778       80.       X         35       35       35       Ceiling       11       3       1       2       2       334.444       80.       X         4       18       Ceiling       11       3       1       2       2       334.444       80.       X         4       18       Ceiling       11       3       1       2       2       334.444       80.       X         4       18       Ceiling       11       3       1       2       2       334.444       80.       X         4       18       Ceiling       11       1       2       2       344.444       80.       X         5       35       Ceiling       11       3       1       2       2       344.444       80.       X         4       18       Ceiling       11       1       2       1       1       1       1       1       1       1       1	32	2B Ceiling	8	3	1	2	2	230.417	80.	X	
34       18       Ceiling       10       3       1       2       2       261.778       80.       X         35       35       03       Ceiling       11       3       1       2       2       334.444       80.       X         Image: State St	33	15 Ceiling	9	3	1	2	2	423.111	80.	X	
	34	1B Ceiling	10	3	1	2	2	261.778	80.	X	
	35	35 Ceiling	11	3	1	2	Z	334.444	80.	X	

Attachment 5a – GOTHIC Model Conductors, page 1

#### CALCULATION SHEET

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# 2016' Aux. Building Battery and SWBD room GOTHIC temperature analysis

CALCULA	<b>CALCULATION NO:</b>							
GK-19, Rev	v. 0 Add. 3							
PREPARED BY: Kurt Linsenbardt	<b>REVIEWED BY:</b> Tom Carr							

Thermal Conductors           Cond         Vol HT Vol HT Cond S. A. Init.           Pescription         A Co B         O Type (ft2) T.(F) Or           27         ClN Ceiling         3         1         2         2         382.222         80. X           28         Cciling         4         3         1         2         2         444. 80. X           29         Sciling         6         3         1         2         2         444. 80. X           30         48         Ceiling         6         3         1         2         2         265.222         80. X           31         28         Ceiling         6         1         2         2         239.633         80. X           31         28         Ceiling         1         2         2         239.633         80. X           34         18         Ceiling         1         1         2         2         292.513         80. X           36         28         Floor         4         2         13         3         2         292.513         80. X           39         C2 S Floor         2         2         33         2<	Cond # 27 28 29 30 31 32 33 33 35 36 37 38 36 37 38 40	Description C1N Ceiling C2 Ceiling 48 Ceiling 28 Ceiling 18 Ceiling 18 Ceiling 18 Ceiling 38 Ceiling 38 Ceiling 28 Floor	The Vol A 3 4 5 6 7 8 9 10 11 12	HT Co 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Condu Vol B 1 1 1 1 1 1 1 1 1 1	HT Co 2 2 2 2 2 2	Cond Type 2 2 2 2 2 2	S. A. (ft2) 382.222 444. 419.333	Init. T.(F) 80. 80.	Or X	
	Cond # 27 28 29 30 31 32 33 33 35 36 37 38 36 37 38 40	Description CLM Ceiling C2 Ceiling 43 Ceiling 23 Ceiling 13 Ceiling 13 Ceiling 13 Ceiling 33 Ceiling 33 Ceiling 25 Floor	Vol A 3 4 5 6 7 8 9 10 11 12	HT Co 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	Vol B 1 1 1 1 1 1 1 1	HT Co 2 2 2 2 2 2 2	Cond Type 2 2 2 2 2	S. A. (ft2) 382.222 444. 419.333	Init. T.(F) 80. 80.	0r X	
9         Description         A         Co         B         Co         Type         (ft2)         T. (f)         Or           27         CIM Ceiling         3         1         2         2         38:2.22         80.         X           28         C2 Ceiling         5         3         1         2         2         44:4         80.         X           29         45         Ceiling         6         3         1         2         2         44:4         80.         X           30         28         Ceiling         6         3         1         2         2         265.222         80.         X           31         28         Ceiling         7         3         1         2         2         30.444         80.         X           35         38         Ceiling         1         2         2         222.         80.         X           36         28         Floor         4         2         13         3         2         222.         80.         X           36         28         Floor         5         2         33         32         38.2         38.3	# 27 28 29 30 31 32 33 34 35 36 37 38 37 38 39 40	Description CIN Ceiling C2 Ceiling 48 Ceiling 28 Ceiling 18 Ceiling 18 Ceiling 38 Ceiling 38 Ceiling C2 S Floor	A 3 4 5 6 7 8 9 10 11 12	Co 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	B 1 1 1 1 1 1	Co 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Type 2 2 2 2 2	(ft2) 382.222 444. 419.333	T.(F) 80. 80.	Or X	
27       CLW Ceiling       3       1       2       2       382.222       80.       X         28       C2 Ceiling       4       3       1       2       2       444.       80.       X         30       45       Ceiling       5       3       1       2       2       444.       80.       X         31       25       Ceiling       6       3       1       2       2       435.222       80.       X         32       25       Ceiling       7       3       1       2       2       239.63       80.       X         33       15       2       2       239.41       80.       X       43.1       80.       X         34       15       Ceiling       1       1       2       234.44       80.       X         35       Sceling       1       2       222.51       80.       X         35       Ceiling       1       2       222.51       80.       X         36       Ceiling       1       2       222.51       80.       X         36       Ceiling       2       13       2       285.22       <	27 28 30 31 32 33 34 35 36 37 38 37 38 39 40	ClN Ceiling C2 Ceiling 43 Ceiling 25 Ceiling 28 Ceiling 18 Ceiling 18 Ceiling 38 Ceiling 38 Ceiling 38 Ceiling 22 Floor C2 N Floor	3 4 5 6 7 8 9 10 11 12			2 2 2 2 2 2	2 2 2 2 2	382.222 444. 419.333	80. 80.	×	
22       C2 Cetling       4       3       1       2       2       2444, 80. X         30       4B Cetling       6       3       1       2       245, 22.8       80. X         31       25       Cetling       6       3       1       2       245, 22.8       80. X         32       26       Cetling       8       3       1       2       230, 417       80. X         33       15       Cetling       9       3       1       2       240, 317       80. X         34       18       Cetling       10       3       1       2       245, 774       80. X         35       36       Cetling       11       3       1       2       245, 774       80. X         36       38       Cetling       11       2       222, 80. X       80. X       80. X         37       C2       Floor       4       2       13       2       236, 514       80. X       X         39       C15       Floor       2       13       3       2       236, 222       80. X       X         41       45       15       Floor       7       13 <td< th=""><th>28 29 30 31 32 33 35 36 37 38 39 40</th><th>C2 Ceiling 43 Ceiling 48 Ceiling 28 Ceiling 18 Ceiling 18 Ceiling 38 Ceiling 38 Ceiling 22 S Floor C2 N Floor</th><th>4 5 7 8 9 10 11 12</th><th>****</th><th></th><th>NNNN</th><th>2 2 2</th><th>444. 419.333</th><th>80.</th><th>×</th><th></th></td<>	28 29 30 31 32 33 35 36 37 38 39 40	C2 Ceiling 43 Ceiling 48 Ceiling 28 Ceiling 18 Ceiling 18 Ceiling 38 Ceiling 38 Ceiling 22 S Floor C2 N Floor	4 5 7 8 9 10 11 12	****		NNNN	2 2 2	444. 419.333	80.	×	
29       4S       Ceiling       5       3       1       2       2       2       2       2       3       3       3       3       2       2       2       2       3       3       3       3       3       3       2       2       2       2       2       2       3       3       3       1       2       2       2       2       2       3       3       3       1       2       2       2       2       3       3       3       1       2       2       2       2       3       3       3       1       2       2       2       2       1       3       3       1       1       2       2       2       1       3       3       3       1       2       2       2       3       3       2       2       2       3       3       2       2       2       3       3       2       2       2       3       3       2       2       2       3       3       2       2       3       3       2       2       2       3       3       2       2       3       3       2       2       2       3	29 30 31 32 33 34 35 36 37 38 39 40	4S Ceiling 4B Ceiling 2S Ceiling 1S Ceiling 1B Ceiling 3S Ceiling 3B Ceiling 3B Ceiling C2 S Floor C2 N Floor	5 6 7 8 9 10 11 12	3 3 3 3 3 3 3 3	1 1 1 1	2 2 2 2	2 2 2	419.333		A 10	
30       4B       Cetling       6       3       1       2       2       265,222       80.       X         31       2S       Cetling       8       3       1       2       2       39,333       80.       X         34       1S       Cetling       9       3       1       2       2       230,417       80.       X         35       1S       Cetling       10       3       1       2       2       231,11       80.       X         36       37       C2       Floor       4       2       2       234,444       80.       X         37       C2       Floor       4       2       13       3       2       22,22.       80.       X         38       C2 N Floor       4       2       13       3       2       22,22.       80.       X         39       C1s Floor       2       13       3       2       235,222       80.       X         41       43       Floor       3       2       233,222       80.       X         44       28 Floor       7       2       13       2       233,4,444       80	30 31 32 33 34 35 36 37 38 39 40	4B Ceiling 2S Ceiling 2B Ceiling 1S Ceiling 3B Ceiling 3S Ceiling 3B Ceiling C2 S Floor C2 N Floor	6 7 8 9 10 11 12	33333	1 1 1	2	2		80.	X	P 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
31       22       22       339,833       80.       X         32       28       Ceiling       9       3       1       2       2       230,417       80.       X         34       LB       Ceiling       10       3       1       2       2       230,417       80.       X         35       Cs       Floor       1       2       2       234,444       80.       X         36       38       Ceiling       11       3       1       2       2       292,513       80.       X         36       38       Ceiling       12       2       222.       80.       X         37       C2       S Floor       4       2       14       3       2       265.222       80.       X         40       Bin Floor       3       2       265.222       80.       X	31 32 34 35 36 37 38 39 40	2S Ceiling 2B Ceiling 1S Ceiling 1B Ceiling 3S Ceiling 3B Ceiling C2 S Floor C2 N Floor	7 8 9 10 11 12	3 3 3 3 3	1 1 1	2	2	265.222	80.	х	
33       13       2       2       20.0.417       80.       X         33       15       Celling       9       3       1       2       2       2.0.417       80.       X         34       1B       Celling       10       3       1       2       2       2.2.42.111       80.       X         35       35       Celling       11       1       2       2.2.42.513       80.       X         36       36       Celling       12       2       2.2.5.514       80.       X         37       C2       Floor       4       2       13       3       2       22.2.       80.       X         39       C1S       Floor       2       13       3       2       22.5.51       80.       X         41       45       Floor       6       2       13       3       2       25.2.22       80.       X         42       4B       Floor       6       2       13       3       2       25.1.11       80.       X         43       25       Floor       12       2       14       3       2       25.5.2.1.11       80.	32 34 35 36 37 38 39 40	2B Ceiling 1S Ceiling 1B Ceiling 3S Ceiling 3B Ceiling C2 S Floor C2 N Floor	8 9 10 11 12	3333	1 1	1.2		339.833	80.	X	
33       18       Celling       9       3       1       2       2       423.111       80.       X         34       1B       Celling       10       3       1       2       2       243.111       80.       X         35       35       Celling       12       2       234.444       60.       X         36       36       Celling       12       3       2       222.800.       X         36       C2 N       Floor       4       2       13       2       222.800.       X         40       Eloor       3       2       13       2       236.514       80.       X         41       43       Floor       5       2       13       2       236.514       80.       X         42       B Floor       5       2       13       2       230.417       80.       X         43       28       Floor       9       2       14       3       2       233.106       80.       X         44       28       Floor       10       2       433.11       80.       X         50       ESF 1       Walls       1	33 34 35 36 37 38 39 40	1S Ceiling 1B Ceiling 3S Ceiling 3B Ceiling C2 S Floor C2 N Floor	9 10 11 12	333	1	- 2	2	230.417	80.	X	▏  ੵੵੑ <del>ੑੑ</del> ੑ <del>ੑ</del> <del>ੑ</del>
34       1B Celling       10       3       1       2       2       261.778       80.       X         35       35 Celling       11       3       1       2       2       281.444       80.       X         36       38 Celling       12       3       1       2       2       294.444       80.       X         37       C2 S Floor       4       2       13       3       2       222.       80.       X         38       C2 N Floor       4       2       13       3       2       222.       80.       X         39       C1S Floor       2       2       13       3       2       222.       80.       X         41       43 Floor       5       2       13       3       2       235.222       80.       X         42       28 Floor       7       2       13       3       2       239.833       80.       X         44       28 Floor       12       14       2       230.417       80.       X         45       15 Floor       10       2       14       2       251.36       80.       X         50<	34 35 36 37 38 39 40	1B Ceiling 3S Ceiling 3B Ceiling C2 S Floor C2 N Floor	10 11 12	3		2	2	423.111	80.	X	
35       38       Celling       11       3       1       2       2       334.444       80.       X         36       38       Celling       12       3       1       2       2       292.513       80.       X         37       C2       S Floor       4       2       13       3       2       222.       80.       X         38       C2       N Floor       4       2       14       3       2       222.       80.       X         40       Gins       Floor       3       2       146.0.       X       A       A       Floor       5       2       13       3       2       380.       X         41       45       Floor       6       2       13       3       2       255.222       80.       X         42       25       Floor       7       2       13       3       2       245.722       80.       X         45       15       Floor       9       2       14       3       2       292.51       80.       X         46       18       Floor       12       2       161.05       80.       X <td>35 36 37 38 39 40</td> <td>3S Ceiling 3B Ceiling C2 S Floor C2 N Floor</td> <td>11 12</td> <td>3</td> <td></td> <td>2</td> <td>2</td> <td>261.778</td> <td>80.</td> <td>X</td> <th></th>	35 36 37 38 39 40	3S Ceiling 3B Ceiling C2 S Floor C2 N Floor	11 12	3		2	2	261.778	80.	X	
36       BE Celling       12       3       1       2       2       292.513       80.       X         37       C2 S Floor       4       2       13       3       2       222.       80.       X         39       C1S Floor       4       2       14       3       2       222.       80.       X         39       C1S Floor       2       2       13       3       2       222.       80.       X         41       45       Floor       3       2       265.222       80.       X         42       45       Floor       5       2       13       3       2       39.833       80.       X         42       45       Floor       7       2       13       3       2       39.833       80.       X         43       25       Floor       9       14       3       2       230.417       80.       X         44       26       Floor       10       2       14       3       2       251.86       80.       X         50       ESF 1       Walls       14       1       1       2       256.78       80.	36 37 38 39 40	3B Ceiling C2 S Floor C2 N Floor	12		1	2	2	334.444	80.	X	
37       C2 S Floor       4       2       13       3       2       222.       80.       X         38       C2 M Floor       4       2       14       3       2       222.       80.       X         39       C1S Floor       2       2       13       3       2       226.5.14       80.       X         40       GLN Floor       3       2       14       3       2       326.5.22       80.       X         41       45 Floor       6       2       13       3       2       235.2.22       80.       X         42       28 Floor       6       2       13       3       2       230.417       80.       X         43       28 Floor       7       2       13       3       2       230.417       80.       X         45       15 Floor       9       2       14       3       2       230.444       80.       X         48       38 Floor       11       2       243.111       80.       X       X         50       ESF 1       Walls       14       1       1       2       216.21.24       80.       X	37 38 39 40	C2 S Floor C2 N Floor		3		2	2	292.513	80.	X	▏ <mark>╏<mark>╆<sub>╖</sub>╧╬╴</mark>╪╧╪╲<u></u>╉╴<i>┝┥</i>╾╪╧┍┽╧╖</mark>
38       C2 N Floor       4       2       14       3       2       222.       80.       X         39       CIS Floor       2       2       13       3       2       222.       80.       X         40       GIN Floor       2       2       13       3       2       236.514       80.       X         41       45 Floor       5       2       13       3       2       419.333       80.       X         42       45 Floor       6       2       13       3       2       419.333       80.       X         43       28 Floor       7       2       13       3       2       339.833       80.       X         44       28 Floor       7       2       13       3       2       330.417       80.       X         45       18 Floor       10       2       14       3       2       261.778       80.       X         46       1B Floor       10       2       14.41       2       733.106       80.       X         51       ESF I Walls       14       1       2       160.57       80.       X         5	38 39 40	C2 N Floor	4	2	13	3	2	222.	80.	X	
39       ClS Floor       2       2       13       3       2       236.514       80.       X         40       QuN Floor       3       2       14       3       2       382.222       80.       X         41       48 Floor       5       2       13       3       2       419.333       80.       X         42       4B Floor       6       2       13       3       2       265.222       80.       X         43       25 Floor       6       2       13       3       2       265.222       80.       X         44       25 Floor       7       2       13       3       2       265.222       80.       X         45       15 Floor       9       2       14       3       2       204.171       80.       X         46       1B Floor       10       2       14       3       2       292.513       80.       X         49       ESF Connector       13       1       1       1       2       160.       X         50       ESF 1 Walls       14       1       1       2       2160.       3       2       256.7<	39 40		4	2	14	3	2	222.	80.	X	
40       GLN Floor       3       2       14       3       2       982.222       80. X         41       45 Floor       5       2       13       3       2       419.333       80. X         42       48 Floor       6       2       13       3       2       255.222       80. X         43       28 Floor       7       2       13       3       2       255.222       80. X         44       28 Floor       7       2       13       3       2       295.222       80. X         44       28 Floor       7       2       13       3       2       390.833       80. X         45       18 Floor       9       2       14       3       2       433.11       80. X         46       18 Floor       10       2       14       3       2       235.106       80. X         47       38 Floor       11       2       141       1       2       573.108       80. X       X         50       ESF I Walls       13       1       1       2       163.51       80. X       X         52       ESF I Floor       13       1       3 </td <td>40</td> <td>C1S Floor</td> <td>2</td> <td>2</td> <td>13</td> <td>3</td> <td>2</td> <td>236.514</td> <td>80.</td> <td>X</td> <th></th>	40	C1S Floor	2	2	13	3	2	236.514	80.	X	
41       45       Floor       5       2       13       3       2       419.333       80.       X         42       46       Floor       6       2       13       3       2       265.222       80.       X         43       23       Floor       7       2       13       3       2       255.222       80.       X         44       28       Floor       8       2       13       3       2       239.833       80.       X         44       28       Floor       8       2       13       3       2       239.417       80.       X         45       15       Floor       10       2       14       3       2       226.1778       80.       X         46       1B       Floor       10       2       14       3       2       229.513       80.       X         49       ESF       Commercio       13       1       1       1       2       1401.57       80.       X         52       ESF       1 X alls       13       1       1       2       150.58       80.       X         55       ESF		ClN Floor	3	2	14	3	2	382.222	80.	X	22 JUN 221 JUN
42       4B Floor       6       2       13       3       2       255.222       80. X         43       23 Floor       7       2       13       3       2       239.833       80. X         44       2B Floor       8       2       13       3       2       339.833       80. X         45       1S Floor       9       2       14       3       2       423.111       80. X         46       1B Floor       10       2       14       3       2       423.111       80. X         47       3S Floor       11       2       14       3       2       334.444       80. X         48       3B Floor       12       2       14       3       2       292.513       80. X         49       ESF Connector       13       1       1       1       2       573.333       80. X         50       ESF 1       Walls       14       1       1       2       1621.24       80. X       X         53       ESF 2       Storeling       14       2       1       3       2       256.7       80. X       X         54       ESF 1       Flo	41	4S Floor	5	2	13	3	2	419.333	80.	X	
43       25 Floor       7       2       13       3       2       39.633       80. X         44       28 Floor       8       2       13       3       2       230.417       80. X         44       28 Floor       9       2       14       3       2       423.111       80. X         45       15 Floor       10       2       14       3       2       423.111       80. X         46       1B Floor       10       2       14       3       2       423.111       80. X         47       35 Floor       12       2       14       3       2       225.13       80. X         48       38 Floor       12       2       14       3       2       292.513       80. X         50       ESF Connector       13       1       1       2       753.333       80. X         52       ESF Connector       13       1       1       2       1621.51       80. X         53       ESF 2 Floor       13       1       2       1621.54       80. X       56         54       ESF 1 Floor       13       2       2566.7       80. X       57 <td< td=""><td>42</td><td>4B Floor</td><td>6</td><td>2</td><td>13</td><td>3</td><td>2</td><td>265.222</td><td>80.</td><td>X</td><th>50 70 140 150</th></td<>	42	4B Floor	6	2	13	3	2	265.222	80.	X	50 70 140 150
44       2B Floor       8       2       13       3       2       200.417       80. X         45       1S Floor       9       2       14       3       2       423.111       80. X         46       1B Floor       10       2       14       3       2       230.417       80. X         47       3S Floor       11       2       14       3       2       251.778       80. X         48       3B Floor       11       2       14       3       2       251.778       80. X         49       ESF Connector       13       1       14       1       2       783.106       80. X       X         50       ESF 1 Walls       13       1       1       1       2       773.333       80. X       X         51       ESF 2 Walls       13       1       1       2       163.51       80. X       X         53       ESF 1 Floor       13       1       2       163.51       80. X       X         54       ESF 1 Floor       13       2       2       163.08       80. X       X         57       2 B Thick       8       1       1	43	25 Floor	7	2	13	3	2	339.833	80.	X	
45       IS Floor       9       2       14       3       2       43.111       80.       X         46       IB Floor       10       2       14       3       2       261.778       80.       X         47       35 Floor       11       2       14       3       2       261.778       80.       X         48       35 Floor       11       2       14       3       2       292.513       80.       X         49       ESF Connector       13       1       14       1       2       733.93       60.       X         50       ESF I Walls       14       1       1       2       573.333       60.       X         51       ESF I Ceiling       14       3       1       2       1621.51       80.       X         53       ESF I Floor       13       1       2       1621.24       60.       X         54       ESF I Floor       13       2       150.5       80.       X         56       2 SW Thick       7       1       1       3       179.167       80.       X         58       3 SW Thick       11       1	44	2B Floor	8	2	13	3	2	230.417	80.	X	
46       LB Floor       10       2       14       3       2       261.778       80. X         47       38 Floor       11       2       14       3       2       334.444       80. X         48       3B Floor       11       2       14       3       2       334.444       80. X         49       25F Connector       13       1       14       1       2       783.106       80. X         50       ESF Connector       13       1       14       1       2       783.303       80. X         51       ESF 1 Walls       13       1       1       1       2       573.333       80. X         53       ESF 1x Ceiling       14       3       1       2       1815.51       80. X         54       ESF 1 Floor       14       2       1       3       2       256.7       80. X         55       ESF 2 Floor       13       2       13       2       256.7       80. X       X         56       2 SW Thick       8       1       1       3       150.5       80. X       X         57       2 B Thick       8       1       1       3<	45	1S Floor	9	2	14	3	2	423.111	80.	X	
47       38 Floor       11       2       14       3       2       334.444       80.       X         48       38 Floor       12       2       14       3       2       292.513       80.       X         49       ESF Connector       13       1       14       1       2       293.106       80.       X         50       ESF 1 Walls       13       1       1       1       2       573.333       80.       X         51       ESF 2 Walls       13       1       1       2       573.333       80.       X         52       ESF 1 Calling       14       3       1       2       1631.571       80.       X         54       ESF 1 Floor       13       1       2       21621.24       80.       X         55       ESF 2 Floor       13       2       2       160.       X         55       ESF 2 Floor       13       2       2       160.       X         57       2 B Thick       8       1       1       3       63.903       80.       X         58       3 SW Thick       12       1       1       3       139.56 <td>46</td> <td>1B Floor</td> <td>10</td> <td>2</td> <td>14</td> <td>3</td> <td>2</td> <td>261.778</td> <td>80.</td> <td>X</td> <th></th>	46	1B Floor	10	2	14	3	2	261.778	80.	X	
48       3B Floor       12       2       14       3       2       292.513       80. X         49       ESF Connector       13       1       14       1       2       783.106       80. X         50       ESF 1 Walls       14       1       1       2       783.106       80. X         51       ESF 2 Walls       13       1       1       1       2       179.107       80. X         52       ESF 1 X ceiling       14       1       1       2       179.167       80. X         53       ESF 2x Ceiling       13       3       1       2       1621.24       80. X         54       ESF 1 Floor       13       2       140.80       80. X       7         54       ESF 1 Floor       13       2       13       2       256.7       80. X         56       2 SW Thick       8       1       1       3       63.903       80. X         57       2 B Thick       8       1       1       3       199.167       80. X         57       2 B Thick       11       1       3       150.5       80. X       X         59       3 B Thick	47	35 Floor	11	2	14	3	2	334.444	80.	X	
49       ESF Connector       13       1       14       1       2       783.106       80.       X         50       ESF 1 Walls       13       1       1       1       2       573.333       80.       X         51       ESF 2 Walls       13       1       1       1       2       573.333       80.       X         52       ESF 1 Walls       13       1       1       2       1010.57       80.       X         53       ESF 1x Ceiling       14       3       1       2       1615.51       80.       X         54       ESF 1 Floor       14       2       1       3       2       261.24       80.       X         55       ESF 2 Floor       13       2       163.903       80.       X         56       2 SU Thick       8       1       1       3       63.903       80.       X         57       2 B Thick       8       1       1       3       271.703       80.       X         59       3 B Thick       12       1       1       3       1935.       60.       X         60       ESF 1 Thick       14       1 </td <td>48</td> <td>3B Floor</td> <td>12</td> <td>2</td> <td>14</td> <td>3</td> <td>2</td> <td>292.513</td> <td>80.</td> <td>X</td> <th></th>	48	3B Floor	12	2	14	3	2	292.513	80.	X	
S0       ESF 1 Walls       14       1       1       1       2       573.333       80.       X         S1       ESF 2 Walls       13       1       1       2       173.333       80.       X         S2       ESF 1x Ceiling       14       1       1       2       1401.57       80.       X         S3       ESF 2x Ceiling       13       1       2       1401.57       80.       X         S4       ESF 1 Floor       13       2       1621.24       80.       X         S5       ESF 2 Floor       13       2       163.2       163.2       256.7       80.       X         S5       ESF 2 Floor       13       2       1.51.51       80.       X         S6       2 SW Thick       8       1       1       3       63.903       80.       X         S6       2 SW Thick       11       1       3       150.5       80.       X         S7       2 B Thick       8       1       1       3       193.5       80.       X         S6       2 SW Thick       13       1       3       115.3       3 0.0.       X       93       B Thi	49	ESF Connector	13	1	14	1	2	783.106	80.	X	
S1       ESF 2 Walls       13       1       1       1       2       1401.57       80. X         S2       ESF 1x Ceiling       13       1       2       1813.51       80. X       X         S3       ESF 2x Ceiling       13       1       2       1813.51       80. X       X         S4       ESF 1 Floor       14       2       1       3       2       2 1813.51       80. X         S5       ESF 1 Floor       14       2       1       3       2       2 180. X       X         S5       ESF 2 Floor       14       2       1       3       2 2 2566.7       80. X       X         S6       2 SW Thick       7       1       1       3       159.5       80. X       X         S6       2 SW Thick       8       1       1       3       150.5       80. X       X         S7       2 B Thick       8       11       1       3       271.703       80. X       X         S9       3 B Thick       12       1       1       3       1935. 80. X       X       90. X         60       ESF 1 Thick       13       1       1       3	50	ESF 1 Walls	14	1	1	1	2	573.333	80.	X	
52       ESF 1x Ceiling       14       3       1       2       2       1613.51       80. X         53       ESF 2x Ceiling       13       3       1       2       2       1621.24       80. X         54       ESF 1 Floor       13       2       1       3       2       3240.       80. X         55       ESF 2 Floor       13       2       1       3       2       2566.7       80. X         56       2 SW Thick       7       1       1       3       63.903       80. X       X         58       3 SW Thick       11       1       3       271.703       80. X       X         59       3 B Thick       12       1       3       1935.       80. X       X         60       ESF 1 Thick       14       1       1       3       193.5.       80. X       X         60       ESF 1 Thick       14       1       1       3       116.33       60. X       X	51	ESF 2 Walls	13	1	1	1	2	1401.57	80.	X	
53       ESF 2x Ceiling       13       3       1       2       2       1621.24       80. X         54       ESF 1 Floor       14       2       1       3       2       3140.       80. X         55       ESF 2 Floor       13       2       1       3       2       566.7       80. X         56       2 SW Thick       7       1       1       1       3       159.5       80. X         57       2 B Thick       8       1       1       1       3       159.5       80. X         58       3 SW Thick       7       1       1       1       3       150.5       80. X         58       3 SW Thick       12       1       1       3       150.5       80. X         59       3 B Thick       12       1       1       3       217.703       80. X         60       ESF 1 Thick       13       1       1       3       1935.       80. X         61 <esf 2="" td="" thick<="">       13       1       1       1       1       1       3       1935.</esf>	52	ESF 1x Ceiling	14	3	1	2	2	1813.51	80.	X	
54       ESF 1 Floor       14       2       1       3       2       3140.       80.       X         55       ESF 2 Floor       13       2       1       3       2       2566.7       80.       X         56       2 SU Thick       7       1       1       3       197.167       80.       X         57       2 SU Thick       8       1       1       3       63.903       80.       X         58       3 SW Thick       11       1       3       150.5       80.       X         59       3 B Thick       12       1       1       3       1935.       80.       X         60       ESF 1 Thick       14       1       1       3       1935.       80.       X         60       ESF 2 Thick       13       1       1       3       116.33       80.       X	53	ESF 2x Ceiling	13	3	1	2	2	1621.24	80.	X	
55       ESF 2 Floor       13       2       1       3       2       2566.7       80. X         56       2 SW Thick       7       1       1       1       3       179.167       80. X         57       2 B Thick       8       1       1       3       63.903       80. X         58       3 SW Thick       11       1       1       3       210.5       80. X         59       3 B Thick       12       1       1       3       210.5       80. X         60       ESF 1 Thick       12       1       1       3       1935.       80. X         60       ESF 2 Thick       13       1       1       3       1935.       80. X         61       ESF 2 Thick       13       1       1       3       1935.       80. X	54	ESF 1 Floor	14	2	1	3	2	3140.	80.	X	
56       2 SW Thick       7       1       1       1       3       179.167       80. X         57       2 B Thick       8       1       1       1       3       63.903       80. X         58       3 SW Thick       11       1       1       3       150.5       80. X         59       3 B Thick       12       1       1       3       217.703       80. X         60       ESF 1 Thick       14       1       1       3       1935.       80. X         61       ESF 2 Thick       13       1       1       1       3       1935.       80. X	55	ESF 2 Floor	13	2	1	3	2	2566.7	80.	X	
57     2 B Thick     8     1     1     1     3     63.903     80.     X       58     3 SW Thick     11     1     1     3     150.5     80.     X       59     3 B Thick     12     1     1     3     271.703     80.     X       60     ESF     1 Thick     14     1     1     3     1995.     80.     X       61     ESF     2 Thick     13     1     1     3     116.33     80.     X	56	2 SW Thick	7	1	1	1	3	179.167	80.	X	
58       3 SW Thick       11       1       1       3       150.5       80. X         59       3 B Thick       12       1       1       1       3       271.703       80. X         60       ESF 1 Thick       14       1       1       3       1935.       80. X         61       ESF 2 Thick       13       1       1       3       1935.       80. X	57	2 B Thick	8	1	1	1	3	63.903	80.	X	
59     3 B Thick     12     1     1     1     3     271.703     80.     X       60     ESF 1 Thick     14     1     1     1     3     1935.     80.     X       61     ESF 2 Thick     13     1     1     3     116.33     80.     X	58	3 SW Thick	11	1	1	1	3	150.5	80.	X	
60 ESF 1 Thick 14 1 1 1 3 1935. 80. X 4 61 ESF 2 Thick 13 1 1 1 3 1116.33 80. X 4	59	3 B Thick	12	1	1	1	3	271.703	80.	X	
61 ESF 2 Thick 13 1 1 1 3 1116.33 80. X	60	ESF 1 Thick	14	1	1	1	3	1935.	80.	X	
	61	ESF 2 Thick	13	1		1	3	1116.33	80.	х	💆
											<b>11</b>

# Attachment 5b – GOTHIC Model Conductors, page 2

Collet/Heater         Heater         Collet/Heaters         State Colspan=t         Collet/Heaters         State Colspan=t         Collet/Heaters         State Colspan=t         Display Study Lungs         Position Coopenent         Display Study Colspan=t         D		
Interest       0.00 Off       Flow       Flow <td>Cooler/Heater</td> <td></td>	Cooler/Heater	
IH       4S       5       13.00       VTI         2H       4B       6       0.288       VTI         4H       2B       9       0.350       VTI         4H       2B       9       0.350       VTI         4H       2B       9       0.350       VTI         6H       3B       12       0.150       VTI         9H       25F 1       14       27.455       VTI         10H       2SF 72       13       26.526       VTI         10H       2SF 72       13       26.526       VTI         10H       2SF PT IPET RS REFER       10       10       26.526         Locate Cooler       10       10       10       10         Locate Cooler       10       10       10       10         Dorder Cooponent       Papiay Subvolumes       Poistin Cooponent       10       10         10H       2SF PT IPET RS REFER       10       10       10       10       10         10H       2G       13       26.526       VTI       10       10       10         Dorde       13       10       10       10       10       10	Heater On Off Flow Flow Heat Heat Cooler Vol. Trip Trip Rate Rate Rate Phs # Description # # # (CFM) FF (Btu/s) FF Opt	
	1H       4S       5       13.09       VTI         2H       4B       6       0.285       VTI         3H       2S       7       0.153       VTI         3H       2S       8       0.153       VTI         5H       1S       9       13.09       VTI         6H       1B       10       0.285       VTI         7H       3S       11       2.775       VTI         8H       3B       12       0.153       VTI         9H       ESF 1       14       27.455       VTI         10H       ESF 2       13       0       26.526       VTI         10H       ESF 2       13       0       11.01       26.526       VTI         10H       ESF 2	

Attachment 6a – GOTHIC Model Heat Loads (ESFAS conditions)

#### CALCULATION SHEET

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# 2016' Aux. Building Battery and SWBD room GOTHIC temperature analysis

CALCULA	ΓΙΟN NO :							
GK-19, Rev	GK-19, Rev. 0 Add. 3							
PREPARED BY: Kurt Linsenbardt	<b>REVIEWED BY:</b> Tom Carr							



III DI	rect lable Edit	mode (i	SSCAPE 0	L ENTER	recuri	is co me	nu)	
		Flow P	aths - 1	Table 1				
F.P.		Vol	Elev	Ht	Vol	Elev	Ht	
#	Description	A	(ft)	(ft)	в	(ft)	(ft)	
1	4 Vent Top	5	2022.5	0.5	6	2022.5	0.5	
2	4 Vent Bottom	5	2022.	0.5	6	2022.	0.5	_
3	2 Vent Top	7	2022.5	0.5	8	2022.5	0.5	1
4	2 Vent Bottom	7	2022.	0.5	8	2022.	0.5	
5	l Vent Top	9	2022.5	0.5	10	2022.5	0.5	
6	1 Vent Bottom	9	2022.	0.5	10	2022.	0.5	
7	3 Vent Top	11	2022.5	0.5	12	2022.5	0.5	
8	3 Vent Bottom	11	2022.	0.5	12	2022.	0.5	
9	Cor. NS Top	2	2023.2	7.166	3	2023.2	7.166	
10	Cor. NS Bottom	2	2016.	7.166	3	2016.	7.166	
11	C2 S Top	2	2023.2	7.166	4	2023.2	7.166	
12	C2 S B	2	2016.	7.166	4	2016.	7.166	
13	C2NT	3	2023.2	7.166	4	2023.2	7.166	
14	C2 N B	3	2016.	7.166	4	2016.	7.166	
15	41 T	2	2019.6	3.585	5	2019.6	3.583	
16	41 B	2	2016.	3.583	5	2016.	3.583	
17	42 T	5	2019.6	3.585	7	2019.6	3.583	
18	4Z B	5	2016.	3.583	7	2016.	3.583	
19	51 T	5	2019.6	3.585	6	2019.6	3.583	
20	51 B	5	2016.	3.583	6	2016.	3.583	
21	52 T		2019.6	3.585	4	2019.6	3.583	
22	52 B		2016.	3.583	4	2016.	3.583	
23	101 1		2019.6	3.585	× ×	2019.6	3.583	
24		L	2016.	3.583	°,	2016.	3.583	
20	111 1		2019.6	3.303	4	2019.6	3.303	
20			2010.	3.303	4	2010.	3.303	
20	71 1	4	2019.6	3.303	10	2019.6	3.303	
20	71 D	10	2010.	3.303		2010.	3.303	
29	74 I 72 P		2019.0	3.303	, <i>7</i>	2019.0	3.303	
20	72 D	5	2010.6	0.000	, , , , , , , , , , , , , , , , , , ,	2010.	3.303	
32			2019.0	3.505		2019.0	3.303	
22	82 T		2010.	3 585	1 i i	2010.	3 593	
34	82 B		2015.0	3 583	11	2015.0	3 583	
35	131 T	12	2019 6	3 585	4	2019 6	3 583	
	Tor 1	12	2012.0	0.000		2012.0	0.000	
								5



Attachment 7a – GOTHIC Model Flowpaths page 1a

### CALCULATION SHEET

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# 2016' Aux. Building Battery and SWBD room GOTHIC temperature analysis

<b>CALCULATION NO:</b>							
GK-19, Rev. 0 Add. 3							
PREPARED BY: Kurt Linsenbardt	<b>REVIEWED BY:</b> Tom Carr						

In Di	rect Tabl	e Edit mo	de (ESCAP	E or ENTE	R returns	to men	u)	
			Flow Path	ns - Table	≥ 2			
Flow	Flow	Hyd.	Inertia	Friction	Relative	Dep	Mom	Strat
Path	Area	Diam.	Length	Length	Rough-	Bend	Trn	Flow
#	(ft2)	(ft)	(ft)	(ft)	ness	(deg)	Opt	Opt
1	0.347	0.833	15.7				-	NONE
2	0.347	0.833	15.7				-	NOME
3	0.347	0.833	15.7				-	NOME
4	0.347	0.833	15.7				-	NONE
5	0.347	0.833	15.7				-	NONE
6	0.347	0.833	15.7				-	NONE
7	0.347	0.833	15.7				-	NONE
8	0.347	0.833	15.7				-	NONE
9	47.778	9.101	44.				-	NOME
10	47.778	9.101	44.				-	NOME
11	43.	13.063	21.8				-	NOME
12	43.	13.063	21.8				-	NOME
13	43.	13.063	21.8				-	NOME
14	43.	13.063	21.8				-	NOME
15	8.958	3.707	14.666				-	NOME
16	8.958	3.707	14.666				-	NONE
17	8.958	3.707	21.166				-	NONE
18	8.958	3.707	21.166				-	NONE
19	11.944	4.55	15.666				-	NONE
20	11.944	4.55	15.666				-	NONE
21	11.944	4.55	12.417				-	NOME
22	11.944	4.55	12.417				-	NOME
23	11.944	4.55	15.666				-	NOME
24	11.944	4.55	15.666				-	NOME
25	11.944	4.55	12.417				-	NONE
26	11.944	4.55	12.417				-	NONE
27	11.944	4.55	12.333				-	NOME
28	11.944	4.55	12.333				-	NONE
29	11.944	4.55	15.666				-	NONE
30	11.944	4.55	15.666				-	N(ONE
31	14.333	5.134	14.666				-	10(0)010
32	14.333	5.134	14.666				-	14(0)415
33	14.333	5.134	21.166				-	10(0)010
34	14.333	5.134	21.166				-	0(0)0



Attachment 7b –	GOTHIC Model	Flowpaths pa	age 1b
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In Di	rect Table Edit	mode ()	ESCAPE o	r ENTER	return	ns to me	nu)	
	LCCC TABLE EULC	Flow-P	athe	Cable J	LCCUL	ло со ше.		
		FIOW F		abie i				13 10H 25D 14 19H 3F
F.P.		Vol	Elev	Ht	Vol	Elev	Ht	
#	Description	A	(ft)	(ft)	в	(ft)	(ft)	
22	52 B	6	2016	3 583	А	2016	3 583	
23	101 T	7	2019.6	3.585	8	2019.6	3.583	
24	101 B	7	2016.	3.583	8	2016.	3.583	
2.5	111 T	8	2019.6	3.585	4	2019.6	3.583	
26	111 B	8	2016.	3.583	4	2016.	3.583	
27	71 T	4	2019.6	3.585	10	2019.6	3.583	
28	71 B	4	2016.	3.583	10	2016.	3.583	
29	72 T	10	2019.6	3.585	9	2019.6	3.583	
30	72 B	10	2016.	3.583		2016.	3.583	
31	81 T	3	2019.6	3.585		2019.6	3.583	
32	81 B	3	2016.	3.583	9	2016.	3.583	
33	82 T	9	2019.6	3.585	11	2019.6	3.583	
34	82 B	9	2016.	3.583	11	2016.	3.583	
35	131 T	12	2019.6	3.585	4	2019.6	3.583	
36	131 B	4	2016.	3.583	12	2016.	3.583	
37	141 T	11	2019.6	3.585	12	2019.6	3.583	
38	141 B	11	2016.	3.583	12	2016.	3.583	
39	11+23 T	13	2004.	4.	14	2004.	4.	
40	11+23 B	13	2000.	4.	14	2000.	4.	
41	Wind in	1	2000.	100.	1F	2000.	100.	
42	Wind out	1	2000.	100.	2P	2000.	100.	
43	ESF Pressure	14	2006.	1.	ЗР	2006.	1.	
44	2016 Pressure	3	2022.	1.	4P	2022.	1.	
45	Grill Top	13	2008.	2.	14	2008.	2.	
46	Grill Bottom	13	2006.	2.	14	2006.	2.	
47	B4 in	6	2022.	2.	5F	2022.	2.	
48	B2 in	8	2022.	2.	6F	2022.	2.	
49	54 in	5	2022.	2.	7F	2022.	2.	
50	S2 in	7	2022.	2.	8F	2022.	2.	
51	ESF in	13	2006.	2.	9F	2006.	z.	
52	B4 out		2020.	2.	TOF	2020.	2.	
53	B2 OUC	l ë	2020.	2.	115	2020.	2.	
54	54 OUC	<u> </u>	2020.	2.	125	2020.	2.	
55	SZ OUC	1	2020.	4.	135	2020.	<u> </u>	
- 36	Epr ouc	1.3	2004.	2.	141	2004.	2.	

Attachment 7c – GOTHIC Model Flowpaths page 2a

#### CALCULATION SHEET

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2016' Aux. Building Battery and SWBD room GOTHIC temperature analysis

<b>CALCULATION NO:</b>							
GK-19, Rev. 0 Add. 3							
PREPARED BY: Kurt Linsenbardt	<b>REVIEWED BY:</b> Tom Carr						



Attachment 7d – GOTHIC Model Flowpaths page 2b

ATTACHMENT 7

USE OF GOTHIC 7.2a

Attachment 7 Page 1 of 3

Numerical Applications, Inc. (NAI) is the developer of the GOTHIC thermal hydraulics analysis code which has been used previously for Callaway containment pressure/temperature analyses and numerous other nuclear plant related analysis tasks. (See the discussion of License Amendment 168 below.) GOTHIC is developed and maintained under NAI's QA Program that conforms to the requirements of 10CFR50 Appendix B and 10CFR Part 21. Detailed descriptions of available GOTHIC user options and models are included in References 1 and 2 below. Information about GOTHIC qualification is available in Reference 3. The Callaway engineers qualified to use GOTHIC document their proficiency via the Engineering Support Personnel (ESP) qualification card requirement titled "ESP/504A, Perform Containment Pressure / Temperature Calculation Using the GOTHIC Computer Code."

1. George, TL, et al., *GOTHIC Containment Analysis Package User Manual*, Version 7.2a(QA), NAI 8907-02, Rev. 17, Numerical Applications, Inc., Richland, WA, January 2006.

2. George, TL, et al., *GOTHIC Containment Analysis Package Technical Manual*, Version 7.2a(QA), NAI 8907-06, Rev. 16, Numerical Applications, Inc., Richland, WA, January 2006.

3. George, TL, et al., *GOTHIC Containment Analysis Package Qualification Report*, Version 7.2a(QA), NAI 8907-09, Rev. 9, Numerical Applications, Inc., Richland, WA, January 2006.

The following discussion of GOTHIC 7.2a was provided in ULNRC-05734 dated October 26, 2010:

# "GOTHIC 7.2a (Callaway 50.59 Evaluation Log No. 06-02)

GOTHIC 7.2a Software Documentation Package

Activity Description:

Current Containment/Main Steam Tunnel temperature/pressure analyses performed for FSAR Chapters 3.B and 6.2 were completed by Westinghouse using version 7.1pl of the GOTHIC code. However, future analyses will be performed by Callaway personnel on site, and GOTHIC version 7.1 pl is no longer distributed by EPRI. GOTHIC version 7.2 replaced version 7.1 pl, but version 7.2a will be considered since most of the changes were corrections of errors from version 7.2. A software documentation package has been prepared to enable the use of GOTHIC version 7.2a per procedure EDP-ZZ-04011, "Nuclear Engineering Analytical Software Controls." This 10 CFR 50.59 Evaluation is being performed as part of the 10 CFR 50.59 review of the Software Documentation Package. Summary of Evaluation:

Evaluation question 8, "Does the proposed activity result in a departure from a method of evaluation described in the FSAR used in establishing the design bases or in the safety analyses?" is applicable to this change. GOTHIC 7.2a calculates some results that are conservative and some that are non-conservative with respect to results from version 7.1p1. A review of the change in these results indicates that the results are conservative or essentially the same as those from GOTHIC version 7.1 p1 and thus do not represent a departure from a method of evaluation described in the FSAR and do not require prior NRC approval. Other limitations on the use of GOTHIC remain consistent with NRC approval of the use of GOTHIC in previous applications. In addition, user-controlled enhancements which could impact the results in GOTHIC 7.2a will not be used for Callaway calculations."

The validation of GOTHIC 7.2a included the comparison of peak containment temperatures calculated for 3 LOCA cases and 3 MSLB cases approved by the NRC in LA168 using GOTHIC 7.1p1.

	Summary of Changes in Peak Containment Temperatures from GOTHIC 7.1p1 to GOTHIC 7.2a												
					MSLD	MSLB Main Stoom							
	LOCA DEPSG (pump suction)	LOCA DEPSG (pump suction) MinSI	LOCA DEHL	MSLB DER 102% RTP failed MSIV	Split Break 2% RTP	Tunnel 1.0 sq.ft.							
Peak Temperature Change	-0.22%	-0.19%	-0.18%	-0.19%	-0.18%	0.01%							

The following is an excerpt approving GOTHIC 7.1p1 from the Safety Evaluation for Callaway License Amendment 168 dated September 29, 2005 (Callaway Plant, Unit 1 – Issuance of Amendment Regarding the Steam Generator Replacement Project (TAC NO. MC4437), ADAMS ACCESSION Numbers: ML052570054, Package ML052570086, TS ML052730083):

"3.6.3.3 Application of GOTHIC to Callaway Containment Safety Analyses

The GOTHIC code is a general purpose thermal hydraulics computer program for the analysis of a nuclear power plant containment. GOTHIC was developed for the Electric Power Research Institute (EPRI) by Numerical Applications, Incorporated (NAI). NAI validated GOTHIC by comparison with analytical solutions and experimental data. The NRC has previously approved containment analyses using the GOTHIC code. The licensee stated that it has used GOTHIC 7.1p1 for the containment analyses and these analyses are consistent with the conditions and limitations of a previous staff review of GOTHIC (Reference 6.3). In the following statement, the licensee described the quality assurance program used for the application of the GOTHIC code to Callaway.

The GOTHIC computer code for the Callaway RSG [replacement steam generator] Program was developed and implemented by Westinghouse in accordance with their Quality Assurance program. That invokes the requirements of 10 CFR 21 and 10 CFR 50 Appendix B. Westinghouse is currently listed on the AmerenUE Qualified Supplier List for Engineering Services.

Based on this quality control on the application of the GOTHIC code to Callaway, the NRC staff finds that the licensee's use of GOTHIC in the Callaway containment analyses is acceptable."

#### **"8.0 REFERENCES**

Section 3.6 of this SE:

6.1 Westinghouse LOCA Mass and Energy Release Model for Containment Design, WCAP- 10325-P-A, May 1983 (Proprietary), WCAP 10326-A (Non-Proprietary) March 1979.

6.2 GOTHIC Containment Analysis Package, Version 7.0, Electric Power Research Institute.

6.3 Issuance of Kewaunee Nuclear Power Plant License Amendment No. 169, September 29, 2003."