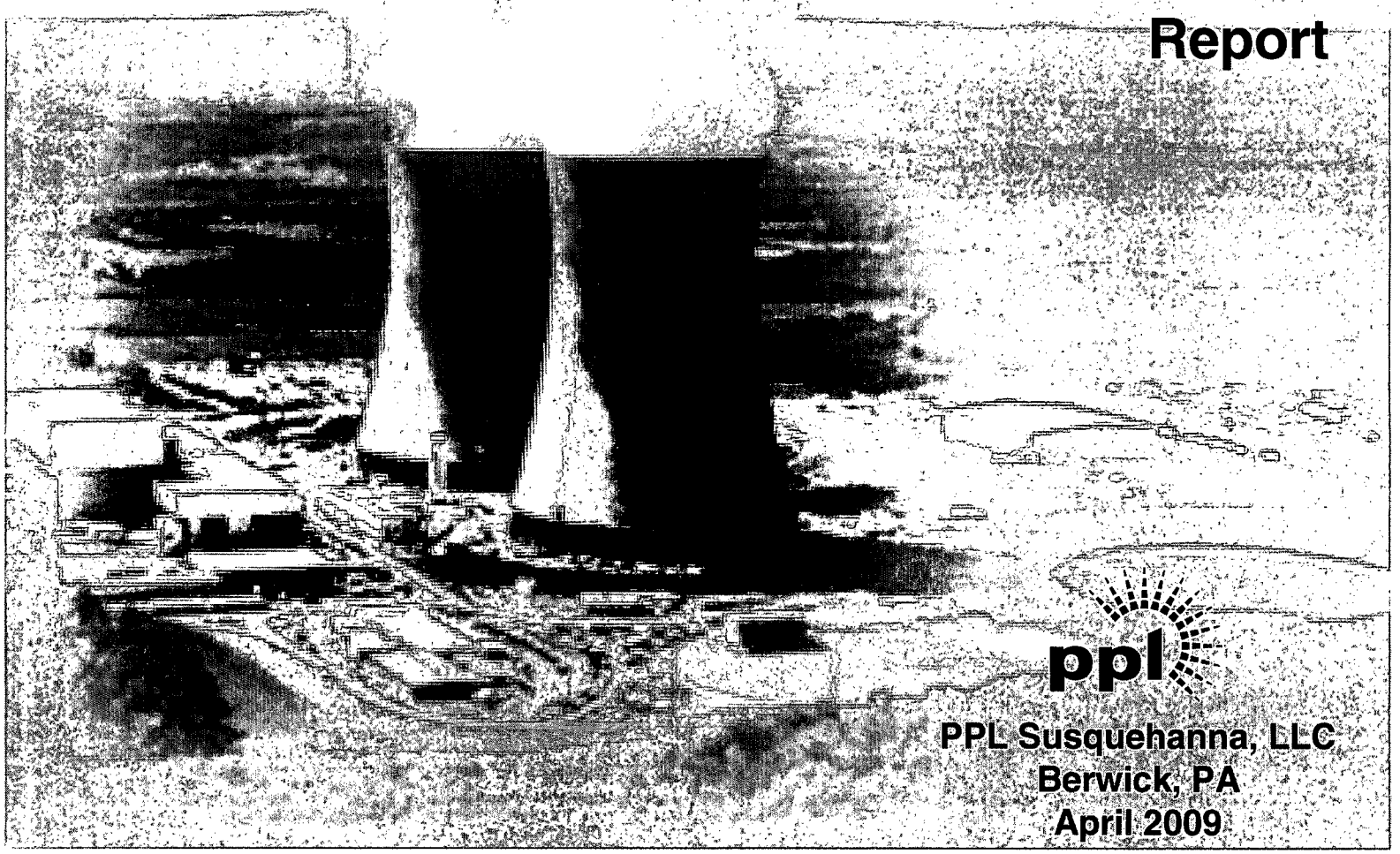
Susquehanna Steam Electric Station

Units 1 & 2

Radioactive Effluent Release Report

2008 Annual Report



PPL Susquehanna, LLC
Berwick, PA
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RADIOACTIVE EFFLUENT RELEASE REPORT

REPORT PERIOD: 01/01/08 - 12/31/08

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SECTION 1

INTRODUCTION, SUMMARY AND SUPPLEMENTAL INFORMATION

INTRODUCTION

The submittal of the 2008 Radioactive Effluent Release Report is in accordance with PPL Susquehanna, LLC Tech Spec. 5.6.3. The enclosed information is consistent with the objectives outlined in the Offsite Dose Calculation Manual (ODCM) and Process Control Program (PCP). The 2008 Radioactive Effluent Release Report is in conformance with 10CFR50.36a and 10CFR50, Appendix I, Section IV.B.1.

PPL Susquehanna, LLC is located in Salem Township, Luzerne County, Pennsylvania. It is on the west bank of the Susquehanna River, 8 km northeast of Berwick. The Station consists of two boiling water reactor generating units, each with about 1,200 MW net electrical capacity. The reactor and generating units were supplied by General Electric, while the Bechtel Corporation served as architect-engineer and constructor.

Construction of the Station began in the early 1970s. Fuel load began in Unit 1 in July of 1982. Initial criticality was achieved in the Unit 1 reactor on September 10, 1982. The reactor reached 100% power for the first time on February 4, 1983. Commercial operation of Unit 1 was declared on June 8, 1983. Initial criticality of Unit 2 occurred on May 8, 1984. Unit 2 was declared commercial on February 12, 1985.

Airborne effluents are released from the Station via five rooftop vents on the reactor building (see Figure 1-1). Continuous sampling for particulates and iodines is performed at each vent as well as continuous monitoring for noble gases. A program of periodic sampling and analysis for tritium and noble gases along with periodic analysis of particulate and iodine samples is conducted as specified in the plant Technical Requirements. All waterborne effluents are released in batch mode and are sampled and analyzed prior to release. Waterborne effluents from the site are released into the cooling tower blowdown line for dilution prior to release to the Susquehanna River (see Figure 1-2). Blowdown line flow rates are at least 5,000 gpm during periods of liquid radwaste release. The diluted effluent is introduced to the river by way of a perforated diffuser pipe placed on the river bed. The diffuser serves to rapidly and uniformly mix the station discharge with the main flow of the river.

This report presents a summary of the quantities of radioactive materials which were released from the Station during the period from January 1, 2008 to December 31, 2008. In addition, this report serves as a medium for notifying the US Nuclear Regulatory Commission staff of changes to the ODCM, PCP and documentation of any exceptions to the effluent monitoring program which must be reported per Technical Requirements.

Airborne and waterborne radioactive effluent releases to the environment during the report period were sampled and analyzed in accordance with the Technical Requirements. All radioactive effluent releases were within the concentration and release limits specified in the Technical Requirements. Calculations and terms utilized in this report are those outlined in the ODCM.

Section 1 contains supplemental information pertaining to effluents from the Susquehanna plant. Included are regulatory limits (Table 1-1), sampling and analysis methods, characterization of the number and duration of batch and abnormal releases and a brief summary of the applicable year's effluents.

Section 2 contains effluent and waste disposal data for the report period. Table 2-1 contains a summation of all airborne releases, grouped into the radionuclide categories of gases, particulates, iodines, and tritium. Average release rates are presented and compared to the applicable limits. Table 2-2 presents the activity totals of specific radionuclides in airborne effluents.

Waterborne effluents are summarized in Table 2-3. Average diluted concentrations are presented and compared to the applicable limits. Table 2-4 presents the release quantities of specific radionuclides in waterborne effluents over the report period. Figures 2-1 and 2-2 present the Susquehanna River Monthly Average Flow Rates for 2008 and the Monthly Liquid Radwaste Discharge Totals for 2008, respectively.

Table 2-5 contains estimates of the errors associated with the measurements involved in quantifying effluents. Sampling errors, counting errors, and errors associated with determining effluent flow rates and volumes all contribute to the total error of effluent measurements. Error estimates are presented for each category of radionuclide detected in airborne and waterborne effluents and solid wastes during the report period.

Tables 2-7 through 2-19 present a characterization of the solid radioactive waste shipped offsite during the report period. An estimate of major nuclide composition is presented for each waste type. Also included are the volumes and curie contents associated with each type of solid waste. The number of waste shipments from the site transported directly for burial or disposal are listed in Table 2-6.

Section 3 presents meteorological data for 2008, including data recovery, joint frequency distribution of wind speed and direction, stability class distribution, and atmospheric dispersion estimates for selected locations.

Section 4 of this report contains an assessment of the calculated doses attributed to the reported radiological effluents for the calendar year. The Radioactive Effluent Tracking and Dose Assessment Software (RETDAS) computer code was used for calculation of doses from waterborne effluents. Site-specific parameters used in the calculations for the Danville receiver are shown in Table 4-1. The RETDAS code was also used for calculation of doses from airborne effluents. The calculated doses and direct radiation estimates can be used to estimate the doses to maximally exposed members of the public. Table 4-2 summarizes maximum calculated doses to members of the public from airborne and waterborne effluents. Table 4-3 presents calculated collective doses to members of the public within the Riverlands/Energy Information Center Complex. Table 4-4 summarizes the calculated doses for residences and other occupied areas within the site boundary and the nearest dairy.

Section 5 of this report documents changes to the Offsite Dose Calculation Manual, Technical Requirements Manual and the Solid Radioactive Waste Process Control Program.

Section 6 presents a listing of cases (if any) in which airborne or waterborne effluent monitoring instrumentation was declared inoperable and was not restored to operability within the time period specified in Technical Requirements 3.11.1.4, 3.11.1.5 and 3.11.2.6 Action Statements. In addition, this section presents issues (if any) with the collection of milk or fresh leafy vegetables per Technical Requirement 3.11.4.1 and changes due to the land use census per Technical Requirement 3.11.4.2. Section 6 also includes reporting associated with the Nuclear Energy Institute (NEI) Groundwater Protection Initiative.

Section 7 contains corrections (if any) to previous Radioactive Effluent Release Reports.

Section 8 contains information on effluent and offsite dose from the systems classified as insignificant effluent pathways.

SUMMARY

Liquid effluent releases for 2008 were similar to those of previous years. During 2008 there were eighty-nine (89) liquid batch releases resulting in a total release volume of seven hundred thousand nine hundred (700,900) gallons. The total number of liquid batch releases and total volume released in 2008 was lower than the corresponding values for 2007 (93 releases resulting in 1,200,000 gallons released in 2007). The predominant radionuclide released in liquid effluents during 2008 was tritium. Approximately thirty-three (33) curies of tritium were released in liquid effluents in 2008, compared to seventy (70) curies released in 2007. When compared with all radionuclides released in liquid effluents in 2008, tritium and Zn-65 were the main contributors to the resultant offsite dose. Consistent with previous years, the offsite dose from liquid releases in 2008 was less than one percent (1%) of the annual limits for both organ and whole body dose.

Gaseous effluents for 2008 were also comparable to those of previous years. Similar to liquid effluents in 2008, the predominant radionuclide released in gaseous effluents was tritium. When compared with all radionuclides released in gaseous effluents in 2008, tritium was the main contributor to the resultant offsite dose. Approximately sixty (60) curies of tritium were released in gaseous effluents in 2008 compared to eighty-nine (89) curies in 2007. The resultant maximum offsite organ dose due to gaseous effluents from Unit-1 for 2008 was 8.94E-02 mrem, which is 0.6 percent (0.6%) of the per unit annual limit of fifteen (15) mrem. The resultant maximum offsite organ dose due to gaseous effluents from Unit-2 for 2008 was 4.21E-01 mrem, which is 2.8 percent (2.8 %) of the per unit annual limit of fifteen (15) mrem. The maximum offsite dose from gaseous effluents was higher in 2008 when compared with 2007 (4.21E-01 vs. 4.06E-01 mrem) due to a slight increase in tritium released from the Unit-2 Turbine vent. The main source of the tritium in liquid and gaseous effluents is from control rod blades.

FIGURE 1-1

AIRBORNE EFFLUENT RELEASE POINTS

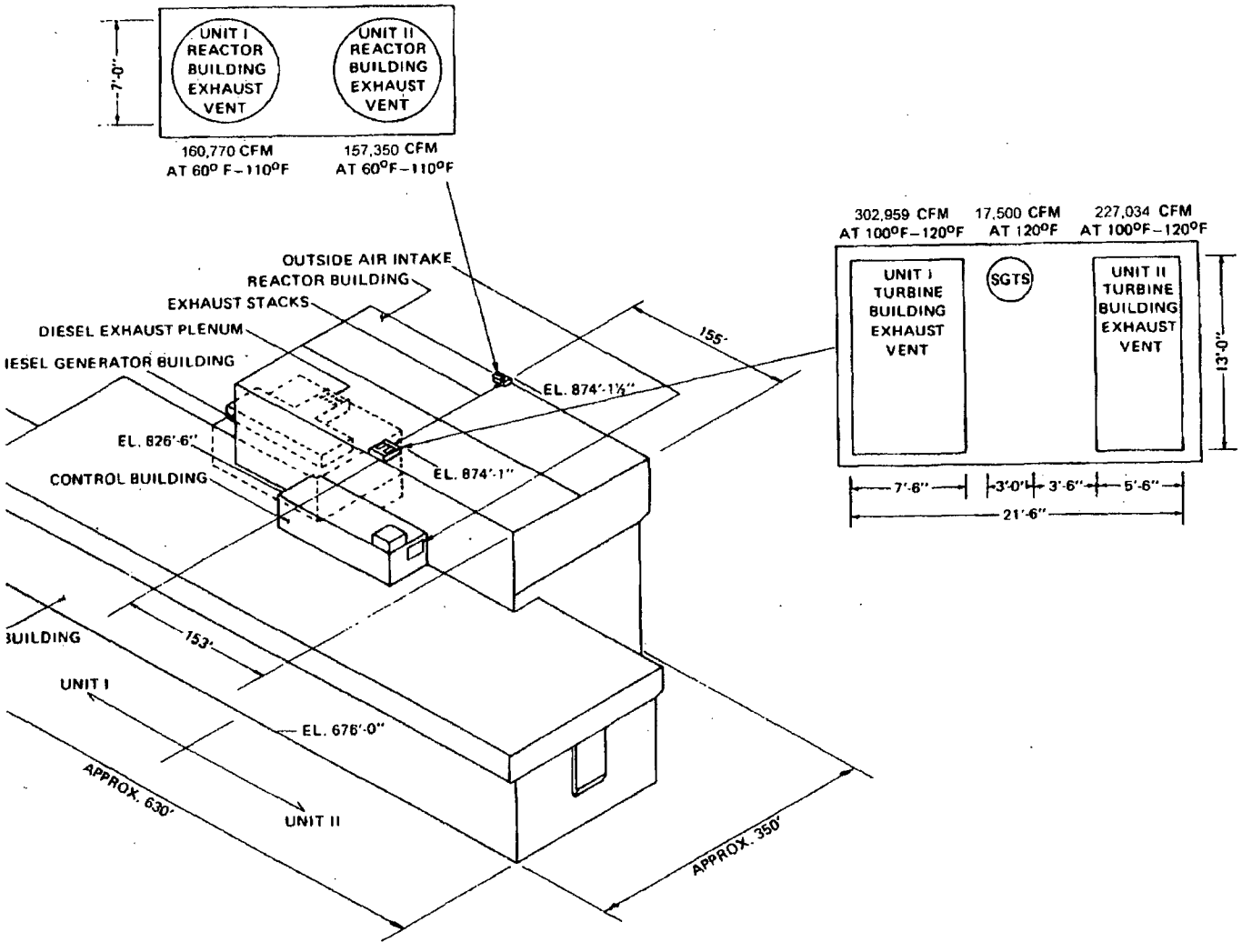
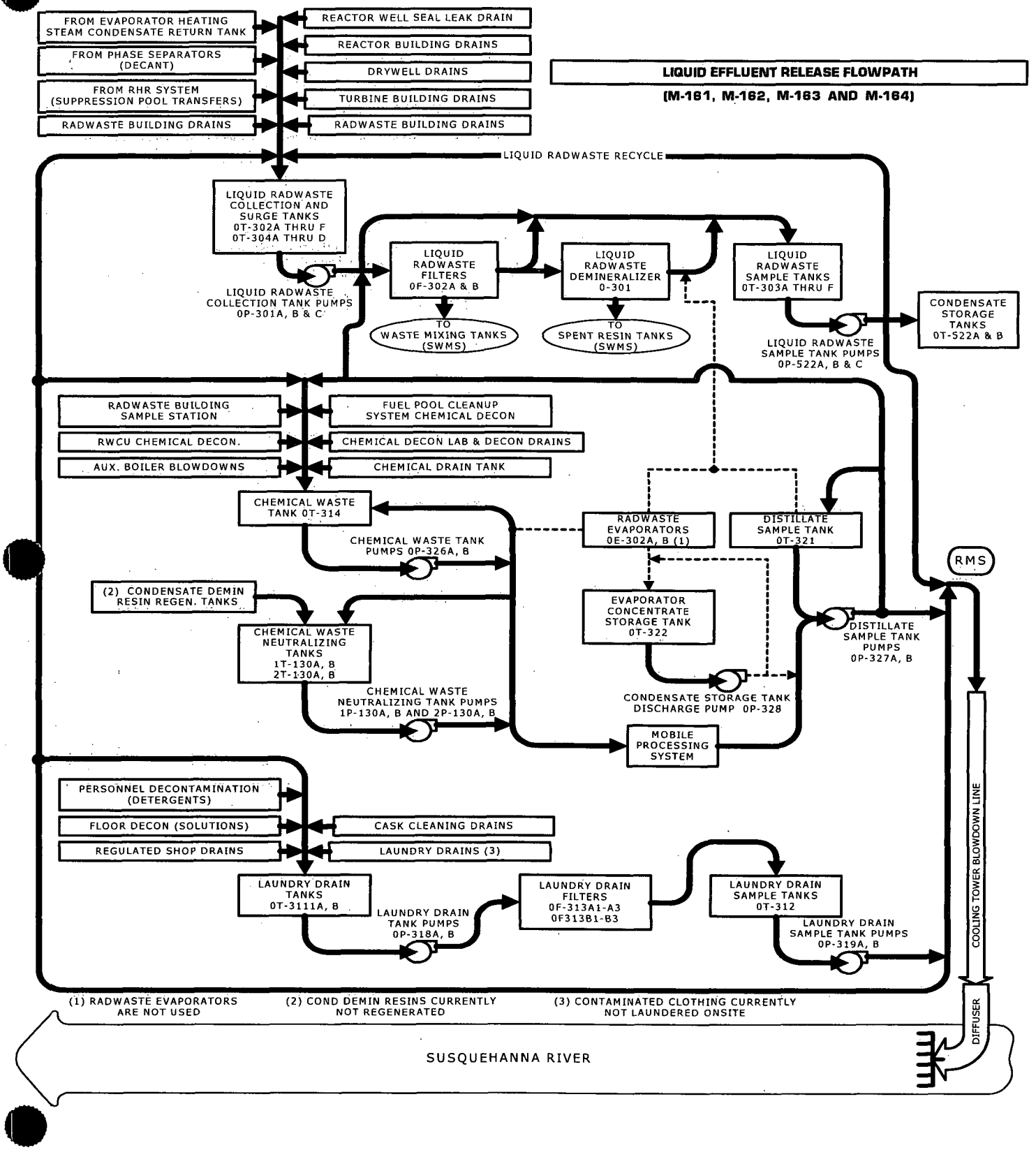


FIGURE 1-2

WATERBORNE EFFLUENT PATHWAY



SUPPLEMENTAL INFORMATION

1. Regulatory Limits

Technical Requirements 3.11.1 and 3.11.2 outline requirements for release of radioactive liquid and gaseous effluents, respectively. Concentration of radioactive materials released in liquid effluents and resulting dose are limited in unrestricted areas. Dose and dose rate due to radioactive materials released in gaseous effluents are limited in areas at or beyond the site boundary. Technical Requirement limits are listed in Table 1-1.

2. Maximum Permissible Concentrations in Waterborne Effluents

The concentration of radioactive material released in liquid effluents to unrestricted areas is limited to 10 times the concentrations specified in 10 CFR Part 20 Appendix B Table 2, Column 2, for radionuclides other than dissolved or entrained noble gases.

For dissolved or entrained noble gases, the concentration is limited to 2.0E-04 μCi/ml total activity (TRO 3.11.1.1).

3. Average Energy of Fission and Activation Gas

The Calculation of Noble Gas Effluent Average Energies E-Bar Beta and Gamma was not performed due to the fact that no noble gases were measured in station vent air samples above detection limits during 2008.

4. Measurements and Approximations of Total Radioactivity

Analyses of specific radionuclides in effluent samples are used to evaluate the radioactive composition and concentration of effluents.

5. Methods of Quantifying Effluents

a. **Fission and Activation Gases**: Gas samples are routinely collected monthly and analyzed with a high resolution (HPGE) detector system which incorporates a data reduction program to determine radionuclide composition in terms of specific activity. Data from the continuous vent monitors are used to determine the average concentration of noble gases. The high resolution (HPGE) isotopic scan is used to convert the continuous vent monitor activity to actual activity based on the determined nuclide mixture. The vent and sample flow rates are continuously monitored and the average flow rates for each vent are used to calculate the total activity released in a given time period. When the continuous monitors are out of service, manual grab

samples are taken from each vent once each eight hours (once each four hours for the standby gas treatment vent).

b. **Iodines**: Iodine is continuously collected on charcoal or silver zeolite cartridges via an isokinetic sampling assembly in each vent. Filters are normally exchanged once per week and analyzed on a high resolution (HPGE) system. The daily average flow rates for the vents and sample pumps are averaged for the duration of the sampling period and a ratio of vent flow rate to sample flow rate is determined. The ratio is used to determine the total activity of each isotope released during the time period in question. When the continuous samplers are out of service, iodine is continuously collected from alternate sampling ports available on the sample lines or directly from the affected rooftop vent(s).

c. **Particulates**: Particulates are continuously collected via an isokinetic sampling assembly in each vent. Filters are normally exchanged once per week and analyzed on a high resolution (HPGE) system. Flow rate corrections are performed as for iodines. When the continuous samplers are out of service, particulates are continuously collected from alternate sampling ports available on the sample lines or directly from the affected rooftop vent(s).

d. **Tritium**: Airborne tritium is collected monthly via bubbler sampler. The sample is collected for one hour at a flow rate of approximately 1000 cc/min. Tritium activity in the bubbler sample is determined by liquid scintillation counting. The liquid sample tritium concentration is then converted to air concentration by volume proportion.

e. **Waterborne Effluents**: Each tank of liquid radwaste is sampled and analyzed for principal gamma emitters prior to release. Each sample tank is recirculated for a sufficient amount of time prior to sampling to ensure that a representative sample is obtained. Samples are analyzed on a high resolution (HPGE) system and release permits are generated based on the values obtained from the isotopic analysis and the most recent values for tritium, gross alpha, iron-55, and strontium-89 and -90. An aliquot based on release volume is saved and added to monthly and quarterly composite containers. The monthly tritium analysis is done in-house. A monthly composite is sent to a vendor laboratory for gross alpha analysis. A quarterly composite is sent to a vendor laboratory for iron-55, strontium-89 and-90 analyses.

The concentration of each radionuclide in each batch is multiplied by the volume of the batch to determine the total quantity of each nuclide released in each batch. The isotopic totals for each batch are summed to determine the total source term for the report period.

TABLE 1-1

TECHNICAL REQUIREMENT LIMITS

A. NOBLE GASES:

1. ≤500 mrem/year - TOTAL BODY
   ≤3000 mrem/year - SKIN

   - dose rate limit at and beyond the site boundary
     (TRO 3.11.2.1.I)

2. ≤5 mrad - AIR GAMMA
   ≤10 mrad - AIR BETA

   - quarterly air dose limits per reactor unit at and beyond the site boundary
     (TRO 3.11.2.2a)

3. ≤10 mrad - AIR GAMMA
   ≤20 mrad - AIR BETA

   - annual air dose limits per reactor unit at and beyond the site boundary
     (TRO 3.11.2.2.b)

B. AIRBORNE I-131, I-133, TRITIUM, PARTICULATES WITH HALF-LIVES > 8 DAYS:

1. ≤1500 mrem/year - ORGAN
   (inhalation pathways only)

   - dose rate limit at and beyond the site boundary
     (TRO 3.11.2.1.II.A)

2. ≤7.5 mrem - ORGAN

   - quarterly dose limit per reactor unit at and beyond the site boundary
     (TRO 3.11.2.3.a)

3. ≤15 mrem - ORGAN

   - annual dose limit per reactor unit at and beyond the site boundary
     (TRO 3.11.2.3.b)

C. LIQUID EFFLUENTS:

1. ≤1.5 mrem - TOTAL BODY
   ≤5.0 mrem - ORGAN
   - quarterly dose limits per unit (TRO 3.11.1.2.a)

2. ≤3.0 mrem - TOTAL BODY
   ≤10.0 mrem - ORGAN
   - annual dose limits per unit (TRO 3.11.1.2.b)

D. AIRBORNE EFFLUENT: BASES FOR PERCENT OF APPLICABLE LIMIT VALUES IN TABLE 2-1

Fission and Activation Gases

Derived release rate limits based on the Technical Requirement (TRO 3.11.2.1.I.A and B) limits of 500 mrem/yr to the total body and 3000 mrem/yr to the skin were calculated (PPL calculation EC-ENVR-1041 Rev. 2) from the expected mix of noble gas radionuclides presented in Attachment A of ODCM-QA-003, Effluent Monitor Setpoints. The lower limit of 1.00E+06 µCi/min (1.67E+04 µCi/sec) based on total body dose rate is used.

Iodine-131

A derived release rate limit for I-131 based on the Technical Requirement (TRO 3.11.2.1.II.A) limit of 1500 mrem/yr from I-131, I-133, tritium and particulates with half-lives greater than 8 days was calculated (PPL calculation EC-ENVR-1041 Rev. 2) based on the ratio of the expected annual release quantities of I-131 and I-133 provided in Attachment E of ODCM-QA-004, Airborne Effluent Dose Calculations. The limit is 1.04E+02 µCi/min I-131 (1.73E+00 µCi/sec).

Particulates

A derived release rate limit for particulate activity other than iodines based on the Technical Requirement (TRO 3.11.2.1.II.A) limit of 1500 mrem/yr from I-131, I-133, tritium and particulates with half-lives greater than 8 days was calculated (PPL calculation EC-ENVR-1041 Rev. 2) based on the expected annual release quanities of particulate radionuclides provided in Attachment E of ODCM-QA-004, Airborne Effluent Dose Calculations. The limit is 3.02E+03 µCi/min (5.03E+01 µCi/sec).

Tritium

A derived release rate was calculated based on the 10 CFR 20, Appendix B, Table 2, Column 1, Effluent Concentration Limit for tritium (1.0E-07 µCi/cc) to unrestricted areas. A relative concentration of 4.1E-05 sec/m^3 was assumed (PPL calculation EC-ENVR-1040). The limit is 1.46E+05 µCi/min (2.44E+03 µCi/sec).

Radionuclide Fractional Summation

The sum of the percents of applicable limits for particulates, iodine and tritium must be less than 100%.

E. WATERBORNE EFFLUENT: BASES FOR PERCENT OF APPLICABLE LIMIT VALUES IN TABLE 2-3

Fission and Activation Products

Concentrations of fission and activation products in liquid effluent from radwaste effluent are determined for each batch prior to release. Each isotope concentration is compared to ten times the 10CFR20 Appendix B, Table 2, Column 2 Effluent Concentration Values (TRO 3.11.1.1).

Tritium

Liquid effluent quarterly tritium concentrations are compared to ten times the 10 CFR 20 Appendix B, Table 2, Column 2, Effluent Concentration value of 1.0E-03 µCi/ml to unrestricted areas.

Dissolved and Entrained Gases

Liquid effluent concentrations for dissolved and entrained gases are compared to the limiting value for total noble gas activity of 2.0E-04 µCi/ml (TRO 3.11.1.1).

Radionuclide Fractional Summation

The sum of the percents of applicable limits for fission and activation products, tritium and dissolved and entrained gases must be less than 100%.

SECTION 2

EFFLUENT AND WASTE DISPOSAL DATA

Airborne Effluents

Summaries of the radionuclide total curie activities and average release rates are included in Tables 2-1 and 2-2. If a radionuclide was not detected, zero activity was used for that isotope in dose calculations and the activity is listed as "<MDC" (less than the minimum detectable concentration) in Tables 2-1 and 2-2. <MDC indicates that no activity was positively detected in any sample when samples were analyzed with techniques which achieved the required Lower Limits of Detection (LLD) as specified in the Technical Requirement (TRO) Table 3.11.2.1-1, Radioactive Gaseous Effluent Sampling and Analysis Program. In all cases, the measurement laboratory MDCs were at or below the LLD levels required by Technical Requirements. The following are typical measurement laboratory MDCs.

Typical MDCs

Radionuclide	MDC (µCi/cc)
Kr-87	4.3 E-08
Kr-88	4.6 E-08
Xe-133	3.0 E-08
Xe-133m	1.1 E-07
Xe-135	1.5 E-08
Xe-135m	8.0 E-08
Xe-138	1.5 E-07
Mn-54	2.9 E-13
Fe-59	2.8 E-13
Co-58	1.8 E-13
Co-60	3.8 E-13
Zn-65	1.0 E-13
Mo-99	1.0 E-12
Cs-134	2.4 E-13
Cs-137	1.1 E-13
Ce-141	1.0 E-13
Ce-144	5.0 E-13
I-131	4.4 E-14
Sr-89	1.1 E-13
Sr-90	1.3 E-14
H-3	1.5 E-08
Gross Alpha	2.3 E-14

Batch Releases

1. Number of Batch Releases:	0
2. Total Time Period for Batch Release:	NA
3. Maximum Time Period for a Batch Release:	NA
4. Average Time Period for a Batch Release:	NA
5. Minimum Time Period for a Batch Release:	NA

Abnormal Releases

1. Number of Releases	0
2. Total Activity Released	NA

TABLE 2-1

AIRBORNE EFFLUENT - SUMMATION OF ALL RELEASES

A. Fission and Activation Gas	Unit	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
Total Release	Ci	<MDC	<MDC	<MDC	<MDC
Average Release Rate for Period	µCi/sec	0	0	0	0
Percent of Applicable Limit (1.67E+04 µCi/sec)	%	0	0	0	0

B. Iodines

Total I-131	Ci	<MDC	<MDC	<MDC	<MDC
Average Release Rate for Period	µCi/sec	0	0	0	0
Percent of Applicable Limit (1.73E+00 µCi/sec)	%	0	0	0	0

Particulate

Particulate with Half-Life >8 Days	Ci	2.24E-05	2.92E-06	3.89E-05	<MDC
Average Release Rate for Period	µCi/sec	2.85E-06	3.71E-07	4.89E-06	0
Percent of Applicable Limit (5.03E+01 µCi/sec)	%	5.67E-06	7.38E-07	9.72E-06	0
Gross Alpha Radioactivity	Ci	<MDC	<MDC	<MDC	<MDC

D. Tritium

Total Release	Ci	1.14E+01	7.06E+00	1.62E+01	2.52E+01
Average Release Rate for Period	µCi/sec	1.45E+00	8.98E-01	2.04E+00	3.17E+00
Percent of Applicable Limit (2.44E+03 µCi/sec)	%	5.94E-02	3.68E-02	8.35E-02	1.30E-01

E. Radionuclide Fractional Summation

Sum of Percent of Applicable Limit During Period for B, C and D (Limit = 100%)	%	0.06	0.04	0.08	0.13

TABLE 2-2

AIRBORNE EFFLUENT - RADIONUCLIDES RELEASED

		Releases in Continuous Mode			
Nuclides Released	**Unit**	**First Quarter**	**Second Quarter**	**Third Quarter**	**Fourth Quarter**
A. Fission and Activation Gases					
Ar-41	Ci	<MDC	<MDC	<MDC	<MDC
Kr-85	Ci	<MDC	<MDC	<MDC	<MDC
Kr-85m	Ci	<MDC	<MDC	<MDC	<MDC
Kr-87	Ci	<MDC	<MDC	<MDC	<MDC
Kr-88	Ci	<MDC	<MDC	<MDC	<MDC
Kr-89	Ci	<MDC	<MDC	<MDC	<MDC
Xe-133	Ci	<MDC	<MDC	<MDC	<MDC
Xe-135	Ci	<MDC	<MDC	<MDC	<MDC
Xe-135m	Ci	<MDC	<MDC	<MDC	<MDC
Xe-137	Ci	<MDC	<MDC	<MDC	<MDC
Xe-138	Ci	<MDC	<MDC	<MDC	<MDC
Total for Period	**Ci**	**0**	**0**	**0**	**0**
B. Iodines					
I-131	Ci	<MDC	<MDC	<MDC	<MDC
I-133	Ci	<MDC	<MDC	<MDC	<MDC
I-135	Ci	<MDC	<MDC	<MDC	<MDC
Total for Period	**Ci**	**0**	**0**	**0**	**0**
C. Particulate					
Cr-51	Ci	<MDC	<MDC	<MDC	<MDC
Mn-54	Ci	<MDC	<MDC	<MDC	<MDC
Fe-59	Ci	<MDC	<MDC	<MDC	<MDC
Co-57	Ci	<MDC	<MDC	<MDC	<MDC
Co-58	Ci	<MDC	<MDC	<MDC	<MDC
Co-60	Ci	<MDC	1.71E-06	3.89E-05	<MDC
Zn-65	Ci	2.24E-05	1.21E-06	<MDC	<MDC
Sr-89	Ci	<MDC	<MDC	<MDC	<MDC
Sr-90	Ci	<MDC	<MDC	<MDC	<MDC
Cs-134	Ci	<MDC	<MDC	<MDC	<MDC
Cs-137	Ci	<MDC	<MDC	<MDC	<MDC
Ce-141	Ci	<MDC	<MDC	<MDC	<MDC
Ce-144	Ci	<MDC	<MDC	<MDC	<MDC
Nb-95	Ci	<MDC	<MDC	<MDC	<MDC
Ba-La-140	Ci	<MDC	<MDC	<MDC	<MDC
Total for Period	**Ci**	**2.24E-05**	**2.92E-06**	**3.89E-05**	**0**

Waterborne Effluents

Summaries of the radionuclide total curie activities, average diluted concentrations, and percent of applicable Technical Requirement limits are included in Tables 2-3 and 2-4.

	Batch Releases*	Qtr. 1	Qtr. 2	Qtr. 3	Qtr. 4	Annual
1.	Number of Batch Releases	15	24	15	35	89
2.	Total Time Period for a Batch Release	1.78E+03	2.81E+03	9.75E+02	3.77E+03	9.34E+03
3.	Maximum Time Period for a Batch Release	2.96E+02	3.04E+02	8.40E+01	2.98E+02	3.04E+02
4.	Average Time Period for a Batch Release	1.19E+02	1.17E+02	6.50E+01	1.08E+02	1.05E+02
5.	Minimum Time Period for a Batch Release	3.00E+01	2.20E+01	2.90E+01	2.80E+01	2.20E+01
6.	Average Cooling Tower Blowdown Flow Rate During Periods of Release	6.75E+03	8.68E+03	1.21E+04	1.00E+04	9.20E+03
7.	Susquehanna River Flow Rate	1.70E+07	6.16E+06	1.46E+06	4.90E+06	7.35E+06

*Units of time and flow are expressed in minutes and gallons per minute (gpm), respectively.

If a radionuclide was not detected, zero activity was used for that isotope in dose calculations and the activity is listed as "<MDC" (less than the miniumum detectable concentration) in Tables 2-3 and 2-4. <MDC indicates that no activity was positively detected in any sample when samples were analyzed with techniques which achieved the required Lower Limits of Detection (LLD) as specified in the Technical Requirement 3.11.1.1-1, Radioactive Liquid Waste Sampling and Analysis Program. In all cases, the measurement laboratory MDCs were at or below the LLD levels required by Technical Requirements. The following are typical measurement laboratory MDCs.

Radionuclide	MDC (µCi/ml)
Mn-54	4.5 E-08
Fe-59	5.0 E-08
Co-58	4.0 E-08
Co-60	5.4 E-08
Zn-65	4.9 E-08
Mo-99	1.7 E-07
I-131	2.0 E-08
Cs-134	2.2 E-08
Cs-137	2.6 E-08
Ce-141	3.2 E-08
Ce-144	1.3 E-07
Sr-89	4.4 E-08
Sr-90	1.6 E-08
Fe-55	8.2 E-07
H-3	3.6 E-06
Gross Alpha	3.7 E-09

Abnormal Releases

1.	Number of releases	0	0	0	0
2.	Volume Released	N/A	N/A	N/A	N/A
3.	Total Activity Released	N/A	N/A	N/A	N/A

TABLE 2-3

WATERBORNE EFFLUENT - SUMMATION OF ALL RELEASES

A. Fission and Activation Products	Unit	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
1. Total Release (excluding: Tritium, Ent. Gases, Alpha)	Ci	4.43E-04	1.33E-03	6.61E-06	6.55E-04
2. Average Diluted Concentration During Period	µCi/ml	9.74E-09	1.44E-08	1.48E-10	4.59E-09
3. Sum of Average Diluted C_n/L_n Ratio During Period	Unitless	1.18E-04	1.89E-04	3.84E-06	9.53E-05
4. Percent of Applicable Limit (Ratio < 1.0)	%	0.01	0.02	0.0004	0.01
B. Tritium					
1. Total Release	Ci	5.12E+00	8.93E+00	2.48E+00	1.65E+01
2. Average Diluted Concentration During Period	µCi/ml	1.13E-04	9.67E-05	5.57E-05	1.16E-04
3. Percent of Applicable Limit (1.0E-2 µCi/ml)	%	1.13	1.00	0.56	1.16
C. Dissolved and Entrained Gases					
1. Total Release	Ci	<MDC	<MDC	<MDC	1.89E-06
2. Average Diluted Concentration During Period	µCi/ml	0.00E+00	0.00E+00	0.00E+00	1.33E-11
3. Percent of Applicable Limit (2.0E-4 µCi/ml)	%	0.00E+00	0.00E+00	0.00E+00	6.63E-06
D. Radionuclide Fractional Summation					
1. Sum of Percent of Applicable Limit During Period for A, B and C (Limit = 100%)	%	1.14	1.02	0.56	1.17
E. Gross Alpha Radioactivity					
1. Total Release	Ci	<MDC	<MDC	<MDC	<MDC
F. Volume of Water Released (Prior to Dilution)	Gallons	1.37E+05	2.15E+05	6.58E+04	2.83E+05
	Liters	5.19E+05	8.13E+05	2.49E+05	1.07E+06
G. Volume of Dilution Water Used During Period of Release	Gallons	1.19E+07	2.42E+07	1.17E+07	3.75E+07
	Liters	4.49E+07	9.15E+07	4.43E+07	1.42E+08
H. Volume of Dilution Water Used Over Entire Period	Gallons	9.78E+08	1.34E+09	1.52E+09	1.24E+09
	Liters	3.70E+09	5.07E+09	5.74E+09	4.69E+09

TABLE 2-4

WATERBORNE EFFLUENT - RADIONUCLIDES RELEASED

Nuclides Released	Unit	Releases in Batch Mode			
		First Quarter	Second Quarter	Third Quarter	Fourth Quarter
A. Fission and Activation Products					
Na-24	Ci	<MDC	<MDC	<MDC	<MDC
Cr-51	Ci	1.73E-04	3.48E-04	<MDC	<MDC
Mn-54	Ci	5.44E-05	3.49E-04	1.64E-06	1.72E-05
Fe-55	Ci	<MDC	<MDC	<MDC	<MDC
Co-58	Ci	2.32E-05	1.06E-04	<MDC	1.18E-04
Fe-59	Ci	<MDC	6.96E-05	<MDC	<MDC
Co-60	Ci	1.37E-04	4.50E-04	4.97E-06	1.93E-04
Zn-65	Ci	1.95E-05	<MDC	<MDC	3.25E-04
Sr-89	Ci	<MDC	<MDC	<MDC	<MDC
Sr-90	Ci	<MDC	<MDC	<MDC	<MDC
Nb-95	Ci	<MDC	5.30E-06	<MDC	<MDC
Rh-105	Ci	3.53E-05	<MDC	<MDC	<MDC
Sb-124	Ci	<MDC	<MDC	<MDC	2.17E-06
Ce-141	Ci	<MDC	<MDC	<MDC	<MDC
Ta-182	Ci	<MDC	<MDC	<MDC	<MDC
Total for Period	**Ci**	**4.43E-04**	**1.33E-03**	**6.61E-06**	**6.55E-04**
B. Tritium					
Total for Period	**Ci**	**5.12E+00**	**8.93E+00**	**2.48E+00**	**1.65E+01**
C. Dissolved and Entrained Gases					
Ar-41	Ci	<MDC	<MDC	<MDC	<MDC
Kr-85	Ci	<MDC	<MDC	<MDC	<MDC
Kr-85m	Ci	<MDC	<MDC	<MDC	<MDC
Kr-87	Ci	<MDC	<MDC	<MDC	<MDC
Kr-88	Ci	<MDC	<MDC	<MDC	<MDC
Xe-131m	Ci	<MDC	<MDC	<MDC	<MDC
Xe-133m	Ci	<MDC	<MDC	<MDC	<MDC
Xe-133	Ci	<MDC	<MDC	<MDC	<MDC
Xe-135m	Ci	<MDC	<MDC	<MDC	<MDC
Xe-135	Ci	<MDC	<MDC	<MDC	1.89E-06
Total for Period	**Ci**	**0**	**0**	**0**	**1.89E-06**

Figure 2-1

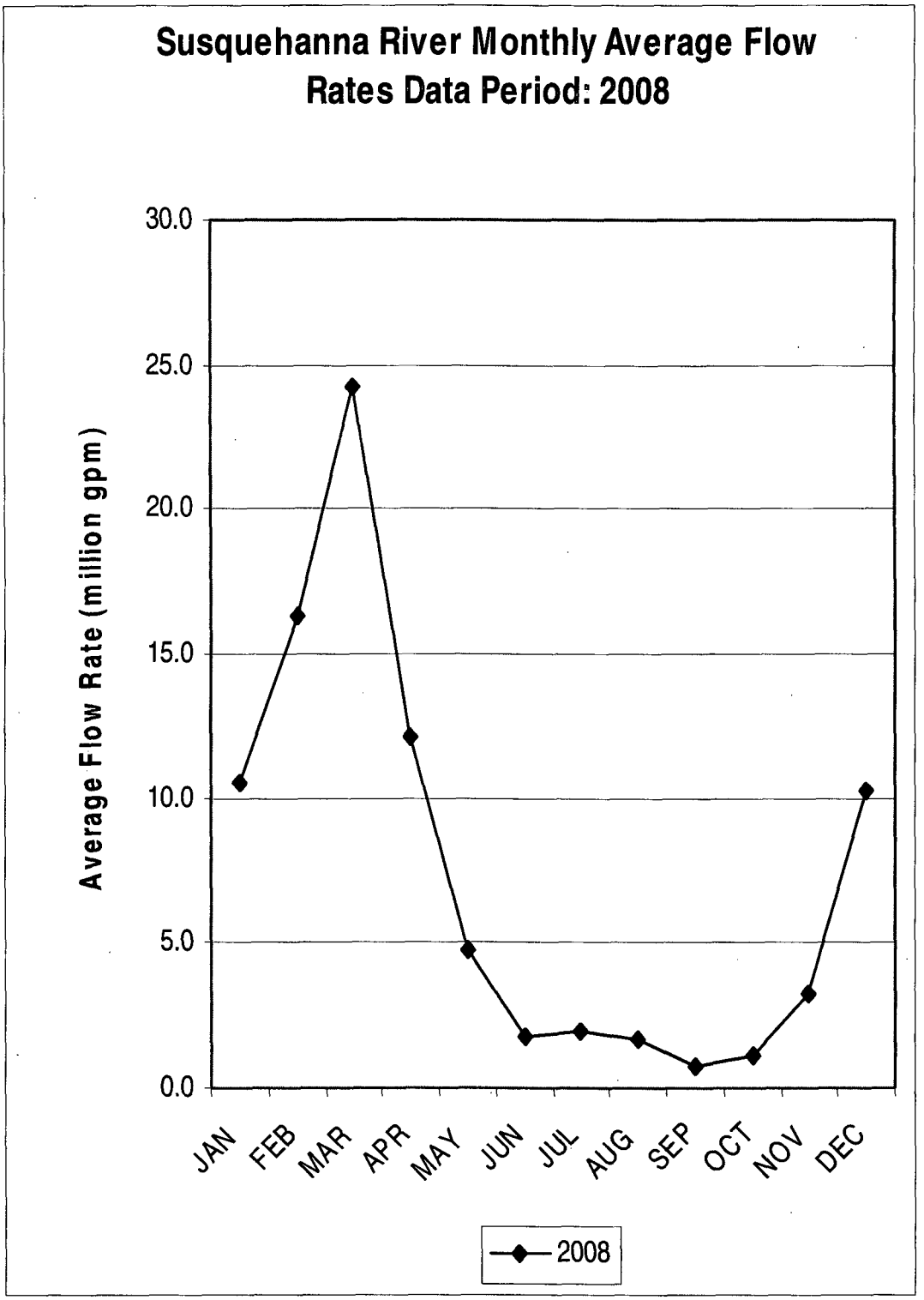

Susquehanna River Monthly Average Flow Rates Data Period: 2008
Average Flow Rate (million gpm)
30.0
25.0
20.0
15.0
10.0
5.0
0.0
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
2008

Figure 2-2

Monthly Liquid Radwaste Discharge Totals

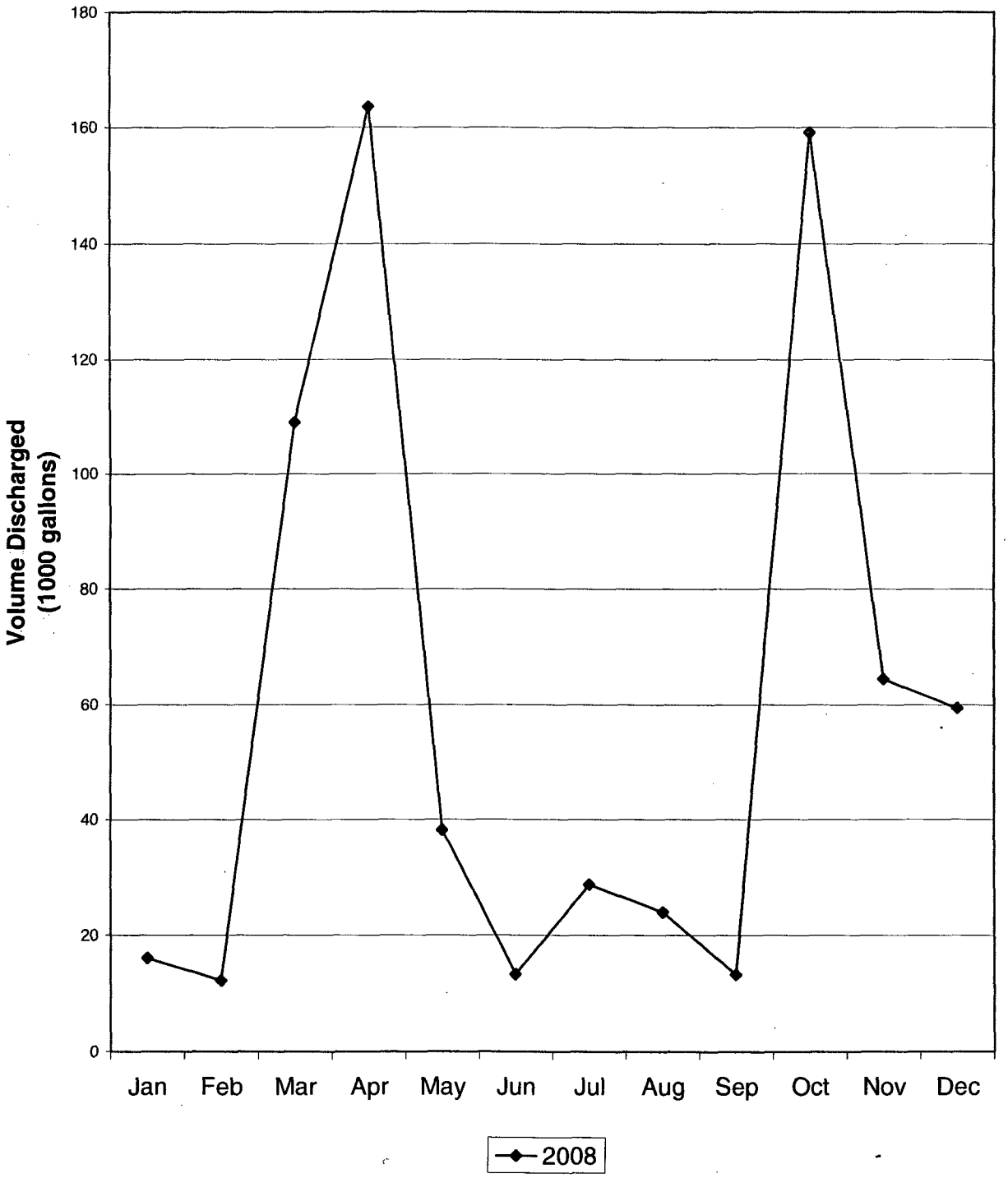


TABLE 2-5

ESTIMATED TOTAL ERRORS ASSOCIATED WITH EFFLUENTS MEASUREMENTS

MEASUREMENT	ESTIMATED TOTAL ERROR
1. Airborne Effluents	
a. Fission and Activation Gases	15.9%
b. I-131	13.3%
c. Particulates (incl. Gross Alpha)	15.8%
d. Tritium	13.6%
2. Waterborne Effluents	
a. Fission and Activation Products	5.0%
b. Tritium	3.3%
c. Dissolved and Entrained Gases	8.4%
d. Gross Alpha Activity	6.0%
e. Volume of Waste Released (Prior to Dilution)	5.0%
f. Volume of Dilution Water Used During Period	15.0%
	ESTIMATED MAXIMUM MEASUREMENT ERROR
3. Solid Wastes	
a. RWCU Filter Media – Class A HIC (Dewatered)	±25%
b. CFS Backwash Media – Class A HIC (Pyrolysis)	±25%
c. CFS Filters – Class A HIC (Pyrolysis)	±25%
d. CFS Filters – Class A Strong Tight Container (Compacted)	±25%
e. Condensate Demineralizer/Radwaste Demineralizer Class – A HIC (Pyrolysis)	±25%
f. Contaminated Waste Oil – Class A (Fuel Blending for Co-Generation)	±25%
g. Liquid Radwaste Filter Media – Class A HIC (Pyrolysis)	±25%
h. Processed DAW – Class A Strong Tight Container (Compacted)	±25%
i. Cartridge Filters – Class B HIC (Non-Processed)	±25%

		ESTIMATED MAXIMUM MEASUREMENT ERROR
3.	**Solid Wastes (cont.)**	
j.	Non-Processed DAW – Class B HIC	±25%
k.	Irradiated Components – Class C Steel Liner	±25%
l.	Condensate Demineralizer/Radwaste Demineralizer Class C HIC (Pyrolysis)	±25%
m.	Liquid Radwaste Filter Media – Class C HIC (Pyrolysis)	±25%

SUSQUEHANNA STEAM ELECTRIC STATION

RADIOACTIVE WASTE REPORT

RADIOACTIVE EFFLUENT RELEASE REPORT

SOLID RADIOACTIVE WASTE

DATA PERIOD: JANUARY 1, 2008 - DECEMBER 31, 2008

PREPARED BY: _____
MICHAEL C. MICCA
HEALTH PHYSICIST

APPROVED BY: _____
ERIC WOLF
RADIOLOGICAL OPERATIONS SUPERVISOR

REPORT NOTES

1. All activities reported in Milli-Curies (mCi) unless otherwise noted.

2. Reported activities, as indicated with the (<) sign, are comprised in whole or part of MDL values.

3. Estimated maximum measurement error is ±25%.

TABLE 2-6

WASTE DISPOSITION

Data Period: January 1, 2008 - December 31, 2008

A. SOLID WASTE SHIPPED OFF-SITE FOR BURIAL OR DISPOSAL

Number of Shipments	Mode of Transportation	Destination
11	Truck	Barnwell, SC

B. IRRADIATED FUEL SHIPMENTS

Number of Shipments	Mode of Transportation	Destination
NONE		

NOTE: The number of shipments listed in A include only the shipments from PPL Susquehanna, LLC to a disposal site. It does not include shipments made to or from volume reduction vendors.

Table 2-7

Annual Waste Release Summary Report

Year: 2008
Class: A Volume Reduction Vendor: No
Source: RWCU Filter Media
Container: HIC (High Integrity Container)
Process: Dewatered

Nuclides	Activity (mCi)	% of Total
AM-241	2.900E-03	0.00 %
C-14	3.460E+00	0.00 %
CE-144	4.890E+02	0.07 %
CM-242	1.090E-02	0.00 %
CM-244	5.420E-03	0.00 %
CO-57	9.520E+01	0.01 %
CO-58	2.950E+04	4.32 %
CO-60	1.710E+05	25.04 %
CR-51	1.570E+04	2.30 %
CS-137	1.770E+02	0.03 %
FE-55	3.250E+05	47.60 %
FE-59	2.540E+03	0.37 %
H-3	9.060E+00	0.00 %
MN-54	5.930E+04	8.68 %
NB-95	5.500E+03	0.81 %
NI-59	4.430E+00	0.00 %
NI-63	3.490E+03	0.51 %
PU-238	4.890E-03	0.00 %
SB-124	2.360E+02	0.03 %
SB-125	7.190E+02	0.11 %
SR-89	8.740E+02	0.13 %
SR-90	3.000E+00	0.00 %
TC-99	5.850E-01	0.00 %
ZN-65	6.550E+04	9.59 %
ZR-95	2.690E+03	0.39 %
Total Activity (Ci)	682.831	100.00 %
Container Volume	132.400 ft3	3.749 m3

Table 2-8

Annual Waste Release Summary Report

Year: 2008
Class: A Volume Reduction Vendor: Yes
Source: CFS Backwash Media
Container: HIC (High Integrity Container)
Process: Pyrolysis

Nuclides	Activity (mCi)	% of Total
C-14	3.029E+00	0.00 %
CE-144	9.510E-51	0.00 %
CO-58	1.010E+02	0.04 %
CO-60	2.965E+04	12.57 %
CS-137	4.357E+01	0.02 %
CU-64	1.750E-11	0.00 %
FE-55	1.966E+05	83.37 %
FE-59	3.420E+01	0.01 %
H-3	6.999E+01	0.03 %
I-129	< 4.910E-03	0.00 %
MN-54	7.349E+03	3.12 %
NB-95	2.350E+01	0.01 %
NI-59	1.893E+00	0.00 %
NI-63	6.367E+02	0.27 %
SR-90	7.592E-01	0.00 %
TC-99	< 2.740E-01	0.00 %
ZN-65	1.297E+03	0.55 %
Total Activity (Ci)	235.811	100.00 %
Container Volume	31.390 ft3	0.889 m3

Table 2-9

Annual Waste Release Summary Report

Year: 2008
Class: A Volume Reduction Vendor: Yes
Source: CFS Filters
Container: HIC (High Integrity Container)
Process: Pyrolysis

Nuclides	Activity (mCi)	% of Total
C-14	3.526E+00	0.09 %
CE-144	1.883E-50	0.00 %
CO-58	2.613E+00	0.07 %
CO-60	5.230E+02	13.07 %
CS-137	9.250E-01	0.02 %
FE-55	3.239E+03	80.94 %
FE-59	1.831E+00	0.05 %
H-3	6.180E+00	0.15 %
I-129	< 7.870E-04	0.00 %
MN-54	1.896E+02	4.74 %
NI-63	2.295E+01	0.57 %
SR-89	5.788E-03	0.00 %
SR-90	5.650E-03	0.00 %
TC-99	< 1.650E-03	0.00 %
ZN-65	1.227E+01	0.31 %
Total Activity (Ci)	4.002	100.00 %
Container Volume	15.440 ft3	0.437 m3

Table 2-10

Annual Waste Release Summary Report

Year: 2008
Class: A Volume Reduction Vendor: Yes
Source: CFS Filters
Container: Strong Tight Container
Process: Compacted

Nuclides	Activity (mCi)	% of Total
C-14	3.965E+01	0.08 %
CO-58	4.966E+01	0.11 %
CO-60	6.031E+03	12.75 %
CS-137	1.044E+01	0.02 %
FE-55	3.819E+04	80.77 %
FE-59	4.191E+01	0.09 %
H-3	1.663E+01	0.04 %
MN-54	2.480E+03	5.24 %
NI-63	2.579E+02	0.55 %
SR-89	1.316E-01	0.00 %
SR-90	6.380E-02	0.00 %
ZN-65	1.664E+02	0.35 %
Total Activity (Ci)	47.284	100.00 %
Container Volume	304.000 ft3	8.608 m3

Table 2-11

Annual Waste Release Summary Report

Year: 2008
Class: A Volume Reduction Vendor: Yes
Source: Condensate Demineralizer / Radwaste Demineralizer
Container: HIC (High Integrity Container)
Process: Pyrolysis

Nuclides	Activity (mCi)	% of Total
C-14	5.739E+01	5.38 %
CE-144	1.542E-01	0.01 %
CM-242	1.390E-03	0.00 %
CM-244	1.588E-03	0.00 %
CO-58	2.522E+01	2.36 %
CO-60	2.966E+02	27.81 %
CR-51	1.501E+01	1.41 %
CS-137	7.156E-01	0.07 %
FE-55	2.625E+01	2.46 %
FE-59	5.697E+00	0.53 %
H-3	4.265E+02	39.99 %
I-129	< 9.450E-03	0.00 %
I-131	6.603E-04	0.00 %
MN-54	1.409E+02	13.21 %
NB-95	2.791E+00	0.26 %
NI-63	3.828E+00	0.36 %
PU-238	7.660E-03	0.00 %
PU-239	1.963E-01	0.02 %
PU-241	8.162E-01	0.08 %
SB-124	7.820E-01	0.07 %
SB-125	3.045E+00	0.29 %
SR-90	9.744E-02	0.01 %
TC-99	1.280E-01	0.01 %
ZN-65	3.826E+01	3.59 %
ZR-95	2.219E+01	2.08 %
Total Activity (Ci)	1.067	100.00 %
Container Volume	172.160 ft3	4.875 m3

Table 2-12

Annual Waste Release Summary Report

Year: 2008
Class: A Volume Reduction Vendor: Yes
Source: Contaminated Waste Oil
Container: None
Process: Fuel Blending for Co-Generation

Nuclides	Activity (mCi)	% of Total
C-14	< 4.420E-08	0.00 %
CO-60	6.280E-01	12.00 %
CS-137	3.430E-03	0.07 %
FE-55	7.330E-01	14.00 %
H-3	3.780E+00	72.22 %
I-129	< 4.450E-09	0.00 %
MN-54	8.580E-02	1.64 %
NI-63	3.630E-03	0.07 %
SR-90	3.010E-05	0.00 %
TC-99	< 4.680E-07	0.00 %
Total Activity (Ci)	0.005	100.00 %
Container Volume	0.000 ft3	0.000 m3

Table 2-13

Annual Waste Release Summary Report

Year: 2008
Class: A Volume Reduction Vendor: Yes
Source: Liquid Radwaste Filter Media
Container: HIC (High Integrity Container)
Process: Pyrolysis

Nuclides	Activity (mCi)	% of Total
C-14	8.302E-02	0.00 %
CE-144	9.440E-01	0.00 %
CM-244	5.000E-02	0.00 %
CO-58	2.517E+02	0.51 %
CO-60	8.787E+03	17.82 %
CR-51	1.336E+02	0.27 %
CS-137	2.010E+00	0.00 %
FE-55	3.512E+04	71.22 %
FE-59	7.004E+01	0.14 %
H-3	6.892E+01	0.14 %
I-129	5.270E-04	0.00 %
MN-54	3.469E+03	7.03 %
NB-95	3.260E+01	0.07 %
NI-59	3.670E-01	0.00 %
NI-63	4.882E+02	0.99 %
PU-241	1.145E+01	0.02 %
SB-124	7.094E+00	0.01 %
SR-90	3.914E-01	0.00 %
TA-182	2.244E+01	0.05 %
TC-99	2.740E-02	0.00 %
ZN-65	8.386E+02	1.70 %
ZR-95	7.087E+00	0.01 %
Total Activity (Ci)	49.308	100.00 %
Container Volume	39.400 ft3	1.116 m3

Table 2-14

Annual Waste Release Summary Report

Year: 2008
Class: A Volume Reduction Vendor: Yes
Source: Processed DAW
Container: Strong Tight Container
Process: Compacted

Nuclides	Activity (mCi)	% of Total
AM-241	5.320E-06	0.00 %
C-14	4.994E-01	0.01 %
CE-144	6.890E-01	0.01 %
CM-242	1.260E-05	0.00 %
CM-244	9.840E-06	0.00 %
CO-57	1.358E-01	0.00 %
CO-58	3.077E+01	0.67 %
CO-60	1.498E+03	32.42 %
CR-51	2.213E+01	0.48 %
CS-137	6.484E+00	0.14 %
FE-55	2.265E+03	49.04 %
FE-59	1.912E+01	0.41 %
H-3	1.951E+02	4.22 %
I-129	1.480E-04	0.00 %
MN-54	4.218E+02	9.13 %
NB-95	9.930E+00	0.21 %
NI-59	8.133E-03	0.00 %
NI-63	1.642E+01	0.36 %
PU-238	8.950E-06	0.00 %
SB-124	1.251E-01	0.00 %
SB-125	2.156E+00	0.05 %
SR-89	6.944E-01	0.02 %
SR-90	5.906E-02	0.00 %
TA-182	2.290E-04	0.00 %
TC-99	7.864E-03	0.00 %
ZN-65	1.285E+02	2.78 %
ZR-95	1.643E+00	0.04 %
Total Activity (Ci)	4.619	100.00 %
Container Volume	11568.950 ft3	327.602 m3

Table 2-15

Annual Waste Release Summary Report

Year: 2008
Class: B Volume Reduction Vendor: No
Source: Cartridge Filters
Container: HIC (High Integrity Container)
Process: Non-Processed

Nuclides	Activity (mCi)	% of Total
C-14	< 1.420E+02	0.05 %
CO-57	2.267E+01	0.01 %
CO-58	9.749E+02	0.31 %
CO-60	8.358E+04	26.80 %
CR-51	7.232E+02	0.23 %
CS-137	3.944E+02	0.13 %
FE-55	1.837E+05	58.91 %
FE-59	6.132E+02	0.20 %
H-3	< 1.950E+02	0.06 %
I-129	< 6.000E+00	0.00 %
MN-54	3.571E+04	11.45 %
NB-95	7.113E+02	0.23 %
NI-63	8.835E+02	0.28 %
SB-124	2.230E+01	0.01 %
SB-125	8.404E+02	0.27 %
TC-99	3.100E+01	0.01 %
ZN-65	2.936E+03	0.94 %
ZR-95	3.604E+02	0.12 %
Total Activity (Ci)	311.846	100.00 %
Container Volume	120.030 ft3	3.399 m3

Table 2-16

Annual Waste Release Summary Report

Year: 2008
Class: B Volume Reduction Vendor: No
Source: Non-Processed DAW
Container: HIC (High Integrity Container)
Process: Non-Processed

Nuclides	Activity (mCi)	% of Total
C-14	< 3.760E-02	0.04 %
CO-57	6.580E-03	0.01 %
CO-58	2.360E-01	0.28 %
CO-60	2.190E+01	26.09 %
CR-51	1.990E-01	0.24 %
CS-137	1.310E-01	0.16 %
FE-55	4.950E+01	58.98 %
FE-59	1.690E-01	0.20 %
H-3	< 5.720E-02	0.07 %
I-129	< 1.790E-03	0.00 %
MN-54	1.000E+01	11.91 %
NB-95	2.670E-01	0.32 %
NI-63	2.100E-01	0.25 %
SB-125	2.550E-01	0.30 %
TC-99	< 1.110E-01	0.13 %
ZN-65	7.350E-01	0.88 %
ZR-95	1.160E-01	0.14 %
Total Activity (Ci)	0.084	100.00 %
Container Volume	0.230 ft3	0.007 m3

Table 2-17

Annual Waste Release Summary Report

Year: 2008
Class: C Volume Reduction Vendor: No
Source: Irradiated Components
Container: Steel Liner
Process: N/A

Nuclides	Activity (mCi)	% of Total
C-14	5.103E+03	0.00 %
CO-58	3.109E+05	0.12 %
CO-60	1.408E+07	5.41 %
CR-51	6.721E+05	0.26 %
CS-137	1.555E-02	0.00 %
FE-55	6.704E+06	2.58 %
FE-59	2.125E+04	0.01 %
H-3	6.449E+02	0.00 %
HF-181	3.869E+05	0.15 %
I-129	< 2.640E-05	0.00 %
MN-54	5.291E+05	0.20 %
NB-94	1.757E+02	0.00 %
NB-95	6.940E+07	26.66 %
NI-59	1.781E+03	0.00 %
NI-63	3.135E+05	0.12 %
SB-125	2.177E+07	8.36 %
SN-113	3.415E+06	1.31 %
SN-119M	5.005E+07	19.22 %
SN-123	1.381E+06	0.53 %
TA-182	4.840E+05	0.19 %
TC-99	4.040E+00	0.00 %
TE-125M	1.246E+06	0.48 %
ZR-95	8.957E+07	34.40 %
Total Activity (Ci)	260339.97	100.00 %
Container Volume	516.600 ft3	14.629 m3

Table 2-18

Annual Waste Release Summary Report

Year: 2008
Class: C Volume Reduction Vendor: Yes
Source: Condensate Demineralizer / Radwaste Demineralizer
Container: HIC (High Integrity Container)
Process: Pyrolysis

Nuclides	Activity (mCi)	% of Total
C-14	1.715E+01	4.69 %
CE-144	5.158E-02	0.01 %
CM-242	5.666E-04	0.00 %
CM-244	1.450E-04	0.00 %
CO-58	1.011E+01	2.76 %
CO-60	9.975E+01	27.28 %
CR-51	7.600E-02	0.02 %
CS-137	2.341E-01	0.06 %
FE-55	8.175E+00	2.24 %
FE-59	1.700E-02	0.00 %
H-3	1.270E+02	34.72 %
I-129	< 4.720E-03	0.00 %
MN-54	6.297E+01	17.22 %
NI-63	1.264E+00	0.35 %
PU-238	6.056E-02	0.02 %
PU-239	8.820E-03	0.00 %
PU-241	2.040E-01	0.06 %
SB-124	6.960E-02	0.02 %
SB-125	2.040E-01	0.06 %
SR-90	3.181E-02	0.01 %
TC-99	< 1.950E-01	0.05 %
ZN-65	3.812E+01	10.42 %
Total Activity (Ci)	0.366	100.00 %
Container Volume	76.480 ft3	2.166 m3

Table 2-19

Annual Waste Release Summary Report

Year: 2008
Class: C Volume Reduction Vendor: Yes
Source: Liquid Radwaste Filter Media
Container: HIC (High Integrity Container)
Process: Pyrolysis

Nuclides	Activity (mCi)	% of Total
C-14	1.500E-03	0.00 %
CE-144	4.020E-02	0.00 %
CM-244	2.270E-03	0.00 %
CO-58	4.920E+00	0.50 %
CO-60	1.960E+02	20.05 %
CR-51	2.110E+00	0.22 %
CS-137	2.070E-03	0.00 %
FE-55	6.720E+02	68.75 %
FE-59	9.180E-01	0.09 %
H-3	1.400E+00	0.14 %
I-129	< 3.550E-03	0.00 %
MN-54	5.800E+01	5.93 %
NB-95	5.770E-01	0.06 %
NI-63	1.810E+01	1.85 %
PU-241	5.190E-01	0.05 %
SR-90	1.500E-02	0.00 %
TC-99	< 2.310E-03	0.00 %
ZN-65	2.280E+01	2.33 %
Total Activity (Ci)	0.977	100.00 %
Container Volume	4.510 ft3	0.128 m3

SECTION 3

METEOROLOGICAL DATA AND DISPERSION ESTIMATES

METEOROLOGY AND DISPERSION DATA

Meteorological data have been collected at the PPL Susquehanna, LLC site since the early 1970s. At the present time, the meteorological system is based on a 300-foot high tower located approximately 1,000 feet to the southeast of the plant. Wind sensors are mounted at the 10m and 60m elevations on this tower. Vertical temperature differential is measured with redundant sensor pairs between the 10m and 60m levels. Sigma theta (the standard deviation of horizontal wind direction) is calculated from wind direction at both levels. Dew point and ambient temperature sensors are present at the 10m level. Precipitation is measured at ground level.

A back-up meteorological tower was erected in 1982. It is a 10m tower providing alternate measurements of wind speed, wind direction, and sigma theta. A 10m supplemental downriver meteorological tower is also available. This tower measures wind speed, wind direction, sigma theta, temperature and dew point.

Meteorological data are transmitted to the plant Control Room, Technical Support Center, Emergency Operations Facility for emergency response availability, and ABSG Consulting, Inc. ABSG Consulting, Inc., located in Rockville, Maryland, provides meteorological consulting services to PPL Susquehanna, LLC.

Regulatory Guide 1.23 (Safety Guide 23) requires at least 90% data recovery for meteorological instrumentation. During 2008, all meteorological instrumentation met the 90% data recovery requirement. Table 3-1 lists the percent valid data recovery values for the parameters monitored as part of the PPL Susquehanna Meteorological Monitoring Program.

Dispersion modeling for effluents from normal operation is done using the MIDAS system XDCALC program, a straight-line Gaussian plume model designed to estimate average relative concentration. The model was developed in accordance with Regulatory Guide 1.111. For periods when the wind speed is calm, the actual wind direction that last occurred is used.

XDCALC and the XQINTR program that interpolates X/Q values to exact locations both use terrain correction factors to account for the temporal and spatial variations in the airflow in the region. A straight-line trajectory model assumes that a constant mean wind transports and diffuses effluents in the direction of airflow at the release point within the entire region of interest. The terrain correction factors were taken from FSAR Table 2.3-128.

Tables 3-2 and 3-3 provide the joint frequency distribution of wind speed and direction (as a function of delta temperature) at the 10 and 60 meter elevations of the primary meteorological tower. Table 3-4 lists no decay, undepleted X/Q values at various distances from the site. Table 3-5 lists 2.26 day decay, undepleted X/Q values at various distances from the site. Table 3-6 lists 8-day decay, depleted X/Q values at various distances from the site and Table 3-7 is a listing of D/Q (relative deposition) values at various distances from the site.

TABLE 3-1

METEOROLOGICAL DATA RECOVERY FOR 2008

Parameter	Percent Valid Data Recovery
Wind Speed 10m - Primary (1) Wind Speed 60m – Primary Wind Speed 10m – Backup (2) Wind Speed 10m – Downriver (3)	99.6 99.8 99.9 99.7
Wind Direction 10m - Primary Wind Direction 60m – Primary Wind Direction 10m – Backup Wind Direction 10m – Downriver	99.5 99.7 99.9 99.7
Temperature 10m – Primary Dew Point 10m – Primary	99.6 99.0(4)
Delta Temperature 60m – Primary	99.6
Sigma Theta 10m – Primary Sigma Theta 60m – Primary Sigma Theta 10m – Backup Sigma Theta 10m – Downriver	99.6 99.8 99.9 99.7
Precipitation – Primary	100.0(5)
Composite Parameters	
Wind Speed and Direction 10m, Delta Temperature 60-10m	99.3
Wind Speed and Direction 60m, Delta Temperature 60-10m	99.6

(1) SSES "Primary" meteorological tower

(2) SSES "Backup" meteorological tower

(3) SSES "Downriver" meteorological tower

(4) Data supplemented with data from the Environmental Laboratory and NWS for the period of May 5 through October 30, 2008.

(5) Data supplemented with data from the Environmental Laboratory and NWS for the periods of May 9 through June 2 and November 1 through December 18, 2008.

TABLE 3-2

SSES JOINT FRQUENCY DISTRIBUTION OF WIND SPEED AND WIND DIRECTION 10m VERSUS DELTA TEMPERATURE 60-10m FOR THE PERIOD OF JANUARY 1, 2008 THROUGH DECEMBER 31, 2008

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 1/1/2008 00:00 12/31/2008 23:00

Elevation: **Speed:** 10M_SPD **Direction:** 10M_WD **Lapse:** DT60-10A

Stability Class A Delta Temperature Extremely Unstable

Wind Speed (m/s)

Wind Direction (from)	0.23 - 0.50	0.51 - 0.75	0.76 - 1.0	1.1 - 1.5	1.6 - 2.0	2.1 - 3.0	3.1 - 5.0	5.1 - 7.0	7.1 - 10.0	10.1 - 13.0	13.1 - 18.0	> 18.0	Total
N	0	0	0	1	0	1	0	0	0	0	0	0	2
NNE	0	0	0	0	0	0	3	0	0	0	0	0	3
NE	0	0	0	0	0	2	0	0	0	0	0	0	2
ENE	0	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	0	0	1	0	1	0	0	0	0	0	2
ESE	0	0	1	1	0	0	2	0	0	0	0	0	4
SE	0	0	0	0	0	0	4	0	0	0	0	0	4
SSE	0	0	0	1	0	0	5	0	0	0	0	0	6
S	0	0	0	1	0	1	3	2	0	0	0	0	7
SSW	0	0	0	1	1	3	8	0	0	0	0	0	13
SW	0	0	0	0	3	7	30	1	0	0	0	0	41
WSW	0	0	0	1	1	1	6	2	0	0	0	0	11
W	0	0	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals	0	0	1	6	6	15	62	5	0	0	0	0	95

Number of Calm Hours not included above for:	**Total Period**	1
Number of Variable Direction Hours for:	**Total Period**	0
Number of Invalid Hours for:	**Total Period**	58
Number of Valid Hours for:	**Total Period**	95
Total Hours for:	**Total Period**	8784

TABLE 3-2
(continued)

SSES JOINT FRQUENCY DISTRIBUTION OF WIND SPEED AND WIND DIRECTION 10m VERSUS DELTA TEMPERATURE 60-10m FOR THE PERIOD OF JANUARY 1, 2008 THROUGH DECEMBER 31, 2008 (Continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 1/1/2008 00:00 12/31/2008 23:00

Elevation: **Speed:** 10M_SPD **Direction:** 10M_WD **Lapse:** DT60-10A

Stability Class B Delta Temperature Moderately Unstable

Wind Speed (m/s)

Wind Direction (from)	0.23 - 0.50	0.51 - 0.75	0.76 - 1.0	1.1 - 1.5	1.6 - 2.0	2.1 - 3.0	3.1 - 5.0	5.1 - 7.0	7.1 - 10.0	10.1 - 13.0	13.1 - 18.0	> 18.0	Total
N	0	0	0	0	0	1	4	1	0	0	0	0	6
NNE	0	0	0	0	1	4	10	0	0	0	0	0	15
NE	0	0	0	0	2	6	2	0	0	0	0	0	10
ENE	0	0	0	1	0	1	0	0	0	0	0	0	2
E	0	0	0	2	1	1	2	0	0	0	0	0	6
ESE	0	0	0	2	1	2	3	0	0	0	0	0	8
SE	0	0	0	2	0	0	3	0	0	0	0	0	5
SSE	0	0	0	1	1	1	10	0	0	0	0	0	13
S	0	0	0	1	0	1	5	0	0	0	0	0	7
SSW	0	0	0	0	2	7	5	0	0	0	0	0	14
SW	0	0	0	0	0	12	34	5	0	0	0	0	51
WSW	0	0	0	0	1	3	18	9	0	0	0	0	31
W	0	0	0	1	0	2	3	1	0	0	0	0	7
WNW	0	0	0	0	0	0	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0	2	0	0	0	0	2
NNW	0	0	0	0	0	0	3	0	0	0	0	0	3
Totals	0	0	0	10	9	41	102	18	0	0	0	0	180

Number of Calm Hours not included above for:	**Total Period**	1
Number of Variable Direction Hours for:	**Total Period**	0
Number of Invalid Hours for:	**Total Period**	58
Number of Valid Hours for:	**Total Period**	180
Total Hours for:	**Total Period**	8784

TABLE 3-2
(continued)

SSES JOINT FRQUENCY DISTRIBUTION OF WIND SPEED AND WIND DIRECTION 10m VERSUS DELTA TEMPERATURE 60-10m FOR THE PERIOD OF JANUARY 1, 2008 THROUGH DECEMBER 31, 2008 (Continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 1/1/2008 00:00 12/31/2008 23:00

Elevation: **Speed:** 10M_SPD **Direction:** 10M_WD **Lapse:** DT60-10A

Stability Class C Delta Temperature Slightly Unstable

Wind Speed (m/s)

Wind Direction (from)	0.23 - 0.50	0.51 - 0.75	0.76 - 1.0	1.1 - 1.5	1.6 - 2.0	2.1 - 3.0	3.1 - 5.0	5.1 - 7.0	7.1 - 10.0	10.1 - 13.0	13.1 - 18.0	> 18.0	Total
N	0	0	0	0	0	1	23	0	0	0	0	0	24
NNE	0	0	0	0	3	10	11	0	0	0	0	0	24
NE	0	0	0	2	7	10	1	0	0	0	0	0	20
ENE	0	0	0	1	4	2	0	0	0	0	0	0	7
E	0	0	0	3	1	0	0	0	0	0	0	0	4
ESE	0	0	1	0	0	2	4	0	0	0	0	0	7
SE	0	0	0	1	3	4	8	0	0	0	0	0	16
SSE	0	0	0	0	1	4	7	0	0	0	0	0	12
S	0	0	0	1	2	5	7	1	0	0	0	0	16
SSW	0	0	0	2	3	15	8	0	0	0	0	0	28
SW	0	0	0	0	3	27	57	8	0	0	0	0	95
WSW	0	0	0	0	2	9	19	10	5	0	0	0	45
W	0	0	0	0	0	1	11	5	0	0	0	0	17
WNW	0	0	0	0	1	1	2	1	0	0	0	0	5
NW	0	0	0	1	1	1	1	2	0	0	0	0	6
NNW	0	0	0	0	2	4	11	2	0	0	0	0	19
Totals	0	0	1	11	33	96	170	29	5	0	0	0	345

Number of Calm Hours not included above for:	**Total Period**	1
Number of Variable Direction Hours for:	**Total Period**	0
Number of Invalid Hours for:	**Total Period**	58
Number of Valid Hours for:	**Total Period**	345
Total Hours for:	**Total Period**	8784

TABLE 3-2
(continued)

SSES JOINT FRQUENCY DISTRIBUTION OF WIND SPEED AND WIND DIRECTION 10m VERSUS DELTA TEMPERATURE 60-10m FOR THE PERIOD OF JANUARY 1, 2008 THROUGH DECEMBER 31, 2008 (Continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 1/1/2008 00:00 12/31/2008 23:00

Elevation: **Speed:** 10M_SPD **Direction:** 10M_WD **Lapse:** DT60-10A

Stability Class D Delta Temperature Neutral

Wind Speed (m/s)

Wind Direction (from)	0.23 - 0.50	0.51 - 0.75	0.76 - 1.0	1.1 - 1.5	1.6 - 2.0	2.1 - 3.0	3.1 - 5.0	5.1 - 7.0	7.1 - 10.0	10.1 - 13.0	13.1 - 18.0	> 18.0	Total
N	0	1	5	20	33	96	132	5	0	0	0	0	292
NNE	0	4	18	49	42	108	68	0	0	0	0	0	289
NE	0	6	25	64	59	78	22	0	0	0	0	0	254
ENE	2	12	33	47	13	24	7	0	0	0	0	0	138
E	1	21	36	38	19	29	8	1	0	0	0	0	153
ESE	3	17	20	36	14	32	17	1	0	0	0	0	140
SE	2	14	37	43	24	42	25	1	0	0	0	0	188
SSE	0	13	17	41	36	60	27	3	0	0	0	0	197
S	0	6	23	44	45	70	36	0	0	0	0	0	224
SSW	0	3	7	60	53	95	45	0	0	0	0	0	263
SW	0	2	9	39	78	192	250	36	6	1	0	0	613
WSW	0	0	3	18	29	71	132	77	26	1	0	0	357
W	0	0	1	16	15	46	77	44	5	0	0	0	204
WNW	0	0	0	8	12	42	69	55	2	0	0	0	188
NW	1	1	3	2	13	51	145	43	3	0	0	0	262
NNW	0	0	0	11	22	80	162	31	3	0	0	0	309
Totals	9	100	237	536	507	1116	1222	297	45	2	0	0	4071

Number of Calm Hours not included above for:	**Total Period**	1
Number of Variable Direction Hours for:	**Total Period**	0
Number of Invalid Hours for:	**Total Period**	58
Number of Valid Hours for:	**Total Period**	4071
Total Hours for:	**Total Period**	8784

TABLE 3-2
(continued)

SSES JOINT FRQUENCY DISTRIBUTION OF WIND SPEED AND WIND DIRECTION 10m VERSUS DELTA TEMPERATURE 60-10m FOR THE PERIOD OF JANUARY 1, 2008 THROUGH DECEMBER 31, 2008 (Continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 1/1/2008 00:00 12/31/2008 23:00

Elevation: **Speed:** 10M_SPD **Direction:** 10M_WD **Lapse:** DT60-10A

Stability Class E Delta Temperature Slightly Stable

Wind Speed (m/s)

Wind Direction (from)	0.23 - 0.50	0.51 - 0.75	0.76 - 1.0	1.1 - 1.5	1.6 - 2.0	2.1 - 3.0	3.1 - 5.0	5.1 - 7.0	7.1 - 10.0	10.1 - 13.0	13.1 - 18.0	> 18.0	Total
N	3	1	3	26	27	32	10	0	0	0	0	0	102
NNE	1	7	24	87	72	40	3	0	0	0	0	0	234
NE	2	33	63	122	49	31	5	0	0	0	0	0	305
ENE	6	69	113	89	11	3	4	0	0	0	0	0	295
E	7	79	70	28	3	3	1	0	0	0	0	0	191
ESE	8	60	59	16	5	7	4	0	0	0	0	0	159
SE	9	37	54	28	4	5	4	0	0	0	0	0	141
SSE	1	30	40	29	14	9	7	1	0	0	0	0	131
S	3	12	37	85	51	53	11	4	0	0	0	0	256
SSW	0	2	19	65	66	86	39	3	0	0	0	0	280
SW	0	4	9	33	39	66	41	4	0	0	0	0	196
WSW	0	0	3	10	9	15	12	2	0	0	0	0	51
W	0	0	0	4	3	2	4	1	0	0	0	0	14
WNW	0	0	1	4	4	1	1	0	0	0	0	0	11
NW	0	0	2	7	3	3	3	0	1	0	0	0	19
NNW	0	1	3	5	5	14	3	1	0	0	0	0	32
Totals	40	335	500	638	365	370	152	16	1	0	0	0	2417

Number of Calm Hours not included above for:	**Total Period**	1
Number of Variable Direction Hours for:	**Total Period**	0
Number of Invalid Hours for:	**Total Period**	58
Number of Valid Hours for:	**Total Period**	2417
Total Hours for:	**Total Period**	8784

TABLE 3-2
(continued)

SSES JOINT FRQUENCY DISTRIBUTION OF WIND SPEED AND WIND DIRECTION 10m VERSUS DELTA TEMPERATURE 60-10m FOR THE PERIOD OF JANUARY 1, 2008 THROUGH DECEMBER 31, 2008 (Continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 1/1/2008 00:00 12/31/2008 23:00

Elevation: **Speed:** 10M_SPD **Direction:** 10M_WD **Lapse:** DT60-10A

Stability Class F Delta Temperature Moderately Stable

Wind Speed (m/s)

Wind Direction (from)	0.23 - 0.50	0.51 - 0.75	0.76 - 1.0	1.1 - 1.5	1.6 - 2.0	2.1 - 3.0	3.1 - 5.0	5.1 - 7.0	7.1 - 10.0	10.1 - 13.0	13.1 - 18.0	> 18.0	Total
N	0	0	1	2	5	2	0	0	0	0	0	0	10
NNE	2	1	7	18	9	0	0	0	0	0	0	0	37
NE	2	9	49	58	12	0	0	0	0	0	0	0	130
ENE	11	73	188	177	10	0	0	0	0	0	0	0	459
E	5	72	74	26	0	0	0	0	0	0	0	0	177
ESE	6	38	22	4	0	0	0	0	0	0	0	0	70
SE	2	13	17	5	0	0	0	0	0	0	0	0	37
SSE	1	6	11	14	1	0	0	0	0	0	0	0	33
S	0	5	9	18	4	2	0	0	0	0	0	0	38
SSW	0	3	4	7	6	1	1	0	0	0	0	0	22
SW	0	1	3	4	1	2	2	0	0	0	0	0	13
WSW	0	0	1	2	0	0	0	0	0	0	0	0	3
W	0	0	1	0	0	0	0	0	0	0	0	0	1
WNW	0	0	0	0	1	0	0	0	0	0	0	0	1
NW	0	0	0	1	0	0	0	0	0	0	0	0	1
NNW	0	0	0	1	1	1	0	0	0	0	0	0	3
Totals	29	221	387	337	50	8	3	0	0	0	0	0	1035

Number of Calm Hours not included above for:	**Total Period**	1
Number of Variable Direction Hours for:	**Total Period**	0
Number of Invalid Hours for:	**Total Period**	58
Number of Valid Hours for:	**Total Period**	1035
Total Hours for:	**Total Period**	8784

TABLE 3-2
(continued)

SSES JOINT FRQUENCY DISTRIBUTION OF WIND SPEED AND WIND DIRECTION 10m VERSUS DELTA TEMPERATURE 60-10m FOR THE PERIOD OF JANUARY 1, 2008 THROUGH DECEMBER 31, 2008 (Continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 1/1/2008 00:00 12/31/2008 23:00

Elevation: **Speed:** 10M_SPD **Direction:** 10M_WD **Lapse:** DT60-10A

Stability Class G Delta Temperature Extremely Stable

Wind Speed (m/s)

Wind Direction (from)	0.23 - 0.50	0.51 - 0.75	0.76 - 1.0	1.1 - 1.5	1.6 - 2.0	2.1 - 3.0	3.1 - 5.0	5.1 - 7.0	7.1 - 10.0	10.1 - 13.0	13.1 - 18.0	> 18.0	Total
N	0	1	0	0	0	0	0	0	0	0	0	0	1
NNE	0	1	2	6	2	0	0	0	0	0	0	0	11
NE	0	9	31	25	5	0	0	0	0	0	0	0	70
ENE	3	27	135	205	6	1	0	0	0	0	0	0	377
E	3	21	42	12	0	0	0	0	0	0	0	0	78
ESE	1	4	9	3	0	0	0	0	0	0	0	0	17
SE	0	3	7	5	0	0	0	0	0	0	0	0	15
SSE	0	2	3	1	1	0	0	0	0	0	0	0	7
S	0	0	1	1	1	0	0	0	0	0	0	0	3
SSW	0	0	1	0	0	0	0	0	0	0	0	0	1
SW	0	0	0	0	0	0	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0	0	0	0	0	0	0
NNW	0	1	0	0	1	0	0	0	0	0	0	0	2
Totals	7	69	231	258	16	1	0	0	0	0	0	0	582

Number of Calm Hours not included above for:	**Total Period**	1
Number of Variable Direction Hours for:	**Total Period**	0
Number of Invalid Hours for:	**Total Period**	58
Number of Valid Hours for:	**Total Period**	582
Total Hours for:	**Total Period**	8784

TABLE 3-2
(continued)

SSES JOINT FRQUENCY DISTRIBUTION OF WIND SPEED AND WIND DIRECTION 10m VERSUS DELTA TEMPERATURE 60-10m FOR THE PERIOD OF JANUARY 1, 2008 THROUGH DECEMBER 31, 2008 (Continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Summary of All Stability Classes

Total Period

Period of Record = 1/1/2008 00:00 12/31/2008 23:00

Elevation: **Speed:** 10M_SPD **Direction:** 10M_WD **Lapse:** DT60-10A

Delta Temperature

Wind Speed (m/s)

Wind Direction (from)	0.23 - 0.50	0.51 - 0.75	0.76 - 1.0	1.1 - 1.5	1.6 - 2.0	2.1 - 3.0	3.1 - 5.0	5.1 - 7.0	7.1 - 10.0	10.1 - 13.0	13.1 - 18.0	> 18.0	Total
N	3	3	9	49	65	133	169	6	0	0	0	0	437
NNE	3	13	51	160	129	162	95	0	0	0	0	0	613
NE	4	57	168	271	134	127	30	0	0	0	0	0	791
ENE	22	181	469	520	44	31	11	0	0	0	0	0	1278
E	16	193	222	109	25	33	12	1	0	0	0	0	611
ESE	18	119	112	62	20	43	30	1	0	0	0	0	405
SE	13	67	115	84	31	51	44	1	0	0	0	0	406
SSE	2	51	71	87	54	74	56	4	0	0	0	0	399
S	3	23	70	151	103	132	62	7	0	0	0	0	551
SSW	0	8	31	135	131	207	106	3	0	0	0	0	621
SW	0	7	21	76	124	306	414	54	6	1	0	0	1009
WSW	0	0	7	31	42	99	187	100	31	1	0	0	498
W	0	0	2	21	18	51	95	51	5	0	0	0	243
WNW	0	0	1	12	18	44	72	56	2	0	0	0	205
NW	1	1	5	11	17	55	149	47	4	0	0	0	290
NNW	0	2	3	17	31	99	179	34	3	0	0	0	368
Totals	85	725	1357	1796	986	1647	1711	365	51	2	0	0	8725

Number of Calm Hours not included above for:	**Total Period**	1
Number of Variable Direction Hours for:	**Total Period**	0
Number of Invalid Hours for:	**Total Period**	58
Number of Valid Hours for:	**Total Period**	8725
Total Hours for:	**Total Period**	8784

TABLE 3-3

SSES JOINT FRQUENCY DISTRIBUTION OF WIND SPEED AND WIND DIRECTION 60m VERSUS DELTA TEMPERATURE 60-10m FOR THE PERIOD OF JANUARY 1, 2008 THROUGH DECEMBER 31, 2008

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 1/1/2008 00:00 12/31/2008 23:00

Elevation: **Speed:** 60M_SPD **Direction:** 60M_WD **Lapse:** DT60-10A

Stability Class A Delta Temperature Extremely Unstable

	Wind Speed (m/s)												
Wind Direction (from)	**0.23 - 0.50**	**0.51 - 0.75**	**0.76 - 1.0**	**1.1 - 1.5**	**1.6 - 2.0**	**2.1 - 3.0**	**3.1 - 5.0**	**5.1 - 7.0**	**7.1 - 10.0**	**10.1 - 13.0**	**13.1 - 18.0**	**> 18.0**	**Total**
N	0	0	0	0	0	1	0	0	0	0	0	0	1
NNE	0	0	0	1	0	0	3	1	0	0	0	0	5
NE	0	0	0	0	0	0	1	0	0	0	0	0	1
ENE	0	0	2	0	0	0	0	0	0	0	0	0	2
E	0	0	0	0	0	1	1	1	0	0	0	0	3
ESE	0	0	0	0	0	0	0	1	0	0	0	0	1
SE	0	0	0	0	0	0	1	3	2	0	0	0	6
SSE	0	0	0	0	0	0	1	2	0	0	0	0	3
S	0	0	1	1	0	0	0	2	2	0	0	0	6
SSW	0	0	0	1	0	2	3	2	3	0	0	0	11
SW	0	0	0	1	0	2	22	19	2	0	0	0	46
WSW	0	0	0	0	1	0	0	6	3	0	0	0	10
W	0	0	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals	0	0	3	4	1	6	32	37	12	0	0	0	95

Number of Calm Hours not included above for:	**Total Period**	0
Number of Variable Direction Hours for:	**Total Period**	0
Number of Invalid Hours for:	**Total Period**	43
Number of Valid Hours for:	**Total Period**	95
Total Hours for:	**Total Period**	8784

TABLE 3-3
(continued)

SSES JOINT FRQUENCY DISTRIBUTION OF WIND SPEED AND WIND DIRECTION 60m VERSUS DELTA TEMPERATURE 60-10m FOR THE PERIOD OF JANUARY 1, 2008 THROUGH DECEMBER 31, 2008 (Continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 1/1/2008 00:00 12/31/2008 23:00

Elevation: **Speed:** 60M_SPD **Direction:** 60M_WD **Lapse:** DT60-10A

Stability Class B Delta Temperature Moderately Unstable

Wind Speed (m/s)

Wind Direction (from)	0.23 - 0.50	0.51 - 0.75	0.76 - 1.0	1.1 - 1.5	1.6 - 2.0	2.1 - 3.0	3.1 - 5.0	5.1 - 7.0	7.1 - 10.0	10.1 - 13.0	13.1 - 18.0	> 18.0	Total
N	0	0	0	0	0	0	3	3	0	0	0	0	6
NNE	0	0	0	0	0	3	10	4	0	0	0	0	17
NE	0	0	1	2	1	1	4	0	0	0	0	0	9
ENE	0	0	2	0	0	0	0	0	0	0	0	0	2
E	0	0	0	0	2	0	1	2	1	0	0	0	6
ESE	0	0	0	1	1	0	4	0	0	0	0	0	6
SE	0	0	0	0	0	2	2	1	0	0	0	0	5
SSE	0	0	0	1	1	0	1	8	0	0	0	0	11
S	0	0	0	0	1	0	0	3	2	0	0	0	6
SSW	0	0	0	0	1	4	2	4	4	0	0	0	15
SW	0	0	0	0	1	1	27	19	5	1	0	0	54
WSW	0	0	0	0	1	0	9	15	10	0	0	0	35
W	0	0	0	0	0	0	0	1	0	0	0	0	1
WNW	0	0	0	0	0	0	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	1	2	0	0	0	0	3
NNW	0	0	0	0	0	0	3	1	0	0	0	0	4
Totals	0	0	3	4	9	11	67	63	22	1	0	0	180

Number of Calm Hours not included above for:	**Total Period**	0
Number of Variable Direction Hours for:	**Total Period**	0
Number of Invalid Hours for:	**Total Period**	43
Number of Valid Hours for:	**Total Period**	180
Total Hours for:	**Total Period**	8784

TABLE 3-3
(continued)

SSES JOINT FRQUENCY DISTRIBUTION OF WIND SPEED AND WIND DIRECTION 60m VERSUS DELTA TEMPERATURE 60-10m FOR THE PERIOD OF JANUARY 1, 2008 THROUGH DECEMBER 31, 2008 (Continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 1/1/2008 00:00 12/31/2008 23:00

Elevation: **Speed:** 60M_SPD **Direction:** 60M_WD **Lapse:** DT60-10A

Stability Class C Delta Temperature Slightly Unstable

Wind Speed (m/s)

Wind Direction (from)	0.23 - 0.50	0.51 - 0.75	0.76 - 1.0	1.1 - 1.5	1.6 - 2.0	2.1 - 3.0	3.1 - 5.0	5.1 - 7.0	7.1 - 10.0	10.1 - 13.0	13.1 - 18.0	> 18.0	Total
N	0	0	0	0	2	1	15	6	0	0	0	0	24
NNE	0	0	0	0	5	6	17	6	1	0	0	0	35
NE	0	1	0	3	1	8	4	0	0	0	0	0	17
ENE	0	0	0	0	0	1	0	0	0	0	0	0	1
E	0	0	0	0	0	0	1	1	1	0	0	0	3
ESE	0	0	1	0	0	3	1	1	1	0	0	0	7
SE	0	0	0	0	2	2	6	2	2	0	0	0	14
SSE	0	0	0	0	0	1	6	2	0	0	0	0	9
S	0	0	1	1	1	3	4	4	2	0	0	0	16
SSW	0	0	0	0	3	4	7	7	2	0	0	0	23
SW	0	0	0	0	1	9	59	27	4	0	0	0	100
WSW	0	0	0	0	0	1	20	9	15	4	1	0	50
W	0	0	0	0	1	0	6	6	5	0	0	0	18
WNW	0	0	0	0	0	0	2	0	0	0	0	0	2
NW	0	0	0	0	1	1	2	2	1	0	0	0	7
NNW	0	0	0	0	0	2	11	6	0	0	0	0	19
Totals	0	1	2	4	17	42	161	79	34	4	1	0	345

Number of Calm Hours not included above for:	**Total Period**	0
Number of Variable Direction Hours for:	**Total Period**	0
Number of Invalid Hours for:	**Total Period**	43
Number of Valid Hours for:	**Total Period**	345
Total Hours for:	**Total Period**	8784

TABLE 3-3
(continued)

SSES JOINT FRQUENCY DISTRIBUTION OF WIND SPEED AND WIND DIRECTION 60m VERSUS DELTA TEMPERATURE 60-10m FOR THE PERIOD OF JANUARY 1, 2008 THROUGH DECEMBER 31, 2008 (Continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 1/1/2008 00:00 12/31/2008 23:00

Elevation: **Speed:** 60M_SPD **Direction:** 60M_WD **Lapse:** DT60-10A

Stability Class D Delta Temperature Neutral

Wind Speed (m/s)

Wind Direction (from)	0.23 - 0.50	0.51 - 0.75	0.76 - 1.0	1.1 - 1.5	1.6 - 2.0	2.1 - 3.0	3.1 - 5.0	5.1 - 7.0	7.1 - 10.0	10.1 - 13.0	13.1 - 18.0	> 18.0	Total
N	0	1	2	21	18	51	129	51	0	0	0	0	273
NNE	1	0	7	32	29	66	126	60	7	0	0	0	328
NE	0	6	24	47	19	46	50	13	3	0	0	0	208
ENE	0	8	17	24	24	12	21	4	0	0	0	0	110
E	2	14	9	24	15	27	39	12	4	0	0	0	146
ESE	1	6	11	13	9	18	30	12	4	0	0	0	104
SE	0	6	6	18	18	25	46	12	8	0	0	0	139
SSE	0	7	12	17	13	29	53	18	3	0	0	0	152
S	0	5	7	29	22	30	61	30	16	0	0	0	200
SSW	0	1	8	31	42	59	53	34	22	0	0	0	250
SW	1	2	5	24	37	127	238	149	42	1	0	0	626
WSW	1	0	1	9	14	43	150	167	122	32	10	0	549
W	0	0	0	6	8	24	87	64	54	3	0	0	246
WNW	0	1	0	3	7	15	91	71	43	0	0	0	231
NW	0	0	0	1	5	20	143	78	15	0	0	0	262
NNW	0	0	2	4	3	24	126	86	4	0	0	0	249
Totals	6	57	111	303	283	616	1443	861	347	36	10	0	4073

Number of Calm Hours not included above for:	**Total Period**	0
Number of Variable Direction Hours for:	**Total Period**	0
Number of Invalid Hours for:	**Total Period**	43
Number of Valid Hours for:	**Total Period**	4073
Total Hours for:	**Total Period**	8784

TABLE 3-3
(continued)

SSES JOINT FRQUENCY DISTRIBUTION OF WIND SPEED AND WIND DIRECTION 60m VERSUS DELTA TEMPERATURE 60-10m FOR THE PERIOD OF JANUARY 1, 2008 THROUGH DECEMBER 31, 2008 (Continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 1/1/2008 00:00 12/31/2008 23:00

Elevation: **Speed:** 60M_SPD **Direction:** 60M_WD **Lapse:** DT60-10A

Stability Class E Delta Temperature Slightly Stable

Wind Speed (m/s)

Wind Direction (from)	0.23 - 0.50	0.51 - 0.75	0.76 - 1.0	1.1 - 1.5	1.6 - 2.0	2.1 - 3.0	3.1 - 5.0	5.1 - 7.0	7.1 - 10.0	10.1 - 13.0	13.1 - 18.0	> 18.0	Total
N	0	2	8	14	36	59	53	6	0	0	0	0	178
NNE	1	5	16	68	86	113	90	13	2	0	0	0	394
NE	3	16	44	71	39	45	43	4	1	0	0	0	266
ENE	1	9	24	20	19	26	10	4	0	0	0	0	113
E	3	10	25	16	15	18	5	2	0	0	0	0	94
ESE	2	11	13	12	5	17	9	3	1	0	0	0	73
SE	2	11	20	21	4	9	15	5	4	0	0	0	91
SSE	2	6	12	28	6	17	19	2	3	0	0	0	95
S	0	7	13	29	16	14	50	32	9	2	0	0	172
SSW	0	2	13	43	37	45	70	56	26	4	0	0	296
SW	0	4	3	20	43	68	141	73	4	0	0	0	356
WSW	0	0	1	2	11	30	64	44	11	1	0	0	164
W	0	0	1	6	6	9	6	5	1	0	0	0	34
WNW	0	2	0	2	5	7	4	0	1	0	0	0	21
NW	1	0	2	1	4	12	15	2	0	0	0	0	37
NNW	0	2	3	4	3	11	17	1	1	0	0	0	42
Totals	15	87	198	357	335	500	611	252	64	7	0	0	2426

Number of Calm Hours not included above for:	**Total Period**	0
Number of Variable Direction Hours for:	**Total Period**	0
Number of Invalid Hours for:	**Total Period**	43
Number of Valid Hours for:	**Total Period**	2426
Total Hours for:	**Total Period**	8784

TABLE 3-3
(continued)

SSES JOINT FRQUENCY DISTRIBUTION OF WIND SPEED AND WIND DIRECTION 60m VERSUS DELTA TEMPERATURE 60-10m FOR THE PERIOD OF JANUARY 1, 2008 THROUGH DECEMBER 31, 2008 (Continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 1/1/2008 00:00 12/31/2008 23:00

Elevation: **Speed:** 60M_SPD **Direction:** 60M_WD **Lapse:** DT60-10A

Stability Class F Delta Temperature Moderately Stable

Wind Speed (m/s)

Wind Direction (from)	0.23 - 0.50	0.51 - 0.75	0.76 - 1.0	1.1 - 1.5	1.6 - 2.0	2.1 - 3.0	3.1 - 5.0	5.1 - 7.0	7.1 - 10.0	10.1 - 13.0	13.1 - 18.0	> 18.0	Total
N	0	0	3	23	36	80	13	0	0	0	0	0	155
NNE	1	1	8	58	136	139	27	0	0	0	0	0	370
NE	0	6	19	60	21	18	0	0	0	0	0	0	124
ENE	0	10	18	21	2	1	0	0	0	0	0	0	52
E	1	3	16	15	2	0	0	0	0	0	0	0	37
ESE	0	4	10	17	0	0	1	0	0	0	0	0	32
SE	0	2	9	8	4	0	0	0	0	0	0	0	23
SSE	0	0	4	12	4	4	0	0	0	0	0	0	24
S	0	0	7	13	6	7	5	1	0	0	0	0	39
SSW	0	1	5	10	8	14	20	3	1	0	0	0	62
SW	0	0	5	5	6	19	25	1	1	0	0	0	62
WSW	0	0	0	6	2	4	12	1	1	0	0	0	26
W	0	0	0	0	2	0	0	0	0	0	0	0	2
WNW	0	0	1	1	1	1	1	0	0	0	0	0	5
NW	0	0	0	2	2	5	2	0	0	0	0	0	11
NNW	0	0	1	1	7	2	3	0	0	0	0	0	14
Totals	2	27	106	252	239	294	109	6	3	0	0	0	1038

Number of Calm Hours not included above for:	**Total Period**	0
Number of Variable Direction Hours for:	**Total Period**	0
Number of Invalid Hours for:	**Total Period**	43
Number of Valid Hours for:	**Total Period**	1038
Total Hours for:	**Total Period**	8784

TABLE 3-3
(continued)

SSES JOINT FRQUENCY DISTRIBUTION OF WIND SPEED AND WIND DIRECTION 60m VERSUS DELTA TEMPERATURE 60-10m FOR THE PERIOD OF JANUARY 1, 2008 THROUGH DECEMBER 31, 2008 (Continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 1/1/2008 00:00 12/31/2008 23:00

Elevation: **Speed:** 60M_SPD **Direction:** 60M_WD **Lapse:** DT60-10A

Stability Class G Delta Temperature Extremely Stable

Wind Speed (m/s)

Wind Direction (from)	0.23 - 0.50	0.51 - 0.75	0.76 - 1.0	1.1 - 1.5	1.6 - 2.0	2.1 - 3.0	3.1 - 5.0	5.1 - 7.0	7.1 - 10.0	10.1 - 13.0	13.1 - 18.0	> 18.0	Total
N	0	0	3	5	21	63	12	0	0	0	0	0	104
NNE	0	1	6	39	84	110	7	0	0	0	0	0	247
NE	0	1	8	22	16	12	0	0	0	0	0	0	59
ENE	0	1	11	17	6	1	0	0	0	0	0	0	36
E	0	0	4	11	0	0	0	0	0	0	0	0	15
ESE	0	0	6	8	2	2	0	0	0	0	0	0	18
SE	0	1	5	8	3	2	0	0	0	0	0	0	19
SSE	0	0	2	4	5	3	2	0	0	0	0	0	16
S	0	0	2	7	5	3	2	1	0	0	0	0	20
SSW	0	0	1	1	6	12	2	1	0	0	0	0	23
SW	0	0	0	0	2	10	8	0	0	0	0	0	20
WSW	0	0	0	0	1	0	1	0	0	0	0	0	2
W	0	0	0	1	0	0	0	0	0	0	0	0	1
WNW	0	0	0	0	0	0	1	0	0	0	0	0	1
NW	0	0	0	0	0	0	0	0	0	0	0	0	0
NNW	0	0	1	0	0	2	0	0	0	0	0	0	3
Totals	0	4	49	123	151	220	35	2	0	0	0	0	584

Number of Calm Hours not included above for:	**Total Period**	0
Number of Variable Direction Hours for:	**Total Period**	0
Number of Invalid Hours for:	**Total Period**	43
Number of Valid Hours for:	**Total Period**	584
Total Hours for:	**Total Period**	8784

TABLE 3-3
(continued)

SSES JOINT FRQUENCY DISTRIBUTION OF WIND SPEED AND WIND DIRECTION 60m VERSUS DELTA TEMPERATURE 60-10m FOR THE PERIOD OF JANUARY 1, 2008 THROUGH DECEMBER 31, 2008 (Continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Summary of All Stability Classes

Total Period

Period of Record = 1/1/2008 00:00 12/31/2008 23:00

Elevation: **Speed:** 60M_SPD **Direction:** 60M_WD **Lapse:** DT60-10A

Delta Temperature

Wind Speed (m/s)

Wind Direction (from)	0.23 - 0.50	0.51 - 0.75	0.76 - 1.0	1.1 - 1.5	1.6 - 2.0	2.1 - 3.0	3.1 - 5.0	5.1 - 7.0	7.1 - 10.0	10.1 - 13.0	13.1 - 18.0	> 18.0	Total
N	0	3	16	63	113	255	225	66	0	0	0	0	741
NNE	3	7	37	198	340	437	280	84	10	0	0	0	1396
NE	3	30	96	205	97	130	102	17	4	0	0	0	684
ENE	1	28	74	82	51	41	31	8	0	0	0	0	316
E	6	27	54	66	34	46	47	18	6	0	0	0	304
ESE	3	21	41	51	17	40	45	17	6	0	0	0	241
SE	2	20	40	55	31	40	70	23	16	0	0	0	297
SSE	2	13	30	62	29	54	82	32	6	0	0	0	310
S	0	12	31	80	51	57	122	73	31	2	0	0	459
SSW	0	4	27	86	97	140	157	107	58	4	0	0	680
SW	1	6	13	50	90	236	520	288	58	2	0	0	1264
WSW	1	0	2	17	30	78	256	242	162	37	11	0	836
W	0	0	1	13	17	33	99	76	60	3	0	0	302
WNW	0	3	1	6	13	23	99	71	44	0	0	0	260
NW	1	0	2	4	12	38	163	84	16	0	0	0	320
NNW	0	2	7	9	13	41	160	94	5	0	0	0	331
Totals	23	176	472	1047	1035	1689	2458	1300	482	48	11	0	8741

Number of Calm Hours not included above for:	**Total Period**	0
Number of Variable Direction Hours for:	**Total Period**	0
Number of Invalid Hours for:	**Total Period**	43
Number of Valid Hours for:	**Total Period**	8741
Total Hours for:	**Total Period**	8784

TABLE 3-4

2008 SSES Annual Relative Concentrations - No Decay, Undepleted X/Q (sec/m^3)

	Miles									
Direction From	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 10	10 - 20	20 - 30	30 - 40	40 - 50
N	4.25E-06	8.13E-07	3.36E-07	1.76E-07	1.13E-07	4.16E-08	1.13E-08	5.43E-09	3.40E-09	2.39E-09
NNE	8.78E-06	1.78E-06	7.95E-07	4.27E-07	2.76E-07	1.03E-07	2.83E-08	1.39E-08	8.86E-09	6.34E-09
NE	1.70E-05	3.25E-06	1.48E-06	8.33E-07	5.51E-07	2.17E-07	6.54E-08	3.28E-08	2.11E-08	1.53E-08
ENE	4.88E-05	9.09E-06	4.45E-06	2.63E-06	1.76E-06	6.97E-07	2.03E-07	9.85E-08	6.38E-08	4.69E-08
E	2.12E-05	3.88E-06	1.71E-06	9.68E-07	6.47E-07	2.63E-07	8.30E-08	4.20E-08	2.71E-08	1.98E-08
ESE	1.28E-05	2.52E-06	1.14E-06	6.37E-07	4.22E-07	1.70E-07	4.70E-08	2.07E-08	1.33E-08	9.59E-09
SE	1.23E-05	2.43E-06	1.10E-06	6.21E-07	4.11E-07	1.67E-07	4.15E-08	1.53E-08	9.74E-09	7.00E-09
SSE	9.05E-06	1.77E-06	7.82E-07	4.36E-07	2.92E-07	1.25E-07	3.24E-08	1.15E-08	7.34E-09	5.25E-09
S	7.52E-06	1.62E-06	7.83E-07	4.51E-07	3.08E-07	1.42E-07	3.91E-08	1.34E-08	8.51E-09	6.08E-09
SSW	7.83E-06	1.59E-06	7.27E-07	4.09E-07	2.70E-07	1.12E-07	2.88E-08	1.09E-08	6.87E-09	4.88E-09
SW	7.44E-06	1.50E-06	7.07E-07	4.02E-07	2.68E-07	1.16E-07	2.93E-08	9.71E-09	6.07E-09	4.26E-09
WSW	3.33E-06	6.39E-07	2.96E-07	1.74E-07	1.18E-07	5.53E-08	1.71E-08	6.35E-09	3.22E-09	1.75E-09
W	1.42E-06	2.63E-07	1.12E-07	6.11E-08	3.97E-08	1.59E-08	4.16E-09	1.65E-09	1.01E-09	6.92E-10
WNW	1.33E-06	2.41E-07	9.58E-08	4.99E-08	3.16E-08	1.15E-08	3.04E-09	1.42E-09	8.65E-10	5.93E-10
NW	2.07E-06	3.82E-07	1.51E-07	7.67E-08	4.84E-08	1.72E-08	4.46E-09	2.08E-09	1.27E-09	8.72E-10
NNW	2.89E-06	5.35E-07	2.25E-07	1.20E-07	7.53E-08	2.61E-08	6.47E-09	3.06E-09	1.89E-09	1.31E-09

TABLE 3-5

2008 SSES Annual Relative Concentrations - 2.26-Day Decay, Undepleted X/Q (sec/m^3)

	Miles									
Direction From	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 10	10 - 20	20 - 30	30 - 40	40 - 50
N	4.24E-06	8.08E-07	3.33E-07	1.74E-07	1.11E-07	4.04E-08	1.06E-08	4.92E-09	2.96E-09	2.01E-09
NNE	8.75E-06	1.76E-06	7.86E-07	4.20E-07	2.70E-07	9.91E-08	2.63E-08	1.23E-08	7.45E-09	5.07E-09
NE	1.69E-05	3.22E-06	1.46E-06	8.16E-07	5.36E-07	2.08E-07	5.98E-08	2.83E-08	1.71E-08	1.17E-08
ENE	4.87E-05	9.00E-06	4.38E-06	2.57E-06	1.71E-06	6.63E-07	1.84E-07	8.37E-08	5.09E-08	3.51E-08
E	2.11E-05	3.84E-06	1.68E-06	9.42E-07	6.25E-07	2.48E-07	7.39E-08	3.46E-08	2.07E-08	1.40E-08
ESE	1.27E-05	2.49E-06	1.12E-06	6.20E-07	4.08E-07	1.60E-07	4.17E-08	1.69E-08	1.00E-08	6.70E-09
SE	1.22E-05	2.40E-06	1.09E-06	6.05E-07	3.98E-07	1.58E-07	3.72E-08	1.27E-08	7.56E-09	5.06E-09
SSE	9.02E-06	1.76E-06	7.70E-07	4.27E-07	2.84E-07	1.19E-07	2.95E-08	9.83E-09	5.86E-09	3.94E-09
S	7.50E-06	1.60E-06	7.73E-07	4.43E-07	3.01E-07	1.37E-07	3.62E-08	1.18E-08	7.10E-09	4.82E-09
SSW	7.81E-06	1.58E-06	7.20E-07	4.03E-07	2.65E-07	1.08E-07	2.70E-08	9.81E-09	5.96E-09	4.06E-09
SW	7.43E-06	1.50E-06	7.01E-07	3.97E-07	2.64E-07	1.13E-07	2.79E-08	8.92E-09	5.39E-09	3.65E-09
WSW	3.33E-06	6.36E-07	2.94E-07	1.72E-07	1.17E-07	5.42E-08	1.64E-08	5.90E-09	2.91E-09	1.53E-09
W	1.42E-06	2.62E-07	1.12E-07	6.06E-08	3.92E-08	1.56E-08	3.99E-09	1.54E-09	9.16E-10	6.11E-10
WNW	1.32E-06	2.40E-07	9.52E-08	4.95E-08	3.13E-08	1.13E-08	2.93E-09	1.33E-09	7.88E-10	5.25E-10
NW	2.07E-06	3.80E-07	1.50E-07	7.59E-08	4.78E-08	1.69E-08	4.27E-09	1.93E-09	1.15E-09	7.65E-10
NNW	2.88E-06	5.32E-07	2.23E-07	1.18E-07	7.42E-08	2.55E-08	6.17E-09	2.82E-09	1.68E-09	1.13E-09

TABLE 3-6

2008 SSES Annual Relative Concentrations - 8-Day Decay, Depleted X/Q (sec/m^3)

	Miles									
Direction From	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 10	10 - 20	20 - 30	30 - 40	40 - 50
N	3.88E-06	6.88E-07	2.72E-07	1.36E-07	8.45E-08	2.89E-08	6.95E-09	2.92E-09	1.64E-09	1.04E-09
NNE	8.02E-06	1.50E-06	6.43E-07	3.30E-07	2.07E-07	7.13E-08	1.74E-08	7.44E-09	4.22E-09	2.73E-09
NE	1.55E-05	2.75E-06	1.19E-06	6.44E-07	4.11E-07	1.50E-07	4.00E-08	1.74E-08	9.96E-09	6.52E-09
ENE	4.46E-05	7.69E-06	3.59E-06	2.03E-06	1.31E-06	4.82E-07	1.23E-07	5.20E-08	3.00E-08	1.98E-08
E	1.93E-05	3.28E-06	1.38E-06	7.47E-07	4.82E-07	1.81E-07	5.03E-08	2.20E-08	1.26E-08	8.23E-09
ESE	1.17E-05	2.13E-06	9.22E-07	4.92E-07	3.15E-07	1.17E-07	2.85E-08	1.08E-08	6.14E-09	3.98E-09
SE	1.12E-05	2.05E-06	8.91E-07	4.79E-07	3.06E-07	1.15E-07	2.52E-08	8.02E-09	4.54E-09	2.93E-09
SSE	8.26E-06	1.50E-06	6.32E-07	3.37E-07	2.18E-07	8.65E-08	1.98E-08	6.09E-09	3.45E-09	2.22E-09
S	6.87E-06	1.37E-06	6.33E-07	3.49E-07	2.31E-07	9.88E-08	2.40E-08	7.14E-09	4.05E-09	2.61E-09
SSW	7.15E-06	1.35E-06	5.88E-07	3.17E-07	2.02E-07	7.76E-08	1.77E-08	5.84E-09	3.30E-09	2.13E-09
SW	6.80E-06	1.27E-06	5.72E-07	3.12E-07	2.01E-07	8.08E-08	1.81E-08	5.24E-09	2.94E-09	1.87E-09
WSW	3.04E-06	5.41E-07	2.40E-07	1.35E-07	8.87E-08	3.86E-08	1.06E-08	3.43E-09	1.57E-09	7.75E-10
W	1.30E-06	2.23E-07	9.09E-08	4.74E-08	2.98E-08	1.11E-08	2.57E-09	8.94E-10	4.92E-10	3.07E-10
WNW	1.21E-06	2.04E-07	7.75E-08	3.87E-08	2.37E-08	8.00E-09	1.89E-09	7.68E-10	4.22E-10	2.63E-10
NW	1.89E-06	3.23E-07	1.22E-07	5.95E-08	3.63E-08	1.20E-08	2.76E-09	1.12E-09	6.18E-10	3.86E-10
NNW	2.64E-06	4.53E-07	1.82E-07	9.27E-08	5.64E-08	1.82E-08	4.00E-09	1.65E-09	9.15E-10	5.78E-10

TABLE 3-7

2008 SSES Annual Relative Concentrations - D/Q (m^{-2})

	Miles									
Direction From	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 10	10 - 20	20 - 30	30 - 40	40 - 50
N	2.50E-08	3.69E-09	1.51E-09	7.17E-10	4.24E-10	1.34E-10	3.21E-11	1.18E-11	6.31E-12	3.97E-12
NNE	3.31E-08	5.13E-09	2.23E-09	1.06E-09	6.23E-10	1.94E-10	4.53E-11	1.67E-11	8.89E-12	5.59E-12
NE	3.99E-08	6.02E-09	2.58E-09	1.25E-09	7.40E-10	2.38E-10	5.84E-11	2.15E-11	1.15E-11	7.21E-12
ENE	6.83E-08	1.06E-08	4.73E-09	2.31E-09	1.37E-09	4.32E-10	9.85E-11	3.45E-11	1.84E-11	1.16E-11
E	3.19E-08	4.65E-09	1.90E-09	9.05E-10	5.40E-10	1.78E-10	4.51E-11	1.66E-11	8.86E-12	5.57E-12
ESE	2.42E-08	3.66E-09	1.56E-09	7.52E-10	4.50E-10	1.49E-10	3.39E-11	1.09E-11	5.84E-12	3.67E-12
SE	2.90E-08	4.40E-09	1.92E-09	9.49E-10	5.70E-10	1.92E-10	4.01E-11	1.10E-11	5.85E-12	3.68E-12
SSE	2.70E-08	4.03E-09	1.72E-09	8.47E-10	5.16E-10	1.85E-10	4.05E-11	1.08E-11	5.75E-12	3.61E-12
S	2.67E-08	4.28E-09	2.01E-09	1.03E-09	6.43E-10	2.49E-10	5.81E-11	1.49E-11	7.96E-12	5.00E-12
SSW	3.62E-08	5.54E-09	2.49E-09	1.26E-09	7.62E-10	2.66E-10	5.91E-11	1.69E-11	8.99E-12	5.65E-12
SW	5.28E-08	8.39E-09	3.95E-09	2.04E-09	1.26E-09	4.74E-10	1.07E-10	2.73E-11	1.46E-11	9.16E-12
WSW	2.98E-08	4.59E-09	2.14E-09	1.15E-09	7.30E-10	3.01E-10	8.47E-11	2.45E-11	1.07E-11	5.26E-12
W	1.21E-08	1.82E-09	7.88E-10	3.93E-10	2.40E-10	8.58E-11	2.09E-11	6.56E-12	3.50E-12	2.20E-12
WNW	1.15E-08	1.66E-09	6.68E-10	3.19E-10	1.90E-10	6.15E-11	1.52E-11	5.59E-12	2.98E-12	1.87E-12
NW	1.74E-08	2.55E-09	1.02E-09	4.76E-10	2.81E-10	8.93E-11	2.14E-11	7.89E-12	4.21E-12	2.64E-12
NNW	2.21E-08	3.29E-09	1.39E-09	6.72E-10	3.93E-10	1.20E-10	2.70E-11	9.94E-12	5.30E-12	3.33E-12

TABLE 3-8

2008 ATMOSPHERIC DISPERSION ESTIMATES FOR RETDAS INPUT AT SELECTED LOCATIONS

AFFECTED SECTOR	LOCATION	MILES	X/Q(1)	X/Q DEC(2)	X/Q DEC+DEP(3)	DEPOSITION(4)
10/SSW	Maximum (X/Q) Site Boundary	0.39	1.26E-05	1.25E-05	1.17E-05	5.03E-08
9/S	Closest (X/Q) Site Boundary	0.38	6.03E-06	6.03E-06	5.62E-06	3.79E-08
12 / WSW	Maximum (X/Q) Residence	1.3	1.13E-05	1.12E-05	9.62E-06	1.35E-08
3 / NE	Maximum (D/Q) Residence	0.9	3.21E-06	3.20E-06	2.82E-06	2.00E-08
12 / WSW	Maximum (D/Q) Garden	1.3	1.13E-05	1.12E-05	9.62E-06	1.35E-08
12 / WSW	Maximum (D/Q) Dairy	1.7	7.70E-06	7.61E-06	6.44E-06	8.79E-09
12 / WSW	Maximum (D/Q) Meat Producer	1.7	7.70E-06	7.61E-06	6.44E-06	8.79E-09
3 / NE	Riverlands / EIC	0.7	4.63E-06	4.62E-06	4.13E-06	3.05E-08
12 / WSW	Tower's Club	0.5	3.86E-05	3.85E-05	3.53E-05	5.40E-08

NEAREST RESIDENCE WITHIN A 5-MILE RADIUS BY SECTOR

SECTOR NUMBER	AFFECTED SECTOR	NAME	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
1	N	H. Burd	1.3	1.96E-06	1.94E-06	1.67E-06	5.38E-09
2	NNE	E. Ashbridge III	1	2.87E-06	2.85E-06	2.50E-06	1.11E-08
3	NE	W. Tuggle	0.9	3.21E-06	3.20E-06	2.82E-06	2.00E-08
4	ENE	D. Barberi	2.1	3.83E-07	3.81E-07	3.15E-07	2.77E-09
5	E	L. Kozlowski/ W. Witts	1.4	2.90E-07	2.89E-07	2.47E-07	2.04E-09
6	ESE	R. Panetta	0.5	1.43E-06	1.43E-06	1.31E-06	1.24E-08
7	SE	J. Futoma	0.5	1.96E-06	1.95E-06	1.79E-06	1.65E-08
8	SSE	J. Naunczek	0.6	2.29E-06	2.29E-06	2.07E-06	1.69E-08
9	S	S. Slusser	1	1.53E-06	1.53E-06	1.34E-06	7.66E-09
10	SSW	S. Molnar	0.9	3.84E-06	3.82E-06	3.36E-06	1.25E-08
11	SW	F. Michael	1.5	3.27E-06	3.24E-06	2.77E-06	6.06E-09
12	WSW	F. Michael	1.3	1.13E-05	1.12E-05	9.62E-06	1.35E-08
13	W	F. Hummel	1.2	5.55E-06	5.50E-06	4.77E-06	6.97E-09
14	WNW	R. Orlando	0.8	6.84E-06	6.79E-06	6.04E-06	1.15E-08
15	NW	B. Kramer	0.7	6.61E-06	6.57E-06	5.84E-06	1.39E-08
16	NNW	G. John	0.6	6.02E-06	6.00E-06	5.43E-06	1.72E-08

NEAREST GARDEN WITHIN A 5-MILE RADIUS BY SECTOR

SECTOR NUMBER	AFFECTED SECTOR	NAME	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
1	N	J. Wojcik	3.2	5.13E-07	5.05E-07	4.02E-07	1.21E-09
2	NNE	R. Chapin	2.3	8.49E-07	8.41E-07	6.92E-07	2.91E-09
3	NE	F. Kremski	2.6	6.80E-07	6.74E-07	5.47E-07	3.75E-09
4	ENE	G. Dennis	2.4	3.19E-07	3.17E-07	2.59E-07	2.31E-09
5	E	W. Daily	1.8	1.94E-07	1.93E-07	1.62E-07	1.35E-09
6	ESE	B. Smith	3.1	6.24E-08	6.19E-08	4.92E-08	4.12E-10
7	SE	F. Scholl	0.6	1.49E-06	1.49E-06	1.35E-06	1.21E-08
8	SSE	H. Roinick	2.9	1.72E-07	1.71E-07	1.37E-07	1.02E-09
9	S	A. Kamir	1.2	1.15E-06	1.14E-06	9.88E-07	5.50E-09
10	SSW	S. Bodnar	1.2	2.48E-06	2.46E-06	2.13E-06	7.55E-09
11	SW	R. Broody	1.9	2.30E-06	2.27E-06	1.90E-06	4.13E-09
12	WSW	F. Michael	1.3	1.13E-05	1.12E-05	9.62E-06	1.35E-08
13	W	F. Hummel	1.2	5.55E-06	5.50E-06	4.77E-06	6.97E-09
14	WNW	P. Moskaluk	1.3	3.17E-06	3.14E-06	2.71E-06	4.76E-09
15	NW	R. Reider	4.5	4.04E-07	3.92E-07	3.02E-07	5.61E-10
16	NNW	P. Culver	4	3.44E-07	3.36E-07	2.61E-07	6.36E-10

TABLE 3-8
(continued)

NEAREST ANIMAL RAISED FOR MEAT CONSUMPTION WITHIN A 5-MILE RADIUS BY SECTOR

SECTOR NUMBER	AFFECTED SECTOR	NAME	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
2	NNE	R.Chapin	2.3	8.49E-07	8.41E-07	6.92E-07	2.91E-09
4	ENE	G.Dennis	2.4	3.19E-07	3.17E-07	2.59E-07	2.31E-09
5	E	W. Daily	1.8	1.94E-07	1.93E-07	1.62E-07	1.35E-09
6	ESE	B. Smith	3.1	6.24E-08	6.19E-08	4.92E-08	4.12E-10
10	SSW	C. & K. Drasher	3.5	3.95E-07	3.88E-07	3.06E-07	9.79E-10
12	WSW	T. & M Berger	1.7	7.70E-06	7.61E-06	6.44E-06	8.79E-09

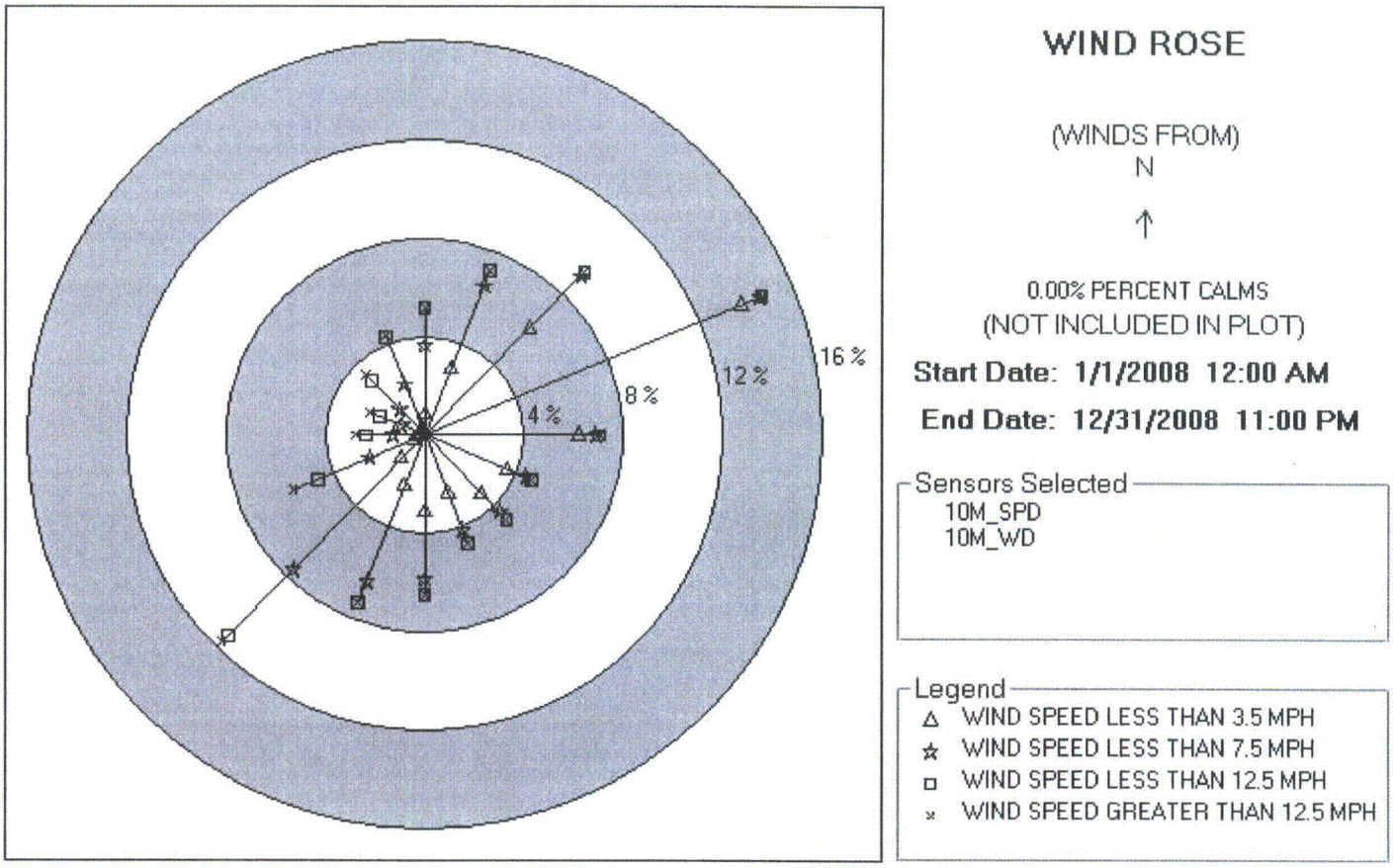
ALL DAIRY LOCATIONS

SECTOR NUMBER	AFFECTED SECTOR	NAME	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
5	E	W.Bloss	4.5	3.90E-08	3.86E-08	2.93E-08	2.36E-10
6	ESE	F.Rinehimer	4.2	3.27E-08	3.24E-08	2.48E-08	2.00E-10
10	SSW	C. & K. Drasher	3.5	3.95E-07	3.88E-07	3.06E-07	9.79E-10
10	SSW	K.Davis	14.01	3.22E-08	3.00E-08	2.00E-08	5.22E-11
12	WSW	T. & M. Berger	1.7	7.70E-06	7.61E-06	6.44E-06	8.79E-09
13	W	J. Dent	5	5.03E-07	4.84E-07	3.69E-07	4.03E-10

1	X/Q	RELATIVE CONCENTRATION (SEC/M^3)
2	X/Q DEC	DECAYED AND UNDEPLETED, HALF-LIFE 2.26 DAYS (SEC/M^3)
3	X/Q DEC+DEP	DECAYED AND DEPLETED, HALF-LIFE 8 DAYS (SEC/M^3)
4	DEPOSITION	RELATIVE DEPOSITION RATE (1/M^2)

FIGURE 3-1

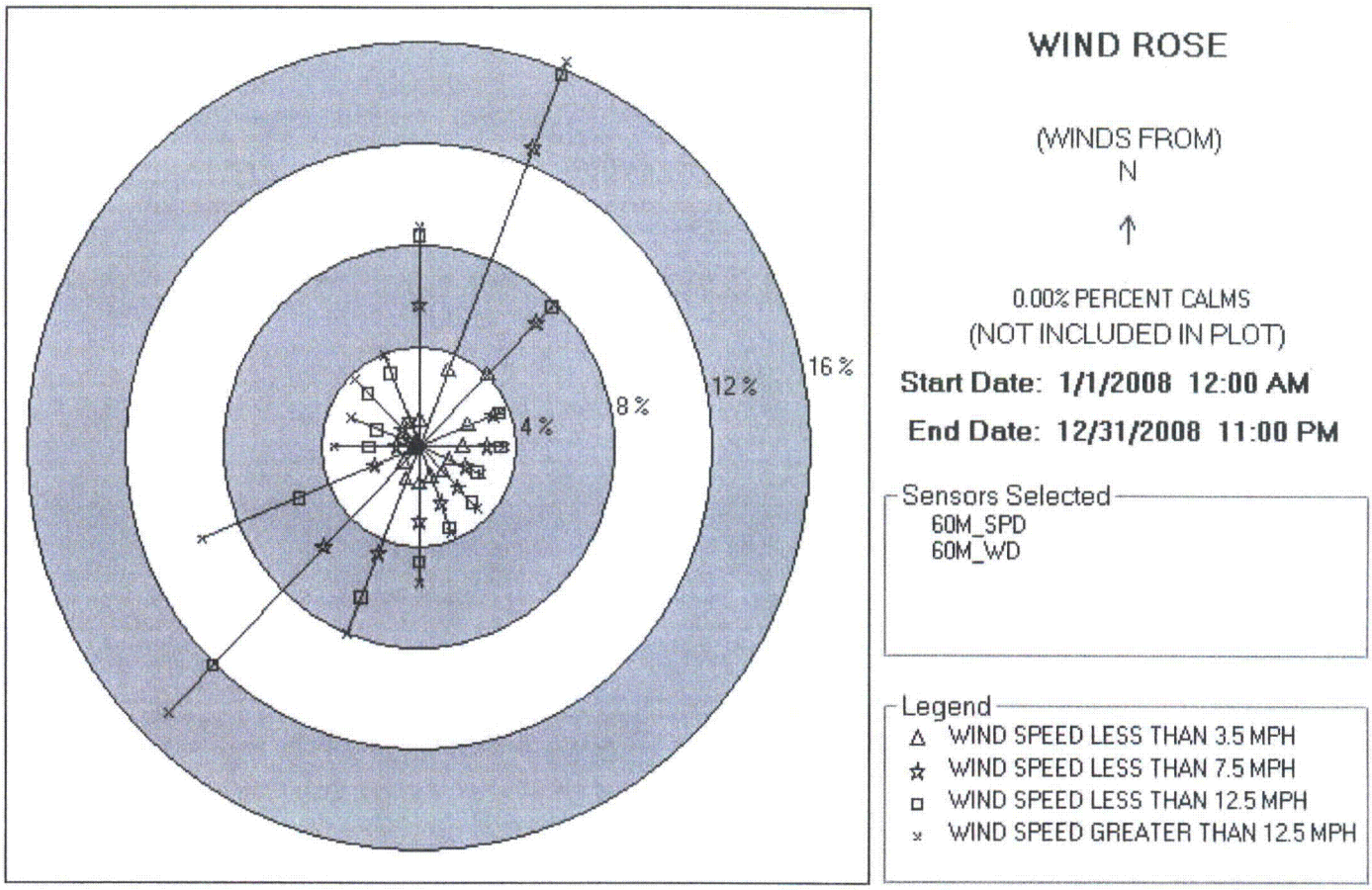
2008 ANNUAL WIND ROSE 10M LEVEL – PRIMARY TOWER



This wind rose displays the frequency of hourly average wind direction from a given sector. In 2008, the predominant wind direction occurred 14.6 % of the time from the ENE sector. The average wind speed was 4.8 mph and the average wind speed for the predominant sector (ENE) was 2.4 mph. The sector with the highest average wind speed was WSW (8.8 mph).

FIGURE 3-2

2008 ANNUAL WIND ROSE 60M LEVEL – PRIMARY TOWER

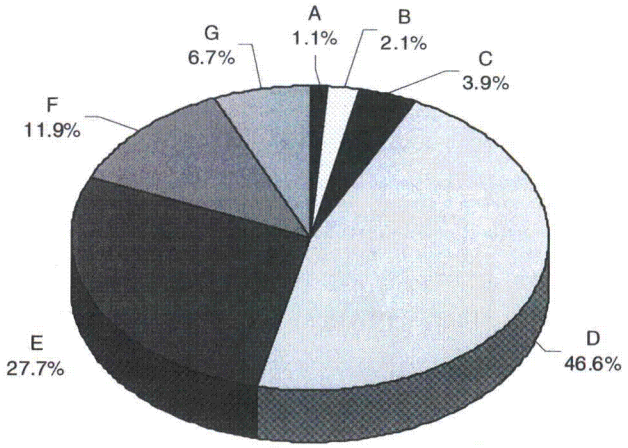


This wind rose displays the frequency of hourly average wind direction from a given sector. In 2008, the predominant wind direction occurred 16 % of the time from the NNE sector. The average wind speed was 7.6 mph and the average wind speed for the predominant sector (NNE) was 5.8 mph. The sector with the highest average wind speed was WSW (12.4 mph.).

FIGURE 3-3

PASQUIL STABILITY CLASS PREVALENCES DATA
Period: 2008

Joint Frequency Distributions at 10 Meters
Wind Speed and Direction 10M vs. Delta Temperature 60-10M
(Based on 8,725 Valid Hours)



SECTION 4

DOSE MEASUREMENTS AND ASSESSMENTS

Radiological Impact on Man

Sampling and analysis of airborne and waterborne effluents were performed in accordance with the frequencies, types of analysis, and Lower Limit of Detection (LLD) outlined in the PPL Susquehanna, LLC Technical Requirements Manual.

Radioactive material was detected in some of the airborne and waterborne effluent samples analyzed. Dose calculations using measured effluent activity levels, meteorological data from the current reporting period and average river flow dilution factors resulted in estimated doses to individuals at levels below 10 CFR 20 and 10 CFR 50, Appendix I limits. Direct radiation resulting from plant operation (reported in the 2008 Annual Radiological Environmental Operating Report) contributed a maximum of 3.80E-2 mrem (measured at TLD Location 9S2) at the Protected Area Boundary south of the plant. The maximum organ (including thyroid)/total body dose from all airborne effluent is 5.10E-1 mrem (CHILD, LIVER Table 4-4). The maximum organ/total body dose from all liquid effluent is 1.79E-3 mrem (ADULT, GI-LLI Table 4-2). Conservatively adding the maximum organ (including thyroid)/total body dose from liquid and gaseous effluent and the maximum total body dose determined from direct radiation bounds the dose that any member of the public receives from station operations. The result (5.50E-1 mrem) is 2.2% of the 40CFR190 limit of 25 mrem to total body/organ (except thyroid) and 0.7% of the 40CFR190 limit of 75 mrem to the thyroid.

Doses to a maximally exposed member of the public from waterborne effluents are calculated for fish ingestion and shoreline exposure at the plant outfall, and drinking water ingestion at Danville, PA. Site specific parameters used in the calculations for the Danville receiver, specific for actual average blowdown and river level for the entire year are shown in Table 4-1.

TABLE 4-1

SITE-SPECIFIC PARAMETERS USED FOR RETDAS CALCULATIONS (DANVILLE RECEIVER) FOR 2008

PARAMETER	ENTIRE YEAR
Cooling Tower Blowdown (CFS)	21.5
Average Net River Level (ft.)	6.8
Dilution Factor at Danville[1]	413.2
Transit time to Danville (hr.)[1]	24.7

[1]From ODCM-QA-005, Att. E

Summaries of maximum individual doses resulting from airborne and waterborne radioactive effluent releases from each unit are given in Table 4-2. Meteorological data from Section 3 were used to calculate the dose from airborne effluents.

The Radioactive Effluent Release Report includes an assessment of the radiation dose from radioactive effluents to members of the public within the site boundary. Within the Site Boundary there are several areas frequented by members of the public. There are no significant exposure pathways from waterborne effluents in these areas. Doses from airborne effluent are calculated for members of the public for the following locations: Riverlands Energy Information Center, the Towers Club, and residence with the maximum X/Q value; the garden, dairy and meat producing farm with the maximum D/Q value; and the site boundary with the maximum X/Q value. Summaries of the calculated maximum doses within the site boundary and selected locations resulting from airborne effluents are presented in Table 4-4. The above referenced locations are shown on Figure 4-1.

In the area comprising the Riverlands recreation area, which surrounds the Energy Information Center, three pathways of radiation exposure can be identified: plume, ground, and inhalation. There are no significant exposure pathways from waterborne effluents in this area. There are approximately 100,000 visitors to the Riverlands/Energy Information Center complex each year. For dose calculations, it is assumed the visitor stays in the area for one hour. The calculated dose rate and collective dose for visitors to the Riverlands/Energy Information Center during 2008 are shown on Table 4-3.

Use of the RETDAS code yields calculated doses for the Riverlands area for the report period. These doses assume an occupancy factor of 100% for a member of the public during 2008. These calculated dose values are shown on Table 4-4.

TABLE 4-2

SUMMARY OF MAXIMUM INDIVIDUAL DOSES TO MEMBERS OF THE PUBLIC

DATA PERIOD: 1/1/08 TO 12/31/08

UNIT	EFFLUENT	AGE GROUP	APPLICABLE ORGAN	ESTIMATED MAXIMUM DOSE (MREM/MRAD)	LOCATION		PERCENT OF LIMIT	LIMIT (MREM/ MRAD)[2]
					DIST (MILES)	AFFECTED SECTOR		
1	Liquid[1]	Child	Total Body	5.80E-04	(3)		0.02	3
1	Liquid[1]	Adult	GI-LLI	8.95E-04	(3)		0.01	10
1	Noble Gas	N/A	Air Dose (Gamma-MRAD)	0.00E+00	0.5	WSW	0	10
1	Noble Gas	N/A	Air Dose (Beta-MRAD)	0.00E+00	0.5	WSW	0	20
1	Airborne Iodine, Tritium and Particulates	Child	Lung	8.94E-02	0.5	WSW	0.60	15
2	Liquid[1]	Child	Total Body	5.80E-04	(3)		0.02	3
2	Liquid[1]	Adult	GI-LLI	8.95E-04	(3)		0.01	10
2	Noble Gas	N/A	Air Dose (Gamma-MRAD)	0.00E+00	0.5	WSW	0	10
2	Noble Gas	N/A	Air Dose (Beta-MRAD)	0.00E+00	0.5	WSW	0	20
2	Airborne Iodine, Tritium and Particulates	Child	Liver	4.21E-01	0.5	WSW	2.81	15

[1]Estimated dose is based on a site total activity release equally divided between Unit 1 and Unit 2.

[2]10 CFR 50, Appendix I limits are in terms of mrad or mrem/reactor-year for airborne and waterborne effluent from each unit.

[3]Doses from liquid effluent are estimated from fish ingestion and shoreline exposure at the site outfall and from the drinking water pathway at Danville, PA.

TABLE 4-3

CALCULATED COLLECTIVE DOSES TO MEMBERS OF THE PUBLIC WITHIN THE RIVERLANDS/ENERGY INFORMATION CENTER COMPLEX

DATA PERIOD: 1/1/08 TO 12/31/08

EFFLUENT	AGE GROUP	APPLICABLE ORGAN	DOSE RATE[1] (MREM/HR)	COLLECTIVE DOSE[2] (PERSON-REM)
Noble Gas	N/A	Total Body	0	0
Noble Gas	N/A	Skin	0	0
Iodine, Tritium and Particulates	Child	Liver	7.07E-06	7.07E-04

[1]Estimated dose and dose rate is based on annual site total activity release.

[2]Collective dose is based on 100,000 person-hours.

TABLE 4-4

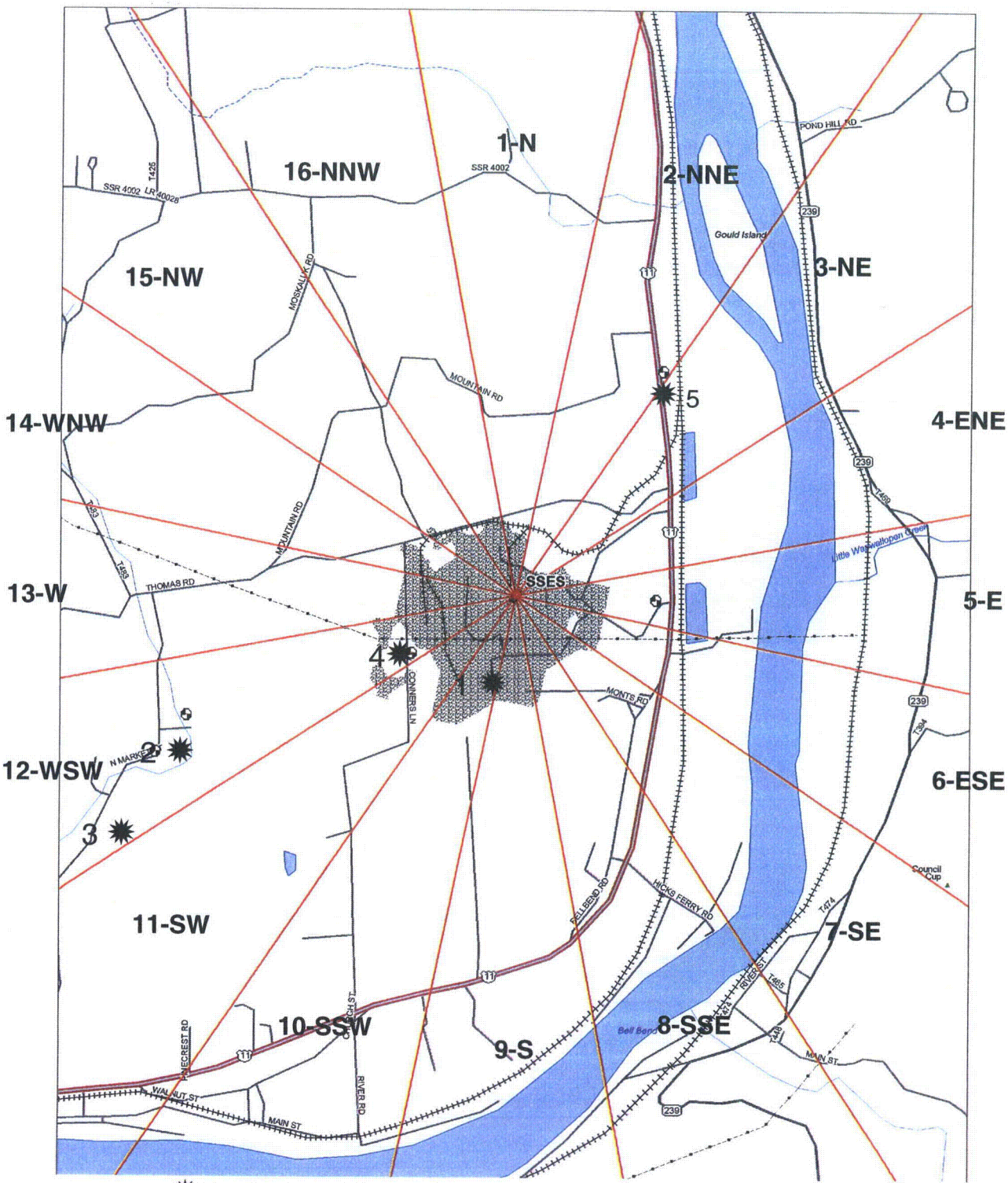
SUMMARY OF MAXIMUM INDIVIDUAL DOSES FROM AIRBORNE EFFLUENT

LOCATION	PATHWAY	MAXIMUM TOTAL BODY DOSE (MREM)		MAXIMUM ORGAN DOSE (MREM)		MAXIMUM THYROID DOSE (MREM)	
1. Maximum site boundary X/Q	Total (All)	1.68E-01	(CHILD)	1.68E-01	(CHILD, LIVER)	1.67E-01	(CHILD)
2. Maximum X/Q Residence + Maximum D/Q Garden	Total (All)	1.49E-01	(CHILD)	1.49E-01	(CHILD, LIVER)	1.49E-01	(CHILD)
3. Maximum D/Q Dairy + Maximum D/Q Meat	Total (All)	1.02E-01	(CHILD)	1.02E-01	(CHILD, LIVER)	1.01E-01	(CHILD)
4. Tower's Club	Total (All)	5.10E-01	(CHILD)	5.10E-01	(CHILD, LIVER)	5.09E-01	(CHILD)
5. Riverland/EIC	Total (All)	6.20E-02	(CHILD)	6.21E-02	(CHILD, LIVER)	6.17E-02	(CHILD)

Note: The doses shown above are based on 100% occupancy at the indicated locations. They are based on a composite of all pathways resulting in a total dose to the maximally exposed individual due to airborne effluents from both Unit-1 and Unit-2 operations.

FIGURE 4-1

AIRBORNE-DOSE CALCULATION LOCATIONS



✸ Indicates airborne-dose calculation location per Table 4-4

SECTION 5

CHANGES TO THE OFFSITE DOSE CALCULATION MANUAL (ODCM), TECHNICAL REQUIREMENTS MANUAL (TRM) AND THE SOLID RADIOACTIVE WASTE PROCESS CONTROL PROGRAM

CHANGES TO THE OFFSITE DOSE CALCULATION MANUAL

The PPL Susquehanna, LLC ODCM consists of nine (9) individual procedures.

ODCM-QA-003, Effluent Monitor Setpoints, was revised on April 21, 2008. The revision: 1) updated a reference and Attachment A to clarify the revision of a PPL calculation; 2) updated Attachment A to support implementation of the Extended Power Uprate project; 3) updated guidance for the liquid radiation monitor setpoint determination.

ODCM-QA-004, Airborne Effluent Dose Calculations, was revised on April 21, 2008. The revision: 1) updated and added references to support implementation of the Extended Power Uprate project; 2) updated Attachment B with more current annual average dispersion values; 3) made miscellaneous typographical corrections.

ODCM-QA-005, Waterborne Effluent Dose Calculations, was revised on May 7, 2008. The revision updated Attachments A, B, C and D to add dose factors. The dose factors are in software used for liquid effluent dose calculations but were not listed in the ODCM.

ODCM-QA-007, Radioactive Waste Treatment Systems, was revised on April 30, 2008. The revision was an administrative change to correct a typographical error in section 6.1.1.

ODCM-QA-008, Radiological Environmental Monitoring Program, was revised on January 31, 2008. The revision updated Attachments D and G to add six new groundwater monitoring well sample locations.

ODCM-QA-009, Dose Assessment Policy Statements, was revised on April 11, 2008. The revision: 1) updated the definition of an Insignificant Effluent Pathway; 2) updated position titles; 3) made miscellaneous typographical corrections.

CHANGES TO THE TECHNICAL REQUIREMENTS MANUAL

Section 3.11 and 3.6.1 of the Unit-1 and Unit-2 Technical Requirements Manual (TRM) by reference are part of the ODCM. The following limits and requirements are contained in Section 3.11: liquid and gaseous effluent dose limits, liquid and gaseous effluent treatment system operability criteria (based on effluent dose), liquid and gaseous effluent radiation monitor operability criteria and the conduct of the Radiological Environmental Monitoring Program. Section 3.6.1 contains requirements for venting or purging of primary containment.

There were no changes to the Unit-1 or Unit-2 TRM Sections 3.6.1 or 3.11 during 2008.

PROCESS CONTROL PROGRAM CHANGES

The following changes were made to the Process Control Program and implementing procedures during 2008. None of the changes reduce the overall conformance of the solidified waste product to existing criteria for solid wastes. All changes were reviewed and approved by PORC (as necessary) as documented on the attached summary of procedure changes. The following procedures were changed:

1. CH-RC-076, Gamma Spectral Analysis

2. ME-ORF-165, Fuel Pool Cleanout – EnergySolutions – Handling Procedure for 3-55 Cask C of C #5805

3. ME-ORF-172, Fuel Pool Cleanout EnergySolutions Operating Guidelines for Use of Polyethylene High Integrity Containers

4. MT-EO-051, Fuel Pool Cleanout Operation of EnergySolutions shielded Transfer Bell and Verification of No Free Standing Water in FEXM High Integrity Container

5. WM-PS-100, Shipment of Radioactive Waste

6. WM-PS-120, General Shipment of Radioactive Material

7. WM-PS-180, Advanced Notification of Applicable States

8. WM-PS-210, Packaging and Loading of DAW and Radioactive Material

9. WM-PS-310, Use of the 10-142B USA 9208/B Shipping Cask

10. WM-PS-351, Use of the 21-300 Shipping Package

11. WM-RP-012, Handling and Use of Steel Liners and High Integrity Containers

NDAP-QA-0646 continues to fully implement the requirements and intent of the following:

1. Sections 11.4 and 13.5 of the FSAR
2. Section 3.7.4 of the Technical Requirements Manual
3. 10 CFR 20, 10 CFR 61, 10 CFR 71, 49 CFR 100-177, and 40 CFR 261

Compliance with all applicable regulatory requirements listed above continues to be met as the result of these changes to the program. These changes to the Process Control Program will not reduce the overall conformance of the solidified waste product to existing criteria for solid wastes.

PROCEDURE REVISION SUMMARY
CH-RC-076

1. Clarify/correct formula for calculation of activity for selected or unknown isotope in Step 7.5.2.d.(8). Formula needs correction/clarification based on change to Apex software.

PROCEDURE REVISION SUMMARY
ME-ORF-165

1. Revised step 6.26.2 to add additional information for Soap Bubble Test.

2. Incorporate CHANGES IAW Certificate of Compliance (COC) No. 5805, Revision 26, for Model 3-55 Package.

3. Changed procedure Adherence level to Step by Step.

4. Changed step 8.20.12 to leave the cask bell section attached to the crane if desired.

PROCEDURE REVISION SUMMARY
ME-ORF-172

1. Revise vendor name throughout procedure.

2. Removed CNS procedure S20-AD-010 References.

3. Add note before step 4.1.

4. Add step 4.1.13:

   PL14-170 and PL14-215 are HICs equipped with the modified baskets compatible with the Radlock 179/195 grapple and have the following maximum gross weight limits: PL14-170 10,800 lbs; PL14-215 13,000 lbs.

PROCEDURE REVISION SUMMARY
MT-EO-051

1. Added directions for lifting of shielded transfer bell with/without shipping container.

2. Various Administrative changes.

3. Revised Section 8.3 to be consistent with EnergySolutions Procedure, FP-OP-023, "Operation of the Shield Transfer Bell and the Dewatering of Filter HICS for Fuel Pool Projects"

PROCEDURE REVISION SUMMARY
WM-PS-100

1. The US government agency responsible for setting the security threat level is now the Department of Homeland Security. Changed the procedure to reflect this change as well as other administrative changes

2. Added requirement to notify the Shift Manager and write an AR if it has been discovered that a shipment is missing or lost.

PROCEDURE REVISION SUMMARY
WM-PS-120

1. Added requirement to write an AR if the shipment is missing or lost.

PROCEDURE REVISION SUMMARY
WM-PS-180

1. Clarified purpose of the procedure.

2. Updated method to send notifications to the governors.

3. Provided guidance concerning notifications in Section 7.

4. Changed signatory on Forms – 1, -2, and -3 to the Radioactive Material Shipper.

PROCEDURE REVISION SUMMARY
WM-PS-210

1. Defined Engineered Load Securement Plan.

2. Clarified in Step 6.1.4, when the Engineered Load Securement Plan must be approved. The intent is to be able to load the material and make in-field adjustments to the securement and then evaluate the final securement prior to approval.

3. Added vehicle marking requirement to Attachment K if package bulk markings are not visible during transport.

4. Made various administrative changes for clarification.

PROCEDURE REVISION SUMMARY
WM-PS-310

1. Updated Vendor Procedure Number in Reference Section.

2. Incorporated PCAF 2005-1409.

3. Updated the expiration date of the Certificate of Compliance to 10/1/08 in the Prerequisites Section.

4. Updated procedure due to vendor procedure manual change.

PROCEDURE REVISION SUMMARY
WM-PS-351

1. Incorporate PCAF 2005-1406 and miscellaneous administrative changes/corrections.

PROCEDURE REVISION SUMMARY
WM-RP-012

1. Add Note to step 6.1.5 to clarify that South Carolina Certificate of Compliance does not apply when High Integrity Container is shipped to a processing vendor.

2. Change steps 6.1.15 and 6.2.13 to clarify range of sling diameters that are acceptable, based on container drawings and certifications that are provided by manufacturer.

SECTION 6

MISCELLANEOUS TECHNICAL REQUIREMENTS MANUAL (TRM), FSAR, 40CFR190 AND NEI GROUNDWATER PROTECTION INITIATIVE REPORTING

1. TRM Action 3.11.1.4.F.2 requires the reporting of Liquid Radwaste Effluent Monitoring Instrumentation inoperability not corrected in a timely manner.

   None to report for 2008.

2. TRM Action 3.11.1.5.C.1 requires the reporting of Radioactive Liquid Process Effluent Monitoring Instrumentation inoperability not corrected in a timely manner.

   None to report for 2008.

3. TRM Action 3.11.2.6.K requires an explanation for Radioactive Gaseous Effluent Monitoring Instrumentation required actions and completion times not met.

   None to report for 2008.

4. TRM Action 3.11.4.1.F.2 requires reporting the cause of the unavailability of milk or fresh leafy vegetable samples and identify the new locations for obtaining replacements.

   4/7/08– Milk sample unavailable from Ray Ryman Farm (location 10D2, 3.1 miles SSW) due to owners have discontinued dairy farming. Location 10D2 was an indicator milk sampling location as required by TRM Table 3.11.4.1-1. Location 10D2 was replaced by the W. Bloss Farm (location 5E2, 4.5 miles E) which is the dairy farm with the next highest dose potential who are willing to participate in the Radiological Environmental Monitoring Program (REMP) milk sampling program.

5. TRM Action 3.11.4.2.A requires reporting when land use census identifies a new location which yields a calculated dose or dose commitment greater than the values currently being calculated in Requirement 3.11.2.3 (Gaseous Effluent Dose due to Iodine, Tritium, and Radionuclides in Particulate Form).

   None to report for 2008.

6. TRM Action 3.11.4.2.B requires reporting when land use census identifies locations that yield a calculated dose or dose commitment (via the same exposure pathway) 20 percent greater than at a location from which samples are currently being obtained in accordance with Requirement 3.11.4.1 (Radiological Environmental Monitoring Program).

   None to report for 2008.

7. The limits outlined in 40CFR190.10 (Environmental Standards for the Uranium Fuel Cycle-Standards for Normal Operations) were not exceeded by station operations during 2008. Refer to Section 2 and Page 4-2 for specific values.

8. FSAR Section 11.6.11 requires the reporting of airborne radioactivity detected in the Low Level Radwaste Holding Facility.

   No airborne radioactivity detected above analysis MDC's in air samples from the Low Level Radwaste Holding Facility during 2008.

9. The PPL Susquehanna station has implemented an Action Plan in response to the NEI Initiative on Groundwater Protection. Part of the Action Plan includes the assessment of the current groundwater monitoring program. Groundwater is sampled and analyzed quarterly as part of the Radiological Environmental Monitoring Program (REMP). REMP groundwater sampling locations are defined in ODCM-QA-008 Attachment G. In August 2006, additional groundwater sampling was initiated at locations which are not listed in the ODCM. The additional locations are three manholes which collect water from a perimeter drain system. The perimeter drain system consists of perforated piping installed just above the footing along the exterior base of the vertical walls of the reactor, turbine and radwaste buildings. In 2008 four new groundwater monitoring wells were installed at the PPL Susquehanna Station. These wells are in addition to the six wells installed in 2007. Outlined in Table 6-1 are the tritium analysis results from sampling of the perimeter drain system and the four new groundwater monitoring wells. No gamma emitting radionuclides were identified above analysis MDC's for the perimeter drain or monitoring well samples. The four new groundwater monitoring wells were added to the ODCM in March 2009 and future results from these monitoring wells shall be reported in the Annual Radiological Environmental Operating Report. The tritium results reported in Table 6-1 did not exceed any Reporting Level thresholds in the PPL Susquehanna Technical Requirements Manual or any reporting criteria established in response to the NEI Groundwater Protection Initiative.

TABLE 6-1

NEI Ground Water Protection Initiative Reporting

Perimeter Drain Sampling Results: 2008

	Manhole FD-1 (7S9 - E of U2 CST)	Manhole FD-2 (16S3- NW corner of RW Bldg.)	Manhole FD-3 (9S3 - I/S RCA @ U2 HP Cont. Pt. Closet)
Date	Tritium (pCi/liter)	Tritium (pCi/liter)	Tritium (pCi/liter)
2/14/2008	457	340	389
5/14/2008	525	332	358
8/13/2008	421	235	246
11/10/2008	350	220	249

Ground Water Monitoring Well Sampling Results: 2008

Monitoring Well	Tritium (pCi/Liter)	Date
MW-8A (South of Sewage Treatment Plant)	171	8/28/2008
	181	9/29/2008
	178	11/13/2008
MW-8B (South of Sewage Treatment Plant)	N/A (well was dry)	8/28/2008
	N/A (well was dry)	9/29/2008
	N/A (well was dry)	11/13/2008
MW-9 (West of River Water Intake Bldg.)	<110	8/28/2008
	<91	9/25/2008
	<116	11/11/2008
MW-10 (North of S-2 Sediment Pond)	<113	9/2/2008
	<106	9/25/2008
	<119	11/12/2008

SECTION 7

CORRECTIONS TO PREVIOUS RADIOACTIVE EFFLUENT RELEASE REPORTS

CORRECTIONS TO PREVIOUS
RADIOACTIVE EFFLUENT RELEASE REPORTS

The value reported for the nuclear fuel cycle (40CFR190) dose to a member of the public for 2007 included dose due to liquid effluent from only one unit at the PPL Susquehanna site. Total dose due to fuel cycle operations includes dose attributable to all liquid effluents, gaseous effluents and direct radiation sources attributable to station operations. The liquid radwaste processing system is common to both units and the total dose (total body and organ) due to liquid effluent is split between Unit-1 and Unit-2.
The maximum organ/total body dose from all liquid effluent reported on page 4-2 of the 2007 Radioactive Effluent Release Report was 9.25E-4 mrem. The corrected value is 1.85E-3 mrem. The correction has minimal impact on the total dose reported due to station operations. The total dose reported in the 2007 report was 8.27E-1 mrem. The corrected total dose value is 8.28E-1 mrem. Corrected page 4-2 of the 2007 Radioactive Effluent Release Report is included in this section.

The value reported for Cs-137 in Table 2-19 of the 2007 Radioactive Effluent Release Report was incorrect. The reported value was 1.960E+03 mCi. The corrected value is 1.912E-02 mCi. Corrected Table 2-19 is included in this section.

Corrected Page from 2007 Report

Radiological Impact on Man

Sampling and analysis of airborne and waterborne effluents were performed in accordance with the frequencies, types of analysis, and Lower Limit of Detection (LLD) outlined in the PPL Susquehanna, LLC Technical Requirements Manual.

Radioactive material was detected in some of the airborne and waterborne effluent samples analyzed. Dose calculations using measured effluent activity levels, meteorological data from the current reporting period and average river flow dilution factors resulted in estimated doses to individuals at levels below 10 CFR 20 and 10 CFR 50, Appendix I limits. Direct radiation resulting from plant operation (reported in the 2007 Annual Radiological Environmental Operating Report) contributed a maximum of 3.21E-2 mrem (measured at TLD Location 9S2) at the Protected Area Boundary south of the plant. The maximum organ (including thyroid)/total body dose from all airborne effluent is 7.94E-1 mrem (CHILD, LUNG Table 4-4). The maximum organ/total body dose from all liquid effluent is **1.85E-3** mrem (CHILD LIVER Table 4-2). Conservatively adding the maximum organ (including thyroid)/total body dose from liquid and gaseous effluent and the maximum total body dose determined from direct radiation bounds the dose that any member of the public receives from station operations. The result (**8.28E-1** mrem) is 3.3% of the 40CFR190 limit of 25 mrem to total body/organ (except thyroid) and 1.1% of the 40CFR190 limit of 75 mrem to the thyroid.

Doses to a maximally exposed member of the public from waterborne effluents are calculated for fish ingestion and shoreline exposure at the plant outfall, and drinking water ingestion at Danville, PA. Site specific parameters used in the calculations for the Danville receiver, specific for actual average blowdown and river level for the entire year are shown in Table 4-1.

TABLE 4-1

SITE-SPECIFIC PARAMETERS USED FOR RETDAS CALCULATIONS (DANVILLE RECEIVER) FOR 2007

PARAMETER	ENTIRE YEAR
Cooling Tower Blowdown (CFS)	20.5
Average Net River Level (ft.)	6.8
Dilution Factor at Danville[1]	413.2
Transit time to Danville (hr.)[1]	24.7

[1]From ODCM-QA-005, Att. E

Table 2-19 (corrected)

Annual Waste Release Summary Report

Year: 2007

Class: C Volume Reduction Vendor: No

Source: Irradiated Components

Container: Steel Liner

Process: N/A

Nuclides	Activity (mCi)	% of Total
C-14	6.306E+03	0.00 %
CO-58	4.752E+05	0.11 %
CO-60	1.466E+07	3.43 %
CR-51	1.270E+06	0.30 %
CS-137	**1.912E-02**	0.00 %
FE-55	4.624E+06	1.08 %
FE-59	3.697E+04	0.01 %
H-3	2.669E+02	0.00 %
HF-181	6.091E+05	0.14 %
I-129	1.900E-08	0.00 %
MN-54	5.155E+05	0.12 %
NB-94	2.212E+02	0.00 %
NB-95	1.566E+08	36.68 %
NI-59	1.142E+03	0.00 %
NI-63	1.850E+05	0.04 %
SB-124	1.745E+04	0.00 %
SB-125	2.879E+07	6.74 %
SN-113	5.039E+06	1.18 %
SN-119M	6.750E+07	15.81 %
SN-123	2.126E+06	0.50 %
TC-99	3.995E+00	0.00 %
TE-125M	3.948E+06	0.92 %
ZR-95	1.405E+08	32.91 %
Total Activity (Ci)	**426924.75**	100.00 %
Container Volume	574.000 ft^3	16.254 m^3

SECTION 8

EFFLUENT FROM SYSTEMS CLASSIFIED AS INSIGNIFICANT EFFLUENT PATHWAYS

EFFLUENT FROM SYSTEMS CLASSIFIED AS INSIGNIFICANT EFFLUENT PATHWAYS

Insignificant Effluent Pathways are: 1) evaporation from the Unit 1 and Unit 2 Condensate Storage Tanks (CST's); 2) evaporation from the common Refueling Water Storage Tank (RWST); 3) gaseous effluent from the Hydrogen Seal Oil, Main Turbine and RFPT lubrication oil mist eliminators which vent to the turbine building roofs.

These pathways are not continuously monitored. The CSTs and RWST are sampled monthly to determine the concentration of radionuclides present in these tanks. Tritium analysis on these samples is performed quarterly. Airborne release to the environment from the tanks is estimated based on conservative estimates of the evaporation rates from each of the tanks using a modified method established within Chapter 7 of EPA AP-42. A conservative carry-over fraction of radionuclides from the water to the evaporated liquid is then assumed. Airborne release to the environment from the demisters conservatively assumes the maximum moisture (condensate) concentration of the lubrication oil as measured via sampling during 2008. The calculation also assumes immediate removal of 100% of the water by the oil mist eliminators as it passes through the turbines. The annual release of tritium, iodines and particulates with half-lives greater than 8 days was calculated based on these conservative assumptions. The calculated releases are shown in Table 8-1. All nuclides, except for tritium, released from insignificant effluent pathways are negligible compared to the airborne release data shown in Tables 2-1 and 2-2. The maximum dose to the public from a release of 1.83 Ci of tritium is calculated to be 5.03E-3 mrem (child). This is a small fraction of the maximum dose from airborne effluent reported in Section 4.

TABLE 8-1

ANNUAL RELEASE FROM SYSTEMS CLASSIFIED AS INSIGNIFICANT EFFLUENT PATHWAYS

Nuclide	RWST (Ci)	U1-CST and Main Turbine/RFPT Lube Oil Systems (Ci)	U2-CST and Main Turbine/RFPT Lube Oil Systems (Ci)	Total (Ci)
H-3	6.38E-02	8.42E-01	9.24E-01	1.83E+00
Mn-54	2.40E-09	9.63E-09	1.73E-09	1.38E-08
Co-60	1.61E-08	3.05E-08	1.52 E-08	6.18E-08
Cs-137	4.59E-11	0.00E+00	0.00E+00	4.59E-11
Xe-135	0.00E+00	8.72E-08	0.00E+00	8.72E-08
Co-58	1.27E-09	7.51E-09	8.47E-10	9.63E-09
Zn-65	2.55E-10	5.90E-09	0.00E+00	6.15E-09
Cr-51	1.38E-09	0.00E+00	0.00E+00	1.38E-09
Sb-124	0.00E+00	0.00E+00	1.54E-10	1.54E-10
Nb-95	4.42E-11	0.00E+00	0.00E+00	4.42E-11