NUCLEAR ENGINEERING CALCULATION COVER SHEET

NEPM-QA-0221-1

➢2. TYPE: CALC ➢3. NUMBER: EC-ENVR-1058 ➢4. REVISION: 0

*➢5. UNIT 3 *➢6. QUALITY CLASS: Q

➢7. DESCRIPTION: CRHE Accident Dispersion Factors (χ/Q)

8. SUPERSEDED BY:

9. Alternate Number: 10. Cycle:

11. Computer Code/Model used: ARCON96 12. Discipline: R

➢13. Are any results of this calculation described in the Licensing Documents?

☒ Yes, *Refer to NDAP-QA-0730 and NDAP-QA-0731* ☐ No

➢14. Is this calculation changing any method of evaluation described in the FSAR and using the results to support or change the FSAR? (Refer to PPL Resource Manual for Definition of FSAR)

☒ Yes, *50.59 screen or evaluation required.* ☐ No

➢15. Is this calculation Prepared by an External Organization?

☒ Yes ☐ No

EG771 Qualifications may not be required for individuals from external organizations (see Section 7.4.3).

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TO BE COMPLETED BY DCS

DCS SIGNATURE/DATE Rosemarie Shaffer

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FORM NEPM-QA-0221-1, Revision 8, Page 1 of 1, ELECTRONIC FORM

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PP&L CALCULATION SHEET

Dept.	0341 Rad & Eff Tech.	PROJECT	
Date	5/9/05	CRHE Accident Dispersion Factors	Calc. No. EC-ENVR-1058
Designed By	M. M. Waselus	(χ/Q)	Sh. No. 2
Checked By	P. L. Bunker		

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1.0 PURPOSE

The purpose of this analysis is to calculate short term accident χ/Q's for the SSES Control Room Habitability Envelope (CRHE) using the methodology provided in NUREG/CR-6331 - ARCON96 (Reference 1) and onsite meteorological data documented in Reference 2. The ARCON96 code uses hourly meteorological data and recently developed methods for estimating χ/Q's in the vicinity of buildings to calculate relative concentrations at control room air intakes that would be exceeded no more than five percent of the time. These concentrations are calculated for averaging periods ranging from one hour to 30 days in duration. The term χ/Q (sec/m^3) is an expression of the relative dispersion occurring between a source (release) location and a receptor location. This relative dispersion is used to determine the expected atmospheric concentration at some defined distance away from the source for a known quantity of effluent released.

The release points included in this analysis are defined as follows:

1. Reactor Building Unit 1 exhaust vent.
2. Reactor Building Unit 2 exhaust vent.
3. Turbine Building Unit 1 exhaust vent.
4. Turbine Building Unit 2 exhaust vent.
5. Standby Gas Treatment System exhaust vent.
6. Reactor Building Unit 1 closest distance.
7. Reactor Building Unit 2 closest distance.
8. Turbine Building Unit 1 closest distance.
9. Turbine Building Unit 2 closest distance.
10. Reactor Building Unit 1 main steam tunnel blowout panel.
11. Turbine Building Unit 1 main steam tunnel blowout panel.
12. Turbine Building Unit 2 main steam tunnel blowout panel

2.0 CONCLUSIONS AND RECOMMENDATIONS

The CRHE χ/Q's for the above release points as determined in this calculation are listed as follows.

#	Release Point	CRHE χ/Q'S (sec/m^3) without Occupancy Correction Factors				
	Time Period	0 to 2 hours	2 to 8 hours	8 to 24 hours	1 to 4 days	4 to 30 days
1	RB Unit 1 Exhaust Vent	1.17E-03	7.50E-04	2.58E-04	2.40E-04	2.09E-04
2	RB Unit 2 Exhaust Vent	1.18E-03	7.02E-04	2.46E-04	2.28E-04	1.98E-04
3	TB Unit 1 Exhaust Vent	5.09E-03	4.15E-03	1.20E-03	1.16E-03	1.01E-03
4	TB Unit 2 Exhaust Vent	6.00E-03	4.93E-03	1.44E-03	1.38E-03	1.21E-03
5	SGTS Exhaust Vent	5.15E-03	4.22E-03	1.23E-03	1.19E-03	1.04E03
6	RB Unit 1 Closest Distance	3.22E-03	2.43E-03	9.25E-04	7.68E-04	6.56E-04
7	RB Unit 2 Closest Distance	3.89E-03	3.12E-03	9.29E-04	9.34E-04	8.10E-04
8	TB Unit 1 Closest Distance	1.09E-03	5.19E-04	2.07E-04	1.46E-04	1.16E-04
9	TB Unit 2 Closest Distance	2.72E-03	1.35E-03	5.59E-04	4.29E-04	3.49E-04
10	RB Unit 1 MST Blowout Panel	2.80E-03	2.21E-03	6.25E-04	6.01E-04	5.29E-04
11	TB Unit 1 MST Blowout Panel	7.05E-04	5.61E-04	1.59E-04	1.53E-04	1.34E-04
12	TB Unit 2 MST Blowout Panel	1.49E-03	6.99E-04	2.88E-04	1.99E-04	1.59E-04

These χ/Q values are to be used in subsequent CRHE radiological evaluations for SSES.

3.0 ASSUMPTIONS / INPUT

There are no assumptions in this analysis which require future confirmation.

The input data and assumptions used in this analysis are summarized as follows:

1. Reactor building grade elevation – 670' (Reference 9).
2. Turbine and Control building grade elevation – 676' (Reference 9).
3. Elevation of the 12 release points and references are shown on Table 2.
4. All release heights are taken from the 676' grade elevation. The reactor building elevations are corrected for the difference in grade elevations by inputting -1.8m (-6 ft) as the terrain elevation difference in the RECEPTOR INPUT block.
5. All release points are of assumed to be ground level release type as discussed in References 4 and 6.
6. Plant north and true north are essentially the same at SSES.
7. Other input is referenced as appropriate throughout the analysis.

4.0 METHODOLOGY

The χ/Q's for the SSES CRHE are determined using the ARCON96 computer code. ARCON96 mainly requires inputs involving physical relationships between release points and receptor locations. Table 1 lists the required inputs in order for ARCON96 to provide the χ/Q's. ARCON96 also has default values for other parameters used in the dispersion model, but they are not normally changed. These parameters, as used herein, will remain the default values except for the Surface Roughness Length and Averaging Sector Width Constant, which will be set at 0.2 and 4.3, respectively, in lieu of the default values of 0.1 and 4.0, in accordance with the recommendations in USNRC Regulatory Guide 1.194 (Reference 3).

Table 1 – Inputs required for ARCON96

Meteorological Input	**Receptor Input**
Number of Met Data Files	Distance to receptor
Lower Measurement Height	Intake Height
Upper Measurement Height	Elevation Difference
Wind Speed	Direction to Source
Source Input	
Release Type	**Output Files**
Release Height	Output File Name fn.log
Building Area	CFD File Name fn.cfd
Vertical Velocity	Expanded Output no
Stack Flow	
Stack Radius	

Meteorological Input

The meteorological data files consist of five files documented in Reference 2. The meteorological data consists of five years of hourly data, covering the years from 1999 to 2003. Each record of the hourly data contains a location identifier, Julian day (1-366), hour (0 to 23), low-level direction, low-level speed, stability class (1=A to 7=G), upper level direction, and upper level speed. The identifier and upper level data is optional. Wind speeds are entered in tenths of a reporting unit with no decimal. Wind directions are from 1 to 360 in degrees.

identifier and upper level data is optional. Wind speeds are entered in tenths of a reporting unit

These five files were combined into one file for ease of code execution. This file contains all the data for the SSES site from 1999-2003, which satisfies the ARCON96 (Reference 1) requirements for having 3 to 5 years of hourly data. The Upper and Lower Measurement Heights are 10m and 60 m, respectively, and the Wind Speed units are m/s (Reference 2).

Source Input

Twelve Source (or Release) points are analyzed. These sources are chosen to primarily support Condition IV type accidents, but are not limited to just these accidents. The release points along with the release height and references are listed in Table 2.

Table 2 – Release Points and Release Heights

#	Description	Release Elevation, ft	Release Height, ft (1)	Release Height, m	Reference
1	Reactor Building Unit 1 exhaust vent (2)	874.1	198.1	60.4	14
2	Reactor Building Unit 2 exhaust vent (2)	874.1	198.1	60.4	15
3	Turbine Building Unit 1 exhaust vent (2)	874.7	198.7	60.6	16
4	Turbine Building Unit 2 exhaust vent (20	874.7	198.7	60.6	16
5	Standby Gas Treatment System exhaust vent (2)	874.7	198.7	60.6	16
6	Reactor Building Unit 1 closest distance (3)	670	-6.0	-1.8	9
7	Reactor Building Unit 2 closest distance (3)	670	-6.0	-1.8	9
8	Turbine Building Unit 1 closest distance (4)	676	0.0	0.0	9
9	Turbine Building Unit 2 closest distance (4)	676	0.0	0.0	9
10	RB Unit 1 main steam tunnel blowout panel (2)	802.5	126.5	38.6	18
11	TB Unit 1 main steam tunnel blowout panel (2)	717.5	41.5	12.7	19,21
12	TB Unit 2 main steam tunnel blowout panel (2)	717.5	41.5	12.7	19,21

1. Release height = Release elevation (ft) – 676 ft (grade elevation for TB and CR).
2. Release height set = to CRHE outside air intake height (36.9 m) in ARCON96 since "taut string" distance used for this release point.
3. Release height set = to 0 in ARCON96. "Taut string" distance not used in ARCON96. Correction for elevation difference entered into ARCON96 in Receptor Input (Terrain Elevation Distance) as -1.8 meters.
4. Release height set = 0 in ARCON96. "Taut string" distance not used in ARCON96.

Distance) as -1.8 meters.

The Building Area used for determining the wake effects is 2685 m^2 per Reference 5 (included as Attachment 15).

The remaining values for Source input (vertical velocity, stack flow and stack radius)are specified as 0 since only ground level release types are being analyzed.

Receptor Input

The receptor considered in the calculation is the SSES CRHE outside air intakes. The CRHE Intake is approximately located at column lines L and 32 (References 7, 8). Reference 12 provides a sketch of the general arrangement of the CRHE intake with respect to several of the release points. No dimensions are taken from Reference 12, it is used for general orientation only. The CRHE intake elevation from Reference 7 is 797'. Grade elevation for the SSES site at the Control Building is 676' (Reference 9). Therefore, the CRHE intake height is 121' [797' – 676'] or 36.9m. Turbine Building elevations are measured from the same reference point and the elevation difference is zero. The Reactor Building elevations are measured from the Reactor Building grade elevation of 670' and the elevation difference is -6 feet or -1.8 m.

With the combinations of release points and intake identified, the direction and distance between the release point and the intake is determined by scaling from the reference drawings. Wind direction data are recorded as the direction from which the wind blows (e.g., a north wind blows from the north, a wind blowing out of the west is recorded with a direction of 270 degrees). The direction input to ARCON96 is the wind direction that would carry the plume from the release point to the intake. For example, an analyst standing at the intake facing west to the release point, would enter 270 degrees; an analyst facing north, would enter 360 degrees, etc.
The source-to-receptor distance is the shortest horizontal distance between the release point and the intake. ARCON96 uses this distance and the elevations of the source and receptor to calculate the slant path. For releases within building complexes, the distance between the release point and the intake could be through intervening buildings. In these cases, the length of the

calculate the slant path. For releases within building complexes, the distance between the release

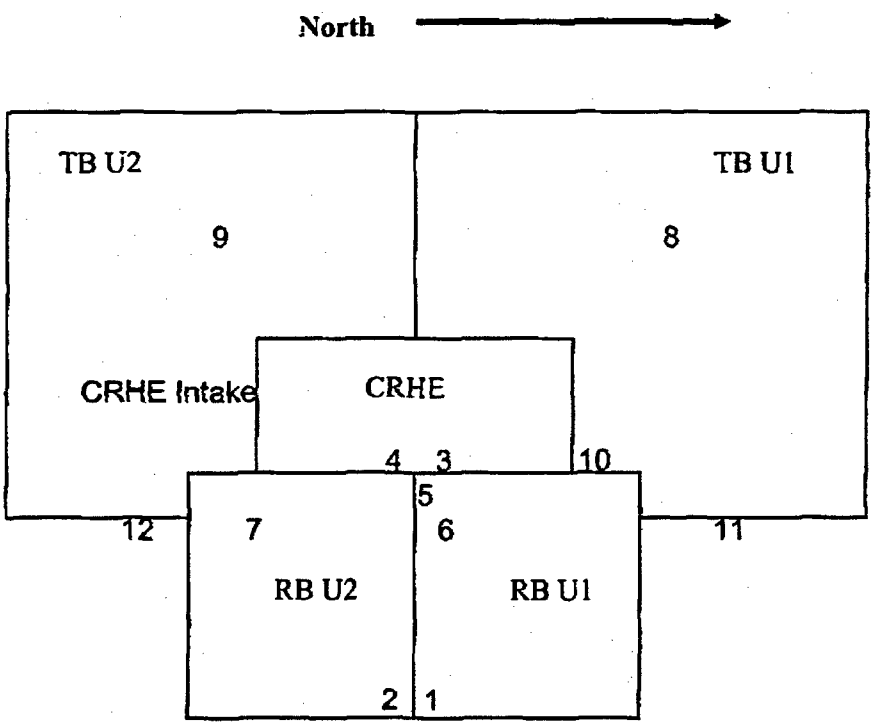
shortest path is taken around or over the intervening building as the source-to-receptor distance (e.g., "taut string length"). The resulting source-to-receptor horizontal distances and direction are listed in Table 3. The values were determined by scaling from the reference drawings.

Table 3 - Release Point Horizontal Distances and Directions

#	Description	Horizontal Distance meters	Direction degrees	Reference
1	RB Unit 1 exhaust vent	56.4	69	11,14
2	RB Unit 2 exhaust vent	55.7	72	11,15
3	TB Unit 1 exhaust vent	23.5	21	11,16,22
4	TB Unit 2 exhaust vent	19.0	25	11,16,22
5	SGTS exhaust vent	22.3	27	11,16,22
6	RB Unit 1 closest distance	21.6	28	21
7	RB Unit 2 closest distance	10.8	90	21
8	TB Unit 1 closest distance	55.6	337	13
9	TB Unit 2 closest distance	24.7	238	13
10	RB Unit 1 MST blowout panel	45.1	8	11,17
11	TB Unit 1 MST blowout panel	76.4	8	19,21
12	TB Unit 2 MST blowout panel	40.2	162	19,21

In accordance with Reference 3, section 3.4, taut string distances are determined below for release point numbers 1, 2, 3, 4, 5, 10, 11 and 12. Release points 5, 6, 7 and 8 do not use the taut string methodology and the values from Table 3 are directly entered into ARCON96.

The overall site/building arrangement is shown on Reference 10. The relative locations of the release points corresponding to the above are shown as follows:

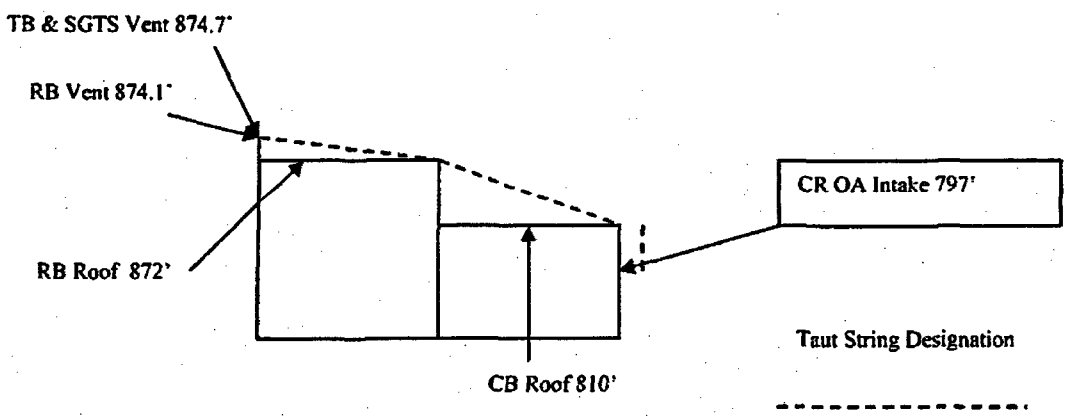


The approximate roof elevations for the structures are listed as follows:

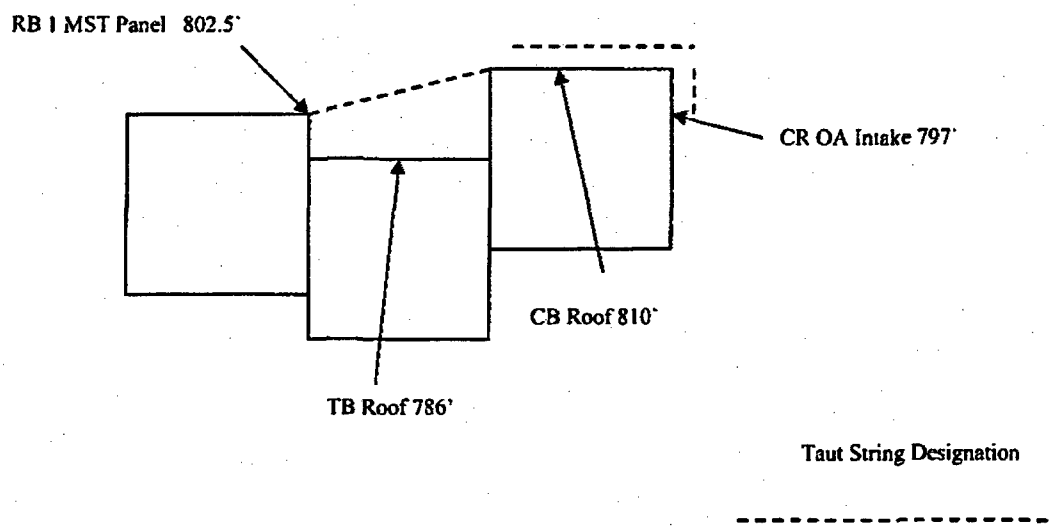
1. Turbine Building 786' Reference 9
2. Control Building 810' Reference 9
3. Reactor Building 872' Reference 11

These elevations are used in determining the "taut string lengths" in accordance with Reference 3, Section 3.4. A simple schematic of each of these release points is provided in the following sketches.

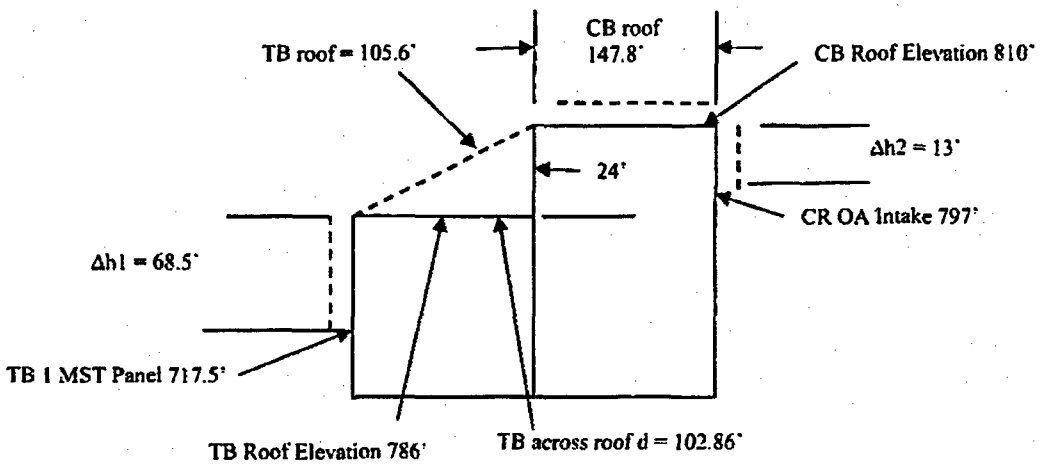
Release points #1, 2, 3, 4, 5: RB 1 & 2 vents, TB 1 & 2 vents and SGTS vent (References 11, 14 15 and 16).



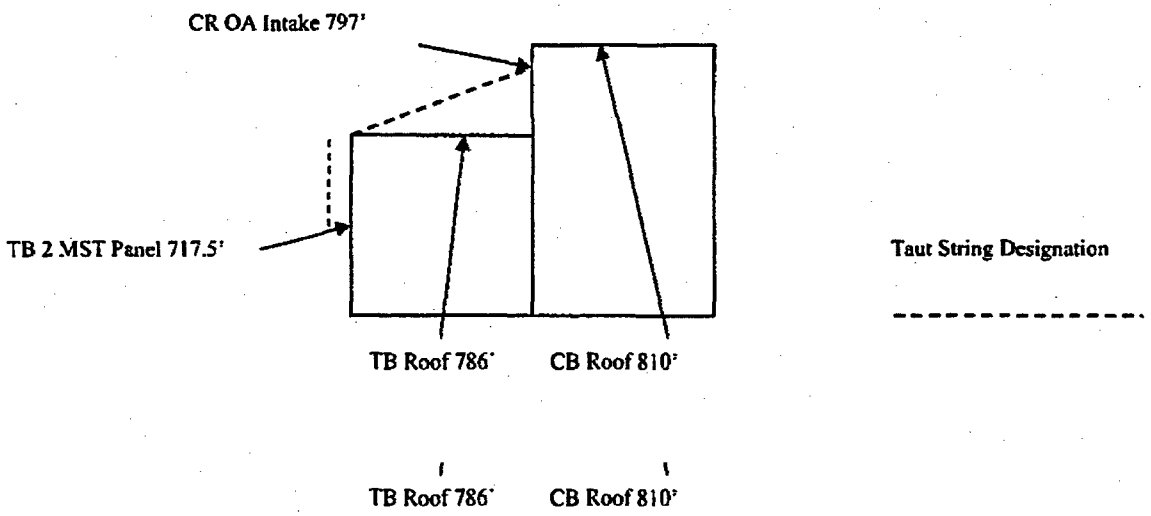
Release point #10: RB 1 main steam tunnel blowout panel (Reference 11, 18)



Release Point # 11: TB 1 main steam tunnel blowout panel (References 19, 21).



Release Point # 12: TB 2 main steam tunnel blowout panel (References 19, 21).



The following provides an example of the calculation of the taut string distance for the TB 1 main steam tunnel blowout panel (Release point # 11).

d (ft) = Δh1 + TB roof + CB roof + Δh2 where:

Δh1 = TB roof elevation – Panel elevation = 786' – 717.5' = 68.5'

TB roof = $((\text{TB hor. dist.})^2 + (\text{CB roof} - \text{TB roof})^2)^{1/2} = ((102.86)^2 - (810'-786')^2)^{1/2} = 105.6'$

CB roof = distance across CB roof = 147.8'

Δh2 = CB roof elevation– CR O.A. intake elevation = 810' – 797' = 13'

Therefore,

d(ft) = 68.5' + 105.6' + 147.8' + 13' = 335' or 102.1m

The distances for the remaining release points were similarly calculated and the results are shown on Attachment 1 (EXCEL file). Attachment 2 shows the formula version of the EXCEL file. A summary of the resulting values from Attachment 1 is provided in Table 4.

Table 4 – Taut String Distances (meters)

#	Location	Horizontal Distance meters Table 3	Taut String Distance meters Attachment 1
1	Reactor Building Unit 1 exhaust vent	56.4	74.6
2	Reactor Building Unit 2 exhaust vent	55.7	73.7
3	Turbine Building Unit 1 exhaust vent	23.5	36.3
4	Turbine Building Unit 2 exhaust vent	19.0	33.3
5	Standby Gas Treatment System exhaust vent	22.3	36.1
10	RB Unit 1 main steam tunnel blowout panel	45.1	49.5
11	TB Unit 1 main steam tunnel blowout panel	76.4	102.1
12	TB Unit 2 main steam tunnel blowout panel	40.2	61.2

| 12 | TB Unit 2 main steam tunnel blowout | 40.2 | 61.2 |

5.0 5.0 RESULTS

The results of the analysis are provided on the ARCON96 computer outputs (Attachments 3 to 14) and summarized on Table 5. As noted in Reference 6, section 4.2.6, ARCON96 output does not include the CRHE occupancy correction factors that may be applied in CRHE dose evaluations.

Table 5 – CRHE χ/Q's as a Function of Release Point without Occupancy Correction

# lea:	Release Point	0 to 2 hours sec/m³	2 to 8 hours sec/m³	8 to 24 hours sec/m³	1 to 4 days sec/m³	4 to 30 days sec/m³	ARCON96 file	Reference
Ur1	RB Unit 1 Exhaust Vent	1.17E-03	7.50E-04	2.58E-04	2.40E-04	2.09E-04	RB1EV.log	Attachment 3
Ur2	RB Unit 2 Exhaust Vent	1.18E-03	7.02E-04	2.46E-04	2.28E-04	1.98E-04	RB2EV.log	Attachment 4
Ur3	TB Unit 1 Exhaust Vent	5.09E-03	4.15E-03	1.20E-03	1.16E-03	1.01E-03	TB1EV.log	Attachment 5
Ur4	TB Unit 2 Exhaust Vent	6.00E-03	4.93E-03	1.44E-03	1.38E-03	1.21E-03	TB2EV.log	Attachment 6
TS5	SGTS Exhaust Vent	5.15E-03	4.22E-03	1.23E-03	1.19E-03	1.04E03	SGTSEV.log	Attachment 7
Ur6	RB Unit 1 Closest Distance	3.22E-03	2.43E-03	9.25E-04	7.68E-04	6.56E-04	RB1CD.log	Attachment 8
Ur7	RB Unit 2 Closest Distance	3.89E-03	3.12E-03	9.29E-04	9.34E-04	8.10E-04	RB2CD.log	Attachment 9
Ur8	TB Unit 1 Closest Distance	1.09E-03	5.19E-04	2.07E-04	1.46E-04	1.16E-04	TB1CD.log	Attachment 10
Ur9	TB Unit 2 Closest Distance	2.72E-03	1.35E-03	5.59E-04	4.29E-04	3.49E-04	TB2CD.log	Attachment 11
Ur10	RB Unit 1 MST Blowout Panel	2.80E-03	2.21E-03	6.25E-04	6.01E-04	5.29E-04	RB1MST.log	Attachment 12
Ur11	TB Unit 1 MST Blowout Panel	7.05E-04	5.61E-04	1.59E-04	1.53E-04	1.34E-04	TB1MST.log	Attachment 13
Ur12	TB Unit 2 MST Blowout Panel	1.49E-03	6.99E-04	2.88E-04	1.99E-04	1.59E-04	TB2MST.log	Attachment 14

6.0 REFERENCES

1. NUREG/CR-6331, Atmospheric Relative Concentrations in Building Wakes, Revision 1, May, 1997 (ARCON96 computer code).
2. EC-ENVR-1057, Offsite χ/Q values for SSES Based on 1999 – 2003 Meteorological Data, Revision 0.
3. USNRC Regulatory Guide 1.194, Atmospheric Relative Concentrations for Control Room Radiological Habitability Assessments at Nuclear Power Plants, June, 2003.
4. NEI-99-03, Control Room Habitability Assessment Guidance, Nuclear Energy Institute, June 2001.
5. SSES PLE-23733 included as Attachment 15.
6. USNRC Regulatory Guide 1.183, Alternative Radiological Source Terms For Evaluating Design Basis Accidents At Nuclear Power Reactors, July 2000.
7. PPL Drawing E-106446 Sheet 10 Revision 16.
8. PPL Drawing E-106446 Sheet 15 Revision 9.
9. PPL Drawing E-106312 Revision F.
10. PPL Drawing E105002 Sheet 1 Revision 12.
11. PPL Drawing E-105004 Sheet 7 Revision 27.
12. FSAR Figure 6.4-2. Revision 49.
13. PPL Drawing E-105004 Sheet 4 Revision 25.
14. PPL Drawing E-106454 Sheet 14 Revision 11.
15. PPL Drawing E-106458 Sheet 14 Revision 8.
16. PPL Drawing E-106429-8 Revision 16.
17. PPL Drawing E-105007 Sheet 1 Revision 9.
18. PPL Drawing E-105618 Revision 1.
19. PPL Drawing E-105670 Revision 8.
20. PPL Drawing E-105005 Sheet 1 Revision 9.
21. PPL Drawing E-105004 Sheet 3 Revision 26.
22. PPL Drawing E-106429-10 Revision 15..
20. PPL Drawing E-105005 Sheet 1 Revision 9.

Attachment 1 - EXCEL File – Taut String Distances

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1					taut	string	Reference								
2		Distances	distance ft	distance m	d ft	d m									
3	1	RB 1 vent horizontal	185.14	56.4			11,14								
4		RB 1 vent across RB roof	167.14	51.0											
5		RB 1 vent across CB roof	18.00	5.5	244.7	74.6									
6															
7	2	RB 2 vent horizontal	182.57	55.7			11,15								
8		RB 1 vent across RB roof	163.93	50.0											
9		RB 1 vent across CB roof	18.64	5.7	241.7	73.7									
10															
11	3	TB 1 vent horizontal	77.14	23.5			11, 16								
12		TB1 vent across RB roof	24.43	7.4											
13		TB1 vent across CB roof	52.71	16.1	119.0	36.3									
14															
15	4	TB 2 vent horizontal	62.36	19.0			11, 16								
16		TB2 vent across RB roof	22.50	6.9											
17		TB2 vent across CB roof	39.86	12.2	109.4	33.3									
18															
19	5	SGTS horizontal	73.29	22.3			11, 16								
20		SGTS vent across RB roof	28.93	8.8											
21		SGTS vent across cB roof	44.36	13.5	118.3	36.1									
22															
23	10	RB 1 panel horizontal	147.86	45.1			11,18								
24		RB 1 panel across TB roof	19.29	5.9											
25		RB 1 panel across CB roof	128.57	39.2	162.3	49.5									
26															
27	11	TB 1 panel horizontal	250.71	76.4			19, 21								
28		TB 1 panel across TB roof	102.86	31.4											
29		TB 1 panel across CB roof	147.86	45.1	335.0	102.1									
30															
31	12	TB 2 panel horizontal	131.79	40.2			19,21								
32		TB 2 panel across TB roof	131.79	40.2	200.7	61.2									
33															
34															
35															
36															
37															
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Attachment 2 - EXCEL File (Formula)– Taut String Distances

	A	B	C	D	E	F	G	H
1					laut	string	Reference	
2		Distances	distance ft	distance m	d ft	d m		
3	1	RB 1 vent horizontal	185.14	=C3/3.28			11.14	
4		RB 1 vent across RB roof	167.14	=C4/3.28				
5		RB 1 vent across CB roof	18	=C5/3.28	=((C4^2)+(2.1^2))^0.5+((C5^2)+(62^2))^0.5+(13)	=E5/3.28		
6								
7	2	RB 2 vent horizontal	182.57	=C7/3.28			11.15	
8		RB 1 vent across RB roof	163.93	=C8/3.28				
9		RB 1 vent across CB roof	18.64	=C9/3.28	=((C8^2)+(2.1^2))^0.5+((C9^2)+(62^2))^0.5+(13)	=E9/3.28		
10								
11	3	TB 1 vent horizontal	77.14	=C11/3.28			11. 16	
12		TB1 vent across RB roof	24.43	=C12/3.28				
13		TB1 vent across CB roof	52.71	=C13/3.28	=((C12^2)+(2.7^2))^0.5+((C13^2)+(62^2))^0.5+(13)	=E13/3.28		
14								
15	4	TB 2 vent horizontal	62.36	=C15/3.28			11. 16	
16		TB2 vent across RB roof	22.5	=C16/3.28				
17		TB2 vent across CB roof	39.86	=C17/3.28	=((C16^2)+(2.7^2))^0.5+((C17^2)+(62^2))^0.5+(13)	=E17/3.28		
18								
19	5	SGTS horizontal	73.29	=C19/3.28			11. 16	
20		SGTS vent across RB roof	28.93	=C20/3.28				
21		SGTS vent across CB roof	44.36	=C21/3.28	=((C20^2)+(2.7^2))^0.5+((C21^2)+(62^2))^0.5+(13)	=E21/3.28		
22								
23	10	RB 1 panel horizontal	147.86	=C23/3.28			11.18	
24		RB 1 panel across TB roof	19.29	=C24/3.28				
25		RB 1 panel across CB roof	128.57	=C25/3.28	=((C24^2)+(7.5^2))^0.5+(C25)+(13)	=E25/3.28		
26								
27	11	TB 1 panel horizontal	250.714285714286	=C27/3.28			19. 21	
28		TB 1 panel across TB roof	102.857142857143	=C28/3.28				
29		TB 1 panel across CB roof	147.857142857143	=C29/3.28	=((C28^2)+(24^2))^0.5+68.5+13+C29	=E29/3.28		
30								
31	12	TB 2 panel horizontal	131.785714285714	=C31/3.28			19.21	
32		TB 2 panel across TB roof	131.785714285714	=C32/3.28	=((C32^2)+(11)^2)^0.5+68.5	=E32/3.28		
33								
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Attachment 3 – RB1EV.log
ARCON96 Output
for
Reactor Building Unit 1 Exhaust Vent

RB1EV.log

```
Program Title:  ARCON96.

Developed For:  U.S. Nuclear Regulatory Commission
                Office of Nuclear Reactor Regulation
                Division of Reactor Program Management

Date:           June 25, 1997    11:00 a.m.

NRC Contacts:   J. Y. Lee        Phone: (301) 415 1080
                                 e-mail: jyl1@nrc.gov
                J. J. Hayes      Phone: (301) 415 3167
                                 e-mail: jjh@nrc.gov
                L. A  Brown      Phone: (301) 415 1232
                                 e-mail: lab2@nrc.gov

Code Developer: J. V. Ramsdell   Phone: (509) 372 6316
                                 e-mail: j_ramsdell@pnl.gov

Code Documentation:  NUREG/CR-6331 Rev. 1

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employees, makes any warranty, expressed or implied, or assumes any legal
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use, of any portion of this program or represents that its use by such third
party would not infringe privately owned rights.

Program Run   5/ 5/2005  at  11:36:01

 ******* ARCON INPUT **********

    Number of Meteorological Data Files  =  1
    Meteorological Data File Names
      C:\ARCON96\SQ99_0-1.MET

    Height of lower wind instrument (m)  =     10.0
    Height of upper wind instrument (m)  =     60.0
    Wind speeds entered as meters/second

    Ground-level release
    Release height (m)                   =     36.9
    Building Area (m^2)                  =   2685.0
    Effluent vertical velocity (m/s)     =       .00
    Vent or stack flow  (m^3/s)          =       .00
    Vent or stack radius (m)             =       .00

    Direction .. intake to source (deg)  =      069
    Wind direction sector width (deg)    =       90
    Wind direction window (deg)          =   024 - 114
    Distance to intake (m)               =     74.6
    Intake height  (m)                   =     36.9
    Terrain elevation difference (m)     =       .0

    Output file names
      rb1ev.log
      rb1ev.cfd

    Minimum Wind Speed (m/s)             =       .5
    Surface roughness length (m)         =       .20
    Sector averaging constant            =      4.3

    Initial value of sigma y             =       .00
    Initial value of sigma z             =       .00

    Expanded output for code testing not selected

    Total number of hours of data processed =  43824
    Hours of missing data                   =    297
    Hours direction in window               =  12042
    Hours elevated plume w/ dir. in window  =      0
    Hours of calm winds                     =     23
    Hours direction not in window or calm   =  31462

    DISTRIBUTION SUMMARY DATA BY AVERAGING INTERVAL
  AVER. PER.          1          2          4          8         12         24         96        168        360        720
  UPPER LIM.   1.00E-02   1.00E-02   1.00E-02   1.00E-02   1.00E-02   1.00E-02   1.00E-02   1.00E-02   1.00E-02   1.00E-02
    LOW LIM.   1.00E-06   1.00E-06   1.00E-06   1.00E-06   1.00E-06   1.00E-06   1.00E-06   1.00E-06   1.00E-06   1.00E-06
 ABOVE RANGE        0.         0.         0.         0.         0.         0.         0.         0.         0.         0.
    IN RANGE    12065.     15222.     19260.     24546.     28406.     34500.     42511.     42567.     42457.     43155.
 BELOW RANGE        0.         0.         0.         0.         0.         0.         0.         0.         0.         0.
       ZERO    31462.     28259.     24142.     18710.     14894.      8653.       446.        54.        0.         0.
  TOTAL X/Qs   43527.     43481.     43402.     43256.     43300.     43153.     42957.     42621.     42457.     43155.
  % NON ZERO   27.72      35.01      44.38      56.75      65.60      79.95      98.96      99.87     100.00     100.00

    95th PERCENTILE X/Q VALUES
               1.17E-03   1.10E-03   9.76E-04   8.55E-04   6.74E-04   4.57E-04   2.94E-04   2.64E-04   2.39E-04   2.20E-04

    95% X/Q for standard averaging intervals
       ZERO    31462.     28259.     24142.     18710.     14894.      8653.       446.        54.        0.         0.
  TOTAL X/Qs   43527.     43481.     43402.     43256.     43300.     43153.     42957.     42621.     42457.     43155.
  % NON ZERO   27.72      35.01      44.38      56.75      65.60      79.95      98.96      99.87     100.00     100.00
```

0 to 2 hours	1.17E-03
2 to 8 hours	7.50E-04
8 to 24 hours	2.58E-04
1 to 4 days	2.40E-04
4 to 30 days	2.09E-04

	HOURLY VALUE RANGE	
	MAX X/Q	MIN X/Q
CENTERLINE	1.46E-03	1.71E-05
SECTOR-AVERAGE	8.53E-04	9.94E-06

NORMAL PROGRAM COMPLETION

Attachment 4 – RB2EV.log
ARCON96 Output
for
Reactor Building Unit 2 Exhaust Vent

RB2EV.log

```
Program Title:  ARCON96.

Developed For:  U.S. Nuclear Regulatory Commission
                Office of Nuclear Reactor Regulation
                Division of Reactor Program Management

Date:           June 25, 1997    11:00 a.m.

NRC Contacts:   J. Y. Lee        Phone: (301) 415 1080
                                 e-mail: jyl1@nrc.gov
                J. J. Hayes      Phone: (301) 415 3167
                                 e-mail: jjh@nrc.gov
                L. A  Brown      Phone: (301) 415 1232
                                 e-mail: lab2@nrc.gov

Code Developer: J. V. Ramsdell   Phone: (509) 372 6316
                                 e-mail: j_ramsdell@pnl.gov

Code Documentation:  NUREG/CR-6331 Rev. 1

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use, of any portion of this program or represents that its use by such third
party would not infringe privately owned rights.

Program Run   5/ 5/2005  at  11:40:53

 ******* ARCON INPUT **********

    Number of Meteorological Data Files  =  1
    Meteorological Data File Names
      C:\ARCON96\SQ99_0-1.MET

    Height of lower wind instrument (m)  =     10.0
    Height of upper wind instrument (m)  =     60.0
    Wind speeds entered as meters/second

    Ground-level release
    Release height (m)                   =     36.9
    Building Area (m^2)                  =   2685.0
    Effluent vertical velocity (m/s)     =       .00
    Vent or stack flow  (m^3/s)          =       .00
    Vent or stack radius (m)             =       .00

    Direction .. intake to source (deg)  =      072
    Wind direction sector width (deg)    =       90
    Wind direction window (deg)          =   027 - 117
    Distance to intake (m)               =     73.7
    Intake height  (m)                   =     36.9
    Terrain elevation difference (m)     =       .0

    Output file names
      rb2ev.log
      rb2ev.cfd

    Minimum Wind Speed (m/s)             =       .5
    Surface roughness length (m)         =       .20
    Sector averaging constant            =      4.3

    Initial value of sigma y             =       .00
    Initial value of sigma z             =       .00

    Expanded output for code testing not selected

    Total number of hours of data processed =  43824
    Hours of missing data                   =    297
    Hours direction in window               =  11325
    Hours elevated plume w/ dir. in window  =      0
    Hours of calm winds                     =     23
    Hours direction not in window or calm   =  32179
```

DISTRIBUTION SUMMARY DATA BY AVERAGING INTERVAL

AVER. PER.	1	2	4	8	12	24	96	168	360	720
UPPER LIM.	1.00E-02	1.00E-02	1.00E-02	1.00E-02	1.00E-02	1.00E-02	1.00E-02	1.00E-02	1.00E-02	1.00E-02
LOW LIM.	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06
ABOVE RANGE	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
IN RANGE	11348.	14628.	18838.	24335.	28327.	34543.	42634.	42612.	42457.	43155.
BELOW RANGE	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
ZERO	32179.	28853.	24564.	18921.	14973.	8610.	323.	9.	0.	0.
TOTAL X/Qs	43527.	43481.	43402.	43256.	43300.	43153.	42957.	42621.	42457.	43155.
% NON ZERO	26.07	33.64	43.40	56.26	65.42	80.05	99.25	99.98	100.00	100.00

95th PERCENTILE X/Q VALUES

IN RANGE	[illegible]	14628.	18838.	24335.	28327.	34543.	42634.	42612.	42457.	43155.
BELOW RANGE	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
ZERO	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

95% X/Q for standard averaging intervals

0 to 2 hours	1.18E-03
2 to 8 hours	7.02E-04
8 to 24 hours	2.46E-04
1 to 4 days	2.28E-04
4 to 30 days	1.98E-04

HOURLY VALUE RANGE

	MAX X/Q	MIN X/Q
CENTERLINE	1.50E-03	1.74E-05
SECTOR-AVERAGE	8.73E-04	1.02E-05

NORMAL PROGRAM COMPLETION

Attachment 5 – TB1EV.log
ARCON96 Output
for
Turbine Building Unit 1 Exhaust Vent

TB1EV.log

```
Program Title:  ARCON96.

Developed For:  U.S. Nuclear Regulatory Commission
                Office of Nuclear Reactor Regulation
                Division of Reactor Program Management

Date:           June 25, 1997    11:00 a.m.

NRC Contacts:   J. Y. Lee        Phone: (301) 415 1080
                                 e-mail: jyl1@nrc.gov
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                                 e-mail: jjh@nrc.gov
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                                 e-mail: lab2@nrc.gov

Code Developer: J. V. Ramsdell   Phone: (509) 372 6316
                                 e-mail: j_ramsdell@pnl.gov

Code Documentation:  NUREG/CR-6331 Rev. 1

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use, of any portion of this program or represents that its use by such third
party would not infringe privately owned rights.

Program Run   5/ 5/2005  at  11:41:40

 ******* ARCON INPUT **********

    Number of Meteorological Data Files  =  1
    Meteorological Data File Names
      C:\ARCON96\SQ99_0-1.MET

    Height of lower wind instrument (m)  =     10.0
    Height of upper wind instrument (m)  =     60.0
    Wind speeds entered as meters/second

    Ground-level release
    Release height (m)                   =     36.9
    Building Area (m^2)                  =   2685.0
    Effluent vertical velocity (m/s)     =       .00
    Vent or stack flow  (m^3/s)          =       .00
    Vent or stack radius (m)             =       .00

    Direction .. intake to source (deg)  =      021
    Wind direction sector width (deg)    =       90
    Wind direction window (deg)          =   336 - 066
    Distance to intake (m)               =     36.3
    Intake height  (m)                   =     36.9
    Terrain elevation difference (m)     =       .0

    Output file names
      tblev.log
      tblev.cfd

    Minimum Wind Speed (m/s)             =       .5
    Surface roughness length (m)         =       .20
    Sector averaging constant            =      4.3

    Initial value of sigma y             =       .00
    Initial value of sigma z             =       .00

    Expanded output for code testing not selected

    Total number of hours of data processed =  43824
    Hours of missing data                   =    297
    Hours direction in window               =  15508
    Hours elevated plume w/ dir. in window  =      0
    Hours of calm winds                     =     23
    Hours direction not in window or calm   =  27996

    DISTRIBUTION SUMMARY DATA BY AVERAGING INTERVAL
  AVER. PER.          1         2         4         8        12        24        96       168       360       720
  UPPER LIM.   1.00E-02  1.00E-02  1.00E-02  1.00E-02  1.00E-02  1.00E-02  1.00E-02  1.00E-02  1.00E-02  1.00E-02
    LOW LIM.   1.00E-06  1.00E-06  1.00E-06  1.00E-06  1.00E-06  1.00E-06  1.00E-06  1.00E-06  1.00E-06  1.00E-06
ABOVE RANGE         0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
   IN RANGE     15531.    17677.    20720.    25213.    28820.    34963.    42679.    42621.    42457.    43155.
BELOW RANGE         0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
       ZERO     27996.    25804.    22682.    18043.    14480.     8190.      278.        0.        0.        0.
 TOTAL X/Qs     43527.    43481.    43402.    43256.    43300.    43153.    42957.    42621.    42457.    43155.
 % NON ZERO      35.68     40.65     47.74     58.29     66.56     81.02     99.35    100.00    100.00    100.00

    95th PERCENTILE X/Q VALUES
   IN RANGE  5.08E-03  4.88E-03  4.81E-03  4.38E-03  3.68E-03  2.26E-03  1.43E-03  1.27E-03  1.13E-03  1.07E-03
   IN RANGE     15531.    17677.    20720.    25213.    28820.    34963.    42679.    42621.    42457.    43155.
BELOW RANGE         0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
       ZERO     27996.    25804.    22682.    18043.    14480.     8190.      278.        0.        0.        0.
```

95% X/Q for standard averaging intervals

0 to 2 hours	5.09E-03
2 to 8 hours	4.15E-03
8 to 24 hours	1.20E-03
1 to 4 days	1.16E-03
4 to 30 days	1.01E-03

	HOURLY VALUE RANGE	
	MAX X/Q	MIN X/Q
CENTERLINE	5.90E-03	1.50E-04
SECTOR-AVERAGE	3.44E-03	8.73E-05

NORMAL PROGRAM COMPLETION

Attachment 6 – TB2EV.log
ARCON96 Output
for
Turbine Building Unit 2 Exhaust Vent

TB2EV.log

```
Program Title:  ARCON96.

Developed For:  U.S. Nuclear Regulatory Commission
                Office of Nuclear Reactor Regulation
                Division of Reactor Program Management

Date:           June 25, 1997    11:00 a.m.

NRC Contacts:   J. Y. Lee        Phone: (301) 415 1080
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                                 e-mail: jjh@nrc.gov
                L. A  Brown      Phone: (301) 415 1232
                                 e-mail: lab2@nrc.gov

Code Developer: J. V. Ramsdell   Phone: (509) 372 6316
                                 e-mail: j_ramsdell@pnl.gov

Code Documentation:  NUREG/CR-6331 Rev. 1

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use, of any portion of this program or represents that its use by such third
party would not infringe privately owned rights.

Program Run   5/ 5/2005  at  11:42:25

 ******* ARCON INPUT **********

   Number of Meteorological Data Files  =  1
   Meteorological Data File Names
     C:\ARCON96\SQ99_0-1.MET

   Height of lower wind instrument (m)  =     10.0
   Height of upper wind instrument (m)  =     60.0
   Wind speeds entered as meters/second

   Ground-level release
   Release height (m)                   =     36.9
   Building Area (m^2)                  =   2685.0
   Effluent vertical velocity (m/s)     =       .00
   Vent or stack flow  (m^3/s)          =       .00
   Vent or stack radius (m)             =       .00

   Direction .. intake to source (deg)  =      025
   Wind direction sector width (deg)    =       90
   Wind direction window (deg)          =   340 - 070
   Distance to intake (m)               =     33.9
   Intake height  (m)                   =     36.9
   Terrain elevation difference (m)     =       .0

   Output file names
     tb2ev.log
     tb2ev.cfd

   Minimum Wind Speed (m/s)             =       .5
   Surface roughness length (m)         =       .20
   Sector averaging constant            =      4.3

   Initial value of sigma y             =       .00
   Initial value of sigma z             =       .00

   Expanded output for code testing not selected

   Total number of hours of data processed =  43824
   Hours of missing data                   =    297
   Hours direction in window               =  15500
   Hours elevated plume w/ dir. in window  =      0
   Hours of calm winds                     =     23
   Hours direction not in window or calm   =  28004

   DISTRIBUTION SUMMARY DATA BY AVERAGING INTERVAL
```

AVER. PER.	1	2	4	8	12	24	96	168	360	720
UPPER LIM.	1.00E-02	1.00E-02	1.00E-02	1.00E-02	1.00E-02	1.00E-02	1.00E-02	1.00E-02	1.00E-02	1.00E-02
LOW LIM.	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06
ABOVE RANGE	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
IN RANGE	15523.	17650.	20672.	25158.	28764.	34866.	42677.	42621.	42457.	43155.
BELOW RANGE	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
ZERO	28004.	25831.	22730.	18098.	14536.	8287.	280.	0.	0.	0.
TOTAL X/Qs	43527.	43481.	43402.	43256.	43300.	43153.	42957.	42621.	42457.	43155.
% NON ZERO	35.66	40.59	47.63	58.16	66.43	80.80	99.35	100.00	100.00	100.00

95th PERCENTILE X/Q VALUES

IN RANGE	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	15523.	17650.	20672.	25158.	28764.	34866.	42677.	42621.	42457.	43155.
BELOW RANGE	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
----	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

95% X/Q for standard averaging intervals

0 to 2 hours	6.00E-03
2 to 8 hours	4.93E-03
8 to 24 hours	1.44E-03
1 to 4 days	1.38E-03
4 to 30 days	1.21E-03

	HOURLY VALUE RANGE	
	MAX X/Q	MIN X/Q
CENTERLINE	6.99E-03	1.77E-04
SECTOR-AVERAGE	4.07E-03	1.03E-04

NORMAL PROGRAM COMPLETION

Attachment 7 – SGTSEV.log
ARCON96 Output
for
Standby Gas Treatment System Exhaust Vent

SGTSEV.log

```
Program Title:  ARCON96.

Developed For:  U.S. Nuclear Regulatory Commission
                Office of Nuclear Reactor Regulation
                Division of Reactor Program Management

Date:           June 25, 1997    11:00 a.m.

NRC Contacts:   J. Y. Lee        Phone: (301) 415 1080
                                 e-mail: jyl1@nrc.gov
                J. J. Hayes      Phone: (301) 415 3167
                                 e-mail: jjh@nrc.gov
                L. A  Brown      Phone: (301) 415 1232
                                 e-mail: lab2@nrc.gov

Code Developer: J. V. Ramsdell   Phone: (509) 372 6316
                                 e-mail: j_ramsdell@pnl.gov

Code Documentation:  NUREG/CR-6331 Rev. 1

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use, of any portion of this program or represents that its use by such third
party would not infringe privately owned rights.

Program Run   5/ 5/2005  at  11:43:01

 ******* ARCON INPUT **********

   Number of Meteorological Data Files  =  1
   Meteorological Data File Names
     C:\ARCON96\SQ99_0-1.MET

   Height of lower wind instrument (m)  =     10.0
   Height of upper wind instrument (m)  =     60.0
   Wind speeds entered as meters/second

   Ground-level release
   Release height (m)                   =     36.9
   Building Area (m^2)                  =   2685.0
   Effluent vertical velocity (m/s)     =       .00
   Vent or stack flow  (m^3/s)          =       .00
   Vent or stack radius (m)             =       .00

   Direction .. intake to source (deg)  =      027
   Wind direction sector width (deg)    =       90
   Wind direction window (deg)          =   342 - 072
   Distance to intake (m)               =     36.1
   Intake height  (m)                   =     36.9
   Terrain elevation difference (m)     =       .0

   Output file names
     sgtsev.log
     sgtsev.cfd

   Minimum Wind Speed (m/s)             =       .5
   Surface roughness length (m)         =       .20
   Sector averaging constant            =      4.3

   Initial value of sigma y             =       .00
   Initial value of sigma z             =       .00

   Expanded output for code testing not selected

   Total number of hours of data processed =  43824
   Hours of missing data                   =    297
   Hours direction in window               =  15493
   Hours elevated plume w/ dir. in window  =      0
   Hours of calm winds                     =     23
   Hours direction not in window or calm   =  28011

   DISTRIBUTION SUMMARY DATA BY AVERAGING INTERVAL
 AVER. PER.          1          2          4          8         12         24         96        168        360        720
 UPPER LIM.   1.00E-02   1.00E-02   1.00E-02   1.00E-02   1.00E-02   1.00E-02   1.00E-02   1.00E-02   1.00E-02   1.00E-02
   LOW LIM.   1.00E-06   1.00E-06   1.00E-06   1.00E-06   1.00E-06   1.00E-06   1.00E-06   1.00E-06   1.00E-06   1.00E-06
ABOVE RANGE        0.         0.         0.         0.         0.         0.         0.         0.         0.         0.
   IN RANGE    15516.     17639.     20654.     25144.     28766.     34871.     42705.     42621.     42457.     43155.
BELOW RANGE        0.         0.         0.         0.         0.         0.         0.         0.         0.         0.
       ZERO    28011.     25842.     22748.     18112.     14534.      8282.       252.         0.         0.         0.
 TOTAL X/Qs    43527.     43491.     43402.     43256.     43300.     43153.     42957.     42621.     42457.     43155.
 % NON ZERO     35.65      40.57      47.59      58.13      66.43      80.81      99.41     100.00     100.00     100.00

 95th PERCENTILE X/Q VALUES
ABOVE RANGE        0.         0.         0.         0.         0.         0.         0.         0.         0.         0.
   IN RANGE    15516.     17639.     20654.     25144.     28766.     34871.     42705.     42621.     42457.     43155.
BELOW RANGE        0.         0.         0.         0.         0.         0.         0.         0.         0.         0.
            5.15E-03   5.03E-03   4.86E-03   4.45E-03   3.53E-03   2.30E-03   1.47E-03   1.29E-03   1.16E-03   1.09E-03
```

95% X/Q for standard averaging intervals

0 to 2 hours	5.15E-03
2 to 8 hours	4.22E-03
8 to 24 hours	1.23E-03
1 to 4 days	1.19E-03
4 to 30 days	1.04E-03

HOURLY VALUE RANGE

	MAX X/Q	MIN X/Q
CENTERLINE	5.97E-03	1.51E-04
SECTOR-AVERAGE	3.48E-03	8.82E-05

NORMAL PROGRAM COMPLETION

Attachment 8 – RB1CD.log
ARCON96 Output
for
Reactor Building Unit 1 Closest Distance

RB1CD.log

```
Program Title:  ARCON96.

Developed For:  U.S. Nuclear Regulatory Commission
                Office of Nuclear Reactor Regulation
                Division of Reactor Program Management

Date:           June 25, 1997    11:00 a.m.

NRC Contacts:   J. Y. Lee        Phone: (301) 415 1080
                                 e-mail: jyl1@nrc.gov
                J. J. Hayes      Phone: (301) 415 3167
                                 e-mail: jjh@nrc.gov
                L. A  Brown      Phone: (301) 415 1232
                                 e-mail: lab2@nrc.gov

Code Developer: J. V. Ramsdell   Phone: (509) 372 6316
                                 e-mail: j_ramsdell@pnl.gov

Code Documentation:  NUREG/CR-6331 Rev. 1

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employees, makes any warranty, expressed or implied, or assumes any legal
liability or responsibilities for any third party's use, or the results of such
use, of any portion of this program or represents that its use by such third
party would not infringe privately owned rights.

Program Run   5/ 5/2005  at  11:44:23

 ******* ARCON INPUT **********

    Number of Meteorological Data Files  =  1
    Meteorological Data File Names
      C:\ARCON96\SQ99_0-1.MET

    Height of lower wind instrument (m)  =     10.0
    Height of upper wind instrument (m)  =     60.0
    Wind speeds entered as meters/second

    Ground-level release
    Release height (m)                   =       .0
    Building Area (m^2)                  =   2685.0
    Effluent vertical velocity (m/s)     =       .00
    Vent or stack flow  (m^3/s)          =       .00
    Vent or stack radius (m)             =       .00

    Direction .. intake to source (deg)  =      028
    Wind direction sector width (deg)    =       90
    Wind direction window (deg)          =   343 - 073
    Distance to intake (m)               =     21.6
    Intake height  (m)                   =     36.9
    Terrain elevation difference (m)     =     -1.8

    Output file names
      rb1cd.log
      rb1cd.cfd

    Minimum Wind Speed (m/s)             =       .5
    Surface roughness length (m)         =       .20
    Sector averaging constant            =      4.3

    Initial value of sigma y             =       .00
    Initial value of sigma z             =       .00

    Expanded output for code testing not selected

    Total number of hours of data processed =  43824
    Hours of missing data                   =    297
    Hours direction in window               =  15190
    Hours elevated plume w/ dir. in window  =      0
    Hours of calm winds                     =     16
    Hours direction not in window or calm   =  28321

    DISTRIBUTION SUMMARY DATA BY AVERAGING INTERVAL
  AVER. PER.          1          2          4          8         12         24         96        168        360        720
  UPPER LIM.    1.00E-02   1.00E-02   1.00E-02   1.00E-02   1.00E-02   1.00E-02   1.00E-02   1.00E-02   1.00E-02   1.00E-02
    LOW LIM.    1.00E-06   1.00E-06   1.00E-06   1.00E-06   1.00E-06   1.00E-06   1.00E-06   1.00E-06   1.00E-06   1.00E-06
 ABOVE RANGE          0.         0.         0.         0.         0.         0.         0.         0.         0.         0.
    IN RANGE      15206.     18729.     22847.     28216.     32251.     38207.     42940.     42621.     42457.     43155.
 BELOW RANGE          0.         0.         0.         0.         0.         0.         0.         0.         0.         0.
       ZERO       28321.     24752.     20555.     15040.     11049.      4946.        17.         0.         0.         0.
  TOTAL X/Qs      43527.     43481.     43402.     43256.     43300.     43153.     42957.     42621.     42457.     43155.
  % NON ZERO       34.93      43.07      52.64      65.23      74.48      88.54      99.96     100.00     100.00     100.00

    95th PERCENTILE X/Q VALUES
                  3.22E-03   3.09E-03   2.87E-03   2.63E-03   2.12E-03   1.49E-03   9.49E-04   8.50E-04   7.42E-04   6.95E-04

 BELOW RANGE          0.         0.         0.         0.         0.         0.         0.         0.         0.         0.
       ZERO       28321.     24752.     20555.     15040.     11049.      4946.        17.         0.         0.         0.
```

```
95% X/Q for standard averaging intervals

0 to 2 hours        3.22E-03
2 to 8 hours        2.43E-03
8 to 24 hours       9.25E-04
1 to 4 days         7.68E-04
4 to 30 days        6.56E-04

                          HOURLY VALUE RANGE
                        MAX X/Q              MIN X/Q
     CENTERLINE        4.00E-03             1.73E-04
     SECTOR-AVERAGE    2.33E-03             1.01E-04

NORMAL PROGRAM COMPLETION
```

Attachment 9 – RB2CD.log
ARCON96 Output
for
Reactor Building Unit 2 Closest Distance

RB2CD.log

```
Program Title:  ARCON96.

Developed For:  U.S. Nuclear Regulatory Commission
                Office of Nuclear Reactor Regulation
                Division of Reactor Program Management

Date:           June 25, 1997    11:00 a.m.

NRC Contacts:   J. Y. Lee        Phone: (301) 415 1080
                                 e-mail: jyl1@nrc.gov
                J. J. Hayes      Phone: (301) 415 3167
                                 e-mail: jjh@nrc.gov
                L. A  Brown      Phone: (301) 415 1232
                                 e-mail: lab2@nrc.gov

Code Developer: J. V. Ramsdell   Phone: (509) 372 6316
                                 e-mail: j_ramsdell@pnl.gov

Code Documentation:  NUREG/CR-6331 Rev. 1

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employees, makes any warranty, expressed or implied, or assumes any legal
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use, of any portion of this program or represents that its use by such third
party would not infringe privately owned rights.

Program Run   5/ 5/2005  at  11:45:00

 ******* ARCON INPUT **********

   Number of Meteorological Data Files  =  1
   Meteorological Data File Names
     C:\ARCON96\SQ99_0-1.MET

   Height of lower wind instrument (m)  =     10.0
   Height of upper wind instrument (m)  =     60.0
   Wind speeds entered as meters/second

   Ground-level release
   Release height (m)                   =       .0
   Building Area (m^2)                  =   2685.0
   Effluent vertical velocity (m/s)     =       .00
   Vent or stack flow  (m^3/s)          =       .00
   Vent or stack radius (m)             =       .00

   Direction .. intake to source (deg)  =      090
   Wind direction sector width (deg)    =       90
   Wind direction window (deg)          =   045 - 135
   Distance to intake (m)               =     10.8
   Intake height  (m)                   =     36.9
   Terrain elevation difference (m)     =     -1.8

   Output file names
     rb2cd.log
     rb2cd.cfd

   Minimum Wind Speed (m/s)             =       .5
   Surface roughness length (m)         =       .20
   Sector averaging constant            =      4.3

   Initial value of sigma y             =       .00
   Initial value of sigma z             =       .00

   Expanded output for code testing not selected

   Total number of hours of data processed =  43824
   Hours of missing data                   =    297
   Hours direction in window               =  15048
   Hours elevated plume w/ dir. in window  =      0
   Hours of calm winds                     =     16
   Hours direction not in window or calm   =  28463

   DISTRIBUTION SUMMARY DATA BY AVERAGING INTERVAL
```

AVER. PER.	1	2	4	8	12	24	96	168	360	720
UPPER LIM.	1.00E-02	1.00E-02	1.00E-02	1.00E-02	1.00E-02	1.00E-02	1.00E-02	1.00E-02	1.00E-02	1.00E-02
LOW LIM.	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06
ABOVE RANGE	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
IN RANGE	15064.	18593.	23055.	28986.	33133.	39466.	42957.	42621.	42457.	43155.
BELOW RANGE	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
ZERO	28463.	24888.	20347.	14270.	10167.	4687.	0.	0.	0.	0.
TOTAL X/Qs	43527.	43481.	43402.	43256.	43300.	43153.	42957.	42621.	42457.	43155.
% NON ZERO	34.61	42.76	53.12	67.01	76.52	89.14	100.00	100.00	100.00	100.00

95th PERCENTILE X/Q VALUES

IN RANGE	15064.	18593.	23055.	28986.	33133.	39466.	42957.	42621.	42457.	43155.
BELOW RANGE	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
----	3.89E-03	3.78E-03	3.63E-03	3.31E-03	2.64E-03	1.72E-03	1.13E-03	1.02E-03	9.08E-04	8.53E-04

95% X/Q for standard averaging intervals

0 to 2 hours	3.89E-03
2 to 8 hours	3.12E-03
8 to 24 hours	9.29E-04
1 to 4 days	9.34E-04
4 to 30 days	8.10E-04

	HOURLY VALUE RANGE	
	MAX X/Q	MIN X/Q
CENTERLINE	4.84E-03	1.36E-04
SECTOR-AVERAGE	2.82E-03	7.95E-05

NORMAL PROGRAM COMPLETION

Attachment 10 – TB1CD.log
ARCON96 Output
for
Turbine Building Unit 1 Closest Distance

TB1CD.log

```
Program Title:  ARCON96.

Developed For:  U.S. Nuclear Regulatory Commission
                Office of Nuclear Reactor Regulation
                Division of Reactor Program Management

Date:           June 25, 1997    11:00 a.m.

NRC Contacts:   J. Y. Lee        Phone: (301) 415 1080
                                 e-mail: jyl1@nrc.gov
                J. J. Hayes      Phone: (301) 415 3167
                                 e-mail: jjh@nrc.gov
                L. A  Brown      Phone: (301) 415 1232
                                 e-mail: lab2@nrc.gov

Code Developer: J. V. Ramsdell   Phone: (509) 372 6316
                                 e-mail: j_ramsdell@pnl.gov

Code Documentation:  NUREG/CR-6331 Rev. 1

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employees, makes any warranty, expressed or implied, or assumes any legal
liability or responsibilities for any third party's use, or the results of such
use, of any portion of this program or represents that its use by such third
party would not infringe privately owned rights.

Program Run   5/ 5/2005  at  11:45:31

 ******* ARCON INPUT **********

   Number of Meteorological Data Files  =  1
   Meteorological Data File Names
     C:\ARCON96\SQ99_0-1.MET

   Height of lower wind instrument (m)  =     10.0
   Height of upper wind instrument (m)  =     60.0
   Wind speeds entered as meters/second

   Ground-level release
   Release height (m)                   =       .0
   Building Area (m^2)                  =   2685.0
   Effluent vertical velocity (m/s)     =      .00
   Vent or stack flow  (m^3/s)          =      .00
   Vent or stack radius (m)             =      .00

   Direction .. intake to source (deg)  =      337
   Wind direction sector width (deg)    =       90
   Wind direction window (deg)          =  292 - 022
   Distance to intake (m)               =     55.6
   Intake height  (m)                   =     36.9
   Terrain elevation difference (m)     =       .0

   Output file names
     tb1cd.log
     tb1cd.cfd

   Minimum Wind Speed (m/s)             =       .5
   Surface roughness length (m)         =      .20
   Sector averaging constant            =      4.3

   Initial value of sigma y             =      .00
   Initial value of sigma z             =      .00

   Expanded output for code testing not selected

   Total number of hours of data processed =  43824
   Hours of missing data                   =    297
   Hours direction in window               =   7275
   Hours elevated plume w/ dir. in window  =      0
   Hours of calm winds                     =     16
   Hours direction not in window or calm   =  36236

   DISTRIBUTION SUMMARY DATA BY AVERAGING INTERVAL
  AVER. PER.          1         2         4         8        12        24        96       168       360       720
  UPPER LIM.   1.00E-02  1.00E-02  1.00E-02  1.00E-02  1.00E-02  1.00E-02  1.00E-02  1.00E-02  1.00E-02  1.00E-02
    LOW LIM.   1.00E-06  1.00E-06  1.00E-06  1.00E-06  1.00E-06  1.00E-06  1.00E-06  1.00E-06  1.00E-06  1.00E-06
 ABOVE RANGE        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
    IN RANGE     7291.     9097.    11835.    16110.    19692.    27112.    41206.    42255.    42457.    43155.
 BELOW RANGE        0.        0.        0.        0.        0.        0.       14.       22.        0.        0.
       ZERO    36236.    34384.    31567.    27146.    23608.    16041.     1737.      344.        0.        0.
  TOTAL X/Qs   43527.    43481.    43402.    43256.    43300.    43153.    42957.    42621.    42457.    43155.
  % NON ZERO    16.75     20.92     27.27     37.24     45.48     62.83     95.96     99.19    100.00    100.00

 ABOVE RANGE        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
    IN RANGE     7291.     9097.    11835.    16110.    19692.    27112.    41206.    42255.    42457.    43155.
 95th PERCENTILE X/Q VALUES
            1.09E-03  8.24E-04  7.57E-04  6.63E-04  5.25E-04  3.59E-04  1.99E-04  1.66E-04  1.40E-04  1.27E-04
```

95% X/Q for standard averaging intervals

0 to 2 hours	1.09E-03
2 to 8 hours	5.19E-04
8 to 24 hours	2.07E-04
1 to 4 days	1.46E-04
4 to 30 days	1.16E-04

HOURLY VALUE RANGE

	MAX X/Q	MIN X/Q
CENTERLINE	1.78E-03	6.64E-05
SECTOR-AVERAGE	1.04E-03	3.87E-05

NORMAL PROGRAM COMPLETION

Attachment 11 – TB2CD.log
ARCON96 Output
for
Turbine Building Unit 2 Closest Distance

TB2CD.log

```
Program Title:  ARCON96.

Developed For:  U.S. Nuclear Regulatory Commission
                Office of Nuclear Reactor Regulation
                Division of Reactor Program Management

Date:           June 25, 1997    11:00 a.m.

NRC Contacts:   J. Y. Lee        Phone: (301) 415 1080
                                 e-mail: jyl1@nrc.gov
                J. J. Hayes      Phone: (301) 415 3167
                                 e-mail: jjh@nrc.gov
                L. A  Brown      Phone: (301) 415 1232
                                 e-mail: lab2@nrc.gov

Code Developer: J. V. Ramsdell   Phone: (509) 372 6316
                                 e-mail: j_ramsdell@pnl.gov

Code Documentation:  NUREG/CR-6331 Rev. 1

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employees, makes any warranty, expressed or implied, or assumes any legal
liability or responsibilities for any third party's use, or the results of such
use, of any portion of this program or represents that its use by such third
party would not infringe privately owned rights.

Program Run   5/ 5/2005  at  11:46:05

 ******* ARCON INPUT **********

   Number of Meteorological Data Files  =  1
   Meteorological Data File Names
     C:\ARCON96\SQ99_0-1.MET

   Height of lower wind instrument (m)  =     10.0
   Height of upper wind instrument (m)  =     60.0
   Wind speeds entered as meters/second

   Ground-level release
   Release height (m)                   =       .0
   Building Area (m^2)                  =   2685.0
   Effluent vertical velocity (m/s)     =       .00
   Vent or stack flow  (m^3/s)          =       .00
   Vent or stack radius (m)             =       .00

   Direction .. intake to source (deg)  =      238
   Wind direction sector width (deg)    =       90
   Wind direction window (deg)          =   193 - 283
   Distance to intake (m)               =     24.7
   Intake height  (m)                   =     36.9
   Terrain elevation difference (m)     =       .0

   Output file names
     tb2cd.log
     tb2cd.cfd

   Minimum Wind Speed (m/s)             =       .5
   Surface roughness length (m)         =       .20
   Sector averaging constant            =      4.3

   Initial value of sigma y             =       .00
   Initial value of sigma z             =       .00

   Expanded output for code testing not selected

   Total number of hours of data processed =  43824
   Hours of missing data                   =    297
   Hours direction in window               =  11439
   Hours elevated plume w/ dir. in window  =      0
   Hours of calm winds                     =     16
   Hours direction not in window or calm   =  32072

   DISTRIBUTION SUMMARY DATA BY AVERAGING INTERVAL
  AVER. PER.          1         2         4         8        12        24        96       168       360       720
  UPPER LIM.   1.00E-02  1.00E-02  1.00E-02  1.00E-02  1.00E-02  1.00E-02  1.00E-02  1.00E-02  1.00E-02  1.00E-02
    LOW LIM.   1.00E-06  1.00E-06  1.00E-06  1.00E-06  1.00E-06  1.00E-06  1.00E-06  1.00E-06  1.00E-06  1.00E-06
 ABOVE RANGE        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
    IN RANGE    11455.    13984.    17606.    22889.    27150.    34278.    42479.    42581.    42457.    43155.
 BELOW RANGE        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
       ZERO    32072.    29497.    25796.    20367.    16150.     8875.      478.       40.        0.        0.
  TOTAL X/Qs   43527.    43481.    43402.    43256.    43300.    43153.    42957.    42621.    42457.    43155.
  % NON ZERO    26.32     32.16     40.56     52.92     62.70     79.43     98.89     99.91    100.00    100.00

   95th PERCENTILE X/Q VALUES
               2.72E-03  2.44E-03  2.02E-03  1.69E-03  1.33E-03  9.37E-04  5.56E-04  4.81E-04  4.14E-04  3.76E-04

 BELOW RANGE        0.        0.        0.        0.        0.        0.        0.        0.        0.        0.
       ZERO    32072.    29497.    25796.    20367.    16150.     8875.      478.       40.        0.        0.
```

95% X/Q for standard averaging intervals.

0 to 2 hours	2.72E-03
2 to 8 hours	1.35E-03
8 to 24 hours	5.59E-04
1 to 4 days	4.29E-04
4 to 30 days	3.49E-04

	HOURLY VALUE RANGE	
	MAX X/Q	MIN X/Q
CENTERLINE	3.98E-03	6.67E-05
SECTOR-AVERAGE	2.32E-03	3.89E-05

NORMAL PROGRAM COMPLETION

Attachment 12 – RB1MST.log
ARCON96 Output
for
Reactor Building Unit 1 Main Steam Tunnel Blowout Panel

RB1MST.log

```
Program Title:  ARCON96.

Developed For:  U.S. Nuclear Regulatory Commission
                Office of Nuclear Reactor Regulation
                Division of Reactor Program Management

Date:           June 25, 1997    11:00 a.m.

NRC Contacts:   J. Y. Lee        Phone: (301) 415 1080
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                J. J. Hayes      Phone: (301) 415 3167
                                 e-mail: jjh@nrc.gov
                L. A  Brown      Phone: (301) 415 1232
                                 e-mail: lab2@nrc.gov

Code Developer: J. V. Ramsdell   Phone: (509) 372 6316
                                 e-mail: j_ramsdell@pnl.gov

Code Documentation:  NUREG/CR-6331 Rev. 1

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use, of any portion of this program or represents that its use by such third
party would not infringe privately owned rights.

Program Run   5/ 5/2005  at  11:46:54

 ******* ARCON INPUT **********

   Number of Meteorological Data Files  =  1
   Meteorological Data File Names
     C:\ARCON96\SQ99_0-1.MET

   Height of lower wind instrument (m)  =     10.0
   Height of upper wind instrument (m)  =     60.0
   Wind speeds entered as meters/second

   Ground-level release
   Release height (m)                   =     36.9
   Building Area (m^2)                  =   2685.0
   Effluent vertical velocity (m/s)     =       .00
   Vent or stack flow  (m^3/s)          =       .00
   Vent or stack radius (m)             =       .00

   Direction .. intake to source (deg)  =      008
   Wind direction sector width (deg)    =       90
   Wind direction window (deg)          =   323 - 053
   Distance to intake (m)               =     49.5
   Intake height  (m)                   =     36.9
   Terrain elevation difference (m)     =       .0

   Output file names
     rb1mst.log
     rb1mst.cfd

   Minimum Wind Speed (m/s)             =       .5
   Surface roughness length (m)         =       .20
   Sector averaging constant            =      4.3

   Initial value of sigma y             =       .00
   Initial value of sigma z             =       .00

   Expanded output for code testing not selected

   Total number of hours of data processed =  43824
   Hours of missing data                   =    297
   Hours direction in window               =  15137
   Hours elevated plume w/ dir. in window  =      0
   Hours of calm winds                     =     23
   Hours direction not in window or calm   =  28367

   DISTRIBUTION SUMMARY DATA BY AVERAGING INTERVAL
```

AVER. PER.	1	2	4	8	12	24	96	168	360	720
UPPER LIM.	1.00E-02	1.00E-02	1.00E-02	1.00E-02	1.00E-02	1.00E-02	1.00E-02	1.00E-02	1.00E-02	1.00E-02
LOW LIM.	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06	1.00E-06
ABOVE RANGE	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
IN RANGE	15160.	17454.	20556.	25034.	28623.	34865.	42714.	42621.	42457.	43155.
BELOW RANGE	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
ZERO	28367.	26027.	22846.	18222.	14677.	8288.	243.	0.	0.	0.
TOTAL X/Qs	43527.	43481.	43402.	43256.	43300.	43153.	42957.	42621.	42457.	43155.
% NON ZERO	34.83	40.14	47.36	57.87	66.10	80.79	99.43	100.00	100.00	100.00

95th PERCENTILE X/Q VALUES

IN RANGE	15160.	17454.	20556.	25034.	28623.	34865.	42714.	42621.	42457.	43155.
BELOW RANGE	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
----	2.80E-03	2.72E-03	2.61E-03	2.35E-03	1.85E-03	1.20E-03	7.51E-04	6.64E-04	5.97E-04	5.59E-04

95% X/Q for standard averaging intervals

0 to 2 hours	2.80E-03
2 to 8 hours	2.21E-03
8 to 24 hours	6.25E-04
1 to 4 days	6.01E-04
4 to 30 days	5.29E-04

	HOURLY VALUE RANGE	
	MAX X/Q	MIN X/Q
CENTERLINE	3.23E-03	7.53E-05
SECTOR-AVERAGE	1.88E-03	4.39E-05

NORMAL PROGRAM COMPLETION

Attachment 13 – TB1MST.log
ARCON96 Output
for
Turbine Building Unit 1 Main Steam Tunnel Blowout Panel

TB1MST.log

```
Program Title:  ARCON96.

Developed For:  U.S. Nuclear Regulatory Commission
                Office of Nuclear Reactor Regulation
                Division of Reactor Program Management

Date:           June 25, 1997    11:00 a.m.

NRC Contacts:   J. Y. Lee        Phone: (301) 415 1080
                                 e-mail: jyl1@nrc.gov
                J. J. Hayes      Phone: (301) 415 3167
                                 e-mail: jjh@nrc.gov
                L. A  Brown      Phone: (301) 415 1232
                                 e-mail: lab2@nrc.gov

Code Developer: J. V. Ramsdell   Phone: (509) 372 6316
                                 e-mail: j_ramsdell@pnl.gov

Code Documentation:  NUREG/CR-6331 Rev. 1

The program was prepared for an agency of the United States Government. Neither
the United States Government nor any agency thereof, nor any of their
employees, makes any warranty, expressed or implied, or assumes any legal
liability or responsibilities for any third party's use, or the results of such
use, of any portion of this program or represents that its use by such third
party would not infringe privately owned rights.

Program Run   5/ 5/2005  at  11:47:32

 ******* ARCON INPUT **********

   Number of Meteorological Data Files  =  1
   Meteorological Data File Names
     C:\ARCON96\SQ99_0~1.MET

   Height of lower wind instrument (m)  =     10.0
   Height of upper wind instrument (m)  =     60.0
   Wind speeds entered as meters/second

   Ground-level release
   Release height (m)                   =     36.9
   Building Area (m^2)                  =   2685.0
   Effluent vertical velocity (m/s)     =       .00
   Vent or stack flow  (m^3/s)          =       .00
   Vent or stack radius (m)             =       .00

   Direction .. intake to source (deg)  =      008
   Wind direction sector width (deg)    =       90
   Wind direction window (deg)          =   323 - 053
   Distance to intake (m)               =    102.1
   Intake height  (m)                   =     36.9
   Terrain elevation difference (m)     =       .0

   Output file names
     tb1mst.log
     tb1mst.cfd

   Minimum Wind Speed (m/s)             =       .5
   Surface roughness length (m)         =       .20
   Sector averaging constant            =      4.3

   Initial value of sigma y             =       .00
   Initial value of sigma z             =       .00

   Expanded output for code testing not selected

   Total number of hours of data processed =  43824
   Hours of missing data                   =    297
   Hours direction in window               =  15137
   Hours elevated plume w/ dir. in window  =      0
   Hours of calm winds                     =     23
   Hours direction not in window or calm   =  28367

   DISTRIBUTION SUMMARY DATA BY AVERAGING INTERVAL
 AVER. PER.          1          2          4          8         12         24         96        168        360        720
 UPPER LIM.   1.00E-03   1.00E-03   1.00E-03   1.00E-03   1.00E-03   1.00E-03   1.00E-03   1.00E-03   1.00E-03   1.00E-03
   LOW LIM.   1.00E-07   1.00E-07   1.00E-07   1.00E-07   1.00E-07   1.00E-07   1.00E-07   1.00E-07   1.00E-07   1.00E-07
ABOVE RANGE        0.         0.         0.         0.         0.         0.         0.         0.         0.         0.
   IN RANGE    15160.     17454.     20556.     25034.     28623.     34865.     42714.     42621.     42457.     43155.
BELOW RANGE        0.         0.         0.         0.         0.         0.         0.         0.         0.         0.
     ZERO      28367.     26027.     22846.     18222.     14677.      8288.       243.         0.         0.         0.
 TOTAL X/Qs    43527.     43481.     43402.     43256.     43300.     43153.     42957.     42621.     42457.     43155.
 % NON ZERO     34.83      40.14      47.36      57.87      66.10      80.79      99.43     100.00     100.00     100.00

 95th PERCENTILE X/Q VALUES
   IN RANGE   7.05E-04   6.88E-04   6.62E-04   5.97E-04   4.70E-04   3.05E-04   1.91E-04   1.69E-04   1.52E-04   1.42E-04
BELOW RANGE        0.         0.         0.         0.         0.         0.         0.         0.         0.         0.
     ZERO      28367.     26027.     22846.     18222.     14677.      8288.       243.         0.         0.         0.
```

95% X/Q for standard averaging intervals

0 to 2 hours	7.05E-04
2 to 8 hours	5.61E-04
8 to 24 hours	1.59E-04
1 to 4 days	1.53E-04
4 to 30 days	1.34E-04

HOURLY VALUE RANGE

	MAX X/Q	MIN X/Q
CENTERLINE	8.03E-04	1.92E-05
SECTOR-AVERAGE	4.68E-04	1.12E-05

NORMAL PROGRAM COMPLETION

Attachment 14 – TB2MST.log
ARCON96 Output
for
Turbine Building Unit 2 Main Steam Tunnel Blowout Panel

TB2MST.log

```
Program Title:  ARCON96.

Developed For:  U.S. Nuclear Regulatory Commission
                Office of Nuclear Reactor Regulation
                Division of Reactor Program Management

Date:           June 25, 1997    11:00 a.m.

NRC Contacts:   J. Y. Lee        Phone: (301) 415 1080
                                 e-mail: jyl1@nrc.gov
                J. J. Hayes      Phone: (301) 415 3167
                                 e-mail: jjh@nrc.gov
                L. A  Brown      Phone: (301) 415 1232
                                 e-mail: lab2@nrc.gov

Code Developer: J. V. Ramsdell   Phone: (509) 372 6316
                                 e-mail: j_ramsdell@pnl.gov

Code Documentation:  NUREG/CR-6331 Rev. 1

The program was prepared for an agency of the United States Government. Neither
the United States Government nor any agency thereof, nor any of their
employees, makes any warranty, expressed or implied, or assumes any legal
liability or responsibilities for any third party's use, or the results of such
use, of any portion of this program or represents that its use by such third
party would not infringe privately owned rights.

Program Run   5/ 5/2005  at  11:48:03

 ******* ARCON INPUT **********

   Number of Meteorological Data Files  =  1
   Meteorological Data File Names
     C:\ARCON96\SQ99_0-1.MET

   Height of lower wind instrument (m)  =     10.0
   Height of upper wind instrument (m)  =     60.0
   Wind speeds entered as meters/second

   Ground-level release
   Release height (m)                   =     36.9
   Building Area (m^2)                  =   2685.0
   Effluent vertical velocity (m/s)     =       .00
   Vent or stack flow  (m^3/s)          =       .00
   Vent or stack radius (m)             =       .00

   Direction .. intake to source (deg)  =      162
   Wind direction sector width (deg)    =       90
   Wind direction window (deg)          =   117 - 207
   Distance to intake (m)               =     61.2
   Intake height  (m)                   =     36.9
   Terrain elevation difference (m)     =       .0

   Output file names
     tb2mst.log
     tb2mst.cfd

   Minimum Wind Speed (m/s)             =       .5
   Surface roughness length (m)         =       .20
   Sector averaging constant            =      4.3

   Initial value of sigma y             =       .00
   Initial value of sigma z             =       .00

   Expanded output for code testing not selected

   Total number of hours of data processed =  43824
   Hours of missing data                   =    297
   Hours direction in window               =   8657
   Hours elevated plume w/ dir. in window  =      0
   Hours of calm winds                     =     23
   Hours direction not in window or calm   =  34847

   DISTRIBUTION SUMMARY DATA BY AVERAGING INTERVAL
  AVER. PER.          1          2          4          8         12         24         96        168        360        720
  UPPER LIM.   1.00E-02   1.00E-02   1.00E-02   1.00E-02   1.00E-02   1.00E-02   1.00E-02   1.00E-02   1.00E-02   1.00E-02
    LOW LIM.   1.00E-06   1.00E-06   1.00E-06   1.00E-06   1.00E-06   1.00E-06   1.00E-06   1.00E-06   1.00E-06   1.00E-06
 ABOVE RANGE        0.         0.         0.         0.         0.         0.         0.         0.         0.         0.
    IN RANGE     8680.     11450.     15415.     21066.     25268.     33084.     42677.     42621.     42457.     43155.
 BELOW RANGE        0.         0.         0.         0.         0.         0.        30.         0.         0.         0.
       ZERO    34847.     32031.     27987.     22190.     18032.     10069.       250.         0.         0.         0.
  TOTAL X/Qs   43527.     43481.     43402.     43256.     43300.     43153.     42957.     42621.     42457.     43155.
  % NON ZERO    19.94      26.33      35.52      48.70      58.36      76.67      99.42     100.00     100.00     100.00

   95th PERCENTILE X/Q VALUES
          --- ------  1.49E-03   1.27E-03   1.05E-03   8.96E-04   7.13E-04   4.91E-04   2.72E-04   2.33E-04   1.94E-04   1.74E-04
 BELOW RANGE        0.         0.         0.         0.         0.         0.        30.         0.         0.         0.
       ZERO    34847.     32031.     27987.     22190.     18032.     10069.       250.         0.         0.         0.
```

95% X/Q for standard averaging intervals

0 to 2 hours	1.49E-03
2 to 8 hours	6.99E-04
8 to 24 hours	2.88E-04
1 to 4 days	1.99E-04
4 to 30 days	1.59E-04

	HOURLY VALUE RANGE	
	MAX X/Q	MIN X/Q
CENTERLINE	2.14E-03	3.24E-05
SECTOR-AVERAGE	1.25E-03	1.89E-05

NORMAL PROGRAM COMPLETION

Attachment 15 – PLE-23733 – Cross Sectional Area

PPL Susquehanna, LLC
Two North Ninth Street
Allentown, PA 18101-1179
Tel. 610.774.4717 Fax 610.774.7782
tfmackay@pplweb.com

November 5, 2004

Mr. Mark Abrams
ABS Consulting, Inc.
4 Research Place
Suite 200
Rockville, MD 20850

SUSQUEHANNA STEAM ELECTRIC STATION
CONTROL ROOM ACCIDENT X/Q ANALYSIS
PLE-23733

Dear Mr. Abrams:

Attached for your use is our evaluation of the minimum vertical cross-sectional area of the reactor building for your use in evaluating accident atmospheric dispersion factors. Also attached are the SSES design drawings referenced in the analysis. Please review and verify that the attached analysis is appropriate for the accident χ/Q analysis. Keith Woodard had indicated in a previous discussion that it may be possible to include this minimum area analysis in your χ/Q calculation. If you cannot, please let me know since we will then need to formalize the minimum area analysis in a formal PPL calculation.

Please contact me at 610-774-4717 if you need additional information. My email address is tfmackay@pplweb.com.

Sincerely,

Terrence F. Mackay

Terrence F. Mackay
Senior Engineer – Rad & Effl Technology

Attachment 1. Analysis Of Vertical Cross-Sectional Area (Minimum) Of Reactor Building For Evaluation Of χ/Q's.

Attachment 2. SSES Design Drawings:
E106312, Revision F (AE Dwg. M-207
E105004, Sheet 6, Revision 22; AE Dwg. A-16)
E105007, Sheet 1, Revision 9 (AE Dwg. A-21, Sht. 1)

E105329, Revision 9 (AE Dwg. C-322)
E105257, Revision 9 (AE Dwg. C-227)
E105259, Revision 8 (AE Dwg. C-229)

cc: w/ Att. 1 only:

R.A. Vazquies	GENPL5
Francis J. Hickey	NUCSA3
R.L. Doty	GENPL5
D.G. Kostelnik	GENPL5
Nuclear Records	GENPL4

g:\goadmin\nde elec\doty.tfm\ple-23733.doc

Attachment 1

Analysis Of Vertical Cross-Sectional Area (Minimum) Of Reactor Building For Evaluation Of χ/Q's

The general arrangement of the reactor building is shown in SSES design drawing E106312, Revision F (AE Dwg. M-207). Above the turbine building roof elevation, the reactor building area includes the superstructure area and the area associated with the blowout panels and duct spaces between Column Lines P and M (see SSES design drawing E105004, Sheet 6, Revision 22; AE Dwg. A-16). Below the turbine building roof elevation, credit is only taken for the reactor building area between Column Lines U and P, including the concrete outer walls.

1. Reactor Building Roof to Bottom Of Superstructure

   References: SSES Drawings
   E105007, Sheet 1, Revision 9 (AE Dwg. A-21, Sht. 1)
   E105329, Revision 9 (AE Dwg. C-322)

   Reactor Building Roof Elevation = 873'-1½ " = 873.12 ft
   Superstructure Bottom Elevation = 809'- 7 5/8" = 809.64 ft
   ∴ Height = 873.12 ft - 809.64 ft = 63.49 ft

   Width Of Superstructure = 161'-9 5/8" = 161.80 ft

   Area = 63.49 ft X 161.80 ft = 10273 ft^2

2. Reactor Building Bottom Of Superstructure to Turbine Building Roof Elevation

   References: SSES Drawings
   E105007, Sheet 1, Revision 9 (AE Dwg. A-21, Sht. 1)
   E105329, Revision 9 (AE Dwg. C-322)
   E105257, Revision 9 (AE Dwg. C-227)
   E105259, Revision 8 (AE Dwg. C-229)

   Superstructure Bottom Elevation = 809'- 7 5/8" = 809.64 ft
   Turbine Building Roof Elevation = 789'-8¾ " = 789.73 ft
   ∴ Height = 809.64 ft - 789.73 ft = 19.91 ft

   Width = (1'-6") + Distance Column U to Column P + (16'-0") + (1'-9 5/16")
   Width = (1'-6") + (26'-6") + (27'-6") + (17'-6") + (8'-0") + (25'-6") + (29'-0") +(16'-0") + (1'-9 5/16")
   Width = 153.28 ft

   Area = 19.91 ft X 153.28 ft = 3052 ft^2

Attachment 1

Analysis Of Vertical Cross-Sectional Area (Minimum) Of Reactor Building For Evaluation Of χ/Q's

3. Turbine Building Roof Elevation to Grade Elevation

References: SSES Drawings
E105007, Sheet 1, Revision 9 (AE Dwg. A-21, Sht. 1)
E105257, Revision 9 (AE Dwg. C-227)
E105259, Revision 8 (AE Dwg. C-229)

Turbine Building Roof Elevation = 789'-8¾ " = 789.73 ft
Grade Elevation = 676'-0"
∴ Height = 789.73 ft - 676 ft = 113.73 ft

Width = (1'-6") + Distance Column U to Column P + (1'-6")
Width = (1'-6") + (26'-6") + (27'-6") + (17'-6") + (8'-0") + (25'-6") + (29'-0")+(1'-6")
Width = 137 ft

Area = 113.73 ft X 137 ft = 15581 ft^2

4. Total Reactor Building Minimum Cross-Sectional Area

Total Area = 10273 ft^2 + 3052 ft^2 + 15581 ft^2
Total Area = 28906 ft^2 x (.0929 m^2 / ft^2) = 2685 m^2