PLC *Professional Loss Control, Inc.*

STRUCTURAL STEEL ANALYSIS

for

PEACH BOTTOM GENERATING STATION

Calculation No .51

Unit 2,3

Turbine Building El. 135'

Corridor to Switchgear Rooms

Fire Area 78A

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PEACH BOTTOM GENERATING STATION

1. AREA DESCRIPTION

The area under consideration is the corridor to the Switchgear Rooms on the 135'elevation of the Turbine Building (Fire Area 78A). The bounding walls are constructed of concrete block with an average thickness of 1 ft. The total surface area for heat transfer is 4,432 ft^2 (see Attachment A for a sketch of the area under consideration).

2. COMBUSTIBLE LOADING

This area contains cable trays. The average loading in the cable trays is 4.77 lbs/ft^2 of cable tray surface area. The total surface area of cable trays in this area is 241 ft^2.

There are no combustible liquids in this area. Enclosed combustibles such as cabling in conduit have not been considered in this analysis.

3. VENTILATION PARAMETERS

There are 11 doors which enter this area. Eight doors measure 3' wide by 7' high and three doors measure 3'-7 1/2" wide and 6'-9 3/4" high.

4. CASES EXAMINED

A spreading cable fire was assumed to originate in the area of heaviest cable concentration in order to present the worst case. The fire is assumed to start at a point source and spread horizontally along the cable trays in each direction at a rate of 10 ft. per hour and instantaneously up any vertical trays encountered. The fire will spread a distance of 8 feet in each direction along the cable trays before the original point source dies out after 48 minutes. A maximum surface area of 49 ft^2 of cable trays (see Attachment B for a list of trays) will be involved at any one time, which corresponds to a heat output of 861.6 kW. This heat output is assumed constant throughout the fire duration. The actual heat output as the fire spreads out of the area originally involved would be less since the quantity of cabling involved at any one time would be less.

5. RESULTS

The first case examined was that of a spreading cable fire. The fire duration was taken to be 180 minutes which is the maximum fire resistance rating required for the barrier The maximum temperature reached was 527 ^{o}F, which is below the critical temperature for the structural steel (see Attachment C for results of analysis.) Since the resulting fire was fuel controlled with one door open, it will also be fuel controlled if any additional doors are open.

The positions of cable trays relative to structural steel members were examined throughout the area in order to assess the potential for localized heating. Attachment D contains the results of calculations performed to determine the response of the affected structural members to localized heating. These calculations are conservative because they assume that the entire length of the member is subjected to the exposure temperature, whereas, in reality only a short section would be. The duration of each cable tray fire is taken to be 48 minutes which is the time required for a cable tray to burn to completion. The cable tray exposures and beam responses are tabulated as follows:

Case No.	Exposure Trays	Separation Distance	Member Type	Exposure Temp. (º)	Final Beam Temp. (ºF)
1	ZC2CV030	<2'	W12x27	1300	1300
2	ZD2CV040	<1'	W12x27	1500	1500
3	ZC3PV02	<2'	W16x36	1300	1299
4	ZD2CN070	1'-5 1/2"	Same as Case 1		
5	ZD3QV02	<1'	Same as Case 2		
6	3CGB86 ZC3PV03	1'-11 1/2"	Same as Case 3		

6. EFFECTS OF TRANSIENT COMBUSTIBLES

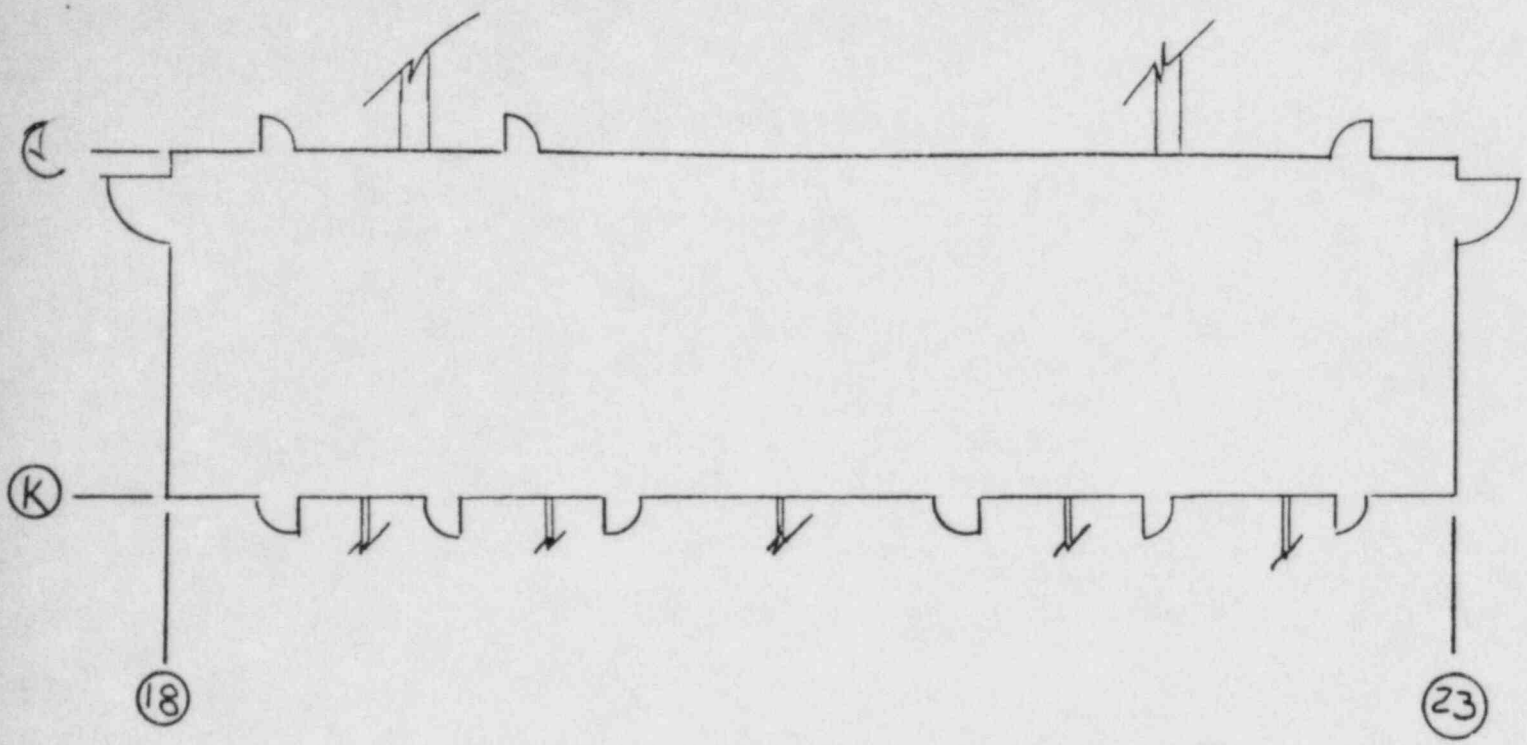
The worst case fire examined was fuel controlled with a duration of 180 minutes. The maximum additional heat release rate due to transient materials in the area which will result in an area temperature less than 1100°F is listed below.

Fire Duration	Q/A (kW/m^2)	Q(kW)
180	6.5	1,814

The distance between the floor and the deepest beams supporting the ceiling is 11'-0 1/2". The heat release rates required of floor level transient combustible fires to produce plume temperatures of 1100°F, 1300°F and 1500°F at the bottom flange of the beam have been determined and tabulated below. For the temperatures greater than 1100°F the time required

to heat the sizes of the beams supporting the ceiling have also been determined.

		Time to 1100°F (min)	
T(°)	Q(kW)	W12x27	W16x36 kW)
1100	2,576	-	-
1300	3,389	10	13
1500	4,274	7	8



Turbine Building Elevation 135'

Corridor to Switchgear Rooms

Surface Area Calculation

Walls

North wall	(4.5' x 14')	63 ft^2
East wall	(132.5' x 14)	1855 ft^2
South wall	(4.5' x 14')	63 ft^2
West wall	(132.5' x 14)	1855 ft^2
Ceiling	(132.5' x 4.5')	596 ft^2
Total Surface Area for Heat Transfer		4432 ft^2

SPREADING CABLE FIRE TRAY

TRAY	SECTION	LENGTH	WIDTH	SQUARE FEET
3CQB	86	16	2	32
2C3PV	02	4.5	2	9
2C3PV	03	4	2	8
				49 Sq. Ft.

CASE NO.: 1
BUILDING: PEACH BOTTOM TURBINE BUILDING
ELEVATION AND AREA DESCRIPTION: 135' CORRIDOR IN FRONT OF THE SWGR. ROOMS
CASE DESCRIPTION: SPREADING CABLE FIRE

CEILING/WALL THICKNESS (FT.)	CEILING/WALL MATERIAL	Ao SQ. FT.	Ho FT.	Aw SQ. FT.	Q KW
1.0	CONCRETE BLOCK	21.0	7.0	4432	862

FIRE IS FUEL CONTROLLED

FIRE DURATION (MIN.)	GAS TEMPERATURE (DEG. F)
10	408
20	419
30	428
40	437
50	445
60	452
70	459
80	466
90	473
100	480
110	486
120	492
130	498
140	504
150	510
160	516
170	522
180	527

CASE NO.: 1
BUILDING: PEACH BOTTOM UNITS 2&3 TURBINE BUILDING
ELEVATION AND AREA DESCRIPTION: 135' CORRIDOR TO THE SWGR. ROOM
CASE DESCRIPTION: W12X27

EFFECTS OF LOCAL HEATING ON STRUCTURAL STEEL

FIRE TEMPERATURE (DEG. F): 1300
WEIGHT OF STEEL MEMBER (LBS./FT.): 27
SURFACE OF STEEL MEMBER HEATED (SQ. FT./FT): 4.12

TIME (MIN.)	STEEL TEMPERATURE (DEG. F)
5	811
10	1106
15	1223
20	1269
25	1288
30	1295
35	1298
40	1299
45	1300
50	1300

CASE NO.: 2
BUILDING: PEACH BOTTOM UNITS 2&3 TURBINE BUILDING
ELEVATION AND AREA DESCRIPTION: 135' CORRIDOR TO THE SWGR. ROOM
CASE DESCRIPTION: W12X27

EFFECTS OF LOCAL HEATING ON STRUCTURAL STEEL

FIRE TEMPERATURE (DEG. F): 1500
WEIGHT OF STEEL MEMBER (LBS./FT.): 27
SURFACE OF STEEL MEMBER HEATED (SQ. FT./FT): 4.12

TIME (MIN.)	STEEL TEMPERATURE (DEG. F)
5	932
10	1275
15	1411
20	1465
25	1486
30	1494
35	1498
40	1499
45	1500
50	1500

CASE NO.: 3
BUILDING: PEACH BOTTOM UNITS 2&3 TURBINE BUILDING
ELEVATION AND AREA DESCRIPTION: 135' CORRIDOR TO THE SWGR. ROOM
CASE DESCRIPTION: W16X36

EFFECTS OF LOCAL HEATING ON STRUCTURAL STEEL

FIRE TEMPERATURE (DEG. F): 1300
WEIGHT OF STEEL MEMBER (LBS./FT.): 36
SURFACE OF STEEL MEMBER HEATED (SQ. FT./FT): 4.87

TIME (MIN.)	STEEL TEMPERATURE (DEG. F)
5	727
10	1033
15	1176
20	1242
25	1273
30	1288
35	1294
40	1297
45	1299
50	1299