Entergy

Entergy Nuclear Operations, Inc.
Pilgrim Nuclear Power Station
600 Rocky Hill Road
Plymouth, MA 02360

May 13, 2016

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

SUBJECT: Entergy's Annual Radioactive Effluent Release Report for January 1 through December 31, 2015

Pilgrim Nuclear Power Station
Docket No. 50-293
Renewed License No. DPR-35

LETTER NUMBER: 2.16.026

Dear Sir or Madam:

In accordance with Pilgrim Nuclear Power Station Technical Specification 5.6.3, Entergy Nuclear Operations, Inc. submits the attached Annual Radioactive Effluent Release Report for January 1 through December 31, 2015.

If you have any questions regarding this information, please contact me at (508) 830-8323.

There are no regulatory commitments contained in this letter.

Sincerely,

Everett P. Perkins, Jr.
Manager, Regulatory Assurance

EPP/rb

Attachment: Pilgrim Nuclear Power Station Annual Radioactive Effluent Release Report

IE48
NRR

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ATTACHMENT

To

PNPS Letter 2.16.026

PILGRIM NUCLEAR POWER STATION
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

PILGRIM NUCLEAR POWER STATION

Facility Operating License DPR-35

Annual Radioactive Effluent Release Report

January 1 through December 31, 2015

Entergy

PILGRIM NUCLEAR POWER STATION
Facility Operating License DPR-35

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

JANUARY 01 THROUGH DECEMBER 31, 2015

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Senior HP/Chemistry Specialist

Reviewed by: _____ 5-9-16
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Pilgrim Nuclear Power Station
Annual Radioactive Effluent Release Report
January-December 2015

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PILGRIM NUCLEAR POWER STATION
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT
JANUARY 01 THROUGH DECEMBER 31, 2015

INTRODUCTION

This report quantifies the radioactive gaseous, liquid, and radwaste releases, and summarizes the local meteorological data for the period from January 01 through December 31, 2015. This document has been prepared in accordance with the requirements set forth in the Pilgrim Nuclear Power Station (PNPS) Technical Specifications and Revision 1 of Regulatory Guide 1.21, "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Material in Liquid and Gaseous Effluents from Light Water Cooled Nuclear Power Plants". This document has been prepared in accordance with the requirements of PNPS Technical Specifications section 5.6.3.

The quantity of radioactive material released from PNPS was determined from sample analyses and continuous on-line monitoring of gaseous releases from the main stack, reactor building vent, turbine building, and various decontamination facilities, and liquid releases into the discharge canal.

The quantity and volume of radioactive waste shipped offsite from PNPS for processing and burial were determined from data contained on the radwaste shipping documentation. The meteorological data were obtained from monitoring instruments located on the 220-foot meteorological tower located at Pilgrim Station.

GASEOUS EFFLUENTS

Gaseous radioactive releases for the reporting period are quantified in Tables 2.2-A, 2.2-B, and 2.2-C. Radioactive noble gases released during the period totaled 1.99 Curies. Releases of radioactive iodines and particulates with half-life of greater than 8 days totaled 0.00091 Curies, tritium releases totaled 72 Curies, and carbon-14 totaled 7.2 Curies. No gross alpha radioactivity was detected in gaseous effluents.

Noble gases released in gaseous effluents resulted in a maximum total body dose of 0.000074 mrem, with a corresponding skin dose of 0.00014 mrem. The release of radioactive particulates, iodines, tritium, and carbon-14 in gaseous effluents from PNPS during the reporting period resulted in a total body dose to the maximum-exposed hypothetical individual of about 0.016 mrem. The maximum hypothetical dose to any organ from radioactive particulates, iodines, tritium, and carbon-14 was about 0.071 mrem. The maximum, hypothetical total body dose from the combined release of all airborne radioactivity in gaseous effluents was 0.016 mrem.

The maximum individual doses from gaseous radioactive effluents were compared to the applicable ODCM dose limits. Noble gas doses were less than 0.0012% of the corresponding 10CFR50 dose objectives. Maximum doses resulting from releases of particulates, iodines, tritium, and carbon-14 in gaseous effluents were less than 0.47% of corresponding 10CFR50 objectives.

LIQUID EFFLUENTS

Liquid radioactive releases for the reporting period are quantified in Tables 2.3-A and 2.3-B. Seven discharges of liquid effluents containing radioactivity occurred during the reporting period. These discharges contained 3.6 Curies of tritium, and 0.00066 Curies of fission and activation products. The resulting maximum total body dose was 0.000067 mrem, with a corresponding organ dose of 0.00020 mrem. All doses from liquid discharges were less than 0.0057% of corresponding 10CFR50 objectives.

METEOROLOGICAL DATA

Meteorological joint frequency distributions are listed in Appendix A. Data recovery for the entire annual period was 78% for the 33-ft and 76% for the 220-ft levels of the tower. The predominant wind direction was from the south-southwest, which occurred approximately 13% of the time during the reporting period. The predominant stability class was Class A, which occurred about 29% of the time during the reporting period

OFFSITE AMBIENT RADIATION MEASUREMENTS

Ambient radiation exposure was evaluated to complete the assessment of radiological impact on humans. A small number of thermoluminescent dosimeters (TLDs) indicated an elevation in ambient radiation exposure on Entergy property in close proximity to the station, when compared to background levels in the region. This elevation is due to nitrogen-16 contained within the plant steam system, as opposed to radioactive effluent released from the plant. The dose to the maximum-exposed member of the public at the PNPS Health Club, even though they are within the owner-controlled area, was estimated as being about 1.3 mrem during 2015. There was no measurable increase during 2015 in ambient radiation measurements at the location of the nearest resident 0.8 km southeast of PNPS.

COMBINED DOSE IMPACT

The collective total body dose to a maximum-exposed hypothetical member of the public from airborne radioactivity, liquid-borne radioactivity, and ambient radiation exposure resulting from PNPS operation during 2015 was calculated as being about 0.79 mrem. This amount is about 0.2% of the typical dose of 300 to 400 mrem received each year by an average person from other sources of natural and man-made radiation. Although this calculated collective dose occurs to a maximum-exposed hypothetical individual, it is also well below the NRC dose limit of 100 mrem/yr specified in 10CFR20.1301, as well as the EPA dose limit of 25 mrem/yr specified in 40CFR190. Both of these limits are to be applied to real members of the general public, so the fact that the dose to the hypothetical maximum-exposed individual is within the limits ensures that any dose received by a real member of the public would be smaller and well within any applicable limit.

RADIOACTIVE SOLID WASTE DISPOSAL

Solid radioactive wastes shipped offsite for processing and disposal during the reporting period are described in Table 7.0. Approximately 1220 cubic meters of solid waste, containing almost 191 Curies of radioactivity, were shipped during the reporting period.

ONSITE GROUNDWATER MONITORING PROGRAM

In response to the Nuclear Energy Institute Groundwater Protection Initiative, Pilgrim Station instituted a groundwater monitoring program during 2007. Four monitoring wells were installed onsite during the fourth quarter of 2007, and the first samples were collected in late November 2007. Additional sampling wells were added in 2010, 2011, 2012, 2013, and 2014. As of the end of 2015, samples are being collected from a total of 23 monitoring wells. Low levels of tritium, a radioactive isotope of hydrogen, were detected in several of these onsite wells. No other plant-related radioactivity was detected in the groundwater samples. The average concentration of tritium detected in these onsite monitoring wells during 2015 was well below the voluntary communications reporting level established by the EPA Drinking Water Standard of 20,000 pCi/L. Although the EPA Standard provides a standard for comparison, no drinking water sources are affected by this tritium. The maximum hypothetical dose resulting from tritium in groundwater presumed to enter Cape Cod Bay is calculated to be 0.0000000061 mrem/yr. Results of the groundwater monitoring program are presented in Appendix B.

CONCLUSION

The PNPS Offsite Dose Calculation Manual contains effluent controls to limit doses resulting from releases of radioactivity to the environment. None of the effluent controls associated with liquid or gaseous effluents were exceeded during the reporting period, as confirmed by conservative dose assessments performed at weekly and monthly intervals. Conformance to the PNPS ODCM effluent control limits ensures that releases of radioactivity in liquid and gaseous effluents are kept as low as reasonably achievable in accordance with 10 CFR Part 50, Appendix I. Compliance with the ODCM also demonstrates that requirements of the Environmental Protection Agency's nuclear fuel cycle standard, 40CFR190.10, Subpart B, have been met. Based on the dose assessment results for 2015, there was no significant radiological impact on the general public from PNPS operation.

2.0 RADIOACTIVE EFFLUENT DATA

Radioactive gaseous and liquid releases for the reporting period are given in the standard format presented in Tables 1A, 1B, 1C, 2A, 2B, and Supplemental Information table from NRC Regulatory Guide 1.21 (Reference 1) format.

2.1 Supplemental Effluent Release Data

Supplemental information related to radioactive gaseous and liquid releases for the reporting period are given in the standard NRC Regulatory Guide 1.21 format in Table 2.1.

2.2 Gaseous Effluent Data

Gaseous radioactivity is released from Pilgrim Station to the atmosphere from the main stack, reactor building vent, turbine building, and various decontamination facilities. Combined gaseous effluent releases from all release points are summarized in Table 2.2-A. No alpha activity was detected on any of the particulate filters collected during the reporting period. The total gaseous releases for various categories of radionuclides, as well as the corresponding average release rates, can be summarized as follows:

- Noble gases: 1.99 Ci, 0.0630 μCi/sec
- Iodines and particulates with half-life greater than 8 days: 0.000905 Ci, 0.0000287 μCi/sec
- Tritium: 71.9 Ci, 2.28 μCi/sec
- Carbon-14: 7.18 Ci, 0.228 uCi/sec

Effluent releases from the main stack are detailed in Table 2.2-B. The main stack is 335 feet tall, and represents an elevated release point with a total height of approximately 400 feet above sea level. The main stack is located about 700 feet west-northwest of the reactor building.

Ground-level effluent releases are detailed in Table 2.2-C. Data in this table include releases from the reactor building vent, turbine building, and assorted equipment decontamination facilities (e.g., hot machine shop, carbon dioxide pellet decon trailer, plastic media decon trailer, etc.) used during the period. Due to the close proximity of the reactor building, all of these release points are considered to be mixed-mode/ground level release points.

Following the revision of Regulatory Guide 1.21 in 2009, the nuclear industry re-assessed their gaseous effluent releases in accordance with the new definition of "principal radionuclide". Under this new definition, any radionuclide that contributed greater than 1% of the effluent dose calculated to demonstrate compliance with 10CFR50 Appendix I, or contributed more than 1% of the total activity for that type of effluent release, would be classified as a principal radionuclide. Although Carbon-14 (C-14) had been exempted from gaseous effluent calculations in the 1970s, industry assessments in 2009 revealed that Carbon-14 would qualify as a principal radionuclide. Based on this 2009 re-assessment, licensees were required to begin reporting C-14 gaseous effluents in the Annual Radioactive Effluent Release Report beginning with calendar-year 2010. Carbon-14 releases for 2015 are summarized in Tables 2.2-A through 2.2-C, and the dose consequences from C-14 are incorporated into the dose assessments documented in Section 4.2 of this report.

Table 3.1-2 of the PNPS ODCM requires that if any of the gaseous effluent monitors are inoperable for more than 30-days, such events are to be reported in the Annual Radioactive Effluent Release Report with an explanation of why the affected monitor was not returned to operable status in a timely manner. There were no instances in 2015 during which an single-channel effluent monitor was out of service for more than a 30 consecutive day period, or when both channels of a dual-channel effluent monitor were out of service at the same time during a 30 consecutive day period.

2.3 Liquid Effluent Data

Liquid radioactivity is released from PNPS to Cape Cod Bay via the circulating water discharge canal. These effluents enter Cape Cod Bay at the outfall of the canal, which is located about 1100 feet north of the reactor building.

Liquid effluent releases are summarized in Table 2.3-A. Detailed breakdowns for individual radionuclides are listed in Table 2.3-B. There were seven discharges of liquid effluents containing radioactivity during the reporting period. Total releases for the various categories of radionuclides, as well as their corresponding mean concentrations, can be summarized as follows:

- Total Effluent Volume: 424,000 Liters
- Total Dilution Volume: 562 billion Liters
- Fission/Activation products: 0.000659 Ci, 0.00000000000117 μCi/mL
- Tritium: 3.56 Ci, 0.00000000633 μCi/mL
- Dissolved/entrained noble gases: 0.00 Ci, 0.00 μCi/mL

Table 2.1
Pilgrim Nuclear Power Station
Annual Radioactive Effluent Release Report
Supplemental Information
January-December 2015

FACILITY: PILGRIM NUCLEAR POWER STATION **LICENSE: DPR-35**

1. REGULATORY LIMITS					
a. Fission and activation gases:	500 mrem/yr total body and 3000 mrem/yr for skin at site boundary				
b,c. Iodines, particulates with half-life: >8 days, tritium	1500 mrem/yr to any organ at site boundary				
d. Liquid effluents:	0.06 mrem/month for whole body and 0.2 mrem/month for any organ (without radwaste treatment)				
2. EFFLUENT CONCENTRATION LIMITS					
a. Fission and activation gases:	10CFR20 Appendix B Table II				
b. Iodines:	10CFR20 Appendix B Table II				
c. Particulates with half-life > 8 days:	10CFR20 Appendix B Table II				
d. Liquid effluents:	2E-04 μCi/mL for entrained noble gases; 10CFR20 Appendix B Table II values for all other radionuclides				
3. AVERAGE ENERGY	Not Applicable				
4. MEASUREMENTS AND APPROXIMATIONS OF TOTAL RADIOACTIVITY					
a. Fission and activation gases: b. Iodines: c. Particulates: d. Liquid effluents:	High purity germanium gamma spectroscopy for all gamma emitters; radiochemistry analysis for H-3, Fe-55 (liquid effluents), Sr-89, and Sr-90				
5. BATCH RELEASES	Jan-Mar 2015	Apr-Jun 2015	Jul-Sep 2015	Oct-Dec 2015	Jan-Dec 2015
a. Liquid Effluents					
1. Total number of releases:	N/A	6	N/A	1	7
2. Total time period (minutes):	N/A	1.35E+03	N/A	9.00E+02	2.25E+03
3. Maximum time period (minutes):	N/A	9.10E+02	N/A	9.00E+02	9.10E+02
4. Average time period (minutes):	N/A	2.26E+02	N/A	9.00E+02	5.63E+02
5. Minimum time period (minutes):	N/A	8.50E+01	N/A	9.00E+02	8.50E+01
6. Average stream flow during periods of release of effluents into a flowing stream (Liters/min):	N/A	7.93E+05	N/A	8.94E+05	8.43E+05
b. Gaseous Effluents	None	None	None	None	None
6. ABNORMAL RELEASES					
a. Liquid Effluents	None	None	None	None	None
b. Gaseous Effluents	None	None	None	None	None

Table 2.2-A
Pilgrim Nuclear Power Station
Annual Radioactive Effluent Release Report
Gaseous Effluents - Summation of All Releases
January-December 2015

RELEASE PERIOD	Jan-Mar 2015	Apr-Jun 2015	Jul-Sep 2015	Oct-Dec 2015	Jan-Dec 2015	Est. Total Error
A. FISSION AND ACTIVATION GASES						
Total Release: Ci	9.79E-01	9.76E-01	NDA	3.11E-02	1.99E+00	±22%
Average Release Rate: µCi/sec	1.24E-01	1.24E-01	N/A	3.94E-03	6.30E-02	
Percent of Effluent Control Limit*	*	*	*	*	*	
B. IODINE-131						
Total Iodine-131 Release: Ci	5.42E-05	1.30E-04	2.84E-05	3.40E-05	2.47E-04	±20%
Average Release Rate: µCi/sec	6.88E-06	1.65E-05	3.61E-06	4.32E-06	7.83E-06	
Percent of Effluent Control Limit*	*	*	*	*	*	
C. PARTICULATES WITH HALF-LIVES > 8 DAYS						
Total Release: Ci	5.98E-05	1.86E-04	1.21E-06	1.04E-05	2.58E-04	±21%
Average Release Rate: µCi/sec	7.59E-06	2.36E-05	1.53E-07	1.31E-06	8.17E-06	
Percent of Effluent Control Limit*	*	*	*	*	*	
Gross Alpha Radioactivity: Ci	NDA	NDA	NDA	NDA	NDA	
D. TRITIUM						
Total Release: Ci	3.26E+01	1.26E+01	1.22E+01	1.45E+01	7.19E+01	±20%
Average Release Rate: µCi/sec	4.14E+00	1.59E+00	1.55E+00	1.83E+00	2.28E+00	
Percent of Effluent Control Limit*	*	*	*	*	*	
E. CARBON-14						
Total Release: Ci	1.71E+00	1.29E+00	2.06E+00	2.13E+00	7.18E+00	N/A
Average Release Rate: µCi/sec	2.17E-01	1.64E-01	2.61E-01	2.70E-01	2.28E-01	
Percent of Effluent Control Limit*	*	*	*	*	*	

Notes for Table 2.2-A:

* Percent of Effluent Control Limit values based on dose assessments are provided in Section 6 of this report.

1. NDA stands for No Detectable Activity.
2. LLD for airborne gross alpha activity listed as NDA is 1E-11 µCi/cc.
3. N/A stands for not applicable.

Table 2.2-B
Pilgrim Nuclear Power Station
Annual Radioactive Effluent Release Report
Gaseous Effluents – Elevated Release
January-December 2015

CONTINUOUS MODE RELEASES FROM ELEVATED RELEASE POINT					
Nuclide Released	Jan-Mar 2015	Apr-Jun 2015	Jul-Sep 2015	Oct-Dec 2015	Jan-Dec 2015
1. FISSION AND ACTIVATION GASES: Ci					
Ar-41	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Kr-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Kr-85m	3.53E-01	3.69E-01	0.00E+00	3.11E-02	7.52E-01
Kr-87	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Kr-88	3.90E-01	6.07E-01	0.00E+00	0.00E+00	9.98E-01
Xe-131m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Xe-133	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Xe-133m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Xe-135	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Xe-135m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Xe-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Xe-138	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total for Period	7.43E-01	9.76E-01	0.00E+00	3.11E-02	1.75E+00
2. IODINES: Ci					
I-131	1.68E-06	6.18E-06	2.92E-07	3.08E-07	8.46E-06
I-133	0.00E+00	3.49E-06	0.00E+00	0.00E+00	3.49E-06
Total for Period	1.68E-06	9.67E-06	2.92E-07	3.08E-07	1.19E-05
3. PARTICULATES WITH HALF-LIVES > 8 DAYS: Ci					
Cr-51	0.00E+00	5.35E-07	0.00E+00	0.00E+00	5.35E-07
Mn-54	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Fe-59	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Co-58	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Co-60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Zn-65	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-90	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-103	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-137	3.88E-06	0.00E+00	0.00E+00	0.00E+00	3.88E-06
Ba/La-140	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total for Period	3.88E-06	5.35E-07	0.00E+00	0.00E+00	4.42E-06
4. TRITIUM: Ci					
H-3	3.88E-02	2.82E-02	3.89E-02	2.40E-02	1.30E-01
5. CARBON-14: Ci					
C-14	1.66E+00	1.25E+00	1.99E+00	2.06E+00	6.97E+00

Notes for Table 2.2-B:

1. N/A stands for not applicable.
2. NDA stands for No Detectable Activity.
3. LLDs for airborne radionuclides listed as NDA are as follows:
   - Fission Gases: 1E-04 μCi/cc
   - Iodines: 1E-12 μCi/cc
   - Particulates: 1E-11 μCi/cc

Table 2.2-B (continued)
Pilgrim Nuclear Power Station
Annual Radioactive Effluent Release Report
Gaseous Effluents – Elevated Release
January-December 2015

BATCH MODE RELEASES FROM ELEVATED RELEASE POINT					
Nuclide Released	Jan-Mar 2015	Apr-Jun 2015	Jul-Sep 2015	Oct-Dec 2015	Jan-Dec 2015
1. FISSION AND ACTIVATION GASES: Ci					
Ar-41	N/A	N/A	N/A	N/A	N/A
Kr-85	N/A	N/A	N/A	N/A	N/A
Kr-85m	N/A	N/A	N/A	N/A	N/A
Kr-87	N/A	N/A	N/A	N/A	N/A
Kr-88	N/A	N/A	N/A	N/A	N/A
Xe-131m	N/A	N/A	N/A	N/A	N/A
Xe-133	N/A	N/A	N/A	N/A	N/A
Xe-133m	N/A	N/A	N/A	N/A	N/A
Xe-135	N/A	N/A	N/A	N/A	N/A
Xe-135m	N/A	N/A	N/A	N/A	N/A
Xe-137	N/A	N/A	N/A	N/A	N/A
Xe-138	N/A	N/A	N/A	N/A	N/A
Total for period	N/A	N/A	N/A	N/A	N/A
2. IODINES: Ci					
I-131	N/A	N/A	N/A	N/A	N/A
I-133	N/A	N/A	N/A	N/A	N/A
Total for period	N/A	N/A	N/A	N/A	N/A
3. PARTICULATES WITH HALF-LIVES > 8 DAYS: Ci					
Cr-51	N/A	N/A	N/A	N/A	N/A
Mn-54	N/A	N/A	N/A	N/A	N/A
Fe-59	N/A	N/A	N/A	N/A	N/A
Co-58	N/A	N/A	N/A	N/A	N/A
Co-60	N/A	N/A	N/A	N/A	N/A
Zn-65	N/A	N/A	N/A	N/A	N/A
Sr-89	N/A	N/A	N/A	N/A	N/A
Sr-90	N/A	N/A	N/A	N/A	N/A
Ru-103	N/A	N/A	N/A	N/A	N/A
Cs-134	N/A	N/A	N/A	N/A	N/A
Cs-137	N/A	N/A	N/A	N/A	N/A
Ba/La-140	N/A	N/A	N/A	N/A	N/A
Total for period	N/A	N/A	N/A	N/A	N/A
4. TRITIUM: Ci					
H-3	N/A	N/A	N/A	N/A	N/A
5. CARBON-14: Ci					
C-14	N/A	N/A	N/A	N/A	N/A

Notes for Table 2.2-B:

1. N/A stands for not applicable.
2. NDA stands for No Detectable Activity.
3. LLDs for airborne radionuclides listed as NDA are as follows:
   - Fission Gases: 1E-04 µCi/cc
   - Iodines: 1E-12 µCi/cc
   - Particulates: 1E-11 µCi/cc

Table 2.2-C
Pilgrim Nuclear Power Station
Annual Radioactive Effluent Release Report
Gaseous Effluents – Ground-Level Release
January-December 2015

CONTINUOUS MODE RELEASES FROM GROUND-LEVEL RELEASE POINT					
Nuclide Released	Jan-Mar 2015	Apr-Jun 2015	Jul-Sep 2015	Oct-Dec 2015	Jan-Dec 2015
1. FISSION AND ACTIVATION GASES: Ci					
Ar-41	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Kr-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Kr-85m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Kr-87	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Kr-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Xe-131m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Xe-133	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Xe-133m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Xe-135	2.36E-01	0.00E+00	0.00E+00	0.00E+00	2.36E-01
Xe-135m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Xe-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Xe-138	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total for period	2.36E-01	0.00E+00	0.00E+00	0.00E+00	2.36E-01
2. IODINES: Ci					
I-131	5.26E-05	1.24E-04	2.81E-05	3.37E-05	2.38E-04
I-133	1.22E-04	8.02E-05	9.10E-05	1.04E-04	3.97E-04
Total for period	1.74E-04	2.04E-04	1.19E-04	1.38E-04	6.36E-04
3. PARTICULATES WITH HALF-LIVES > 8 DAYS: Ci					
Cr-51	0.00E+00	3.01E-05	0.00E+00	0.00E+00	3.01E-05
Mn-54	4.10E-06	5.77E-05	1.21E-06	2.78E-06	6.58E-05
Fe-59	0.00E+00	4.39E-06	0.00E+00	0.00E+00	4.39E-06
Co-58	0.00E+00	3.62E-06	0.00E+00	0.00E+00	3.62E-06
Co-60	7.68E-06	7.45E-05	0.00E+00	0.00E+00	8.21E-05
Zn-65	0.00E+00	1.53E-05	0.00E+00	0.00E+00	1.53E-05
Sr-89	1.11E-05	0.00E+00	0.00E+00	7.58E-06	1.87E-05
Sr-90	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-103	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-137	3.74E-06	0.00E+00	0.00E+00	0.00E+00	3.74E-06
Ba/La-140	2.93E-05	0.00E+00	0.00E+00	0.00E+00	2.93E-05
Total for period	5.60E-05	1.86E-04	1.21E-06	1.04E-05	2.53E-04
4. TRITIUM: Ci					
H-3	3.26E+01	1.25E+01	1.22E+01	1.44E+01	7.17E+01
5. CARBON-14: Ci					
C-14	5.13E-02	3.86E-02	6.17E-02	6.38E-02	2.15E-01

Notes for Table 2.2-C:

1. N/A stands for not applicable.
2. NDA stands for No Detectable Activity.
3. LLDs for airborne radionuclides listed as NDA are as follows:
   - Fission Gases: 1E-04 μCi/cc
   - Iodines: 1E-12 μCi/cc
   - Particulates: 1E-11 μCi/cc

Table 2.2-C (continued)
Pilgrim Nuclear Power Station
Annual Radioactive Effluent Release Report
Gaseous Effluents – Ground-Level Release
January-December 2015

BATCH MODE RELEASES FROM GROUND-LEVEL RELEASE POINT					
Nuclide Released	Jan-Mar 2015	Apr-Jun 2015	Jul-Sep 2015	Oct-Dec 2015	Jan-Dec 2015
1. FISSION AND ACTIVATION GASES: Ci					
Ar-41	N/A	N/A	N/A	N/A	N/A
Kr-85	N/A	N/A	N/A	N/A	N/A
Kr-85m	N/A	N/A	N/A	N/A	N/A
Kr-87	N/A	N/A	N/A	N/A	N/A
Kr-88	N/A	N/A	N/A	N/A	N/A
Xe-131m	N/A	N/A	N/A	N/A	N/A
Xe-133	N/A	N/A	N/A	N/A	N/A
Xe-133m	N/A	N/A	N/A	N/A	N/A
Xe-135	N/A	N/A	N/A	N/A	N/A
Xe-135m	N/A	N/A	N/A	N/A	N/A
Xe-137	N/A	N/A	N/A	N/A	N/A
Xe-138	N/A	N/A	N/A	N/A	N/A
Total for period	N/A	N/A	N/A	N/A	N/A
2. IODINES: Ci					
I-131	N/A	N/A	N/A	N/A	N/A
I-133	N/A	N/A	N/A	N/A	N/A
Total for period	N/A	N/A	N/A	N/A	N/A
3. PARTICULATES WITH HALF-LIVES > 8 DAYS: Ci					
Cr-51	N/A	N/A	N/A	N/A	N/A
Mn-54	N/A	N/A	N/A	N/A	N/A
Fe-59	N/A	N/A	N/A	N/A	N/A
Co-58	N/A	N/A	N/A	N/A	N/A
Co-60	N/A	N/A	N/A	N/A	N/A
Zn-65	N/A	N/A	N/A	N/A	N/A
Sr-89	N/A	N/A	N/A	N/A	N/A
Sr-90	N/A	N/A	N/A	N/A	N/A
Ru-103	N/A	N/A	N/A	N/A	N/A
Cs-134	N/A	N/A	N/A	N/A	N/A
Cs-137	N/A	N/A	N/A	N/A	N/A
Ba/La-140	N/A	N/A	N/A	N/A	N/A
Total for period	N/A	N/A	N/A	N/A	N/A
4. TRITIUM: Ci					
H-3	N/A	N/A	N/A	N/A	N/A
5. CARBON-14: Ci					
C-14	N/A	N/A	N/A	N/A	N/A

Notes for Table 2.2-C:

1. N/A stands for not applicable.
2. NDA stands for No Detectable Activity.
3. LLDs for airborne radionuclides listed as NDA are as follows:
   - Fission Gases: 1E-04 µCi/cc
   - Iodines: 1E-12 µCi/cc
   - Particulates: 1E-11 µCi/cc

Table 2.3-A
Pilgrim Nuclear Power Station
Annual Radioactive Effluent Release Report
Liquid Effluents - Summation of All Releases
January-December 2015

RELEASE PERIOD	Jan-Mar 2015	Apr-Jun 2015	Jul-Sep 2015	Oct-Dec 2015	Jan-Dec 2015	Est. Total Error
A. FISSION AND ACTIVATION PRODUCTS						
Total Release (not including tritium, gases, alpha): Ci	N/A	6.36E-04	N/A	2.23E-05	6.59E-04	±12%
Average Diluted Concentration During Period: μCi/mL	N/A	5.87E-12	N/A	1.44E-13	1.17E-12	
Percent of Effluent Concentration Limit*	N/A	7.25E-05%	N/A	1.44E-05%	1.80E-05%	
B. TRITIUM						
Total Release: Ci	N/A	3.56E+00	N/A	1.75E-03	3.56E+00	±9.4%
Average Diluted Concentration During Period: μCi/mL	N/A	3.28E-08	N/A	1.13E-11	6.33E-09	
Percent of Effluent Concentration Limit*	N/A	3.28E-03%	N/A	1.13E-06%	6.33E-04%	
C. DISSOLVED AND ENTRAINED GASES						
Total Release: Ci	N/A	NDA	N/A	NDA	NDA	±16%
Average Diluted Concentration During Period: μCi/mL	N/A	NDA	N/A	NDA	NDA	
Percent of Effluent Concentration Limit*	N/A	0.00E+00%	N/A	0.00E+00%	0.00E+00%	
D. GROSS ALPHA RADIOACTIVITY						
Total Release: Ci	N/A	NDA	N/A	N/A	NDA	±34%
E. VOLUME OF WASTE RELEASED PRIOR TO DILUTION						
Waste Volume: Liters	N/A	3.86E+05	N/A	3.79E+04	4.24E+05	±5.7%
F. VOLUME OF DILUTION WATER USED DURING PERIOD						
Dilution Volume: Liters	1.44E+11	1.08E+11	1.55E+11	1.55E+11	5.62E+11	±10%

Notes for Table 2.3-A:

* Additional percent of Effluent Control Limit values based on dose assessments are provided in Section 6 of this report.

1. N/A stands for not applicable.
2. NDA stands for No Detectable Activity.
3. LLD for dissolved and entrained gases listed as NDA is 1E-05 μCi/mL.
4. LLD for liquid gross alpha activity listed as NDA is 1E-07 μCi/mL.

Table 2.3-B
Pilgrim Nuclear Power Station
Annual Radioactive Effluent Release Report
Liquid Effluents
January-December 2015

CONTINUOUS MODE RELEASES					
Nuclide Released	Jan-Mar 2015	Apr-Jun 2015	Jul-Sep 2015	Oct-Dec 2015	Jan-Dec 2015
1. FISSION AND ACTIVATION PRODUCTS: Ci					
Cr-51	N/A	N/A	N/A	N/A	N/A
Mn-54	N/A	N/A	N/A	N/A	N/A
Fe-55	N/A	N/A	N/A	N/A	N/A
Fe-59	N/A	N/A	N/A	N/A	N/A
Co-58	N/A	N/A	N/A	N/A	N/A
Co-60	N/A	N/A	N/A	N/A	N/A
Zn-65	N/A	N/A	N/A	N/A	N/A
Zn-69m	N/A	N/A	N/A	N/A	N/A
Sr-89	N/A	N/A	N/A	N/A	N/A
Sr-90	N/A	N/A	N/A	N/A	N/A
Zr/Nb-95	N/A	N/A	N/A	N/A	N/A
Mo/Tc-99	N/A	N/A	N/A	N/A	N/A
Ag-110m	N/A	N/A	N/A	N/A	N/A
Sb-124	N/A	N/A	N/A	N/A	N/A
I-131	N/A	N/A	N/A	N/A	N/A
I-133	N/A	N/A	N/A	N/A	N/A
Cs-134	N/A	N/A	N/A	N/A	N/A
Cs-137	N/A	N/A	N/A	N/A	N/A
Ba/La-140	N/A	N/A	N/A	N/A	N/A
Ce-141	N/A	N/A	N/A	N/A	N/A
Total for period	N/A	N/A	N/A	N/A	N/A
2. DISSOLVED AND ENTRAINED GASES: Ci					
Xe-133	N/A	N/A	N/A	N/A	N/A
Xe-135	N/A	N/A	N/A	N/A	N/A
Total for period	N/A	N/A	N/A	N/A	N/A

Notes for Table 2.3-B:

1. N/A stands for not applicable.
2. NDA stands for No Detectable Activity.
3. LLDs for liquid radionuclides listed as NDA are as follows:
   - Strontium: 5E-08 µCi/mL
   - Iodines: 1E-06 µCi/mL
   - Noble Gases: 1E-05 µCi/mL
   - All Others: 5E-07 µCi/mL

Table 2.3-B (continued)
Pilgrim Nuclear Power Station
Annual Radioactive Effluent Release Report
Liquid Effluents
January-December 2015

BATCH MODE RELEASES					
Nuclide Released	Jan-Mar 2015	Apr-Jun 2015	Jul-Sep 2015	Oct-Dec 2015	Jan-Dec 2015
1. FISSION AND ACTIVATION PRODUCTS: Ci					
Na-24	N/A	0.00E+00	N/A	0.00E+00	0.00E+00
Cr-51	N/A	0.00E+00	N/A	0.00E+00	0.00E+00
Mn-54	N/A	3.90E-04	N/A	0.00E+00	3.90E-04
Fe-55	N/A	0.00E+00	N/A	0.00E+00	0.00E+00
Fe-59	N/A	1.76E-05	N/A	0.00E+00	1.76E-05
Co-58	N/A	6.58E-06	N/A	0.00E+00	6.58E-06
Co-60	N/A	1.56E-04	N/A	0.00E+00	1.56E-04
Zn-65	N/A	3.82E-05	N/A	0.00E+00	3.82E-05
Zn-69m	N/A	0.00E+00	N/A	0.00E+00	0.00E+00
Sr-89	N/A	0.00E+00	N/A	0.00E+00	0.00E+00
Sr-90	N/A	0.00E+00	N/A	0.00E+00	0.00E+00
Zr/Nb-95	N/A	0.00E+00	N/A	0.00E+00	0.00E+00
Mo/Tc-99	N/A	0.00E+00	N/A	0.00E+00	0.00E+00
Ag-110m	N/A	1.24E-05	N/A	0.00E+00	1.24E-05
Sb-124	N/A	0.00E+00	N/A	0.00E+00	0.00E+00
I-131	N/A	0.00E+00	N/A	0.00E+00	0.00E+00
I-133	N/A	0.00E+00	N/A	0.00E+00	0.00E+00
Cs-134	N/A	0.00E+00	N/A	0.00E+00	0.00E+00
Cs-137	N/A	0.00E+00	N/A	2.23E-05	2.23E-05
Ba/La-140	N/A	1.50E-05	N/A	0.00E+00	1.50E-05
Ce-141	N/A	0.00E+00	N/A	0.00E+00	0.00E+00
Ce-144	N/A	0.00E+00	N/A	0.00E+00	0.00E+00
Total for period	N/A	6.36E-04	N/A	2.23E-05	6.59E-04
2. DISSOLVED AND ENTRAINED GASES: Ci					
Xe-133	N/A	NDA	N/A	N/A	NDA
Xe-135	N/A	NDA	N/A	N/A	NDA
Total for period	N/A	NDA	N/A	N/A	NDA

Notes for Table 2.3-B:

1. N/A stands for not applicable.
2. NDA stands for No Detectable Activity.
3. LLDs for liquid radionuclides listed as NDA are as follows:
   - Strontium: 5E-08 μCi/mL
   - Iodines: 1E-06 μCi/mL
   - Noble Gases: 1E-05 μCi/mL
   - All Others: 5E-07 μCi/mL

3.0 METEOROLOGICAL DATA

Meteorological data are summarized for the reporting period in Appendix A, in the standard joint frequency distribution format as given in NRC Regulatory Guide 1.21.

The predominant meteorological conditions observed during the annual reporting period can be summarized with their corresponding frequencies as follows:

- Stability Class: Class A, 29%
- 33-ft Wind Direction (from): South-southwest, 13%
- 33-ft Wind Speed: 3.5-7.5 mph, 56%
- 220-ft Wind Direction (from): Southwest, 13%
- 220-ft Wind Speed: 12.5-18.5 mph, 36%

Joint data recovery for the 33-ft level was 78.2% and for the 220-ft level of the tower was 76.0%, neither of which meet the 90% annual data recovery goal specified by the NRC. Problems were encountered in the first quarter of the year when the cable supplying power to the aspirator fans on the temperature sensors of the 220-ft tower failed, resulting in invalid delta-temperature readings used to determine atmospheric stability class. In December 2015, the main power supply for the 220-ft tower meteorological dataloggers failed, resulting in the loss of three weeks of data at the end of the year. Although a new backup 160-ft tower was constructed in late October-2015, it was not put into service until March 2016.

4.0 MAXIMUM INDIVIDUAL DOSES

Doses to the maximum exposed individual resulting from radionuclides in effluents released offsite were calculated using methods presented in the PNPS Offsite Dose Calculation Manual (ODCM, Reference 2), NRC Regulatory Guide 1.109 (Reference 3), NRC Regulatory Guide 1.111 (Reference 4), and the Pilgrim Station Unit 1 Appendix I Evaluation (Reference 5). Maximum individual doses are calculated separately for: (1) noble gases in gaseous effluents, (2) particulates, iodines, and tritium in gaseous effluents; and, (3) liquid effluents. Maximum consumption and use factors for various pathways from Table E-5 of the PNPS ODCM are used for calculating the doses to the maximum exposed individual.

Information related to liquid and gaseous effluent releases are summarized Section 2 of this report. These effluent release data were used as input to computer programs to calculate the resulting doses. PNPS ODCM methodologies were used to calculate the dose contributions to the various organs in each age class from major exposure pathways.

4.1 Doses From Noble Gas Releases

Gaseous effluent release data presented in Tables 2.2-A, 2.2-B, and 2.2-C from this effluent release report were used as input to a dose assessment computer program to calculate radiation doses. These data include gaseous releases from the PNPS main stack, reactor building vent, and turbine building roof exhausters. Meteorological data obtained from the PNPS 220-foot meteorological tower during the 10-year period from 1994 through 2003 were used as input to the "AEOLUS-3" computer program (Reference 6). This program was used to calculate the annual average atmospheric dispersion and deposition factors used in the dose assessment computer program to calculate maximum individual doses.

The maximum individual doses resulting from radioactive noble gases released in gaseous effluents are presented in Table 4.1 according to specific receptor locations. This table includes all noble gas doses for the individual calendar quarters and total calendar year.

Noble gases released in gaseous effluents from PNPS during 2015 resulted in a maximum total body dose of 0.000074 mrem. The maximum skin dose was 0.00014 mrem. Both of these doses occurred to a hypothetical individual, assumed to be present 24 hours per day, 365 days per year, at the site boundary location yielding the highest dose (0.63 km SSW of the Reactor Building). For the more "realistic" individuals at offsite locations, the maximum total body dose was 0.000066 mrem (nearest residence, 0.86 kilometers WNW from the Reactor Building), while the maximum skin dose was 0.00010 mrem (nearest residence, 0.86 kilometers WNW from the Reactor Building).

Table 4.1

Maximum Doses From Noble Gas Releases During 2015[a]

Release Period	Gamma Air Dose mrad/period (location)	Beta Air Dose mrad/period (location)	Total Body Dose mrem/period (location)	Skin Dose mrem/period (location)
Jan-Mar	5.34E-05 (0.52 km SSE)	9.45E-05 (0.64 km ESE)	3.58E-05 (0.52 km SSE)	1.08E-04 (0.54 km NW)
Apr-Jun	5.63E-05 (0.63 km SSW)	1.09E-05 (0.63 km SSW)	3.81E-05 (0.63 km SSW)	5.23E-05 (0.63 km SSW)
Jul-Sep	0.00E+00 (0.64 km ESE)	0.00E+00 (0.64 km ESE)	0.00E+00 (0.64 km ESE)	0.00E+00 (0.64 km ESE)
Oct-Dec	2.22E-07 (0.63 km SSW)	2.66E-07 (0.63 km SSW)	1.48E-07 (0.63 km SSW)	3.70E-07 (0.63 km SSW)
Jan-Dec	1.09E-04 (0.63 km SSW)	9.64E-05 (0.64 km ESE)	7.36E-05 (0.63 km SSW)	1.41E-04 (0.63 km SSW)

[a] All directions and distances are with respect to the reactor building vent.

4.2 Doses From Gaseous Effluent Releases

Gaseous effluent release data presented in Tables 2.2-A, 2.2-B, and 2.2-C from this effluent release report were used as input to a dose assessment computer program to calculate radiation doses. These data include gaseous releases from the PNPS main stack, reactor building vent, and turbine building roof exhausters. Meteorological data obtained from the PNPS 220-foot meteorological tower during the 10-year period from 2005 through 2014 were used as input to the NRC XOQDOQ computer program (Reference 7). This program was used to calculate the annual average atmospheric dispersion and deposition factors used in the dose assessment computer program to calculate maximum individual doses.

The maximum individual doses resulting from radioactive particulates, radioiodines, tritium and carbon-14 released in gaseous effluents are presented in Tables 4.2-A through 4.2-E. These tables cover the individual calendar quarters and the total calendar year, respectively. Doses resulting from releases of noble gases are addressed independently in the PNPS ODCM. Therefore, none of these tables for maximum individual doses include any dose contribution from noble gases. The presentation and analysis of doses resulting from noble gases are addressed in Section 4.1 of this report.

Tables 4.2-A through 4.2-E summarize the maximum total body and organ doses for the adult, teen, child, and infant age classes resulting from the major gaseous exposure pathways. These tables present the dose data according to specific receptor location and the exposure pathways assumed to occur at that location. For example, the second column of the tables presents the information for the hypothetical maximum-exposed at the most restrictive site boundary location, where only inhalation and ground deposition exposure pathways are assumed to occur. Since this is a shoreline location controlled by Entergy, the other pathways of garden vegetable production, milk production, and meat production are assumed not to occur. Doses for other offsite locations not under Entergy control, where other exposure pathways can and do occur, are presented in subsequent columns of the tables, and represent the potential maximum doses to individuals at these locations. For consistency, all distances listed in the first row of Tables 4.2-A through 4.2-E are measured from the Reactor Building Vent. However, doses at the specific receptor locations are calculated based on the actual distances from the applicable release points (PNPS main stack, reactor building vent, and turbine building roof exhausters).

Radioactivity (particulates, radioiodines, tritium, and carbon-14) released in gaseous effluents from PNPS during 2015 resulted in a maximum total body dose of 0.016 mrem (child age class at nearest meat animal, 3.82 kilometers S from the Reactor Building), while the maximum organ dose was 0.071 mrem (child bone at nearest meat animal, 3.82 kilometers S from the Reactor Building). Carbon-14 contributed 91% of the child total body dose and >99% of the child bone dose at the location of the nearest meat animal.

Table 4.2-A

Maximum Individual Organ Dose at Receptor Location -- mrem
From Gaseous Release Period: Jan-Mar 2015

Receptor: Direction: Distance[1]: Pathway[2]:	Bound WNW 0.24km DI	Resident S 2.22 km DI	Garden S 3.44 km DIV[3]	Cow/Goat W 3.75 km DIVCG[3]	Cow/Meat W 5.17 km DIVCM[3]	Meat S 3.82 km DIVM[3]
Age Class: Adult						
Bone	5.30E-05	1.22E-04	4.31E-03	2.23E-03	1.97E-03	5.20E-03
GI-LLI	1.88E-04	1.61E-04	1.32E-03	9.98E-04	7.62E-04	1.47E-03
Kidney	1.88E-04	1.60E-04	1.32E-03	9.98E-04	7.62E-04	1.47E-03
Liver	1.88E-04	1.60E-04	1.32E-03	1.00E-03	7.63E-04	1.47E-03
Lung	1.89E-04	1.61E-04	1.32E-03	9.98E-04	7.62E-04	1.47E-03
Thyroid	1.95E-04	1.66E-04	1.34E-03	1.10E-03	8.21E-04	1.49E-03
T.Body	1.88E-04	1.60E-04	1.32E-03	9.99E-04	7.62E-04	1.47E-03
Age Class: Teen						
Bone	7.59E-05	1.74E-04	6.97E-03	3.75E-03	2.97E-03	7.34E-03
GI-LLI	1.94E-04	1.72E-04	1.90E-03	1.38E-03	9.99E-04	1.92E-03
Kidney	1.94E-04	1.72E-04	1.90E-03	1.39E-03	1.00E-03	1.92E-03
Liver	1.94E-04	1.72E-04	1.90E-03	1.39E-03	1.00E-03	1.92E-03
Lung	1.95E-04	1.72E-04	1.90E-03	1.38E-03	9.99E-04	1.92E-03
Thyroid	2.02E-04	1.78E-04	1.92E-03	1.54E-03	1.09E-03	1.94E-03
T.Body	1.94E-04	1.72E-04	1.90E-03	1.39E-03	1.00E-03	1.92E-03
Age Class: Child						
Bone	1.05E-04	2.41E-04	1.67E-02	9.05E-03	6.98E-03	**1.69E-02**
GI-LLI	1.78E-04	1.68E-04	4.03E-03	2.72E-03	1.97E-03	4.01E-03
Kidney	1.78E-04	1.68E-04	4.03E-03	2.72E-03	1.97E-03	4.01E-03
Liver	1.78E-04	1.68E-04	4.03E-03	2.72E-03	1.97E-03	4.01E-03
Lung	1.79E-04	1.68E-04	4.03E-03	2.72E-03	1.97E-03	4.01E-03
Thyroid	1.88E-04	1.75E-04	4.06E-03	3.01E-03	2.13E-03	4.04E-03
T.Body	1.78E-04	1.68E-04	4.03E-03	2.72E-03	1.97E-03	**4.01E-03**
Age Class: Infant						
Bone	7.73E-05	1.78E-04	1.31E-04	5.68E-03	3.97E-03	1.16E-04
GI-LLI	1.07E-04	1.06E-04	9.22E-05	1.66E-03	1.10E-03	7.96E-05
Kidney	1.07E-04	1.06E-04	9.22E-05	1.67E-03	1.10E-03	7.97E-05
Liver	1.07E-04	1.06E-04	9.22E-05	1.68E-03	1.10E-03	7.97E-05
Lung	1.07E-04	1.07E-04	9.27E-05	1.67E-03	1.10E-03	8.00E-05
Thyroid	1.16E-04	1.13E-04	9.87E-05	2.32E-03	1.46E-03	8.51E-05
T.Body	1.07E-04	1.06E-04	9.22E-05	1.67E-03	1.10E-03	7.96E-05

[1] Distances are measured with respect to the reactor building vent.

[2] Pathway designations are as follows:

D = Deposition (Ground Plane) I = Inhalation V = Vegetable Garden
C = Cow Milk G = Goat Milk M = Meat

[3] Doses are conservative since it is unlikely for vegetables to be grown outside or for animals to be fed on pasture during winter months.

Table 4.2-B

Maximum Individual Organ Dose at Receptor Location -- mrem
From Gaseous Release Period: Apr-Jun 2015

Receptor: Direction: Distance[1]: Pathway[2]:	Bound WNW 0.24km DI	Resident S 2.22 km DI	Garden S 3.44 km DIV[3]	Cow/Goat W 3.75 km DIVCG[3]	Cow/Meat W 5.17 km DIVCM[3]	Meat S 3.82 km DIVM[3]
Age Class: Adult						
Bone	4.00E-05	9.18E-05	3.25E-03	1.68E-03	1.48E-03	3.91E-03
GI-LLI	7.63E-05	7.03E-05	8.30E-04	5.53E-04	4.42E-04	9.56E-04
Kidney	7.61E-05	7.02E-05	8.24E-04	5.50E-04	4.39E-04	9.48E-04
Liver	7.61E-05	7.02E-05	8.25E-04	5.50E-04	4.40E-04	9.49E-04
Lung	8.01E-05	7.33E-05	8.27E-04	5.50E-04	4.39E-04	9.50E-04
Thyroid	8.82E-05	8.00E-05	8.82E-04	7.90E-04	5.77E-04	1.01E-03
T.Body	7.61E-05	7.02E-05	8.25E-04	5.49E-04	4.39E-04	9.49E-04
Age Class: Teen						
Bone	5.72E-05	1.31E-04	5.25E-03	2.82E-03	2.23E-03	5.52E-03
GI-LLI	8.01E-05	7.82E-05	1.25E-03	8.14E-04	6.07E-04	1.29E-03
Kidney	8.00E-05	7.81E-05	1.24E-03	8.12E-04	6.05E-04	1.28E-03
Liver	8.00E-05	7.81E-05	1.24E-03	8.12E-04	6.05E-04	1.28E-03
Lung	8.57E-05	8.26E-05	1.25E-03	8.12E-04	6.05E-04	1.28E-03
Thyroid	9.50E-05	9.02E-05	1.29E-03	1.16E-03	8.04E-04	1.33E-03
T.Body	7.99E-05	7.81E-05	1.24E-03	8.11E-04	6.04E-04	1.28E-03
Age Class: Child						
Bone	7.89E-05	1.81E-04	1.26E-02	6.81E-03	5.25E-03	**1.28E-02**
GI-LLI	7.60E-05	8.13E-05	2.78E-03	1.71E-03	1.27E-03	2.79E-03
Kidney	7.60E-05	8.13E-05	2.78E-03	1.72E-03	1.27E-03	2.79E-03
Liver	7.60E-05	8.13E-05	2.78E-03	1.72E-03	1.28E-03	2.79E-03
Lung	8.06E-05	8.49E-05	2.78E-03	1.71E-03	1.27E-03	2.79E-03
Thyroid	9.30E-05	9.50E-05	2.85E-03	2.39E-03	1.66E-03	2.86E-03
T.Body	7.60E-05	8.13E-05	2.78E-03	1.72E-03	1.27E-03	**2.79E-03**
Age Class: Infant						
Bone	5.82E-05	1.34E-04	9.88E-05	4.28E-03	2.99E-03	8.73E-05
GI-LLI	4.68E-05	5.40E-05	4.52E-05	1.09E-03	7.36E-04	3.92E-05
Kidney	4.69E-05	5.40E-05	4.52E-05	1.09E-03	7.38E-04	3.93E-05
Liver	4.69E-05	5.40E-05	4.52E-05	1.10E-03	7.39E-04	3.93E-05
Lung	4.98E-05	5.63E-05	4.73E-05	1.09E-03	7.35E-04	4.11E-05
Thyroid	6.25E-05	6.65E-05	5.67E-05	2.63E-03	1.59E-03	4.90E-05
T.Body	4.69E-05	5.40E-05	4.52E-05	1.09E-03	7.36E-04	3.92E-05

[1] Distances are measured with respect to the reactor building vent.

[2] Pathway designations are as follows:

D = Deposition (Ground Plane) I = Inhalation V = Vegetable Garden
C = Cow Milk G = Goat Milk M = Meat

Table 4.2-C

Maximum Individual Organ Dose at Receptor Location -- mrem
From Gaseous Release Period: Jul-Sep 2015

Receptor: Direction: Distance[1]: Pathway[2]:	Bound WNW 0.24km DI	Resident S 2.22 km DI	Garden S 3.44 km DIV[3]	Cow/Goat W 3.75 km DIVCG[3]	Cow/Meat W 5.17 km DIVCM[3]	Meat S 3.82 km DIVM[3]
Age Class: Adult						
Bone	6.37E-05	1.46E-04	5.18E-03	2.68E-03	2.36E-03	6.24E-03
GI-LLI	7.86E-05	7.90E-05	1.20E-03	7.41E-04	6.10E-04	1.41E-03
Kidney	7.86E-05	7.90E-05	1.20E-03	7.42E-04	6.10E-04	1.41E-03
Liver	7.86E-05	7.90E-05	1.20E-03	7.42E-04	6.10E-04	1.41E-03
Lung	7.86E-05	7.90E-05	1.20E-03	7.41E-04	6.10E-04	1.41E-03
Thyroid	8.25E-05	8.20E-05	1.22E-03	7.97E-04	6.42E-04	1.42E-03
T.Body	7.86E-05	7.90E-05	1.20E-03	7.42E-04	6.10E-04	1.41E-03
Age Class: Teen						
Bone	9.11E-05	2.10E-04	8.37E-03	4.50E-03	3.56E-03	8.81E-03
GI-LLI	8.43E-05	9.12E-05	1.86E-03	1.14E-03	8.64E-04	1.93E-03
Kidney	8.44E-05	9.13E-05	1.86E-03	1.14E-03	8.64E-04	1.93E-03
Liver	8.43E-05	9.13E-05	1.86E-03	1.14E-03	8.64E-04	1.93E-03
Lung	8.43E-05	9.13E-05	1.86E-03	1.14E-03	8.64E-04	1.93E-03
Thyroid	8.93E-05	9.51E-05	1.87E-03	1.22E-03	9.10E-04	1.94E-03
T.Body	8.43E-05	9.12E-05	1.86E-03	1.14E-03	8.64E-04	1.93E-03
Age Class: Child						
Bone	1.26E-04	2.89E-04	2.00E-02	1.09E-02	8.38E-03	**2.03E-02**
GI-LLI	8.30E-05	1.00E-04	4.26E-03	2.51E-03	1.89E-03	4.30E-03
Kidney	8.30E-05	1.00E-04	4.26E-03	2.51E-03	1.89E-03	4.30E-03
Liver	8.30E-05	1.00E-04	4.26E-03	2.51E-03	1.89E-03	4.30E-03
Lung	8.30E-05	1.00E-04	4.26E-03	2.51E-03	1.89E-03	4.30E-03
Thyroid	8.89E-05	1.05E-04	4.28E-03	2.67E-03	1.98E-03	4.32E-03
T.Body	8.30E-05	1.00E-04	4.26E-03	2.51E-03	1.89E-03	**4.30E-03**
Age Class: Infant						
Bone	9.27E-05	2.13E-04	1.57E-04	6.81E-03	4.77E-03	1.39E-04
GI-LLI	5.28E-05	6.92E-05	5.63E-05	1.62E-03	1.11E-03	4.90E-05
Kidney	5.28E-05	6.92E-05	5.63E-05	1.63E-03	1.11E-03	4.90E-05
Liver	5.28E-05	6.92E-05	5.63E-05	1.62E-03	1.11E-03	4.90E-05
Lung	5.28E-05	6.92E-05	5.63E-05	1.62E-03	1.11E-03	4.90E-05
Thyroid	5.82E-05	7.34E-05	6.02E-05	1.97E-03	1.31E-03	5.24E-05
T.Body	5.28E-05	6.92E-05	5.63E-05	1.62E-03	1.11E-03	4.90E-05

[1] Distances are measured with respect to the reactor building vent.

[2] Pathway designations are as follows:

D = Deposition (Ground Plane) I = Inhalation V = Vegetable Garden
C = Cow Milk G = Goat Milk M = Meat

Table 4.2-D

Maximum Individual Organ Dose at Receptor Location -- mrem
From Gaseous Release Period: Oct-Dec 2015

Receptor:	Bound	Resident	Garden	Cow/Goat	Cow/Meat	Meat
Direction:	WNW	S	S	W	W	S
Distance[1]:	0.24km	2.22 km	3.44 km	3.75 km	5.17 km	3.82 km
Pathway[2]:	DI	DI	DIV[3]	DIVCG[3]	DIVCM[3]	DIVM[3]
Age Class: Adult						
Bone	6.59E-05	1.51E-04	5.36E-03	2.77E-03	2.44E-03	6.46E-03
GI-LLI	9.13E-05	8.94E-05	1.27E-03	7.98E-04	6.52E-04	1.48E-03
Kidney	9.13E-05	8.94E-05	1.27E-03	7.98E-04	6.52E-04	1.48E-03
Liver	9.13E-05	8.94E-05	1.27E-03	7.98E-04	6.52E-04	1.48E-03
Lung	9.13E-05	8.94E-05	1.27E-03	7.98E-04	6.52E-04	1.48E-03
Thyroid	9.58E-05	9.29E-05	1.29E-03	8.64E-04	6.90E-04	1.50E-03
T.Body	9.12E-05	8.93E-05	1.27E-03	7.98E-04	6.52E-04	1.48E-03
Age Class: Teen						
Bone	9.43E-05	2.17E-04	8.67E-03	4.66E-03	3.69E-03	9.12E-03
GI-LLI	9.73E-05	1.02E-04	1.95E-03	1.21E-03	9.17E-04	2.02E-03
Kidney	9.73E-05	1.02E-04	1.95E-03	1.21E-03	9.17E-04	2.02E-03
Liver	9.73E-05	1.02E-04	1.95E-03	1.21E-03	9.17E-04	2.02E-03
Lung	9.74E-05	1.02E-04	1.95E-03	1.21E-03	9.17E-04	2.02E-03
Thyroid	1.03E-04	1.07E-04	1.97E-03	1.31E-03	9.72E-04	2.04E-03
T.Body	9.73E-05	1.02E-04	1.95E-03	1.21E-03	9.17E-04	2.02E-03
Age Class: Child						
Bone	1.30E-04	2.99E-04	2.07E-02	1.12E-02	8.67E-03	**2.11E-02**
GI-LLI	9.47E-05	1.10E-04	4.45E-03	2.65E-03	1.99E-03	4.48E-03
Kidney	9.47E-05	1.10E-04	4.45E-03	2.65E-03	1.99E-03	4.48E-03
Liver	9.47E-05	1.10E-04	4.45E-03	2.65E-03	1.99E-03	4.48E-03
Lung	9.48E-05	1.11E-04	4.45E-03	2.65E-03	1.99E-03	4.48E-03
Thyroid	1.02E-04	1.16E-04	4.47E-03	2.84E-03	2.09E-03	4.51E-03
T.Body	9.47E-05	1.10E-04	4.45E-03	2.65E-03	1.99E-03	**4.48E-03**
Age Class: Infant						
Bone	9.60E-05	2.21E-04	1.63E-04	7.05E-03	4.93E-03	1.44E-04
GI-LLI	5.97E-05	7.55E-05	6.19E-05	1.71E-03	1.16E-03	5.39E-05
Kidney	5.97E-05	7.55E-05	6.19E-05	1.71E-03	1.16E-03	5.39E-05
Liver	5.97E-05	7.55E-05	6.19E-05	1.71E-03	1.16E-03	5.39E-05
Lung	5.98E-05	7.56E-05	6.20E-05	1.71E-03	1.16E-03	5.39E-05
Thyroid	6.60E-05	8.05E-05	6.65E-05	2.12E-03	1.40E-03	5.78E-05
T.Body	5.97E-05	7.55E-05	6.19E-05	1.71E-03	1.16E-03	5.39E-05

[1] Distances are measured with respect to the reactor building vent.

[2] Pathway designations are as follows:

D = Deposition (Ground Plane) I = Inhalation V = Vegetable Garden
C = Cow Milk G = Goat Milk M = Meat

[3] Doses are conservative since it is unlikely for vegetables to be grown outside or for animals to be fed on pasture during winter months.

Table 4.2-E

Maximum Individual Organ Dose at Receptor Location -- mrem
From Gaseous Release Period: Jan-Dec 2015

Receptor: Direction: Distance[1]: Pathway[2]:	Bound WNW 0.24km DI	Resident S 2.22 km DI	Garden S 3.44 km DIV[3]	Cow/Goat W 3.75 km DIVCG[3]	Cow/Meat W 5.17 km DIVCM[3]	Meat S 3.82 km DIVM[3]
Age Class: Adult						
Bone	2.23E-04	5.11E-04	1.81E-02	9.36E-03	8.25E-03	2.18E-02
GI-LLI	4.34E-04	3.99E-04	4.62E-03	3.09E-03	2.47E-03	5.31E-03
Kidney	4.34E-04	3.99E-04	4.62E-03	3.09E-03	2.46E-03	5.31E-03
Liver	4.34E-04	3.99E-04	4.62E-03	3.09E-03	2.46E-03	5.31E-03
Lung	4.39E-04	4.03E-04	4.62E-03	3.09E-03	2.46E-03	5.31E-03
Thyroid	4.61E-04	4.21E-04	4.73E-03	3.55E-03	2.73E-03	5.42E-03
T.Body	4.34E-04	3.99E-04	4.62E-03	3.09E-03	2.46E-03	5.31E-03
Age Class: Teen						
Bone	3.19E-04	7.32E-04	2.93E-02	1.57E-02	1.25E-02	3.08E-02
GI-LLI	4.56E-04	4.43E-04	6.96E-03	4.55E-03	3.39E-03	7.16E-03
Kidney	4.56E-04	4.43E-04	6.96E-03	4.55E-03	3.39E-03	7.15E-03
Liver	4.56E-04	4.43E-04	6.96E-03	4.55E-03	3.39E-03	7.16E-03
Lung	4.62E-04	4.48E-04	6.96E-03	4.55E-03	3.39E-03	7.16E-03
Thyroid	4.90E-04	4.70E-04	7.06E-03	5.23E-03	3.77E-03	7.25E-03
T.Body	4.56E-04	4.43E-04	6.96E-03	4.55E-03	3.38E-03	7.15E-03
Age Class: Child						
Bone	4.40E-04	1.01E-03	7.00E-02	3.80E-02	2.93E-02	**7.11E-02**
GI-LLI	4.32E-04	4.60E-04	1.55E-02	9.59E-03	7.12E-03	1.56E-02
Kidney	4.32E-04	4.60E-04	1.55E-02	9.60E-03	7.12E-03	1.56E-02
Liver	4.32E-04	4.60E-04	1.55E-02	9.60E-03	7.13E-03	1.56E-02
Lung	4.38E-04	4.64E-04	1.55E-02	9.59E-03	7.12E-03	1.56E-02
Thyroid	4.72E-04	4.91E-04	1.57E-02	1.09E-02	7.86E-03	1.57E-02
T.Body	4.32E-04	4.60E-04	1.55E-02	9.60E-03	7.12E-03	**1.56E-02**
Age Class: Infant						
Bone	3.24E-04	7.45E-04	5.50E-04	2.38E-02	1.67E-02	4.87E-04
GI-LLI	2.66E-04	3.05E-04	2.56E-04	6.08E-03	4.10E-03	2.22E-04
Kidney	2.66E-04	3.05E-04	2.56E-04	6.10E-03	4.11E-03	2.22E-04
Liver	2.66E-04	3.05E-04	2.56E-04	6.10E-03	4.11E-03	2.22E-04
Lung	2.70E-04	3.08E-04	2.58E-04	6.08E-03	4.10E-03	2.24E-04
Thyroid	3.02E-04	3.34E-04	2.82E-04	9.05E-03	5.75E-03	2.44E-04
T.Body	2.66E-04	3.05E-04	2.56E-04	6.09E-03	4.11E-03	2.22E-04

[1] Distances are measured with respect to the reactor building vent.

[2] Pathway designations are as follows:

D = Deposition (Ground Plane) I = Inhalation V = Vegetable Garden
C = Cow Milk G = Goat Milk M = Meat

[3] Doses are conservative since it is unlikely for vegetables to be grown outside or for animals to be fed on pasture during winter months.

4.3 Doses From Liquid Effluent Releases

Liquid effluent release data presented in Tables 2.3-A and 2.3-B were used as input to the dose assessment computer program to calculate radiation doses. The maximum individual doses resulting from radionuclides released in liquid effluents are presented in Tables 4.3-A through 4.3-E. These tables cover the individual calendar quarters and the total calendar year, respectively.

Tables 4.3-A through 4.3-E summarize the maximum total body and organ doses for the adult, teen, and child age classes resulting from the major liquid exposure pathways. NRC Regulatory Guide 1.109 does not recognize the infant age class as being exposed to the liquid effluent pathways. Therefore, doses for this age class are not included in any of the tables.

It should be noted that doses calculated for the entire year might not equal the sum of the doses for the individual quarters. Doses from liquid effluents are based on the concentration (activity divided by volume) of radionuclides released in the effluent, as prescribed by the NRC in Regulatory Guide 1.109. If a larger proportion of activity is released with a relatively smaller volume of dilution water during a given quarter, the resulting concentration for that quarter will be higher than concentrations from other quarters. This will result in a proportionally higher dose for that quarter. However, when that quarter's activity values are included in the annual sum, and divided by the total annual dilution flow, the resulting dose contribution will be smaller. In such a situation, the annual dose will actually be less than the sum of the individual quarterly doses.

Radioactivity released in liquid effluents from PNPS during the reporting period resulted in a maximum total body dose (child age class) of 0.000067 mrem. The maximum organ dose (adult age class, GI-LLI) was 0.00020 mrem.

Table 4.3-A

Maximum Individual Organ Doses -- mrem
From Liquid Release Period: Jan-Mar 2015

Organ	Age Class Organ Dose – mrem *		
	Adult	Teen	Child
Bone	0.00E+00	0.00E+00	0.00E+00
GI-LLI	0.00E+00	0.00E+00	0.00E+00
Kidney	0.00E+00	0.00E+00	0.00E+00
Liver	0.00E+00	0.00E+00	0.00E+00
Lung	0.00E+00	0.00E+00	0.00E+00
Thyroid	0.00E+00	0.00E+00	0.00E+00
T.Body	0.00E+00	0.00E+00	0.00E+00

* These doses are conservative since the same usage factor was applied for each quarter. In reality, it is unlikely that anyone would be swimming or boating during the entire year. However, the resulting dose is considerably lower than those from other pathways and does not contribute much to the total dose.

Table 4.3-B

Maximum Individual Organ Doses -- mrem
From Liquid Release Period: Apr-Jun 2015

Organ	Age Class Organ Dose – mrem		
	Adult	Teen	Child
Bone	5.23E-05	5.17E-05	5.24E-05
GI-LLI	**2.64E-04**	1.75E-04	6.63E-05
Kidney	9.95E-05	9.20E-05	7.42E-05
Liver	1.74E-04	1.62E-04	1.39E-04
Lung	1.20E-05	1.93E-05	1.01E-05
Thyroid	6.50E-06	1.35E-05	5.10E-06
T.Body	8.06E-05	8.10E-05	**8.59E-05**

Table 4.3-C

Maximum Individual Organ Doses -- mrem
From Liquid Release Period: Jul-Sep 2015

Organ	Age Class Organ Dose – mrem		
	Adult	Teen	Child
Bone	0.00E+00	0.00E+00	0.00E+00
GI-LLI	0.00E+00	0.00E+00	0.00E+00
Kidney	0.00E+00	0.00E+00	0.00E+00
Liver	0.00E+00	0.00E+00	0.00E+00
Lung	0.00E+00	0.00E+00	0.00E+00
Thyroid	0.00E+00	0.00E+00	0.00E+00
T.Body	0.00E+00	0.00E+00	0.00E+00

Table 4.3-D

Maximum Individual Organ Doses -- mrem
From Liquid Release Period: Oct-Dec 2015

Organ	Age Class Organ Dose – mrem *		
	Adult	Teen	Child
Bone	6.82E-07	1.04E-06	9.09E-07
GI-LLI	9.03E-08	4.18E-07	9.06E-08
Kidney	3.57E-07	6.94E-07	3.43E-07
Liver	9.08E-07	**1.25E-06**	8.75E-07
Lung	1.68E-07	5.18E-07	1.78E-07
Thyroid	7.42E-08	4.06E-07	8.56E-08
T.Body	6.21E-07	**7.00E-07**	2.02E-07

* These doses are conservative since the same usage factor was applied for each quarter. In reality, it is unlikely that anyone would be swimming or boating during these months. However, the resulting dose is considerably lower than those from other pathways and does not contribute much to the total dose.

Table 4.3-E

Maximum Individual Organ Doses -- mrem
From Liquid Release Period: Jan-Dec 2015

Organ	Age Class Organ Dose – mrem *		
	Adult	Teen	Child
Bone	4.11E-05	4.11E-05	4.15E-05
GI-LLI	**2.04E-04**	1.36E-04	5.13E-05
Kidney	7.72E-05	7.17E-05	5.76E-05
Liver	1.35E-04	1.27E-04	1.08E-04
Lung	9.48E-06	1.55E-05	7.99E-06
Thyroid	5.10E-06	1.09E-05	4.03E-06
T.Body	6.29E-05	6.33E-05	**6.65E-05**

* These doses are conservative since the same usage factor was applied for each quarter. In reality, it is unlikely that anyone would be swimming or boating during the entire year. However, the resulting dose is considerably lower than those from other pathways and does not contribute much to the total dose.

5.0 OFFSITE AMBIENT RADIATION MEASUREMENTS

The PNPS ODCM does not contain control limits related specifically to offsite ambient radiation exposure. However, Regulatory Guide 1.21 (Reference 1) recommends calculation of ambient radiation exposure as part of the overall assessment of radiological impact on man.

Thermoluminescent dosimeters (TLDs) are located at 86 sites beyond the boundary of the PNPS restricted/protected area. A number of these TLDs are located within the site boundary, on Entergy property in close proximity to the station proper. The TLDs are collected on a quarterly basis and used to calculate the ambient radiation exposure in milliRoentgen (mR) over the exposure period. These TLDs are grouped into four zones of increasing distance from the station. Average exposure values for each of these zones were calculated for each calendar quarter and the total year. The average exposure values (mR) for the four zones are presented in Table 5.0.

In addition to responding to ambient radiation exposure, TLDs will also record radiation resulting from noble gases (plume and immersion exposure), particulate materials deposited on the ground, cosmic rays from outer space, and from naturally-occurring radioactivity in the soil and air. Typically, the exposure from cosmic rays and other natural radioactivity components is about 40 to 70 mR/year. As calculated in Sections 4.1 and 4.2 of this report, the ambient radiation component of doses from PNPS effluent emissions are below 1 mrem/yr and would not be discernible above the natural radiation exposure levels.

The major source of ambient radiation exposure from PNPS results from high-energy gamma rays emitted from nitrogen-16 (N-16) contained in steam flowing through the turbine. Although the N-16 is enclosed in the process lines and turbine and is not released into the environment, the ambient radiation exposure and sky shine from this contained source accounts for the majority of the radiation dose, especially in close proximity to the station. Other sources of ambient radiation exposure include radiation emitted from contained radioactive materials and/or radwaste at the facility. Despite these sources of ambient radiation exposure at PNPS, increases in exposure from ambient radiation are typically not observable above background levels at locations beyond Entergy controlled property.

The average exposure values presented in Table 5.0 appear to indicate an elevation in ambient exposures in Zone 1, those TLDs within 2 miles of PNPS. Most of this elevation is due to increases in exposure levels measured at TLD locations on Entergy property in close proximity to the station proper. For example, the annual exposure at TLD location OA, located at the Overlook Area near the PNPS Health Club (I&S Building), was 178 mR for the entire year. This location is immediately adjacent to the station proper and overlooks the turbine building, therefore receiving the highest direct ambient and sky shine exposure. When the near-site TLDs (those located within 0.6 km of the Reactor Building) are removed from the calculation of averages, the mean annual exposure in Zone 1 falls from 71.3 ± 22.1 mR/yr to 61.4 ± 8.7 mR/yr. Such a corrected dose is not statistically different from the Zone 4 average of 57.9 ± 10.2 mR/yr, and is indicative of natural background radiation.

Although the annual exposure at TLD location OA was 120 mR above the average Zone 4 exposure, members of the general public do not continuously occupy this area. When adjusted for such occupancy, a hypothetical member of the public who was at this location for 40 hours per year would only receive an incremental dose of 0.55 mrem over natural background radiation levels. At the nearest residence 0.8 kilometers (0.5 miles) southeast of the PNPS Reactor Building, the annual exposure was calculated as being 57.9 ± 8.0 mR (based on continuous occupancy at this location), which compares quite well to the Zone 4 annual average background radiation level of 57.9 ± 10.2 mR. Statistically, there is no difference between these two values.

Pilgrim Station began moving spent fuel to the Independent Spent Fuel Storage Installation (ISFSI) located within the protected area immediately west of the PNPS Reactor Building. Three new TLDs were installed at the beginning of 2016 to monitor any incremental dose from this facility. TLD ISF-1 was located on Rocky Hill Road 0.35 km (0.21 mi) southwest of the reactor building. The annual exposure at this location was calculated as being 73.1 ± 9.0 mR (based on continuous occupancy at this location), or 15.2 mR above the Zone 4 average of 57.9 mR. However, the area is not continuously occupied, and when corrected for an exposure time of 365 hours/year, the estimated exposure to a person walking along this section of Rocky Hill Road would be 0.63 mR/year.

It must be emphasized that the projected ambient exposures discussed above and on the previous page are calculated to occur to a maximum-exposed hypothetical individual. Even though conservative assumptions are made in the projection of these dose consequences, all of the projected doses are well below the NRC dose limit of 100 mrem/yr specified in 10CFR20.1301, as well as the EPA dose limit of 25 mrem/yr specified in 40CFR190. Both of these limits are to be applied to real members of the general public, so the fact that the dose to the hypothetical maximum-exposed individual is within the limits ensures that any dose received by a real member of the public would be smaller and well within any applicable limit.

In 1994, Pilgrim Station opened the old training facility (I&S Building) overlooking the plant as a health club for its employees. This site is immediately adjacent to the protected area boundary near monitoring location OA and receives appreciable amounts of direct ambient and sky shine exposure from the turbine building. Although personnel using this facility are employees of Entergy, they are considered to be members of the public. Due to their extended presence in the facility (500 hr/yr, assuming utilization of the facility for 2 hr/day, 5 days a week, for 50 weeks/yr), these personnel represent the most conservative case in regards to ambient radiation exposure to a member of the public within the PNPS owner controlled area. Their annual incremental radiation dose above background during 2015 is estimated as being about 1.3 mrem, based on the average exposure measured by the TLD in the building.

The exposures measured by the TLD located in the health club would also include any increase in ambient radiation resulting from noble gases and/or particulate activity deposited on the ground from gaseous releases. However, they would not indicate any internal dose received by personnel in this facility from inhalation of small amounts of PNPS-related radioactivity contained in the air. An environmental air sampler located immediately adjacent to the health club did not indicate any PNPS-related activity during 2015. Dose calculations performed in the same manner as those outlined in Section 4.2 for airborne effluent releases yielded a projected total body dose to the maximum-exposed individual (500 hr/yr exposure) of about 0.0018 mrem, resulting from inhalation.

Again, it must be emphasized that the above-described exposures were received by personnel who are employees or contractors of Entergy, accessing areas or facilities on property under the ownership and control of Entergy. Since this exposure was received within the owner-controlled area, it is not used for comparison to the annual dose limit of 25 mrem/yr specified in 40CFR190. This regulation explicitly applies to areas at or beyond the owner-controlled property, and is not applicable in this situation. As stated earlier, TLDs at and beyond the site boundary do not indicate elevated ambient radiation levels resulting from the operation of Pilgrim Station.

Although some of the TLDs in close proximity to PNPS indicate increases in exposure levels from ambient radiation, such increases are localized to areas under Entergy control. For members of the general public who are not employed or contracted with Entergy and are accessing Entergy controlled areas (e.g., parking lots, etc.), such increases in dose from ambient radiation exposure are estimated as being less than 1.3 mrem/year.

Table 5.0

Average TLD Exposures By Distance Zone During 2015

Exposure Period	Average Exposure ± Standard Deviation: mR/period			
	Zone 1* 0-3 km	Zone 2 3-8 km	Zone 3 8-15 km	Zone 4 >15 km
Jan-Mar	16.0 ± 4.9	12.7 ± 2.4	11.9 ± 1.8	11.8 ± 1.3
Apr-Jun	17.4 ± 4.8	14.5 ± 1.7	14.1 ± 1.2	15.3 ± 2.3
Jul-Sep	18.0 ± 5.7	13.7 ± 2.1	13.4 ± 1.7	14.2 ± 2.0
Oct-Dec	19.9 ± 6.0	16.4 ± 2.3	15.0 ± 1.5	16.5 ± 2.1
Jan-Dec	71.3 ± 22.1	57.3 ± 10.1	54.3 ± 7.6	57.9 ± 10.2

* Zone 1 extends from the PNPS restricted/protected area boundary outward to 3 kilometers (2 miles), and includes several TLDs located within the site boundary.

** When corrected for TLDs located within the site boundary, the Zone 1 annual average is calculated to be 61.4 ± 8.7 mR/yr.

6.0 PERCENT OF ODCM EFFLUENT CONTROL LIMITS

The PNPS ODCM contains dose and concentration limits for radioactive effluents. In addition, the effluent controls specified ensure that radioactive releases are maintained as low as reasonably achievable. The percentage of the PNPS ODCM Control limit values were determined from doses calculated in Section 4, the effluent releases summarized in Section 2, and the ODCM Control limits/objectives listed in Tables 6.1 and 6.2.

The percent of applicable control limit values are provided to supplement the information provided in the Section 2 of this report. The format for the percent of applicable limits is modified from that prescribed in Regulatory Guide 1.21 (Reference 1) to accommodate the Radioactive Effluents Technical Specifications (RETS) that became effective March 01, 1986. The percentages have been grouped according to whether the releases were via liquid or gaseous effluent pathways.

6.1 Gaseous Effluent Releases

Dose-based effluent controls related to exposures arising from gaseous effluent releases are presented in Table 6.1. The maximum quarterly air doses and annual whole body doses listed in Table 4.1 were used to calculate the percentage values shown in Table 6.1. All doses resulting from noble gas exposure were a small percentage of the applicable effluent control.

Organ dose limits for the maximum-exposed individual from radioactive particulates, iodines, and tritium from the PNPS ODCM are also shown in Table 6.1. The maximum quarterly and annual organ doses from Tables 4.2-A through 4.2-E were used to calculate the percentages shown in Table 6.1. The resulting organ doses from Pilgrim Station's gaseous releases during 2015 were a small percentage of the corresponding effluent control.

Table 6.1

Percent of ODCM Effluent Control Limits
for Gaseous Effluent Releases During 2015

A. Instantaneous Dose Rate Limit - Noble Gases
PNPS ODCM Control 3.3.1.a
Limit: 500 mrem/yr Total Body Dose

Period	Value - mrem/yr	Fraction of Limit
Jan-Dec	7.36E-05	1.47E-05%

B. Instantaneous Dose Rate Limit - Noble Gases
PNPS ODCM Control 3.3.1.a
Limit: 3000 mrem/yr Skin Dose

Period	Value - mrem/yr	Fraction of Limit
Jan-Dec	1.41E-04	4.69E-06%

C. Instantaneous Dose Rate Limit - Particulates, Iodines, & Tritium
PNPS ODCM Control 3.3.1.b
Limit: 1500 mrem/yr Organ Dose

Period	Value - mrem/yr	Fraction of Limit
Jan-Dec	7.11E-02	4.74E-03%

D. Quarterly Dose Objective - Noble Gas Gamma Air Dose
PNPS ODCM Control 3.3.2.a
Objective: 5 mrad Gamma Air Dose

Period	Value – mrad	Fraction of Limit
Jan-Mar	5.34E-05	1.07E-03%
Apr-Jun	5.63E-05	1.13E-03%
Jul-Sep	0.00E+00	0.00E+00%
Oct-Dec	2.22E-07	4.45E-06%

E. Annual Dose Objective - Noble Gas Gamma Air Dose
PNPS ODCM Control 3.3.2.b
Objective: 10 mrad Gamma Air Dose

Period	Value - mrad/yr	Fraction of Limit
Jan-Dec	1.09E-04	1.09E-03%

Table 6.1 (continued)

Percent of ODCM Effluent Control Limits
for Gaseous Effluent Releases During 2015

F. Quarterly Dose Objective - Noble Gas Beta Air Dose
PNPS ODCM Control 3.3.2.a
Objective: 10 mrad Beta Air Dose

Period	Value - mrad	Fraction of Limit
Jan-Mar	9.45E-05	9.45E-04%
Apr-Jun	1.09E-05	1.09E-04%
Jul-Sep	0.00E+00	0.00E+00%
Oct-Dec	2.66E-07	2.66E-06%

G. Annual Dose Objective - Noble Gas Beta Air Dose
PNPS ODCM Control 3.3.2.b
Objective: 20 mrad Beta Air Dose

Period	Value - mrad/yr	Fraction of Limit
Jan-Dec	9.64E-05	4.82E-04%

H. Quarterly Dose Objective - Particulates, Iodines, Tritium, and Carbon-14
PNPS ODCM Control 3.3.3.a
Objective: 7.5 mrem Organ Dose

Period	Value - mrem	Fraction of Limit
Jan-Mar	1.69E-02	2.26E-01%
Apr-Jun	1.28E-02	1.70E-01%
Jul-Sep	2.03E-02	2.71E-01%
Oct-Dec	2.11E-02	2.81E-01%

I. Annual Dose Objective - Particulates, Iodines, Tritium, and Carbon-14
PNPS ODCM Control 3.3.3.b
Objective: 15 mrem Organ Dose

Period	Value - mrem/yr	Fraction of Limit
Jan-Dec	7.11E-02	4.74E-01%

6.2 Liquid Effluent Releases

Liquid effluent concentration limits and dose objectives from the PNPS ODCM are shown in Table 6.2. The quarterly average concentrations from Table 2.3-A were used to calculate the percent concentration limits. The maximum quarterly and annual whole body and organ doses from Tables 4.3-A through 4.3-E were used to calculate the percentages shown in Table 6.2. The resulting concentrations, as well as organ and total body doses from Pilgrim Station's liquid releases during the reporting period were a small percentage of the corresponding effluent controls.

Table 6.2

Percent of ODCM Effluent Control Limits
for Liquid Effluent Releases During 2015

A. Fission and Activation Product Effluent Concentration Limit
PNPS ODCM Control 3.2.1
Limit: 10CFR20 Appendix B, Table 2, Column 2 Value

Period	Value - μCi/mL	Fraction of Limit
Jan-Mar	0.00E+00	0.00E+00%
Apr-Jun	5.87E-12	7.25E-05%
Jul-Sep	0.00E+00	0.00E+00%
Oct-Dec	1.44E-13	1.44E-05%
Jan-Dec	1.17E-12	1.80E-05%

B. Tritium Average Concentration Limit
PNPS ODCM Control 3.2.1
Limit: 1.0E-03 μCi/mL

Period	Value - μCi/mL	Fraction of Limit
Jan-Mar	0.00E+00	0.00E+00%
Apr-Jun	3.28E-08	3.28E-03%
Jul-Sep	0.00E+00	0.00E+00%
Oct-Dec	1.13E-11	1.13E-06%
Jan-Dec	6.33E-09	6.33E-04%

C. Dissolved and Entrained Noble Gases Concentration Limit
PNPS ODCM Control 3.2.1
Limit: 2.0E-04 μCi/mL

Period	Value - μCi/mL	Fraction of Limit
Jan-Mar	0.00E+00	0.00E+00%
Apr-Jun	0.00E+00	0.00E+00%
Jul-Sep	0.00E+00	0.00E+00%
Oct-Dec	0.00E+00	0.00E+00%
Jan-Dec	0.00E+00	0.00E+00%

Table 6.2 (continued)

Percent of ODCM Effluent Control Limits
for Liquid Effluent Releases During 2015

D. Quarterly Total Body Dose Objective
PNPS ODCM Control 3.2.2.a
Objective: 1.5 mrem Total Body Dose

Period	Value - mrem	Fraction of Limit
Jan-Mar	0.00E+00	0.00E+00%
Apr-Jun	8.59E-05	5.73E-03%
Jul-Sep	0.00E+00	0.00E+00%
Oct-Dec	7.00E-07	4.67E-05%

E. Annual Total Body Dose Objective
PNPS ODCM Control 3.2.2.b
Objective: 3 mrem Total Body Dose

Period	Value - mrem	Fraction of Limit
Jan-Dec	6.65E-05	2.22E-03%

F. Quarterly Organ Dose Objective
PNPS ODCM Control 3.2.2.a
Objective: 5 mrem Organ Dose

Period	Value - mrem	Fraction of Limit
Jan-Mar	0.00E+00	0.00E+00%
Apr-Jun	2.64E-04	5.27E-03%
Jul-Sep	0.00E+00	0.00E+00%
Oct-Dec	1.25E-06	2.50E-05%

G. Annual Organ Dose Objective
PNPS ODCM Control 3.2.2.b
Objective: 10 mrem Organ Dose

Period	Value - mrem	Fraction of Limit
Jan-Dec	2.04E-04	2.04E-03%

7.0 RADIOACTIVE WASTE DISPOSAL DATA

Radioactive wastes that were shipped offsite for processing and disposal during the reporting period are described in Table 7.0, in the standard NRC Regulatory Guide 1.21 format.

The total quantity of radioactivity in Curies and the total volume in cubic meters are summarized in Table 7.0 for the following waste categories:

- Spent resins, filter sludges, and evaporator bottoms;
- Dry activated wastes, contaminated equipment, etc.;
- Irradiated components, control rods, etc.; and,
- Other.

During the reporting period approximately 111.0 cubic meters of spent resins, filter sludges, etc., containing a total activity of about 182.0 Curies were shipped from PNPS for processing and disposal. Dry activated wastes and contaminated equipment shipped during the period totaled 1110.0 cubic meters and contained 8.77 Curies of radioactivity. There were no shipments of irradiated components during the reporting period. There were no shipments of "Other wastes" during the reporting period. There were no shipments of irradiated fuel during the reporting period.

Estimates of major radionuclides, those comprising greater than 1% of the total activity in each waste category shipped, are listed in Table 7.0. There were 42 shipments to Energy Solutions' Bear Creek Facility in Oak Ridge, TN; 5 shipments to Energy Solutions Erwin Resin Solutions' Facility in Erwin, TN.; and 1 shipment to Energy Solutions Clive Disposal Site in Clive Utah.

Table 7.0
Pilgrim Nuclear Power Station
Annual Radioactive Effluent Release Report
Solid Waste and Irradiated Fuel Shipments
January-December 2015

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (Not irradiated fuel)

1. Estimate of volume and activity content by type of waste

Type of waste	Jan-Dec 2015		
	Volume - m^3	Curies	Total Error
a. Spent resins, filters, filter sludges, evaporator bottoms, etc.	1.11E+02	1.82 E+02	± 25%
b. Dry activated waste, contaminated equipment, etc.	1.11E+03	8.77E+00	± 25%
c. Irradiated components, control rods, etc.	0.00E+00	0.00E+00	N/A
d. Other (describe):	0.00E+00	0.00E+00	N/A

2. Estimate of major nuclide composition by type of waste[1]

Type of waste	Radionuclide	Abundance	Total Error
a. Spent resins, filters, filter sludge's, evaporator bottoms, etc.	H-3	2.11%	± 25%
	Cr-51	2.06%	± 25%
	Mn-54	13.28%	± 25%
	Fe-55	18.98%	± 25%
	Co-58	1.01%	± 25%
	Co-60	32.52%	± 25%
	Zn-65	14.71%	± 25%
	Cs-137	9.24%	± 25%
	Ce-144	2.17%	± 25%
b. Dry activated waste, contaminated equipment, etc.	Mn-54	3.72%	± 25%
	Fe-55	70.39%	± 25%
	Co-60	19.86%	± 25%
	Ni-63	1.92%	± 25%
	Zn-65	2.45%	± 25%
c. Irradiated components, control rods, etc.	N/A	N/A	N/A
d. Other (describe): Contaminated oil and water	N/A	N/A	N/A

[1] *"Major" is defined as any radionuclide comprising >1% of the total activity in the waste category.*

3. Solid Waste Disposition

Number of Shipments	Mode of Transportation	Destination
42	Tractor-trailer (Hittman Transport)	Energy Solutions, Bear Creek Facility[2] Oak Ridge, TN
1	Tractor-trailer (Hittman Transport)	Energy Solutions, Clive Disposal Site Clive, UT
5	Tractor-trailer (Hittman Transport)	Energy Solutions, Erwin Resin Solutions,[2] Erwin, TN

[2] *This processor provides volume reduction services for dry compressible waste, contaminated equipment, etc. Remaining radioactive wastes will be shipped to Envirocare, Inc. in Clive, UT for final disposal.*

B. IRRADIATED FUEL SHIPMENTS & DISPOSITION

Number of Shipments	Mode of Transportation	Destination
None	N/A	N/A

8.0 OFFSITE DOSE CALCULATION MANUAL REVISIONS

The PNPS Offsite Dose Calculation Manual (ODCM) was not revised during the calendar year of 2015. Information regarding revisions to the ODCM can be found attached as Appendix D of this report.

9.0 PROCESS CONTROL PROGRAM REVISIONS

The following list summarizes changes made during 2015 to various procedures related to the Process Control Program (PCP):

EN-RW-102, "Radioactive Shipping Procedure", Rev.12:
The primary purpose of this revision is to issues identified in CR-HQN-2014-00230, CA-07 and CR-HQN-2014-00813

EN-RW-102, "Radioactive Shipping Procedure", Rev.13:
The primary purpose of this revision is to issue identified in CR-HQN-2015-00751 regarding notification of Reactor Engineering of non-waste shipments containing SNM.

- Attachments 9.2, 9.3, 9.4, 9.5, 9.6, 9.7, 9.8, 9.9: replaced "NRC form 540/541" with "the manifest"
- Updated section 8 with information provided by the GGNS Commitment Review
- Added missing document numbers for W3 and RBS entries in section 8
- Added commitment number for GGNS entry in section 8 regarding GNRI-92/00195
- Deleted W3 commitment P-11757 from section 8 per W3 Commitment Review response

EN-RW-104, "Scaling Factors", Rev.11:
Revised step 5.2[2](a) 2nd bullet item adding W3 waste stream sampling method.

EN-RW-104, "Scaling Factors", Rev.12:
Editorial revision to remove reference to specific version of RADMAN software per CR-HQN-2015-00069

- Removed VY from coversheet
- Changed title of section 5.6 as recommended by CR-HQN-2015-00069
- Reworded steps 5.3[2](b) and 5.4[3](b) to align with change being made to title of section 5.6

EN-RW-105, "Process Control Program", Rev.5:
The primary purpose of this revision is to incorporate GGNS Temp Change in response to CR-GGN-2015-1277. Specifically:

- Step 5.1[1](b) added the words "owned by Entergy"
- Added new step 5.9[2] (same as step 5.1[1](b))
- Other changes:
- Removed VY from coversheet and deleted step 5.8[4](e) as fleet procedures no longer apply to VY.
- Reformatted table in section 8 for compliance with EN-AD-101-01, updated the table and deleted VY entries from the table. Updated cross references to section 8 within the body of the procedure.
- Deleted reference to VY commitments from step 5.8[3]

EN-RW-106, "Integrated Transportation Security Plan", Rev. 4:

- Attachment 9.2, "10 CFR Part 37 Subpart D Physical Protection in Transit Required Summary" is deleted and being replaced by other Attachments. What was formerly Attachment 9.3, now becomes Attachment 9.2. Changed reference within the procedure body to reflect this change.
- Added new Attachments 9.3 – 9.8
- Section 4.0: deleted steps [1] and [6] as Physical Security is not responsible for transportation security (per CR-HQN-2015-00098, CA-2)
- Step 4.0[2]: added new responsibility for Training Manager
- Step 5.5[1]: reworded for clarity
- Step 5.5[4]: inserted new step regarding annual review of Carrier TSP (per CR-HQN-2015-0105, CA-3)
- Step 5.5[9]: Changed reference to Attachment from 9.3 to 9.2 to reflect change in attachment number
- Step 5.7.1[2]: revised to reflect new checklist attachments
- Step 5.7.2.1[1]: added reference to Attachment 9.3
- Step 5.7.2.1[2] is separated into two steps and reworded to improve clarity and to provide reference to Attachments 9.4 and 9.5
- Added new steps 5.6[4] and 5.6[5] to address hazmat training requirements identified in CR-HQN-2015-00043
- Added Attachments 9.6, 9.7 and 9.8 to Section 7.0 RECORDS

10.0 REFERENCES

1. U.S. Nuclear Regulatory Commission, "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water Cooled Nuclear Power Plants", Regulatory Guide 1.21, Revision 1, June 1974.

2. "Pilgrim Nuclear Power Station Offsite Dose Calculation Manual", Revision 10, May 2009.

3. U.S. Nuclear Regulatory Commission, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10CFR50 Appendix I", Regulatory Guide 1.109, Revision 1, October 1977.

4. U.S. Nuclear Regulatory Commission, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors", Regulatory Guide 1.111, July 1977.

5. Boston Edison Company, "Pilgrim Station Unit 1 Appendix I Evaluation", April 1977.

6. Entech Engineering Inc., P100-R19, "AEOLUS-3 - A Computer Code for the Determination of Atmospheric Dispersion and Deposition of Nuclear Power Plant Effluents During Continuous, Intermittent and Accident Conditions in Open-Terrain Sites, Coastal Sites and Deep-River Valleys".

7. U.S. Nuclear Regulatory Commission, "XOQDOQ: Computer Program for the Meteorological Evaluation of Routine Effluent Releases at Nuclear Power Stations", NUREG/CR2919, September 1982.

APPENDIX A

Meteorological Joint Frequency Distributions

Table A-1
Joint Frequency Distribution of Wind Directions and Speeds
For the 33-ft level of the 220-ft Tower

Jan-Mar 2015

Class A Freq: 0.024

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
3.5-7.5	6	0	0	0	0	0	0	0	0	0	0	0	1	3	2	7	19
7.5-12.5	0	1	3	0	0	0	0	0	0	0	0	0	0	3	1	0	8
12.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	7	1	3	0	0	0	0	0	0	0	0	0	1	6	3	8	29

Class B Freq: 0.024

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	4
3.5-7.5	1	0	0	0	0	0	0	0	0	0	0	0	7	5	2	1	16
7.5-12.5	2	0	1	1	0	0	0	0	0	0	0	0	0	5	0	0	9
12.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	4	0	1	1	0	0	0	0	0	0	0	0	7	10	2	4	29

Class C Freq: 0.042

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2
3.5-7.5	1	1	0	1	0	0	0	0	0	1	0	1	10	1	2	2	20
7.5-12.5	0	2	1	5	0	0	0	0	0	0	1	0	9	8	1	2	29
12.5-18.5	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	2	3	2	6	0	0	0	0	0	1	1	1	19	10	3	4	52

Class D Freq: 0.682

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	4	3	2	6	4	0	1	2	2	8	9	6	4	13	8	4	76
3.5-7.5	11	21	15	12	7	4	2	1	9	30	43	55	99	48	47	18	422
7.5-12.5	5	31	38	4	3	4	5	5	7	12	6	10	59	61	42	18	310
12.5-18.5	3	11	0	0	0	0	1	7	1	0	0	0	1	7	0	0	31
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	23	66	55	22	14	8	9	15	19	50	58	71	163	129	97	40	839

Table A-1 (continued)

Jan-Mar 2015

Class E Freq: 0.202

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	1	0	1	0	0	2	2	4	5	10	6	6	9	4	2	52
3.5-7.5	0	0	0	0	0	0	10	10	8	10	25	50	41	21	5	1	181
7.5-12.5	0	1	0	0	0	0	4	1	0	0	0	1	3	0	0	0	10
12.5-18.5	0	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	6
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	4	4	1	0	0	16	13	12	15	35	57	50	30	9	3	249

Class F Freq: 0.026

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	2
3.5-7.5	0	0	0	0	0	0	2	0	0	0	17	4	5	1	0	0	29
7.5-12.5	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
12.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	3	0	0	0	18	5	5	1	0	0	32

Class G Freq: 0.000

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.5-7.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.5-12.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Class All Freq: 1.000

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	7	4	2	7	4	0	3	4	6	13	20	13	10	23	12	10	138
3.5-7.5	19	22	15	13	7	4	14	11	17	41	85	110	163	79	58	29	687
7.5-12.5	7	35	43	10	3	4	10	6	7	12	7	11	71	77	44	20	367
12.5-18.5	3	13	5	0	0	0	1	7	1	0	0	0	1	7	0	0	38
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	36	74	65	30	14	8	28	28	31	66	112	134	245	186	114	59	1230

Table A-1 (continued)

Apr-Jun 2015

Class A Freq: 0.411

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	23	26	20	35	28	6	2	1	0	0	0	1	1	8	12	5	168
3.5-7.5	22	22	45	38	57	25	21	8	16	31	17	11	15	39	22	17	406
7.5-12.5	0	4	0	0	0	4	5	4	22	112	27	7	1	0	0	0	186
12.5-18.5	0	0	0	0	0	0	0	2	2	12	0	0	0	0	0	0	16
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	45	52	65	73	85	35	28	15	40	155	44	19	17	47	34	22	776

Class B Freq: 0.024

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	1	0	0	3	1	0	1	0	0	3	0	0	1	0	0	2	12
3.5-7.5	1	2	6	0	1	0	1	1	2	2	0	1	0	1	1	0	19
7.5-12.5	0	0	0	0	0	0	0	1	2	5	1	0	1	0	0	0	10
12.5-18.5	0	0	0	0	0	0	1	2	0	1	0	0	0	0	0	0	4
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	2	2	6	3	2	0	3	4	4	11	1	1	2	1	1	2	45

Class C Freq: 0.026

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	2	2	0	1	0	0	1	0	0	0	1	0	0	0	0	3	10
3.5-7.5	1	7	7	0	1	1	4	1	2	3	1	0	1	0	1	0	30
7.5-12.5	0	0	0	0	0	0	0	2	0	3	0	0	0	0	0	0	5
12.5-18.5	0	0	0	0	0	0	4	1	0	0	0	0	0	0	0	0	5
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	3	9	7	1	1	1	9	4	2	6	2	0	1	0	1	3	50

Class D Freq: 0.189

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	17	3	6	6	11	5	3	2	6	4	4	1	2	1	5	6	82
3.5-7.5	2	18	18	0	2	3	16	12	12	32	14	7	9	10	5	0	160
7.5-12.5	0	2	0	0	0	4	8	4	4	53	34	0	2	1	0	0	112
12.5-18.5	0	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0	3
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	19	23	24	6	13	13	27	18	22	89	54	8	13	12	10	6	357

Table A-1 (continued)

Apr-Jun 2015

Class E Freq: 0.203

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
0.95-3.5	6	2	3	4	3	4	4	7	6	6	5	1	6	12	4	9	82
3.5-7.5	3	4	1	0	1	4	7	17	15	52	40	19	37	10	7	1	218
7.5-12.5	0	0	0	0	0	0	0	1	5	31	35	5	1	0	0	0	78
12.5-18.5	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	5
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	10	6	4	4	4	8	11	25	26	89	85	25	44	22	11	10	384

Class F Freq: 0.093

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
0.95-3.5	1	0	0	1	2	1	2	3	8	4	3	16	21	11	8	2	83
3.5-7.5	1	0	0	0	0	0	0	0	5	4	26	19	9	3	5	1	73
7.5-12.5	0	0	0	0	0	0	0	0	0	0	13	4	0	0	0	0	17
12.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	3	0	0	1	2	1	2	3	13	8	42	40	30	14	13	3	175

Class G Freq: 0.054

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
0.95-3.5	0	1	0	0	0	0	1	0	4	2	2	22	17	7	4	3	63
3.5-7.5	0	0	0	1	1	0	0	1	0	1	12	5	1	1	0	0	23
7.5-12.5	0	0	0	0	0	0	0	0	0	0	14	2	0	0	0	0	16
12.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1	1	0	1	1	0	1	1	4	3	28	29	18	8	4	3	103

Class All Freq: 1.000

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	3	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	4
0.95-3.5	50	34	29	50	45	16	14	13	24	19	15	41	48	39	33	30	500
3.5-7.5	30	53	77	39	63	33	49	40	52	125	110	62	72	64	41	19	929
7.5-12.5	0	6	0	0	0	8	13	12	33	204	124	18	5	1	0	0	424
12.5-18.5	0	0	0	0	0	1	5	5	2	13	7	0	0	0	0	0	33
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	83	93	106	89	108	58	81	70	111	361	256	122	125	104	74	49	1890

Table A-1 (continued)

Jul-Sep 2015

Class A Freq: 0.382

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
0.95-3.5	24	39	34	43	38	12	3	3	4	2	2	3	15	15	19	14	270
3.5-7.5	17	63	32	22	29	16	14	24	46	68	59	24	21	3	1	4	443
7.5-12.5	0	0	0	0	0	0	5	11	24	25	7	0	0	0	0	0	72
12.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	41	102	67	65	67	28	22	38	74	95	68	27	36	18	20	18	786

Class B Freq: 0.012

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	1	2	2	0	1	0	1	0	0	0	0	0	1	0	0	8
3.5-7.5	0	4	1	0	0	1	0	1	2	3	1	0	0	0	1	0	14
7.5-12.5	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	3
12.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	5	3	2	0	2	0	3	2	4	2	0	0	1	1	0	25

Class C Freq: 0.015

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	1	0	0	2	1	0	0	0	0	0	0	2	1	1	0	2	10
3.5-7.5	1	2	1	0	1	0	0	1	5	1	3	4	0	0	0	0	19
7.5-12.5	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2
12.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	2	2	1	2	2	0	1	2	5	1	3	6	1	1	0	2	31

Class D Freq: 0.098

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	5	2	9	1	5	3	0	5	1	1	1	5	4	1	7	5	55
3.5-7.5	5	9	3	2	2	7	12	11	14	30	7	10	3	4	1	3	123
7.5-12.5	0	0	0	0	0	0	3	10	1	7	0	0	0	0	0	0	21
12.5-18.5	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	3
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	10	11	12	3	7	10	16	27	17	38	8	15	7	5	8	8	202

Table A-1 (continued)

Jul-Sep 2015

Class E Freq: 0.288

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
0.95-3.5	9	17	22	10	4	12	8	8	15	14	14	3	16	17	20	10	199
3.5-7.5	4	27	6	5	1	10	5	24	46	115	55	36	2	0	0	0	336
7.5-12.5	0	0	0	0	0	0	1	1	1	37	17	1	0	0	0	0	58
12.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	13	44	28	15	5	22	14	33	62	167	86	40	18	17	20	10	594

Class F Freq: 0.151

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
0.95-3.5	3	6	5	5	0	2	2	8	8	6	14	37	18	9	5	0	128
3.5-7.5	0	0	0	0	0	0	0	4	8	13	75	55	2	0	0	0	157
7.5-12.5	0	0	0	0	0	0	0	0	0	8	15	1	0	0	0	0	24
12.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	3	6	5	5	0	3	2	12	16	27	104	93	20	9	5	0	310

Class G Freq: 0.054

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	2
0.95-3.5	0	0	1	0	0	0	1	1	9	7	11	27	10	2	0	1	70
3.5-7.5	0	0	0	0	0	0	0	0	1	5	19	11	0	0	0	0	36
7.5-12.5	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	3
12.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	1	0	0	0	1	1	11	12	33	38	11	2	0	1	111

Class All Freq: 1.000

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	1	0	0	1	0	0	1	1	0	0	1	0	0	0	5
0.95-3.5	42	65	73	63	48	30	14	26	37	30	42	77	64	46	51	32	740
3.5-7.5	27	105	43	29	33	34	31	65	122	235	219	140	28	7	3	7	1128
7.5-12.5	0	0	0	0	0	0	10	24	26	78	43	2	0	0	0	0	183
12.5-18.5	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	3
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	69	170	117	92	81	65	56	116	187	344	304	219	93	53	54	39	2059

Table A-1 (continued)

Oct-Dec 2015

Class A Freq: 0.235

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	7	7	12	12	6	2	0	0	3	1	0	0	5	4	6	5	70
3.5-7.5	16	32	14	13	4	6	5	1	12	13	27	16	35	23	13	17	247
7.5-12.5	0	13	1	0	0	3	8	6	9	12	9	3	6	4	0	0	74
12.5-18.5	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	23	52	27	25	10	11	14	7	24	26	36	19	46	31	19	22	392

Class B Freq: 0.032

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	1	0	0	0	2	0	0	0	0	0	1	0	0	0	4
3.5-7.5	1	12	1	1	0	1	1	0	1	1	3	2	5	0	1	0	30
7.5-12.5	0	12	1	0	0	0	0	1	1	1	0	0	3	0	0	0	19
12.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1	24	3	1	0	1	3	1	2	2	3	2	9	0	1	0	53

Class C Freq: 0.040

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	0	0	1	0	1	1	0	0	1	0	0	0	0	0	4
3.5-7.5	0	6	3	1	1	1	0	1	3	2	4	1	1	0	2	0	26
7.5-12.5	0	19	3	0	0	0	6	0	0	6	1	0	1	0	0	0	36
12.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	25	6	1	2	1	7	2	3	8	6	1	2	0	2	0	66

Class D Freq: 0.190

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	2	2	1	2	0	2	0	3	0	1	2	1	3	3	3	0	25
3.5-7.5	17	45	21	2	1	4	5	5	12	15	7	8	9	6	16	10	183
7.5-12.5	9	39	9	0	0	4	10	2	4	9	3	1	3	1	1	1	96
12.5-18.5	0	0	0	0	0	0	6	6	2	0	0	0	0	0	0	0	14
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	28	86	31	4	1	10	21	16	18	25	12	10	15	10	20	11	318

Table A-1 (continued)

Oct-Dec 2015

Class E Freq: 0.314

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
0.95-3.5	4	1	2	2	1	0	1	5	9	5	5	9	6	3	3	0	56
3.5-7.5	13	6	4	2	2	3	15	25	32	57	58	74	46	29	32	2	400
7.5-12.5	3	1	0	0	0	0	6	9	4	17	12	8	7	0	0	1	68
12.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	20	8	6	4	3	3	22	39	45	79	75	91	60	32	35	3	525

Class F Freq: 0.147

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
0.95-3.5	2	2	0	0	0	2	4	10	7	2	6	5	8	4	3	1	56
3.5-7.5	0	0	0	0	0	0	11	31	28	27	53	28	4	2	0	1	185
7.5-12.5	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	3
12.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	2	2	0	0	0	2	15	41	35	29	63	33	12	6	3	2	245

Class G Freq: 0.043

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	0	0	0	0	1	4	2	6	18	14	3	0	0	0	48
3.5-7.5	0	0	0	0	0	0	0	0	0	3	13	4	0	0	0	0	20
7.5-12.5	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	3
12.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	1	4	2	9	34	18	3	0	0	0	71

Class All Freq: 1.000

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	2
0.95-3.5	15	12	16	16	8	6	9	23	21	15	32	29	26	14	15	6	263
3.5-7.5	47	101	43	19	8	15	37	63	88	118	165	133	100	60	64	30	1091
7.5-12.5	12	84	14	0	0	7	30	18	18	45	31	12	20	5	1	2	299
12.5-18.5	0	0	0	0	0	0	7	6	2	0	0	0	0	0	0	0	15
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	74	197	73	35	16	28	83	110	129	178	229	174	147	79	80	38	1670

Table A-1 (continued)

Jan-Dec 2015

Class A Freq: 0.290

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
0.95-3.5	55	72	66	90	72	20	5	4	7	3	2	4	21	27	37	25	510
3.5-7.5	61	117	91	73	90	47	40	33	74	112	103	51	72	68	38	45	1115
7.5-12.5	0	18	4	0	0	7	18	21	55	149	43	10	7	7	1	0	340
12.5-18.5	0	0	0	0	0	0	1	2	2	12	0	0	0	0	0	0	17
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	116	207	162	163	162	74	64	60	138	276	148	65	100	102	76	70	1983

Class B Freq: 0.022

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	2	1	3	5	1	1	3	1	0	3	0	0	2	1	0	5	28
3.5-7.5	3	18	8	1	1	2	2	2	5	6	4	3	12	6	5	1	79
7.5-12.5	2	12	2	1	0	0	0	3	3	7	2	0	4	5	0	0	41
12.5-18.5	0	0	0	0	0	0	1	2	0	1	0	0	0	0	0	0	4
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	7	31	13	7	2	3	6	8	8	17	6	3	18	12	5	6	152

Class C Freq: 0.029

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	4	2	0	3	2	0	2	1	0	0	2	2	1	2	0	5	26
3.5-7.5	3	16	11	2	3	2	4	3	10	7	8	6	12	1	5	2	95
7.5-12.5	0	21	4	5	0	0	7	3	0	9	2	0	10	8	1	2	72
12.5-18.5	0	0	1	0	0	0	4	1	0	0	0	0	0	0	0	0	6
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	7	39	16	10	5	2	17	8	10	16	12	8	23	11	6	9	199

Class D Freq: 0.251

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	28	10	18	15	20	10	4	12	9	14	16	13	13	18	23	15	238
3.5-7.5	35	93	57	16	12	18	35	29	47	107	71	80	120	68	69	31	888
7.5-12.5	14	72	47	4	3	12	26	21	16	81	43	11	64	63	43	19	539
12.5-18.5	3	11	0	0	0	1	8	14	4	0	2	0	1	7	0	0	51
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	80	186	122	35	35	41	73	76	76	202	132	104	198	156	135	65	1716

Table A-1 (continued)

Jan-Dec 2015

Class E Freq: 0.256

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	3
0.95-3.5	19	21	27	17	8	16	15	22	34	30	34	19	34	41	31	21	389
3.5-7.5	20	37	11	7	4	17	37	76	101	234	178	179	126	60	44	4	1135
7.5-12.5	3	2	0	0	0	0	11	12	10	85	64	15	11	0	0	1	214
12.5-18.5	0	2	4	0	0	0	0	0	0	0	5	0	0	0	0	0	11
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	43	62	42	24	12	33	63	110	145	350	281	213	172	101	75	26	1752

Class F Freq: 0.111

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	1	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	4
0.95-3.5	6	8	5	6	2	5	8	21	23	12	24	59	47	24	16	3	269
3.5-7.5	1	0	0	0	0	0	13	35	41	44	171	106	20	6	5	2	444
7.5-12.5	0	0	0	0	0	0	1	0	0	8	31	5	0	0	0	0	45
12.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	8	8	5	6	2	6	22	56	64	64	227	171	67	30	21	5	762

Class G Freq: 0.042

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	3
0.95-3.5	0	1	1	0	0	0	3	5	15	15	31	63	30	9	4	4	181
3.5-7.5	0	0	0	1	1	0	0	1	1	9	44	20	1	1	0	0	79
7.5-12.5	0	0	0	0	0	0	0	0	0	0	20	2	0	0	0	0	22
12.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1	1	1	1	1	0	3	6	17	24	95	85	32	10	4	4	285

Class All Freq: 1.000

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	3	0	1	0	0	1	0	0	1	1	1	1	2	0	0	0	11
0.95-3.5	114	115	120	136	105	52	40	66	88	77	109	160	148	122	111	78	1641
3.5-7.5	123	281	178	100	111	86	131	179	279	519	579	445	363	210	166	85	3835
7.5-12.5	19	125	57	10	3	19	63	60	84	339	205	43	96	83	45	22	1273
12.5-18.5	3	13	5	0	0	1	14	19	6	13	7	0	1	7	0	0	89
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	262	534	361	246	219	159	248	324	458	949	901	649	610	422	322	185	6849

Table A-2
Joint Frequency Distribution of Wind Directions and Speeds
For the 220-ft level of the 220-ft Tower

Jan-Mar 2015

Class A Freq: 0.022

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.5-7.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
7.5-12.5	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	4
12.5-18.5	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	2	6
18.5-24	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	4	6
>24	2	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	6
TOTAL	6	0	3	0	0	0	0	0	0	0	0	0	1	5	2	7	24

Class B Freq: 0.026

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.5-7.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4
7.5-12.5	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	3
12.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	5	2	0	0	7
18.5-24	1	0	1	1	0	0	0	0	0	0	0	0	0	3	2	1	9
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	6
TOTAL	1	0	1	1	0	0	0	0	0	0	0	0	7	8	4	7	29

Class C Freq: 0.045

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.5-7.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
7.5-12.5	0	0	0	0	0	0	0	0	0	1	0	1	2	0	0	0	4
12.5-18.5	1	0	0	0	0	0	0	0	0	0	0	0	7	0	2	1	11
18.5-24	1	0	0	2	0	0	0	0	0	0	1	0	3	2	0	1	10
>24	0	2	2	4	0	0	0	0	0	0	0	0	4	7	2	2	23
TOTAL	2	2	2	6	0	0	0	0	0	1	1	1	16	9	5	5	50

Class D Freq: 0.684

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	1	1	0	0	0	0	1	1	1	0	0	0	0	0	0	0	5
3.5-7.5	1	2	1	5	0	0	0	0	1	7	6	5	6	2	5	3	44
7.5-12.5	4	4	9	8	5	0	1	0	4	27	28	26	20	8	10	6	160
12.5-18.5	6	12	4	6	3	2	5	2	2	10	22	30	46	14	19	6	189
18.5-24	3	5	8	0	2	6	1	0	0	6	4	9	35	25	12	9	125
>24	23	37	14	4	4	1	0	0	0	0	0	1	5	50	63	27	229
TOTAL	38	61	36	23	14	9	8	3	8	50	60	71	112	99	109	51	752

Table A-2 (continued)

Jan-Mar 2015

Class E Freq: 0.196

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
3.5-7.5	1	2	1	0	0	1	0	0	0	1	3	1	2	2	2	2	18
7.5-12.5	1	0	1	0	0	2	1	2	1	6	3	11	14	5	5	3	55
12.5-18.5	0	0	0	0	0	2	4	3	2	5	9	21	39	17	13	4	119
18.5-24	0	0	0	0	0	0	1	0	0	0	1	4	5	2	3	0	16
>24	0	4	3	0	0	0	0	0	0	0	0	0	0	0	0	0	7
TOTAL	2	6	6	0	0	5	6	5	3	12	16	37	60	26	23	9	216

Class F Freq: 0.026

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.5-7.5	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
7.5-12.5	0	0	0	0	0	0	0	0	0	0	2	2	4	1	2	0	11
12.5-18.5	0	0	0	0	0	0	0	0	0	0	4	6	3	0	2	0	15
18.5-24	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	2
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	7	9	7	2	4	0	29

Class G Freq: 0.000

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.5-7.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.5-12.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Class All Freq: 1.000

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	1	1	1	0	0	0	1	1	1	0	0	0	0	0	0	0	6
3.5-7.5	3	4	2	5	0	1	0	0	1	8	9	6	8	5	8	11	71
7.5-12.5	7	4	10	8	5	2	2	2	5	34	33	40	42	17	17	9	237
12.5-18.5	8	12	5	6	3	4	9	5	4	15	35	57	101	33	37	13	347
18.5-24	5	5	11	3	2	6	2	0	0	6	7	14	43	32	17	15	168
>24	25	43	19	8	4	1	0	0	0	0	0	1	9	62	68	31	271
TOTAL	49	69	48	30	14	14	14	8	11	63	84	118	203	149	147	79	1100

Table A-2 (continued)

Apr-Jun 2015

Class A Freq: 0.411

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	1	7	5	4	1	1	1	0	0	0	0	0	0	0	2	2	24
3.5-7.5	21	23	26	19	21	14	9	3	1	2	5	1	4	4	6	6	165
7.5-12.5	9	11	17	19	19	44	19	5	13	14	17	10	8	9	11	10	235
12.5-18.5	18	6	4	0	0	5	13	4	19	71	28	7	9	27	3	11	225
18.5-24	7	5	1	0	0	3	0	0	3	52	8	0	2	9	7	5	102
>24	7	1	0	0	0	1	1	1	1	6	2	0	0	1	3	1	25
TOTAL	63	53	53	42	41	68	43	13	37	145	60	18	23	50	32	35	776

Class B Freq: 0.024

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2
3.5-7.5	0	0	0	1	0	1	0	1	0	2	1	0	0	0	1	0	7
7.5-12.5	2	0	3	0	0	0	1	1	1	0	0	0	0	0	0	1	9
12.5-18.5	0	0	3	0	0	0	1	1	2	4	1	1	0	0	2	0	15
18.5-24	1	1	0	0	0	0	0	1	0	1	2	0	0	0	0	0	6
>24	1	0	0	0	0	0	2	0	0	2	0	0	0	1	0	0	6
TOTAL	4	1	6	1	0	1	5	5	3	9	4	1	0	1	3	1	45

Class C Freq: 0.026

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.5-7.5	1	1	0	1	0	1	0	0	0	0	1	0	0	0	1	1	7
7.5-12.5	2	0	3	0	1	1	0	1	0	2	0	0	0	0	0	1	11
12.5-18.5	1	0	4	0	0	3	1	1	1	4	1	0	1	0	0	0	17
18.5-24	2	5	0	0	0	0	0	2	0	1	0	0	0	0	1	0	11
>24	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	4
TOTAL	6	6	7	1	1	5	5	4	1	7	2	0	1	0	2	2	50

Class D Freq: 0.189

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	2	0	0	0	1	0	1	0	0	0	0	1	0	0	5
3.5-7.5	4	5	1	6	6	4	2	1	7	6	1	0	0	0	0	3	46
7.5-12.5	3	2	9	0	3	4	5	10	5	5	6	3	1	0	3	11	70
12.5-18.5	6	4	7	0	1	5	8	8	2	34	22	4	6	5	6	2	120
18.5-24	2	9	1	0	0	2	3	0	1	32	32	0	2	4	4	0	92
>24	3	1	1	0	4	1	1	0	0	2	10	0	0	0	1	0	24
TOTAL	18	21	21	6	14	16	20	19	16	79	71	7	9	10	14	16	357

Table A-2 (continued)

Apr-Jun 2015

Class E Freq: 0.203

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	1	0	0	2	1	2	0	1	1	1	1	0	0	0	0	10
3.5-7.5	0	4	2	2	1	2	3	5	0	2	2	1	0	1	2	0	27
7.5-12.5	6	0	1	2	0	4	5	12	4	6	8	3	6	1	1	7	66
12.5-18.5	4	1	0	0	0	1	1	9	7	27	33	10	20	8	8	4	133
18.5-24	4	0	0	0	0	2	0	1	4	26	42	2	3	18	6	2	110
>24	2	0	0	0	2	0	0	0	0	1	26	0	0	3	4	0	38
TOTAL	16	6	3	4	5	10	11	27	16	63	112	17	29	31	21	13	384

Class F Freq: 0.093

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	2	2	0	1	1	0	1	0	0	0	0	0	0	0	0	0	7
3.5-7.5	4	4	1	2	1	0	3	4	1	1	1	0	0	1	2	2	27
7.5-12.5	2	1	0	0	0	0	5	3	2	2	1	4	3	9	8	5	45
12.5-18.5	2	0	0	0	0	0	0	1	3	3	10	16	7	13	8	2	65
18.5-24	0	0	0	0	0	0	0	0	1	1	9	4	0	1	3	2	21
>24	1	0	0	0	0	0	0	0	0	0	4	1	0	0	1	3	10
TOTAL	11	7	1	3	2	0	9	8	7	7	25	25	10	24	22	14	175

Class G Freq: 0.054

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	2
3.5-7.5	3	1	1	2	2	2	0	0	2	1	0	1	0	0	4	3	22
7.5-12.5	4	4	0	0	0	1	1	1	2	2	1	3	2	2	12	5	40
12.5-18.5	3	1	0	0	0	0	0	1	0	1	5	4	2	5	3	1	26
18.5-24	0	0	0	0	0	0	0	0	0	0	1	8	0	0	0	0	9
>24	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	4
TOTAL	10	6	2	2	3	3	1	2	4	4	9	18	4	7	19	9	103

Class All Freq: 1.000

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	3	10	8	5	5	2	6	1	2	1	1	1	0	1	2	2	50
3.5-7.5	33	38	31	33	31	24	17	14	11	14	11	3	4	6	16	15	301
7.5-12.5	28	18	33	21	23	54	36	33	27	31	33	23	20	21	35	40	476
12.5-18.5	34	12	18	0	1	14	24	25	34	144	100	42	45	58	30	20	601
18.5-24	16	20	2	0	0	7	3	4	9	113	94	14	7	32	21	9	351
>24	14	2	1	0	6	2	8	1	1	11	44	3	0	5	9	4	111
TOTAL	128	100	93	59	66	103	94	78	84	314	283	86	76	123	113	90	1890

Table A-2 (continued)

Jul-Sep 2015

Class A Freq: 0.389

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	8	7	8	5	3	2	1	1	1	1	0	0	0	0	1	5	43
3.5-7.5	14	8	28	21	17	25	16	4	5	4	6	10	9	8	7	11	193
7.5-12.5	15	20	17	2	18	20	19	16	31	28	30	24	23	8	5	7	283
12.5-18.5	27	17	11	7	4	0	4	8	22	53	34	8	11	7	1	4	218
18.5-24	9	17	0	0	0	0	0	0	1	2	6	0	0	0	0	0	35
>24	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4
TOTAL	76	69	64	35	42	47	40	29	60	88	76	42	43	23	14	28	776

Class B Freq: 0.012

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.5-7.5	0	1	0	0	1	0	1	1	0	0	0	0	0	0	1	0	5
7.5-12.5	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	3
12.5-18.5	0	1	0	1	0	0	1	1	0	3	4	0	0	0	0	0	11
18.5-24	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	4
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1	3	3	1	1	0	2	2	0	3	5	0	0	0	1	1	23

Class C Freq: 0.015

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.5-7.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.5-12.5	1	0	0	1	0	1	0	0	3	2	1	0	5	0	1	2	17
12.5-18.5	1	1	1	0	0	0	0	1	1	1	2	1	0	1	0	0	10
18.5-24	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	3	1	1	1	0	1	1	1	4	3	3	1	5	1	1	2	29

Class D Freq: 0.096

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1	3
3.5-7.5	3	0	3	0	3	1	0	3	1	0	0	1	2	1	0	1	19
7.5-12.5	4	3	2	2	5	6	7	3	7	10	0	2	2	3	1	2	59
12.5-18.5	2	4	4	5	2	0	2	15	5	23	14	2	4	1	2	1	86
18.5-24	1	0	0	0	0	0	1	2	0	4	2	0	1	0	0	2	13
>24	5	2	0	0	0	0	1	0	1	0	0	0	0	0	0	2	11
TOTAL	15	9	9	9	10	7	11	23	14	37	16	5	9	5	3	9	191

Table A-2 (continued)

Jul-Sep 2015

Class E Freq: 0.289

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	1	1	0	1	0	0	0	1	0	0	0	0	0	0	0	4
3.5-7.5	6	3	3	2	1	1	5	1	3	5	2	2	0	0	3	4	41
7.5-12.5	15	6	25	9	8	1	6	7	11	23	11	5	2	2	3	6	140
12.5-18.5	6	14	6	9	8	4	3	14	15	78	58	18	16	4	3	16	272
18.5-24	2	6	0	2	0	0	0	0	1	45	41	1	7	0	0	0	105
>24	4	7	0	0	0	0	0	0	1	2	0	0	0	0	0	0	14
TOTAL	33	37	35	22	18	6	14	22	32	153	112	26	25	6	9	26	576

Class F Freq: 0.147

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	2	0	0	0	0	3	0	0	0	0	0	0	0	0	0	1	6
3.5-7.5	1	0	2	0	1	2	2	3	0	2	1	0	0	0	6	5	25
7.5-12.5	3	1	5	7	3	0	0	5	3	9	3	7	17	22	8	8	101
12.5-18.5	2	1	0	1	0	0	0	4	8	3	14	31	41	18	5	0	128
18.5-24	0	0	0	0	0	0	0	0	0	2	24	6	1	0	0	0	33
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	8	2	7	8	4	5	2	12	11	16	42	44	59	40	19	14	293

Class G Freq: 0.054

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
0.95-3.5	0	1	2	2	0	2	0	0	0	1	0	0	0	1	0	0	9
3.5-7.5	0	0	1	0	2	2	3	1	1	0	0	0	0	2	5	0	17
7.5-12.5	1	1	0	2	1	1	3	0	5	2	1	10	9	8	5	1	50
12.5-18.5	0	0	0	1	0	0	0	3	3	1	3	3	7	4	3	0	28
18.5-24	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	3
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1	3	3	5	3	5	6	4	9	4	7	13	16	15	13	1	108

Class All Freq: 1.000

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
0.95-3.5	10	9	11	9	4	7	1	1	2	2	0	0	0	1	1	7	65
3.5-7.5	24	12	37	23	25	31	27	13	10	11	9	13	11	11	22	21	300
7.5-12.5	39	31	51	23	35	29	35	31	60	74	47	48	58	43	23	26	653
12.5-18.5	38	38	22	24	14	4	10	46	54	162	129	63	79	35	14	21	753
18.5-24	14	24	1	2	0	0	2	2	2	53	76	7	9	0	0	3	195
>24	12	9	0	0	0	0	1	0	2	2	0	0	0	0	0	3	29
TOTAL	137	124	122	81	78	71	76	93	130	304	261	131	157	90	60	81	1996

Table A-2 (continued)

Oct-Dec 2015

Class A Freq: 0.235

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	1	0	3	3	1	0	0	0	0	0	0	0	0	0	0	0	8
3.5-7.5	7	7	11	8	9	3	2	0	3	1	2	1	3	5	9	0	71
7.5-12.5	5	6	3	1	7	4	5	1	6	5	12	15	12	10	4	5	101
12.5-18.5	9	8	11	0	1	3	7	6	3	12	30	3	10	21	2	9	135
18.5-24	2	5	8	0	0	4	1	0	3	2	2	1	3	7	7	8	53
>24	0	7	1	0	1	0	0	0	0	0	0	0	3	5	1	6	24
TOTAL	24	33	37	12	19	14	15	7	15	20	46	20	31	48	23	28	392

Class B Freq: 0.032

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.5-7.5	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	3
7.5-12.5	0	0	1	0	0	0	1	0	0	0	1	0	1	2	0	0	6
12.5-18.5	0	2	7	1	0	1	0	1	0	3	1	1	1	1	1	0	20
18.5-24	1	5	7	0	0	0	0	0	0	1	0	0	4	1	0	0	19
>24	0	4	0	0	0	0	0	0	0	0	0	0	1	0	0	0	5
TOTAL	1	11	16	1	0	3	1	1	0	4	2	1	7	4	1	0	53

Class C Freq: 0.039

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.5-7.5	0	0	0	0	0	1	0	1	0	0	1	1	0	0	0	0	4
7.5-12.5	0	0	0	1	1	0	0	0	1	0	2	0	0	0	1	0	6
12.5-18.5	0	4	2	2	0	2	4	1	0	6	5	1	0	1	1	0	29
18.5-24	0	0	3	0	0	0	1	0	0	0	2	0	1	0	0	0	7
>24	0	17	2	0	0	0	0	0	0	0	0	0	0	0	0	0	19
TOTAL	0	21	7	3	1	3	5	2	1	6	10	2	1	1	2	0	65

Class D Freq: 0.191

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	3
3.5-7.5	1	1	3	1	0	2	1	1	1	0	0	1	0	1	1	0	14
7.5-12.5	1	5	0	1	0	0	1	5	3	8	3	3	2	2	3	2	39
12.5-18.5	11	20	5	2	1	3	7	2	1	13	8	5	9	2	8	5	102
18.5-24	5	14	23	3	0	2	3	6	0	9	4	0	2	1	8	3	83
>24	18	20	11	1	1	2	4	3	2	0	0	0	1	2	2	10	77
TOTAL	36	60	42	9	2	9	17	17	7	31	15	9	14	8	22	20	318

Table A-2 (continued)

Oct-Dec 2015

Class E Freq: 0.315

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	1	0	1	1	0	0	0	1	0	0	0	0	0	1	5
3.5-7.5	0	1	1	1	0	2	2	0	2	3	0	0	0	1	0	0	13
7.5-12.5	1	3	4	1	0	1	6	8	7	13	12	8	4	0	4	1	73
12.5-18.5	9	1	0	4	3	1	7	16	18	29	55	30	53	29	13	2	270
18.5-24	4	1	0	0	1	0	0	1	4	15	21	12	18	21	26	7	131
>24	5	1	0	0	0	0	0	0	0	2	8	0	3	1	11	2	33
TOTAL	19	7	6	6	5	5	15	25	31	63	96	50	78	52	54	13	525

Class F Freq: 0.147

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	3
3.5-7.5	0	1	2	0	2	3	0	0	2	1	0	2	0	1	0	0	14
7.5-12.5	4	1	0	0	1	3	14	8	6	4	7	4	7	4	4	0	67
12.5-18.5	2	0	0	0	0	2	14	17	6	15	17	18	30	7	5	4	137
18.5-24	0	0	0	0	0	0	0	1	0	1	15	1	2	2	0	0	22
>24	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	2
TOTAL	6	2	3	1	4	8	28	26	14	21	40	25	39	14	9	5	245

Class G Freq: 0.043

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	0	1	2	1	3	1	0	1	1	0	0	0	0	0	10
3.5-7.5	0	0	0	0	2	6	0	5	1	1	0	0	8	2	0	0	25
7.5-12.5	0	0	0	0	0	1	2	1	0	0	4	3	3	1	1	3	19
12.5-18.5	0	0	0	0	0	1	1	0	0	0	3	1	2	3	1	0	12
18.5-24	0	0	0	0	0	0	0	0	0	0	3	1	0	1	0	0	5
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	1	4	9	6	7	1	2	11	5	13	7	2	3	71

Class All Freq: 1.000

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	1	0	5	6	5	2	4	1	0	3	1	0	0	0	0	1	29
3.5-7.5	8	10	18	10	13	19	5	7	9	6	3	5	11	10	10	0	144
7.5-12.5	11	15	8	4	9	9	29	23	23	30	41	33	29	19	17	11	311
12.5-18.5	31	35	25	9	5	13	40	43	28	78	119	59	105	64	31	20	705
18.5-24	12	25	41	3	1	6	5	8	7	28	47	15	30	33	41	18	320
>24	23	49	14	1	2	2	4	3	2	2	9	0	8	8	14	19	160
TOTAL	86	134	111	33	35	51	87	85	69	147	220	112	183	134	113	69	1669

Table A-2 (continued)

Jan-Dec 2015

Class A Freq: 0.296

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	10	14	16	12	5	3	2	1	1	1	0	0	0	0	3	7	75
3.5-7.5	43	38	65	48	47	42	27	7	9	7	13	12	16	17	22	18	431
7.5-12.5	31	37	37	22	44	68	43	22	50	47	59	49	43	29	20	22	623
12.5-18.5	55	31	27	7	5	8	24	18	44	136	92	18	31	55	7	26	584
18.5-24	18	27	11	0	0	7	1	0	7	56	16	1	5	16	14	17	196
>24	12	8	1	0	1	1	1	1	1	6	2	0	3	9	5	8	59
TOTAL	169	155	157	89	102	129	98	49	112	253	182	80	98	126	71	98	1968

Class B Freq: 0.023

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2
3.5-7.5	0	1	1	1	1	3	1	2	0	2	1	0	0	0	2	4	19
7.5-12.5	2	0	6	0	0	0	2	1	1	0	2	0	3	3	0	1	21
12.5-18.5	0	3	10	2	0	1	2	3	2	10	6	2	6	3	3	0	53
18.5-24	4	7	9	1	0	0	0	1	0	2	2	0	4	4	2	2	38
>24	1	4	0	0	0	0	2	0	0	2	0	0	1	3	2	2	17
TOTAL	7	15	26	4	1	4	8	8	3	16	11	2	14	13	9	9	150

Class C Freq: 0.029

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.5-7.5	1	1	0	1	0	2	0	1	0	0	2	1	0	0	2	2	13
7.5-12.5	3	0	3	2	2	2	0	1	4	5	3	1	7	0	2	3	38
12.5-18.5	3	5	7	2	0	5	5	3	2	11	8	2	8	2	3	1	67
18.5-24	4	5	3	2	0	0	2	2	0	1	3	0	4	2	1	1	30
>24	0	19	4	4	0	0	4	0	0	0	0	0	4	7	2	2	46
TOTAL	11	30	17	11	2	9	11	7	6	17	16	4	23	11	10	9	194

Class D Freq: 0.243

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	1	1	2	3	0	0	3	1	2	1	0	0	0	1	0	1	16
3.5-7.5	9	8	8	12	9	7	3	5	10	13	7	7	8	4	6	7	123
7.5-12.5	12	14	20	11	13	10	14	18	19	50	37	34	25	13	17	21	328
12.5-18.5	25	40	20	13	7	10	22	27	10	80	66	41	65	22	35	14	497
18.5-24	11	28	32	3	2	10	8	8	1	51	42	9	40	30	24	14	313
>24	49	60	26	5	9	4	6	3	3	2	10	1	6	52	66	39	341
TOTAL	107	151	108	47	40	41	56	62	45	197	162	92	144	122	148	96	1618

Table A-2 (continued)

Jan-Dec 2015

Class E Freq: 0.256

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	2	3	0	4	2	2	0	2	2	1	1	0	0	0	1	20
3.5-7.5	7	10	7	5	2	6	10	6	5	11	7	4	2	4	7	6	99
7.5-12.5	23	9	31	12	8	8	18	29	23	48	34	27	26	8	13	17	334
12.5-18.5	19	16	6	13	11	8	15	42	42	139	155	79	128	58	37	26	794
18.5-24	10	7	0	2	1	2	1	2	9	86	105	19	33	41	35	9	362
>24	11	12	3	0	2	0	0	0	1	5	34	0	3	4	15	2	92
TOTAL	70	56	50	32	28	26	46	79	82	291	336	130	192	115	107	61	1701

Class F Freq: 0.111

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	4	2	1	2	2	3	1	0	0	0	0	0	0	0	0	1	16
3.5-7.5	5	5	5	2	4	5	5	7	3	4	2	2	0	3	8	7	67
7.5-12.5	9	3	5	7	4	3	19	16	11	15	13	17	31	36	22	13	224
12.5-18.5	6	1	0	1	0	2	14	22	17	21	45	71	81	38	20	6	345
18.5-24	0	0	0	0	0	0	0	1	1	4	49	12	3	3	3	2	78
>24	1	0	0	0	0	0	0	0	0	0	5	1	0	0	1	4	12
TOTAL	25	11	11	12	10	13	39	46	32	44	114	103	115	80	54	33	742

Class G Freq: 0.042

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
0.95-3.5	0	1	3	3	3	3	3	1	0	2	1	0	0	1	0	0	21
3.5-7.5	3	1	2	2	6	10	3	6	4	2	0	1	8	4	9	3	64
7.5-12.5	5	5	0	2	1	3	6	2	7	4	6	16	14	11	18	9	109
12.5-18.5	3	1	0	1	0	1	1	4	3	2	11	8	11	12	7	1	66
18.5-24	0	0	0	0	0	0	0	0	0	0	7	9	0	1	0	0	17
>24	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	4
TOTAL	11	9	5	8	10	17	13	13	14	10	27	36	33	29	34	13	282

Class All Freq: 1.000

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
0.95-3.5	15	20	25	20	14	11	12	4	5	6	2	1	0	2	3	10	150
3.5-7.5	68	64	88	71	69	75	49	34	31	39	32	27	34	32	56	47	816
7.5-12.5	85	68	102	56	72	94	102	89	115	169	154	144	149	100	92	86	1677
12.5-18.5	111	97	70	39	23	35	83	119	120	399	383	221	330	190	112	74	2406
18.5-24	47	74	55	8	3	19	12	14	18	200	224	50	89	97	79	45	1034
>24	74	103	34	9	12	5	13	4	5	15	53	4	17	75	91	57	571
TOTAL	400	427	374	203	193	239	271	264	294	828	848	447	619	496	433	319	6655

APPENDIX B

Results of Onsite Groundwater Monitoring Program

In response to the Nuclear Energy Institute (NEI) Groundwater Protection Initiative, Pilgrim Station instituted a groundwater monitoring program during 2007. Four monitoring wells were installed inside the protected area fence during the fourth quarter of 2007. The first samples were collected in November 2007. Since these are onsite wells, they are not considered part of the Radiological Environmental Monitoring Program (REMP), and data from these wells are being reported in the annual Radiological Effluent Release Report. Two pre-existing wells were incorporated into the groundwater monitoring program in early 2008. Additional wells were added to the program in 2010 (12 wells), 2011 (2 wells), 2012 (1 well), 2013 (3 wells), and 2014 (1 well). A total of 23 wells are being sampled on a routine basis.

In addition to sampling the onsite monitoring wells, samples of surface water are collected from two locations in the PNPS Intake Canal. These locations are along the shoreline in the same direction as the groundwater flow gradient.

All samples collected are analyzed for tritium, a radioactive isotope of hydrogen, and also for gamma emitting radionuclides. In accordance with industry practice established under the NEI initiative, lower limits of detection (LLDs) used for analysis of REMP samples were used when assessing these samples for the presence of radioactivity. Low levels of tritium were detected in many of the onsite wells. Although gamma spectroscopy indicated the presence of naturally-occurring radioactivity, such as Potassium-40 and radon daughters from the uranium/thorium decay chains, there was no indication of any plant-related radioactivity in the groundwater samples, other than tritium. Such levels of natural radioactivity are expected as these radionuclides are dissolved into the groundwater from the rocks and soil. The fact that these low levels of naturally-occurring radioactivity can be detected demonstrates the ability of the gamma spectroscopy analyses to detect radioactivity in groundwater. Analyses are also performed for hard-to-detect radionuclides, including Iron-55, Nickel-63, Strontium-89, and Strontium-90 on a less frequent basis. These hard-to-detect radionuclides were also non-detectable in all of the wells sampled and analyzed during 2015.

A summary of the results of the tritium analyses conducted in 2015 are presented in the following table. In this table, a value of "NDA < xx" in the columns indicates that no activity was detected in the sample when analyzed to the minimum-detectable level following the "<" sign. For example, the sample collected from MW201 on 16-Jan-2015 contained no detectable tritium, and a minimum detectable concentration of 369 pCi/L was achieved on that sample. The achieved sensitivity of 369 pCi/L is well below the required REMP LLD of 3000 pCi/L, and no tritium was detected even when counted to this more sensitive level of detection. No plant-related radioactivity (other than tritium) was detected in any of the monitoring wells, and no tritium or plant-related radioactivity was detected in surface water samples collected from the intake canal.

Monitoring Well ID	Installation Date	Number of Samples	Number of Positive Results	Minimum Concentration pCi/L	Maximum Concentration pCi/L
MW201	Nov-2007	9	2	NDA < 318	476
MW202	Nov-2007	4	2	NDA < 339	459
MW202-I	Apr-2010	4	0	NDA < 337	NDA < 339
MW203	Nov-2007	Well decommissioned in 2013 during construction of ISFSI pad			
MW204	Nov-2007	4	2	NDA < 306	579
MW205	Apr-2010	15	8	NDA < 344	956
MW206	Apr-2010	43	1	NDA < 183	543
MW207	Apr-2010	4	1	NDA < 335	572
MW208-S	Apr-2010	4	0	NDA < 330	NDA < 380
MW208-I	Apr-2010	4	0	NDA < 333	NDA < 395
MW209	Aug-2010	50	48	NDA < 312	1420
MW210	Aug-2010	4	4	424	842
MW211	Aug-2010	22	22	749	1990
MW212	Aug-2010	4	4	533	759
MW213	Aug-2010	4	0	NDA < 329	NDA < 390
MW214	Aug-2010	4	0	NDA < 327	NDA < 354
MW215	Dec-2011	16	16	521	1010
MW216	Sep-2012	49	49	420	4300
MW217	Dec-2011	4	2	NDA < 349	678
MW218	Nov-2013	49	49	1210	4040
MW219	Dec-2013	21	21	410	2060
MW220	Dec-2014	10	8	NDA < 377	823
MW3	Jul-1987	4	0	NDA < 332	NDA < 385
MW4	Jul-1997	Well decommissioned in 2013 during installation of MW4R			
MW4-R	Nov-2013	4	0	NDA < 331	NDA < 374
All Wells	--	336	239	NDA < 183	4300
Intake Canal West	--	52	0	NDA < 183	NDA < 426
Intake Canal East	--	4	0	NDA < 330	NDA < 363

Concentrations of tritium detected in the onsite wells ranged from non-detectable at less than 183 pCi/L, up to a maximum concentration of 4300 pCi/L. The average concentrations from these onsite wells are well below the voluntary communication reporting level of 20,000 pCi/L as established by the EPA Drinking Water Standard. Although the EPA Standard provides a baseline for comparison, no drinking water sources are affected by this tritium. All of the affected wells are onsite, and the general groundwater flow pathway is under Pilgrim Station and out into the salt water of Cape Cod Bay. As such, there is no potential to influence any off-site drinking water wells. Even if worst-case assumptions were made and the water from monitoring well MW216 (average concentration = 2504 pCi/L) was consumed as drinking water for an entire year, the maximum dose consequence would be less than 0.22 mrem/yr. In actuality, any dose consequence would be much less than this, as any tritium-laden water potentially leaving the site would be diluted into the seawater of Cape Cod Bay before being incorporated into any ingestion pathways. No drinking water ingestion pathway exists at the Pilgrim Station site.

Although there are no indications that the groundwater containing detectable tritium is actually migrating offsite, a bounding calculation was performed to assess the potential dose impact of such a scenario. Based on the tritium concentrations detected during 2015, the annual average concentrations of tritium in groundwater in the four monitoring wells most closely adjacent to the shoreline (MW204, MW205, MW202, and MW201) were used to estimate potential tritium migration into the intake bay. Hydrological characteristics of the compacted backfill in the vicinity of these wells were measured in 2010 and indicate the hydraulic conductivity ranges from 0.002 cm/sec to about 0.006 cm/sec. When coupled with the hydraulic slope of 0.014 and average porosity of 0.3, the flow velocity was calculated as being between 0.08 and 0.23 meters per day. Using an assumed horizontal shoreline interface area 236 meters long by 3 meters deep that could potentially transmit groundwater into the intake bay, the annual discharge of groundwater would be about 12.5 million Liters of water per year. Assuming this volume of 12.5 million liters contained the segment-weighted average concentration of 481 pCi/L, the annual discharge of tritium into the intake bay under this hypothetical scenario would be 0.00601 Curies. This activity represents less than 0.008% of the annual airborne effluent of tritium released from the reactor building vent (see Table 2.2-C). Such airborne effluents can be washed down to the ground surface during precipitation events and infiltrate into the ground, thereby introducing tritium into the groundwater.

In the hypothetical scenario described above, the 0.00601 Curies of tritium entering the intake bay would be further diluted into the circulating water flow of the plant. As documented in Table 2.3-A, the total volume of circulating water flow during 2015 was 562 billion Liters, yielding an effective concentration of tritium in the intake bay of about 0.011 pCi/L. Such a concentration would be well below the detection sensitivity of about 450 pCi/L used to analyze water collected from the discharge canal as part of the radiological environmental monitoring program (REMP). The calculated dose to the maximum-exposed member of the public from such a hypothetical release would be 0.0000000061 millirem, resulting from ingestion of tritium incorporated into fish and shellfish. Since the tritium would be incorporated into seawater, there is no drinking water ingestion pathway in the described scenario.

The following table lists the hydrological characteristics in the vicinity of each of the monitoring wells used to estimate tritium migration. Predicted flow velocities, annual discharge volumes, average tritium concentrations, and hypothetical tritium discharges are listed for each shoreline segment represented by each monitoring well.

Shoreline Segment Number	1	2	3	4
Monitoring Well Number	MW204	MW205	MW202	MW201
Hydraulic Conductivity - cm/sec	1.99E-03	4.27E-03	3.13E-03	5.64E-03
Hydraulic Slope	0.014	0.014	0.014	0.014
Porosity	0.300	0.300	0.300	0.300
Flow Velocity - m/day	8.02E-02	1.72E-01	1.26E-01	2.27E-01
Flow Velocity - ft/yr	9.61E+01	2.06E+02	1.51E+02	2.72E+02
Length of Shoreline Segment – m	61.0	38.1	45.7	91.4
Thickness of Water Layer – m	3.0	3.0	3.0	3.0
Volumetric Discharge - m^3/day	4.40E+00	5.90E+00	5.19E+00	1.87E+01
Volumetric Discharge - Liter/yr	1.61E+06	2.16E+06	1.90E+06	6.84E+06
Annual Average H-3 Concentration - pCi/L	5.35E+02	5.70E+02	4.18E+02	4.57E+02
Annual Segment Tritium Discharge - Ci/yr	8.60E-04	1.23E-03	7.93E-04	3.12E-03
Total Volumetric Discharge - L/yr	1.25E+07			
Total H-3 Discharge - Ci/yr	6.01E-03			
Annual Circulating Water Flow - Liter/yr	5.62E+11			
Discharge Canal H-3 Concentration - Ci/L	1.07E-14			
Discharge Canal H-3 Concentration - pCi/L	1.07E-02			
Max. Indiv. Dose Factor - mrem/yr per Ci/L	5.73E+05			
Maximum Individual Dose - mrem/yr	6.12E-09			

In conclusion, the only radionuclide detected in groundwater during the 2015 monitoring effort that is attributable to Pilgrim Station operations is tritium. Although some soil samples near the separation in the underground discharge line from the neutralizing sump indicated the presence of low-level gamma radioactivity, such activity has not been detected in the groundwater and indicates the radioactivity is immobile and confined to the soil. Even in the case of the three reportable events that occurred in 2013 and subsequent sample results in 2015, the total dose impact to a maximally-exposed member of the public would have been much less than 1 mrem/yr.

APPENDIX C

CORRECTIONS TO PREVIOUS EFFLUENT REPORTS

There were no corrections made to previous effluent reports during calendar-year 2015.

APPENDIX D

CHANGES TO PNPS
OFFSITE DOSE CALCULATION MANUAL

No revisions were made to the PNPS Offsite Dose Calculation Manual (ODCM) during calendar year 2015.