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Donald C. Cook Nuclear Plant Units 1 and 2
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

In accordance with Technical Specification 5.6.3, Indiana Michigan Power Company, the licensee for Donald C. Cook Nuclear Plant Units 1 and 2, is providing the Annual Radioactive Effluent Release Report as an enclosure to this letter. This report covers the period January 1, 2013, through December 31, 2013.

This letter contains no new or modified regulatory commitments. Should you have any questions, please contact Mr. Michael K. Scarpello, Regulatory Affairs Manager, at (269) 466-2649.

Sincerely,

Joel P. Gebbie
Site Vice President

DB/amp

Enclosure: Donald C. Cook Nuclear Plant Units 1 and 2 Annual Radioactive Effluent Release Report

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ENCLOSURE TO AEP-NRC-2014-30

**DONALD C. COOK NUCLEAR PLANT UNITS 1 AND 2
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT**

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I. INTRODUCTION

This report discusses the radioactive discharges from Unit 1 and Unit 2 of the Donald C. Cook Nuclear Plant (CNP) during 2013. This is in accordance with the requirements of CNP Technical Specification (TS) 5.6.3.

The table below summarizes the pertinent statistics concerning the Plant's operation during the period from January 1, 2013, to December 31, 2013. The data in this table and the descriptive information on plant operation are based upon the respective unit's Monthly Operating Reports, Performance Indicators and Control Room Logs for 2013.

Parameter	Unit 1	Unit 2
Gross Electrical Energy Generation (Megawatt Hour (MWH))	8,111,515	8,696,904
Unit Service Factor (Percent (%))	85.3	88.0
Unit Capacity Factor (Maximum Dependable Capacity (MDC)) Net (%)	87.0	89.4

Unit 1 entered the reporting period in Mode 1 at Nominal Full Power (NFP). Small power adjustments were made to facilitate main turbine valve testing throughout the year. The unit performed a normal downpower and was manually tripped on March 27, 2013, entering the refueling outage U1C25. The unit attained criticality on May 18, 2013 and attained NFP on May 24, 2013. On December 13, 2013, a planned downpower to 24% power was performed to support containment glowplug replacement work. The unit returned to NFP on December 16, 2013. The unit exited the reporting period at NFP.

Unit 2 entered the reporting period in Mode 1 at NFP. Small power adjustments were made to facilitate main turbine valve testing throughout the year. Unit 2 performed manual reactor trip and entered a forced outage on July 28, 2013 due to a Condensate Heater Bypass Control valve setpoint issue. The unit returned to NFP on August 1, 2013. The unit performed a normal downpower and was manually tripped on October 2, 2013, entering the refueling outage U2C21. The unit attained criticality on November 11, 2013, and attained NFP on November 18, 2013. The unit exited the reporting period at NFP.

II. RADIOACTIVE RELEASES AND RADIOLOGICAL IMPACT ON MAN

Since a number of release points are common to both units, the release data from both units are combined to form this two-unit, Annual Radioactive Effluent Release Report. Appendix A1.1 through A2.4 of this report present the information in accordance with Section 5.6.3 of Appendix A to the Facility Operating Licenses, as specified in the Technical Specifications, Regulatory Guide 1.21, and 10 CFR Part 50, Appendix I.

The "MIDAS System" is a computer code that calculates doses due to radionuclides that were released from the CNP.

All liquid and gaseous releases were well within Offsite Dose Calculation Manual (ODCM) limits and federal limits.

There were no abnormal liquid releases and no abnormal gaseous releases in 2013.

The Independent Spent Fuel Storage Installation (ISFSI) impacts are included with Unit 1 and Unit 2 statistics. The ISFSI cask system does not create any radioactive materials or have any radioactive waste treatment systems. Therefore, specific operating procedures for the control of radioactive effluents are not required. Specification 3.1.1, Multi-Purpose Canister (MPC), provides assurance that there are not radioactive effluents from the ISFSI.

Liquid Releases

During 2013 there were 90 liquid batch releases performed. The number of liquid batch releases for the four quarters in 2013 was 18, 24, 25, and 23, respectively.

Estimated doses (in mrem) to maximally exposed individuals via the liquid release pathways are given in Appendix A1.2 of this report.

Gaseous Releases

During the first quarter of 2013 there were two batch releases from Gas Decay Tanks (GDT), one containment purge, and 102 Containment Pressure Reliefs (CPR). During the second quarter there was one batch release from GDTs and 108 CPR. During the third quarter there were four batch releases from GDTs and 119 CPR. During the fourth quarter there was one batch release from GDTs, two containment purges, and 62 CPR. The CPR continue to be listed as batch releases as described in Nuclear Regulatory Commission Inspections 50-315/89017 (DRSS); 50-316/89016 (DRSS) for CNP, dated June 13, 1989. Doses continue to be calculated utilizing continuous criteria as allowed by NUREG-0133. There were a total of eight GDT releases, three containment purges, and 391 CPR gaseous batch releases made during 2013.

In calculating the dose consequences for continuous and batch gaseous releases during 2013, the meteorological data measured at the time of the release were used.

The estimated doses (in mrem) to maximally exposed individuals via the gaseous release pathways are given in Appendix A1.2 of this report. For individuals that are within the site boundary, the occupancy time is sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the site boundary.

Solid Waste Disposition

There were 23 shipments of radioactive waste made during 2013. These included shipments made from the site to various radioactive waste processors for ultimate disposal.

III. METEOROLOGICAL

Appendices A2.1, A2.2, A2.3, and A2.4 of this report contain the cumulative joint frequency distribution tables of wind speed and wind direction, corresponding to the various atmospheric stability classes for the first, second, third and fourth quarters of 2013. Hourly meteorological data is available for review and/or inspection upon request.

IV. OFFSITE DOSE CALCULATION MANUAL (ODCM) CHANGES

The ODCM, PMP-6010-OSD-001, was not revised during the report period.

V. TOTAL DOSE

Section 3.2.5 of the ODCM requires that the dose or dose commitment to a real individual from all uranium fuel cycle sources in Berrien County be limited to no more than 25 mrem to the total body or any organ (except the thyroid, which is limited to no more than 75 mrem) over a period of 12 consecutive months to show conformance with the requirements of 40 CFR Part 190. The maximum cumulative dose to an individual from liquid and gaseous effluents during 2013 was well within the ODCM limits. Measurements using thermoluminescent dosimeters (TLD) at 12 onsite stations indicate that the dose due to direct radiation is consistent with preoperational and current control (background) levels. This is fully evaluated in CNP's 2013 Annual Radiological Environmental Operating Report.

The annual dose to the maximum individual will be estimated by first, summing the quarterly total body air dose, the quarterly skin air dose, the quarterly critical organ dose from iodines and particulates (I&P), the quarterly total body dose from liquid effluents, the quarterly critical organ dose from liquid effluents, and the Radiological Environmental Monitoring Program onsite direct radiation TLD data. These quarterly values are summed with the annual Carbon-14 dose and compared to the annual total body limit for conservative reasons. The table that follows here represents the above written description:

Dose (mrem)	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
I & P	8.56E-03	1.50E-02	4.53E-02	7.51E-02
Total Body Air	2.10E-04	2.90E-04	9.80E-04	3.10E-04
Skin	3.40E-04	4.70E-04	1.60E-03	9.20E-04
Liquid TB	2.42E-02	9.22E-03	2.51E-02	8.12E-03
Liquid Organ	2.42E-02	9.25E-03	2.51E-02	8.30E-03
C14 (Annual)				2.20E+00
Direct Radiation	0	0	0	0
Total	5.75E-02	3.42E-02	9.81E-02	2.29E+00
Grand Total Dose (Total Body or any other Organ) mrem				2.48E+00
Annual Dose Limit (mrem)				25
Percent of limit				9.93E+00

The following data reflects a comparison with 2009 annual dose data (the last year without calculating C-14 dose), 2013 annual dose data, and 2013 annual dose data with C-14 added. This indicates that 2013 was a 'normal' dual unit outage year with respect to radioactive effluents and allows for easier comparison. The table is presented as follows:

	Annual Dose (mrem)	% of limit
2009	2.60E-01	1.04
2013	2.83E-01	1.13
2013 with C-14	2.48	9.93

VI. RADIATION MONITORS INOPERABLE GREATER THAN 30 DAYS

There were no release pathways unmonitored for greater than 30 days.

VII. NOTEWORTHY CONDITIONS IDENTIFIED IN 2013

During the Fourth Quarter of 2012, an intermittent fault was identified on the CNP 60-Meter Meteorological Tower that resulted in a large number of invalid data hours collected. A Condition Report (2012-2305) was initiated and repair work performed. The issue appeared to be a connection to the Delta Temperature instrumentation. Repairs yielded better data collection results in December 2012, however the intermittent fault returned and the system yielded additional invalid data hours during the First and Second Quarters of 2013. Additional repair work was performed when conditions allowed for safe work on the tower, and this resulted in the problem being positively identified as cabling fault grounding out the 10 Meter Delta Temperature instrumentation on the Main 60 Meter Tower. The repairs on the cable and instrumentation were successful at eliminating the intermittent fault and data collection has returned to near 100% valid hours.

The meteorological data gathered from the 60 meter tower during valid hours along with data substituted in for invalid hours from a secondary 10 Meter Temperature instrumentation located onsite by our meteorological third party vendor indicate normal weather patterns consistent with historical norms. The updated data was utilized in the dose calculations performed in the MIDAS software to ensure accurate dose assessments. The Joint Frequency Tables attached are taken using the primary instrumentation only as there is no method available in the software to illustrate the data substitution utilized by the vendor. This methodology of data substitution has always been used for any invalid hours, since the usage of MIDAS software at CNP, to ensure the most accurate dose calculations and reporting. The large number of invalid data hours is unusual though, so it is important to clarify that this did not impact the ability to calculate public dose negatively as a process of data substitution by our vendor already was in place to address any invalid hours.

Carbon-14 Supplemental Information for the 2013 Annual Radioactive Effluent Release Report.

C-14 has a 5730 year half-life and is a naturally occurring radionuclide produced by cosmic ray interactions in the atmosphere. C-14 is a relatively low energy beta emitter. Nuclear weapons testing in the 1950s and 1960s significantly increased the amount of C-14 in the atmosphere. C-14 is also produced in commercial nuclear reactors, but the amounts

produced are much less than those produced naturally, from weapons testing, or coal burning power plants. The inventory of C-14 in Earth's biosphere is about 300 million Curies, of which most is in the oceans.

Since the U.S. Nuclear Regulatory Commission (NRC) published Regulatory Guide (RG) 1.21, Revision 1, in 1974, the analytical methods for determining C-14 have improved. Coincidentally, the radioactive effluents from commercial nuclear power plants over the same period have decreased to the point that C-14 is likely to be a principal radionuclide in gaseous effluents. Based on these reasons and a desire to adjust policy to align with international standards, the nuclear industry was required to report, starting in 2010, the quantity and dose impact of C-14 here in the United States. The dose will be reported both with and without C-14 so a comparison to 2009 can be made, keeping in mind the differing standards.

The quantity of C-14 released to the environment can be estimated by use of a C-14 source term scaling factor based on power generation (Ref. RG 1.21, Revision 2). A recent study recommends a source term scaling factor of approximately 9.0 to 9.8 Curies/GWe-yr for a Westinghouse Pressurized Water Reactor (Ref. EPRI 1021106 "Estimation of Carbon-14 in Nuclear Plant Gaseous Effluents" December 23, 2010). A scaling factor of 9.4 Curies/GWe-yr was assumed for this report. Using this source term scaling factor and actual electrical generation (in MWH) produced during 2013 results in a site total of 18.03 Curies produced.

C-14 releases from PWRs occur primarily as a mix of organic carbon (methane) and inorganic (carbon dioxide). As a general rule, C-14 in the primary coolant is essentially all organic with a large fraction as gas. Any time the primary coolant is exposed to an oxidizing environment (during shutdown or refueling), a slow transformation from an organic to an inorganic species occurs. Various studies documenting measured C-14 releases from PWRs suggest an average 80% organic fraction with the remainder being carbon dioxide. This equates to 3.61 Curies released as carbon dioxide which is available for the food pathway through photosynthesis to vegetation.

Dose is calculated utilizing the methodology prescribed in RG 1.109, Appendix C with the vegetation dose being the most predominant. A 'p' factor of 0.33 is determined utilizing the 209 hours of batch gaseous releases performed during 2013 and the assumption that 70% of the C-14 released is from gaseous batch releases. A further reduction to the vegetation and leafy vegetable dose is warranted due to the limited growing season in Michigan, which was conservatively limited to nine months.

The final results indicated a calculated organ dose from C-14 to a child at the site boundary of 1.74 mrem to the bone and a whole body dose of 0.461 mrem, for a combined total C-14 dose of 2.20 mrem. This is less than the dose limit of 15 mrem/unit to any organ prescribed in 10 CFR 50, Appendix I, and the 40 CFR Part 190 limit of 25 mrem for total body and for any organ (≤ 75 mrem for thyroid).

VIII. CONCLUSION

Based on the information presented in this report, it is concluded that CNP Units 1 and 2 performed their intended design function with no demonstrable adverse effect on the health and safety of the general public.

2013 Effluent and Waste Disposal Annual Report

SUPPLEMENTAL INFORMATION

Facility: Donald C. Cook Nuclear Plant
Licensee: Indiana Michigan Power Company

1 REGULATORY LIMITS

1.1 Noble Gases

The air dose in unrestricted areas due to noble gases released in gaseous effluents shall be limited to the following:

1.1.1 During any calendar quarter, to ≤ 5 mrad/unit for gamma radiation and ≤ 10 mrad/unit for beta radiation.

1.1.2 During any calendar year, to ≤ 10 mrad/unit for gamma radiation and ≤ 20 mrad/unit for beta radiation.

1.2 Iodines - Particulates

The dose to a member of the public from radioiodines, radioactive materials in particulate form, and radionuclides other than noble gases with half-lives greater than eight days in gaseous effluents released to unrestricted areas shall be limited to the following:

1.2.1 During any calendar quarter to ≤ 7.5 mrem/unit to any organ.

1.2.2 During any calendar year to ≤ 15 mrem/unit to any organ.

1.3 Liquid Effluents

The dose or dose commitment to an individual from radioactive material in liquid effluents released to unrestricted areas shall be limited:

1.3.1 During any calendar quarter to ≤ 1.5 mrem/unit to the total body and to ≤ 5 mrem/unit to any organ.

1.3.2 During any calendar year to ≤ 3 mrem/unit to the total body and to ≤ 10 mrem/unit to any organ.

2013 Effluent and Waste Disposal Annual Report

1.4 Total Dose

The dose or dose commitment to a real individual from all uranium fuel cycle sources is limited to ≤ 25 mrem to the total body or any organ (except the thyroid, which is limited to ≤ 75 mrem) over a period of 12 consecutive months.

2 MAXIMUM PERMISSIBLE CONCENTRATIONS

2.1 Gaseous Effluents

The dose rate due to radioactive materials released in gaseous effluents from the site shall be limited to the following:

2.1.1 For noble gases: ≤ 500 mrem/yr to the total body and ≤ 3000 mrem/yr to the skin.

2.1.2 For all radioiodines and for all radioactive materials in particulate form and radionuclides (other than noble gases) with half-lives greater than eight days: ≤ 1500 mrem/yr to any organ.

The above limits are provided to insure that radioactive material discharged in gaseous effluents will not result in the exposure of an individual in an unrestricted area to annual average concentrations exceeding the limits in 10 CFR Part 20, Appendix B, Table 2, Column 1.

2.2 Liquid Effluents

The concentration of radioactive material released at any time from the site to unrestricted areas shall be limited to 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 shall be limited to 2×10^{-4} $\mu\text{Ci/ml}$ total activity.

2013 Effluent and Waste Disposal Annual Report

3 AVERAGE ENERGY

The average energy (\bar{E}) of the radionuclide mixture in releases of fission and activation gases as defined in Regulatory Guide 1.21, Appendix B, Section A.3 is not applicable because the limits used for gaseous releases are based on calculated dose to members of the public. Release rates are calculated using an isotopic mix from actual samples rather than average energy.

4 MEASUREMENTS and APPROXIMATIONS of TOTAL RADIOACTIVITY

4.1 Fission and Activation Gases

Sampled and analyzed on a 4096 channel analyzer and HpGe detector. Tritium analysis is performed using liquid scintillation counters.

4.2 Iodines

Sampled on iodine adsorbing media and analyzed on a 4096 channel analyzer and HpGe detector.

4.3 Particulates

Sampled on a glass filter and analyzed on a 4096 channel analyzer and HpGe detector. Sr-89 and Sr-90 analyses are performed by offsite vendor.

4.4 Liquid Effluents

Sampled and analyzed on a 4096 channel analyzer and HpGe detector. Tritium analysis is performed using liquid scintillation counter. Fe-55, Sr-89 and Sr-90 analyses performed by offsite vendor. Ni-63 is also currently being analyzed by the offsite vendor in response to evaluation of the 10 CFR 61 sample results.

2013 Effluent and Waste Disposal Annual Report

5 BATCH RELEASES

5.1 Liquid

5.1.1 Number of batch releases:

18 releases in the 1st quarter, 2013
24 releases in the 2nd quarter, 2013
25 releases in the 3rd quarter, 2013
23 releases in the 4th quarter, 2013

5.1.2 Total time period for batch releases:

56,988 minutes

5.1.3 Maximum time for a batch release:

2,466 minutes

5.1.4 Average time period for batch release:

.633 minutes

5.1.5 Minimum time period for a batch release:

.95 minutes

5.1.6 Average stream flow during periods of release of effluent into a flowing stream:

6.93E+5 gpm circulating water

2013 Effluent and Waste Disposal Annual Report

5.2 Gaseous

5.2.1 Number of batch releases:

105 releases in the 1st quarter, 2013
109 releases in the 2nd quarter, 2013
123 releases in the 3rd quarter, 2013
65 releases in the 4th quarter, 2013

5.2.2 Total time period for batch releases:

12,517 minutes

5.2.3 Maximum time for a batch release:

358 minutes

5.2.4 Average time period for batch release:

31 minutes

5.2.5 Minimum time period for a batch release:

.7 minutes

2013 Effluent and Waste Disposal Annual Report

6 ABNORMAL RELEASES

6.1 Liquid

6.1.1 Number of Releases:

<u>1st Quarter</u>	<u>2nd Quarter</u>	<u>3rd Quarter</u>	<u>4th Quarter</u>
0	0	0	0

6.1.2 Total activity released (Ci):

<u>1st Quarter</u>	<u>2nd Quarter</u>	<u>3rd Quarter</u>	<u>4th Quarter</u>
0	0	0	0

6.2 Gaseous

6.2.1 Number of Releases:

<u>1st Quarter</u>	<u>2nd Quarter</u>	<u>3rd Quarter</u>	<u>4th Quarter</u>
0	0	0	0

6.2.2 Total activity released (Ci):

<u>1st Quarter</u>	<u>2nd Quarter</u>	<u>3rd Quarter</u>	<u>4th Quarter</u>
0	0	0	0

2013 EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
GASEOUS EFFLUENTS-GROUND LEVEL RELEASES

CONTINUOUS MODE

Nuclides Released	Unit	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
1. FISSION GASES					
H3	Ci	2.96E+01	2.76E+01	3.03E+01	3.75E+01
XE135m	Ci	-----	-----	-----	1.60E-03
KR85	Ci	-----	-----	-----	5.68E-03
XE131m	Ci	-----	-----	-----	2.43E-03
XE133m	Ci	-----	-----	-----	3.86E-03
XE133	Ci	-----	8.00E-03	-----	1.77E-01
XE135	Ci	-----	-----	-----	1.95E-02
Total for Period	Ci	2.96E+01	2.76E+01	3.03E+01	3.77E+01
2. IODINES					
I131	Ci	-----	1.72E-05	1.29E-06	1.91E-03
I132	Ci	-----	1.84E-10	-----	-----
I133	Ci	-----	-----	-----	2.47E-06
Total for Period	Ci	-----	1.72E-05	1.29E-06	1.91E-03
3. PARTICULATES					
MN54	Ci	-----	-----	-----	-----
CO60	Ci	-----	-----	-----	-----
CS137	Ci	-----	-----	-----	-----
Total for Period	Ci	-----	-----	-----	-----

* DENOTES SUPPLEMENTAL ISOTOPES

2013 EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
GASEOUS EFFLUENTS-GROUND LEVEL RELEASES

BATCH MODE

Nuclides Released	Unit	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
1. FISSION GASES					
H3	Ci	8.33E-02	1.85E-02	1.99E-02	4.48E-02
AR41	Ci	5.51E-01	2.04E-01	3.25E-01	2.60E-01
KR85	Ci	8.10E-01	5.00E-02	4.04E-01	5.69E-01
XE131M	Ci	-----	3.95E-04	1.73E-03	3.40E-03
XE133M	Ci	-----	-----	3.09E-04	-----
XE133	Ci	8.27E-02	1.56E-01	2.98E-01	2.37E-01
XE135	Ci	-----	-----	7.01E-05	4.28E-03
Total for Period	Ci	7.98E-01	4.29E-01	1.05E+00	1.12E+00
2. IODINES					
I131	Ci	-----	-----	-----	5.90E-08
I133	Ci	-----	-----	-----	-----
Total for Period	Ci	-----	-----	-----	5.90E-08
3. PARTICULATES					
* BR80	Ci	-----	-----	-----	-----
* BR82	Ci	-----	-----	-----	-----
Total for Period	Ci	-----	-----	-----	-----

* DENOTES SUPPLEMENTAL ISOTOPES

2013 EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
GASEOUS EFFLUENTS-SUMMATION OF ALL RELEASES

	Units	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Est. Total Error, %

A. FISSION AND ACTIVATION GASES						

1. Total Release	Ci	7.14E-01	4.18E-01	1.03E+00	1.28E+00	11.6

2. Average release rate for period	uCi/sec	9.19E-02	5.32E-02	1.30E-01	1.61E-01	

3. Percent of applicable limit*	% Gamma Beta	8.38E-03 1.53E-03	9.83E-03 2.07E-03	3.40E-02 7.78E-03	1.19E-02 2.20E-02	

B. IODINES						

1. Total I-131	Ci	0.00E+00	1.72E-05	1.29E-06	1.91E-03	11.6

2. Average release rate for period	uCi/sec	0.00E+00	2.19E-06	1.62E-07	2.40E-04	

3. Percent of applicable limit*	%	0.00E+00	6.25E-06	4.63E-07	6.84E-04	

C. PARTICULATES						

1. Particulates with half lives > 8 days	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A

2. Average release rate for period	uCi/sec	0.00E+00	0.00E+00	0.00E+00	0.00E+00	

3. Percent of applicable limit*	%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	

4. Gross alpha radioactivity	Ci	<1.32E-06	<1.34E-06	<1.35E-06	<1.35E-06	

D. TRITIUM						

1. Total Release	Ci	2.96E+01	2.76E+01	3.03E+01	3.76E+01	13.0

2. Average release rate for period	uCi/sec	3.81E+00	3.51E+00	3.81E+00	4.72E+00	

3. Percent of applicable limit*	%	2.17E-02	2.00E-02	2.17E-02	2.69E-02	

* Applicable limits are expressed in terms of dose. See Appendices A1.2-1 through A1.2-4

2013 EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT

LIQUID EFFLUENTS

CONTINUOUS MODE

Nuclides Released	Unit	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
H3	Ci	1.17E-02	1.38E-02	1.89E-02	2.53E-02
CS137	Ci	-----	-----	-----	-----

BATCH MODE

Nuclides Released	Unit	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
H3	Ci	7.45E+02	3.25E+02	9.68E+02	2.47E+02
CR51	Ci	-----	1.36E-05	-----	-----
MN54	Ci	-----	3.26E-06	-----	1.42E-06
FE55	Ci	-----	-----	-----	-----
CO58	Ci	1.31E-05	3.35E-04	8.22E-05	2.77E-04
CO60	Ci	8.35E-05	9.90E-05	1.05E-04	9.69E-05
NI63	Ci	-----	-----	-----	-----
*KR85	Ci	-----	-----	1.97E-04	-----
ZR95	Ci	-----	-----	-----	-----
NB95	Ci	-----	1.87E-06	-----	2.37E-06
MO99	Ci	-----	-----	-----	-----
TC99m	Ci	-----	-----	-----	6.61E-07
AG110m	Ci	2.26E-04	9.72E-05	1.83E-05	4.44E-05
*XE131m	Ci	-----	-----	1.86E-04	5.40E-05
SB125	Ci	-----	-----	-----	7.98E-06
CS134	Ci	-----	-----	-----	2.53E-05
CS137	Ci	-----	1.02E-05	9.63E-07	2.82E-05
*XE135	Ci	-----	-----	2.90E-05	-----
I131	Ci	-----	-----	-----	1.21E-04
*XE133	Ci	3.17E-04	4.63E-05	8.24E-03	3.33E-03
*XE133m	Ci	-----	-----	6.19E-05	2.37E-05

* DENOTES SUPPLEMENTAL ISOTOPES

2013 EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
LIQUID EFFLUENTS-SUMMATION OF ALL RELEASES
BATCH MODE

	Units	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Est. Total Error, %

A. FISSION AND ACTIVATION PRODUCTS						

1. Total Release	Ci	3.23E-04	5.60E-04	2.06E-04	6.05E-04	12.4

2. Average diluted concentration during period	uCi/ml	8.55E-12	2.07E-11	3.29E-12	2.50E-11	

3. Percent of applicable limit	%	1.75E-04	2.82E-04	6.88E-05	9.57E-04	

B. TRITIUM						

1. Total Release	Ci	7.45E+02	3.25E+02	9.68E+02	2.47E+02	10.1

2. Average diluted concentration during period	uCi/ml	1.97E-05	1.20E-05	1.55E-05	1.02E-05	

3. Percent of applicable limit	%	1.97E+00	1.20E+00	1.55E+00	1.02E+00	

C. DISSOLVED AND ENTRAINED GASES						

1. Total Release	Ci	3.17E-04	4.63E-05	8.26E-03	3.33E-03	11.6

2. Average diluted concentration during period	uCi/ml	8.41E-12	1.71E-12	1.32E-10	1.38E-10	

3. Percent of applicable limit	%	4.21E-06	8.57E-07	6.60E-05	6.89E-05	

D. GROSS ALPHA RADIOACTIVITY TOTAL RELEASE	Ci	<1.05E-04	<1.40E-04	<1.46E-04	<1.35E-04	N/A

E. VOLUME OF WASTE RELEASED	Liters	1.36E+07	1.23E+07	1.51E+07	2.49E+07	2.00

F. VOLUME OF DILUTION WATER USED DURING PERIOD	Liters	7.08E+11	1.51E+11	8.97E+11	6.47E+11	3.48

2013 EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
LIQUID EFFLUENTS-SUMMATION OF ALL RELEASES
CONTINUOUS MODE

	Units	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Est. Total Error, %

A. FISSION AND ACTIVATION PRODUCTS						

1. Total Release	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A

2. Average diluted concentration during period	uCi/ml	0.00E+00	0.00E+00	0.00E+00	0.00E+00	

3. Percent of applicable limit	%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	

B. TRITIUM						

1. Total Release	Ci	1.17E-02	1.38E-02	1.89E-02	2.53E-02	22.6

2. Average diluted concentration during period	uCi/ml	1.74E-11	1.11E-10	2.27E-11	4.06E-11	

3. Percent of applicable limit	%	1.74E-04	1.11E-03	2.27E-04	4.06E-04	

C. DISSOLVED AND ENTRAINED GASES						

1. Total Release	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A

2. Average diluted concentration during period	uCi/ml	0.00E+00	0.00E+00	0.00E+00	0.00E+00	

3. Percent of applicable limit	%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	

D. GROSS ALPHA RADIOACTIVITY TOTAL RELEASE	Ci	0.00E+00	<8.94E-08	0.00E+00	<8.94E-08	N/A

E. VOLUME OF WASTE RELEASED	Liters	7.73E+06	1.09E+07	1.36E+07	2.36E+07	2.00

F. VOLUME OF DILUTION WATER USED DURING PERIOD	Liters	6.71E+11	1.24E+11	8.34E+11	6.23E+11	3.48

2013 Effluent and Waste Disposal Annual Report Solid Waste and Irradiated Fuel Shipments

Solid Waste Shipped Offsite for Burial or Disposal

1) Type of Waste	Unit	Estimated amount	Estimated Total Error, %
a) Spent resins, filters, sludge, evaporator bottoms, etc.	m ³ Curies	1.68E+01 2.80E+01	1.00E+00 3.75E+00
b) Dry compressible waste, contaminated equipment, etc.	m ³ Curies	5.78E+02 2.81E+00	1.00E+00 6.48E+00
c) Irradiated components, control rods, etc.	m ³ Curies		
d) Other (contaminated soil)	m ³ Curies		

2) Estimate of Principle Radionuclide Composition

a)	H-3	49 %	Co-58	9 %	Sb-125	2 %	Cs-137	1 %
	Mn-54	0.5 %	Co-60	13 %	Cs-134	0.5 %		
	Fe-55	12 %	Ni-63	12 %	Ni-59	1 %		
b)	Ni-59	0.5 %	Co-58	1 %	Sb-125	1 %		
	Mn-54	0.5 %	Co-60	46 %	Zr/Nb-95	1 %		
	Fe-55	36 %	Ni-63	13 %	Cs-137	0.5 %	C-14	0.5 %
d)								

3) Solid Waste Disposition

No. of Shipments	Mode of Transportation	Destination
16	Truck	Memphis, TN
3	Truck	Oak Ridge, TN
4	Truck	Erwin, TN

4) Type of Containers used for Shipment: Containers used are excepted packages, Type A, Sea Land, metal boxes, drums, tankers, and high integrity containers (HICs).

5) Solidification Agent: There were no solidifications performed during this report period.

2013 Effluent and Waste Disposal Annual Report Yearly Release Rates

GASES		
Fission and Activation Gases	Total Release	3.44E+00 Curies
	Average Release Rate	1.09E-01 μ Ci/sec
	% of Applicable Limits*	γ 1.60E-02 % β 8.35E-03 %
Iodines	Total I-131 Release	1.93E-03 Curies
	Average Release Rate	6.06E-05 μ Ci/sec
	% of Applicable Limit*	6.91E-04 %
Particulates	Total Release	0.00 Curies
	Average Release Rate	0.00 μ Ci/sec
	% of Applicable Limit*	0.00 %
LIQUIDS		
Fission and Activation Products	Total Release	1.69E-03 Curies
	Average Diluted Concentration	1.44E-11 μ Ci/ml
	% of Applicable Limits*	Total Body 1.11E+00 % Organ 3.34E-01 %

* Applicable limits are expressed in terms of the annual 10 CFR 50, Appendix I, dose limits.

Site Boundary and Nearest Residence Listing

The following distances were used in the calculation of the maximum individual doses:

<u>Sector</u>	<u>Direction</u>	<u>Boundary (Meters)</u>	<u>Nearest Residence (Meters)</u>
A	N	651	659
B	NNE	617	660
C	NE	789	943
D	ENE	1497	1747
E	E	1274	1716
F	ESE	972	1643
G	SE	629	1640
H	SSE	594	964
J	S	594	997
K	SSW	629	942

Summary of Maximum Individual Doses

First Quarter 2013

EFFLUENT	APPLICABLE ORGAN	ESTIMATED DOSE (mrem)	AGE GROUP	LOCATION DIST DIR (M) (Toward)	% OF APPLICABLE LIMIT	LIMIT (mrem) QTR
Liquid	Total Body	2.42E-02	Child	Receptor 1	1.61E+00	1.5E+0
Liquid	GI-tract	2.42E-02	Child	Receptor 1	4.84E-01	5.0E+0
Noble Gas	Air Dose (Gamma-mrad)	4.19E-04	Any Age	629 (SE)	8.38E-03	5.0E+0
Noble Gas	Air dose (Beta-mrad)	1.53E-04	Any Age	629 (SE)	1.53E-03	1.0E+1
Iodines and Particulates	Total Body	8.56E-03	Child	659 (N)	1.14E-01	7.5E+0

Summary of Maximum Individual Doses

Second Quarter 2013

EFFLUENT	APPLICABLE ORGAN	ESTIMATED DOSE (mrem)	AGE GROUP	LOCATION DIST DIR (M) (Toward)	% OF APPLICABLE LIMIT	LIMIT (mrem) QTR
Liquid	Total Body	9.22E-03	Child	Receptor 1	6.15E-01	1.5E+0
Liquid	Liver	9.25E-03	Child	Receptor 1	1.85E-01	5.0E+0
Noble Gas	Air Dose (Gamma-mrad)	4.92E-04	Any Age	651 (N)	9.83E-03	5.0E+0
Noble Gas	Air dose (Beta-mrad)	2.07E-04	Any Age	651 (N)	2.07E-03	1.0E+1
Iodines and Particulates	Thyroid	1.50E-02	Child	659 (N)	2.00E-01	7.5E+0

Summary of Maximum Individual Doses

Third Quarter 2013

EFFLUENT	APPLICABLE ORGAN	ESTIMATED DOSE (mrem)	AGE GROUP	LOCATION DIST DIR (M) (Toward)	% OF APPLICABLE LIMIT	LIMIT (mrem) QTR
Liquid	Total Body	2.51E-02	Child	Receptor 1	1.67E+00	1.5E+0
Liquid	Liver	2.51E-02	Child	Receptor 1	5.02E-01	5.0E+0
Noble Gas	Air Dose (Gamma-mrad)	1.70E-03	Any Age	651 (N)	3.40E-02	5.0E+0
Noble Gas	Air dose (Beta-mrad)	7.78E-04	Any Age	651 (N)	7.78E-03	1.0E+1
Iodines and Particulates	Total Body	4.53E-02	Child	659 (N)	6.04E-01	7.5E+0

Summary of Maximum Individual Doses

Fourth Quarter 2013

EFFLUENT	APPLICABLE ORGAN	ESTIMATED DOSE (mrem)	AGE GROUP	LOCATION DIST DIR (M) (Toward)	% OF APPLICABLE LIMIT	LIMIT (mrem) QTR
Liquid	Total Body	8.12E-03	Child	Receptor 1	5.42E-01	1.5E+0
Liquid	Liver	8.30E-03	Child	Receptor 1	1.66E-01	5.0E+0
Noble Gas	Air Dose (Gamma-mrad)	5.94E-04	Any Age	594 (SSE)	1.19E-02	5.0E+0
Noble Gas	Air dose (Beta-mrad)	2.20E-03	Any Age	629 (SSW)	2.20E-02	1.0E+1
Iodines and Particulates	Thyroid	7.51E-02	Child	659 (N)	1.00E+00	7.5E+0

2013 GPI Sample Data

Samples analyzed for tritium. Values noted are in microcuries per milliliter (uCi/mL)
Lower Limit of Detection = LLD

Date	MW-22D	MW-22M	MW-22S	MW-24D	MW-24M	MW-24S	MW-25D	MW-25M
01/04/2013				<LLD	<LLD	<LLD		
01/28/2013							<LLD	<LLD
02/15/2013	<LLD	<LLD	<LLD					
02/25/2013				<LLD	<LLD	<LLD	<LLD	<LLD
03/21/2013	<LLD	<LLD	<LLD					
03/28/2013							<LLD	<LLD
03/30/2013				<LLD	<LLD	<LLD		
04/27/2013	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
05/07/2013	<LLD	<LLD	<LLD					
05/31/2013				<LLD	<LLD	<LLD	<LLD	<LLD
07/09/2013	<LLD	<LLD	<LLD					
10/14/2013	<LLD							
10/15/2013		<LLD	<LLD					
10/24/2013				<LLD	<LLD	<LLD	<LLD	<LLD
11/22/2013							<LLD	<LLD
12/02/2013				<LLD	<LLD	<LLD		
12/03/2013	<LLD	<LLD	<LLD					
12/06/2013							<LLD	<LLD

Date	MW-25S	MW-26D	MW-26M	MW-26S	MW-27D	MW-27M	MW-27S	EW-19
01/07/2013								<LLD
01/28/2013	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	
02/25/2013	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	
03/28/2013	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	
04/02/2013								<LLD
04/27/2013	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	
05/31/2013	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	
07/22/2013								<LLD
10/14/2013								<LLD
10/24/2013	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	
11/22/2013	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	
12/02/2013								<LLD
12/06/2013	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	

(Note: Wells MW-22 through MW 27 are multi-port wells installed in the Fall of 2009, with three sample points placed at different depths. S= Shallow M= Middle D= Deep.)

(Note: A "*" symbol following a sample result denotes a gamma count was performed. Any gamma results above LLD will be additionally flagged and documented in the analysis section.)

2013 GPI Sample Data

Samples analyzed for tritium. Values noted are in microcuries per milliliter (uCi/mL)
Lower Limit of Detection = LLD

Date	SG-1	SG-2	SG-4	SG-5	OW-4	MW-20	MW-21	95-11A
01/18/2013					<LLD			
01/25/2013	<LLD	<LLD	<LLD	<LLD				
01/28/2013						<LLD	<LLD	
02/15/2013	<LLD	<LLD	<LLD	<LLD		<LLD	<LLD	
02/28/2013					<LLD			
03/21/2013	<LLD	<LLD	<LLD	<LLD		<LLD	<LLD	
03/31/2013					<LLD			
04/28/2013	<LLD	<LLD	<LLD	<LLD		<LLD	<LLD	
04/30/2013					<LLD			
05/07/2013						<LLD		
05/08/2013	<LLD	<LLD	<LLD	<LLD			<LLD	
07/10/2013	<LLD	<LLD	<LLD	<LLD		<LLD	<LLD	
10/14/2013						<LLD	<LLD	
11/04/2013	<LLD	<LLD	<LLD	<LLD		<LLD		
11/05/2013							<LLD	
12/02/2013	<LLD	<LLD	<LLD	<LLD				
12/03/2013						<LLD	<LLD	
12/17/2013								<LLD

(Note: A "*" symbol following a sample result denotes a gamma count was performed. Any gamma results above LLD will be additionally flagged and documented in the analysis section.)

2013 GPI Sample Data

Samples analyzed for tritium. Values noted are in microcuries per milliliter (uCi/mL)
Lower Limit of Detection = LLD

Date	W-9	W-10	W-11	W-12	W-13	W-14	W-15	OW-1
01/07/2013							<LLD	
01/08/2013					<LLD	<LLD		
01/18/2013								<LLD
01/28/2013		<LLD	<LLD	<LLD	<LLD	<LLD		
01/29/2013	<LLD						<LLD	
02/15/2013				<LLD	<LLD	<LLD		
02/28/2013							<LLD	<LLD
03/21/2013			<LLD	<LLD	<LLD	<LLD		
03/30/2013							<LLD	
03/31/2013								<LLD
04/27/2013					<LLD	<LLD		
04/28/2013		<LLD	<LLD	<LLD			<LLD	
04/30/2013								<LLD
05/07/2013					<LLD	<LLD		
05/08/2013		<LLD	<LLD	<LLD				
05/09/2013	<LLD						<LLD	
07/09/2013			<LLD	<LLD	<LLD	<LLD		
07/22/2013		<LLD					<LLD	
07/23/2013	<LLD							
10/14/2013		<LLD		<LLD	<LLD	<LLD	<LLD	
10/15/2013			<LLD					
11/04/2013		<LLD	<LLD	<LLD		<LLD		
11/05/2013	<LLD				<LLD		<LLD	
12/02/2013			<LLD	<LLD			<LLD	
12/03/2013					<LLD	<LLD		
12/17/2013								<LLD

(Note: A "*" symbol following a sample result denotes a gamma count was performed. Any gamma results above LLD will be additionally flagged and documented in the analysis section.)

2013 GPI Sample Data

Samples analyzed for tritium. Values noted are in microcuries per milliliter (uCi/mL)

Lower Limit of Detection = LLD

Date	W-1	W-2	W-3	W-4	W-5	W-6	W-7	W-8
01/08/2013			<LLD					
01/25/2013			<LLD					
01/28/2013	<LLD						<LLD	
01/29/2013		<LLD						
01/30/2013				<LLD	<LLD	<LLD		<LLD
05/07/2013	<LLD						<LLD	
05/08/2013			<LLD					<LLD
05/09/2013		<LLD						
05/10/2013				<LLD	<LLD	<LLD		
07/23/2013								<LLD
07/24/2013	<LLD							
07/25/2013		<LLD					<LLD	
07/26/2013			<LLD	<LLD	<LLD	<LLD		
10/14/2013			<LLD					
11/04/2013	<LLD		<LLD				<LLD	
11/05/2013		<LLD						
11/07/2013								<LLD
11/08/2013				<LLD	<LLD	<LLD		

(Note: A "*" symbol following a sample result denotes a gamma count was performed. Any gamma results above LLD will be additionally flagged and documented in the analysis section.)

Samples analyzed for tritium. Values noted are in microcuries per milliliter (uCi/mL)

Lower Limit of Detection = LLD

Date	EW-18	OW-2						
05/10/2013		<LLD						
12/02/2013	<LLD							

(Note: A "*" symbol following a sample result denotes a gamma count was performed. Any gamma results above LLD will be additionally flagged and documented in the analysis section.)

2013 GPI Sample Data

Analysis of the Sample Data

The Groundwater Protection Initiative (GPI) Sample Data for 2013 indicates no groundwater contamination in excess of the reporting threshold of $2.00\text{E-}5$ uCi/mL for tritium. Gamma spectroscopy was performed on all Radiological Environmental Monitoring Program wells quarterly. Those results are not actual GPI results so are not included in the ARERR, but are part of CNP's 2013 Annual Radiological Environmental Operating Report. There were no positively identified radionuclides from plant effluents detected in any of the GPI well samples.

The LLD value used for tritium counting of the samples varied between $9.42\text{E-}7$ and $9.63\text{E-}7$ uCi/mL, depending on which scintillation counter was used. This is well below the required maximum LLD value of $2.00\text{E-}6$ uCi/mL per the ODCM.

While no tritium values were found above LLD for 2013, values found above the LLD are not abnormal, unexpected, or inconsistent with past sampling history. The samples observed above LLD historically were expected results from the release of tritiated water into the Absorption Pond, a licensed pathway and part of plant design, or the result of recapture deposition of tritium from licensed radioactive gaseous release points. The 2013 results were expected considering the reduction in tritium released to the Absorption Pond and a reduction in rainfall experienced.

Wells located inside the Protected Area of the plant are subject to recapture deposition of tritium and may show occasional sample results above LLD values following rainfalls and snow melt. The results observed in 2013 continue to reflect normal expectations and behaviors as they relate to recaptured tritium for the weather conditions observed in 2013. All gamma samples taken in support of the GPI were less than detectable.

The sample data indicates that no radioactive spills or unidentified leaks have occurred in 2013 impacting groundwater. The sample results indicate proper well placement to ensure the protection of the groundwater and early identification of any abnormal conditions involving groundwater. This is validated by the demonstrated ability to monitor percolation from the Absorption Pond and recaptured tritium in precipitation, with flow direction and behavior acting as described in the plant licensing documents.

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 01/01/2013 - 03/31/2013
Elevation: Speed: SPD60M **Direction:** DIR60M **Lapse:** DT60M
Stability Class A **Delta Temperature** **Extremely Unstable**

Wind Speed (mph)

<u>Wind Direction</u>	<u>1-4</u>	<u>4-8</u>	<u>8-13</u>	<u>13-19</u>	<u>19-25</u>	<u>> 25</u>	<u>Total</u>	
N	0	0	1	2	0	0	3	
NNE	0	0	0	0	0	0	0	
NE	0	0	0	0	0	0	0	
ENE	0	0	0	0	0	0	0	
E	0	0	0	0	0	0	0	
ESE	0	1	0	0	0	0	1	
SE	0	1	0	0	0	0	1	
SSE	0	1	1	0	0	0	2	
S	0	0	1	3	0	0	4	
SSW	0	0	0	0	0	0	0	
SW	0	0	0	4	4	0	8	
WSW	0	0	2	0	0	0	2	
W	0	0	2	4	0	3	9	
WNW	0	0	0	2	0	0	2	
NW	0	0	0	9	0	0	9	
NNW	0	0	0	1	0	0	1	
Total	0	3	7	25	4	3	42	
Calm Hours not Included above for :							Total Period	1
Valid Hours for this Stability Class for:							Total Period	42
Total Hours for Period								2160

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 01/01/2013 - 03/31/2013
Elevation: Speed: SPD60M **Direction:** DIR60M **Lapse:** DT60M
Stability Class B Delta Temperature Moderately Unstable

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>≥ 25</u>	<u>Total</u>	
N	0	0	1	0	0	0	1	
NNE	0	0	0	0	0	0	0	
NE	0	0	0	0	0	0	0	
ENE	0	0	0	0	0	0	0	
E	0	1	5	0	0	0	6	
ESE	0	3	1	0	0	0	4	
SE	0	1	0	0	0	0	1	
SSE	0	1	0	0	0	0	1	
S	0	0	1	1	0	0	2	
SSW	0	0	0	0	0	0	0	
SW	0	0	1	6	0	0	7	
WSW	0	0	0	1	0	0	1	
W	0	0	1	3	0	1	5	
WNW	0	1	1	8	2	0	12	
NW	0	0	1	1	0	0	2	
NNW	0	0	0	2	1	0	3	
Total	0	7	12	22	3	1	45	
Calm Hours not Included above for :							Total Period	1
Valid Hours for this Stability Class for:							Total Period	45
Total Hours for Period								2160

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 01/01/2013 - 03/31/2013
Elevation: **Speed:** SPD60M **Direction:** DIR60M **Lapse:** DT60M
Stability Class C Delta Temperature Slightly Unstable

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>> 25</u>	<u>Total</u>	
N	0	0	0	2	0	0	2	
NNE	0	1	3	0	0	0	4	
NE	0	2	0	0	0	0	2	
ENE	0	1	1	1	0	0	3	
E	0	1	3	0	0	0	4	
ESE	0	4	0	1	0	0	5	
SE	0	0	1	0	0	0	1	
SSE	1	1	3	0	0	0	5	
S	0	1	1	4	0	1	7	
SSW	0	0	0	1	0	0	1	
SW	0	0	0	2	3	0	5	
WSW	0	1	1	3	3	0	8	
W	0	0	2	7	3	3	15	
WNW	0	0	2	2	8	0	12	
NW	0	2	3	4	1	0	10	
NNW	0	3	1	0	0	0	4	
Total	1	17	21	27	18	4	88	
Calm Hours not Included above for :							Total Period	1
Valid Hours for this Stability Class for:							Total Period	88
Total Hours for Period								2160

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 01/01/2013 - 03/31/2013
Elevation: **Speed:** SPD60M **Direction:** DIR60M **Lapse:** DT60M
Stability Class D Delta Temperature Neutral

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>> 25</u>	<u>Total</u>	
N	1	0	9	20	0	0	30	
NNE	0	4	8	1	0	0	13	
NE	0	5	7	0	0	0	12	
ENE	2	12	2	1	0	1	18	
E	0	7	5	5	3	0	20	
ESE	1	3	11	6	4	0	25	
SE	0	8	12	9	0	0	29	
SSE	1	8	10	2	2	0	23	
S	0	1	16	6	2	2	27	
SSW	2	1	19	14	2	1	39	
SW	1	2	12	29	5	0	49	
WSW	0	0	13	21	18	6	58	
W	1	1	13	39	36	13	103	
WNW	1	2	19	48	52	11	133	
NW	0	1	9	45	21	6	82	
NNW	1	1	11	16	4	0	33	
Total	11	56	176	262	149	40	694	
Calm Hours not Included above for :							Total Period	1
Valid Hours for this Stability Class for:							Total Period	694
Total Hours for Period								2160

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 01/01/2013 - 03/31/2013
 Elevation: Speed: SPD60M Direction: DIR60M Lapse: DT60M
 Stability Class E Delta Temperature Slightly Stable

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>≥ 25</u>	<u>Total</u>
N	1	8	7	3	0	0	19
NNE	2	2	1	0	0	0	5
NE	0	5	4	1	0	0	10
ENE	0	2	9	8	1	2	22
E	0	4	2	0	1	1	8
ESE	0	2	3	2	0	0	7
SE	0	4	9	4	3	0	20
SSE	0	1	10	5	4	1	21
S	1	1	12	13	7	0	34
SSW	0	1	7	5	7	0	20
SW	0	3	6	4	9	1	23
WSW	0	0	3	0	0	1	4
W	1	2	6	0	3	1	13
WNW	0	1	9	9	1	0	20
NW	0	3	4	4	1	0	12
NNW	0	2	2	2	0	0	6
Total	5	41	94	60	37	7	244
Calm Hours not Included above for :							1
Valid Hours for this Stability Class for:							244
Total Hours for Period							2160

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 01/01/2013 - 03/31/2013
Elevation: Speed: SPD60M **Direction:** DIR60M **Lapse:** DT60M
Stability Class F **Delta Temperature** **Moderately Stable**

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>> 25</u>	<u>Total</u>
N	0	2	0	1	0	0	3
NNE	0	2	0	0	0	0	2
NE	0	1	0	0	0	0	1
ENE	0	1	0	0	0	0	1
E	0	0	0	0	0	0	0
ESE	0	1	1	1	0	0	3
SE	1	1	1	1	0	0	4
SSE	0	1	1	1	0	0	3
S	0	2	1	1	0	0	4
SSW	0	0	1	2	0	0	3
SW	0	0	1	0	1	0	2
WSW	0	1	0	0	1	0	2
W	0	1	0	0	0	1	2
WNW	0	1	1	0	0	0	2
NW	0	0	1	0	0	0	1
NNW	0	1	0	0	0	0	1
Total	1	15	8	7	2	1	34
Calm Hours not Included above for :							1
Valid Hours for this Stability Class for:							34
Total Hours for Period							2160

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 01/01/2013 - 03/31/2013
Elevation: Speed: SPD60M **Direction:** DIR60M **Lapse:** DT60M
Stability Class G **Delta Temperature** **Extremely Stable**

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>≥ 25</u>	<u>Total</u>	
N	0	1	0	0	0	0	1	
NNE	0	1	0	0	0	0	1	
NE	1	0	0	0	0	0	1	
ENE	1	3	0	0	0	0	4	
E	1	2	0	0	0	0	3	
ESE	0	0	0	0	0	0	0	
SE	0	1	6	0	0	0	7	
SSE	0	2	6	0	0	0	8	
S	1	1	1	0	0	0	3	
SSW	0	1	0	0	0	0	1	
SW	0	0	0	0	0	0	0	
WSW	0	0	1	0	0	0	1	
W	0	1	1	0	0	0	2	
WNW	0	0	0	0	0	0	0	
NW	0	0	3	0	0	0	3	
NNW	0	0	0	0	0	0	0	
Total	4	13	18	0	0	0	35	
Calm Hours not Included above for :							Total Period	1
Valid Hours for this Stability Class for:							Total Period	35
Total Hours for Period								2160

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Summary of All Stability Classes

Total Period

Period of Record =

01/01/2013 - 03/31/2013

Elevation: Speed: SPD60M

Direction: DIR60M

Lapse: DT60M

Delta Temperature

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>> 25</u>	<u>Total</u>
N	2	11	18	28	0	0	59
NNE	2	10	12	1	0	0	25
NE	1	13	11	1	0	0	26
ENE	3	19	12	10	1	3	48
E	1	15	15	5	4	1	41
ESE	1	14	16	10	4	0	45
SE	1	16	29	14	3	0	63
SSE	2	15	31	8	6	1	63
S	2	6	33	28	9	3	81
SSW	2	3	27	22	9	1	64
SW	1	5	20	45	22	1	94
WSW	0	2	20	25	22	7	76
W	2	5	25	53	42	22	149
WNW	1	5	32	69	63	11	181
NW	0	6	21	63	23	6	119
NNW	1	7	14	21	5	0	48
Total	22	152	336	403	213	56	1182

Calm Hours not Included above for :	Total Period	1
Variable Direction Hours for:	Total Period	0
Invalid Hours for:	Total Period	977
Valid Hours for this Stability Class for:	Total Period	1182
Total Hours for Period		2160

Hours are not adjusted to Daylight Savings Time

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 04/01/2013 - 06/30/2013
Elevation: **Speed:** SPD60M **Direction:** DIR60M **Lapse:** DT60M
Stability Class A Delta Temperature Extremely Unstable

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>> 25</u>	<u>Total</u>	
N	0	3	14	21	7	0	45	
NNE	0	1	1	0	0	0	2	
NE	1	6	5	0	0	0	12	
ENE	3	4	5	1	0	0	13	
E	0	4	7	3	0	0	14	
ESE	1	3	6	3	0	0	13	
SE	2	5	7	2	0	0	16	
SSE	0	6	11	1	0	0	18	
S	1	1	10	24	1	0	37	
SSW	0	0	2	0	0	0	2	
SW	0	5	13	8	1	0	27	
WSW	0	6	16	3	0	0	25	
W	2	13	12	0	0	0	27	
WNW	0	14	7	1	0	0	22	
NW	0	14	19	7	2	0	42	
NNW	0	19	54	12	1	0	86	
Total	10	104	189	86	12	0	401	
Calm Hours not Included above for :							Total Period	0
Valid Hours for this Stability Class for:							Total Period	401
Total Hours for Period								2184

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 04/01/2013 - 06/30/2013
Elevation: Speed: SPD60M **Direction:** DIR60M **Lapse:** DT60M
Stability Class B **Delta Temperature** **Moderately Unstable**

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>> 25</u>	<u>Total</u>	
N	0	1	4	0	0	0	5	
NNE	0	0	1	0	0	0	1	
NE	0	0	2	0	0	0	2	
ENE	0	0	0	0	0	0	0	
E	0	1	1	0	0	0	2	
ESE	0	0	4	1	0	0	5	
SE	0	1	1	1	0	0	3	
SSE	0	1	2	1	0	0	4	
S	1	1	2	8	0	0	12	
SSW	0	1	4	2	0	0	7	
SW	0	1	6	1	0	0	8	
WSW	0	1	0	2	0	0	3	
W	0	2	1	0	0	0	3	
WNW	1	1	0	0	0	0	2	
NW	0	1	0	0	0	0	1	
NNW	0	1	4	3	2	0	10	
Total	2	13	32	19	2	0	68	
Calm Hours not Included above for :							Total Period	0
Valid Hours for this Stability Class for:							Total Period	68
Total-Hours for-Period								2184

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 04/01/2013 - 06/30/2013
Elevation: **Speed:** SPD60M **Direction:** DIR60M **Lapse:** DT60M
Stability Class C Delta Temperature Slightly Unstable

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>> 25</u>	<u>Total</u>
N	1	2	5	0	2	0	10
NNE	0	2	1	0	0	0	3
NE	0	1	1	0	0	0	2
ENE	1	3	3	0	0	0	7
E	0	1	3	0	0	0	4
ESE	0	0	2	0	0	0	2
SE	1	2	3	0	0	0	6
SSE	0	0	0	0	0	0	0
S	0	1	2	7	2	0	12
SSW	0	1	4	3	0	0	8
SW	0	1	1	2	0	0	4
WSW	0	1	-2	0	0	0	3
W	0	4	0	1	0	0	5
WNW	0	1	0	1	0	0	2
NW	0	3	3	0	1	0	7
NNW	0	4	3	2	0	0	9
Total	3	27	33	16	5	0	84
Calm Hours not Included above for :							Total Period 0
Valid Hours for this Stability Class for:							Total Period 84
Total Hours for Period							2184

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 04/01/2013 - 06/30/2013
Elevation: Speed: SPD60M **Direction:** DIR60M **Lapse:** DT60M
Stability Class D **Delta Temperature** Neutral

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>> 25</u>	<u>Total</u>
N	1	5	10	8	2	0	26
NNE	0	1	4	1	0	0	6
NE	0	1	4	2	0	0	7
ENE	2	0	2	3	2	0	9
E	0	1	5	1	7	2	16
ESE	0	1	6	3	0	0	10
SE	0	1	10	0	0	0	11
SSE	1	3	6	9	0	0	19
S	2	1	14	22	3	0	42
SSW	0	3	7	5	0	0	15
SW	2	3	7	10	2	4	28
WSW	0	6	4	5	1	1	17
W	2	6	5	2	2	0	17
WNW	1	3	2	0	2	0	8
NW	3	4	1	7	6	0	21
NNW	0	5	8	4	1	2	20
Total	14	44	95	82	28	9	272
Calm Hours not Included above for :							0
Valid Hours for this Stability Class for:							272
Total Hours for Period							2184

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 04/01/2013 - 06/30/2013
Elevation: **Speed:** SPD60M **Direction:** DIR60M **Lapse:** DT60M
Stability Class E Delta Temperature Slightly Stable

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>> 25</u>	<u>Total</u>
N	0	4	15	1	1	0	21
NNE	0	3	15	0	0	0	18
NE	1	4	10	0	0	0	15
ENE	0	3	11	1	0	0	15
E	0	6	11	5	5	1	28
ESE	0	5	13	12	1	0	31
SE	1	1	6	2	0	0	10
SSE	1	1	16	19	2	0	39
S	0	1	15	14	2	0	32
SSW	1	2	12	4	1	0	20
SW	0	5	7	3	5	0	20
WSW	0	2	6	2	-1	0	-1
W	0	3	4	1	1	0	9
WNW	1	1	0	0	0	0	2
NW	1	5	6	4	1	0	17
NNW	1	5	6	2	0	0	14
Total	7	51	153	70	-20	-1	302
Calm Hours not Included above for :							Total Period 0
Valid Hours for this Stability Class for:							Total Period 302
Total-Hours for Period							2184

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 04/01/2013 - 06/30/2013
Elevation: Speed: SPD60M **Direction:** DIR60M **Lapse:** DT60M
Stability Class F **Delta Temperature** **Moderately Stable**

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>> 25</u>	<u>Total</u>	
N	0	3	1	1	0	0	5	
NNE	0	4	4	0	0	0	8	
NE	0	2	10	1	0	0	13	
ENE	0	7	9	2	0	0	18	
E	0	2	11	3	0	0	16	
ESE	1	3	12	1	0	0	17	
SE	1	2	6	0	0	0	9	
SSE	1	1	6	5	1	0	14	
S	0	1	3	4	0	0	8	
SSW	0	3	1	0	0	0	4	
SW	2	1	1	0	0	0	4	
WSW	0	1	3	0	0	0	4	
W	0	0	3	0	0	0	3	
WNW	1	2	0	0	0	0	3	
NW	0	1	1	0	0	0	2	
NNW	1	3	0	0	0	0	4	
Total	7	36	71	17	1	0	132	
Calm Hours not Included above for :							Total Period	0
Valid Hours for this Stability Class for:							Total Period	132
Total Hours for Period								2184

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 04/01/2013 - 06/30/2013
Elevation: Speed: SPD60M **Direction:** DIR60M **Lapse:** DT60M
Stability Class G **Delta Temperature** **Extremely Stable**

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>> 25</u>	<u>Total</u>
N	1	1	2	1	0	0	5
NNE	1	6	6	1	0	0	14
NE	1	6	1	0	0	0	8
ENE	2	3	10	2	0	0	17
E	0	8	10	5	0	0	23
ESE	3	3	8	1	0	0	15
SE	2	3	7	1	0	0	13
SSE	1	6	7	2	0	0	16
S	5	3	4	0	0	0	12
SSW	1	1	4	1	0	0	7
SW	2	4	4	0	0	0	10
WSW	0	4	1	0	0	0	5
W	0	0	1	0	0	0	1
WNW	4	1	1	0	0	0	6
NW	0	4	1	0	0	0	5
NNW	2	1	0	0	0	0	3
Total	25	54	67	14	0	0	160
Calm Hours not Included above for :							Total Period
Valid Hours for this Stability Class for:							Total Period
Total Hours for Period							2184

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Summary of All Stability Classes

Total Period

Period of Record = 04/01/2013 - 06/30/2013
 Elevation: Speed: SPD60M Direction: DIR60M Lapse: DT60M

Delta Temperature

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>> 25</u>	<u>Total</u>
N	3	19	51	32	12	0	117
NNE	1	17	32	2	0	0	52
NE	3	20	33	3	0	0	59
ENE	8	20	40	9	2	0	79
E	0	23	48	17	12	3	103
ESE	5	15	51	21	1	0	93
SE	7	15	40	6	0	0	68
SSE	4	18	48	37	3	0	110
S	9	9	50	79	8	0	155
SSW	2	11	34	15	1	0	63
SW	6	20	39	24	8	4	101
WSW	0	21	32	12	2	1	68
W	4	28	26	4	3	0	65
WNW	8	23	10	2	2	0	45
NW	4	32	31	18	10	0	95
NNW	4	38	75	23	4	2	146
Total	68	329	640	304	68	10	1419
Calm Hours not Included above for :							Total Period 0
Variable Direction Hours for:							Total Period 0
Invalid Hours for:							Total Period 765
Valid Hours for this Stability Class for:							Total Period 1419
Total Hours for Period							2184

Hours are not adjusted for Daylight Savings Time

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 07/01/2013 - 09/30/2013
Elevation: Speed: SPD60M **Direction:** DIR60M **Lapse:** DT60M
Stability Class A **Delta Temperature** **Extremely Unstable**

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>> 25</u>	<u>Total</u>
N	1	2	19	19	3	0	44
NNE	0	3	1	2	1	0	7
NE	2	10	10	4	0	0	26
ENE	2	7	9	0	0	0	18
E	2	5	7	0	0	0	14
ESE	0	14	9	0	0	0	23
SE	0	21	15	0	0	0	36
SSE	0	6	24	3	0	0	33
S	0	12	12	6	0	0	30
SSW	0	2	2	0	0	0	4
SW	0	15	37	19	1	0	72
WSW	0	18	27	8	1	0	54
W	1	26	17	7	0	0	51
WNW	3	35	18	0	0	0	56
NW	1	13	7	6	0	0	27
NNW	0	14	96	38	4	0	152
Total	12	203	310	112	10	0	647
Calm Hours not Included above for :							0
Valid Hours for this Stability Class for:							647
Total Hours for Period.							2208

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 07/01/2013 - 09/30/2013
Elevation: Speed: SPD60M **Direction:** DIR60M **Lapse:** DT60M
Stability Class B **Delta Temperature** **Moderately Unstable**

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>> 25</u>	<u>Total</u>
N	0	1	3	1	1	0	6
NNE	0	0	2	0	0	0	2
NE	0	0	2	1	0	0	3
ENE	0	0	1	0	0	0	1
E	0	2	0	0	0	0	2
ESE	1	2	1	0	0	0	4
SE	0	0	2	0	0	0	2
SSE	0	2	3	0	0	0	5
S	0	2	7	2	0	0	11
SSW	0	2	0	0	0	0	2
SW	0	3	6	1	0	0	10
WSW	1	3	1	1	0	0	6
W	2	1	0	0	0	0	3
WNW	1	1	3	1	0	0	6
NW	0	0	1	1	0	0	2
NNW	0	3	2	1	0	0	6
Total	5	22	34	9	1	0	71
Calm Hours not Included above for :							0
Valid Hours for this Stability Class for:							71
Total Hours for Period							2208

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 07/01/2013 - 09/30/2013
Elevation: **Speed:** SPD60M **Direction:** DIR60M **Lapse:** DT60M
Stability Class C Delta Temperature Slightly Unstable

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>> 25</u>	<u>Total</u>	
N	0	3	8	3	0	0	14	
NNE	1	0	0	0	0	0	1	
NE	0	2	1	0	0	0	3	
ENE	0	1	1	0	0	0	2	
E	0	1	0	0	0	0	1	
ESE	0	0	0	0	0	0	0	
SE	1	1	1	1	0	0	4	
SSE	0	4	2	0	0	0	6	
S	0	0	5	0	0	0	5	
SSW	0	7	1	0	0	0	8	
SW	1	2	4	3	0	0	10	
WSW	0	2	1	0	0	0	3	
W	1	0	1	0	1	0	3	
WNW	0	3	0	1	0	0	4	
NW	0	2	1	1	0	0	4	
NNW	0	1	4	0	0	0	5	
Total	4	29	30	9	1	0	73	
Calm Hours not Included above for :							Total Period	0
Valid Hours for this Stability Class for:							Total Period	73
Total Hours for Period								2208

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 07/01/2013 - 09/30/2013
 Elevation: Speed: SPD60M Direction: DIR60M Lapse: DT60M
 Stability Class D Delta Temperature Neutral

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>> 25</u>	<u>Total</u>
N	1	16	17	8	5	0	47
NNE	1	3	11	4	0	0	19
NE	1	6	17	3	0	0	27
ENE	0	4	10	0	0	0	14
E	0	3	4	1	0	0	8
ESE	1	2	7	1	0	0	11
SE	0	4	9	0	0	0	13
SSE	0	6	10	5	2	0	23
S	1	8	17	6	0	0	32
SSW	3	1	17	6	0	0	27
SW	2	8	7	39	4	0	60
WSW	0	5	7	5	1	0	18
W	1	2	6	12	2	0	23
WNW	2	0	4	12	1	0	19
NW	1	1	6	9	0	0	17
NNW	1	9	7	1	0	0	18
Total	15	78	156	112	15	0	376
Calm Hours not Included above for :							Total Period 0
Valid Hours for this Stability Class for:							Total Period 376
Total Hours for Period							2208

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 07/01/2013 - 09/30/2013
Elevation: Speed: SPD60M **Direction:** DIR60M **Lapse:** DT60M
Stability Class E **Delta Temperature** **Slightly Stable**

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>> 25</u>	<u>Total</u>
N	1	9	18	3	0	0	31
NNE	0	10	13	2	0	0	25
NE	2	2	20	6	0	0	30
ENE	1	8	9	1	0	0	19
E	2	2	4	0	0	0	8
ESE	1	1	17	0	0	0	19
SE	1	4	20	3	0	0	28
SSE	3	6	10	5	0	0	24
S	1	12	34	9	1	0	57
SSW	0	2	14	8	0	0	24
SW	0	2	12	21	1	0	36
WSW	1	2	14	0	0	0	17
W	1	5	3	0	0	0	9
WNW	2	2	4	1	0	0	9
NW	3	1	1	1	0	0	6
NNW	3	6	5	1	1	0	16
Total	22	74	198	61	3	0	358
Calm Hours not Included above for :							0
Valid Hours for this Stability Class for:							358
Total Hours for Period							2208

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 07/01/2013 - 09/30/2013
Elevation: Speed: SPD60M **Direction:** DIR60M **Lapse:** DT60M
Stability Class F **Delta Temperature** **Moderately Stable**

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>> 25</u>	<u>Total</u>
N	0	3	6	2	0	0	11
NNE	0	8	9	0	0	0	17
NE	0	10	14	4	0	0	28
ENE	0	6	13	0	0	0	19
E	0	3	10	1	0	0	14
ESE	2	4	14	2	0	0	22
SE	0	3	9	3	0	0	15
SSE	1	5	11	4	0	0	21
S	1	4	18	5	0	0	28
SSW	1	2	7	1	0	0	11
SW	1	3	5	0	0	0	9
WSW	0	2	5	0	0	0	7
W	0	0	1	0	0	0	1
WNW	1	3	0	0	0	0	4
NW	2	0	0	0	0	0	2
NNW	1	2	1	0	0	0	4
Total	10	58	123	22	0	0	213
Calm Hours not Included above for :							0
Valid Hours for this Stability Class for:							213
Total Hours for Period							2208

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 07/01/2013 - 09/30/2013
Elevation: Speed: SPD60M **Direction:** DIR60M **Lapse:** DT60M
Stability Class G **Delta Temperature** **Extremely Stable**

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>> 25</u>	<u>Total</u>
N	1	4	1	0	0	0	6
NNE	0	8	5	1	0	0	14
NE	0	10	18	1	0	0	29
ENE	0	12	16	0	0	0	28
E	0	6	25	7	0	0	38
ESE	1	7	27	4	0	0	39
SE	3	7	20	10	0	0	40
SSE	3	10	24	11	0	0	48
S	1	7	10	6	0	0	24
SSW	4	3	12	2	0	0	21
SW	2	3	10	2	0	0	17
WSW	1	2	0	0	0	0	3
W	4	2	0	0	0	0	6
WNW	2	3	0	0	0	0	5
NW	1	3	0	0	0	0	4
NNW	0	6	4	0	0	0	10
Total	23	93	172	44	0	0	332
Calm Hours not Included above for :							Total Period
							0
Valid Hours for this Stability Class for:							Total Period
							332
Total Hours for Period							2208

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Summary of All Stability Classes

Total Period

Period of Record =

07/01/2013 - 09/30/2013

Elevation: Speed: SPD60M

Direction: DIR60M

Lapse: DT60M

Delta Temperature

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>> 25</u>	<u>Total</u>
N	4	38	72	36	9	0	159
NNE	2	32	41	9	1	0	85
NE	5	40	82	19	0	0	146
ENE	3	38	59	1	0	0	101
E	4	22	50	9	0	0	85
ESE	6	30	75	7	0	0	118
SE	5	40	76	17	0	0	138
SSE	7	39	84	28	2	0	160
S	4	45	103	34	1	0	187
SSW	8	19	53	17	0	0	97
SW	6	36	81	85	6	0	214
WSW	3	34	55	14	2	0	108
W	10	36	28	19	3	0	96
WNW	11	47	29	15	1	0	103
NW	8	20	16	18	0	0	62
NNW	5	41	119	41	5	0	211
Total	91	557	1023	369	30	0	2070
Calm Hours not Included above for :							Total Period 0
Variable Direction Hours for:							Total Period 0
Invalid Hours for:							Total Period 138
Valid Hours for this Stability Class for:							Total Period 2070
Total Hours for Period							2208

Hours are not adjusted for Daylight Savings Time

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 10/01/2013 - 12/31/2013
Elevation: **Speed:** SPD60M **Direction:** DIR60M **Lapse:** DT60M
Stability Class A Delta Temperature Extremely Unstable

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>> 25</u>	<u>Total</u>	
N	0	1	0	2	2	0	5	
NNE	0	0	2	0	0	0	2	
NE	0	1	6	0	0	0	7	
ENE	0	7	3	3	0	0	13	
E	0	4	7	8	0	0	19	
ESE	0	0	5	0	0	0	5	
SE	0	9	21	9	0	0	39	
SSE	1	11	18	10	2	0	42	
S	0	7	16	18	2	1	44	
SSW	0	1	3	6	0	0	10	
SW	0	5	9	14	6	0	34	
WSW	1	4	12	20	10	1	48	
W	0	1	16	19	9	1	46	
WNW	0	3	5	14	1	0	23	
NW	0	2	6	13	4	0	25	
NNW	0	6	9	3	5	0	23	
Total	2	62	138	139	41	3	385	
Calm Hours not Included above for :							Total Period	0
Valid Hours for this Stability Class for:							Total Period	385
Total Hours for Period								2208

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 10/01/2013 - 12/31/2013
Elevation: Speed: SPD60M **Direction:** DIR60M **Lapse:** DT60M
Stability Class B **Delta Temperature** **Moderately Unstable**

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>> 25</u>	<u>Total</u>
N	0	3	1	0	0	0	4
NNE	0	2	0	0	0	0	2
NE	0	3	5	2	0	0	10
ENE	0	0	0	0	0	0	0
E	0	0	1	8	0	0	9
ESE	0	0	3	3	0	0	6
SE	0	4	6	7	0	0	17
SSE	0	4	5	5	1	0	15
S	0	4	9	11	3	1	28
SSW	0	2	13	6	3	1	25
SW	0	5	5	2	0	0	12
WSW	0	0	3	9	9	2	23
W	0	1	6	11	8	1	27
WNW	0	1	1	7	3	0	12
NW	0	0	5	6	7	1	19
NNW	0	1	1	6	9	0	17
Total	0	30	64	83	43	6	226
Calm Hours not Included above for :							Total Period 0
Valid Hours for this Stability Class for:							Total Period 226
Total Hours for Period							2208

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 10/01/2013 - 12/31/2013
Elevation: **Speed:** SPD60M **Direction:** DIR60M **Lapse:** DT60M
Stability Class C Delta Temperature Slightly Unstable

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>> 25</u>	<u>Total</u>
N	0	1	1	0	0	0	2
NNE	0	1	2	1	0	0	4
NE	0	3	6	0	0	0	9
ENE	0	3	2	1	0	0	6
E	0	0	5	3	0	0	8
ESE	0	1	2	4	0	0	7
SE	0	6	5	4	0	0	15
SSE	0	3	5	7	3	1	19
S	0	2	17	6	2	0	27
SSW	0	1	16	9	0	0	26
SW	0	0	5	4	2	0	11
WSW	0	1	3	21	7	1	33
W	1	1	4	27	12	1	46
WNW	0	0	8	15	2	1	26
NW	0	0	14	18	5	1	38
NNW	1	1	4	4	10	2	22
Total	2	24	99	124	43	7	299
Calm Hours not Included above for :							0
Valid Hours for this Stability Class for:							299
Total Hours for Period							2208

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 10/01/2013 - 12/31/2013
Elevation: **Speed:** SPD60M **Direction:** DIR60M **Lapse:** DT60M
Stability Class D Delta Temperature Neutral

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>> 25</u>	<u>Total</u>
N	1	4	3	0	0	0	8
NNE	1	3	5	0	0	0	9
NE	0	1	11	3	0	0	15
ENE	0	6	4	3	0	0	13
E	1	1	6	2	0	0	10
ESE	1	1	6	6	0	0	14
SE	2	3	28	12	0	0	45
SSE	0	3	24	33	8	1	69
S	0	10	45	33	12	2	102
SSW	0	4	29	54	8	0	95
SW	1	2	14	34	13	1	65
WSW	0	1	12	49	15	6	83
W	0	3	8	43	20	15	89
WNW	0	5	13	65	19	6	108
NW	2	2	16	40	26	1	87
NNW	0	3	10	15	10	0	38
Total	9	52	234	392	131	32	850
Calm Hours not Included above for :							0
Valid Hours for this Stability Class for:							850
Total Hours for Period							2208

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 10/01/2013 - 12/31/2013
Elevation: Speed: SPD60M **Direction:** DIR60M **Lapse:** DT60M
Stability Class E **Delta Temperature** Slightly Stable

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>> 25</u>	<u>Total</u>
N	0	2	0	1	0	0	3
NNE	0	5	2	1	0	0	8
NE	0	1	5	0	0	0	6
ENE	0	0	4	1	0	0	5
E	0	5	3	5	0	0	13
ESE	2	2	13	3	0	0	20
SE	0	8	23	6	0	0	37
SSE	0	1	13	8	0	0	22
S	0	0	26	20	2	0	48
SSW	0	2	24	29	0	0	55
SW	1	1	6	4	2	0	14
WSW	0	1	4	2	1	0	8
W	0	2	6	6	0	0	14
WNW	0	1	3	4	0	0	8
NW	0	0	4	5	0	0	9
NNW	1	2	3	1	0	0	7
Total	4	33	139	96	5	0	277
Calm Hours not Included above for :							0
Valid Hours for this Stability Class for:							277
Total Hours for Period							2208

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 10/01/2013 - 12/31/2013
Elevation: **Speed:** SPD60M **Direction:** DIR60M **Lapse:** DT60M
Stability Class F Delta Temperature Moderately Stable

Wind Speed (mph)

<u>Wind Direction</u>	<u>1-4</u>	<u>4-8</u>	<u>8-13</u>	<u>13-19</u>	<u>19-25</u>	<u>> 25</u>	<u>Total</u>
N	0	0	2	0	0	0	2
NNE	0	1	1	0	0	0	2
NE	0	0	1	0	0	0	1
ENE	0	1	2	0	0	0	3
E	1	0	3	0	0	0	4
ESE	0	1	7	0	0	0	8
SE	0	0	13	14	0	0	27
SSE	0	1	8	6	0	0	15
S	0	0	3	4	0	0	7
SSW	0	0	6	2	0	0	8
SW	0	0	2	2	0	0	4
WSW	0	1	0	0	0	0	1
W	0	1	0	0	0	0	1
WNW	0	0	0	0	0	0	0
NW	0	0	2	0	0	0	2
NNW	0	0	2	0	0	0	2
Total	1	6	52	28	0	0	87
Calm Hours not Included above for :							0
Valid Hours for this Stability Class for:							87
Total Hours for Period							2208

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 10/01/2013 - 12/31/2013
Elevation: **Speed:** SPD60M **Direction:** DIR60M **Lapse:** DT60M
Stability Class G Delta Temperature Extremely Stable

Wind Speed (mph)

<u>Wind Direction</u>	<u>1-4</u>	<u>4-8</u>	<u>8-13</u>	<u>13-19</u>	<u>19-25</u>	<u>>25</u>	<u>Total</u>	
N	0	0	1	0	0	0	1	
NNE	0	0	3	0	0	0	3	
NE	0	2	3	0	0	0	5	
ENE	0	0	5	2	0	0	7	
E	0	1	2	2	0	0	5	
ESE	1	3	6	0	0	0	10	
SE	0	1	13	10	0	0	24	
SSE	0	0	5	6	0	0	11	
S	0	1	0	0	0	0	1	
SSW	1	1	1	0	0	0	3	
SW	0	2	4	0	0	0	6	
WSW	0	0	5	0	0	0	5	
W	0	1	1	0	0	0	2	
WNW	0	0	0	0	0	0	0	
NW	0	0	0	0	0	0	0	
NNW	0	1	0	0	0	0	1	
Total	2	13	49	20	0	0	84	
Calm Hours not Included above for :							Total Period	0
Valid Hours for this Stability Class for:							Total Period	84
Total Hours for Period								2208

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Summary of All Stability Classes

Total Period

Period of Record =

10/01/2013 - 12/31/2013

Elevation: Speed: SPD60M

Direction: DIR60M

Lapse: DT60M

Delta Temperature

Wind Speed (mph)

<u>Wind Direction</u>	<u>1 - 4</u>	<u>4 - 8</u>	<u>8 - 13</u>	<u>13 - 19</u>	<u>19 - 25</u>	<u>> 25</u>	<u>Total</u>	
N	1	11	8	3	2	0	25	
NNE	1	12	15	2	0	0	30	
NE	0	11	37	5	0	0	53	
ENE	0	17	20	10	0	0	47	
E	2	11	27	28	0	0	68	
ESE	4	8	42	16	0	0	70	
SE	2	31	109	62	0	0	204	
SSE	1	23	78	75	14	2	193	
S	0	24	116	92	21	4	257	
SSW	1	11	92	106	11	1	222	
SW	2	15	45	60	23	1	146	
WSW	1	8	39	101	42	10	201	
W	1	10	41	106	49	18	225	
WNW	0	10	30	105	25	7	177	
NW	2	4	47	82	42	3	180	
NNW	2	14	29	29	34	2	110	
Total	20	220	775	882	263	48	2208	
Calm Hours not Included above for :							Total Period	0
Variable Direction Hours for:							Total Period	0
Invalid Hours for:							Total Period	0
Valid Hours for this Stability Class for:							Total Period	2208
Total Hours for Period								2208

Hours are not adjusted for Daylight Savings Time

OFF-SITE DOSE CALCULATION MANUAL CHANGES

The Off-Site Dose Calculation Manual, PMP-6010-OSD-001, was not revised during this reporting period.