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U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Donald C. Cook Nuclear Plant Units 1 and 2
2016 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, 2016, through December 31, 2016.

This letter contains no new or modified regulatory commitments. Should you have any questions, please contact me at (269) 466-2649.

Sincerely,

M. K. Scarpello

Michael K. Scarpello
Regulatory Affairs Manager

RAW/mll

Enclosure: Donald C. Cook Nuclear Plant Units 1 and 2 - 2016 Annual Radioactive Effluent Release Report

c: R.J. Ancona – MPSC
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ENCLOSURE to AEP-NRC-2017-23

Donald C. Cook Nuclear Plant Units 1 and 2
2016 Annual Radioactive Effluent Release Report

TABLE OF CONTENTS

LIST OF APPENDICES

I. INTRODUCTION

This report discusses the radioactive discharges from Unit 1 and Unit 2 of the Donald C. Cook Nuclear Plant (CNP) during 2016. 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, 2016, to December 31, 2016. 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 2016.

Parameter	Unit 1	Unit 2
Gross Electrical Energy Generation (Megawatt Hour (MWH))	8,586,842	7,272,912
Unit Service Factor (Percent (%))	90.1	74.1
Unit Capacity Factor (Maximum Dependable Capacity (MDC)) Net (%)	91.9	74.5

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 23, 2016, entering refueling outage U1C27. The unit attained criticality on April 27, 2016, and attained NFP on May 2, 2016. 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. The unit was manually tripped on July 6, 2016, entering a forced outage due to a steam leak. The unit attained criticality on July 12, 2016, and attained NFP on July 14, 2016. On July 21, 2016, the unit performed a controlled downpower to 48% power at the request of grid operators due to grid conditions, returning to NFP on August 2, 2016. The unit performed a normal downpower and was manually tripped on October 5, 2016, entering refueling outage U2C23. The unit exited the reporting period shutdown.

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 was one abnormal liquid release and no abnormal gaseous releases in 2016. The abnormal liquid release occurred on October 31, 2016, with approximately 1,500 gallons of water leaking past boundary valves on the normal licensed steam generator drainage pathway over a 24 hour period. The water was Secondary side water contained inside a steam generator, which acts as a heat transfer medium from the Reactor Coolant filled Primary side piping. This steam generator water was subsequently discharged to Lake Michigan via the Circulating Water system. This water contained tritium at 15,000 picocuries per liter, which is below the 20,000 picocurie per liter drinking water limit. Though the nuclide level was low, the leakage was unplanned and met the criteria for being an abnormal release of liquid effluent. The total curies of tritium released from the event were 1.71E-04 curies, assuming a conservative 3000 gallons of released water to bound the event. This curie content was added to the liquid release totals and the associated public dose accounted for. Action Request AR# 2016-12597 documented this event and subsequent repairs.

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 2016 there were 89 liquid batch releases performed. The number of liquid batch releases for the four quarters in 2016 was 14, 20, 22, and 33, 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 2016 there were seven batch releases from Gas Decay Tanks (GDT), one containment purge, one system tank venting, and 134 Containment Pressure Reliefs (CPR). During the second quarter there were three batch releases from GDTs, one system tank venting, and 130 CPR. During the third quarter there were four batch releases from GDTs and 150 CPR. During the fourth quarter there were two batch releases from GDTs, one containment purge, one system tank venting, and 86 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 16 GDT releases, two containment purges, three system tank vents, and 500 CPR gaseous batch releases made during 2016.

In calculating the dose consequences for continuous and batch gaseous releases during 2016, 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 33 shipments of radioactive waste made during 2016. 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 2016. 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 2016 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 2016 Annual Radiological Environmental Operating Report. Additional TLD dosimetry installed by Radiation Protection department programs monitor dose received by individuals on site as visitors.

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	1.15E-02	4.46E-01	4.58E-02	9.34E-02
Total Body Air	1.00E-03	2.30E-04	7.60E-04	5.50E-04
Skin	2.20E-03	4.60E-04	2.60E-03	1.10E-03
Liquid TB	1.12E-02	1.26E-02	2.96E-02	1.05E-02
Liquid Organ	1.12E-02	1.26E-02	2.96E-02	1.12E-02
C14 (Annual)				1.97E+00
Direct Radiation	0	0	0	0
Total	3.71E-02	4.72E-01	1.08E-01	2.09E+00
Grand Total Dose (Total Body or any other Organ) mrem				2.71E+00
Annual Dose Limit (mrem)				25
Percent of limit				1.08E+01

The following data reflects a comparison with 2009 annual dose data (the last year without calculating C-14 dose), 2016 annual dose data, and 2016 annual dose data with C-14 added. This indicates that 2016 annual dose was 'typical' for a dual unit outage year with an extended outage duration in regards to radioactive effluents. The table is presented as follows:

	Annual Dose (mrem)	% of limit
2009	2.60E-01	1.04
2016	7.34E-01	2.94
2016 with C-14	2.71	10.8

VI. RADIATION MONITORS INOPERABLE GREATER THAN 30 DAYS

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

VII. NOTEWORTHY CONDITIONS IDENTIFIED IN 2016

The Inadvertent draining of a steam generator in 2016 was discussed in Section II above as an abnormal release. While noteworthy, it had minimal impact on effluent releases or public dose exposure due to the very low tritium curie content of the water.

In addition, it is considered noteworthy that in 2016 two small fuel rodlet defects were identified to have the potential to impact effluents. These defects increased the release of fission product gasses and iodine isotopes into the reactor coolant, which in turn increased activity levels in the effluent streams. The increases contributed to a small impact to the site overall public dose exposure by approximately 1.2% of the limit over the course of the year (2015 was 2.42mRem/ 9.68% of limit vice 2.71mRem/ 10.8% of limit in 2016). The public dose due to operations at CNP remain a small fraction of the legal limits and efforts to keep public dose As Low As Reasonably Achievable (ALARA) were largely successful.

Carbon-14 Supplemental Information for the 2016 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", dated 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 2016 results in a site total of 17.0 Curies produced.

C-14 releases from Pressurized Water Reactors (PWR) occur primarily as a mix of organic carbon (methane) and inorganic carbon (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 2.38 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 time of batch gaseous releases performed during 2016, the time available for photosynthesis in plants, 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 1.64 mrem to the bone and a whole body dose of 0.326 mrem, for a combined total C-14 dose of 1.97 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 ($\leq$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.

IX. ERRATA

There are no errata attached for 2016.

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.

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} µCi/ml total activity.

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 an 8192 channel analyzer and HpGe detector. Tritium analysis is performed using liquid scintillation counters.

4.2 Iodines

Sampled on iodine adsorbing media, and analyzed on an 8192 channel analyzer and HpGe detector.

4.3 Particulates

Sampled on a glass filter and analyzed on an 8192 channel analyzer and HpGe detector. Sr-89 and Sr-90 analyses are performed by offsite vendor.

4.4 Liquid Effluents

Sampled and analyzed on an 8192 channel analyzer and HpGe detector. Tritium analysis is performed using liquid scintillation counters. Fe-55, Sr-89 and Sr-90 analyses are performed by an offsite vendor. Ni-63 is also currently being analyzed by the offsite vendor in response to evaluation of the 10 CFR 61 sample results.

5 BATCH RELEASES

5.1 Liquid

5.1.1 Number of batch releases:

14 releases in the 1st quarter, 2016
20 releases in the 2nd quarter, 2016
22 releases in the 3rd quarter, 2016
33 releases in the 4th quarter, 2016

5.1.2 Total time period for batch releases:

61,822 minutes

5.1.3 Maximum time for a batch release:

1,814 minutes

5.1.4 Average time period for batch release:

695 minutes

5.1.5 Minimum time period for a batch release:

91 minutes

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

6.44E+5 gpm circulating water

5.2 Gaseous

5.2.1 Number of batch releases:

143 releases in the 1st quarter, 2016
134 releases in the 2nd quarter, 2016
154 releases in the 3rd quarter, 2016
90 releases in the 4th quarter, 2016

5.2.2 Total time period for batch releases:

7,392 minutes

5.2.3 Maximum time for a batch release:

354 minutes

5.2.4 Average time period for batch release:

14 minutes

5.2.5 Minimum time period for a batch release:

1 minutes

6 ABNORMAL RELEASES

6.1 Liquid

6.1.1 Number of Releases:

1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
0	0	0	1*

6.1.2 Total activity released (Ci):

1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
0	0	0	1.71e-04

6.2 Gaseous

6.2.1 Number of Releases:

1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
0	0	0	0

6.2.2 Total activity released (Ci):

1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
0	0	0	0

* Discussed on page 2 of this document.

2016 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	1.91E+01	1.92E+01	2.51E+01	6.18E+01
AR41	Ci	3.00E-01	8.12E-07	--------	--------
KR85	Ci	7.12E-06	3.65E-02	--------	--------
XE133	Ci	1.03E+01	4.00E+00	3.61E-02	1.55E+00
XE135	Ci	2.68E-01	2.92E-01	--------	--------
XE131m	Ci	--------	7.05E-03	--------	--------
XE133m	Ci	--------	4.67E-04	--------	--------
XE135m	Ci	--------	--------	--------	--------
Total for Period	Ci	3.00E+01	2.35E+01	2.51E+01	6.34E+01
2. IODINES					
I131	Ci	6.68E-05	1.05E-03	2.83E-05	9.69E-04
I132	Ci	--------	5.76E-06	--------	2.52E-03
I133	Ci	6.79E-05	1.44E-04	2.21E-04	1.08E-05
Total for Period	Ci	1.35E-04	1.20E-03	2.49E-04	3.50E-03
3. PARTICULATES					
MN54	Ci	--------	--------	--------	--------
CO60	Ci	--------	--------	--------	--------
CS137	Ci	--------	--------	--------	--------
Total for Period	Ci	--------	--------	--------	--------

* DENOTES SUPPLEMENTAL ISOTOPES

2016 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	2.83E-01	1.28E-01	1.17E-01	2.32E-01
AR41	Ci	2.86E-01	1.33E-01	2.24E-01	2.18E-01
KR85	Ci	4.57E-01	8.70E-01	9.24E-01	3.97E-01
XE131M	Ci	1.98E-02	5.55E-03	--------	--------
XE133M	Ci	7.01E-03	--------	--------	3.04E-03
XE133	Ci	1.67E+00	1.99E-01	3.24E-01	3.81E-01
XE135m	Ci	--------	2.83E-04	--------	7.16E-04
XE135	Ci	2.24E-03	5.57E-03	8.02E-03	2.20E-02
Total for Period	Ci	2.73E+00	1.34E+00	1.60E+00	1.25E+00
2. IODINES					
I131	Ci	1.33E-08	1.28E-02	--------	--------
I133	Ci	--------	--------	--------	--------
Total for Period	Ci	1.33E-08	1.28E-02	--------	--------
3. PARTICULATES					
CS137	Ci	--------	--------	--------	--------
* BR82	Ci	--------	--------	--------	--------
Total for Period	Ci	--------	--------	--------	--------

* DENOTES SUPPLEMENTAL ISOTOPES

2016 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	1.34E+01	5.56E+00	1.52E+00	2.57E+00	11.4
2.	Average release rate for period	uCi/sec	1.71E+00	7.07E-01	1.91E-01	3.23E-01	
3.	Percent of applicable limit*	% Gamma	6.77E-02	1.34E-02	2.60E-02	3.11E-02	
		Beta	4.95E-02	9.26E-03	7.22E-02	3.22E-02	
B.	IODINES						
1.	Total I-131	Ci	6.39E-05	1.38E-02	1.48E-04	9.69E-04	12.8
2.	Average release rate for period	uCi/sec	8.12E-06	1.76E-03	1.86E-05	1.22E-04	
3.	Percent of applicable limit*	%	2.31E-05	5.02E-03	5.31E-05	3.48E-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	<7.98E-07	<6.25E-07	<8.16E-07	<8.91E-07	
D.	TRITIUM						
1.	Total Release	Ci	1.94E+01	1.93E+01	2.52E+01	6.19E+01	12.6
2.	Average release rate for period	uCi/sec	2.47E+00	2.46E+00	3.17E+00	7.79E+00	
3.	Percent of applicable limit*	%	1.41E-02	1.40E-02	1.81E-02	4.44E-02	

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

2016 EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
LIQUID EFFLUENTS
CONTINUOUS MODE

Nuclides Released	Unit	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
H3	Ci	--------	7.63E-03	--------	--------
CS137	Ci	--------	--------	--------	--------

BATCH MODE

Nuclides Released	Unit	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
H3	Ci	3.32E+02	3.98E+02	1.06E+03	2.88E+02
CR51	Ci	--------	--------	--------	--------
MN54	Ci	--------	2.32E-06	1.28E-06	1.69E-06
FE55	Ci	--------	--------	--------	--------
CO58	Ci	8.56E-06	7.38E-05	2.30E-05	2.09E-04
CO60	Ci	9.00E-05	1.39E-04	2.33E-05	6.86E-05
NI63	Ci	3.00E-04	--------	--------	--------
*KR85	Ci	--------	--------	--------	--------
ZR95	Ci	--------	--------	--------	--------
NB95	Ci	--------	--------	--------	--------
MO99	Ci	--------	--------	--------	--------
TC99m	Ci	--------	5.43E-07	--------	1.94E-06
AG110m	Ci	1.36E-05	2.64E-05	7.88E-06	1.11E-06
SB124	Ci	--------	--------	--------	8.49E-06
SB125	Ci	3.79E-06	6.86E-06	8.18E-06	4.62E-05
CS134	Ci	--------	--------	--------	4.59E-05
CS137	Ci	4.05E-06	8.27E-06	2.13E-06	1.74E-04
I131	Ci	--------	2.05E-05	--------	3.69E-06
*XE133	Ci	4.60E-04	3.67E-03	3.88E-03	4.80E-03
*XE133m	Ci	--------	1.18E-05	1.84E-05	2.86E-05
*XE131m	Ci	--------	1.38E-04	--------	5.78E-05

* DENOTES SUPPLEMENTAL ISOTOPES

2016 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	4.20E-04	2.78E-04	6.57E-05	5.61E-04	12.6
2.	Average diluted concentration during period	uCi/ml	2.16E-11	9.58E-12	9.95E-13	1.55E-11	
3.	Percent of applicable limit	%	2.05E-04	2.88E-04	1.92E-05	7.32E-04	
B.	TRITIUM						
1.	Total Release	Ci	3.23E+02	3.98E+02	1.06E+03	2.88E+02	10.1
2.	Average diluted concentration during period	uCi/ml	1.66E-05	1.37E-05	1.61E-05	7.95E-06	
3.	Percent of applicable limit	%	1.66E+00	1.37E+00	1.61E+00	7.95E-01	
C.	DISSOLVED AND ENTRAINED GASES						
1.	Total Release	Ci	4.60E-04	3.82E-03	3.90E-03	4.89E-03	11.4
2.	Average diluted concentration during period	uCi/ml	2.36E-11	2.12E-11	1.16E-11	1.35E-10	
3.	Percent of applicable limit	%	1.18E-05	1.06E-05	5.80E-06	6.74E-05	
D.	GROSS ALPHA RADIOACTIVITY TOTAL RELEASE	Ci	<1.09E-04	<1.47E-04	<8.17E-05	<3.81E-05	N/A
E.	VOLUME OF WASTE RELEASED	Liters	1.34E+06	7.47E+06	1.67E+06	1.92E+06	2.00
F.	VOLUME OF DILUTION WATER USED DURING PERIOD	Liters	1.95E+10	1.80E+11	3.36E+11	3.63E+10	3.48

2016 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	0.00E+00	7.63E-03	0.00E+00	0.00E+00	22.8
2.	Average diluted concentration during period	uCi/ml	0.00E+00	5.07E-11	0.00E+00	0.00E+00	
3.	Percent of applicable limit	%	0.00E+00	5.07E-06	0.00E+00	0.00E+00	
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	<5.69E-04	0.00E+00	0.00E+00	N/A
E.	VOLUME OF WASTE RELEASED	Liters	0.00E+00	6.36E+06	0.00E+00	0.00E+00	2.00
F.	VOLUME OF DILUTION WATER USED DURING PERIOD	Liters	0.00E+00	1.51E+11	0.00E+00	0.00E+00	3.48

2016 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	1.34E+01 1.26E+02	1.00E+00 3.75E+00
b) Dry compressible waste, contaminated equipment, etc.	m^3 Curies	1.09E+03 1.87E+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	9 %	Co-58	1 %	Sb-125	1 %	Cs-137	1 %
	Mn-54	0.5 %	Co-60	19 %	Cs-134	0.5 %		
	Fe-55	13 %	Ni-63	54 %	C-14	1 %		
b)	Ni-59	1 %	Co-58	1 %	Sb-125	4 %		
	Mn-54	1 %	Co-60	39.5 %	Zr/Nb-95	2 %		
	Fe-55	36 %	Ni-63	12.5 %	Cs-137	2.5 %	C-14	0.5 %

3) Solid Waste Disposition		
No. of Shipments	Mode of Transportation	Destination
25	Truck	Oak Ridge, TN
1	Truck	Erwin, TN
2	Truck	Clive, UT
5	Truck	Wampum, PA

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.

2016 Effluent and Waste Disposal Annual Report Yearly Release Rates

GASES		
Fission and Activation Gases	Total Release	2.31E+01 Curies
	Average Release Rate	7.31E-01 µCi/sec
	% of Applicable Limits*	γ 3.46E-02 % β 4.08E-02 %
Iodines	Total I-131 Release	1.50E-02 Curies
	Average Release Rate	4.75E-04 µCi/sec
	% of Applicable Limit*	1.99E+00 %
Particulates	Total Release	0.00E-00 Curies
	Average Release Rate	0.00E-00 µCi/sec
	% of Applicable Limit*	0.00E-00 %
LIQUIDS		
Fission and Activation Products	Total Release	1.32E-03 Curies
	Average Diluted Concentration	8.78E-12 µCi/ml
	% of Applicable Limits*	Total Body 1.07E+00 % Organ 3.23E-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:

Sector	Direction	Boundary (Meters)	Nearest Residence (Meters)
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 2016

EFFLUENT	APPLICABLE ORGAN	ESTIMATED DOSE (mrem)	AGE GROUP	LOCATION DIST DIR (M) (Toward)	% OF APPLICABLE LIMIT	LIMIT (mrem) QTR
Liquid	Total Body	1.12E-02	Child	Receptor 1	7.45E-01	1.5E+0
Liquid	Liver	1.12E-02	Child	Receptor 1	2.24E-01	5.0E+0
Noble Gas	Air Dose (Gamma-mrad)	3.39E-03	Any Age	594 (SSE)	6.77E-02	5.0E+0
Noble Gas	Air dose (Beta-mrad)	4.95E-03	Any Age	594 (SSE)	4.95E-02	1.0E+1
Iodines and Particulates	Thyroid	1.15E-02	Child	659 (N)	1.53E-01	7.5E+0

Summary of Maximum Individual Doses

Second Quarter 2016

EFFLUENT	APPLICABLE ORGAN	ESTIMATED DOSE (mrem)	AGE GROUP	LOCATION DIST DIR (M) (Toward)	% OF APPLICABLE LIMIT	LIMIT (mrem) QTR
Liquid	Total Body	1.26E-02	Child	Receptor 1	8.40E-01	1.5E+0
Liquid	Liver	1.26E-02	Child	Receptor 1	2.53E-01	5.0E+0
Noble Gas	Air Dose (Gamma-mrad)	6.70E-04	Any Age	594 (S)	1.34E-02	5.0E+0
Noble Gas	Air dose (Beta-mrad)	9.26E-04	Any Age	594 (S)	9.26E-03	1.0E+1
Iodines and Particulates	Thyroid	4.46E-01	Child	997 (S)	5.95E+00	7.5E+0

Summary of Maximum Individual Doses

Third Quarter 2016

EFFLUENT	APPLICABLE ORGAN	ESTIMATED DOSE (mrem)	AGE GROUP	LOCATION DIST DIR (M) (Toward)	% OF APPLICABLE LIMIT	LIMIT (mrem) QTR
Liquid	Total Body	2.96E-02	Child	Receptor 1	1.97E+00	1.5E+0
Liquid	Liver	2.96E-02	Child	Receptor 1	5.91E-01	5.0E+0
Noble Gas	Air Dose (Gamma-mrad)	1.30E-03	Any Age	651 (N)	2.60E-02	5.0E+0
Noble Gas	Air dose (Beta-mrad)	7.22E-03	Any Age	594 (SSE)	7.22E-02	1.0E+1
Iodines and Particulates	Thyroid	4.58E-02	Child	659 (N)	6.11E-01	7.5E+0

Summary of Maximum Individual Doses

Fourth Quarter 2016

EFFLUENT	APPLICABLE ORGAN	ESTIMATED DOSE (mrem)	AGE GROUP	LOCATION DIST DIR (M) (Toward)	% OF APPLICABLE LIMIT	LIMIT (mrem) QTR
Liquid	Total Body	1.05E-02	Child	Receptor 1	6.98E-01	1.5E+0
Liquid	Liver	1.12E-02	Child	Receptor 1	2.24E-01	5.0E+0
Noble Gas	Air Dose (Gamma-mrad)	1.55E-03	Any Age	594 (S)	3.11E-02	5.0E+0
Noble Gas	Air dose (Beta-mrad)	3.22E-03	Any Age	594 (S)	3.22E-02	1.0E+1
Iodines and Particulates	Thyroid	9.34E-02	Child	659 (N)	1.25E+00	7.5E+0

2016 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
03/10/2016	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
06/29/2016	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD		
12/06/2016				<LLD	<LLD	<LLD	<LLD	<LLD
12/12/2016	<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.)

2016 GPI Sample Data

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

Date	MW-25S	MW-26D	MW-26M	MW-26S	MW-27D	MW-27M	MW-27S
03/10/2016	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
12/06/2016	<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.)

2016 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
01/05/2016			<LLD					<LLD
01/06/2016		<LLD						
01/08/2016	<LLD						<LLD	
01/15/2016				<LLD	<LLD	<LLD		
02/03/2016						<LLD		
03/11/2016						<LLD		
03/31/2016			<LLD				<LLD	
04/07/2016	<LLD							<LLD
04/14/2016		<LLD		<LLD	<LLD	<LLD		
05/05/2016						<LLD		
06/28/2016	<LLD						<LLD	
06/29/2016		<LLD	<LLD					<LLD
06/30/2016				<LLD	<LLD	<LLD		
08/11/2016						<LLD		
09/01/2016				<LLD				
10/07/2016				<LLD	<LLD	<LLD		
10/19/2016								<LLD
10/20/2016	<LLD						<LLD	
10/21/2016		<LLD	<LLD					
11/18/2016						<LLD		
12/09/2016						<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.)

2016 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	EW-19	MW-20	MW-21	EW-18
01/06/2016	<LLD	<LLD	<LLD	<LLD	<LLD			
01/07/2016						<LLD	<LLD	
03/10/2016								<LLD
03/31/2016						<LLD	<LLD	
04/05/2016					<LLD			
04/07/2016	<LLD	<LLD	<LLD	<LLD				
06/28/2016						<LLD	<LLD	
06/29/2016	<LLD	<LLD	<LLD	<LLD				
07/11/2016					<LLD			
08/05/2016					<LLD			
10/20/2016						<LLD	<LLD	
10/21/2016	<LLD	<LLD	<LLD	<LLD				
12/07/2016					<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.)

2016 GPI Sample Data

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

Date	OW-1	OW-2	OW-4	MW-28	MW-29
02/03/2016	<LLD	<LLD	<LLD	1.25e-6	<LLD
03/11/2016	<LLD	<LLD	<LLD	1.22e-6	<LLD
04/14/2016		<LLD			
04/21/2016	<LLD		<LLD	1.34e-6	<LLD
05/05/2016	<LLD		<LLD	1.22e-6	<LLD
06/06/2016	<LLD		<LLD	1.33e-6 *	<LLD *
07/22/2016	<LLD	<LLD	<LLD	1.08e-6	<LLD
08/09/2016	<LLD		<LLD	1.15e-6	<LLD
09/15/2016	<LLD	<LLD	<LLD	<LLD	
09/21/2016					<LLD
10/07/2016		<LLD			
11/21/2016	<LLD		<LLD	<LLD	<LLD
12/06/2016	<LLD			9.48e-7	<LLD
12/13/2016			<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.)

2016 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
01/06/2016	<LLD						<LLD
01/07/2016		<LLD	<LLD	<LLD			<LLD
01/08/2016					<LLD	<LLD	
03/31/2016		<LLD	<LLD	<LLD	<LLD	<LLD	
04/07/2016	<LLD						<LLD
06/28/2016		<LLD	<LLD	<LLD	<LLD	<LLD	
06/29/2016	<LLD						<LLD
10/19/2016		<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
10/21/2016	<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.)

Analysis of the Sample Data

The Groundwater Protection Initiative (GPI) Sample Data for 2016 indicates no groundwater contamination in excess of the reporting threshold of 2.00E-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 2016 Annual Radiological Environmental Operating Report. There were no positively identified gamma radionuclides from plant effluents detected in any of the GPI well samples, and a single well with trace levels of tritium just above detection limits.

The LLD value used for tritium counting of the samples varied between 9.42E-7 and 9.59E-7uCi/mL, depending on which scintillation counter was used. This is well below the required maximum LLD value of 2.00E-6 uCi/mL per the ODCM.

No tritium values were found significantly above LLD for 2016, though 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 2016 results were within expected parameters considering the reduction in tritium released to the Absorption Pond and typical rainfall recapture of tritium 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 2016 continue to reflect normal expectations and behaviors as they relate to recaptured tritium for the weather conditions observed in 2016. Well MW-28 lies close to the vent stacks in the predominant wind direction, so it is expected to observe recaptured tritium from precipitation periodically.

The sample data indicates that no radioactive spills or unidentified leaks have occurred in 2016 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.

Site: AEP Cook

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 01/01/2016 - 03/31/2016
Elevation: **Speed:** SPD60M **Direction:** DIR60M **Lapse:** DT60M
Stability Class A Delta Temperature Extremely Unstable

Wind Speed (mph)

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	> 25	Total
N	1	4	19	9	1	3	37
NNE	0	1	2	1	0	0	4
NE	0	2	6	2	0	0	10
ENE	0	1	8	3	0	0	12
E	0	6	12	1	0	0	19
ESE	1	5	7	4	0	0	17
SE	0	3	8	7	1	0	19
SSE	0	4	16	12	0	0	32
S	0	2	17	14	2	0	35
SSW	0	1	5	18	3	0	27
SW	0	2	5	16	1	1	25
WSW	0	10	15	13	3	3	44
W	0	6	14	16	1	0	37
WNW	1	9	10	10	8	0	38
NW	1	9	20	14	6	3	53
NNW	1	9	22	7	0	0	39
Total	5	74	186	147	26	10	448

Calm Hours not Included above for : **Total Period** 2
Valid Hours for this Stability Class for: **Total Period** 448
Total Hours for Period 2184

Site: AEP Cook

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 01/01/2016 - 03/31/2016

Elevation: **Speed:** SPD60M **Direction:** DIR60M **Lapse:** DT60M

Stability Class B Delta Temperature Moderately Unstable

Wind Speed (mph)

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	> 25	Total
N	0	4	7	3	0	0	14
NNE	0	1	0	1	0	0	2
NE	0	3	2	1	0	0	6
ENE	1	1	2	2	1	0	7
E	0	3	4	3	2	0	12
ESE	0	1	0	1	0	0	2
SE	0	2	1	0	0	0	3
SSE	1	1	6	2	0	0	10
S	0	4	3	3	3	0	13
SSW	0	1	3	2	5	1	12
SW	0	5	3	9	2	0	19
WSW	1	1	7	9	4	1	23
W	1	4	3	15	18	0	41
WNW	1	0	4	11	13	0	29
NW	0	1	5	6	7	5	24
NNW	0	2	10	8	1	1	22
Total	5	34	60	76	56	8	239

Calm Hours not Included above for :	**Total Period**	2
Valid Hours for this Stability Class for:	**Total Period**	239
Total Hours for Period		2184

Site: AEP Cook

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 01/01/2016 - 03/31/2016

Elevation: **Speed:** SPD60M **Direction:** DIR60M **Lapse:** DT60M

Stability Class C Delta Temperature Slightly Unstable

Wind Speed (mph)

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	> 25	Total
N	1	3	10	13	4	0	31
NNE	0	1	6	3	1	0	11
NE	1	1	2	5	5	0	14
ENE	1	2	1	0	0	0	4
E	0	2	2	1	1	0	6
ESE	0	1	3	9	2	1	16
SE	1	6	6	9	0	0	22
SSE	0	1	15	4	0	0	20
S	0	3	8	6	0	1	18
SSW	0	3	3	7	4	1	18
SW	0	1	5	4	0	0	10
WSW	0	4	2	3	5	1	15
W	0	1	6	21	12	3	43
WNW	0	1	7	41	24	3	76
NW	1	3	5	16	20	2	47
NNW	0	2	1	28	24	5	60
Total	5	35	82	170	102	17	411

Calm Hours not Included above for :	**Total Period**	2
Valid Hours for this Stability Class for:	**Total Period**	411
Total Hours for Period		2184

Site: AEP Cook

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 01/01/2016 - 03/31/2016

Elevation: **Speed:** SPD60M **Direction:** DIR60M **Lapse:** DT60M

Stability Class D Delta Temperature Neutral

Wind Speed (mph)

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	> 25	Total
N	0	11	15	2	2	3	33
NNE	0	6	17	4	2	0	29
NE	0	1	6	5	0	0	12
ENE	1	2	3	1	0	0	7
E	2	3	3	9	2	0	19
ESE	1	5	12	6	8	2	34
SE	2	4	19	9	4	1	39
SSE	1	5	22	9	5	2	44
S	0	6	20	40	11	3	80
SSW	1	5	16	56	15	0	93
SW	1	4	16	21	12	3	57
WSW	0	3	19	14	15	13	64
W	1	1	1	11	4	1	19
WNW	0	3	3	16	7	1	30
NW	1	3	9	14	5	1	33
NNW	2	2	13	16	16	7	56
Total	13	64	194	233	108	37	649

Calm Hours not Included above for :	**Total Period**	2
Valid Hours for this Stability Class for:	**Total Period**	649
Total Hours for Period		2184

Site: AEP Cook

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 01/01/2016 - 03/31/2016

Elevation: **Speed:** SPD60M **Direction:** DIR60M **Lapse:** DT60M

Stability Class E Delta Temperature Slightly Stable

Wind Speed (mph)

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	> 25	Total
N	2	0	4	0	0	0	6
NNE	0	5	8	0	0	0	13
NE	0	10	7	3	0	0	20
ENE	1	6	7	1	0	0	15
E	0	1	13	0	0	0	14
ESE	0	3	14	1	1	0	19
SE	0	9	15	11	0	0	35
SSE	0	2	24	16	0	0	42
S	0	3	14	18	1	1	37
SSW	0	0	20	18	4	0	42
SW	1	2	9	1	5	0	18
WSW	1	2	6	3	0	3	15
W	0	0	1	1	0	0	2
WNW	0	1	3	0	0	0	4
NW	1	1	1	0	0	0	3
NNW	0	5	2	0	0	1	8
Total	6	50	148	73	11	5	293

Calm Hours not Included above for :	**Total Period**	2
Valid Hours for this Stability Class for:	**Total Period**	293
Total Hours for Period		2184

Site: AEP Cook

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 01/01/2016 - 03/31/2016

Elevation: **Speed:** SPD60M **Direction:** DIR60M **Lapse:** DT60M

Stability Class F Delta Temperature Moderately Stable

Wind Speed (mph)

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	> 25	Total
N	0	1	0	0	0	0	1
NNE	1	2	2	0	0	0	5
NE	0	0	3	0	0	0	3
ENE	0	1	1	0	0	0	2
E	0	1	3	0	0	0	4
ESE	0	2	7	0	0	0	9
SE	0	2	7	2	0	0	11
SSE	0	3	4	4	0	0	11
S	0	4	5	2	0	0	11
SSW	0	2	0	6	0	0	8
SW	0	0	0	1	0	0	1
WSW	1	0	1	0	0	0	2
W	0	0	0	0	0	0	0
WNW	0	2	0	0	0	0	2
NW	0	1	0	0	0	0	1
NNW	0	1	1	0	0	0	2
Total	2	22	34	15	0	0	73

Calm Hours not Included above for :	**Total Period**	2
Valid Hours for this Stability Class for:	**Total Period**	73
Total Hours for Period		2184

Site: AEP Cook

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 01/01/2016 - 03/31/2016
Elevation: **Speed:** SPD60M **Direction:** DIR60M **Lapse:** DT60M
Stability Class G Delta Temperature Extremely Stable

Wind Speed (mph)

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	> 25	Total
N	1	0	0	0	0	0	1
NNE	0	0	0	0	0	0	0
NE	0	1	0	0	0	0	1
ENE	0	1	0	1	0	0	2
E	0	2	2	0	0	0	4
ESE	0	3	5	0	0	0	8
SE	0	2	3	1	0	0	6
SSE	0	0	1	2	0	0	3
S	1	0	1	0	0	0	2
SSW	0	0	4	1	0	0	5
SW	0	1	5	0	0	0	6
WSW	2	0	1	0	0	0	3
W	0	1	1	0	0	0	2
WNW	1	1	0	0	0	0	2
NW	0	1	2	0	0	0	3
NNW	0	1	0	0	0	0	1
Total	5	14	25	5	0	0	49

Calm Hours not Included above for :	**Total Period**	2
Valid Hours for this Stability Class for:	**Total Period**	49
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 = 01/01/2016 - 03/31/2016

Elevation: **Speed:** SPD60M **Direction:** DIR60M **Lapse:** DT60M

Delta Temperature

Wind Speed (mph)

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	> 25	Total
N	5	23	55	27	7	6	123
NNE	1	16	35	9	3	0	64
NE	1	18	26	16	5	0	66
ENE	4	14	22	8	1	0	49
E	2	18	39	14	5	0	78
ESE	2	20	48	21	11	3	105
SE	3	28	59	39	5	1	135
SSE	2	16	88	49	5	2	162
S	1	22	68	83	17	5	196
SSW	1	12	51	108	31	2	205
SW	2	15	43	52	20	4	136
WSW	5	20	51	42	27	21	166
W	2	13	26	64	35	4	144
WNW	3	17	27	78	52	4	181
NW	4	19	42	50	38	11	164
NNW	3	22	49	59	41	14	188
Total	41	293	729	719	303	77	2162

Calm Hours not Included above for :	**Total Period**	2
Variable Direction Hours for:	**Total Period**	0
Invalid Hours for:	**Total Period**	20
Valid Hours for this Stability Class for:	**Total Period**	2162
Total Hours for Period		2184

Site: AEP Cook

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 04/01/2016 - 06/30/2016
Elevation: **Speed:** SPD60M **Direction:** DIR60M **Lapse:** DT60M
Stability Class A Delta Temperature Extremely Unstable

Wind Speed (mph)

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	> 25	Total
N	0	3	23	24	2	1	53
NNE	0	0	0	1	0	0	1
NE	0	0	5	2	0	0	7
ENE	0	2	0	2	0	0	4
E	0	5	5	15	2	0	27
ESE	2	3	15	8	1	0	29
SE	0	6	6	8	3	0	23
SSE	0	1	11	8	0	0	20
S	0	2	6	3	2	1	14
SSW	0	0	1	2	2	0	5
SW	0	0	3	4	3	0	10
WSW	0	2	11	12	0	0	25
W	0	4	11	5	0	1	21
WNW	0	3	5	4	0	1	13
NW	0	6	15	11	7	0	39
NNW	0	9	37	20	7	8	81
Total	2	46	154	129	29	12	372

Calm Hours not Included above for :	**Total Period**	0
Valid Hours for this Stability Class for:	**Total Period**	372
Total Hours for Period		2184

Site: AEP Cook

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 04/01/2016 - 06/30/2016

Elevation: **Speed:** SPD60M **Direction:** DIR60M **Lapse:** DT60M

Stability Class B Delta Temperature Moderately Unstable

Wind Speed (mph)

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	> 25	Total
N	0	3	12	11	3	1	30
NNE	0	1	4	0	0	0	5
NE	0	0	4	1	0	0	5
ENE	1	0	1	2	0	0	4
E	0	1	6	2	0	0	9
ESE	0	2	1	14	2	0	19
SE	0	2	4	2	1	0	9
SSE	0	4	4	1	0	0	9
S	0	2	1	2	1	0	6
SSW	0	0	2	3	1	0	6
SW	0	1	1	2	3	0	7
WSW	1	1	10	6	1	1	20
W	0	2	5	0	0	0	7
WNW	0	4	1	0	0	0	5
NW	1	4	7	6	3	0	21
NNW	0	0	8	11	10	5	34
Total	3	27	71	63	25	7	196

Calm Hours not Included above for :	**Total Period**	0
Valid Hours for this Stability Class for:	**Total Period**	196
Total Hours for Period		2184

Site: AEP Cook

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 04/01/2016 - 06/30/2016

Elevation: **Speed:** SPD60M **Direction:** DIR60M **Lapse:** DT60M

Stability Class C Delta Temperature Slightly Unstable

Wind Speed (mph)

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	> 25	Total
N	1	6	11	6	8	1	33
NNE	0	2	2	0	0	0	4
NE	0	1	2	1	0	0	4
ENE	0	2	11	4	0	0	17
E	0	0	11	4	0	0	15
ESE	0	3	8	6	1	0	18
SE	1	2	9	2	3	0	17
SSE	0	3	6	4	2	0	15
S	0	1	7	2	0	0	10
SSW	0	0	0	3	0	0	3
SW	0	0	7	3	0	0	10
WSW	0	2	9	1	1	0	13
W	0	1	6	3	0	1	11
WNW	0	1	2	2	0	0	5
NW	0	2	9	5	2	0	18
NNW	0	5	10	15	5	3	38
Total	2	31	110	61	22	5	231

Calm Hours not Included above for :	**Total Period**	0
Valid Hours for this Stability Class for:	**Total Period**	231
Total Hours for Period		2184

Site: AEP Cook

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 04/01/2016 - 06/30/2016

Elevation: **Speed:** SPD60M **Direction:** DIR60M **Lapse:** DT60M

Stability Class D Delta Temperature Neutral

Wind Speed (mph)

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	> 25	Total
N	2	9	35	12	2	0	60
NNE	0	11	13	3	0	0	27
NE	0	6	11	1	0	0	18
ENE	1	6	9	4	0	0	20
E	2	7	12	4	1	0	26
ESE	0	11	27	22	6	0	66
SE	1	3	28	12	1	0	45
SSE	0	4	18	13	2	0	37
S	0	3	22	16	4	0	45
SSW	2	1	20	12	1	1	37
SW	2	4	18	19	4	1	48
WSW	1	8	26	7	2	0	44
W	0	16	14	11	1	0	42
WNW	1	21	10	5	1	0	38
NW	2	14	19	12	7	1	55
NNW	0	16	32	6	0	0	54
Total	14	140	314	159	32	3	662

Calm Hours not Included above for :	**Total Period**	0
Valid Hours for this Stability Class for:	**Total Period**	662
Total Hours for Period		2184

Site: AEP Cook

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 04/01/2016 - 06/30/2016

Elevation: **Speed:** SPD60M **Direction:** DIR60M **Lapse:** DT60M

Stability Class E Delta Temperature Slightly Stable

Wind Speed (mph)

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	> 25	Total
N	1	21	8	0	0	0	30
NNE	0	10	9	0	0	0	19
NE	1	6	11	1	0	0	19
ENE	1	4	4	0	0	0	9
E	0	4	6	0	0	0	10
ESE	0	4	19	9	0	0	32
SE	3	7	10	9	0	0	29
SSE	0	2	19	6	0	0	27
S	1	7	14	13	0	0	35
SSW	2	7	13	10	0	0	32
SW	0	6	12	4	1	0	23
WSW	1	12	14	10	2	0	39
W	2	11	7	4	1	0	25
WNW	1	10	2	3	0	0	16
NW	0	5	2	0	0	0	7
NNW	2	10	5	0	0	0	17
Total	15	126	155	69	4	0	369

Calm Hours not Included above for :	**Total Period**	0
Valid Hours for this Stability Class for:	**Total Period**	369
Total Hours for Period		2184

Site: AEP Cook

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 04/01/2016 - 06/30/2016
Elevation: **Speed:** SPD60M **Direction:** DIR60M **Lapse:** DT60M
Stability Class F Delta Temperature Moderately Stable

Wind Speed (mph)

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	> 25	Total
N	0	2	1	0	0	0	3
NNE	0	2	4	0	0	0	6
NE	2	6	13	0	0	0	21
ENE	1	5	9	1	0	0	16
E	2	0	5	2	0	0	9
ESE	1	2	10	1	0	0	14
SE	2	0	12	3	0	0	17
SSE	0	1	6	3	0	0	10
S	0	1	7	7	0	0	15
SSW	2	1	4	7	0	0	14
SW	0	1	4	1	0	0	6
WSW	0	1	1	0	0	0	2
W	1	4	3	0	0	0	8
WNW	0	6	0	0	0	0	6
NW	1	1	1	0	0	0	3
NNW	0	1	1	0	0	0	2
Total	12	34	81	25	0	0	152

Calm Hours not Included above for :	**Total Period**	0
Valid Hours for this Stability Class for:	**Total Period**	152
Total Hours for Period		2184

Site: AEP Cook

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 04/01/2016 - 06/30/2016

Elevation: **Speed:** SPD60M **Direction:** DIR60M **Lapse:** DT60M

Stability Class G Delta Temperature Extremely Stable

Wind Speed (mph)

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	> 25	Total
N	1	5	2	0	0	0	8
NNE	2	2	6	0	0	0	10
NE	0	2	7	0	0	0	9
ENE	0	6	17	3	0	0	26
E	3	2	13	5	0	0	23
ESE	0	4	12	2	0	0	18
SE	0	4	13	2	0	0	19
SSE	1	1	5	12	0	0	19
S	1	2	5	5	0	0	13
SSW	0	2	6	2	0	0	10
SW	0	5	10	0	0	0	15
WSW	1	5	1	0	0	0	7
W	1	8	1	0	0	0	10
WNW	1	4	2	0	0	0	7
NW	0	2	0	0	0	0	2
NNW	0	2	1	0	0	0	3
Total	11	56	101	31	0	0	199

Calm Hours not Included above for :	**Total Period**	0
Valid Hours for this Stability Class for:	**Total Period**	199
Total Hours for Period		2184

Site: AEP Cook

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Summary of All Stability Classes

Total Period

Period of Record = 04/01/2016 - 06/30/2016

Elevation: **Speed:** SPD60M **Direction:** DIR60M **Lapse:** DT60M

Delta Temperature

Wind Speed (mph)

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	> 25	Total
N	5	49	92	53	15	3	217
NNE	2	28	38	4	0	0	72
NE	3	21	53	6	0	0	83
ENE	4	25	51	16	0	0	96
E	7	19	58	32	3	0	119
ESE	3	29	92	62	10	0	196
SE	7	24	82	38	8	0	159
SSE	1	16	69	47	4	0	137
S	2	18	62	48	7	1	138
SSW	6	11	46	39	4	1	107
SW	2	17	55	33	11	1	119
WSW	4	31	72	36	6	1	150
W	4	46	47	23	2	2	124
WNW	3	49	22	14	1	1	90
NW	4	34	53	34	19	1	145
NNW	2	43	94	52	22	16	229
Total	59	460	986	537	112	27	2181

Calm Hours not Included above for :	**Total Period**	0
Variable Direction Hours for:	**Total Period**	0
Invalid Hours for:	**Total Period**	3
Valid Hours for this Stability Class for:	**Total Period**	2181
Total Hours for Period		2184

Site: AEP Cook

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 07/01/2016 - 09/30/2016
Elevation: **Speed:** SPD60M **Direction:** DIR60M **Lapse:** DT60M
Stability Class A Delta Temperature Extremely Unstable

Wind Speed (mph)

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	> 25	Total
N	0	0	7	18	0	0	25
NNE	0	0	2	0	0	0	2
NE	0	1	3	3	0	0	7
ENE	0	3	3	4	0	0	10
E	0	1	5	2	0	0	8
ESE	0	1	8	1	0	0	10
SE	0	1	10	0	0	0	11
SSE	0	0	3	4	0	0	7
S	0	1	4	3	2	0	10
SSW	0	0	0	0	0	0	0
SW	0	0	2	2	0	0	4
WSW	0	0	5	5	5	0	15
W	0	0	5	3	1	0	9
WNW	0	4	2	4	1	0	11
NW	0	6	1	1	0	0	8
NNW	0	5	13	10	0	0	28
Total	0	23	73	60	9	0	165

Calm Hours not Included above for : **Total Period** 3
Valid Hours for this Stability Class for: **Total Period** 165
Total Hours for Period 2208

Site: AEP Cook

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 07/01/2016 - 09/30/2016

Elevation: **Speed:** SPD60M **Direction:** DIR60M **Lapse:** DT60M

Stability Class B Delta Temperature Moderately Unstable

Wind Speed (mph)

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	> 25	Total
N	0	2	1	3	0	0	6
NNE	1	0	2	0	0	0	3
NE	0	0	0	0	0	0	0
ENE	0	0	0	2	0	0	2
E	0	0	0	0	0	0	0
ESE	0	1	3	1	0	0	5
SE	0	0	2	0	0	0	2
SSE	0	1	2	1	0	0	4
S	0	0	2	9	1	0	12
SSW	0	0	2	2	0	0	4
SW	0	0	6	4	0	0	10
WSW	0	1	9	1	1	0	12
W	0	0	2	3	1	1	7
WNW	0	1	0	1	0	0	2
NW	0	0	2	0	0	0	2
NNW	0	1	6	6	0	0	13
Total	1	7	39	33	3	1	84

Calm Hours not Included above for :	**Total Period**	3
Valid Hours for this Stability Class for:	**Total Period**	84
Total Hours for Period		2208

Site: AEP Cook

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 07/01/2016 - 09/30/2016
Elevation: **Speed:** SPD60M **Direction:** DIR60M **Lapse:** DT60M
Stability Class C Delta Temperature Slightly Unstable

Wind Speed (mph)

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	> 25	Total
N	0	1	10	5	0	0	16
NNE	0	0	0	0	0	0	0
NE	1	2	3	1	0	0	7
ENE	0	2	0	0	0	0	2
E	0	1	3	0	0	0	4
ESE	0	2	3	0	0	0	5
SE	0	0	2	3	0	0	5
SSE	0	4	4	0	0	0	8
S	0	3	1	2	0	1	7
SSW	0	0	4	2	0	0	6
SW	0	1	9	3	0	0	13
WSW	0	0	3	3	1	0	7
W	0	0	2	3	1	0	6
WNW	0	4	2	2	0	0	8
NW	0	1	0	0	0	0	1
NNW	0	2	8	3	0	0	13
Total	1	23	54	27	2	1	108

Calm Hours not Included above for :	**Total Period**	3
Valid Hours for this Stability Class for:	**Total Period**	108
Total Hours for Period		2208

Site: AEP Cook

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 07/01/2016 - 09/30/2016

Elevation: **Speed:** SPD60M **Direction:** DIR60M **Lapse:** DT60M

Stability Class D Delta Temperature Neutral

Wind Speed (mph)

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	> 25	Total
N	2	11	36	7	0	0	56
NNE	1	4	9	0	0	0	14
NE	1	5	26	14	0	0	46
ENE	1	2	24	2	0	0	29
E	0	4	22	1	0	0	27
ESE	0	6	10	0	0	0	16
SE	0	8	20	1	0	0	29
SSE	1	9	29	6	0	0	45
S	0	5	44	10	2	0	61
SSW	0	6	26	17	1	0	50
SW	2	9	39	33	0	0	83
WSW	1	6	32	20	5	1	65
W	0	8	14	9	11	0	42
WNW	1	20	15	23	4	0	63
NW	1	11	14	4	0	0	30
NNW	1	16	22	2	0	0	41
Total	12	130	382	149	23	1	697

Calm Hours not Included above for :	**Total Period**	3
Valid Hours for this Stability Class for:	**Total Period**	697
Total Hours for Period		2208

Site: AEP Cook

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 07/01/2016 - 09/30/2016

Elevation: **Speed:** SPD60M **Direction:** DIR60M **Lapse:** DT60M

Stability Class E Delta Temperature Slightly Stable

Wind Speed (mph)

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	> 25	Total
N	5	23	9	1	0	0	38
NNE	5	17	12	2	0	0	36
NE	4	14	28	6	0	0	52
ENE	6	8	19	1	0	0	34
E	5	7	20	2	0	0	34
ESE	4	9	14	1	0	0	28
SE	4	7	15	3	0	0	29
SSE	3	13	11	5	0	0	32
S	2	9	49	7	0	0	67
SSW	0	8	38	4	0	1	51
SW	3	14	9	4	0	0	30
WSW	1	22	19	1	0	1	44
W	3	9	4	3	0	0	19
WNW	6	20	3	10	3	0	42
NW	3	19	3	3	2	0	30
NNW	3	19	7	1	0	0	30
Total	57	218	260	54	5	2	596

Calm Hours not Included above for :	**Total Period**	3
Valid Hours for this Stability Class for:	**Total Period**	596
Total Hours for Period		2208

Site: AEP Cook

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 07/01/2016 - 09/30/2016

Elevation: **Speed:** SPD60M **Direction:** DIR60M **Lapse:** DT60M

Stability Class F Delta Temperature Moderately Stable

Wind Speed (mph)

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	> 25	Total
N	0	2	2	0	0	0	4
NNE	1	6	5	0	0	0	12
NE	3	4	8	0	0	0	15
ENE	1	3	17	0	0	0	21
E	0	0	19	1	0	0	20
ESE	0	4	13	2	0	0	19
SE	2	2	22	1	0	0	27
SSE	2	5	17	7	0	0	31
S	3	9	18	12	1	0	43
SSW	2	2	11	2	0	0	17
SW	1	7	12	0	0	0	20
WSW	2	3	4	0	0	0	9
W	1	1	0	0	0	0	2
WNW	0	1	2	0	0	0	3
NW	1	0	0	0	0	0	1
NNW	1	0	3	0	0	0	4
Total	20	49	153	25	1	0	248

Calm Hours not Included above for :	**Total Period**	3
Valid Hours for this Stability Class for:	**Total Period**	248
Total Hours for Period		2208

Site: AEP Cook

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 07/01/2016 - 09/30/2016

Elevation: **Speed:** SPD60M **Direction:** DIR60M **Lapse:** DT60M

Stability Class G Delta Temperature Extremely Stable

Wind Speed (mph)

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	≥ 25	Total
N	3	10	3	0	0	0	16
NNE	0	4	6	0	0	0	10
NE	5	5	3	1	0	0	14
ENE	2	13	12	1	0	0	28
E	2	9	15	2	0	0	28
ESE	3	10	18	1	0	0	32
SE	0	8	25	2	0	0	35
SSE	0	12	16	11	0	0	39
S	1	7	16	7	0	0	31
SSW	2	4	8	1	0	0	15
SW	1	8	6	0	0	0	15
WSW	3	7	2	1	0	0	13
W	3	3	0	0	0	0	6
WNW	1	4	0	0	0	0	5
NW	0	3	2	0	0	0	5
NNW	0	7	1	0	0	0	8
Total	26	114	133	27	0	0	300

Calm Hours not Included above for :	**Total Period**	3
Valid Hours for this Stability Class for:	**Total Period**	300
Total Hours for Period		2208

Site: AEP Cook

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Summary of All Stability Classes

Total Period

Period of Record = 07/01/2016 - 09/30/2016

Elevation: **Speed:** SPD60M **Direction:** DIR60M **Lapse:** DT60M

Delta Temperature

Wind Speed (mph)

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	> 25	Total
N	10	49	68	34	0	0	161
NNE	8	31	36	2	0	0	77
NE	14	31	71	25	0	0	141
ENE	10	31	75	10	0	0	126
E	7	22	84	8	0	0	121
ESE	7	33	69	6	0	0	115
SE	6	26	96	10	0	0	138
SSE	6	44	82	34	0	0	166
S	6	34	134	50	6	1	231
SSW	4	20	89	28	1	1	143
SW	7	39	83	46	0	0	175
WSW	7	39	74	31	12	2	165
W	7	21	27	21	14	1	91
WNW	8	54	24	40	8	0	134
NW	5	40	22	8	2	0	77
NNW	5	50	60	22	0	0	137
Total	117	564	1094	375	43	5	2198

Calm Hours not Included above for :	**Total Period**	3
Variable Direction Hours for:	**Total Period**	0
Invalid Hours for:	**Total Period**	7
Valid Hours for this Stability Class for:	**Total Period**	2198
Total Hours for Period		2208

Site: AEP Cook

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 10/01/2016 - 12/31/2016
Elevation: **Speed:** SP10M **Direction:** DIR10M **Lapse:** DT60M
Stability Class A Delta Temperature Extremely Unstable

Wind Speed (mph)

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	> 25	Total
N	7	29	2	0	0	0	38
NNE	1	9	2	0	0	0	12
NE	2	2	0	0	0	0	4
ENE	1	0	0	0	0	0	1
E	0	1	0	0	0	0	1
ESE	1	6	0	0	0	0	7
SE	2	7	1	0	0	0	10
SSE	0	20	4	0	0	0	24
S	1	19	7	0	0	0	27
SSW	0	5	6	0	0	0	11
SW	0	8	12	1	0	0	21
WSW	1	13	9	0	0	0	23
W	2	11	6	0	0	0	19
WNW	0	13	1	0	0	0	14
NW	3	7	0	0	0	0	10
NNW	3	12	0	0	0	0	15
Total	24	162	50	1	0	0	237

Calm Hours not Included above for :	**Total Period**	4
Valid Hours for this Stability Class for:	**Total Period**	237
Total Hours for Period		2208

Site: AEP Cook

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 10/01/2016 - 12/31/2016
Elevation: **Speed:** SP10M **Direction:** DIR10M **Lapse:** DT60M
Stability Class B Delta Temperature Moderately Unstable

Wind Speed (mph)

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	> 25	Total
N	2	7	3	0	0	0	12
NNE	1	3	0	0	0	0	4
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	3	0	0	0	0	0	3
ESE	3	1	0	0	0	0	4
SE	0	4	1	0	0	0	5
SSE	1	9	1	0	0	0	11
S	2	12	5	0	0	0	19
SSW	3	6	6	1	0	0	16
SW	0	11	5	1	0	0	17
WSW	1	6	5	0	0	0	12
W	1	6	17	0	0	0	24
WNW	1	11	4	0	0	0	16
NW	3	12	3	0	0	0	18
NNW	1	7	0	0	0	0	8
Total	22	95	50	2	0	0	169

Calm Hours not Included above for :	**Total Period**	4
Valid Hours for this Stability Class for:	**Total Period**	169
Total Hours for Period		2208

Site: AEP Cook

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 10/01/2016 - 12/31/2016

Elevation: **Speed:** SP10M **Direction:** DIR10M **Lapse:** DT60M

Stability Class C Delta Temperature Slightly Unstable

Wind Speed (mph)

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	> 25	Total
N	1	9	3	0	0	0	13
NNE	3	2	0	0	0	0	5
NE	1	0	0	0	0	0	1
ENE	1	1	0	0	0	0	2
E	2	0	0	0	0	0	2
ESE	2	8	2	0	0	0	12
SE	2	15	3	0	0	0	20
SSE	3	17	4	0	0	0	24
S	3	13	7	0	0	0	23
SSW	1	12	10	0	0	0	23
SW	1	3	4	0	0	0	8
WSW	1	7	20	2	0	0	30
W	3	15	30	2	0	0	50
WNW	3	21	12	1	0	0	37
NW	3	15	14	3	0	0	35
NNW	3	7	5	0	0	0	15
Total	33	145	114	8	0	0	300

Calm Hours not Included above for :	**Total Period**	4
Valid Hours for this Stability Class for:	**Total Period**	300
Total Hours for Period		2208

Site: AEP Cook

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 10/01/2016 - 12/31/2016
Elevation: **Speed:** SP10M **Direction:** DIR10M **Lapse:** DT60M
Stability Class D Delta Temperature Neutral

Wind Speed (mph)

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	> 25	Total
N	13	59	11	0	0	0	83
NNE	25	30	1	0	0	0	56
NE	12	5	0	0	0	0	17
ENE	5	2	0	0	0	0	7
E	17	3	0	0	0	0	20
ESE	22	19	2	0	0	0	43
SE	14	39	7	0	0	0	60
SSE	18	37	20	1	0	0	76
S	13	48	33	0	0	0	94
SSW	5	39	50	16	0	0	110
SW	0	26	39	0	0	0	65
WSW	6	27	19	2	0	0	54
W	8	25	18	1	0	0	52
WNW	6	50	12	1	0	0	69
NW	10	41	21	0	0	0	72
NNW	11	27	10	0	0	0	48
Total	185	477	243	21	0	0	926

Calm Hours not Included above for :	**Total Period**	4
Valid Hours for this Stability Class for:	**Total Period**	926
Total Hours for Period		2208

Site: AEP Cook

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 10/01/2016 - 12/31/2016
Elevation: **Speed:** SP10M **Direction:** DIR10M **Lapse:** DT60M
Stability Class E Delta Temperature Slightly Stable

Wind Speed (mph)

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	> 25	Total
N	9	2	0	0	0	0	11
NNE	10	1	0	0	0	0	11
NE	20	1	0	0	0	0	21
ENE	11	0	0	0	0	0	11
E	8	0	0	0	0	0	8
ESE	16	1	0	0	0	0	17
SE	21	8	0	0	0	0	29
SSE	37	15	4	0	0	0	56
S	21	47	6	0	0	0	74
SSW	9	19	3	0	0	0	31
SW	6	12	1	0	0	0	19
WSW	1	2	0	0	0	0	3
W	1	3	0	0	0	0	4
WNW	0	0	0	0	0	0	0
NW	2	0	0	0	0	0	2
NNW	3	4	0	0	0	0	7
Total	175	115	14	0	0	0	304

Calm Hours not Included above for : **Total Period** 4
Valid Hours for this Stability Class for: **Total Period** 304
Total Hours for Period 2208

Site: AEP Cook

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 10/01/2016 - 12/31/2016
Elevation: **Speed:** SP10M **Direction:** DIR10M **Lapse:** DT60M
Stability Class F Delta Temperature Moderately Stable

Wind Speed (mph)

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	> 25	Total
N	0	0	0	0	0	0	0
NNE	2	0	0	0	0	0	2
NE	7	0	0	0	0	0	7
ENE	8	0	0	0	0	0	8
E	20	0	0	0	0	0	20
ESE	23	0	0	0	0	0	23
SE	9	0	0	0	0	0	9
SSE	19	0	0	0	0	0	19
S	29	7	0	0	0	0	36
SSW	5	1	0	0	0	0	6
SW	2	0	0	0	0	0	2
WSW	1	1	0	0	0	0	2
W	0	0	0	0	0	0	0
WNW	1	0	0	0	0	0	1
NW	1	0	0	0	0	0	1
NNW	0	0	0	0	0	0	0
Total	127	9	0	0	0	0	136

Calm Hours not Included above for : **Total Period** 4
Valid Hours for this Stability Class for: **Total Period** 136
Total Hours for Period 2208

Site: AEP Cook

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Total Period

Period of Record = 10/01/2016 - 12/31/2016
Elevation: **Speed:** SP10M **Direction:** DIR10M **Lapse:** DT60M
Stability Class G Delta Temperature Extremely Stable

Wind Speed (mph)

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	≥ 25	Total
N	1	0	0	0	0	0	1
NNE	4	0	0	0	0	0	4
NE	2	0	0	0	0	0	2
ENE	6	0	0	0	0	0	6
E	6	0	0	0	0	0	6
ESE	15	0	0	0	0	0	15
SE	23	0	0	0	0	0	23
SSE	28	0	0	0	0	0	28
S	27	1	0	0	0	0	28
SSW	8	3	0	0	0	0	11
SW	4	0	0	0	0	0	4
WSW	3	0	0	0	0	0	3
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	1	0	0	0	0	0	1
Total	128	4	0	0	0	0	132

Calm Hours not Included above for : **Total Period** 4
Valid Hours for this Stability Class for: **Total Period** 132
Total Hours for Period 2208

Site: AEP Cook

Joint Frequency Distribution

Hours at Each Wind Speed and Direction

Summary of All Stability Classes

Total Period

Period of Record = 10/01/2016 - 12/31/2016

Elevation: **Speed:** SP10M **Direction:** DIR10M **Lapse:** DT60M

Delta Temperature

Wind Speed (mph)

Wind Direction	1 - 4	4 - 8	8 - 13	13 - 19	19 - 25	> 25	Total
N	33	106	19	0	0	0	158
NNE	46	45	3	0	0	0	94
NE	44	8	0	0	0	0	52
ENE	32	3	0	0	0	0	35
E	56	4	0	0	0	0	60
ESE	82	35	4	0	0	0	121
SE	71	73	12	0	0	0	156
SSE	106	98	33	1	0	0	238
S	96	147	58	0	0	0	301
SSW	31	85	75	17	0	0	208
SW	13	60	61	2	0	0	136
WSW	14	56	53	4	0	0	127
W	15	60	71	3	0	0	149
WNW	11	95	29	2	0	0	137
NW	22	75	38	3	0	0	138
NNW	22	57	15	0	0	0	94
Total	694	1007	471	32	0	0	2204

Calm Hours not Included above for :	**Total Period**	4
Variable Direction Hours for:	**Total Period**	0
Invalid Hours for:	**Total Period**	0
Valid Hours for this Stability Class for:	**Total Period**	2204
Total Hours for Period		2208

OFF-SITE DOSE CALCULATION MANUAL CHANGES

The Off-Site Dose Calculation Manual, PMP-6010-OSD-001, was not revised during this 2016 reporting period.