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**DOMINION ENERGY KEWAUNEE, INC.**  
**KEWAUNEE POWER STATION**  
**2010 ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT**

Enclosed is the Kewaunee Power Station (KPS) 2010 Annual Radioactive Effluent Release Report for January through December 2010. This report is submitted to meet the requirements of KPS Technical Specification 5.6.2 and 10 CFR 50.36a(a)(2).

If you have questions or require additional information, please feel free to contact Mr. Jack Gadzala at 920-388-8604.

Very truly yours,

Michael J. Wilson  
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Commitments made by this letter: NONE

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**Dominion<sup>®</sup>**

2010

**Annual**

**Radioactive**

**Effluent**

**Release**

**Report**

*Kewaunee Power Station*

**Dominion Energy Kewaunee, Inc.**

DOCKET 50-305

**KEWAUNEE POWER STATION**

**ANNUAL RADIOACTIVE  
EFFLUENT RELEASE REPORT**

January 1 - December 31, 2010

Dominion Energy Kewaunee, Inc.

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## 0.0 SUMMARY

During 2010 all solid, liquid, and gaseous radioactive effluents from the Kewaunee Power Station were well below regulatory limits. For individual effluent streams, the quarterly limit most closely approached was:

<u>GASEOUS:</u>	Ingestion Pathway-Organ	Liver
	Quarterly Limit (mRems)	7.5
	Actual Dose (mRems)	0.000173 (4 <sup>th</sup> Quarter)
	% of Specification	0.002306

<u>LIQUID:</u>	Ingestion Pathway-Organ	Total Body
	Quarterly Limit (mRems)	1.5
	Actual Dose (mRems)	0.0004926 (4 <sup>th</sup> Quarter)
	% of Limit	0.03284

<u>SOLID:</u>	No upper limit for solid radioactive waste applies.	
	Cubic Meters Shipped	41.26 m <sup>3</sup> (1460 ft <sup>3</sup> )

## 1.0 INTRODUCTION

This report is being submitted in accordance with the requirements of Kewaunee Technical Specifications, Section 6.9.b.2 and the Offsite Dose Calculation Manual, Section 3/4.6. It includes data from all effluent releases made from January 1 - December 31, 2010. The report contains summaries of the gaseous and liquid releases made to the environment including the quantity, characterization, time duration and calculated radiation dose at the site boundary resulting from these releases. The report also includes a summation of solid waste disposal, revisions to the Process Control Program and the Offsite Dose Calculation Manual, and addresses the cumulative meteorological data. Values indicated as 0 (zero) in this report refer to actual values less than the detection limits. A table of these less than (LLD) values is identified in sections 2.1 and 3.1.

### 1.1 Effluent Dose Limits

Specifications are set to insure that offsite doses are maintained as low as reasonably achievable while still allowing for practical and dependable operation of the Kewaunee Plant.

The Kewaunee Offsite Dose Calculation Manual (ODCM) describes the methodology and parameters used in:

- 1.) The calculation of radioactive liquid and gaseous effluent monitoring instrumentation alarm/trip setpoints.
- 2.) The calculation of radioactive liquid and gaseous concentrations, dose rates and cumulative quarterly and annual doses. The ODCM methodology is acceptable for use in demonstrating compliance with 10 CFR 20.106; 10 CFR 50, Appendix I; and 40 CFR 190.

## 2.0 GASEOUS EFFLUENTS

### 2.1 Lower Limits of Detection (LLD) for Gaseous Effluents

Gaseous radioactive effluents are released in both the continuous mode and the batch mode. The auxiliary building stack is sampled continuously for particulates, iodine, noble gases and Strontium by an "off-line" sample train. This stack is also grab-sampled daily for gaseous gamma emitters. Batch releases are sampled prior to release for principal gaseous and particulate gamma emitters, iodine, noble gases and tritium.

The LLD's for gaseous radioanalyses, as listed in Table 4.4 of the Kewaunee ODCM are:

<u>Analysis</u>	<u>LLD (<math>\mu\text{Ci/ml}</math>)</u>
Gaseous Gamma Emitters	1.00 E-04
Iodine 131	3.00 E-12
Particulate Gamma Emitters	1.00 E-11
Particulate Gross Alpha	1.00 E-11
Strontium 89, 90	1.00 E-11
Noble Gases, Gross Beta or Gamma	1.00 E-06

The nominal "a priori" LLD values are shown below.

#### Isotope      a priori LLD ( $\mu\text{Ci/ml}$ )

##### a. Gaseous emissions:

Kr-87	5.61E-08
Kr-88	1.02E-07
Xe-133	6.68E-08
Xe-133m	2.75E-07
Xe-135	2.99E-08
Xe-138	1.13E-07

b. Particulate emissions:

Mn-54	1.11E-13
Fe-59	2.27E-13
Co-58	2.28E-13
Co-60	3.57E-13
Zn-65	1.68E-13
Mo-99	2.73E-13
Cs-134	4.69E-13
Cs-137	1.68E-13
Ce-141	2.08E-13
Ce-144	1.24E-12

c. Other identifiable gamma emitters:

Ar-41	3.97E-10
Kr-85	8.63E-05
Kr-85m	4.62E-08
Kr-89	2.04E-06
Xe-127	4.20E-08
Xe-131m	1.82E-06
Xe-135m	1.90E-08
Xe-137	2.88E-07
I-131	1.32E-13

d. Composite particulate samples:

Sr-89	1.00 E-14
Sr-90	1.00 E-14
Gross Alpha	1.00 E-14

These "a priori" LLDs represent the capabilities of the counting systems in use, not an after the fact "a posteriori" limit for a particular measurement.



## 2.2 Gaseous Batch Release Statistics

The following is a summation of all gaseous batch releases made during 2010.

Number of batch releases.....	30
Total time for all batch releases (min).....	15197.0
Maximum time for a batch release (min).....	14416.0
Average time for a batch release (min).....	506.6
Minimum time for a batch release (min).....	15.0

## 2.3 Gaseous Effluent Data

The following table 2.1 presents a quarterly summation of the total activity released and average release rates of four categories of gaseous effluents. Table 2.2 lists the quarterly sums of individual gaseous radionuclides released by continuous and batch modes. Table 2.3 is essentially the same data, but is presented as monthly summations. Table 2.4 presents the dose limits for gaseous effluents, and the calculated doses this year from gaseous effluents.

**Table 2.1**  
**Annual Radioactive Effluent Release Report 2010**  
**Gaseous Effluents - Summation of all Releases**

Fission and Activation Gases	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Total Activity Released (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Average Release Rate ( $\mu$ Ci/sec)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
<b>Iodine</b>				
Total Activity Released (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Average Release Rate ( $\mu$ Ci/sec)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
<b>Particulates</b>				
Total Activity Released (Ci)	0.000E+00	1.510E-06	0.000E+00	0.000E+00
Average Release Rate ( $\mu$ Ci/sec)	0.000E+00	1.921E-07	0.000E+00	0.000E+00
Gross Alpha Released (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
<b>Tritium</b>				
Total Activity Released (Ci)	1.634E+00	3.555E+00	3.278E+00	8.189E+00
Average Release Rate ( $\mu$ Ci/sec)	2.079E-01	4.522E-01	4.170E-01	1.042E+00

**Table 2.2**  
**Annual Radioactive Effluent Release Report 2010**  
**Gaseous Effluents**

	Nuclides Released (Ci)			
	Continuous Mode			
	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
<b>Fission Gases</b>				
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00
<b>Iodine</b>				
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00
<b>Particulates</b>				
Mn-54	0.000E+00	4.000E-08	0.000E+00	0.000E+00
Co-58	0.000E+00	9.700E-07	0.000E+00	0.000E+00
Co-60	0.000E+00	1.100E-07	0.000E+00	0.000E+00
Cs-137	0.000E+00	3.900E-07	0.000E+00	0.000E+00
Total	0.000E+00	1.510E-06	0.000E+00	0.000E+00

**Table 2.2(cont)**  
**Annual Radioactive Effluent Release Report 2010**  
**Gaseous Effluents**

Nuclides Released (Ci)  
 Batch Mode

Fission Gases

Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00
-------	-----------	-----------	-----------	-----------

Iodine

Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00
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Particulates

Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00
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**Table 2.3A**  
**Annual Radioactive Effluent Release Report 2010**  
**1st Quarter Gaseous Release**  
**Total of all Releases**

**Noble Gasses (Curies)**

Isotope	January	February	March	Total
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00

**Particulates (Curies)**

Isotope	January	February	March	Total
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00

**Iodine (Curies)**

Isotope	January	February	March	Total
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00

**Table 2.3A (Con't)**  
**Annual Radioactive Effluent Release Report 2010**  
**1st Quarter Gaseous Release**  
**Total of all Releases**

Summary	January	February	March	Total
Total Noble Gases (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total Iodine (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total Particulate Gross Beta-Gamma Half-Lives > 8 Days (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total Tritium (Ci)	7.688E-01	8.557E-01	9.924E-03	1.634E+00
Total Particulate Gross Alpha (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00

**Table 2.3A (Con't)**  
**Annual Radioactive Effluent Release Report 2010**  
**2nd Quarter Gaseous Release**  
**Total of all Releases**

Noble Gasses (Curies)

Isotope	April	May	June	Total
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Particulates (Curies)

Isotope	April	May	June	Total
Mn-54	0.000E+00	0.000E+00	4.000E-08	4.000E-08
Co-58	0.000E+00	0.000E+00	9.700E-07	9.700E-07
Co-60	0.000E+00	0.000E+00	1.100E-07	1.100E-07
Cs-137	0.000E+00	0.000E+00	3.900E-07	3.900E-07
Total	0.000E+00	0.000E+00	1.510E-06	1.510E-06

Iodine (Curies)

Isotope	April	May	June	Total
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00

**Table 2.3A (Con't)**  
**Annual Radioactive Effluent Release Report 2010**  
**2nd Quarter Gaseous Release**  
**Total of all Releases**

Summary	April	May	June	Total
Total Noble Gases (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total Iodine (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total Particulate Gross Beta-Gamma Half-Lives>8 Days (Ci)	0.000E+00	0.000E+00	1.510E-06	1.510E-06
Total Tritium (Ci)	6.159E-01	2.000E+00	9.400E-01	3.555E+00
Total Particulate Gross Alpha (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00



**Table 2.3A (con't)**  
**Annual Radioactive Effluent Release Report 2010**  
**3rd Quarter Gaseous Release**  
**Total of all Releases**

Noble Gasses (Curies)

Isotope	July	August	September	Total
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Particulates (Curies)

Isotope	July	August	September	Total
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Iodine (Curies)

Isotope	July	August	September	Total
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00

**Table 2.3A (Con't)**  
**Annual Radioactive Effluent Release Report 2010**  
**3rd Quarter Gaseous Release**  
**Total of all Releases**

Summary	July	August	September	Total
Total Noble Gases (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total Iodine (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total Particulate Gross Beta-Gamma Half-Lives > 8 Days (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total Tritium (Ci)	4.388E-01	6.088E-01	2.231E+00	3.278E+00
Total Particulate Gross Alpha (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00

**Table 2.3A (Con't)**  
**Annual Radioactive Effluent Release Report 2010**  
**4th Quarter Gaseous Release**  
**Total of all Releases**

Noble Gasses (Curies)

Isotope	October	November	December	Total
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Particulates (Curies)

Isotope	October	November	December	Total
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Iodine (Curies)

Isotope	October	November	December	Total
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00

**Table 2.3A (Con't)**  
**Annual Radioactive Effluent Release Report 2010**  
**4th Quarter Gaseous Release**  
**Total of all Releases**

Summary	October	November	December	Total
Total Noble Gases (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total Iodine (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total Particulate Gross Beta-Gamma Half-Lives>8 Days (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total Tritium (Ci)	5.068E+00	2.606E+00	5.148E-01	8.189E+00
Total Particulate Gross Alpha (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00

**Table 2.3B**  
**Annual Radioactive Effluent Release Report 2010**  
**1st Quarter Gaseous Release**  
**Continuous Mode Only**

Noble Gasses (Curies)

Isotope	January	February	March	Total
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Particulates (Curies)

Isotope	January	February	March	Total
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Iodine (Curies)

Isotope	January	February	March	Total
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00

**Table 2.3B (Con't)**  
**Annual Radioactive Effluent Release Report 2010**  
**1st Quarter Gaseous Release**  
**Continuous Mode Only**

Summary	January	February	March	Total
Total Noble Gases (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total Iodine (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total Particulate Gross Beta-Gamma Half-Lives > 8 Days (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total Tritium (Ci)	7.688E-01	8.556E-01	9.924E-03	1.634E+00
Total Particulate Gross Alpha (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00

**Table 2.3B (Con't)**  
**Annual Radioactive Effluent Release Report 2010**  
**2nd Quarter Gaseous Release**  
**Continuous Mode Only**

Noble Gasses (Curies)

Isotope	April	May	June	Total
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Particulates (Curies)

Isotope	April	May	June	Total
Mn-54	0.000E+00	0.000E+00	4.000E-08	4.000E-08
Co-58	0.000E+00	0.000E+00	9.700E-07	9.700E-07
Co-60	0.000E+00	0.000E+00	1.100E-07	1.100E-07
Cs-137	0.000E+00	0.000E+00	3.900E-07	3.900E-07
Total	0.000E+00	0.000E+00	1.510E-06	1.510E-06

Iodine (Curies)

Isotope	April	May	June	Total
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00

**Table 2.3B (Con't)**  
**Annual Radioactive Effluent Release Report 2010**  
**2nd Quarter Gaseous Release**  
**Continuous Mode Only**

Summary	April	May	June	Total
Total Noble Gases (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total Iodine (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total Particulate Gross Beta-Gamma Half-Lives > 8 Days (Ci)	0.000E+00	0.000E+00	1.510E-06	1.510E-06
Total Tritium (Ci)	6.119E-01	1.999E+00	9.396E-01	3.551E+00
Total Particulate Gross Alpha (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00



**Table 2.3B (con't)**  
**Annual Radioactive Effluent Release Report 2010**  
**3rd Quarter Gaseous Release**  
**Continuous Mode Only**

Noble Gasses (Curies)

Isotope	July	August	September	Total
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Particulates (Curies)

Isotope	July	August	September	Total
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Iodine (Curies)

Isotope	July	August	September	Total
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00

**Table 2.3B (Con't)**  
**Annual Radioactive Effluent Release Report 2010**  
**3rd Quarter Gaseous Release**  
**Continuous Mode Only**

Summary	July	August	September	Total
Total Noble Gases (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total Iodine (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total Particulate Gross Beta-Gamma Half-Lives>8 Days (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total Tritium (Ci)	4.380E-01	6.085E-01	2.230E+00	3.277E+00
Total Particulate Gross Alpha (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00

**Table 2.3B (Con't)**  
**Annual Radioactive Effluent Release Report 2010**  
**4th Quarter Gaseous Release**  
**Continuous Mode Only**

Noble Gasses (Curies)

Isotope	October	November	December	Total
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Particulates (Curies)

Isotope	October	November	December	Total
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Iodine (Curies)

Isotope	October	November	December	Total
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00

**Table 2.3B (Con't)**  
**Annual Radioactive Effluent Release Report 2010**  
**4th Quarter Gaseous Release**  
**Continuous Mode Only**

Summary	October	November	December	Total
Total Noble Gases (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total Iodine (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total Particulate Gross Beta-Gamma Half-Lives>8 Days (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total Tritium (Ci)	5.067E+00	2.603E+00	5.119E-01	8.182E+00
Total Particulate Gross Alpha (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00

**Table 2.3C**  
**Annual Radioactive Effluent Release Report 2010**  
**1st Quarter Gaseous Release**  
**Batch Mode Only**

Noble Gasses (Curies)

Isotope	January	February	March	Total
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Particulates (Curies)

Isotope	January	February	March	Total
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Iodine (Curies)

Isotope	January	February	March	Total
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00

**Table 2.3C (Con't)**  
**Annual Radioactive Effluent Release Report 2010**  
**1st Quarter Gaseous Release**  
**Batch Mode Only**

Summary	January	February	March	Total
Total Noble Gases (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total Iodine (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total Particulate Gross Beta-Gamma Half-Lives>8 Days (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total Tritium (Ci)	0.000E+00	7.375E-05	0.000E+00	7.375E-05
Total Particulate Gross Alpha (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00

**Table 2.3C (Con't)**  
**Annual Radioactive Effluent Release Report 2010**  
**2nd Quarter Gaseous Release**  
**Batch Mode Only**

Noble Gasses (Curies)

Isotope	April	May	June	Total
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Particulates (Curies)

Isotope	April	May	June	Total
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Iodine (Curies)

Isotope	April	May	June	Total
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00

**Table 2.3C (Con't)**  
**Annual Radioactive Effluent Release Report 2010**  
**2nd Quarter Gaseous Release**  
**Batch Mode Only**

Summary	April	May	June	Total
Total Noble Gases (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total Iodine (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total Particulate Gross Beta-Gamma Half-Lives>8 Days (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total Tritium (Ci)	3.968E-03	1.797E-04	3.487E-04	4.497E-03
Total Particulate Gross Alpha (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00



**Table 2.3C (con't)**  
**Annual Radioactive Effluent Release Report 2010**  
**3rd Quarter Gaseous Release**  
**Batch Mode Only**

Noble Gasses (Curies)

Isotope	July	August	September	Total
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Particulates (Curies)

Isotope	July	August	September	Total
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Iodine (Curies)

Isotope	July	August	September	Total
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00

**Table 2.3C (Con't)**  
**Annual Radioactive Effluent Release Report 2010**  
**3rd Quarter Gaseous Release**  
**Batch Mode Only**

Summary	July	August	September	Total
Total Noble Gases (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total Iodine (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total Particulate Gross Beta-Gamma Half-Lives > 8 Days (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total Tritium (Ci)	7.817E-04	3.085E-04	5.329E-04	1.623E-03
Total Particulate Gross Alpha (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00

**Table 2.3C (Con't)**  
**Annual Radioactive Effluent Release Report 2010**  
**4th Quarter Gaseous Release**  
**Batch Mode Only**

Noble Gasses (Curies)

Isotope	October	November	December	Total
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Particulates (Curies)

Isotope	October	November	December	Total
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Iodine (Curies)

Isotope	October	November	December	Total
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00

**Table 2.3C (Con't)**  
**Annual Radioactive Effluent Release Report 2010**  
**4th Quarter Gaseous Release**  
**Batch Mode Only**

Summary	October	November	December	Total
Total Noble Gases (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total Iodine (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total Particulate Gross Beta-Gamma Half-Lives > 8 Days (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total Tritium (Ci)	8.449E-04	3.368E-03	2.848E-03	7.061E-03
Total Particulate Gross Alpha (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00

**Table 2.4**  
**Annual Radioactive Effluent Release Report 2010**  
**Dose From Gaseous Effluents**

The offsite dose limits from radioactive materials in gaseous effluents are specified in Section 3/4.4 of the Kewaunee ODCM and can be summarized as follows:

Limit	Whole Body	Skin	Organ
	Gamma	Beta	
Quarterly	5.0 mRad	10.0 mRad	7.5 mRem
Annual	10.0 mRad	20.0 mRad	15.0 mRem

The total release of gaseous effluents during each quarter of 2010 was within limits. The following offsite doses were calculated using equations 2.7, 2.8, and 2.11 from the Kewaunee ODCM. Calculated offsite doses versus quarterly limits are shown below:

	<u>1st Qtr</u>	<u>2nd Qtr</u>	<u>3rd Qtr</u>	<u>4th Qtr</u>
<b>1. Gamma-Whole Body</b>				
Specification (mRads)	5.000E+00	5.000E+00	5.000E+00	5.000E+00
Actual Dose (mRads)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
% of Specification	0.000E+00	0.000E+00	0.000E+00	0.000E+00
<b>2. Beta-Skin</b>				
Specification (mRads)	1.000E+01	1.000E+01	1.000E+01	1.000E+01
Actual Dose (mRads)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
% of Specification	0.000E+00	0.000E+00	0.000E+00	0.000E+00
<b>3. Ingestion Pathway-Organ</b>				
Specification (mRems)	7.500E+00	7.500E+00	7.500E+00	7.500E+00
Actual Dose (mRems)	3.453E-05	7.841E-05	6.926E-05	1.730E-04
% of Specification	4.604E-04	1.045E-03	9.234E-04	2.306E-03
	Liver	Liver	Liver	Liver

**Table 2.4 (Con't)**  
**Annual Radioactive Effluent Release Report 2010**  
**Dose From Gaseous Effluents**

In addition, the cumulative annual offsite doses for the period January 1 - December 31, 2010 versus the ODCM annual limits were:

	<u>Annual</u>
1. Gamma-Whole Body	
Specification (mRads)	1.000E+01
Actual Dose (mRads)	0.000E+00
% of Specification	0.000E+00
2. Beta-Skin	
Specification (mRads)	2.000E+01
Actual Dose (mRads)	0.000E+00
% of Specification	0.000E+00
3. Ingestion Pathway-Organ	
Specification (mRems)	1.500E+01
Actual Dose (mRems)	3.552E-04
% of Specification	2.368E-03
Liver	

**2.4 Estimation of Carbon-14 in Gaseous Releases (Calculation C11988 Rev. 0)**

Kewaunee Power Station conducted a site specific analysis to determine the amount of C-14 generated, the percentage that is in a form contributing to offsite doses, and the impact to the public. C-14 is not a new emission; because of improvements in power plant operations C-14 now qualifies as a principle radionuclide under Federal regulations. Unlike other principle radionuclides, the contribution of C-14 is calculated, not measured. The calculation includes conservative assumptions to estimate the dose.

The total estimated C-14 released was 6.133 Ci.

30% of the estimated C-14 released was assumed to be in the form of CO<sub>2</sub>.

The highest estimated C-14 doses were at the highest X/Q for ingestion and inhalation receptor (one mile west).

- 1.90E-01 mRem as Child Bone Dose
- 3.79E-02 mRem as Child Whole Body

### 3.0 LIQUID EFFLUENTS

#### 3.1 Lower Limits of Detection (LLD) for Liquid Effluents

Liquid radioactive effluents are released as both batch releases and continuous releases. Each batch is sampled prior to release and analyzed for gamma emitters and tritium. A fraction of each sample is retained for a monthly proportional composite which is then analyzed for Gross Alpha, Strontium 89, Strontium 90 and Iron 55.

The LLD's for liquid batch release radioanalyses, as listed in Table 4.3 of the Kewaunee Offsite Dose Calculation Manual, are:

Analysis	LLD ( $\mu\text{Ci/ml}$ )
Principal Gamma Emitters	1.00 E-06
Iodine 131	1.00 E-06
Tritium	1.00 E-05
Gross Alpha	5.00 E-07
Strontium 89, 90	5.00 E-08
Iron 55	1.00 E-06

The actual obtained "a priori" LLD values for batch releases are shown below.

Isotope	Batch Releases				Average a priori LLD ( $\mu\text{Ci/ml}$ )
	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	
Mn-54	8.19E-08	8.19E-08	1.14E-07	1.09E-07	9.66E-08
Fe-59	1.82E-07	1.82E-07	2.47E-07	2.38E-07	2.12E-07
Co-58	8.04E-08	8.04E-08	1.12E-07	1.08E-07	9.51E-08
Co-60	1.21E-07	1.21E-07	1.62E-07	1.55E-07	1.40E-07
Zn-65	2.06E-07	2.06E-07	2.78E-07	2.68E-07	2.40E-07
Mo-99	5.77E-07	5.77E-07	8.08E-07	7.78E-07	6.85E-07
Cs-134	6.34E-08	6.34E-08	9.03E-08	8.70E-08	7.60E-08
Cs-137	7.88E-08	7.88E-08	1.11E-07	1.07E-07	9.40E-08
Ce-141	5.49E-08	6.02E-08	6.89E-08	6.69E-08	6.27E-08
Ce-144	2.98E-07	3.21E-07	3.09E-07	4.59E-07	3.47E-07
I-131	4.80E-08	4.80E-08	7.13E-08	6.85E-08	5.90E-08
H-3	2.62E-06	4.24E-06	2.92E-06	2.67E-06	3.11E-06
Sr-89	1.13E-09	1.59E-08	1.16E-08	6.55E-09	8.80E-09
Sr-90	6.82E-09	1.29E-08	8.75E-09	5.73E-09	8.55E-09
Gross Alpha	7.61E-09	4.56E-09	5.19E-09	6.69E-09	6.01E-09
Fe-55	7.79E-07	6.96E-07	8.00E-07	7.64E-07	7.60E-07

Continuous liquid releases are grab sampled weekly and analyzed for principal gamma emitters. A fraction of each weekly sample is retained for a monthly proportional composite which is then analyzed for Tritium, Gross Alpha, Strontium 89, Strontium 90 and Iron 55.

The LLD's for liquid continuous release radioanalyses, as listed in Table 4.3 of the Kewaunee Offsite Dose Calculation Manual, are:

Analysis	LLD ( $\mu\text{Ci/ml}$ )
Principal Gamma Emitters	5.00 E-07
Iodine 131	1.00 E-06
Tritium	1.00 E-05
Gross Alpha	5.00 E-07
Strontium 89, 90	5.00 E-08
Iron 55	1.00 E-06

The actual obtained "a priori" LLD values for continuous releases are shown below.

Isotope	Continuous Release				Average a priori LLD ( $\mu\text{Ci/ml}$ )
	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	
Mn-54	5.18E-09	3.66E-09	3.66E-09	3.52E-09	4.01E-09
Fe-59	8.07E-09	1.89E-08	8.07E-09	7.76E-09	1.07E-08
Co-58	3.60E-09	4.16E-09	6.57E-09	9.98E-09	6.08E-09
Co-60	5.34E-09	5.34E-09	5.55E-09	5.13E-09	5.34E-09
Zn-65	1.11E-08	1.05E-08	9.09E-09	1.24E-08	1.08E-08
Mo-99	7.22E-08	4.64E-08	3.37E-08	5.29E-08	5.13E-08
Cs-134	8.09E-09	4.58E-09	6.15E-09	7.88E-09	6.68E-09
Cs-137	1.08E-08	8.48E-09	8.11E-09	8.38E-09	8.94E-09
Ce-141	9.63E-09	1.17E-08	8.89E-09	9.68E-09	9.98E-09
Ce-144	5.82E-08	4.74E-08	4.30E-08	5.74E-08	5.15E-08
I-131	6.49E-09	8.59E-09	6.89E-09	9.22E-09	7.80E-09
H-3	2.62E-06	4.24E-06	2.92E-06	2.67E-06	3.11E-06
Sr-89	1.43E-08	1.59E-08	9.93E-09	7.17E-09	1.18E-08
Sr-90	6.89E-09	1.13E-08	7.46E-09	5.77E-09	7.86E-09
Gross Alpha	6.81E-09	5.31E-09	6.10E-09	6.42E-09	6.16E-09
Fe-55	7.77E-07	7.09E-07	8.04E-07	7.82E-07	7.68E-07



### 3.2 Liquid Batch Release Statistics

The following is a summation of all liquid batch releases made during 2010.

<u>Release Type</u>	<u>Number</u>	<u>Gallons Released</u>
A&B WCT	1	1,760.0
A CVC Monitor Tank	2	12,320.0
A SGBT Monitor Tank	7	61,393.0
B CVC Monitor Tank	2	12,950.0
B SGBT Monitor Tank	6	53,398.0

Total time for all batch releases.....7,030.0 Min.

Maximum time for a batch release.....567.0 Min.

Minimum time for a batch release.....89.0 Min.

Average time for a batch release.....390.6 Min.

### 3.3 Liquid Effluent Data

The following Table 3.1 presents a quarterly summation of the total activity released and average concentration for all liquid effluents. It also presents the gross alpha activity released, volume of waste released and volume of dilution water used. Tables 3.2 and 3.3 are monthly summations of the same information in Table 3.1. Table 3.2 contains the quantity of the individual isotopes released to the unrestricted area for batch releases. Table 3.3 presents a monthly summation of gross radioactivity, tritium, gross alpha and isotopic activity for the secondary blowdown and leakage releases. It also presents the monthly total volume for these releases and dilution volumes. Table 3.4 presents the doses from liquid effluents for each quarter and the calculated doses this year from liquid effluents.

**TABLE 3.1**  
**Annual Radioactive Effluent Release Report 2010**  
**Liquid Effluents - Summation of all Releases**

	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
<b>Fission and Activation Products</b>				
Total Release Excluding H3 and Dissolved Gases (Ci)	2.500E-03	4.830E-03	5.906E-03	5.313E-04
Average Concentration (µCi/ml)	2.156E-11	2.396E-11	2.913E-11	2.495E-12
<b>Tritium</b>				
Total Release (Ci)	3.849E+00	1.443E+01	9.835E+00	1.350E+02
Average Concentration (µCi/ml)	3.319E-08	7.158E-08	4.850E-08	6.340E-07
% of Tech. Spec. Limit(3.0E-3 µCi/ml)	1.106E-03	2.386E-03	1.617E-03	2.113E-02
<b>Dissolved Gases</b>				
Total Release (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Average Concentration (µCi/ml)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
% of Tech. Spec. Limit(2.0E-4 µCi/ml)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
<b>Gross Alpha Activity</b>				
Total Release (Ci)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
<b>Volume of Waste Released</b>				
Batch (liters)	6.546E+04	1.739E+05	1.278E+05	1.697E+05
Continuous (liters)	2.141E+07	1.993E+07	1.807E+07	1.892E+07
Total (liters)	2.147E+07	2.010E+07	1.820E+07	1.909E+07
<b>Volume of Dilution Water</b>				
Batch (liters)	7.381E+08	2.933E+09	2.663E+09	3.504E+09
Continuous (liters)	1.152E+11	1.986E+11	2.001E+11	2.094E+11
Total (liters)	1.159E+11	2.015E+11	2.028E+11	2.129E+11

**TABLE 3.2A**  
**Annual Radioactive Effluent Release Report 2010**  
**Liquid Effluents - Batch Releases**

	January	February	March	Total
<b>Gross Radioactivity</b>				
<b>Total Release Excluding H3 and Dissolved Gases (Ci)</b>				
	1.278E-03	1.222E-03	0.000E+00	2.500E-03
<b>Avg. Conc. (µCi/ml)</b>				
	4.117E-09	2.857E-09	0.000E+00	
<b>Tritium</b>				
<b>Total Release (Ci)</b>				
	1.980E+00	1.849E+00	0.000E+00	3.828E+00
<b>Avg. Conc. (µCi/ml)</b>				
	6.378E-06	4.322E-06	0.000E+00	
<b>Dissolved Gases</b>				
<b>Total Release (Ci)</b>				
	0.000E+00	0.000E+00	0.000E+00	0.000E+00
<b>Avg. Conc. (µCi/ml)</b>				
	0.000E+00	0.000E+00	0.000E+00	
<b>Gross Alpha Activity</b>				
<b>Total Release (Ci)</b>				
	0.000E+00	0.000E+00	0.000E+00	0.000E+00
<b>Avg. Conc. (µCi/ml)</b>				
	0.000E+00	0.000E+00	0.000E+00	
<b>Volume of Waste Released (liters)</b>				
	3.409E+04	3.137E+04	0.000E+00	6.546E+04
<b>Volume of Dilution Water (liters)</b>				
	3.104E+08	4.277E+08	0.000E+00	7.381E+08

**TABLE 3.2A (Con't)**  
**Annual Radioactive Effluent Release Report 2010**  
**Liquid Effluents - Batch Releases**

Isotope (Ci)	January	February	March	Total
Ag-110m	1.268E-04	9.971E-05	0.000E+00	2.265E-04
Co-58	5.346E-05	6.584E-05	0.000E+00	1.193E-04
Co-60	2.010E-04	1.491E-04	0.000E+00	3.501E-04
Fe-55	8.966E-04	8.249E-04	0.000E+00	1.722E-03
H-3	1.980E+00	1.849E+00	0.000E+00	3.828E+00
Mn-54	0.000E+00	2.166E-05	0.000E+00	2.166E-05
Sb-125	0.000E+00	6.066E-05	0.000E+00	6.066E-05
<b>Total</b>	<b>1.981E+00</b>	<b>1.850E+00</b>	<b>0.000E+00</b>	<b>3.831E+00</b>

**TABLE 3.2B**  
**Annual Radioactive Effluent Release Report 2010**  
**Liquid Effluents - Batch Releases**

	April	May	June	Total
<b>Gross Radioactivity</b>				
<b>Total Release Excluding H3 and Dissolved Gases (Ci)</b>				
	3.641E-03	0.000E+00	1.189E-03	4.830E-03
<b>Avg. Conc. (µCi/ml)</b>				
	2.147E-09	0.000E+00	9.612E-10	
<b>Tritium</b>				
<b>Total Release (Ci)</b>				
	9.416E+00	0.000E+00	4.946E+00	1.436E+01
<b>Avg. Conc. (µCi/ml)</b>				
	5.553E-06	0.000E+00	3.999E-06	
<b>Dissolved Gases</b>				
<b>Total Release (Ci)</b>				
	0.000E+00	0.000E+00	0.000E+00	0.000E+00
<b>Avg. Conc. (µCi/ml)</b>				
	0.000E+00	0.000E+00	0.000E+00	
<b>Gross Alpha Activity</b>				
<b>Total Release (Ci)</b>				
	0.000E+00	0.000E+00	0.000E+00	0.000E+00
<b>Avg. Conc. (µCi/ml)</b>				
	0.000E+00	0.000E+00	0.000E+00	
<b>Volume of Waste Released</b>				
(liters)	1.046E+05	0.000E+00	6.930E+04	1.739E+05
<b>Volume of Dilution Water</b>				
(liters)	1.696E+09	0.000E+00	1.237E+09	2.933E+09

**TABLE 3.2B (Con't)**  
**Annual Radioactive Effluent Release Report 2010**  
**Liquid Effluents - Batch Releases**

Isotope (Ci)	April	May	June	Total
Ag-110m	1.916E-04	0.000E+00	1.529E-05	2.069E-04
Co-58	1.397E-04	0.000E+00	2.802E-05	1.677E-04
Co-60	1.325E-04	0.000E+00	4.817E-05	1.807E-04
Fe-55	1.088E-03	0.000E+00	7.207E-04	1.808E-03
H-3	9.416E+00	0.000E+00	4.946E+00	1.436E+01
Sb-125	2.089E-03	0.000E+00	3.769E-04	2.466E-03
<b>Total</b>	<b>9.420E+00</b>	<b>0.000E+00</b>	<b>4.947E+00</b>	<b>1.437E+01</b>

**TABLE 3.2C**  
**Annual Radioactive Effluent Release Report 2010**  
**Liquid Effluents - Batch Releases**

	July	August	September	Total
<b>Gross Radioactivity</b>				
<b>Total Release Excluding H3 and Dissolved Gases (Ci)</b>				
	2.752E-03	1.369E-03	1.786E-03	5.906E-03
<b>Avg. Conc. (µCi/ml)</b>				
	2.063E-09	2.046E-09	2.705E-09	
<b>Tritium</b>				
<b>Total Release (Ci)</b>				
	4.068E+00	1.147E+00	4.602E+00	9.817E+00
<b>Avg. Conc. (µCi/ml)</b>				
	3.050E-06	1.714E-06	6.972E-06	
<b>Dissolved Gases</b>				
<b>Total Release (Ci)</b>				
	0.000E+00	0.000E+00	0.000E+00	0.000E+00
<b>Avg. Conc. (µCi/ml)</b>				
	0.000E+00	0.000E+00	0.000E+00	
<b>Gross Alpha Activity</b>				
<b>Total Release (Ci)</b>				
	0.000E+00	0.000E+00	0.000E+00	0.000E+00
<b>Avg. Conc. (µCi/ml)</b>				
	0.000E+00	0.000E+00	0.000E+00	
<b>Volume of Waste Released</b>				
(liters)	6.742E+04	2.737E+04	3.297E+04	1.278E+05
<b>Volume of Dilution Water</b>				
(liters)	1.334E+09	6.692E+08	6.601E+08	2.663E+09

**TABLE 3.2C (Con't)**  
**Annual Radioactive Effluent Release Report 2010**  
**Liquid Effluents - Batch Releases**

Isotope (Ci)	July	August	September	Total
Ag-110m	6.365E-04	4.141E-04	7.724E-04	1.823E-03
Co-58	1.367E-04	5.893E-05	4.091E-05	2.365E-04
Co-60	8.270E-04	4.680E-04	4.312E-04	1.726E-03
Fe-55	9.439E-04	3.832E-04	4.615E-04	1.789E-03
H-3	4.068E+00	1.147E+00	4.602E+00	9.817E+00
Mn-54	7.489E-05	4.475E-05	4.507E-05	1.647E-04
Mn-56	0.000E+00	0.000E+00	3.475E-05	3.475E-05
Sb-125	1.326E-04	0.000E+00	0.000E+00	1.326E-04
<b>Total</b>	<b>4.071E+00</b>	<b>1.148E+00</b>	<b>4.604E+00</b>	<b>9.823E+00</b>



**TABLE 3.2D**  
**Annual Radioactive Effluent Release Report 2010**  
**Liquid Effluents - Batch Releases**

	October	November	December	Total
<b>Gross Radioactivity</b>				
<b>Total Release Excluding H3 and Dissolved Gases (Ci)</b>				
	1.182E-04	3.999E-04	1.312E-05	5.313E-04
<b>Avg. Conc. (<math>\mu</math>Ci/ml)</b>				
	1.377E-10	1.551E-10	1.948E-10	
<b>Tritium</b>				
<b>Total Release (Ci)</b>				
	2.799E+00	1.322E+02	1.954E-03	1.350E+02
<b>Avg. Conc. (<math>\mu</math>Ci/ml)</b>				
	3.261E-06	5.127E-05	2.900E-08	
<b>Dissolved Gases</b>				
<b>Total Release (Ci)</b>				
	0.000E+00	0.000E+00	0.000E+00	0.000E+00
<b>Avg. Conc. (<math>\mu</math>Ci/ml)</b>				
	0.000E+00	0.000E+00	0.000E+00	
<b>Gross Alpha Activity</b>				
<b>Total Release (Ci)</b>				
	0.000E+00	0.000E+00	0.000E+00	0.000E+00
<b>Avg. Conc. (<math>\mu</math>Ci/ml)</b>				
	0.000E+00	0.000E+00	0.000E+00	
<b>Volume of Waste Released</b>				
(liters)	3.426E+04	1.288E+05	6.662E+03	1.697E+05
<b>Volume of Dilution Water</b>				
(liters)	8.584E+08	2.578E+09	6.737E+07	3.504E+09

**TABLE 3.2D (Con't)**  
**Annual Radioactive Effluent Release Report 2010**  
**Liquid Effluents - Batch Releases**

Isotope (Ci)	October	November	December	Total
Ag-110m	2.890E-05	1.296E-04	0.000E+00	1.585E-04
Co-60	2.185E-05	1.660E-05	0.000E+00	3.844E-05
Fe-55	6.750E-05	2.537E-04	1.312E-05	3.343E-04
H-3	2.799E+00	1.322E+02	1.954E-03	1.350E+02
<b>Total</b>	<b>2.799E+00</b>	<b>1.322E+02</b>	<b>1.967E-03</b>	<b>1.350E+02</b>

**TABLE 3.3A**  
**Annual Radioactive Effluent Release Report 2010**  
**Liquid Effluents - Continuous Releases**

	January	February	March	Total
<b>Gross Radioactivity</b>				
<b>Total Release Excluding H3 and Dissolved Gases (Ci)</b>				
	0.000E+00	0.000E+00	0.000E+00	0.000E+00
<b>Avg. Conc. (<math>\mu</math>Ci/ml)</b>				
	0.000E+00	0.000E+00	0.000E+00	
<b>Tritium</b>				
<b>Total Release (Ci)</b>				
	8.769E-03	4.327E-05	1.148E-02	2.029E-02
<b>Avg. Conc. (<math>\mu</math>Ci/ml)</b>				
	2.854E-10	1.416E-12	2.128E-10	
<b>Dissolved Gases</b>				
<b>Total Release (Ci)</b>				
	0.000E+00	0.000E+00	0.000E+00	0.000E+00
<b>Avg. Conc. (<math>\mu</math>Ci/ml)</b>				
	0.000E+00	0.000E+00	0.000E+00	
<b>Gross Alpha Activity</b>				
<b>Total Release (Ci)</b>				
	0.000E+00	0.000E+00	0.000E+00	0.000E+00
<b>Avg. Conc. (<math>\mu</math>Ci/ml)</b>				
	0.000E+00	0.000E+00	0.000E+00	
<b>Volume of Waste Released</b>				
(liters)	6.574E+06	6.567E+06	8.267E+06	2.141E+07
<b>Volume of Dilution Water</b>				
(liters)	3.071E+10	3.055E+10	5.394E+10	1.152E+11

**TABLE 3.3A (Con't)**  
**Annual Radioactive Effluent Release Report 2010**  
**Liquid Effluents - Continuous Releases**

Isotope (Ci)	January	February	March	Total
H-3	8.769E-03	4.327E-05	1.148E-02	2.029E-02
Total	8.769E-03	4.327E-05	1.148E-02	2.029E-02

**TABLE 3.3B**  
**Annual Radioactive Effluent Release Report 2010**  
**Liquid Effluents - Continuous Releases**

	April	May	June	Total
<b>Gross Radioactivity</b>				
<b>Total Release Excluding H3 and Dissolved Gases (Ci)</b>				
	0.000E+00	0.000E+00	0.000E+00	0.000E+00
<b>Avg. Conc. (µCi/ml)</b>				
	0.000E+00	0.000E+00	0.000E+00	
<b>Tritium</b>				
<b>Total Release (Ci)</b>				
	2.124E-02	2.413E-02	1.987E-02	6.523E-02
<b>Avg. Conc. (µCi/ml)</b>				
	3.464E-10	3.162E-10	3.257E-10	
<b>Dissolved Gases</b>				
<b>Total Release (Ci)</b>				
	0.000E+00	0.000E+00	0.000E+00	0.000E+00
<b>Avg. Conc. (µCi/ml)</b>				
	0.000E+00	0.000E+00	0.000E+00	
<b>Gross Alpha Activity</b>				
<b>Total Release (Ci)</b>				
	0.000E+00	0.000E+00	0.000E+00	0.000E+00
<b>Avg. Conc. (µCi/ml)</b>				
	0.000E+00	0.000E+00	0.000E+00	
<b>Volume of Waste Released</b>				
(liters)	6.561E+06	7.796E+06	5.568E+06	1.993E+07
<b>Volume of Dilution Water</b>				
(liters)	6.131E+10	7.628E+10	6.101E+10	1.986E+11

**TABLE 3.3B (Con't)**  
**Annual Radioactive Effluent Release Report 2010**  
**Liquid Effluents - Continuous Releases**

Isotope (Ci)	April	May	June	Total
H-3	2.124E-02	2.413E-02	1.987E-02	6.523E-02
Total	2.124E-02	2.413E-02	1.987E-02	6.523E-02

**TABLE 3.3C**  
**Annual Radioactive Effluent Release Report 2010**  
**Liquid Effluents - Continuous Releases**

	July	August	September	Total
<b>Gross Radioactivity</b>				
<b>Total Release Excluding H3 and Dissolved Gases (Ci)</b>				
	0.000E+00	0.000E+00	0.000E+00	0.000E+00
<b>Avg. Conc. (µCi/ml)</b>				
	0.000E+00	0.000E+00	0.000E+00	
<b>Tritium</b>				
<b>Total Release (Ci)</b>				
	4.831E-03	1.266E-02	7.086E-04	1.820E-02
<b>Avg. Conc. (µCi/ml)</b>				
	7.900E-11	1.656E-10	1.133E-11	
<b>Dissolved Gases</b>				
<b>Total Release (Ci)</b>				
	0.000E+00	0.000E+00	0.000E+00	0.000E+00
<b>Avg. Conc. (µCi/ml)</b>				
	0.000E+00	0.000E+00	0.000E+00	
<b>Gross Alpha Activity</b>				
<b>Total Release (Ci)</b>				
	0.000E+00	0.000E+00	0.000E+00	0.000E+00
<b>Avg. Conc. (µCi/ml)</b>				
	0.000E+00	0.000E+00	0.000E+00	
<b>Volume of Waste Released</b>				
(liters)	5.591E+06	6.449E+06	6.031E+06	1.807E+07
<b>Volume of Dilution Water</b>				
(liters)	6.114E+10	7.646E+10	6.251E+10	2.001E+11

**TABLE 3.3C (Con't)**  
**Annual Radioactive Effluent Release Report 2010**  
**Liquid Effluents - Continuous Releases**

Isotope (Ci)	July	August	September	Total
H-3	4.831E-03	1.266E-02	7.086E-04	1.820E-02
Total	4.831E-03	1.266E-02	7.086E-04	1.820E-02



**TABLE 3.3D**  
**Annual Radioactive Effluent Release Report 2010**  
**Liquid Effluents - Continuous Releases**

	October	November	December	Total
<b>Gross Radioactivity</b>				
<b>Total Release Excluding H3 and Dissolved Gases (Ci)</b>				
	0.000E+00	0.000E+00	0.000E+00	0.000E+00
<b>Avg. Conc. (µCi/ml)</b>				
	0.000E+00	0.000E+00	0.000E+00	
<b>Tritium</b>				
<b>Total Release (Ci)</b>				
	3.652E-03	4.280E-03	3.721E-04	8.304E-03
<b>Avg. Conc. (µCi/ml)</b>				
	5.983E-11	5.601E-11	5.172E-12	
<b>Dissolved Gases</b>				
<b>Total Release (Ci)</b>				
	0.000E+00	0.000E+00	0.000E+00	0.000E+00
<b>Avg. Conc. (µCi/ml)</b>				
	0.000E+00	0.000E+00	0.000E+00	
<b>Gross Alpha Activity</b>				
<b>Total Release (Ci)</b>				
	0.000E+00	0.000E+00	0.000E+00	0.000E+00
<b>Avg. Conc. (µCi/ml)</b>				
		0.000E+00	0.000E+00	0.000E+00
<b>Volume of Waste Released (liters)</b>				
	5.382E+06	5.636E+06	7.904E+06	1.892E+07
<b>Volume of Dilution Water (liters)</b>				
	6.104E+10	7.641E+10	7.194E+10	2.094E+11

**TABLE 3:3D (Con't)**  
**Annual Radioactive Effluent Release Report 2010**  
**Liquid Effluents - Continuous Releases**

Isotope (Ci)	October	November	December	Total
H-3	3.652E-03	4.280E-03	3.721E-04	8.304E-03
Total	3.652E-03	4.280E-03	3.721E-04	8.304E-03

**Table 3.4**  
**Annual Radioactive Effluent Report 2010**  
**Dose From Liquid Effluents**

The dose to a member of the public from total liquid radioactive releases for each quarter was below the ODCM limits of 1.5 mrem to the total body and less than or equal to 5 mrem to any organ. Additionally, the dose to a member of the public from total liquid radioactive releases for the year was below the ODCM limits of 3 mrem to the total body and less than or equal to 10 mrem to any organ.

Instantaneous release concentrations are limited by the individual radionuclide concentrations established in 10 CFR 20, Appendix B, for unrestricted areas. During the report period, none of the isotopes released exceed the concentrations specified in Appendix B. The following offsite doses were calculated using equation 1.5 from the Kewaunee ODCM.

Organ 1st Qtr Dose	Dose Total mRem	Quarterly Limit mRem	Percent of Limit
Total Body	3.739E-05	1.5	2.492E-03
Bone	2.512E-05	5.0	5.024E-04
Liver	4.968E-05	5.0	9.935E-04
Thyroid	2.801E-05	5.0	5.601E-04
Kidney	2.864E-05	5.0	5.727E-04
Lung	3.769E-05	5.0	7.537E-04
GI-LLI	8.869E-05	5.0	1.774E-03

Organ 2nd Qtr Dose	Dose Total mRem	Quarterly Limit mRem	Percent of Limit
Total Body	5.624E-05	1.5	3.749E-03
Bone	1.335E-05	5.0	2.671E-04
Liver	6.236E-05	5.0	1.247E-03
Thyroid	5.257E-05	5.0	1.051E-03
Kidney	5.257E-05	5.0	1.051E-03
Lung	5.777E-05	5.0	1.155E-03
GI-LLI	7.354E-05	5.0	1.471E-03

**Table 3.4 (Con't)**  
**Annual Radioactive Effluent Report 2010**  
**Dose From Liquid Effluents**

Organ 3rd Qtr Dose	Dose Total mRem	Quarterly Limit mRem	Percent of Limit
Total Body	5.770E-05	1.5	3.847E-03
Bone	1.644E-05	5.0	3.288E-04
Liver	6.657E-05	5.0	1.331E-03
Thyroid	4.202E-05	5.0	8.404E-04
Kidney	4.448E-05	5.0	8.897E-04
Lung	4.835E-05	5.0	9.669E-04
GI-LLI	1.805E-04	5.0	3.609E-03

Organ 4th Qtr Dose	Dose Total mRem	Quarterly Limit mRem	Percent of Limit
Total Body	4.926E-04	1.5	3.284E-02
Bone	2.535E-06	5.0	5.071E-05
Liver	4.937E-04	5.0	9.875E-03
Thyroid	4.917E-04	5.0	9.834E-03
Kidney	4.917E-04	5.0	9.834E-03
Lung	4.928E-04	5.0	9.855E-03
GI-LLI	4.956E-04	5.0	9.912E-03

Calculated Dose This Year			
Organ	Dose Total mRem	Quarterly Limit mRem	Percent of Limit
Total Body	6.439E-04	3.0	2.146E-02
Bone	5.745E-05	10.0	5.745E-04
Liver	6.723E-04	10.0	6.723E-03
Thyroid	6.143E-04	10.0	6.143E-03
Kidney	6.174E-04	10.0	6.174E-03
Lung	6.366E-04	10.0	6.366E-03
GI-LLI	8.383E-04	10.0	8.383E-03

### 3.4 Ground Water Monitoring

Sample Point Sample Date and Time	Tritium pCi/L	Total Activity µCi/ml
<b>AB-707</b>		
2/17/10 10:59	2066	None Detected
3/22/10 12:50	1694	None Detected
3/22/10 14:30	1869	None Detected
3/24/10 14:36	1635	None Detected
4/9/10 9:27	2147	None Detected
6/13/10 11:00	1644	None Detected
7/23/10 14:20	1264	None Detected
8/12/10 11:50	929	None Detected
10/18/10 13:58	968	None Detected
<b>AB-708</b>		
2/17/10 10:27	1745	None Detected
3/24/10 10:02	1526	None Detected
4/14/10 13:45	1624	None Detected
6/13/10 11:45	2533	None Detected
7/23/10 14:50	1514	None Detected
8/12/10 12:10	924	None Detected
10/18/10 13:33	997	None Detected
<b>AB-709</b>		
2/17/10 9:56	824	None Detected
4/15/10 8:13	599	None Detected
8/11/10 12:15	621	None Detected
10/30/10 10:50	508	None Detected
<b>AB-710</b>		
2/17/10 9:10	521	None Detected
4/14/10 9:59	465	None Detected
8/10/10 14:37	436	None Detected
10/18/10 13:07	429	None Detected
<b>AB-711</b>		
2/16/10 12:45	622	None Detected
4/14/10 9:28	607	None Detected
8/11/10 12:35	587	None Detected
10/11/10 16:14	508	None Detected
<b>AB-712</b>		
2/17/10 8:25	< 232	None Detected
4/15/10 7:49	913	None Detected
8/11/10 12:50	512	None Detected
10/30/10 10:35	< 236	None Detected

<b>AB-715</b>		
2/16/10 12:12	1154	None Detected
3/24/10 11:44	562	None Detected
4/14/10 13:06	586	None Detected
6/13/10 11:00	564	None Detected
7/23/10 15:25	532	None Detected
8/11/10 13:15	382	None Detected
10/11/10 13:33	484	None Detected
<b>AB-717</b>		
2/16/10 8:01	< 232	None Detected
4/14/10 11:05	< 237	None Detected
8/11/10 14:40	< 233	None Detected
10/29/10 10:24	< 236	None Detected
<b>MW-701</b>		
2/17/10 13:26	< 232	None Detected
4/12/10 11:00	< 235	None Detected
8/11/10 15:30	< 233	None Detected
10/11/10 12:31	< 218	None Detected
<b>MW-702</b>		
2/18/10 11:55	< 232	None Detected
4/15/10 13:16	< 235	None Detected
8/12/10 10:00	< 233	None Detected
10/18/10 10:05	< 218	None Detected
<b>MW-703</b>		
2/18/10 12:23	< 232	None Detected
4/15/10 10:21	< 235	None Detected
8/12/10 9:07	< 233	None Detected
10/18/10 10:40	< 218	None Detected
<b>MW-704</b>		
2/18/10 9:28	239	None Detected
4/15/10 9:34	< 235	None Detected
8/12/10 8:17	242	None Detected
10/18/10 11:03	< 209	None Detected
<b>MW-705</b>		
2/17/10 13:06	239	None Detected
4/14/10 11:25	320	None Detected
8/11/10 14:20	441	None Detected
10/29/10 9:12	300	None Detected
<b>MW-706</b>		
2/16/10 8:27	< 232	None Detected
4/14/10 11:42	< 235	None Detected
8/11/10 14:30	< 233	None Detected
10/29/10 12:04	< 209	None Detected

#### 4.0 UNPLANNED RELEASES

No unplanned releases were made from the Kewaunee Power Station during the report period.

#### 5.0 METEOROLOGICAL DATA

See Appendix A for missing meteorological data and the joint frequency distribution tables.

#### 6.0 SOLID WASTE DISPOSAL

Table 6.1 is a summation of solid wastes shipped during 2010. Presented are the types of wastes, major nuclide composition, disposition of the wastes and shipping containers used. Table 6.1 contains the radionuclide content (curies) and percent abundance for each type of waste.

**Table 6.1**  
**Annual Radioactive Effluent Report 2010**  
**Solid Waste and Irradiated Fuel Shipments**

A. Solid Waste Shipped Off-Site for Burial or Disposal

1. Type of Waste

	<u>Ci</u>	<u>Ci % Error</u>	<u>M<sup>3</sup></u>
a. Resins, Filters and Evap Bottoms	2.28E+01	±25.0	5.66E+00
b. Dry Active Waste (DAW)	4.46E-01	±25.0	3.56E+01
c. Irradiated Components	0.00E+00	±25.0	0.00E+00
d. Other Waste	0.00E+00	±25.0	0.00E+00

2. Estimate of Major Nuclide by Composition

a. Resins, Filters and Evap Bottoms

<u>Nuclide</u>	<u>% Abundance</u>	<u>Ci</u>
H-3	1.873	4.27E-01
C-14	0.092	2.10E-02
Cr-51	1.118	2.55E-01
Mn-54	4.556	1.04E+00
Fe-55	5.993	1.37E+00
Co-57	0.495	1.13E-01
Co-58	1.513	3.45E-01
Co-60	20.042	4.57E+00
Ni-59	0.481	1.10E-01
Ni-63	61.242	1.40E+01
Sr-89	0.006	1.40E-03
Sr-90	0.006	1.35E-03
Nb-94	0.019	4.44E-03
Ag-110m	0.038	8.62E-03
Sb-125	1.713	3.91E-01
Cs-137	0.622	1.42E-01
Ce-144	0.095	2.17E-02
Pu-238	0.000	7.51E-06
Pu-241	0.096	2.19E-02



b. Dry Active Waste (DAW)

<u>Nuclide</u>	<u>% Abundance</u>	<u>Ci</u>
H-3	0.908	4.05E-03
C-14	2.306	1.03E-02
Cr-51	0.605	2.70E-03
Mn-54	1.654	7.38E-03
Fe-55	10.764	4.80E-02
Fe-59	0.100	4.46E-04
Co-57	0.089	3.98E-04
Co-58	6.575	2.93E-02
Co-60	67.730	3.02E-01
Ni-63	5.444	2.43E-02
Zn-65	0.000	0.00E+00
Zr-95	0.408	1.82E-03
Nb-95	1.100	4.90E-03
Sb-125	0.245	1.09E-03
Cs-137	0.397	1.77E-03
Ce-144	1.574	7.02E-03
U-233	0.000	0.00E+00
Pu-241	0.100	4.47E-04
Am-241	0.001	2.55E-06

c. Irradiated Components

<u>Nuclide</u>	<u>% Abundance</u>	<u>Ci</u>
None	N/A	N/A

d. Other Waste

<u>Nuclide</u>	<u>% Abundance</u>	<u>Ci</u>
None	N/A	N/A

3. Solid Waste Disposition

<u>Date of Shipment</u>	<u>Mode of Transportation</u>	<u>Destination</u>
03/23/10	Hittman Transport	Duratek Inc
04/28/10	Hittman Transport	Clive Disposal Facility (Bulk)
11/09/10	Hittman Transport	Duratek Inc
12/16/10	Hittman Transport	Clive Disposal Facility (Containerized)

B. Irradiated Fuel Shipments

No irradiated fuel shipments were made from the Kewaunee Power Station during 2010.

## 7.0 PROGRAM REVISIONS

In accordance with Kewaunee Technical Specifications 6.18.b.3 and 6.19.a, the revisions to the Process Control Program, Offsite Dose Calculation Manual and radioactive waste treatment systems are listed below.

### 7.1 **Process Control Program**

Two minor revisions were made to the Process Control Program (PCP) during 2010. Revision 9 removed two commitment items that were not NRC commitments, changed the name of the committee to review changes to the PCP from Plant Operations Review Committee (PORC) to Facility Safety Review Committee (FSRC). Revision 10 added procedure references to support the implementation of the Improved Technical Specifications (ITS) and Current Technical Specifications (CTS).

### 7.2 **Offsite Dose Calculation Manual**

The Offsite Dose Calculation Manual (ODCM) has not been revised during this report period.

### 7.3 **Major Changes to the Radioactive Liquid, Gaseous and Solid Waste Treatment Systems**

There were no changes to the radioactive waste systems (liquid, gaseous or solids) during this report period.

## 8.0 REPORTABLE OCCURRENCES

None.

Appendix A

Kewaunee Power Station

2010 Meteorological Data

Missing Data

First Quarter: 0.0 hours  
Second Quarter: 15.75 hours  
Third Quarter: 20.75 hours  
Fourth Quarter: 5.5 hours

Note: A total of 42.0 hours of data is missing or otherwise unavailable. This represents the availability of 99.52% of the data for the year:

APPENDIX A

Kewaunee Power Station 2010 Meteorological Data

First Quarter 2010

Stability Class A

Wind Direction

	CALM	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	4.5	18.75	20	0.5	0	43.75
NNE	0	0	6.5	23.25	21	13.5	4.25	68.5
NE	0	0	7.75	15.75	25.5	0.5	0	49.5
ENE	0	0	7.75	18.25	15.25	0	0	41.25
E	0	0	18	27.75	14.75	0	0	60.5
ESE	0	0	14	17.25	6.75	0	0	38
SE	0	0	8.75	5.5	11.5	1.25	0	27
SSE	0	0	2.5	5	7.5	1.5	0	16.5
S	0	0.5	0.25	7	6.5	0	0	14.25
SSW	0	0.5	2.25	3.25	0	0	0	6
SW	0	1.25	13.5	16	0	0	0	30.75
WSW	0	1.75	10.75	18.5	9.75	0	0	40.75
W	0	0	18.25	29	4.25	0	0	51.5
WNW	0	0	8.5	12.5	6.75	0	0	27.75
NW	0	0	17.5	53.5	14.5	0	0	85.5
NNW	0	0	12.75	32.75	24	0	0	69.5
TOTAL	0	4	153.5	304	188	17.25	4.25	671

Stability Class B

Wind Direction

	CALM	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	0.75	4.75	12.25	1.75	0	19.5
NNE	0	0	0.25	9	3.5	2.25	0	15
NE	0	0	1.25	1.5	0.75	0	0	3.5
ENE	0	0	0.5	1.75	0	0	0	2.25
E	0	0	1.25	0.5	0	0	0	1.75
ESE	0	0	2.5	0	0	0	0	2.5
SE	0	0	0.25	0.25	4	0	0	4.5
SSE	0	0	0.25	0.25	0.25	0.75	0	1.5
S	0	0	1	1.25	1	0	0	3.25
SSW	0	0.25	1.5	0	0	0	0	1.75
SW	0	0.5	1	10.75	0	0	0	12.25
WSW	0	0.25	0.5	3	0	0	0	3.75
W	0	0.25	1.25	3.5	0	0	0	5
WNW	0	0	0.25	2.75	0.75	0	0	3.75
NW	0	0	3.75	13	12.5	0	0	29.25
NNW	0	0	5.25	16	11	0	0	32.25
TOTAL	0	1.25	21.5	68.25	46	4.75	0	141.75

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Stability Class C

Wind Direction

	CALM	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	1.25	4.75	3.5	1	0	10.5
NNE	0	0	0.25	2.75	0.75	4	0	7.75
NE	0	0	1.5	2.25	1.75	0	0	5.5
ENE	0	0	0	1.25	0	0	0	1.25
E	0	0	1.25	1.25	0	0	0	2.5
ESE	0	0	3.75	0.25	0	0	0	4
SE	0	0	1.25	2.25	1.75	0	0	5.25
SSE	0	0	1	0	0.25	0.75	0	2
S	0	0	0.5	1.75	0.25	0	0	2.5
SSW	0	0	2.75	0	0	0	0	2.75
SW	0	0	0.5	6	1.75	0	0	8.25
WSW	0	0.75	0	2	3	0	0	5.75
W	0	0.75	3.25	4.25	0.75	0	0	9
WNW	0	0.25	1.5	6	5	0	0	12.75
NW	0	0	3.5	17.25	7.5	0	0	28.25
NNW	0	0	5	14.25	2	0.5	0	21.75
TOTAL	0	1.75	27.25	66.25	28.25	6.25	0	129.75

Stability Class D

Wind Direction

	CALM	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0.25	4	7.5	3.75	0	0	15.5
NNE	0	0	6.25	7	24.25	11.75	0	49.25
NE	0	0	3.5	0.75	0.75	0	0	5
ENE	0	0	3.25	1.25	0	0	0	4.5
E	0	0	9	0.75	0	0	0	9.75
ESE	0	1.5	7.75	0.75	0.5	1	0	11.5
SE	0	3	5.25	2.5	10.25	2.5	1	24.5
SSE	0	2.5	6.75	2.5	2.75	2.5	0	17
S	0	0.25	9.5	5.25	0.75	0.5	0	16.25
SSW	0	0	5	6.75	0	0	0	11.75
SW	0	0.5	2.25	9.5	5.5	0	0	17.75
WSW	0	0.75	1.25	9.75	3.25	0	0	15
W	0	3.5	6.25	3.5	0	0	0	13.25
WNW	0	5.75	16.75	16.25	0.5	0	0	39.25
NW	0	2.5	18	79.5	29	0	0	129
NNW	0	1.25	15.25	22.25	7	3.5	0	49.25
TOTAL	0	21.75	120	175.75	88.25	21.75	1	428.5

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Stability Class E

Wind Direction

	CALM	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0.5	7.25	4.5	0.25	0	0	12.5
NNE	0	0.5	3.5	13.75	13	2.5	0	33.25
NE	0	0	8.5	4.75	0	0	0	13.25
ENE	0	2.25	4.5	0	0	0	0	6.75
E	0	1.5	2	0	0	0	0	3.5
ESE	0	2.25	3.75	1	0	0	0	7
SE	0	1.25	2.5	0	0	0	0	3.75
SSE	0	0.75	4.5	2	0.25	1	0	8.5
S	0	0.25	7.5	1.25	2.75	0.25	0	12
SSW	0	1	28	2.75	0	0	0	31.75
SW	0	1.25	6	12	0	0	0	19.25
WSW	0	1.5	2.25	10.5	0	0	0	14.25
W	0	1.75	10.5	5.75	0	0	0	18
WNW	0	1	11.25	16	0	0	0	28.25
NW	0	1.25	13.25	31.25	7	0	0	52.75
NNW	0	2.5	23.5	13.25	3.5	0	0	42.75
TOTAL	0	19.5	138.75	118.75	26.75	3.75	0	307.5

Stability Class F

Wind Direction

	CALM	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0.75	3	1	0	0	0	4.75
NNE	0	1.75	6.25	3.25	0.25	0	0	11.5
NE	0	0.25	10.75	3.75	0	0	0	14.75
ENE	0	0.75	1.25	0.25	0	0	0	2.25
E	0	0.25	1	0	0	0	0	1.25
ESE	0	0.25	0.75	0.25	0	0	0	1.25
SE	0	1.25	1	0.25	0	0	0	2.5
SSE	0	0.25	0.75	0	0.75	0	0	1.75
S	0	0	4.25	0.5	0.5	0	0	5.25
SSW	0	2.25	20.5	0	0	0	0	22.75
SW	0	1.75	11.25	0.25	0	0	0	13.25
WSW	0	1.75	5.75	5	0	0	0	12.5
W	0	1.25	9.25	1.75	0	0	0	12.25
WNW	0	1	12.5	4	0	0	0	17.5
NW	0	3.75	14.5	5.5	0	0	0	23.75
NNW	0	2.5	14	5.5	0	0	0	22
TOTAL	0	19.75	116.75	31.25	1.5	0	0	169.25

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Stability Class G

Wind Direction

	CALM	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0.25	3.75	0	0	0	0	4
NNE	0	0	1.75	0	0	0	0	1.75
NE	0	0.25	3.5	0.25	0	0	0	4
ENE	0	0	2	0	0	0	0	2
E	0	1	2	0.75	0	0	0	3.75
ESE	0	0	0.75	1	0	0	0	1.75
SE	0	0.25	1.75	0.25	0	0	0	2.25
SSE	0	0.25	9.25	0	0	0	0	9.5
S	0	0.25	5	0	0	0	0	5.25
SSW	0	2.5	24.75	0	0	0	0	27.25
SW	0	6.25	19.75	0.75	0	0	0	26.75
WSW	0	5.75	37.25	8	0	0	0	51
W	0	4	40.25	14.75	0	0	0	59
WNW	0	5.5	28.25	11.75	0	0	0	45.5
NW	0	2.75	47.25	5.25	0	0	0	55.25
NNW	0	2.25	8.25	2.75	0	0	0	13.25
TOTAL	0	31.25	235.5	45.5	0	0	0	312.25

Second Quarter 2010

Stability Class A

Wind Direction

	CALM	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	9.5	13	3.25	0.5	0	26.25
NNE	0	1	15.5	41.5	32	14	1.75	105.75
NE	0	1.25	24.25	29.75	13.25	0	0	68.5
ENE	0	0.5	21.5	13.25	5	0.5	0	40.75
E	0	3	20	0.75	3.75	0	0	27.5
ESE	0	3.5	35	2.5	1	0	0	42
SE	0	4	23.25	3.25	3.25	1.75	0	35.5
SSE	0	2	10.5	12.75	8.5	0	0	33.75
S	0	1.25	2.5	4.75	2	3.25	0.25	14
SSW	1.5	1.75	2	4.75	0	0	0	10
SW	0.5	0	1.25	3.5	15.25	3.75	0	24.25
WSW	1.25	0.25	2.75	14.25	30.5	0.75	0.75	50.5
W	2	0	1	24	17.25	0	0	44.25
WNW	1.25	0.5	19.75	8.25	4.5	0	0	34.25
NW	0	0.5	17.75	17.5	12.25	0.5	0	48.5
NNW	0	0.5	13.5	10.5	3.75	1.75	0	30
TOTAL	6.5	20	220	204.25	155.5	26.75	2.75	635.75

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Stability Class B

Wind Direction

	CALM	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0.25	0.75	1.25	0.25	0.25	0	2.75
NNE	0	0	2	4.5	3	1	0	10.5
NE	0	0.5	2.5	0.75	2.75	0	0	6.5
ENE	0	0.5	1.75	0.25	0.75	0	0	3.25
E	0	0.5	0.75	0.25	0.75	0	0	2.25
ESE	0	0.25	1.5	0	0.25	0	0	2
SE	0	0	3.75	0	1.75	0	0	5.5
SSE	0	0.25	2	0.75	3	0.25	0	6.25
S	0	0.75	2	2.25	0.25	1	0	6.25
SSW	0	0	0.5	0	0	0	0	0.5
SW	0	0	0	0.25	1	0	0	1.25
WSW	0	0	0.5	1.75	0.75	0	0	3
W	0.25	0	1	2.75	0.75	0	0	4.75
WNW	0	0	3	1.5	0.25	0	0	4.75
NW	0	0	2.25	1.5	0.75	0	0	4.5
NNW	0	0	0	2	0.25	1.5	0	3.75
TOTAL	0.25	3	24.25	19.75	16.5	4	0	67.75

Stability Class C

Wind Direction

	CALM	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0.25	0	0.5	0.25	1	0	2
NNE	0	0	1.25	7	2	4.25	0	14.5
NE	0	0.5	2.5	4.5	2.5	0.25	0	10.25
ENE	0	0.5	3.25	1.5	0.5	0	0	5.75
E	0	0.5	2	0.25	0.5	0	0	3.25
ESE	0	0.5	2	2	0	0	0	4.5
SE	0	1.25	4	3.25	0	0	0	8.5
SSE	0	0.75	1.25	1.25	3.25	0.75	0	7.25
S	0	1.5	1.25	3	0.75	0.5	0	7
SSW	0	1.5	0.25	1.75	0	0	0	3.5
SW	0	0.25	0.25	1	0.75	0.5	0	2.75
WSW	0	0	1	1.75	3	0.25	0	6
W	0.25	0	0	3.5	4.75	0	0	8.5
WNW	0.25	0.25	0.25	2.25	0.5	0	0	3.5
NW	0.25	0.5	2.75	2.5	0.25	0	0	6.25
NNW	0	0.25	1	1	1.25	2	0	5.5
TOTAL	0.75	8.5	23	37	20.25	9.5	0	99



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Stability Class D

Wind Direction

	CALM	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0.75	1	1.5	1.25	1.5	0	6
NNE	0	0.25	9	16.5	22.75	4	0.5	53
NE	0	4.75	8.75	13.25	3	0	0	29.75
ENE	0.25	3.5	13.75	6.75	1	0	0	25.25
E	0.75	3.5	6.5	3	0.75	0	0	14.5
ESE	0.5	3.75	7.75	7	1.25	0	0	20.25
SE	1.75	3.25	11.75	4.5	1.25	1.75	0.25	24.5
SSE	0.5	1.25	17.25	10.25	12	1	0	42.25
S	0.75	2	10	14.5	2.75	0.5	0	30.5
SSW	0.25	2.25	6.25	2.75	0	0	0	11.5
SW	0	1	3	6.25	1.75	0.75	0.25	13
WSW	0	2.5	2.75	6.25	6	0	0.75	18.25
W	0.75	2.75	1.75	4	1.25	0	0	10.5
WNW	0	0.75	2	5	2.25	0	0	10
NW	0.25	0.25	3.5	4.75	5.25	0	0	14
NNW	0	0.75	6.25	0.75	5	3	0	15.75
TOTAL	5.75	33.25	111.25	107	67.5	12.5	1.75	339

Stability Class E

Wind Direction

	CALM	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	1.25	5	1.75	2	0	0	10
NNE	0	2.75	14.5	24.75	10.75	0	0	52.75
NE	0	4.5	14.5	3.5	0.75	0	0	23.25
ENE	0	3.5	10.25	5.25	0	0	0	19
E	0	2.75	4	0.5	0	0	0	7.25
ESE	0	4.5	6	4.5	0.5	0.25	0	15.75
SE	0	4.25	12.5	2.5	0.25	0.25	0	19.75
SSE	0	3.75	14.5	27.5	6	0	0	51.75
S	0	2.5	22.75	30.25	2.75	0	0	58.25
SSW	0	2.25	17	6.5	0	0	0	25.75
SW	0	2	4.5	6.75	1.5	0	0	14.75
WSW	0.25	1.25	2.5	10.5	0.5	0	0	15
W	1.5	0.5	9.5	5	0	0	0	16.5
WNW	0	0.75	9.25	9.75	0	0	0	19.75
NW	0	0.5	5.25	2	0.5	0	0	8.25
NNW	0	2	7.25	1	0.25	0	0	10.5
TOTAL	1.75	39	159.25	142	25.75	0.5	0	368.25

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Stability Class F

Wind Direction

	CALM	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	2	3.75	1.25	0.5	0	0	7.5
NNE	0	2	6.25	1.75	0.5	0	0	10.5
NE	0	2.75	5.75	0.5	0	0	0	9
ENE	0	1.75	4.25	1.5	0	0	0	7.5
E	0	3	3.5	1	0	0	0	7.5
ESE	0	3.5	2	2.75	1.25	0	0	9.5
SE	0	3.75	4	3.5	0	0	0	11.25
SSE	0	4	15.75	10.75	2.25	0	0	32.75
S	0.25	4.5	24	7.5	1.75	0	0	38
SSW	0	5.5	16.25	4.25	0	0	0	26
SW	0	3	3.75	4.25	0	0	0	11
WSW	1	2.25	2.75	4	0	0	0	10
W	1.25	3.25	5.5	1.75	0	0	0	11.75
WNW	0	3.25	10.5	0.5	0	0	0	14.25
NW	0	4.75	9.25	2.25	0	0	0	16.25
NNW	0	2.75	7.25	3.75	0	0	0	13.75
TOTAL	2.5	52	124.5	51.25	6.25	0	0	236.5

Stability Class G

Wind Direction

	CALM	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	2.25	3.5	0.75	0	0	0	6.5
NNE	0	1.5	2.25	1	0.25	0	0	5
NE	0	3.25	6.5	1.75	0	0	0	11.5
ENE	0	3.5	3.25	0.75	0	0	0	7.5
E	0	4	3.25	3.5	0	0	0	10.75
ESE	0	5.25	5.5	3.5	0	0	0	14.25
SE	0	5.75	6.75	3.75	0.5	0	0	16.75
SSE	0	9.75	33.25	34	7.5	0	0	84.5
S	0	8.75	22	14.25	1.25	0	0	46.25
SSW	0	16.25	17.25	0.5	0	0	0	34
SW	0	15.75	16.75	4	0	0	0	36.5
WSW	1.25	15.75	13	1.5	0	0	0	31.5
W	0.25	10.75	13	0.25	0	0	0	24.25
WNW	0	10.25	22	2	0	0	0	34.25
NW	0	12.25	18	0.75	0	0	0	31
NNW	0	8.75	13.75	5	0	0	0	27.5
TOTAL	1.5	133.75	200	77.25	9.5	0	0	422

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Third Quarter 2010

Stability Class A

Wind Direction

	CALM	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0.75	3	4	4.75	0	0	12.5
NNE	0	0	10	23.25	5.25	1.75	0	40.25
NE	0	0.25	22	1.75	0	0	0	24
ENE	0	0	17.5	0	0	0	0	17.5
E	0	1.75	23.5	0.5	0	0	0	25.75
ESE	0	1.75	25	4.5	0	0.25	0	31.5
SE	0	0.5	20.25	5	1	0.5	0	27.25
SSE	0	0.5	17.5	8.75	2.75	0.25	0	19.75
S	0	0.75	5.25	6.75	1.5	0	0	14.25
SSW	0	0	11	4.25	0	0	0	15.25
SW	0	0	7.75	14	1.25	0	0	23
WSW	0	0.5	15	33.5	2.5	5	0	56.5
W	0	0.75	22.75	31.5	6.5	1.25	0	62.75
WNW	0	0.5	15.5	34	4	0	0	54
NW	0	0.25	9.25	14.5	3	0	0	27
NNW	0	0	8.25	17.5	2.5	0	0	28.25
TOTAL	0	8.25	223.5	203.75	35	9	0	479.5

Stability Class B

Wind Direction

	CALM	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	0.25	1	0	0	0	1.25
NNE	0	0	2.25	0.75	0	0	0	3
NE	0	0	3	0	0	0	0	3
ENE	0	0.5	0.5	0	0	0	0	1
E	0	0	2.5	0.75	0	0	0	3.25
ESE	0	0.5	3	0.25	0.25	0.25	0	4.25
SE	0	0.5	1.5	0.75	0.5	0	0	3.25
SSE	0	0	2.75	2	0	0	0	4.75
S	0	0	2	7	0	0	0	9
SSW	0	0	1.5	0.5	0	0	0	2
SW	0	0.75	0.25	1	1.75	0	0	3.75
WSW	0	0.25	0.5	4.25	1.75	1	0	7.75
W	0	0	2.25	2.75	3	0	0	8
WNW	0	0	1.25	4	0.5	0	0	5.75
NW	0	0	3.25	1.25	0.75	0	0	5.25
NNW	0	0.25	1.25	1.5	0	0	0	3
TOTAL	0	2.75	28	27.75	8.5	1.25	0	68.25

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Stability Class C

Wind Direction

	CALM	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	0.25	1.25	0	0	0	1.5
NNE	0	0	2	1	0	0	0	3
NE	0	0	1.5	0.5	0	0	0	2
ENE	0	0	1.5	0	0	0	0	1.5
E	0	0	3	0.5	0	0	0	3.5
ESE	0	0.5	4.25	0.75	0	0	0	5.5
SE	0	0	2.75	2	0	0	0	4.75
SSE	0	0.25	0.75	3.25	0.25	0	0	4.5
S	0	0	1	1.5	0.75	0	0	3.25
SSW	0	0	0.75	1	0	0	0	1.75
SW	0	0.5	1	1	0.75	0	0	3.25
WSW	0	0.25	0.75	1.5	2.25	0.5	0	5.25
W	0	0.5	3	2.75	1.5	0	0	7.75
WNW	0	0.25	1.5	2.5	0.5	0	0	4.75
NW	0	0.25	3	1.25	1.25	0	0	5.75
NNW	0	0	1.75	1	0	0	0	2.75
TOTAL	0	2.5	28.75	21.75	7.25	0.5	0	60.75

Stability Class D

Wind Direction

	CALM	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0.25	5.5	4.75	0	0	0	10.5
NNE	0	0	4.75	10.25	0	0	0	15
NE	0	0	8.5	0	0	0	0	8.5
ENE	0	1.25	5.5	0.5	0	0	0	7.25
E	0	2.5	3.75	2.25	0	0	0	8.5
ESE	0	2	4.75	0.5	1	0	0	8.25
SE	0	0.75	7.25	1.25	0.5	0	0	9.75
SSE	0	3	7.5	11.75	3.75	0	0	26
S	0	1.25	15	17	4.25	0.75	0	38.25
SSW	0	0.25	15.5	11.25	1.5	0	0	28.5
SW	0	0.5	7.25	4.5	2.75	0	0	15
WSW	0	0.25	8.5	3.25	1.75	0	0	13.75
W	0	1.75	11.25	16	1.5	0	0	30.5
WNW	0	0.75	11.5	17	0.75	0	0	30
NW	0	0.25	5.75	5.25	2.5	0	0	13.75
NNW	0	0.25	7	1.75	0	0	0	9
TOTAL	0	15	129.25	107.25	20.25	0.75	0	272.5

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Stability Class E

Wind Direction

	CALM	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0.75	7.75	0.5	0	0	0	9
NNE	0	1.25	4	2.75	0.5	0	0	8.5
NE	0	5.5	6.25	0.25	0	0	0	12
ENE	0	3	6.25	0	0	0	0	9.25
E	0	3.75	3	0	0	0	0	6.75
ESE	0	2.75	7	2.5	0	0	0	12.25
SE	0	3.5	11.25	2.75	0.25	0	0	17.75
SSE	0	4.5	15	17.75	4.75	0	0	42
S	0	6.25	38	33.25	2	0.5	0	80
SSW	0	5.5	28	12.25	2.25	0	0	48
SW	0	5.75	8.25	2.75	1	0	0	17.75
WSW	0	4	9.25	2.5	3	0	0	18.75
W	0	4.25	18	8	0	0	0	30.25
WNW	0	4	14.75	4	0	0	0	22.75
NW	0	5.75	10.75	1.75	0.5	0	0	18.75
NNW	0	1.5	13.5	1.5	0	0	0	16.5
TOTAL	0	62	201	92.5	14.25	0.5	0	370.25

Stability Class F

Wind Direction

	CALM	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	1.75	6.75	0.5	0	0	0	9
NNE	0	1.5	0.25	0	0	0	0	1.75
NE	0	5.75	2.75	0	0	0	0	8.5
ENE	0	1.5	8.75	0	0	0	0	10.25
E	0	1.25	6	0	0	0	0	7.25
ESE	0	0.75	3.5	0.5	0.25	0.25	0	5.25
SE	0	2.25	4.75	1.25	0.75	0	0	9
SSE	0	4.5	10.75	16.25	3.75	0	0	35.25
S	0	7.5	26.25	14.75	0.25	0	0	48.75
SSW	0	11.5	40.5	5	0.25	0	0	57.25
SW	0	6	25	1.25	0	0	0	32.25
WSW	0	7.5	12.25	3.25	0	0	0	23
W	0	4.75	15.75	1.5	0	0	0	22
WNW	0	2.75	16.25	0.25	0	0	0	19.25
NW	0	2.5	15.25	0	0	0	0	17.75
NNW	0	3.5	12.25	0	0	0	0	15.75
TOTAL	0	65.25	207	44.5	5.25	0.25	0	322.25

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Stability Class G

Wind Direction	CALM	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	4.5	6.5	0.25	0	0	0	11.25
NNE	0	4.75	1.75	0	0	0	0	6.5
NE	0	5.25	6.75	0	0	0	0	12
ENE	0	1.75	5.25	0	0	0	0	7
E	0	0.75	3	0	0	0	0	3.75
ESE	0	1.5	1.25	0	0	0	0	2.75
SE	0	2.25	7.75	0.5	0	0	0	10.5
SSE	0	2.5	36.25	25.5	13.5	0.5	0	78.25
S	0	11.5	42.5	26.75	0.5	0	0	81.25
SSW	0	18.75	30.25	0.75	0	0	0	49.75
SW	0	12.5	26.5	0.5	0	0	0	39.5
WSW	0	19.25	57	1	0	0	0	77.25
W	0	9.5	86.75	0.25	0	0	0	96.5
WNW	0	6.5	56	0	0	0	0	62.5
NW	0	12.5	36	0	0	0	0	48.5
NNW	0	12.5	14	0	0	0	0	26.5
TOTAL	0	126.25	417.5	55.5	14	0.5	0	613.75

Fourth Quarter 2010

Stability Class A

Wind Direction	CALM	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0.25	0.5	12.75	11.25	0.25	0	25
NNE	0	0	2.5	26	2	0	0	30.5
NE	0	0.25	3.5	8	0.25	0	0	13.5
ENE	0.25	0.5	4.25	4.5	1.75	0.5	0.25	12
E	0	0.25	1.75	2.25	1.25	0	0	5.5
ESE	0	0.5	4.5	3.25	6.25	0	0.25	14.75
SE	0	1	7.5	0	2.25	10.25	7.5	28.5
SSE	0	0	7.5	2.5	1	1.25	2.25	14.5
S	0	0	4.5	13	1.75	0.25	0	19.5
SSW	0	0	6.5	7	1	1	1.25	16.75
SW	0	0	4.75	9	1	1.5	4.75	21
WSW	0	0	3.25	24.5	11.75	1	0	40.5
W	0	0	7	33.25	23.5	2.75	0.25	66.75
WNW	0	0	10.75	20.5	13.25	0	0	44.5
NW	0	0	5.25	15	15	0	0	35.25
NNW	0	0	2	20	6	0	0	28
TOTAL	0.25	2.75	77.5	201.5	99.25	18.75	16.5	416.5

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Stability Class B

Wind Direction	CALM	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	1.25	4.75	0.75	0	0	6.75
NNE	0	0	0.5	3	2.75	0	0	6.25
NE	0	0.25	0.25	0	1	0	0	1.5
ENE	0	0.25	1.5	0	0	0	0	1.75
E	0	0	2.75	0	2.5	0	0	5.25
ESE	0	0	0	0	0	0	0	0
SE	0	0	1.25	0	4.25	0	0	5.5
SSE	0	0	0	0	1	3.75	1	5.75
S	0	0	1	4	0.25	0	0	5.25
SSW	0	0	1.5	1.5	0.25	0.25	0	3.5
SW	0	0	0.5	0.75	2	1.25	0.5	5
WSW	0	0	0.5	3.25	2.5	1.25	0.25	7.75
W	0	0	3	8.25	11.75	0	0	23
WNW	0	0	1	3.25	1	0	0	5.25
NW	0	0	0.75	2.5	2.5	0	0	5.75
NNW	0	0	1.5	6.5	7.75	0	0	15.75
TOTAL	0	0.5	17.25	37.75	40.25	6.5	1.75	104

Stability Class C

Wind Direction	CALM	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	0.5	6	3.25	0	0	9.75
NNE	0	0	0	3.25	4.25	0	0	7.5
NE	0	0	1.25	2	2.75	0	0	6
ENE	0	0	0.75	3.25	2.5	0	0	6.5
E	0	0.25	1.25	0.75	2.5	0	0	4.75
ESE	0	0	0.5	0.75	2.5	0.75	0	4.5
SE	0	0	1.25	1.25	4.5	8.25	0	15.25
SSE	0	0	0.25	0.5	3	1	0	4.75
S	0	0	0.25	3.75	0.25	0	0	4.25
SSW	0	0	1.5	11	0.5	0.25	0	13.25
SW	0	0	0.5	3.25	2.5	1.25	0	7.5
WSW	0	0	1	3.75	0.25	1.75	0.25	7
W	0	0	1.75	5	8.75	0	0.25	15.75
WNW	0	0	2	4.5	1.75	0	0	8.25
NW	0	0	1	2.75	2.5	0	0	6.25
NNW	0	0	1.75	13.25	11.25	0	0	26.25
TOTAL	0	0.25	15.5	65	53	13.25	0.5	147.5

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Stability Class D

Wind Direction

	CALM	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0.25	5	19.25	4.75	1	7.25	37.5
NNE	0	0.25	2	5.25	5.25	1.25	9.75	23.75
NE	0	0.25	2.25	3.5	6.25	1.25	0	13.5
ENE	0	0.25	1.75	1.75	8	1	0	12.75
E	0	0	2.75	1.5	1.75	0	0.25	6.25
ESE	0	0.5	3.5	2.25	0	0	0	6.25
SE	0	0.25	2.25	1.25	7.75	2.5	0	14
SSE	0	0	1.25	4.75	11.25	6	0	23.25
S	0	0.25	4.25	23.25	10	0.75	0	38.5
SSW	0	1.5	11.75	28.75	7	2.25	0	51.25
SW	0	0.25	5.5	5.25	5.5	6.75	1	24.25
WSW	0	0.25	6.25	27.25	5.25	4.25	0	43.25
W	0	0.5	18.75	28.75	13	0.5	0	61.5
WNW	0	0.5	14.75	13.25	4.5	0.25	0	33.25
NW	0	1.25	19	16.75	10.5	0	0	47.5
NNW	0	0.5	15.5	55.75	17.5	8.75	1.75	99.75
TOTAL	0	6.75	116.5	238.5	118.25	36.5	20	536.5

Stability Class E

Wind Direction

	CALM	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	14.75	6.25	5	0	0	26
NNE	0	0.25	2.25	1.25	0.25	0	0	4
NE	0	1	3	1	0	0	0	5
ENE	0	0.5	0.75	0	0	0	0	1.25
E	0	0.75	0.5	0	0	0	0	1.25
ESE	0	1.5	5	0.5	0	0	0	7
SE	0	1.75	11	0	0	0	0	12.75
SSE	0	0.75	11.25	4.5	12.25	3	2	33.75
S	0	1	5.75	15.5	6.75	0	0.5	29.5
SSW	0	0.5	23.5	12	1	0	0	37
SW	0	0.5	12.5	1.5	1	2.5	0.5	18.5
WSW	0	0.25	8.5	18.75	3.25	0.25	0	31
W	0	0.25	11.75	14.5	1.75	0.5	0	28.75
WNW	0	0.5	23	18.5	0	0	0	42
NW	0	0.5	18.25	19.75	0.5	0	0	39
NNW	0	0	12.5	19.5	4.75	0	0	36.75
TOTAL	0	10	164.25	133.5	36.5	6.25	3	353.5



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Stability Class F

Wind Direction

	CALM	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0.75	5.5	1.25	1.25	0	0	8.75
NNE	0	1.25	3.25	0	0	0	0	4.5
NE	0	0.5	1.25	0	0	0	0	1.75
ENE	0	0.5	1.25	0	0	0	0	1.75
E	0	0.75	0.75	0.25	0	0	0	1.75
ESE	0	0.75	2	0	0.25	0	0	3
SE	0	0.75	5.25	1.25	1	0.75	1	10
SSE	0	0.25	8.25	2.25	2.5	3.75	2	19
S	0	3	5.75	1.25	0	0	0	10
SSW	0	7	24.25	0.75	0	0	0	32
SW	0	2.25	17	4	0.25	0	0	23.5
WSW	0	3	8.75	5	0	0	0	16.75
W	0	2	8.75	3.5	0	0	0	14.25
WNW	0	0.75	15.5	20.5	0	0	0	36.75
NW	0	0.75	18.25	21.25	0	0	0	40.25
NNW	0	0.75	15.25	3	7.25	0	0	26.25
TOTAL	0	25	141	64.25	12.5	4.5	3	250.25

Stability Class G

Wind Direction

	CALM	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	4.5	2.75	0	0	0	0	7.25
NNE	0	1.25	0.5	0	0.25	0	0	2
NE	0	0.5	3.25	0	0	0	0	3.75
ENE	0	1	1.25	0	0	0	0	2.25
E	0	0.25	0.75	0	0	0	0	1
ESE	0	0.25	1.5	0.5	0	0	0	2.25
SE	0	0.5	5.5	0	0	0	0	6
SSE	0	1.75	4.25	0.5	0	0	0	6.5
S	0	0.5	3	0	0	0	0	3.5
SSW	0	4	11.75	0	0	0	0	15.75
SW	0.25	4.25	30.75	1.5	0	0	0	36.75
WSW	0	7.5	45.5	5	0	0	0	58
W	0	2.75	70	21.5	1	0	0	95.25
WNW	0.25	4	72	12.5	0	0	0	88.75
NW	0	5.75	33	8	0	0	0	46.75
NNW	0	5.25	13.25	0	0	0	0	18.5
TOTAL	0.5	44	299	49.5	1.25	0	0	394.25