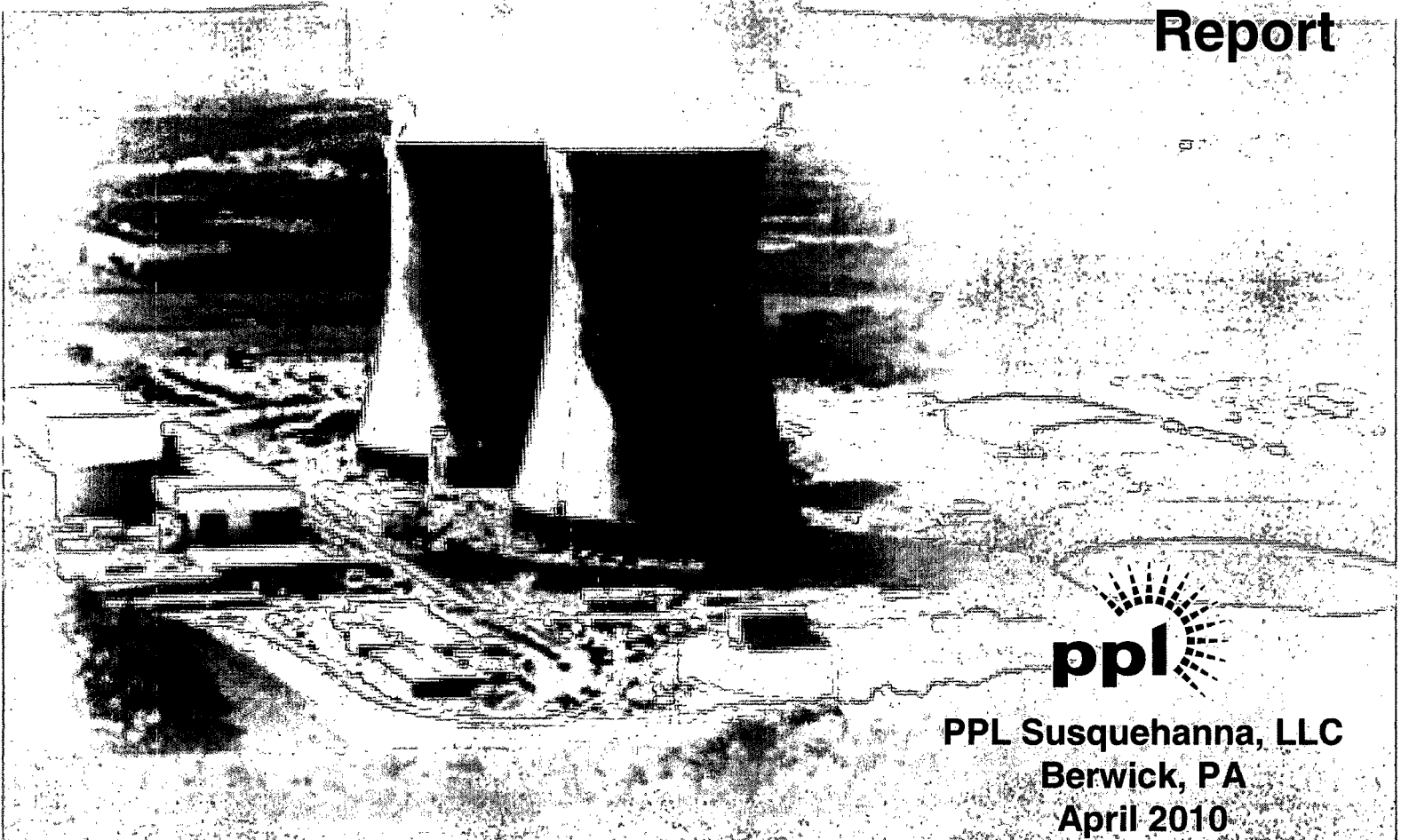


Susquehanna Steam Electric Station

Units 1 & 2

Radioactive Effluent Release Report

**2009
Annual
Report**

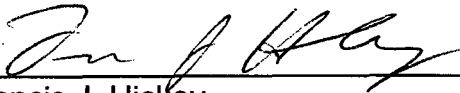


**PPL Susquehanna, LLC
Berwick, PA
April 2010**

**RADIOACTIVE EFFLUENT
RELEASE REPORT**

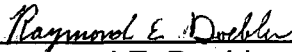
REPORT PERIOD: 01/01/09 - 12/31/09

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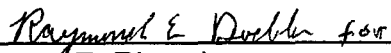
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SECTION 1

INTRODUCTION, SUMMARY AND SUPPLEMENTAL INFORMATION

INTRODUCTION

The submittal of the 2009 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 2009 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 unit is progressing through an Extended Power Uprate process which will result in an increase of licensed thermal power from 3489 MWt (megawatt thermal) to 3952 MWt. Unit-1 is scheduled to complete the power uprate in 2010 and Unit 2 is scheduled to complete the uprate in 2011. 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, 2009 to December 31, 2009. 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 2009 and the Monthly Liquid Radwaste Discharge Totals for 2009, 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 2-13 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 2009, 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 2009 were similar to those of previous years. During 2009 there were eighty-three (83) liquid batch releases resulting in a total release volume of five hundred thirty-two thousand two hundred (532,200) gallons. The total number of liquid batch releases and total volume released in 2009 was lower than the corresponding values for 2008 (89 releases resulting in 700,900 gallons released in 2008). The predominant radionuclide released in liquid effluents during 2009 was tritium. Approximately twenty-three (23) curies of tritium were released in liquid effluents in 2009, compared to thirty-three (33) curies released in 2008. When compared with all radionuclides released in liquid effluents in 2009, Co-60 and tritium were the main contributors to the resultant offsite dose. Consistent with previous years, the offsite dose from liquid releases in 2009 was less than one percent (1%) of the annual limits for both organ and whole body dose.

Gaseous effluents for 2009 were also comparable to those of previous years. The predominant radionuclide released in gaseous effluents was tritium. When compared with all radionuclides released in gaseous effluents in 2009, tritium was the main contributor to the resultant offsite dose. Approximately thirty-eight (38) curies of tritium were released in gaseous effluents in 2009 compared to sixty (60) curies in 2008. The resultant maximum offsite organ dose due to gaseous effluents from Unit-1 for 2009 was $1.48\text{E-}01$ mrem, which is 1.0 percent (1.0%) of the per unit annual limit of fifteen (15) mrem. The resultant maximum offsite organ dose due to gaseous effluents from Unit-2 for 2009 was $1.98\text{E-}01$ mrem, which is 1.3 percent (1.3 %) of the per unit annual limit of fifteen (15) mrem. The maximum offsite dose from gaseous effluents was lower in 2009 when compared with 2008 ($1.98\text{E-}01$ vs. $4.21\text{E-}01$ mrem) due to a decrease 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

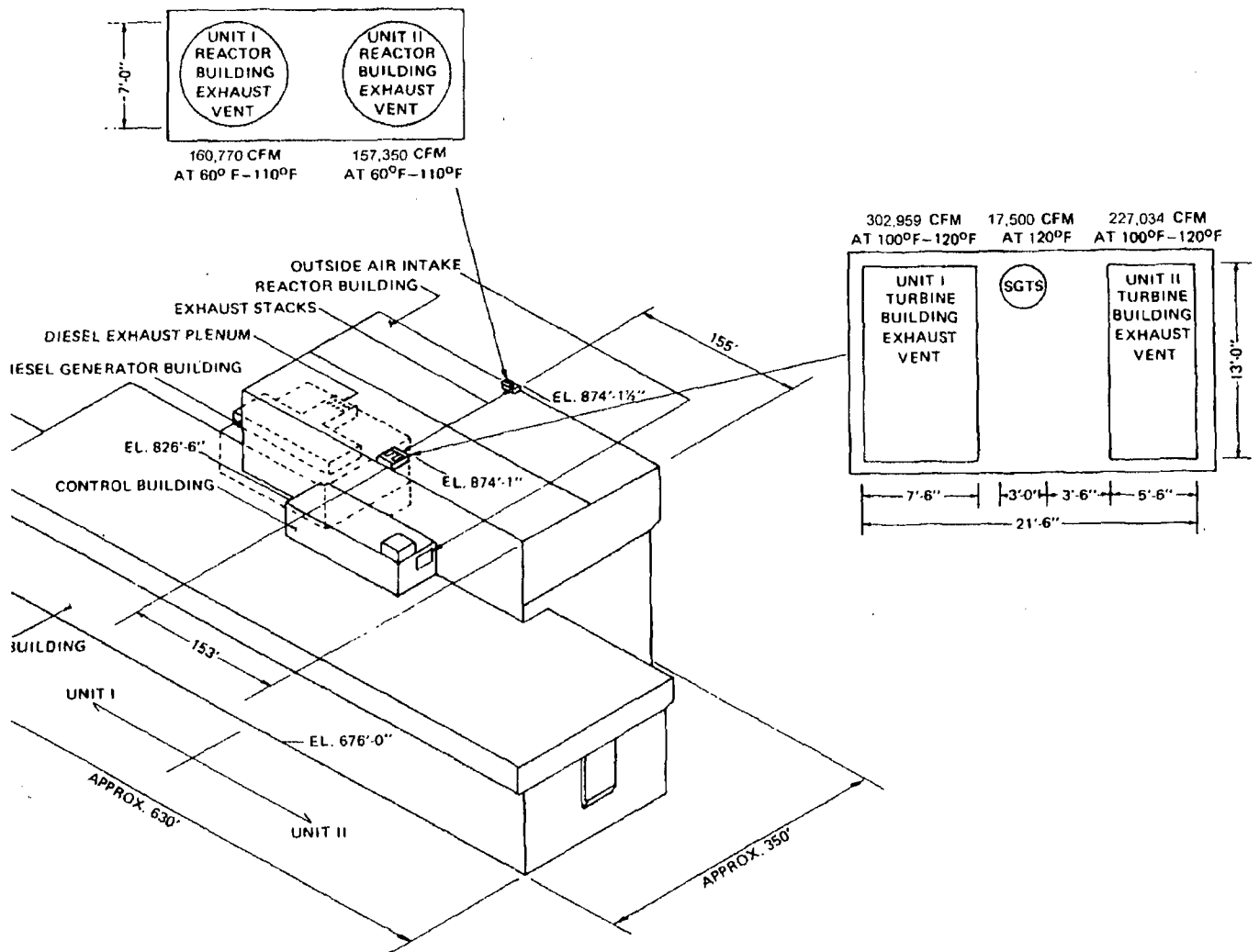
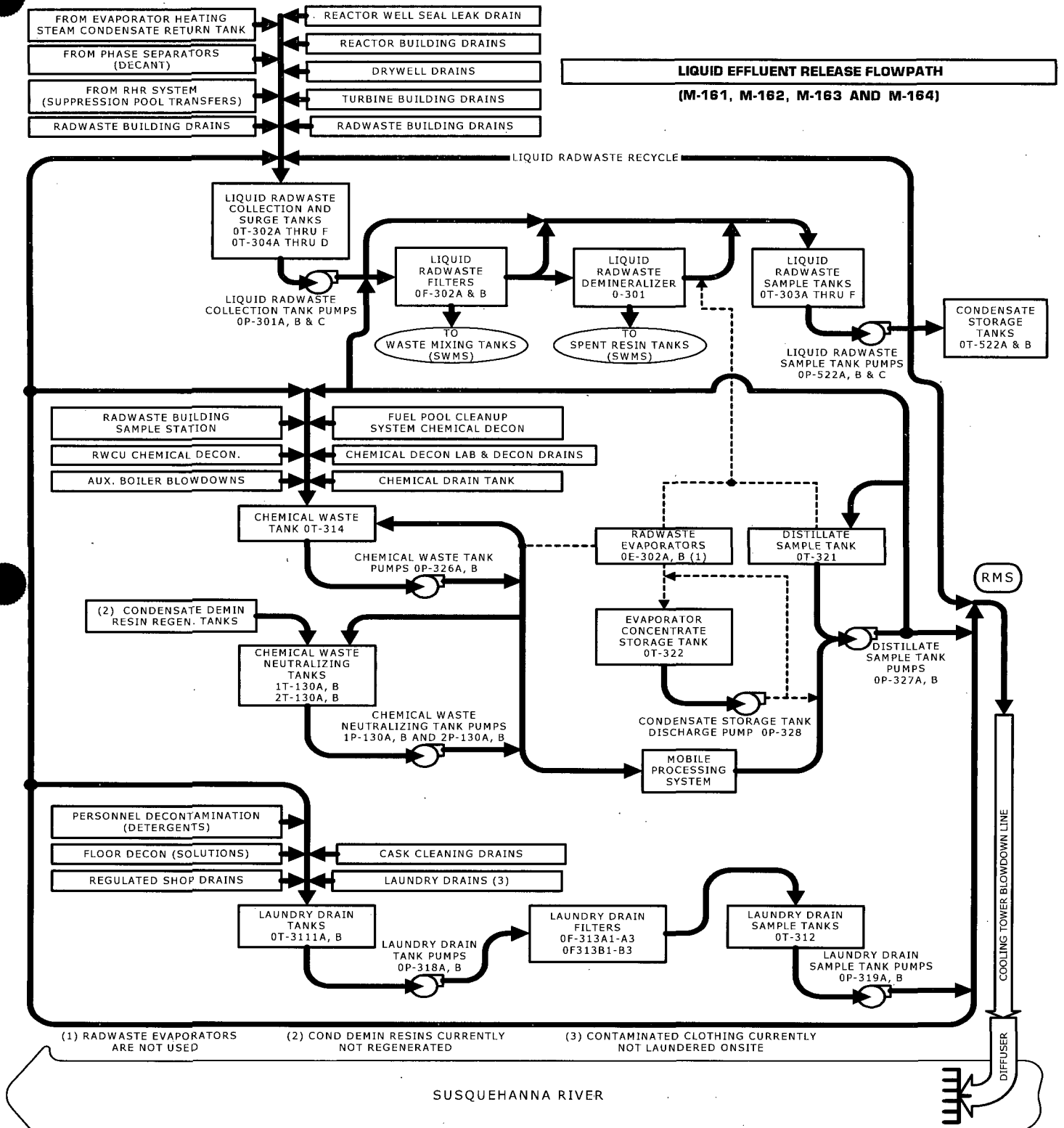


FIGURE 1-2

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 $2.0\text{E-}04$ $\mu\text{Ci/ml}$ 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 2009.

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 3.11.2.2.a)
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 $1.00\text{E}+06$ $\mu\text{Ci}/\text{min}$ ($1.67\text{E}+04$ $\mu\text{Ci}/\text{sec}$) 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 $1.04\text{E}+02$ $\mu\text{Ci}/\text{min}$ I-131 ($1.73\text{E}+00$ $\mu\text{Ci}/\text{sec}$).

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 quantities of particulate radionuclides provided in Attachment E of ODCM-QA-004, Airborne Effluent Dose Calculations. The limit is $3.02\text{E}+03$ $\mu\text{Ci}/\text{min}$ ($5.03\text{E}+01$ $\mu\text{Ci}/\text{sec}$).

Tritium

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

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 $1.0\text{E-}03 \mu\text{Ci/ml}$ 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 $2.0\text{E-}04 \mu\text{Ci/ml}$ (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

<u>Radionuclide</u>	<u>MDC (μCi/cc)</u>
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 | 1* |
| 2. Total Activity Released | NA |

*On April 7, 2009 the auxiliary steam system was identified as contaminated with low levels of tritium ($\sim 2\text{E-}5$ uCi/cc). Conservative assumptions were used in support of the calculation of total radioactive effluent from operation of the auxiliary steam system on April 7, 2009. The radioactive effluent due to auxiliary steam system operation on April 7, 2009 is a small fraction ($<0.001\%$) of the total releases due to station operation in 2009. Additional details on this release are outlined in Section 8.

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

C. Particulate

Particulate with Half-Life >8 Days	Ci	<MDC	1.17E-04	8.75E-05	5.85E-06
Average Release Rate for Period	μCi/sec	0	1.49E-05	1.10E-05	7.36E-07
Percent of Applicable Limit (5.03E+01 μCi/sec)	%	0	2.96E-05	2.19E-05	1.46E-06
Gross Alpha Radioactivity	Ci	<MDC	<MDC	<MDC	<MDC

D. Tritium

Total Release	Ci	1.69E+01	4.95E+00	3.45E+00	1.22E+01
Average Release Rate for Period	μCi/sec	2.17E+00	6.30E-01	4.34E-01	1.53E+00
Percent of Applicable Limit (2.44E+03 μCi/sec)	%	8.90E-02	2.58E-02	1.78E-02	6.28E-02

E. Radionuclide Fractional Summation

Sum of Percent of Applicable Limit During Period for B, C and D (Limit = 100%)	%	0.09	0.03	0.02	0.06
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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	1.04E-05	3.64E-05	5.85E-06
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	1.07E-04	5.11E-05	<MDC
Zn-65	Ci	<MDC	<MDC	<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	0	1.17E-04	8.75E-05	5.85E-06

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.

	<u>Batch Releases*</u>	<u>Qtr. 1</u>	<u>Qtr. 2</u>	<u>Qtr. 3</u>	<u>Qtr. 4</u>	<u>Annual</u>
1.	Number of Batch Releases	29	30	10	14	83
2.	Total Time Period for a Batch Release	1.84E+03	3.91E+03	5.92E+02	9.66E+02	7.30E+03
3.	Maximum Time Period for a Batch Release	8.00E+01	2.94E+02	8.00E+01	9.60E+01	2.94E+02
4.	Average Time Period for a Batch Release	6.35E+01	1.30E+02	5.92E+01	6.90E+01	8.80E+01
5.	Minimum Time Period for a Batch Release	2.80E+01	3.00E+01	3.00E+01	3.00E+01	2.80E+01
6.	Average Cooling Tower Blowdown Flow Rate During Periods of Release	7.20E+03	7.92E+03	1.19E+04	8.83E+03	8.18E+03
7.	Susquehanna River Flow Rate	8.29E+06	6.06E+06	3.50E+06	5.39E+06	5.80E+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 minimum 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.

<u>Radionuclide</u>	<u>MDC (μCi/ml)</u>
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	4.36E-04	2.28E-03	2.10E-03	3.97E-03
2. Average Diluted Concentration During Period		µCi/ml	8.70E-09	1.95E-08	7.88E-08	1.23E-07
3. Sum of Average Diluted C _n /L _n Ratio During Period		Unitless	2.23E-04	4.76E-04	2.33E-03	3.84E-03
4. Percent of Applicable Limit (Ratio < 1.0)		%	0.02	0.05	0.23	0.38
B. Tritium						
1. Total Release		Ci	6.55E+00	1.31E+01	1.06E+00	2.17E+00
2. Average Diluted Concentration During Period		µCi/ml	1.31E-04	1.12E-04	3.97E-05	6.72E-05
3. Percent of Applicable Limit (1.0E-2 µCi/ml)		%	1.31	1.12	0.40	0.67
C. Dissolved and Entrained Gases						
1. Total Release		Ci	<MDC	<MDC	<MDC	<MDC
2. Average Diluted Concentration During Period		µCi/ml	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3. Percent of Applicable Limit (2.0E-4 µCi/ml)		%	0.00E+00	0.00E+00	0.00E+00	0.00E+00
D. Radionuclide Fractional Summation						
1. Sum of Percent of Applicable Limit During Period for A, B and C (Limit = 100%)		%	1.33	1.17	0.63	1.05
E. Gross Alpha Radioactivity						
1. Total Release		Ci	<MDC	1.30E-05	2.03E-06	7.25E-06
F. Volume of Water Released (Prior to Dilution)		Gallons	1.27E+05	3.02E+05	3.82E+04	6.48E+04
		Liters	4.80E+05	1.14E+06	1.45E+05	2.45E+05
G. Volume of Dilution Water Used During Period of Release		Gallons	1.31E+07	3.06E+07	7.00E+06	8.46E+06
		Liters	4.97E+07	1.16E+08	2.65E+07	3.20E+07
H. Volume of Dilution Water Used Over Entire Period		Gallons	9.36E+08	1.01E+09	1.53E+09	1.28E+09
		Liters	3.54E+09	3.81E+09	5.78E+09	4.83E+09

TABLE 2-4

WATERBORNE EFFLUENT - RADIONUCLIDES RELEASED

		Releases in Batch Mode			
Nuclides Released	Unit	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
A. Fission and Activation Products					
Na-24	Ci	<MDC	<MDC	<MDC	<MDC
Cr-51	Ci	<MDC	1.49E-04	<MDC	<MDC
Mn-54	Ci	2.33E-06	1.06E-04	1.23E-05	6.84E-06
Fe-55	Ci	<MDC	<MDC	<MDC	<MDC
Co-58	Ci	1.05E-04	4.16E-04	2.68E-04	2.67E-04
Fe-59	Ci	<MDC	1.02E-05	<MDC	<MDC
Co-60	Ci	3.05E-04	1.59E-03	1.82E-03	3.66E-03
Zn-65	Ci	2.43E-05	1.01E-05	<MDC	3.67E-05
Sr-89	Ci	<MDC	<MDC	<MDC	<MDC
Sr-90	Ci	<MDC	<MDC	<MDC	<MDC
Nb-95	Ci	<MDC	1.14E-06	<MDC	<MDC
Rh-105	Ci	<MDC	<MDC	<MDC	<MDC
Sb-124	Ci	<MDC	1.13E-06	<MDC	<MDC
Ce-141	Ci	<MDC	<MDC	<MDC	<MDC
Ta-182	Ci	<MDC	<MDC	<MDC	<MDC
Total for Period	Ci	4.36E-04	2.28E-03	2.10E-03	3.97E-03
B. Tritium					
Total for Period	Ci	6.55E+00	1.31E+01	1.06E+00	2.17E+00
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	<MDC
Total for Period	Ci	0	0	0	0

Figure 2-1

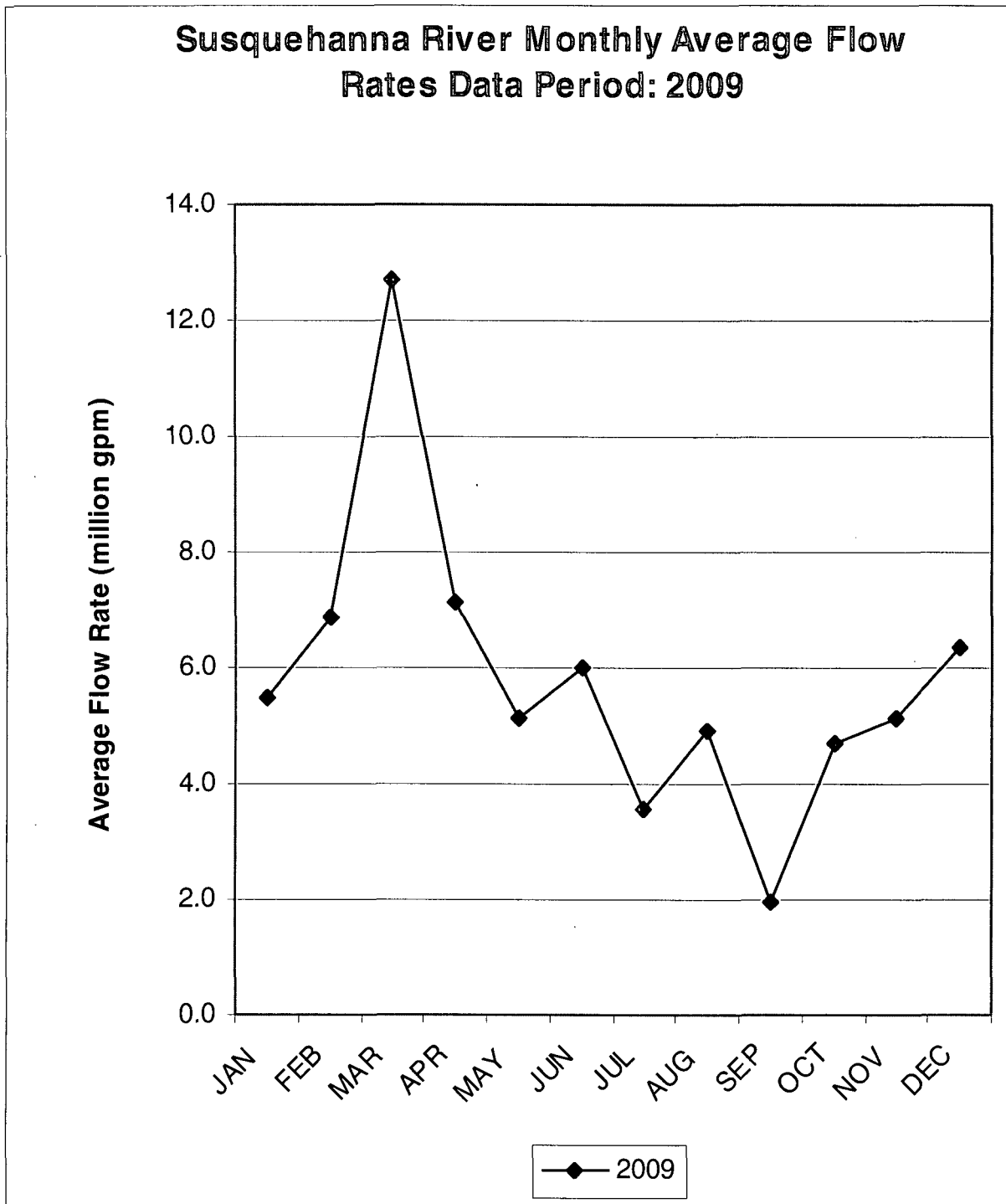


Figure 2-2

Monthly Liquid Radwaste Discharge Totals

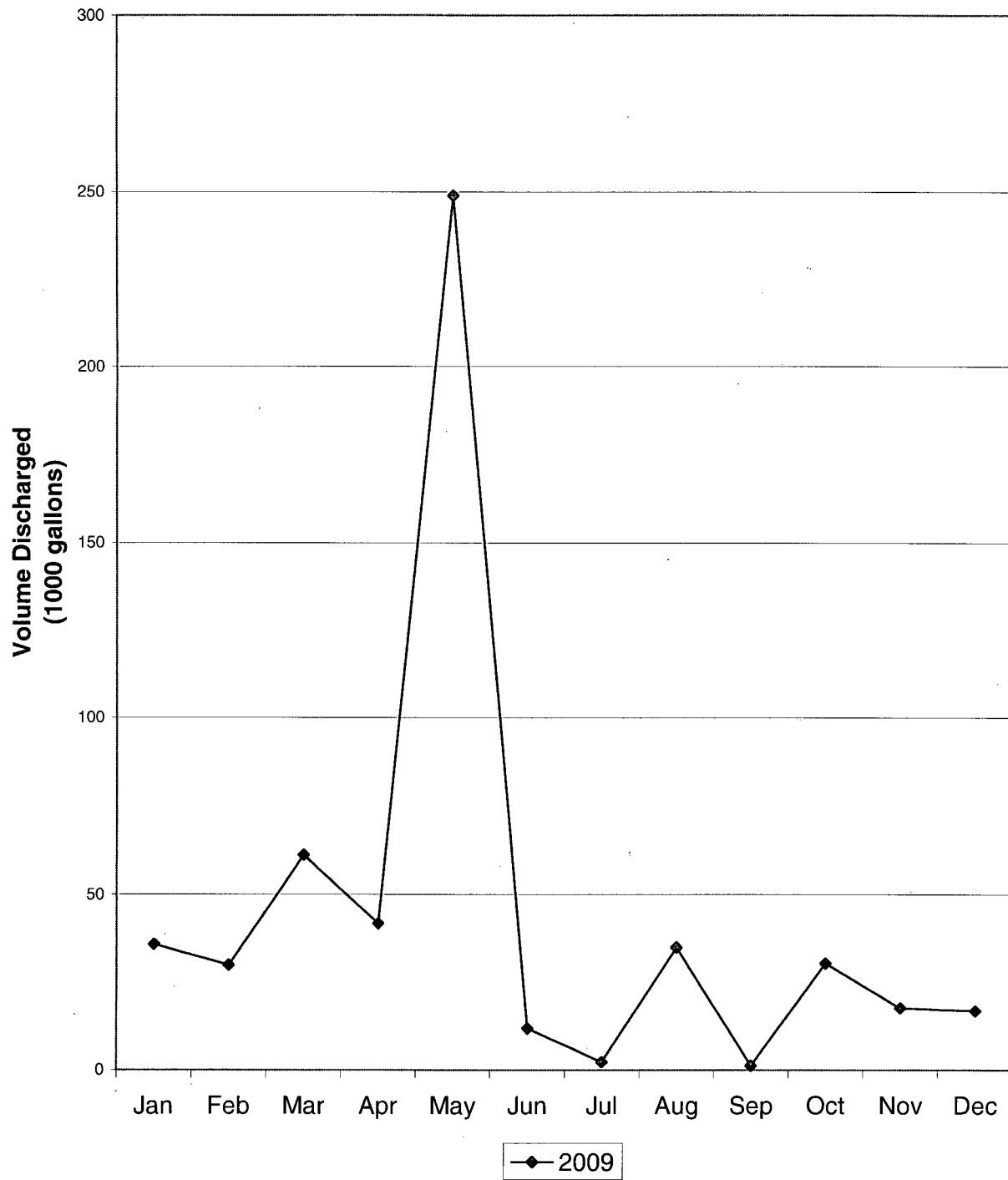


TABLE 2-5

**ESTIMATED TOTAL ERRORS ASSOCIATED WITH
EFFLUENTS MEASUREMENTS**

<u>MEASUREMENT</u>		<u>ESTIMATED TOTAL ERROR</u>
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%
		<u>ESTIMATED MAXIMUM MEASUREMENT ERROR</u>
3. Solid Wastes		
a.	CFS Backwash Media – Class A HIC (Pyrolysis)	±25%
b.	CFS Filters– Class A HIC (Pyrolysis)	±25%
c.	Condensate Demineralizer / Radwaste Demineralizer – Class A HIC (Pyrolysis)	±25%
d.	Liquid Radwaste Filter Media – Class A HIC (Pyrolysis)	±25%
e.	Processed DAW – Class A HIC (Compacted)	±25%
f.	Processed DAW – Class A Strong Tight Container (Compacted)	±25%
g.	Sump Sludge – Class A HIC (Prolysis)	±25%

SUSQUEHANNA STEAM ELECTRIC STATION

RADIOACTIVE WASTE REPORT

RADIOACTIVE EFFLUENT RELEASE REPORT

SOLID RADIOACTIVE WASTE

DATA PERIOD: JANUARY 1, 2009 - DECEMBER 31, 2009

PREPARED BY:



MICHAEL C. MICCA
HEALTH PHYSICIST

APPROVED BY:



RICK KESSLER
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 $\pm 25\%$.

TABLE 2-6

WASTE DISPOSITION

Data Period: January 1, 2009 - December 31, 2009

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

<u>Number of Shipments</u>	<u>Mode of Transportation</u>	<u>Destination</u>
NONE		

B. IRRADIATED FUEL SHIPMENTS

<u>Number of Shipments</u>	<u>Mode of Transportation</u>	<u>Destination</u>
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: 2009
Class: A Volume Reduction Vendor: Yes
 Source: CFS Backwash Media
 Container: HIC (High Integrity Container)
 Process: Pyrolysis

Nuclides	Activity (mCi)	% of Total
C-14	1.860E+01	0.11 %
CO-58	1.973E+01	0.11 %
CO-60	7.265E+03	41.89 %
CS-137	7.704E+00	0.04 %
FE-55	8.344E+03	48.11 %
H-3	9.958E+01	0.57 %
I-129	< 4.760E-02	0.00 %
MN-54	1.285E+03	7.41 %
NI-59	5.024E-01	0.00 %
NI-63	8.383E+01	0.48 %
SR-90	5.119E-02	0.00 %
TC-99	< 4.940E-01	0.00 %
ZN-65	2.179E+02	1.26 %

Total Activity (Ci)	17.343	100.00 %
Container Volume	43.980 ft3	1.245 m3

Table 2-8Annual Waste Release Summary Report

Year: 2009
Class: A Volume Reduction Vendor: Yes
 Source: CFS Filters
Container: HIC (High Integrity Container)
 Process: Pyrolysis

Nuclides	Activity (mCi)	% of Total
C-14	1.251E+00	0.01 %
CO-57	2.127E-01	0.00 %
CO-58	6.587E+00	0.05 %
CO-60	2.787E+03	22.27 %
CR-51	1.701E+00	0.01 %
CS-137	3.418E+00	0.03 %
FE-55	8.903E+03	71.13 %
FE-59	1.033E+00	0.01 %
H-3	4.032E+01	0.32 %
I-129	< 1.950E-03	0.00 %
MN-54	5.883E+02	4.70 %
NB-95	7.898E-01	0.01 %
NI-59	1.892E-01	0.00 %
NI-63	4.318E+01	0.35 %
SR-89	1.507E-01	0.00 %
SR-90	4.009E-02	0.00 %
TC-99	< 2.030E-02	0.00 %
ZN-65	1.393E+02	1.11 %

Total Activity (Ci)	12.517	100.00 %
Container Volume	142.040 ft3	4.022 m3

Table 2-9

Annual Waste Release Summary Report

Year: 2009
 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	1.272E+03	23.29 %
CE-144	2.518E-01	0.00 %
CM-242	2.560E-03	0.00 %
CO-58	5.850E+01	1.07 %
CO-60	2.408E+03	44.07 %
CR-51	3.469E+01	0.64 %
CS-137	8.157E+00	0.15 %
FE-55	3.179E+02	5.82 %
FE-59	2.294E+01	0.42 %
H-3	5.331E+02	9.76 %
HF-181	7.900E+00	0.14 %
I-129	< 4.600E-02	0.00 %
MN-54	5.234E+02	9.58 %
NB-95	2.524E+01	0.46 %
NI-63	9.307E+01	1.70 %
PU-238	3.145E-01	0.01 %
PU-239	7.180E-02	0.00 %
PU-241	9.014E-01	0.02 %
SB-124	1.561E+00	0.03 %
SB-125	6.290E+00	0.12 %
SR-90	1.691E-01	0.00 %
TA-182	7.910E+00	0.14 %
TC-99	< 5.180E-01	0.01 %
ZN-65	1.101E+02	2.01 %
ZR-95	3.009E+01	0.55 %
Total Activity (Ci)	5.463	100.00 %
Container Volume	225.290 ft3	6.380 m3

Table 2-10Annual Waste Release Summary Report

Year: 2009
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	2.563E-01	0.00 %
CO-58	1.317E+02	0.59 %
CO-60	4.437E+03	19.91 %
CR-51	2.028E+01	0.09 %
CS-137	4.868E-01	0.00 %
FE-55	1.602E+04	71.87 %
FE-59	1.833E+01	0.08 %
H-3	1.144E+00	0.01 %
I-129	< 5.550E-02	0.00 %
MN-54	1.328E+03	5.96 %
NI-63	7.721E+01	0.35 %
SR-90	3.488E-02	0.00 %
TC-99	< 5.200E-01	0.00 %
ZN-65	2.543E+02	1.14 %
-----	-----	-----
Total Activity (Ci)	22.285	100.00 %
Container Volume	74.400 ft3	2.107 m3

Table 2-11**Annual Waste Release Summary Report**

Year: 2009
Class: A Volume Reduction Vendor: Yes
 Source: Processed DAW
 Container: HIC (High Integrity Container)
 Process: Compacted

Nuclides	Activity (mCi)	% of Total
C-14	4.550E+00	7.84 %
CE-144	3.960E-02	0.07 %
CM-242	3.090E-04	0.00 %
CO-58	3.120E-01	0.54 %
CO-60	2.660E+01	45.84 %
CS-137	2.750E-01	0.47 %
FE-55	1.960E+00	3.38 %
H-3	1.680E+01	28.95 %
MN-54	2.440E+00	4.21 %
NI-63	3.550E-01	0.61 %
PU-238	8.650E-02	0.15 %
PU-241	1.990E-01	0.34 %
SR-90	3.760E-02	0.06 %
ZN-65	4.370E+00	7.53 %

Total Activity (Ci)	0.058	100.00 %
Container Volume	38.600 ft3	1.093 m3

Table 2-12**Annual Waste Release Summary Report**

Year: 2009
Class: A Volume Reduction Vendor: Yes
 Source: Processed DAW
 Container: Strong Tight Container
 Process: Compacted

Nuclides	Activity (mCi)	% of Total
-----	-----	-----
C-14	1.830E+01	0.92 %
CO-58	2.702E+00	0.14 %
CO-60	5.611E+02	28.27 %
CR-51	7.580E-02	0.00 %
CS-137	4.568E-01	0.02 %
FE-55	1.205E+03	60.70 %
FE-59	1.163E-01	0.01 %
H-3	8.180E+01	4.12 %
MN-54	9.172E+01	4.62 %
NB-95	3.520E+00	0.18 %
NI-59	2.336E-05	0.00 %
NI-63	1.051E+01	0.53 %
SB-124	1.040E-04	0.00 %
SR-89	2.400E-03	0.00 %
SR-90	9.109E-04	0.00 %
TA-182	6.625E-04	0.00 %
ZN-65	9.711E+00	0.49 %
ZR-95	1.134E-04	0.00 %
-----	-----	-----
Total Activity (Ci)	1.985	100.00 %
Container Volume	5469.158 ft3	154.872 m3

Table 2-13Annual Waste Release Summary Report

Year: 2009
Class: A Volume Reduction Vendor: Yes
 Source: Sump Sludge
 Container: HIC (High Integrity Container)
 Process: Pyrolysis

Nuclides	Activity (mCi)	% of Total
C-14	6.785E+01	1.08 %
CO-58	8.331E+00	0.13 %
CO-60	1.898E+03	30.13 %
CR-51	4.625E-01	0.01 %
CS-137	2.489E-01	0.00 %
FE-55	3.692E+03	58.61 %
FE-59	1.761E+00	0.03 %
H-3	3.760E+00	0.06 %
I-129	< 2.260E-02	0.00 %
MN-54	4.957E+02	7.87 %
NB-95	3.771E-01	0.01 %
NI-63	7.158E+01	1.14 %
SB-124	3.198E-01	0.01 %
SR-89	4.586E-02	0.00 %
SR-90	4.091E-02	0.00 %
TC-99	< 2.160E-01	0.00 %
ZN-65	5.781E+01	0.92 %
ZR-95	1.194E+00	0.02 %

Total Activity (Ci)	6.300	100.00 %
Container Volume	27.580 ft3	0.781 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 2009, 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 2009

Parameter	Percent Valid Data Recovery
Wind Speed 10m - Primary (1)	99.5
Wind Speed 60m - Primary	99.0
Wind Speed 10m - Backup (2)	99.6
Wind Speed 10m - Downriver (3)	100.0
Wind Direction 10m - Primary	98.8
Wind Direction 60m - Primary	99.4
Wind Direction 10m - Backup	99.8
Wind Direction 10m - Downriver	100.0
Temperature 10m - Primary	99.6
Dew Point 10m - Primary	98.9
Delta Temperature 60m - Primary	98.7
Sigma Theta 10m - Primary	98.8
Sigma Theta 60m - Primary	99.4
Sigma Theta 10m - Backup	99.8
Sigma Theta 10m - Downriver	100.0
Precipitation - Primary	100.0
Composite Parameters	
Wind Speed and Direction 10m, Delta Temperature 60-10m	98.0
Wind Speed and Direction 60m, Delta Temperature 60-10m	98.5
(1) SSES "Primary" meteorological tower	
(2) SSES "Backup" meteorological tower	
(3) SSES "Downriver" meteorological tower	

TABLE 3-2

**SSES JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND WIND
DIRECTION 10m VERSUS DELTA TEMPERATURE 60-10m FOR THE PERIOD OF
JANUARY 1, 2009 THROUGH DECEMBER 31, 2009**

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 1/1/2009 00:00 12/31/2009 23:00

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

Stability Class A Delta Temperature Extremely Unstable

Wind Speed (m/s)

<u>Wind Direction</u>	<u>0.23 -</u>	<u>0.51 -</u>	<u>0.76 -</u>	<u>1.1 -</u>	<u>1.6 -</u>	<u>2.1 -</u>	<u>3.1 -</u>	<u>5.1 -</u>	<u>7.1 -</u>	<u>10.1 -</u>	<u>13.1 -</u>		
<u>(from)</u>	<u>0.50</u>	<u>0.75</u>	<u>1.0</u>	<u>1.5</u>	<u>2.0</u>	<u>3.0</u>	<u>5.0</u>	<u>7.0</u>	<u>10.0</u>	<u>13.0</u>	<u>18.0</u>	<u>> 18.0</u>	<u>Total</u>
N	0	0	0	1	1	6	2	0	0	0	0	0	10
NNE	0	0	0	0	0	4	9	0	0	0	0	0	13
NE	0	0	0	0	2	5	3	0	0	0	0	0	10
ENE	0	0	0	1	3	0	0	0	0	0	0	0	4
E	0	0	0	2	2	0	0	0	0	0	0	0	4
ESE	0	0	0	2	1	0	0	0	0	0	0	0	3
SE	0	0	0	0	1	0	1	0	0	0	0	0	2
SSE	0	0	0	1	1	2	1	0	0	0	0	0	5
S	0	0	0	2	3	5	2	0	0	0	0	0	12
SSW	0	0	0	3	5	11	15	0	0	0	0	0	34
SW	0	0	0	0	1	17	48	10	0	0	0	0	76
WSW	0	0	0	2	0	4	10	4	0	0	0	0	20
W	0	0	0	1	1	1	3	1	0	0	0	0	7
WNW	0	0	0	0	0	0	2	0	0	0	0	0	2
NW	0	0	0	1	0	0	0	0	0	0	0	0	1
NNW	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals	0	0	0	16	21	55	96	15	0	0	0	0	203

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	171
Number of Valid Hours for:	Total Period	203
Total Hours for:	Total Period	8760

TABLE 3-2
(continued)

**SSES JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND WIND
DIRECTION 10m VERSUS DELTA TEMPERATURE 60-10m FOR THE PERIOD OF
JANUARY 1, 2009 THROUGH DECEMBER 31, 2009 (Continued)**

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 1/1/2009 00:00 12/31/2009 23:00

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

Stability Class B Delta Temperature Moderately Unstable

Wind Speed (m/s)

<u>Wind Direction</u> <u>(from)</u>	<u>0.23 -</u> <u>0.50</u>	<u>0.51 -</u> <u>0.75</u>	<u>0.76 -</u> <u>1.0</u>	<u>1.1 -</u> <u>1.5</u>	<u>1.6 -</u> <u>2.0</u>	<u>2.1 -</u> <u>3.0</u>	<u>3.1 -</u> <u>5.0</u>	<u>5.1 -</u> <u>7.0</u>	<u>7.1 -</u> <u>10.0</u>	<u>10.1 -</u> <u>13.0</u>	<u>13.1 -</u> <u>18.0</u>	<u>> 18.0</u>	<u>Total</u>
N	0	0	0	0	1	0	2	0	0	0	0	0	3
NNE	0	0	0	0	0	10	13	0	0	0	0	0	23
NE	0	0	0	1	2	4	2	0	0	0	0	0	9
ENE	0	0	0	0	1	4	1	0	0	0	0	0	6
E	0	0	1	1	1	1	0	0	0	0	0	0	4
ESE	0	0	0	0	0	1	0	0	0	0	0	0	1
SE	0	0	0	0	1	0	0	0	0	0	0	0	1
SSE	0	0	0	0	1	0	3	0	0	0	0	0	4
S	0	0	0	0	1	2	5	0	0	0	0	0	8
SSW	0	0	0	1	2	10	1	0	0	0	0	0	14
SW	0	0	0	0	2	20	45	3	0	0	0	0	70
WSW	0	0	0	0	0	3	28	8	0	0	0	0	39
W	0	0	0	0	0	1	1	0	0	0	0	0	2
WNW	0	0	0	0	0	0	3	0	0	0	0	0	3
NW	0	0	0	0	0	0	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	3	3	0	0	0	0	6
Totals	0	0	1	3	12	56	107	14	0	0	0	0	193

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	171
Number of Valid Hours for:	Total Period	193
Total Hours for:	Total Period	8760

TABLE 3-2
(continued)

**SSS JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND WIND
DIRECTION 10m VERSUS DELTA TEMPERATURE 60-10m FOR THE PERIOD OF
JANUARY 1, 2009 THROUGH DECEMBER 31, 2009 (Continued)**

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 1/1/2009 00:00 12/31/2009 23:00

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

Stability Class C Delta Temperature Slightly Unstable

Wind Speed (m/s)

<u>Wind Direction</u>	<u>0.23 -</u>	<u>0.51 -</u>	<u>0.76 -</u>	<u>1.1 -</u>	<u>1.6 -</u>	<u>2.1 -</u>	<u>3.1 -</u>	<u>5.1 -</u>	<u>7.1 -</u>	<u>10.1 -</u>	<u>13.1 -</u>		
<u>(from)</u>	<u>0.50</u>	<u>0.75</u>	<u>1.0</u>	<u>1.5</u>	<u>2.0</u>	<u>3.0</u>	<u>5.0</u>	<u>7.0</u>	<u>10.0</u>	<u>13.0</u>	<u>18.0</u>	<u>> 18.0</u>	<u>Total</u>
N	0	0	0	0	1	7	15	1	0	0	0	0	24
NNE	0	0	1	0	4	23	31	1	0	0	0	0	60
NE	0	0	0	1	5	17	2	0	0	0	0	0	25
ENE	0	0	1	2	6	2	0	0	0	0	0	0	11
E	0	0	0	4	2	4	1	0	0	0	0	0	11
ESE	0	0	1	1	2	1	1	0	0	0	0	0	6
SE	0	0	0	1	1	10	3	0	0	0	0	0	15
SSE	0	0	0	1	0	1	5	0	0	0	0	0	7
S	0	0	0	1	3	5	6	0	0	0	0	0	15
SSW	0	0	0	2	7	20	11	1	0	0	0	0	41
SW	0	0	0	1	2	31	46	3	0	0	0	0	83
WSW	0	0	0	1	1	4	50	12	2	0	0	0	70
W	0	0	0	0	1	1	18	1	0	0	0	0	21
WNW	0	0	0	0	0	0	7	0	0	0	0	0	7
NW	0	0	0	0	0	0	0	1	0	0	0	0	1
NNW	0	0	0	0	2	0	6	5	0	0	0	0	13
Totals	0	0	3	15	37	126	202	25	2	0	0	0	410

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	171
Number of Valid Hours for:	Total Period	410
Total Hours for:	Total Period	8760

TABLE 3-2
(continued)

**SSS JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND WIND
DIRECTION 10m VERSUS DELTA TEMPERATURE 60-10m FOR THE PERIOD OF
JANUARY 1, 2009 THROUGH DECEMBER 31, 2009 (Continued)**

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 1/1/2009 00:00 12/31/2009 23:00

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

Stability Class D Delta Temperature Neutral

Wind Speed (m/s)

<u>Wind Direction</u>	<u>0.23 -</u>	<u>0.51 -</u>	<u>0.76 -</u>	<u>1.1 -</u>	<u>1.6 -</u>	<u>2.1 -</u>	<u>3.1 -</u>	<u>5.1 -</u>	<u>7.1 -</u>	<u>10.1 -</u>	<u>13.1 -</u>		
<u>(from)</u>	<u>0.50</u>	<u>0.75</u>	<u>1.0</u>	<u>1.5</u>	<u>2.0</u>	<u>3.0</u>	<u>5.0</u>	<u>7.0</u>	<u>10.0</u>	<u>13.0</u>	<u>18.0</u>	<u>> 18.0</u>	<u>Total</u>
N	1	1	6	22	23	105	144	18	0	0	0	0	320
NNE	0	4	16	59	63	157	91	15	0	0	0	0	405
NE	0	2	25	65	77	173	65	0	0	0	0	0	407
ENE	0	9	33	48	41	36	20	0	0	0	0	0	187
E	0	10	28	47	17	28	26	4	0	0	0	0	160
ESE	2	6	23	40	18	28	25	3	1	0	0	0	146
SE	2	9	22	35	40	47	29	3	0	0	0	0	187
SSE	0	3	19	42	34	51	28	1	0	0	0	0	178
S	0	2	10	59	43	87	66	3	0	0	0	0	270
SSW	0	2	3	39	53	70	38	1	0	0	0	0	206
SW	0	0	5	22	43	93	135	30	0	0	0	0	328
WSW	0	1	5	13	34	61	145	95	44	1	0	0	399
W	0	0	1	2	19	38	102	61	19	0	0	0	242
WNW	0	0	0	4	10	23	48	26	0	0	0	0	111
NW	0	1	0	2	9	38	74	39	7	0	0	0	170
NNW	0	0	3	9	14	52	181	48	5	0	0	0	312
Totals	5	50	199	508	538	1087	1217	347	76	1	0	0	4028

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	171
Number of Valid Hours for:	Total Period	4028
Total Hours for:	Total Period	8760

TABLE 3-2
(continued)

**SSES JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND WIND
DIRECTION 10m VERSUS DELTA TEMPERATURE 60-10m FOR THE PERIOD OF
JANUARY 1, 2009 THROUGH DECEMBER 31, 2009 (Continued)**

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 1/1/2009 00:00 12/31/2009 23:00

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

Stability Class E Delta Temperature Slightly Stable

<u>Wind Direction</u> <u>(from)</u>	<u>Wind Speed (m/s)</u>												<u>Total</u>
	<u>0.23 - 0.50</u>	<u>0.51 - 0.75</u>	<u>0.76 - 1.0</u>	<u>1.1 - 1.5</u>	<u>1.6 - 2.0</u>	<u>2.1 - 3.0</u>	<u>3.1 - 5.0</u>	<u>5.1 - 7.0</u>	<u>7.1 - 10.0</u>	<u>10.1 - 13.0</u>	<u>13.1 - 18.0</u>	<u>> 18.0</u>	
N	0	1	5	25	32	29	12	0	0	0	0	0	104
NNE	0	2	19	69	64	69	1	0	0	0	0	0	224
NE	1	11	71	126	73	27	0	0	0	0	0	0	309
ENE	2	36	118	141	17	4	6	0	0	0	0	0	324
E	5	48	98	39	5	8	2	0	0	0	0	0	205
ESE	0	40	64	23	11	2	1	0	0	0	0	0	141
SE	1	33	53	44	4	10	2	1	0	0	0	0	148
SSE	3	11	31	44	22	16	5	0	0	0	0	0	132
S	1	9	30	77	37	34	14	4	0	0	0	0	206
SSW	0	1	14	63	62	51	19	1	0	0	0	0	211
SW	1	1	3	24	46	66	24	2	0	0	0	0	167
WSW	0	0	5	11	9	16	23	0	0	0	0	0	64
W	0	0	0	6	6	8	1	0	0	0	0	0	21
WNW	0	0	2	2	8	6	1	0	0	0	0	0	19
NW	0	0	3	1	6	9	4	0	0	0	0	0	23
NNW	0	3	2	4	6	24	6	0	0	0	0	0	45
Totals	14	196	518	699	408	379	121	8	0	0	0	0	2343

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	171
Number of Valid Hours for:	Total Period	2343
Total Hours for:	Total Period	8760

TABLE 3-2
(continued)

**SSES JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND WIND
DIRECTION 10m VERSUS DELTA TEMPERATURE 60-10m FOR THE PERIOD OF
JANUARY 1, 2009 THROUGH DECEMBER 31, 2009 (Continued)**

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 1/1/2009 00:00 12/31/2009 23:00

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

Stability Class F Delta Temperature Moderately Stable

Wind Speed (m/s)

<u>Wind Direction</u>	<u>0.23 -</u>	<u>0.51 -</u>	<u>0.76 -</u>	<u>1.1 -</u>	<u>1.6 -</u>	<u>2.1 -</u>	<u>3.1 -</u>	<u>5.1 -</u>	<u>7.1 -</u>	<u>10.1 -</u>	<u>13.1 -</u>		
<u>(from)</u>	<u>0.50</u>	<u>0.75</u>	<u>1.0</u>	<u>1.5</u>	<u>2.0</u>	<u>3.0</u>	<u>5.0</u>	<u>7.0</u>	<u>10.0</u>	<u>13.0</u>	<u>18.0</u>	<u>> 18.0</u>	<u>Total</u>
N	0	0	3	3	2	3	0	0	0	0	0	0	11
NNE	1	2	6	14	3	3	1	0	0	0	0	0	30
NE	0	14	41	50	10	4	2	0	0	0	0	0	121
ENE	1	41	149	174	19	1	0	0	0	0	0	0	385
E	4	50	85	28	1	0	0	0	0	0	0	0	168
ESE	1	22	20	5	1	0	0	0	0	0	0	0	49
SE	1	13	21	1	0	0	0	0	0	0	0	0	36
SSE	3	1	10	13	0	0	0	0	0	0	0	0	27
S	0	3	10	22	0	0	0	0	0	0	0	0	35
SSW	0	2	1	12	2	1	0	0	0	0	0	0	18
SW	0	1	0	3	1	1	1	0	0	0	0	0	7
WSW	0	0	0	2	0	0	0	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	0	0	0	0	0	0	0
NW	0	0	1	0	0	0	0	0	0	0	0	0	1
NNW	0	0	2	0	0	1	0	0	0	0	0	0	3
Totals	11	149	349	328	39	14	4	0	0	0	0	0	894

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	171
Number of Valid Hours for:	Total Period	894
Total Hours for:	Total Period	8760

TABLE 3-2
(continued)

**SSS JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND WIND
DIRECTION 10m VERSUS DELTA TEMPERATURE 60-10m FOR THE PERIOD OF
JANUARY 1, 2009 THROUGH DECEMBER 31, 2009 (Continued)**

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 1/1/2009 00:00 12/31/2009 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	0.23 -	0.51 -	0.76 -	1.1 -	1.6 -	2.1 -	3.1 -	5.1 -	7.1 -	10.1 -	13.1 -		
(from)	0.50	0.75	1.0	1.5	2.0	3.0	5.0	7.0	10.0	13.0	18.0	> 18.0	Total
N	0	0	0	0	0	1	0	0	0	0	0	0	1
NNE	0	1	2	3	1	1	0	0	0	0	0	0	8
NE	0	6	37	35	7	2	0	0	0	0	0	0	87
ENE	1	18	102	165	19	2	0	0	0	0	0	0	307
E	1	16	39	16	0	1	0	0	0	0	0	0	73
ESE	0	6	10	2	0	0	0	0	0	0	0	0	18
SE	0	3	4	3	0	0	0	0	0	0	0	0	10
SSE	0	3	4	3	2	0	0	0	0	0	0	0	12
S	0	0	0	1	0	0	0	0	0	0	0	0	1
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	0	0	0	0	0	0	0	0	0	0	0	0
Totals	2	53	199	228	29	7	0	0	0	0	0	0	518

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	171
Number of Valid Hours for:	Total Period	518
Total Hours for:	Total Period	8760

TABLE 3-2
(continued)

**SSES JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND WIND
DIRECTION 10m VERSUS DELTA TEMPERATURE 60-10m FOR THE PERIOD OF
JANUARY 1, 2009 THROUGH DECEMBER 31, 2009 (Continued)**

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Summary of All Stability Classes

Total Period

Period of Record = 1/1/2009 00:00 12/31/2009 23:00

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

Delta Temperature

Wind Speed (m/s)

<u>Wind Direction</u> <u>(from)</u>	<u>0.23 -</u> <u>0.50</u>	<u>0.51 -</u> <u>0.75</u>	<u>0.76 -</u> <u>1.0</u>	<u>1.1 -</u> <u>1.5</u>	<u>1.6 -</u> <u>2.0</u>	<u>2.1 -</u> <u>3.0</u>	<u>3.1 -</u> <u>5.0</u>	<u>5.1 -</u> <u>7.0</u>	<u>7.1 -</u> <u>10.0</u>	<u>10.1 -</u> <u>13.0</u>	<u>13.1 -</u> <u>18.0</u>	<u>> 18.0</u>	<u>Total</u>
N	1	2	14	51	60	151	175	19	0	0	0	0	473
NNE	1	9	44	145	135	267	146	16	0	0	0	0	763
NE	1	33	174	278	176	232	74	0	0	0	0	0	968
ENE	4	104	403	531	106	49	27	0	0	0	0	0	1224
E	10	124	251	137	28	42	29	4	0	0	0	0	625
ESE	3	74	118	73	33	32	27	3	1	0	0	0	364
SE	4	58	100	84	47	67	35	4	0	0	0	0	399
SSE	6	18	64	104	60	70	42	1	0	0	0	0	365
S	1	14	50	162	87	133	93	7	0	0	0	0	547
SSW	0	5	19	120	131	163	84	3	0	0	0	0	525
SW	1	2	8	50	95	228	299	48	0	0	0	0	731
WSW	0	1	10	29	44	88	256	119	46	1	0	0	594
W	0	0	1	10	27	49	125	63	19	0	0	0	294
WNW	0	0	2	6	18	29	61	26	0	0	0	0	142
NW	0	1	4	4	15	47	78	40	7	0	0	0	196
NNW	0	3	7	13	22	77	196	56	5	0	0	0	379
Totals	32	448	1269	1797	1084	1724	1747	409	78	1	0	0	8589

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	171
Number of Valid Hours for:	Total Period	8589
Total Hours for:	Total Period	8760

TABLE 3-3

**SSES JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND WIND
DIRECTION 60m VERSUS DELTA TEMPERATURE 60-10m FOR THE PERIOD OF
JANUARY 1, 2009 THROUGH DECEMBER 31, 2009**

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 1/1/2009 00:00 12/31/2009 23:00

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

Stability Class A Delta Temperature Extremely Unstable

Wind Speed (m/s)

<u>Wind Direction</u>	<u>0.23 -</u>	<u>0.51 -</u>	<u>0.76 -</u>	<u>1.1 -</u>	<u>1.6 -</u>	<u>2.1 -</u>	<u>3.1 -</u>	<u>5.1 -</u>	<u>7.1 -</u>	<u>10.1 -</u>	<u>13.1 -</u>			
<u>(from)</u>	<u>0.50</u>	<u>0.75</u>	<u>1.0</u>	<u>1.5</u>	<u>2.0</u>	<u>3.0</u>	<u>5.0</u>	<u>7.0</u>	<u>10.0</u>	<u>13.0</u>	<u>18.0</u>	<u>> 18.0</u>	<u>Total</u>	
N	0	0	0	0	1	4	1	2	0	0	0	0	8	
NNE	0	0	0	0	1	3	10	6	0	0	0	0	20	
NE	0	0	0	2	1	1	2	0	0	0	0	0	6	
ENE	0	0	0	2	2	2	0	0	0	0	0	0	6	
E	0	0	0	0	0	1	0	0	0	0	0	0	1	
ESE	0	0	0	0	1	1	0	0	0	0	0	0	2	
SE	0	0	0	0	1	0	0	1	0	0	0	0	2	
SSE	0	0	0	1	1	2	0	1	0	0	0	0	5	
S	0	0	0	2	2	3	0	1	1	0	0	0	9	
SSW	0	0	0	0	5	6	13	9	1	0	0	0	34	
SW	0	0	0	0	1	7	31	33	14	0	0	0	86	
WSW	0	0	0	1	1	2	2	8	2	0	0	0	16	
W	0	0	0	1	0	0	1	4	0	0	0	0	6	
WNW	0	0	0	0	0	0	0	0	0	0	0	0	0	
NW	0	0	1	0	0	0	0	0	0	0	0	0	1	
NNW	0	0	0	0	0	1	0	0	0	0	0	0	1	
Totals	0	0	1	9	17	33	60	65	18	0	0	0	203	
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						135
Number of Valid Hours for:								Total Period						203
Total Hours for:								Total Period						8760

TABLE 3-3
(continued)

**SSS JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND WIND
DIRECTION 60m VERSUS DELTA TEMPERATURE 60-10m FOR THE PERIOD OF
JANUARY 1, 2009 THROUGH DECEMBER 31, 2009 (Continued)**

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 1/1/2009 00:00 12/31/2009 23:00

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

Stability Class B Delta Temperature Moderately Unstable

Wind Speed (m/s)

<u>Wind Direction</u>	<u>0.23 -</u>	<u>0.51 -</u>	<u>0.76 -</u>	<u>1.1 -</u>	<u>1.6 -</u>	<u>2.1 -</u>	<u>3.1 -</u>	<u>5.1 -</u>	<u>7.1 -</u>	<u>10.1 -</u>	<u>13.1 -</u>		
(from)	<u>0.50</u>	<u>0.75</u>	<u>1.0</u>	<u>1.5</u>	<u>2.0</u>	<u>3.0</u>	<u>5.0</u>	<u>7.0</u>	<u>10.0</u>	<u>13.0</u>	<u>18.0</u>	<u>> 18.0</u>	<u>Total</u>
N	0	0	0	1	0	1	1	4	0	0	0	0	7
NNE	0	0	0	0	2	0	16	5	0	0	0	0	23
NE	0	0	0	1	1	3	5	1	0	0	0	0	11
ENE	0	0	0	0	1	0	1	0	0	0	0	0	2
E	0	0	0	0	0	0	2	0	0	0	0	0	2
ESE	0	0	0	1	0	0	0	0	0	0	0	0	1
SE	0	0	0	0	0	2	0	0	0	0	0	0	2
SSE	0	0	0	0	0	0	0	3	0	0	0	0	3
S	0	0	0	0	0	0	1	3	1	0	0	0	5
SSW	0	0	0	0	0	5	12	0	0	0	0	0	17
SW	0	0	0	0	0	6	35	25	6	0	0	0	72
WSW	0	0	0	0	0	0	12	17	9	0	0	0	38
W	0	0	0	0	0	0	2	2	0	0	0	0	4
WNW	0	0	0	0	0	0	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	1	0	1	0	0	0	2
NNW	0	0	0	0	0	0	2	2	0	0	0	0	4
Totals	0	0	0	3	4	17	90	62	17	0	0	0	193

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	135
Number of Valid Hours for:	Total Period	193
Total Hours for:	Total Period	8760

TABLE 3-3
(continued)

SSES JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND WIND DIRECTION 60m VERSUS DELTA TEMPERATURE 60-10m FOR THE PERIOD OF JANUARY 1, 2009 THROUGH DECEMBER 31, 2009 (Continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 1/1/2009 00:00 12/31/2009 23:00

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

Stability Class C Delta Temperature Slightly Unstable

<u>Wind Direction</u> <u>(from)</u>	<u>Wind Speed (m/s)</u>												<u>Total</u>
	<u>0.23 - 0.50</u>	<u>0.51 - 0.75</u>	<u>0.76 - 1.0</u>	<u>1.1 - 1.5</u>	<u>1.6 - 2.0</u>	<u>2.1 - 3.0</u>	<u>3.1 - 5.0</u>	<u>5.1 - 7.0</u>	<u>7.1 - 10.0</u>	<u>10.1 - 13.0</u>	<u>13.1 - 18.0</u>	<u>> 18.0</u>	
N	0	0	1	1	0	5	15	7	3	0	0	0	32
NNE	0	0	0	0	2	13	40	9	0	0	0	0	64
NE	0	0	0	3	6	6	6	0	1	0	0	0	22
ENE	0	0	0	0	1	4	1	0	0	0	0	0	6
E	0	0	1	2	1	1	2	1	0	0	0	0	8
ESE	0	0	0	0	0	3	4	1	0	0	0	0	8
SE	0	0	0	1	0	1	6	0	0	0	0	0	8
SSE	0	0	0	0	1	2	2	3	0	0	0	0	8
S	0	0	0	0	1	2	2	7	1	0	0	0	13
SSW	0	0	0	1	4	11	13	6	0	1	0	0	36
SW	0	0	0	1	3	5	54	34	2	0	0	0	99
WSW	0	0	0	0	0	0	18	36	12	2	0	0	68
W	0	0	0	0	1	0	9	9	0	0	0	0	19
WNW	0	0	0	0	0	0	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	1	1	4	0	0	0	6
NNW	0	0	0	0	2	0	5	4	1	0	0	0	12
Totals	0	0	2	9	22	53	178	118	24	3	0	0	409

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	135
Number of Valid Hours for:	Total Period	409
Total Hours for:	Total Period	8760

TABLE 3-3
(continued)

**SSES JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND WIND
DIRECTION 60m VERSUS DELTA TEMPERATURE 60-10m FOR THE PERIOD OF
JANUARY 1, 2009 THROUGH DECEMBER 31, 2009 (Continued)**

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 1/1/2009 00:00 12/31/2009 23:00

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

Stability Class D Delta Temperature Neutral

Wind Speed (m/s)													
<u>Wind Direction</u>	<u>0.23 -</u>	<u>0.51 -</u>	<u>0.76 -</u>	<u>1.1 -</u>	<u>1.6 -</u>	<u>2.1 -</u>	<u>3.1 -</u>	<u>5.1 -</u>	<u>7.1 -</u>	<u>10.1 -</u>	<u>13.1 -</u>		
<u>(from)</u>	<u>0.50</u>	<u>0.75</u>	<u>1.0</u>	<u>1.5</u>	<u>2.0</u>	<u>3.0</u>	<u>5.0</u>	<u>7.0</u>	<u>10.0</u>	<u>13.0</u>	<u>18.0</u>	<u>> 18.0</u>	<u>Total</u>
N	1	0	4	17	24	42	108	40	12	0	0	0	248
NNE	0	9	5	31	46	95	235	131	31	0	0	0	583
NE	0	1	13	50	33	67	88	9	4	1	0	0	266
ENE	2	3	15	23	24	27	25	20	1	0	0	0	140
E	1	2	8	16	13	20	47	15	18	1	0	0	141
ESE	0	2	9	7	10	19	25	16	5	0	0	0	93
SE	0	1	7	19	13	41	58	20	6	0	0	0	165
SSE	0	3	13	16	13	25	42	13	3	0	0	0	128
S	1	0	8	25	31	21	66	57	13	2	0	0	224
SSW	0	0	3	25	45	64	57	32	13	0	0	0	239
SW	0	2	2	11	39	72	154	85	34	0	0	0	399
WSW	0	0	1	3	12	23	124	142	131	52	6	0	494
W	0	0	1	7	8	21	78	88	44	8	0	0	255
WNW	0	0	0	1	2	11	47	41	26	3	0	0	131
NW	0	0	2	2	4	17	93	103	23	1	0	0	245
NNW	0	0	2	7	8	15	133	87	21	0	0	0	273
Totals	5	23	93	260	325	580	1380	899	385	68	6	0	4024
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	135
Number of Valid Hours for:												Total Period	4024
Total Hours for:												Total Period	8760

TABLE 3-3
(continued)

**SSES JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND WIND
DIRECTION 60m VERSUS DELTA TEMPERATURE 60-10m FOR THE PERIOD OF
JANUARY 1, 2009 THROUGH DECEMBER 31, 2009 (Continued)**

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 1/1/2009 00:00 12/31/2009 23:00

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

Stability Class E Delta Temperature Slightly Stable

Wind Speed (m/s)

<u>Wind Direction</u>	<u>0.23 -</u>	<u>0.51 -</u>	<u>0.76 -</u>	<u>1.1 -</u>	<u>1.6 -</u>	<u>2.1 -</u>	<u>3.1 -</u>	<u>5.1 -</u>	<u>7.1 -</u>	<u>10.1 -</u>	<u>13.1 -</u>		
<u>(from)</u>	<u>0.50</u>	<u>0.75</u>	<u>1.0</u>	<u>1.5</u>	<u>2.0</u>	<u>3.0</u>	<u>5.0</u>	<u>7.0</u>	<u>10.0</u>	<u>13.0</u>	<u>18.0</u>	<u>> 18.0</u>	<u>Total</u>
N	0	3	8	21	43	57	49	3	0	0	0	0	184
NNE	1	3	9	59	112	161	97	12	0	0	0	0	454
NE	1	9	22	63	45	56	39	2	0	0	0	0	237
ENE	1	5	24	30	17	19	14	4	0	0	0	0	114
E	1	5	27	17	11	19	13	2	0	0	0	0	95
ESE	0	10	15	12	11	16	12	3	0	0	0	0	79
SE	1	6	16	26	6	12	18	2	2	0	0	0	89
SSE	2	6	14	30	13	19	23	5	1	0	0	0	113
S	0	3	10	25	20	24	45	20	3	5	0	0	155
SSW	0	5	7	32	34	49	73	29	7	0	0	0	236
SW	0	2	5	17	22	71	116	36	6	0	0	0	275
WSW	0	0	0	8	13	22	63	60	8	0	0	0	174
W	0	0	0	5	4	17	11	2	0	0	0	0	39
WNW	0	0	1	1	2	6	12	2	0	0	0	0	24
NW	0	0	2	5	4	12	34	5	0	0	0	0	62
NNW	0	0	3	4	6	8	22	4	0	0	0	0	47
Totals	7	57	163	355	363	568	641	191	27	5	0	0	2377

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	135
Number of Valid Hours for:	Total Period	2377
Total Hours for:	Total Period	8760

TABLE 3-3
(continued)

SSES JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND WIND DIRECTION 60m VERSUS DELTA TEMPERATURE 60-10m FOR THE PERIOD OF JANUARY 1, 2009 THROUGH DECEMBER 31, 2009 (Continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 1/1/2009 00:00 12/31/2009 23:00

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

Stability Class F Delta Temperature Moderately Stable

Wind Speed (m/s)

<u>Wind Direction</u>	<u>0.23 -</u>	<u>0.51 -</u>	<u>0.76 -</u>	<u>1.1 -</u>	<u>1.6 -</u>	<u>2.1 -</u>	<u>3.1 -</u>	<u>5.1 -</u>	<u>7.1 -</u>	<u>10.1 -</u>	<u>13.1 -</u>		
<u>(from)</u>	<u>0.50</u>	<u>0.75</u>	<u>1.0</u>	<u>1.5</u>	<u>2.0</u>	<u>3.0</u>	<u>5.0</u>	<u>7.0</u>	<u>10.0</u>	<u>13.0</u>	<u>18.0</u>	<u>> 18.0</u>	<u>Total</u>
N	0	0	7	7	41	74	14	0	0	0	0	0	143
NNE	1	1	11	51	100	104	14	1	0	0	0	0	283
NE	0	0	23	57	23	7	2	0	0	0	0	0	112
ENE	0	4	18	27	7	0	0	0	0	0	0	0	56
E	1	2	19	16	2	3	1	0	0	0	0	0	44
ESE	0	0	7	9	1	5	0	0	0	0	0	0	22
SE	0	1	3	15	1	0	1	0	0	0	0	0	21
SSE	0	1	3	13	7	3	1	0	0	0	0	0	28
S	0	0	2	10	8	12	3	0	0	0	0	0	35
SSW	0	0	1	12	12	19	13	3	0	0	0	0	60
SW	0	0	2	4	6	13	24	5	0	0	0	0	54
WSW	1	0	0	2	0	4	6	4	0	0	0	0	17
W	0	0	0	3	0	1	0	0	0	0	0	0	4
WNW	0	0	0	0	1	1	2	1	0	0	0	0	5
NW	0	0	1	2	1	0	3	0	0	0	0	0	7
NNW	0	1	1	2	1	5	3	0	0	0	0	0	13
Totals	3	10	98	230	211	251	87	14	0	0	0	0	904

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	135
Number of Valid Hours for:	Total Period	904
Total Hours for:	Total Period	8760

TABLE 3-3
(continued)

**SSES JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND WIND
DIRECTION 60m VERSUS DELTA TEMPERATURE 60-10m FOR THE PERIOD OF
JANUARY 1, 2009 THROUGH DECEMBER 31, 2009 (Continued)**

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Period of Record = 1/1/2009 00:00 12/31/2009 23:00

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

Stability Class G Delta Temperature Extremely Stable

Wind Speed (m/s)

<u>Wind Direction</u>	<u>0.23 -</u>	<u>0.51 -</u>	<u>0.76 -</u>	<u>1.1 -</u>	<u>1.6 -</u>	<u>2.1 -</u>	<u>3.1 -</u>	<u>5.1 -</u>	<u>7.1 -</u>	<u>10.1 -</u>	<u>13.1 -</u>		
<u>(from)</u>	<u>0.50</u>	<u>0.75</u>	<u>1.0</u>	<u>1.5</u>	<u>2.0</u>	<u>3.0</u>	<u>5.0</u>	<u>7.0</u>	<u>10.0</u>	<u>13.0</u>	<u>18.0</u>	<u>> 18.0</u>	<u>Total</u>
N	0	0	0	14	26	40	12	0	0	0	0	0	92
NNE	0	0	6	20	49	59	6	1	0	0	0	0	141
NE	0	0	9	34	15	6	1	0	0	0	0	0	65
ENE	0	1	8	12	5	2	0	0	0	0	0	0	28
E	0	2	4	15	3	8	0	0	0	0	0	0	32
ESE	0	3	7	11	5	1	0	0	0	0	0	0	27
SE	0	0	3	5	2	2	0	0	0	0	0	0	12
SSE	0	0	3	9	5	2	1	0	0	0	0	0	20
S	0	2	1	4	8	5	2	0	0	0	0	0	22
SSW	0	0	0	5	8	13	14	0	0	0	0	0	40
SW	0	0	0	1	1	11	5	0	0	0	0	0	18
WSW	0	0	0	2	0	2	1	0	0	0	0	0	5
W	0	0	0	1	1	0	0	0	0	0	0	0	2
WNW	0	0	0	0	1	0	0	0	0	0	0	0	1
NW	0	0	1	0	1	1	2	0	0	0	0	0	5
NNW	0	0	0	0	0	1	4	0	0	0	0	0	5
Totals	0	8	42	133	130	153	48	1	0	0	0	0	515

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	135
Number of Valid Hours for:	Total Period	515
Total Hours for:	Total Period	8760

TABLE 3-3
(continued)

SSES JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND WIND DIRECTION 60m VERSUS DELTA TEMPERATURE 60-10m FOR THE PERIOD OF JANUARY 1, 2009 THROUGH DECEMBER 31, 2009 (Continued)

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Summary of All Stability Classes

Total Period

Period of Record = 1/1/2009 00:00 12/31/2009 23:00

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

Wind Speed (m/s)

<u>Wind Direction</u>	<u>0.23 -</u>	<u>0.51 -</u>	<u>0.76 -</u>	<u>1.1 -</u>	<u>1.6 -</u>	<u>2.1 -</u>	<u>3.1 -</u>	<u>5.1 -</u>	<u>7.1 -</u>	<u>10.1 -</u>	<u>13.1 -</u>		
<u>(from)</u>	<u>0.50</u>	<u>0.75</u>	<u>1.0</u>	<u>1.5</u>	<u>2.0</u>	<u>3.0</u>	<u>5.0</u>	<u>7.0</u>	<u>10.0</u>	<u>13.0</u>	<u>18.0</u>	<u>> 18.0</u>	<u>Total</u>
N	1	3	20	61	135	223	200	56	15	0	0	0	714
NNE	2	13	31	161	312	435	418	165	31	0	0	0	1568
NE	1	10	67	210	124	146	143	12	5	1	0	0	719
ENE	3	13	65	94	57	54	41	24	1	0	0	0	352
E	3	11	59	66	30	52	65	18	18	1	0	0	323
ESE	0	15	38	40	28	45	41	20	5	0	0	0	232
SE	1	8	29	66	23	58	83	23	8	0	0	0	299
SSE	2	10	33	69	40	53	69	25	4	0	0	0	305
S	1	5	21	66	70	67	119	88	19	7	0	0	463
SSW	0	5	11	75	108	167	195	79	21	1	0	0	662
SW	0	4	9	34	72	185	419	218	62	0	0	0	1003
WSW	1	0	1	16	26	53	226	267	162	54	6	0	812
W	0	0	1	17	14	39	101	105	44	8	0	0	329
WNW	0	0	1	2	6	18	61	44	26	3	0	0	161
NW	0	0	7	9	10	30	134	109	28	1	0	0	328
NNW	0	1	6	13	17	30	169	97	22	0	0	0	355
Totals	15	98	399	999	1072	1655	2484	1350	471	76	6	0	8625

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	135
Number of Valid Hours for:	Total Period	8625
Total Hours for:	Total Period	8760

TABLE 3-4

2009 SSES Annual Relative Concentrations - No Decay, Undepleted X/Q (sec/m³)

Miles										
Direction From	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 10	10 - 20	20 - 30	30 - 40	40 - 50
N	4.40E-06	8.41E-07	3.47E-07	1.82E-07	1.16E-07	4.27E-08	1.15E-08	5.54E-09	3.46E-09	2.43E-09
NNE	9.02E-06	1.81E-06	8.02E-07	4.27E-07	2.74E-07	1.01E-07	2.73E-08	1.33E-08	8.42E-09	5.99E-09
NE	1.81E-05	3.42E-06	1.55E-06	8.71E-07	5.75E-07	2.26E-07	6.79E-08	3.40E-08	2.18E-08	1.58E-08
ENE	4.10E-05	7.67E-06	3.74E-06	2.20E-06	1.47E-06	5.79E-07	1.68E-07	8.13E-08	5.26E-08	3.86E-08
E	1.93E-05	3.55E-06	1.57E-06	8.85E-07	5.91E-07	2.40E-07	7.57E-08	3.83E-08	2.47E-08	1.80E-08
ESE	1.06E-05	2.09E-06	9.39E-07	5.21E-07	3.45E-07	1.39E-07	3.83E-08	1.67E-08	1.07E-08	7.75E-09
SE	1.13E-05	2.26E-06	1.03E-06	5.78E-07	3.82E-07	1.55E-07	3.85E-08	1.42E-08	9.03E-09	6.48E-09
SSE	8.51E-06	1.66E-06	7.33E-07	4.11E-07	2.76E-07	1.19E-07	3.10E-08	1.11E-08	7.04E-09	5.05E-09
S	6.83E-06	1.46E-06	7.05E-07	4.06E-07	2.77E-07	1.27E-07	3.47E-08	1.19E-08	7.53E-09	5.36E-09
SSW	6.55E-06	1.33E-06	6.06E-07	3.41E-07	2.26E-07	9.34E-08	2.41E-08	9.16E-09	5.81E-09	4.14E-09
SW	5.08E-06	1.02E-06	4.83E-07	2.76E-07	1.85E-07	8.12E-08	2.09E-08	7.03E-09	4.44E-09	3.15E-09
WSW	3.77E-06	7.21E-07	3.33E-07	1.95E-07	1.33E-07	6.22E-08	1.92E-08	7.14E-09	3.63E-09	1.98E-09
W	1.55E-06	2.92E-07	1.25E-07	6.79E-08	4.42E-08	1.78E-08	4.71E-09	1.88E-09	1.16E-09	8.00E-10
WNW	9.69E-07	1.79E-07	7.15E-08	3.73E-08	2.38E-08	8.78E-09	2.38E-09	1.12E-09	6.95E-10	4.82E-10
NW	1.41E-06	2.64E-07	1.06E-07	5.38E-08	3.41E-08	1.23E-08	3.25E-09	1.53E-09	9.44E-10	6.53E-10
NNW	2.79E-06	5.28E-07	2.22E-07	1.18E-07	7.41E-08	2.57E-08	6.36E-09	3.01E-09	1.86E-09	1.29E-09

TABLE 3-5

2009 SSES Annual Relative Concentrations - 2.26-Day Decay, Undepleted X/Q (sec/m³)

Direction From	Miles									
	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 10	10 - 20	20 - 30	30 - 40	40 - 50
N	4.40E-06	8.36E-07	3.44E-07	1.80E-07	1.14E-07	4.16E-08	1.09E-08	5.07E-09	3.06E-09	2.08E-09
NNE	9.00E-06	1.80E-06	7.94E-07	4.20E-07	2.69E-07	9.76E-08	2.56E-08	1.19E-08	7.22E-09	4.92E-09
NE	1.80E-05	3.40E-06	1.53E-06	8.55E-07	5.62E-07	2.17E-07	6.26E-08	2.96E-08	1.80E-08	1.23E-08
ENE	4.08E-05	7.61E-06	3.68E-06	2.15E-06	1.43E-06	5.54E-07	1.53E-07	7.00E-08	4.27E-08	2.95E-08
E	1.93E-05	3.51E-06	1.54E-06	8.63E-07	5.72E-07	2.27E-07	6.80E-08	3.20E-08	1.93E-08	1.31E-08
ESE	1.06E-05	2.07E-06	9.23E-07	5.08E-07	3.34E-07	1.32E-07	3.44E-08	1.40E-08	8.34E-09	5.60E-09
SE	1.13E-05	2.24E-06	1.01E-06	5.64E-07	3.71E-07	1.47E-07	3.48E-08	1.20E-08	7.12E-09	4.78E-09
SSE	8.49E-06	1.64E-06	7.22E-07	4.02E-07	2.69E-07	1.13E-07	2.83E-08	9.51E-09	5.70E-09	3.85E-09
S	6.81E-06	1.45E-06	6.97E-07	3.99E-07	2.71E-07	1.23E-07	3.23E-08	1.05E-08	6.34E-09	4.30E-09
SSW	6.54E-06	1.32E-06	6.00E-07	3.36E-07	2.22E-07	9.05E-08	2.27E-08	8.25E-09	5.02E-09	3.43E-09
SW	5.07E-06	1.02E-06	4.79E-07	2.72E-07	1.82E-07	7.91E-08	1.99E-08	6.45E-09	3.94E-09	2.70E-09
WSW	3.76E-06	7.18E-07	3.31E-07	1.93E-07	1.31E-07	6.09E-08	1.84E-08	6.65E-09	3.29E-09	1.74E-09
W	1.55E-06	2.91E-07	1.24E-07	6.73E-08	4.38E-08	1.75E-08	4.55E-09	1.77E-09	1.06E-09	7.15E-10
WNW	9.68E-07	1.78E-07	7.10E-08	3.69E-08	2.35E-08	8.60E-09	2.28E-09	1.05E-09	6.28E-10	4.23E-10
NW	1.41E-06	2.63E-07	1.05E-07	5.33E-08	3.37E-08	1.21E-08	3.11E-09	1.42E-09	8.52E-10	5.72E-10
NNW	2.79E-06	5.26E-07	2.21E-07	1.17E-07	7.31E-08	2.51E-08	6.07E-09	2.78E-09	1.66E-09	1.12E-09

TABLE 3-6

2009 SSES Annual Relative Concentrations - 8-Day Decay, Depleted X/Q (sec/m³)

Direction From	Miles									
	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 10	10 - 20	20 - 30	30 - 40	40 - 50
N	4.02E-06	7.12E-07	2.81E-07	1.41E-07	8.71E-08	2.97E-08	7.11E-09	2.98E-09	1.67E-09	1.07E-09
NNE	8.24E-06	1.53E-06	6.48E-07	3.30E-07	2.05E-07	7.00E-08	1.68E-08	7.13E-09	4.04E-09	2.60E-09
NE	1.65E-05	2.90E-06	1.25E-06	6.74E-07	4.30E-07	1.57E-07	4.16E-08	1.81E-08	1.03E-08	6.77E-09
ENE	3.74E-05	6.49E-06	3.02E-06	1.70E-06	1.10E-06	4.01E-07	1.02E-07	4.31E-08	2.48E-08	1.64E-08
E	1.77E-05	3.00E-06	1.27E-06	6.83E-07	4.41E-07	1.66E-07	4.60E-08	2.01E-08	1.15E-08	7.57E-09
ESE	9.70E-06	1.77E-06	7.58E-07	4.02E-07	2.57E-07	9.59E-08	2.33E-08	8.80E-09	5.00E-09	3.25E-09
SE	1.03E-05	1.91E-06	8.31E-07	4.46E-07	2.85E-07	1.07E-07	2.34E-08	7.46E-09	4.23E-09	2.73E-09
SSE	7.77E-06	1.40E-06	5.92E-07	3.18E-07	2.06E-07	8.21E-08	1.89E-08	5.86E-09	3.32E-09	2.15E-09
S	6.24E-06	1.23E-06	5.70E-07	3.14E-07	2.07E-07	8.83E-08	2.13E-08	6.33E-09	3.59E-09	2.31E-09
SSW	5.98E-06	1.12E-06	4.90E-07	2.64E-07	1.69E-07	6.49E-08	1.49E-08	4.91E-09	2.79E-09	1.80E-09
SW	4.64E-06	8.66E-07	3.91E-07	2.14E-07	1.39E-07	5.65E-08	1.29E-08	3.79E-09	2.15E-09	1.38E-09
WSW	3.44E-06	6.11E-07	2.70E-07	1.51E-07	9.96E-08	4.33E-08	1.19E-08	3.87E-09	1.77E-09	8.75E-10
W	1.42E-06	2.47E-07	1.01E-07	5.27E-08	3.32E-08	1.24E-08	2.92E-09	1.02E-09	5.66E-10	3.56E-10
WNW	8.85E-07	1.52E-07	5.79E-08	2.89E-08	1.78E-08	6.12E-09	1.47E-09	6.09E-10	3.38E-10	2.13E-10
NW	1.29E-06	2.24E-07	8.54E-08	4.17E-08	2.56E-08	8.59E-09	2.01E-09	8.29E-10	4.59E-10	2.89E-10
NNW	2.55E-06	4.48E-07	1.80E-07	9.13E-08	5.55E-08	1.79E-08	3.93E-09	1.62E-09	9.01E-10	5.68E-10

TABLE 3-7

2009 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	2.74E-08	4.03E-09	1.65E-09	7.84E-10	4.63E-10	1.47E-10	3.51E-11	1.29E-11	6.90E-12	4.33E-12
NNE	4.20E-08	6.50E-09	2.82E-09	1.34E-09	7.90E-10	2.46E-10	5.74E-11	2.11E-11	1.13E-11	7.08E-12
NE	4.95E-08	7.46E-09	3.19E-09	1.54E-09	9.16E-10	2.95E-10	7.23E-11	2.66E-11	1.42E-11	8.93E-12
ENE	6.65E-08	1.03E-08	4.60E-09	2.25E-09	1.33E-09	4.20E-10	9.58E-11	3.36E-11	1.79E-11	1.13E-11
E	3.29E-08	4.80E-09	1.96E-09	9.34E-10	5.57E-10	1.84E-10	4.65E-11	1.71E-11	9.15E-12	5.75E-12
ESE	2.24E-08	3.39E-09	1.44E-09	6.97E-10	4.17E-10	1.38E-10	3.14E-11	1.01E-11	5.41E-12	3.40E-12
SE	2.91E-08	4.42E-09	1.93E-09	9.53E-10	5.72E-10	1.93E-10	4.02E-11	1.10E-11	5.88E-12	3.69E-12
SSE	2.54E-08	3.79E-09	1.61E-09	7.97E-10	4.86E-10	1.74E-10	3.81E-11	1.01E-11	5.41E-12	3.40E-12
S	2.69E-08	4.32E-09	2.03E-09	1.04E-09	6.50E-10	2.51E-10	5.87E-11	1.51E-11	8.04E-12	5.05E-12
SSW	3.13E-08	4.78E-09	2.15E-09	1.09E-09	6.57E-10	2.29E-10	5.09E-11	1.45E-11	7.76E-12	4.87E-12
SW	3.89E-08	6.17E-09	2.90E-09	1.50E-09	9.28E-10	3.49E-10	7.88E-11	2.01E-11	1.07E-11	6.73E-12
WSW	3.60E-08	5.55E-09	2.59E-09	1.39E-09	8.82E-10	3.64E-10	1.02E-10	2.96E-11	1.30E-11	6.35E-12
W	1.49E-08	2.24E-09	9.68E-10	4.83E-10	2.95E-10	1.05E-10	2.57E-11	8.06E-12	4.30E-12	2.70E-12
WNW	7.98E-09	1.15E-09	4.64E-10	2.22E-10	1.32E-10	4.27E-11	1.05E-11	3.88E-12	2.07E-12	1.30E-12
NW	1.19E-08	1.74E-09	6.98E-10	3.25E-10	1.92E-10	6.10E-11	1.46E-11	5.38E-12	2.87E-12	1.81E-12
NNW	2.31E-08	3.43E-09	1.45E-09	7.00E-10	4.10E-10	1.25E-10	2.81E-11	1.04E-11	5.53E-12	3.47E-12

TABLE 3-8

**2009 ATMOSPHERIC DISPERSION ESTIMATES
FOR RETDAS INPUT AT SELECTED LOCATIONS**

AFFECTED SECTOR	LOCATION	MILES	X/Q ⁽¹⁾	X/Q DEC ⁽²⁾	X/Q DEC+ ⁽³⁾ DEP	DEPOSITION ⁽⁴⁾
10/SSW	Maximum (X/Q) Site Boundary	0.39	1.29E-05	1.29E-05	1.20E-05	6.38E-08
9/S	Closest (X/Q) Site Boundary	0.38	6.66E-06	6.65E-06	6.20E-06	4.41E-08
12 / WSW	Maximum (X/Q) Residence	1.3	9.55E-06	9.47E-06	8.16E-06	1.32E-08
3 / NE	Maximum (D/Q) Residence	0.9	2.15E-06	2.15E-06	1.89E-06	1.45E-08
12 / WSW	Maximum (D/Q) Garden	1.3	9.55E-06	9.47E-06	8.16E-06	1.32E-08
12 / WSW	Maximum (D/Q) Dairy	1.7	6.44E-06	6.37E-06	5.39E-06	8.47E-09
12 / WSW	Maximum (D/Q) Meat Producer	1.7	6.44E-06	6.37E-06	5.39E-06	8.47E-09
3 / NE	Riverlands / EIC	0.7	3.11E-06	3.10E-06	2.78E-06	2.21E-08
12 / WSW	Tower's Club	0.5	4.09E-05	4.08E-05	3.74E-05	6.63E-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	1.78E-06	1.77E-06	1.53E-06	5.49E-09
2	NNE	E. Ashbridge III	1	2.39E-06	2.38E-06	2.08E-06	9.56E-09
3	NE	W. Tuggle	0.9	2.15E-06	2.15E-06	1.89E-06	1.45E-08
4	ENE	D. Barberi	2.1	4.33E-07	4.31E-07	3.56E-07	3.36E-09
5	E	L.Kozlowski/ W. Witts	1.4	3.24E-07	3.23E-07	2.76E-07	2.52E-09
6	ESE	R. Panetta	0.5	9.67E-07	9.66E-07	8.84E-07	7.96E-09
7	SE	J. Futoma	0.5	1.41E-06	1.40E-06	1.29E-06	1.19E-08
8	SSE	J. Naunczek	0.6	2.11E-06	2.11E-06	1.91E-06	1.68E-08
9	S	S. Slusser	1	1.55E-06	1.54E-06	1.35E-06	8.17E-09
10	SSW	S. Molnar	0.9	3.82E-06	3.80E-06	3.35E-06	1.55E-08
11	SW	F. Michael	1.5	3.43E-06	3.40E-06	2.90E-06	7.47E-09
12	WSW	F. Michael	1.3	9.55E-06	9.47E-06	8.16E-06	1.32E-08
13	W	F. Hummel	1.2	5.01E-06	4.97E-06	4.31E-06	7.10E-09
14	WNW	R. Orlando	0.8	5.29E-06	5.26E-06	4.68E-06	9.98E-09
15	NW	B. Kramer	0.7	7.54E-06	7.50E-06	6.75E-06	1.81E-08
16	NNW	G. John	0.6	6.48E-06	6.45E-06	5.84E-06	1.85E-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	4.70E-07	4.63E-07	3.68E-07	1.24E-09
2	NNE	R. Chapin	2.3	6.89E-07	6.82E-07	5.61E-07	2.44E-09
3	NE	F. Kremski	2.6	4.52E-07	4.48E-07	3.64E-07	2.69E-09
4	ENE	G. Dennis	2.4	3.55E-07	3.52E-07	2.88E-07	2.76E-09
5	E	W. Daily	1.8	2.16E-07	2.15E-07	1.80E-07	1.66E-09
6	ESE	B. Smith	3.1	4.71E-08	4.67E-08	3.71E-08	2.89E-10
7	SE	T. Scholl	0.6	1.07E-06	1.06E-06	9.62E-07	8.64E-09
8	SSE	H. Roinick	2.9	1.68E-07	1.67E-07	1.33E-07	1.05E-09
9	S	T. Sternrich	2.7	2.99E-07	2.97E-07	2.40E-07	1.39E-09
10	SSW	S. Bodnar	1.2	2.51E-06	2.50E-06	2.16E-06	9.50E-09
11	SW	D. Bankes	1.9	2.37E-06	2.35E-06	1.96E-06	5.04E-09
12	WSW	F. Michael	1.3	9.55E-06	9.47E-06	8.16E-06	1.32E-08
13	W	F. Hummel	1.2	5.01E-06	4.97E-06	4.31E-06	7.10E-09
14	WNW	P. Moskaluk	1.3	2.58E-06	2.56E-06	2.21E-06	4.34E-09
15	NW	R. Reider	4.5	3.82E-07	3.71E-07	2.85E-07	5.72E-10
16	NNW	P. Culver	4	3.32E-07	3.25E-07	2.52E-07	6.12E-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	6.89E-07	6.82E-07	5.61E-07	2.44E-09
4	ENE	G.Dennis	2.4	3.55E-07	3.52E-07	2.88E-07	2.76E-09
5	E	W. Daily	1.8	2.16E-07	2.15E-07	1.80E-07	1.66E-09
6	ESE	B. Smith	3.1	4.72E-08	4.68E-08	3.71E-08	2.89E-10
10	SSW	K. & C. Drasher	3.5	4.26E-07	4.20E-07	3.30E-07	1.34E-09
12	WSW	T. & M Berger	1.7	6.44E-06	6.37E-06	5.39E-06	8.47E-09

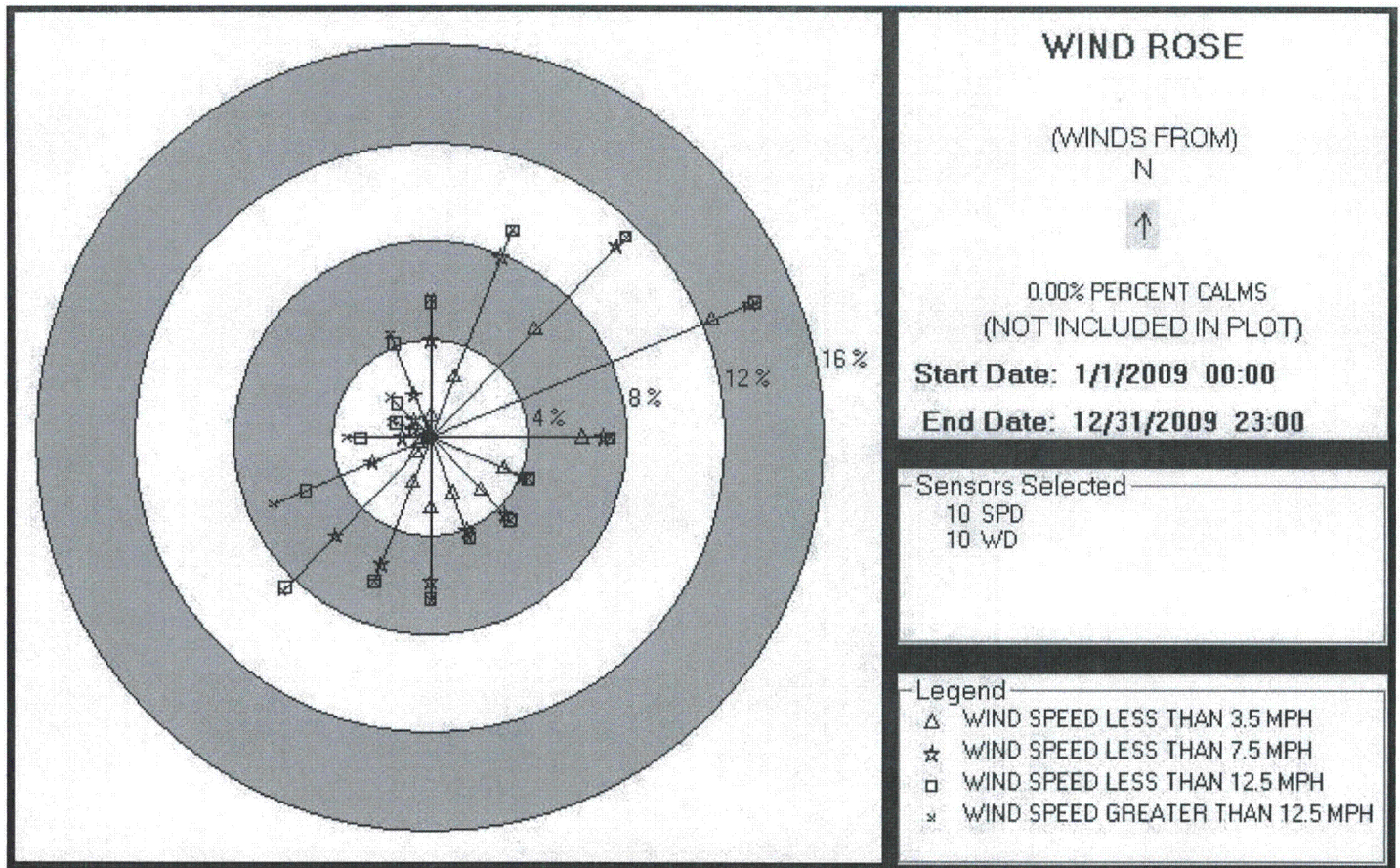
ALL DAIRY LOCATIONS

SECTOR NUMBER	AFFECTED SECTOR	NAME	MILES	X/Q	X/Q DEC	X/Q DEC+DEP	DEPOSITION
5	E	W.Bloss	4.5	4.42E-08	4.37E-08	3.32E-08	2.94E-10
6	ESE	F.Rinehimer	4.2	2.69E-08	2.66E-08	2.04E-08	1.52E-10
10	SSW	K. & C. Drasher	3.5	4.26E-07	4.20E-07	3.30E-07	1.34E-09
10	SSW	K.Davis	14.01	3.11E-08	2.92E-08	1.93E-08	6.63E-11
12	WSW	T. & M. Berger	1.7	6.37E-06	6.37E-06	5.39E-06	8.47E-09
13	W	J. Dent	5	4.90E-07	4.73E-07	3.60E-07	4.43E-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

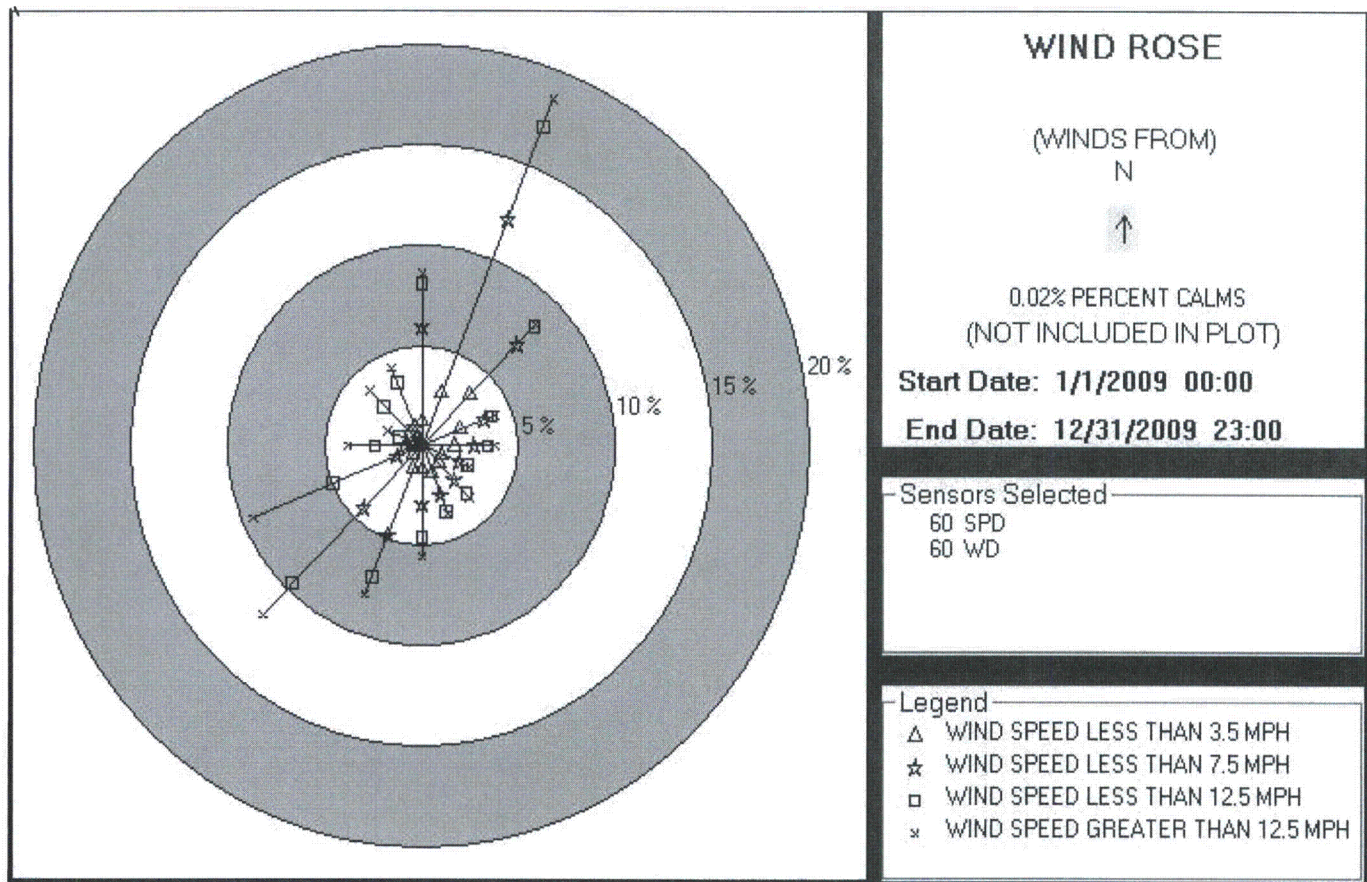
2009 ANNUAL WIND ROSE 10M LEVEL – PRIMARY TOWER



This wind rose displays the frequency of hourly average wind direction from a given sector. In 2009, the predominant wind direction occurred 14.3 % of the time from the ENE sector. The average wind speed was 5.0 mph and the average wind speed for the predominant sector (ENE) was 2.7 mph. The sector with the highest average wind speed was WSW (9.1 mph).

FIGURE 3-2

2009 ANNUAL WIND ROSE 60M LEVEL – PRIMARY TOWER

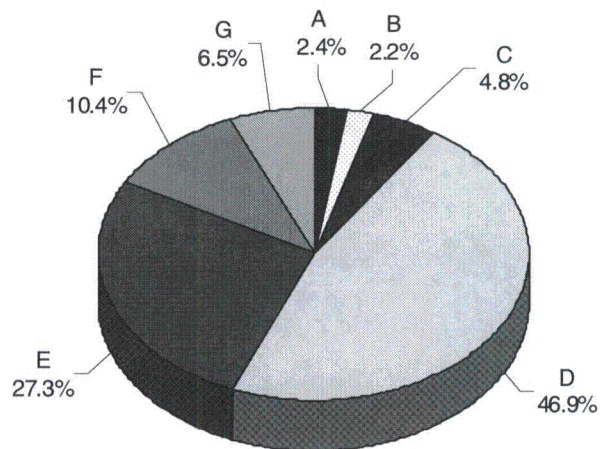


This wind rose displays the frequency of hourly average wind direction from a given sector. In 2009, the predominant wind direction occurred 18.2 % of the time from the NNE sector. The average wind speed was 7.8 mph and the average wind speed for the predominant sector (NNE) was 6.7 mph. The sector with the highest average wind speed was WSW (13.0 mph.).

FIGURE 3-3

PASQUIL STABILITY CLASS PREVALENCES DATA
Period: 2009

Joint Frequency Distributions at 10 Meters
Wind Speed and Direction 10M vs. Delta Temperature 60-10M
(Based on 8,589 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 2009 Annual Radiological Environmental Operating Report) contributed a maximum of $6.80\text{E-}1$ mrem (measured at TLD Location 9S2 and based on an occupancy time by a member of the public of 20 hours per quarter) at the Protected Area Boundary south of the plant. The maximum organ (including thyroid)/total body dose from all airborne effluent is $3.46\text{E-}1$ mrem (CHILD, LUNG Table 4-4). The maximum organ/total body dose from all liquid effluent is $2.55\text{E-}3$ mrem (TEEN, 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 (1.03 mrem) is 4.12% of the 40CFR190 limit of 25 mrem to total body/organ (except thyroid) and 1.37% 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 2009

PARAMETER	ENTIRE YEAR
Cooling Tower Blowdown (CFS)	20.1
Average Net River Level (ft.)	6.6
Dilution Factor at Danville ⁽¹⁾	378.8
Transit time to Danville (hr.) ⁽¹⁾	26.2

⁽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 beyond the site boundary 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 2009 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 2009. 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: 1/1/09 TO 12/31/09**

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⁾	Teen	Total Body	8.50E-04	(3)		0.03	3
1	Liquid ⁽¹⁾	Teen	GI-LLI	1.28E-03	(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	Liver	1.48E-01	0.5	WSW	1.00	15
2	Liquid ⁽¹⁾	Teen	Total Body	8.50E-04	(3)		0.03	3
2	Liquid ⁽¹⁾	Teen	GI-LLI	1.28E-03	(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	Lung	1.98E-01	0.5	WSW	1.32	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: 1/1/09 TO 12/31/09**

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	3.24E-06	3.24E-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

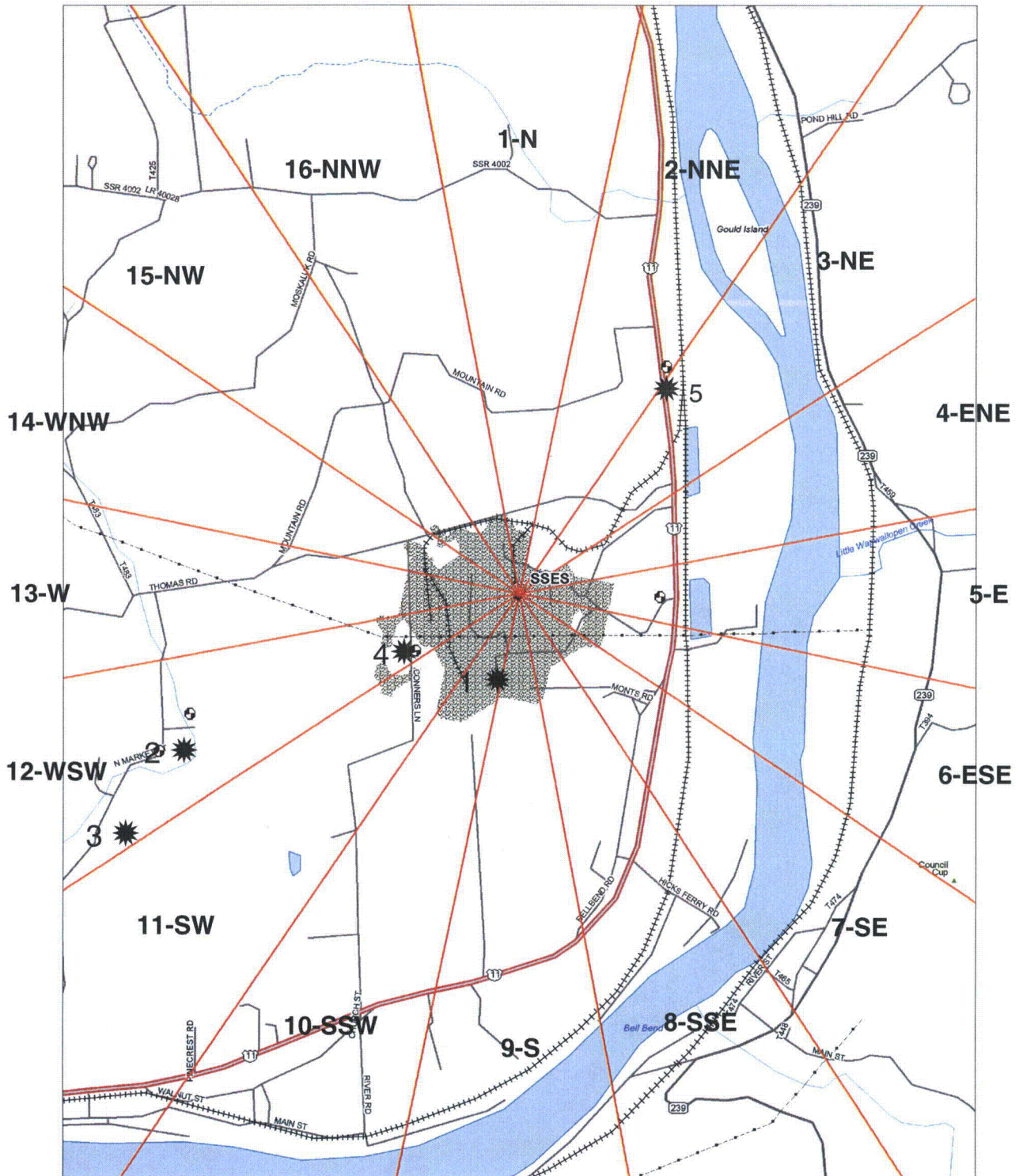
SUMMARY OF MAXIMUM INDIVIDUAL DOSES FROM AIRBORNE EFFLUENT

LOCATION	PATHWAY	MAXIMUM TOTAL BODY DOSE (MREM)		MAXIMUM ORGAN DOSE (MREM)		MAXIMUM THYROID DOSE (MREM)	
1. Maximum site boundary X/Q	Total (All)	1.14E-01	(CHILD)	1.14E-01	(CHILD, GI-LLI)	1.13E-01	(CHILD)
2. Maximum X/Q Residence + Maximum D/Q Garden	Total (All)	8.02E-02	(CHILD)	8.05E-02	(CHILD, LUNG)	8.01E-02	(CHILD)
3. Maximum D/Q Dairy + Maximum D/Q Meat	Total (All)	5.41E-02	(CHILD)	5.42E-02	(CHILD, LUNG)	5.40E-02	(CHILD)
4. Tower's Club	Total (All)	3.45E-01	(CHILD)	3.46E-01	(CHILD, LUNG)	3.44E-01	(CHILD)
5. Riverland/EIC	Total (All)	2.82E-02	(CHILD)	2.84E-02	(CHILD, GI-LLI)	2.81E-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-008, Radiological Environmental Monitoring Program, was revised on April 9, 2009. The revision: 1) Updated Attachments D and G to add four new groundwater monitoring well sample locations and two new surface water sample locations; 2) Updated position titles.

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.

Section 3.11.2.6 of the Unit-1 and Unit-2 TRM was revised on September 8, 2009. The revision clarified the Completion Time requirements for TRO 3.11.2.6. Conditions H and J.

PROCESS CONTROL PROGRAM CHANGES

The following changes were made to the Process Control Program and implementing procedures during 2009. 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. NDAP-QA-0646, Solid Radioactive Waste Process Control Program
2. WM-RP-107, Transfer and Dewater A (B) RWCU Phase Separator
3. WM-RP-109, Transfer of Waste Sludge Phase Separator
4. WM-RP-110, Transfer and Dewatering of Waste Mix Tanks
5. WM-RP-113, Transfer and Dewatering of Waste Mix Tanks
6. WM-RP-106, Transfer and Dewatering Bead Resin
7. CH-RC-075, Sample Preparation and Analysis of Dewatered Radwaste
8. CH-RC-076, Gamma Spectral Analysis
9. WM-PS-150, 10CFR61 Non-Process Waste Stream Sampling
10. WM-RP-009, Combustible Gas Check and Closure of Processing Liners and High Integrity Containers
11. WM-RP-010, Liner Decanting
12. WM-RP-104, Gross Dewatering
13. WM-RP-112, Dewatering Waste to Disposal Criteria
14. WM-RP-012, Handling and Use of Steel Liners and High Integrity Containers
15. WM-PS-100, Shipment of Radioactive Waste
16. WM-PS-110, General Shipment of Radioactive Material

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
NDAP-QA-0646

The following changes will not reduce the overall conformance of the solidified waste product to existing criteria for solid wastes.

1. Updated references to New Vendor Topical Reports.
2. Clarified Quality Control responsibilities.
3. Updated Waste Types section.
4. Deleted various requirements related to Barnwell Waste Management Facility which no longer takes PPL Radwaste.
5. Minor administrative changes.
6. Updated Shipping of Radioactive Waste section (6.13).
7. Added use of Applicability Determination for evaluation of process or operational changes.
8. Removed unnecessary Foreman Effluents signoffs from Form NDAP-QA-0646-1 and NDAP-QA-0646-2.
9. Updated Attachments C and D.

PROCEDURE REVISION SUMMARY
WM-RP-107

1. Procedure revision to incorporate the new processing area modification system: Self Engaging Dewatering System (SEDS).

PROCEDURE REVISION SUMMARY
WM-RP-109

1. Procedure revision to incorporate the new processing area modification system: Self Engaging Dewatering System (SEDS).

PROCEDURE REVISION SUMMARY
WM-RP-110

1. Interim change to support the installation of EC/TEC 1135363, Temporary Processing of Waste Mix Tanks.

PROCEDURE REVISION SUMMARY
WM-RP-113

1. This is a newly issued procedure number which replaces the old WM-RP-110. WM-RP-110 has been revised to reflect interim changes until the radwaste modification is complete.

PROCEDURE REVISION SUMMARY
WM-RP-106

1. Revised procedure to support processing area modifications.

PROCEDURE REVISION SUMMARY
CH-RC-075

1. Incorporate PCAFs 2003-1628 and 2004-3209.
2. Revise Step 7.2 to correspond with changes made to solid Radwaste processing via EC No. 1088096 (Radwaste Processing Changes).
3. Add reference to AR No. 1144103 to support Item 2 above.
4. Update position title of "Chemistry Supervisor" to "Manager – Plant Chemistry/Environmental".
5. Add "ADHERENCE LEVEL: REFERENCE USE" to procedure cover sheet.

PROCEDURE REVISION SUMMARY
CH-RC-076

1. Revise Step 7.4.2.e (7) to add guidance to notify Chemistry Supervision if unable to identify/select an unidentified isotope after reviewing a spectral energy listing.

PROCEDURE REVISION SUMMARY
WM-PS-150

1. Clarified DAW sampling steps.
2. Updated the procedure adherence level.
3. Changed references to Effluents Management Health Physicist to Health Physicist – Radwaste to reflect current staffing.
4. Updated types of filters used.

PROCEDURE REVISION SUMMARY
WM-RP-009

1. Procedure revised due to Processing Area Modification.
2. Incorporate PCAFs 2005-1184 and 2005-1407.

PROCEDURE REVISION SUMMARY
WM-RP-010

1. Revised procedure to support processing area modifications.
2. Incorporate PCAF 2004-1715

PROCEDURE REVISION SUMMARY
WM-RP-104

1. Revised procedure due to processing area modifications.

PROCEDURE REVISION SUMMARY
WM-RP-112

1. New procedure written to address changes in methodology for dewatering waste to disposal criteria. This procedure replaces WM-RP-111.

PROCEDURE REVISION SUMMARY
WM-RP-012

1. Complete rewrite for new container types used for radwaste processing.
2. Incorporate PCAF 2008-1197, as appropriate for new containers.
3. Minor editorial changes.

PROCEDURE REVISION SUMMARY
WM-PS-100

1. Added vendor computer program error tracking mechanism.
2. Updated Form WM-PS-100-1 due to processing area modification.
3. Removed steps and forms related to the Barnwell Waste Management Facility due to PPL inaccessibility to the disposal site.

PROCEDURE REVISION SUMMARY
WM-PS-110

1. Minor administrative enhancements.
2. Incorporated PCAF 2006-1314.
3. Changed the US Government agency that we monitor for security threats to the US Department of Homeland Security.
4. Added requirement to notify the Shift Manager and write an AR if a shipment is determined to be lost or missing.

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 2009.

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 2009.

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 2009.

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.

None to report for 2009

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 2009.

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 2009.

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 2009. 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 2009.

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. Outlined in Table 6-1 are the tritium analysis results from sampling of the perimeter drain system. No gamma emitting radionuclides were identified above analysis MDC's for the perimeter drain samples in 2009. 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. Figure 6-1 is a trend graph of airborne and waterborne effluent tritium releases from the PPL Susquehanna Station starting in 1982.

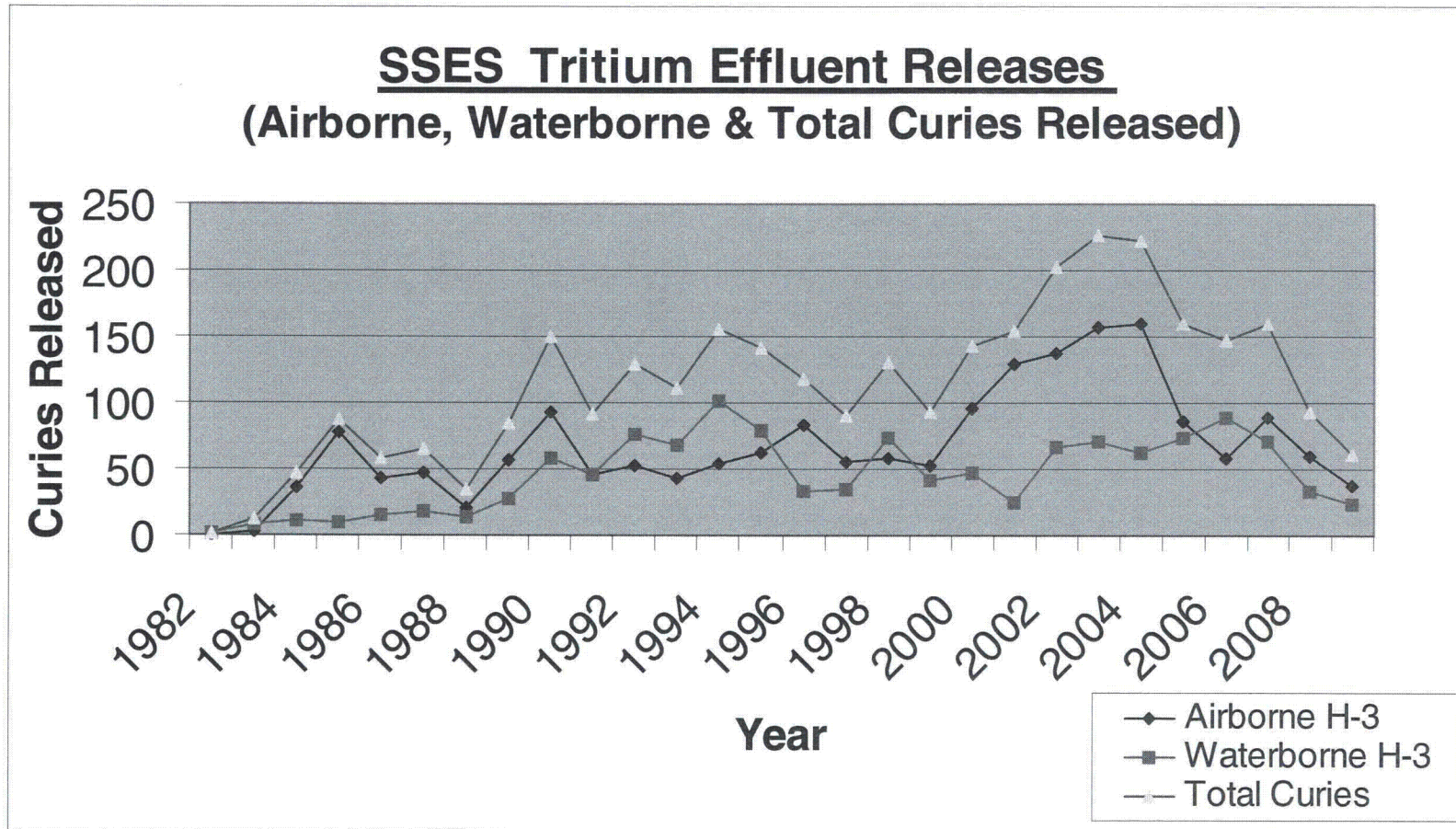
TABLE 6-1

NEI Ground Water Protection Initiative Reporting

Perimeter Drain Sampling Results: 2009

<u>Manhole FD-1</u> (7S9 - E of U2 CST)		<u>Manhole FD-2</u> (16S3- NW corner of RW Bldg.)		<u>Manhole FD-3</u> (9S3 - I/S RCA @ U2 HP Cont. Pt. Closet)	
<u>Date</u>	<u>Tritium (pCi/liter)</u>	<u>Tritium (pCi/liter)</u>		<u>Tritium (pCi/liter)</u>	
2/9/2009	430	288		207	
7/11/2009	335	243		295	
8/10/2009	241	136		214	
11/9/2009	565	432		262	

Figure 6-1



SECTION 7

***CORRECTIONS TO PREVIOUS
RADIOACTIVE EFFLUENT RELEASE REPORTS***

**CORRECTIONS TO PREVIOUS
RADIOACTIVE EFFLUENT RELEASE REPORTS**

No corrections to previous Radioactive Effluent Release Reports are submitted for this report period.

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 2009. The calculation also assumes immediate removal of 100% of the water by the oil mist eliminators as it passes through the turbines.

On April 7, 2009 the auxiliary steam system was identified as contaminated with low levels of tritium ($\sim 2\text{E-}5$ uCi/cc). Airborne release to the environment from auxiliary steam system operation on April 7, 2009 is estimated based on conservative assumptions of system maximum vent flow rates and maximum identified tritium concentration levels. Offsite dose due to the release of $6.86\text{E-}5$ Ci tritium from the auxiliary steam system operation on April 7, 2009 is included in the maximum dose to the public from insignificant effluents.

The annual release of tritium, iodines and particulates with half-lives greater than 8 days was calculated based on the conservative assumptions outlined above. 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 1.05 Ci of tritium is calculated to be $2.89\text{E-}3$ 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**

<u>Nuclide</u>	<u>RWST</u> (Ci)	<u>U1-CST and</u> <u>Main Turbine/RFPT</u> <u>Lube Oil Systems</u> (Ci)	<u>U2-CST and</u> <u>Main Turbine/RFPT</u> <u>Lube Oil Systems</u> (Ci)	<u>Aux. Steam System</u> (Ci)	<u>Total</u> (Ci)
H-3	4.10E-02	5.83E-01	4.28E-01	6.86E-05	1.05E+00
Mn-54	1.67E-08	1.91E-09	7.18E-08		9.04E-08
Co-60	3.57E-08	8.32E-09	1.44E-07		1.88E-07
Fe-59	9.71E-10	0.00E+00	3.99E-09		4.96E-09
Xe-135	0.00E+00	1.19E-07	0.00E+00		1.19E-07
Co-58	1.78E-08	9.24E-10	7.15E-08		9.03E-08
Zn-65	1.04E-09	0.00E+00	6.30E-09		7.35E-09
Cr-51	7.97E-09	0.00E+00	3.28E-08		4.08E-08