Entergy

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

May 13, 2015

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
11555 Rockville Pike
Rockville, MD 20852

SUBJECT: Entergy's Annual Radioactive Effluent Release Report for January 1 through December 31, 2014

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

LETTER NUMBER 2.15.034

Dear Sir or Madam:

In accordance with Pilgrim Technical Specification 5.6.3, Entergy Nuclear Operations, Inc. submits the attached Annual Radioactive Effluent Release Report for January 1 through December 31, 2014.

This letter contains no new regulatory commitments.

Should you have any questions concerning the content of this letter, please contact me at (508) 830-8323.

Sincerely,

Everett (Chip) Perkins Jr
Manager, Regulatory Assurance

EP/rmb

Attachment: Pilgrim's Annual Radioactive Effluent Release Report for January 1 through December 31, 2014

IE48
NRR

cc: Mr. Daniel H. Dorman
Regional Administrator, Region 1
U.S. Nuclear Regulatory Commission
2100 Renaissance Boulevard, Suite 100
King of Prussia, PA 19406-1415

U. S. Nuclear Regulatory Commission
ATTN: Director, Office of Nuclear Reactor Regulation
One White Flint North
11555 Rockville Pike
Rockville, MD 20852

NRC Senior Resident Inspector
Pilgrim Nuclear Power Station

Ms. Nadiyah Morgan, Project Manager
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Mail Stop O-8C2A
Washington, DC 20555

Mr. John Giarrusso Jr.
Planning, Preparedness & Nuclear Section Chief
Mass. Emergency Management Agency
400 Worcester Road
Framingham, MA 01702

ATTACHMENT

To

PNPS Letter 2.15.034

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, 2014

PILGRIM NUCLEAR POWER STATION
Facility Operating License DPR-35

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

JANUARY 01 THROUGH DECEMBER 31, 2014

Prepared by: _____ 24-Apr-2015
K.J. Sejkora
Senior HP/Chemistry Specialist

Reviewed by: _____ 4-29-15
G.W. Blankenbiller
Chemistry Manager

Reviewed by: _____ 4/29/15
A. Zeke
Radiation Protection Manager

TABLE OF CONTENTS

LIST OF TABLES

EXECUTIVE SUMMARY

PILGRIM NUCLEAR POWER STATION
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT
JANUARY 01 THROUGH DECEMBER 31, 2014

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, 2014. 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 1.7 Curies. Releases of radioactive iodines and particulates with half-life of greater than 8 days totaled 0.0015 Curies, tritium releases totaled 90 Curies, and carbon-14 totaled 8.3 Curies. No gross alpha radioactivity was detected in gaseous effluents.

Noble gases released in gaseous effluents resulted in a maximum total body dose of 0.000069 mrem, with a corresponding skin dose of 0.00038 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 0.045 mrem. The maximum hypothetical dose to any organ from radioactive particulates, iodines, tritium, and carbon-14 was about 0.088 mrem. The maximum, hypothetical total body dose from the combined release of all airborne radioactivity in gaseous effluents was 0.045 mrem.

The maximum individual doses from gaseous radioactive effluents were compared to the applicable ODCM dose limits. Noble gas doses were less than 0.0048% of the corresponding 10CFR50 dose objectives. Maximum doses resulting from releases of particulates, iodines, tritium, and carbon-14 in gaseous effluents were less than 0.58% of corresponding 10CFR50 objectives.

LIQUID EFFLUENTS

Liquid radioactive releases for the reporting period are quantified in Tables 2.3-A and 2.3-B. One discharge of liquid effluents containing radioactivity occurred during the reporting period. This discharge contained 0.0039 Curies of tritium, and 0.0000075 Curies of fission and activation products. The resulting maximum total body dose was 0.00000029 mrem, with a corresponding organ dose of 0.00000087 mrem. All doses from liquid discharges were less than 0.00002% of corresponding 10CFR50 objectives.

METEOROLOGICAL DATA

Meteorological joint frequency distributions are listed in Appendix A. Data recovery for the entire annual period was 100% for the 33-ft and 100% for the 220-ft levels of the tower. The predominant wind direction was from the south-southwest, which occurred approximately 15% of the time during the reporting period. The predominant stability class was Class D, which occurred about 44% 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 2014. There was no measurable increase during 2014 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 2014 was calculated as being about 0.57 mrem. This amount is about 0.11% 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 630 cubic meters of solid waste, containing almost 682 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 2014, 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 2014 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 0.0000000050 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 2014, 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: 1.68 Ci, 0.0532 μCi/sec
- Iodines and particulates with half-life greater than 8 days: 0.00149 Ci, 0.0000473 μCi/sec
- Tritium: 90.1 Ci, 2.86 μCi/sec
- Carbon-14: 8.33 Ci, 0.264 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 2014 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. During 2014 the Turbine Building Gaseous Effluent Monitoring System (GEMS, unit C-3003) was inoperable from 01-Jan-2014 through 16-Feb-2014 (47 days). During 2014, the Feed Pump Gaseous Effluent Monitoring System (GEMS, unit C-3004) was inoperable from 01-Jan-2014 through 14-Aug-2014 (226 days). During each of these periods of inoperability, compensatory sampling activities were performed during the duration of the inoperability, including manually sampling the effluent release points twice per week for noble gases, and continuous sampling of the effluent release points twice per week for particulates and radioiodines. In both of these situations, repairs to each of the monitors were delayed due to difficulty in obtaining replacement components necessary to fix the monitor. Appendix C of this report also contains details about inoperable effluent monitors during the 2012 and 2013 reporting periods.

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 was one discharge 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: 22,800 Liters
- Total Dilution Volume: 614 billion Liters
- Fission/Activation products: 0.00000750 Ci, 0.0000000000000122 μCi/mL
- Tritium: 0.00387 Ci, 0.00000000000630 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 2014

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 2014	Apr-Jun 2014	Jul-Sep 2014	Oct-Dec 2014	Jan-Dec 2014
a. Liquid Effluents					
1. Total number of releases:	N/A	1	N/A	N/A	1
2. Total time period (minutes):	N/A	1.44E+03	N/A	N/A	1.44E+03
3. Maximum time period (minutes):	N/A	1.44E+03	N/A	N/A	1.44E+03
4. Average time period (minutes):	N/A	1.44E+03	N/A	N/A	1.44E+03
5. Minimum time period (minutes):	N/A	1.44E+03	N/A	N/A	1.44E+03
6. Average stream flow during periods of release of effluents into a flowing stream (Liters/min):	N/A	1.17E+06	N/A	N/A	1.17E+06
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 2014

RELEASE PERIOD	Jan-Mar 2014	Apr-Jun 2014	Jul-Sep 2014	Oct-Dec 2014	Jan-Dec 2014	Est. Total Error
A. FISSION AND ACTIVATION GASES						
Total Release: Ci	NDA	NDA	NDA	1.68E+00	1.68E+00	±22%
Average Release Rate: µCi/sec	N/A	N/A	N/A	2.13E-01	5.32E-02	
Percent of Effluent Control Limit*	*	*	*	*	*	
B. IODINE-131						
Total Iodine-131 Release: Ci	3.91E-05	7.04E-05	9.16E-05	5.25E-05	2.54E-04	±20%
Average Release Rate: µCi/sec	4.96E-06	8.93E-06	1.16E-05	6.66E-06	8.04E-06	
Percent of Effluent Control Limit*	*	*	*	*	*	
C. PARTICULATES WITH HALF-LIVES > 8 DAYS						
Total Release: Ci	2.41E-05	5.27E-05	2.11E-04	1.79E-05	3.05E-04	±21%
Average Release Rate: µCi/sec	3.05E-06	6.68E-06	2.67E-05	2.26E-06	9.68E-06	
Percent of Effluent Control Limit*	*	*	*	*	*	
Gross Alpha Radioactivity: Ci	NDA	NDA	NDA	NDA	NDA	
D. TRITIUM						
Total Release: Ci	2.32E+01	2.38E+01	2.07E+01	2.23E+01	9.01E+01	±20%
Average Release Rate: µCi/sec	2.95E+00	3.02E+00	2.62E+00	2.83E+00	2.86E+00	
Percent of Effluent Control Limit*	*	*	*	*	*	
E. CARBON-14						
Total Release: Ci	2.14E+00	2.01E+00	2.04E+00	2.15E+00	8.33E+00	N/A
Average Release Rate: µCi/sec	2.71E-01	2.55E-01	2.59E-01	2.73E-01	2.64E-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 2014

CONTINUOUS MODE RELEASES FROM ELEVATED RELEASE POINT					
Nuclide Released	Jan-Mar 2014	Apr-Jun 2014	Jul-Sep 2014	Oct-Dec 2014	Jan-Dec 2014
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	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2. IODINES: Ci					
I-131	2.92E-07	2.69E-06	0.00E+00	0.00E+00	2.98E-06
I-133	0.00E+00	6.83E-06	1.97E-06	0.00E+00	8.80E-06
Total for Period	2.92E-07	9.52E-06	1.97E-06	0.00E+00	1.18E-05
3. PARTICULATES WITH HALF-LIVES > 8 DAYS: Ci					
Cr-51	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba/La-140	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total for Period	0.00E+00	0.00E+00	0.00E+00	3.31E-02	1.08E-01
4. TRITIUM: Ci					
H-3	1.23E-02	2.87E-02	3.40E-02	3.31E-02	1.08E-01
5. CARBON-14: Ci					
C-14	2.07E+00	1.95E+00	1.98E+00	2.09E+00	8.08E+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 2014

BATCH MODE RELEASES FROM ELEVATED RELEASE POINT					
Nuclide Released	Jan-Mar 2014	Apr-Jun 2014	Jul-Sep 2014	Oct-Dec 2014	Jan-Dec 2014
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 2014

CONTINUOUS MODE RELEASES FROM GROUND-LEVEL RELEASE POINT					
Nuclide Released	Jan-Mar 2014	Apr-Jun 2014	Jul-Sep 2014	Oct-Dec 2014	Jan-Dec 2014
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	8.31E-01	8.31E-01
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	8.48E-01	8.48E-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	0.00E+00	0.00E+00	0.00E+00	1.68E+00	1.68E+00
2. IODINES: Ci					
I-131	3.88E-05	6.78E-05	9.16E-05	5.25E-05	2.51E-04
I-133	1.34E-04	2.16E-04	3.23E-04	2.51E-04	9.24E-04
Total for period	1.73E-04	2.84E-04	4.15E-04	3.03E-04	1.17E-03
3. PARTICULATES WITH HALF-LIVES > 8 DAYS: Ci					
Cr-51	0.00E+00	9.87E-06	0.00E+00	9.96E-06	1.98E-05
Mn-54	0.00E+00	3.26E-05	5.29E-06	0.00E+00	3.79E-05
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	4.25E-06	9.34E-06	0.00E+00	0.00E+00	1.36E-05
Zn-65	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-89	0.00E+00	8.70E-07	1.32E-05	2.72E-06	1.68E-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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba/La-140	1.98E-05	0.00E+00	1.92E-04	5.17E-06	2.17E-04
Total for period	2.41E-05	5.27E-05	2.11E-04	1.79E-05	3.05E-04
4. TRITIUM: Ci					
H-3	2.32E+01	2.38E+01	2.06E+01	2.23E+01	9.00E+01
5. CARBON-14: Ci					
C-14	6.41E-02	6.02E-02	6.12E-02	6.52E-02	2.51E-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 2014

BATCH MODE RELEASES FROM GROUND-LEVEL RELEASE POINT					
Nuclide Released	Jan-Mar 2014	Apr-Jun 2014	Jul-Sep 2014	Oct-Dec 2014	Jan-Dec 2014
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 2014

RELEASE PERIOD	Jan-Mar 2014	Apr-Jun 2014	Jul-Sep 2014	Oct-Dec 2014	Jan-Dec 2014	Est. Total Error
A. FISSION AND ACTIVATION PRODUCTS						
Total Release (not including tritium, gases, alpha): Ci	N/A	7.50E-06	N/A	N/A	7.50E-06	±12%
Average Diluted Concentration During Period: μCi/mL	N/A	4.89E-14	N/A	N/A	1.22E-14	
Percent of Effluent Concentration Limit*	N/A	1.47E-06%	N/A	N/A	3.68E-07%	
B. TRITIUM						
Total Release: Ci	N/A	3.87E-03	N/A	N/A	3.87E-03	±9.4%
Average Diluted Concentration During Period: μCi/mL	N/A	2.52E-11	N/A	N/A	6.30E-12	
Percent of Effluent Concentration Limit*	N/A	2.52E-06%	N/A	N/A	6.30E-07%	
C. DISSOLVED AND ENTRAINED GASES						
Total Release: Ci	N/A	NDA	N/A	N/A	NDA	±16%
Average Diluted Concentration During Period: μCi/mL	N/A	NDA	N/A	N/A	NDA	
Percent of Effluent Concentration Limit*	N/A	0.00E+00%	N/A	N/A	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	2.28E+04	N/A	N/A	2.28E+04	±5.7%
F. VOLUME OF DILUTION WATER USED DURING PERIOD						
Dilution Volume: Liters	1.52E+11	1.53E+11	1.55E+11	1.55E+11	6.14E+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 2014

CONTINUOUS MODE RELEASES					
Nuclide Released	Jan-Mar 2014	Apr-Jun 2014	Jul-Sep 2014	Oct-Dec 2014	Jan-Dec 2014
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 2014

BATCH MODE RELEASES					
Nuclide Released	Jan-Mar 2014	Apr-Jun 2014	Jul-Sep 2014	Oct-Dec 2014	Jan-Dec 2014
1. FISSION AND ACTIVATION PRODUCTS: Ci					
Na-24	N/A	0.00E+00	N/A	N/A	0.00E+00
Cr-51	N/A	0.00E+00	N/A	N/A	0.00E+00
Mn-54	N/A	2.21E-06	N/A	N/A	2.21E-06
Fe-55	N/A	0.00E+00	N/A	N/A	0.00E+00
Fe-59	N/A	0.00E+00	N/A	N/A	0.00E+00
Co-58	N/A	0.00E+00	N/A	N/A	0.00E+00
Co-60	N/A	4.64E-06	N/A	N/A	4.64E-06
Zn-65	N/A	0.00E+00	N/A	N/A	0.00E+00
Zn-69m	N/A	0.00E+00	N/A	N/A	0.00E+00
Sr-89	N/A	0.00E+00	N/A	N/A	0.00E+00
Sr-90	N/A	0.00E+00	N/A	N/A	0.00E+00
Zr/Nb-95	N/A	0.00E+00	N/A	N/A	0.00E+00
Mo/Tc-99	N/A	0.00E+00	N/A	N/A	0.00E+00
Ag-110m	N/A	0.00E+00	N/A	N/A	0.00E+00
Sb-124	N/A	0.00E+00	N/A	N/A	0.00E+00
I-131	N/A	0.00E+00	N/A	N/A	0.00E+00
I-133	N/A	0.00E+00	N/A	N/A	0.00E+00
Cs-134	N/A	0.00E+00	N/A	N/A	0.00E+00
Cs-137	N/A	6.39E-07	N/A	N/A	6.39E-07
Ba/La-140	N/A	0.00E+00	N/A	N/A	0.00E+00
Ce-141	N/A	0.00E+00	N/A	N/A	0.00E+00
Ce-144	N/A	0.00E+00	N/A	N/A	0.00E+00
Total for period	N/A	7.50E-06	N/A	N/A	7.50E-06
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 D, 44%
- 33-ft Wind Direction (from): South-southwest, 16%
- 33-ft Wind Speed: 3.5-7.5 mph, 55%
- 220-ft Wind Direction (from): South-southwest, 15%
- 220-ft Wind Speed: 12.5-18.5 mph, 38%

Joint data recovery for both the 33-ft level and 220-ft level of the tower was 100%, which met the 90% annual data recovery goal specified by the NRC.

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 2014 resulted in a maximum total body dose of 0.000069 mrem. The maximum skin dose was 0.00038 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 (0.64 km ESE of the Reactor Building). For the more "realistic" individuals at offsite locations, the maximum total body dose was 0.000054 mrem (nearest residence, 0.80 kilometers ESE from the Reactor Building), while the maximum skin dose was 0.00026 mrem (nearest residence, 0.80 kilometers ESE from the Reactor Building).

Table 4.1

Maximum Doses From Noble Gas Releases During 2014[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	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)
Apr-Jun	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)
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	1.07E-04 (0.64 km ESE)	4.75E-04 (0.64 km ESE)	6.91E-05 (0.64 km ESE)	3.77E-04 (0.64 km ESE)
Jan-Dec	1.07E-04 (0.64 km ESE)	4.75E-04 (0.64 km ESE)	6.91E-05 (0.64 km ESE)	3.77E-04 (0.64 km ESE)

[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 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 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 2014 resulted in a maximum total body dose of 0.045 mrem (child age class at nearest garden location, 0.84 kilometers SE from the Reactor Building), while the maximum organ dose was 0.088 mrem (child bone at nearest garden location, 0.84 kilometers SE from the Reactor Building). Carbon-14 contributed 0.017 mrem (39%) of the 0.045 mrem child total body dose, and 0.087 mrem (99%) of the 0.088 mrem child bone dose at the location of the nearest garden.

Table 4.2-A

Maximum Individual Organ Dose at Receptor Location -- mrem
From Gaseous Release Period: Jan-Mar 2014

Receptor: Direction: Distance[1]: Pathway[2]:	Bound ESE 0.33 km DI	Resident ESE 0.80 km DI	Garden SE 0.84 km DIV[3]	Cow/Goat WSW 3.97 km DIVCG[3]	Cow/Meat W 5.77 km DIVCM[3]	Meat S 3.80 km DIVM[3]
Age Class: Adult						
Bone	2.15E-04	1.45E-04	5.77E-03	2.34E-03	2.05E-03	3.55E-03
GI-LLI	2.72E-03	1.78E-03	5.75E-03	8.53E-04	6.40E-04	9.89E-04
Kidney	2.72E-03	1.78E-03	5.75E-03	8.53E-04	6.40E-04	9.88E-04
Liver	2.72E-03	1.78E-03	5.75E-03	8.52E-04	6.40E-04	9.88E-04
Lung	2.72E-03	1.78E-03	5.75E-03	8.52E-04	6.40E-04	9.88E-04
Thyroid	2.83E-03	1.85E-03	6.01E-03	9.29E-04	6.81E-04	1.01E-03
T.Body	2.72E-03	1.78E-03	5.75E-03	8.52E-04	6.40E-04	9.88E-04
Age Class: Teen						
Bone	3.08E-04	2.07E-04	9.34E-03	3.93E-03	3.09E-03	5.01E-03
GI-LLI	2.76E-03	1.81E-03	6.95E-03	1.23E-03	8.71E-04	1.30E-03
Kidney	2.76E-03	1.81E-03	6.95E-03	1.23E-03	8.71E-04	1.30E-03
Liver	2.76E-03	1.81E-03	6.95E-03	1.23E-03	8.71E-04	1.30E-03
Lung	2.77E-03	1.81E-03	6.95E-03	1.23E-03	8.71E-04	1.30E-03
Thyroid	2.90E-03	1.90E-03	7.19E-03	1.34E-03	9.30E-04	1.31E-03
T.Body	2.76E-03	1.81E-03	6.95E-03	1.23E-03	8.71E-04	1.30E-03
Age Class: Child						
Bone	4.25E-04	2.86E-04	2.23E-02	9.47E-03	7.26E-03	1.16E-02
GI-LLI	2.47E-03	1.61E-03	1.15E-02	2.53E-03	1.81E-03	2.72E-03
Kidney	2.47E-03	1.61E-03	1.15E-02	2.53E-03	1.81E-03	2.72E-03
Liver	2.47E-03	1.61E-03	1.15E-02	2.53E-03	1.81E-03	2.72E-03
Lung	2.47E-03	1.62E-03	1.15E-02	2.53E-03	1.81E-03	2.72E-03
Thyroid	2.64E-03	1.72E-03	1.18E-02	2.75E-03	1.92E-03	2.74E-03
T.Body	2.47E-03	1.61E-03	1.15E-02	2.53E-03	1.81E-03	2.72E-03
Age Class: Infant						
Bone	3.13E-04	2.11E-04	1.76E-04	5.94E-03	4.13E-03	7.92E-05
GI-LLI	1.44E-03	9.40E-04	6.99E-04	1.59E-03	1.04E-03	5.24E-05
Kidney	1.44E-03	9.40E-04	7.00E-04	1.59E-03	1.04E-03	5.24E-05
Liver	1.44E-03	9.40E-04	7.00E-04	1.59E-03	1.04E-03	5.24E-05
Lung	1.44E-03	9.43E-04	7.02E-04	1.59E-03	1.04E-03	5.25E-05
Thyroid	1.59E-03	1.04E-03	7.74E-04	2.07E-03	1.29E-03	5.60E-05
T.Body	1.44E-03	9.40E-04	6.99E-04	1.59E-03	1.04E-03	5.24E-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 2014

Receptor: Direction: Distance[1]: Pathway[2]:	Bound ESE 0.33 km DI	Resident ESE 0.80 km DI	Garden SE 0.84 km DIV	Cow/Goat WSW 3.97 km DIVCG	Cow/Meat W 5.77 km DIVCM	Meat S 3.80 km DIVM
Age Class: Adult						
Bone	2.02E-04	1.36E-04	5.43E-03	2.19E-03	1.92E-03	3.34E-03
GI-LLI	2.78E-03	1.82E-03	5.81E-03	8.34E-04	6.21E-04	9.53E-04
Kidney	2.78E-03	1.82E-03	5.79E-03	8.34E-04	6.21E-04	9.52E-04
Liver	2.78E-03	1.82E-03	5.79E-03	8.34E-04	6.21E-04	9.52E-04
Lung	2.80E-03	1.83E-03	5.80E-03	8.34E-04	6.21E-04	9.52E-04
Thyroid	2.97E-03	1.94E-03	6.25E-03	9.69E-04	6.93E-04	9.82E-04
T.Body	2.78E-03	1.82E-03	5.79E-03	8.34E-04	6.20E-04	9.52E-04
Age Class: Teen						
Bone	2.89E-04	1.95E-04	8.78E-03	3.69E-03	2.90E-03	4.71E-03
GI-LLI	2.82E-03	1.85E-03	6.97E-03	1.19E-03	8.40E-04	1.24E-03
Kidney	2.82E-03	1.85E-03	6.96E-03	1.19E-03	8.40E-04	1.24E-03
Liver	2.82E-03	1.85E-03	6.96E-03	1.19E-03	8.40E-04	1.24E-03
Lung	2.84E-03	1.86E-03	6.96E-03	1.19E-03	8.40E-04	1.24E-03
Thyroid	3.06E-03	2.00E-03	7.38E-03	1.39E-03	9.45E-04	1.27E-03
T.Body	2.82E-03	1.85E-03	6.96E-03	1.19E-03	8.40E-04	1.24E-03
Age Class: Child						
Bone	3.99E-04	2.69E-04	2.10E-02	8.90E-03	6.82E-03	1.09E-02
GI-LLI	2.52E-03	1.65E-03	1.14E-02	2.43E-03	1.73E-03	2.59E-03
Kidney	2.52E-03	1.65E-03	1.14E-02	2.43E-03	1.73E-03	2.59E-03
Liver	2.52E-03	1.65E-03	1.14E-02	2.43E-03	1.73E-03	2.59E-03
Lung	2.54E-03	1.66E-03	1.14E-02	2.43E-03	1.73E-03	2.59E-03
Thyroid	2.81E-03	1.83E-03	1.20E-02	2.81E-03	1.93E-03	2.63E-03
T.Body	2.52E-03	1.65E-03	1.14E-02	2.43E-03	1.73E-03	2.59E-03
Age Class: Infant						
Bone	2.94E-04	1.98E-04	1.65E-04	5.58E-03	3.88E-03	7.44E-05
GI-LLI	1.46E-03	9.59E-04	7.13E-04	1.52E-03	9.87E-04	5.23E-05
Kidney	1.47E-03	9.60E-04	7.14E-04	1.52E-03	9.89E-04	5.23E-05
Liver	1.47E-03	9.60E-04	7.14E-04	1.52E-03	9.89E-04	5.23E-05
Lung	1.48E-03	9.66E-04	7.19E-04	1.52E-03	9.87E-04	5.26E-05
Thyroid	1.73E-03	1.13E-03	8.39E-04	2.38E-03	1.44E-03	5.85E-05
T.Body	1.46E-03	9.59E-04	7.14E-04	1.52E-03	9.88E-04	5.23E-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 2014

Receptor:	Bound	Resident	Garden	Cow/Goat	Cow/Meat	Meat
Direction:	ESE	ESE	SE	WSW	W	S
Distance[1]:	0.33 km	0.80 km	0.84 km	3.97 km	5.77 km	3.80 km
Pathway[2]:	DI	DI	DIV	DIVCG	DIVCM	DIVM
Age Class: Adult						
Bone	2.07E-04	1.39E-04	5.56E-03	2.23E-03	1.96E-03	3.40E-03
GI-LLI	2.43E-03	1.59E-03	5.20E-03	7.89E-04	5.96E-04	9.27E-04
Kidney	2.42E-03	1.58E-03	5.18E-03	7.89E-04	5.96E-04	9.25E-04
Liver	2.42E-03	1.58E-03	5.18E-03	7.89E-04	5.96E-04	9.25E-04
Lung	2.44E-03	1.60E-03	5.19E-03	7.89E-04	5.96E-04	9.26E-04
Thyroid	2.68E-03	1.75E-03	5.81E-03	9.69E-04	6.92E-04	9.65E-04
T.Body	2.42E-03	1.58E-03	5.18E-03	7.88E-04	5.96E-04	9.25E-04
Age Class: Teen						
Bone	2.96E-04	1.99E-04	8.98E-03	3.76E-03	2.95E-03	4.79E-03
GI-LLI	2.46E-03	1.61E-03	6.31E-03	1.14E-03	8.16E-04	1.22E-03
Kidney	2.46E-03	1.61E-03	6.29E-03	1.15E-03	8.16E-04	1.22E-03
Liver	2.45E-03	1.61E-03	6.29E-03	1.14E-03	8.15E-04	1.22E-03
Lung	2.49E-03	1.63E-03	6.31E-03	1.14E-03	8.16E-04	1.22E-03
Thyroid	2.79E-03	1.82E-03	6.87E-03	1.41E-03	9.54E-04	1.25E-03
T.Body	2.45E-03	1.61E-03	6.29E-03	1.14E-03	8.15E-04	1.22E-03
Age Class: Child						
Bone	4.09E-04	2.75E-04	2.15E-02	9.06E-03	6.94E-03	1.11E-02
GI-LLI	2.20E-03	1.44E-03	1.05E-02	2.37E-03	1.71E-03	2.57E-03
Kidney	2.20E-03	1.44E-03	1.05E-02	2.38E-03	1.71E-03	2.57E-03
Liver	2.20E-03	1.44E-03	1.05E-02	2.38E-03	1.71E-03	2.57E-03
Lung	2.23E-03	1.46E-03	1.05E-02	2.37E-03	1.71E-03	2.57E-03
Thyroid	2.60E-03	1.70E-03	1.13E-02	2.88E-03	1.97E-03	2.62E-03
T.Body	2.19E-03	1.44E-03	1.05E-02	2.37E-03	1.71E-03	2.57E-03
Age Class: Infant						
Bone	3.01E-04	2.03E-04	1.69E-04	5.68E-03	3.95E-03	7.57E-05
GI-LLI	1.28E-03	8.38E-04	6.24E-04	1.49E-03	9.80E-04	4.76E-05
Kidney	1.28E-03	8.38E-04	6.24E-04	1.50E-03	9.82E-04	4.76E-05
Liver	1.28E-03	8.38E-04	6.24E-04	1.50E-03	9.82E-04	4.76E-05
Lung	1.31E-03	8.56E-04	6.37E-04	1.49E-03	9.80E-04	4.83E-05
Thyroid	1.65E-03	1.08E-03	8.01E-04	2.64E-03	1.57E-03	5.63E-05
T.Body	1.28E-03	8.37E-04	6.23E-04	1.49E-03	9.81E-04	4.76E-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 2014

Receptor:	Bound	Resident	Garden	Cow/Goat	Cow/Meat	Meat
Direction:	ESE	ESE	SE	WSW	W	S
Distance[1]:	0.33 km	0.80 km	0.84 km	3.97 km	5.77 km	3.80 km
Pathway[2]:	DI	DI	DIV[3]	DIVCG[3]	DIVCM[3]	DIVM[3]
Age Class: Adult						
Bone	2.19E-04	1.47E-04	5.87E-03	2.36E-03	2.06E-03	3.58E-03
GI-LLI	2.61E-03	1.71E-03	5.59E-03	8.41E-04	6.34E-04	9.83E-04
Kidney	2.61E-03	1.71E-03	5.59E-03	8.41E-04	6.34E-04	9.83E-04
Liver	2.61E-03	1.71E-03	5.58E-03	8.41E-04	6.34E-04	9.83E-04
Lung	2.61E-03	1.71E-03	5.58E-03	8.41E-04	6.34E-04	9.83E-04
Thyroid	2.79E-03	1.82E-03	5.96E-03	9.46E-04	6.90E-04	1.01E-03
T.Body	2.61E-03	1.71E-03	5.58E-03	8.41E-04	6.34E-04	9.83E-04
Age Class: Teen						
Bone	3.13E-04	2.10E-04	9.49E-03	3.96E-03	3.11E-03	5.05E-03
GI-LLI	2.65E-03	1.74E-03	6.77E-03	1.22E-03	8.66E-04	1.29E-03
Kidney	2.65E-03	1.74E-03	6.77E-03	1.22E-03	8.67E-04	1.29E-03
Liver	2.65E-03	1.74E-03	6.77E-03	1.22E-03	8.66E-04	1.29E-03
Lung	2.65E-03	1.74E-03	6.77E-03	1.22E-03	8.66E-04	1.29E-03
Thyroid	2.88E-03	1.88E-03	7.12E-03	1.37E-03	9.47E-04	1.31E-03
T.Body	2.65E-03	1.74E-03	6.77E-03	1.22E-03	8.66E-04	1.29E-03
Age Class: Child						
Bone	4.32E-04	2.90E-04	2.27E-02	9.56E-03	7.32E-03	1.17E-02
GI-LLI	2.37E-03	1.55E-03	1.13E-02	2.52E-03	1.81E-03	2.72E-03
Kidney	2.37E-03	1.55E-03	1.13E-02	2.52E-03	1.81E-03	2.72E-03
Liver	2.37E-03	1.55E-03	1.13E-02	2.52E-03	1.81E-03	2.72E-03
Lung	2.37E-03	1.55E-03	1.13E-02	2.52E-03	1.81E-03	2.72E-03
Thyroid	2.64E-03	1.73E-03	1.18E-02	2.82E-03	1.96E-03	2.75E-03
T.Body	2.37E-03	1.55E-03	1.13E-02	2.52E-03	1.81E-03	2.72E-03
Age Class: Infant						
Bone	3.18E-04	2.14E-04	1.79E-04	5.99E-03	4.17E-03	7.99E-05
GI-LLI	1.38E-03	9.05E-04	6.74E-04	1.58E-03	1.04E-03	5.11E-05
Kidney	1.38E-03	9.06E-04	6.74E-04	1.59E-03	1.04E-03	5.11E-05
Liver	1.38E-03	9.05E-04	6.74E-04	1.59E-03	1.04E-03	5.11E-05
Lung	1.38E-03	9.06E-04	6.74E-04	1.58E-03	1.04E-03	5.11E-05
Thyroid	1.63E-03	1.06E-03	7.92E-04	2.25E-03	1.38E-03	5.69E-05
T.Body	1.38E-03	9.05E-04	6.74E-04	1.58E-03	1.04E-03	5.11E-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 2014

Receptor:	Bound	Resident	Garden	Cow/Goat	Cow/Meat	Meat
Direction:	ESE	ESE	SE	WSW	W	S
Distance[1]:	0.33 km	0.80 km	0.84 km	3.97 km	5.77 km	3.80 km
Pathway[2]:	DI	DI	DIV[3]	DIVCG[3]	DIVCM[3]	DIVM[3]
Age Class: Adult						
Bone	8.42E-04	5.66E-04	2.26E-02	9.12E-03	7.99E-03	1.39E-02
GI-LLI	1.05E-02	6.90E-03	2.23E-02	3.32E-03	2.49E-03	3.85E-03
Kidney	1.05E-02	6.89E-03	2.23E-02	3.32E-03	2.49E-03	3.85E-03
Liver	1.05E-02	6.89E-03	2.23E-02	3.32E-03	2.49E-03	3.85E-03
Lung	1.06E-02	6.92E-03	2.23E-02	3.32E-03	2.49E-03	3.85E-03
Thyroid	1.13E-02	7.36E-03	2.40E-02	3.81E-03	2.76E-03	3.96E-03
T.Body	1.05E-02	6.89E-03	2.23E-02	3.32E-03	2.49E-03	3.85E-03
Age Class: Teen						
Bone	1.21E-03	8.11E-04	3.66E-02	1.53E-02	1.21E-02	1.96E-02
GI-LLI	1.07E-02	7.00E-03	2.70E-02	4.78E-03	3.39E-03	5.05E-03
Kidney	1.07E-02	7.00E-03	2.70E-02	4.78E-03	3.39E-03	5.05E-03
Liver	1.07E-02	7.00E-03	2.70E-02	4.78E-03	3.39E-03	5.05E-03
Lung	1.08E-02	7.04E-03	2.70E-02	4.78E-03	3.39E-03	5.05E-03
Thyroid	1.16E-02	7.60E-03	2.86E-02	5.51E-03	3.78E-03	5.15E-03
T.Body	1.07E-02	6.99E-03	2.70E-02	4.78E-03	3.39E-03	5.05E-03
Age Class: Child						
Bone	1.66E-03	1.12E-03	8.75E-02	3.70E-02	2.83E-02	4.52E-02
GI-LLI	9.56E-03	6.26E-03	4.46E-02	9.85E-03	7.06E-03	1.06E-02
Kidney	9.56E-03	6.26E-03	4.46E-02	9.86E-03	7.06E-03	1.06E-02
Liver	9.55E-03	6.25E-03	4.46E-02	9.86E-03	7.06E-03	1.06E-02
Lung	9.61E-03	6.29E-03	4.46E-02	9.85E-03	7.06E-03	1.06E-02
Thyroid	1.07E-02	6.98E-03	4.69E-02	1.13E-02	7.79E-03	1.07E-02
T.Body	9.55E-03	6.25E-03	4.46E-02	9.86E-03	7.06E-03	1.06E-02
Age Class: Infant						
Bone	1.23E-03	8.25E-04	6.89E-04	2.32E-02	1.61E-02	3.09E-04
GI-LLI	5.56E-03	3.64E-03	2.71E-03	6.18E-03	4.04E-03	2.03E-04
Kidney	5.56E-03	3.64E-03	2.71E-03	6.19E-03	4.05E-03	2.03E-04
Liver	5.56E-03	3.64E-03	2.71E-03	6.19E-03	4.05E-03	2.03E-04
Lung	5.61E-03	3.67E-03	2.73E-03	6.18E-03	4.04E-03	2.04E-04
Thyroid	6.60E-03	4.31E-03	3.20E-03	9.35E-03	5.68E-03	2.28E-04
T.Body	5.56E-03	3.64E-03	2.71E-03	6.18E-03	4.04E-03	2.03E-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 (adult age class) of 0.00000029 mrem. The maximum organ dose (adult age class, GI-LLI) was 0.00000087 mrem.

Table 4.3-A

Maximum Individual Organ Doses -- mrem
From Liquid Release Period: Jan-Mar 2014

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 2014

Organ	Age Class Organ Dose – mrem		
	Adult	Teen	Child
Bone	5.28E-08	2.14E-07	6.49E-08
GI-LLI	**8.67E-07**	7.17E-07	2.39E-07
Kidney	6.18E-08	2.21E-07	6.15E-08
Liver	1.49E-07	3.03E-07	1.34E-07
Lung	4.15E-08	2.02E-07	4.59E-08
Thyroid	3.87E-08	1.98E-07	4.32E-08
T.Body	1.43E-07	**2.89E-07**	1.44E-07

Table 4.3-C

Maximum Individual Organ Doses -- mrem
From Liquid Release Period: Jul-Sep 2014

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 2014

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 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 2014

Organ	Age Class Organ Dose – mrem *		
	Adult	Teen	Child
Bone	5.27E-08	2.14E-07	6.47E-08
GI-LLI	**8.66E-07**	7.16E-07	2.39E-07
Kidney	6.17E-08	2.21E-07	6.14E-08
Liver	1.49E-07	3.02E-07	1.34E-07
Lung	4.14E-08	2.01E-07	4.58E-08
Thyroid	3.87E-08	1.98E-07	4.32E-08
T.Body	1.43E-07	**2.89E-07**	1.44E-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 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 83 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 173 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 72.6 ± 23.1 mR/yr to 62.2 ± 8.1 mR/yr. Such a corrected dose is not statistically different from the Zone 4 average of 60.0 ± 7.7 mR/yr, and is indicative of natural background radiation.

Although the annual exposure at TLD location OA was 113 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 0.52 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 65.8 ± 8.6 mR (based on continuous occupancy at this location), which compares quite well to the Zone 4 annual average background radiation level of 60.0 ± 7.7 mR. Statistically, there is no difference between these two values.

It must be emphasized that the projected ambient exposures discussed 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 2014 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 2014. 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 0.0022 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 expressly 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 2014

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	17.9 ± 5.5	14.3 ± 2.1	13.9 ± 1.3	14.6 ± 1.6
Apr-Jun	18.0 ± 5.4	14.2 ± 2.0	13.7 ± 1.9	14.3 ± 2.2
Jul-Sep	19.0 ± 6.7	15.1 ± 2.0	15.0 ± 1.6	16.0 ± 2.3
Oct-Dec	17.6 ± 5.4	14.4 ± 2.4	13.6 ± 1.8	15.2 ± 1.6
Jan-Dec	72.6 ± 23.1**	58.1 ± 8.4	56.1 ± 6.7	60.0 ± 7.7

* 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 62.2 ± 8.1 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 2014 were a small percentage of the corresponding effluent control.

Table 6.1

Percent of ODCM Effluent Control Limits
for Gaseous Effluent Releases During 2014

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	6.91E-05	1.38E-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	3.77E-04	1.26E-05%

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	8.75E-02	5.83E-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	0.00E+00	0.00E+00%
Apr-Jun	0.00E+00	0.00E+00%
Jul-Sep	0.00E+00	0.00E+00%
Oct-Dec	1.07E-04	2.13E-03%

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	1.07E-04	1.07E-03%

Table 6.1 (continued)

Percent of ODCM Effluent Control Limits
for Gaseous Effluent Releases During 2014

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	0.00E+00	0.00E+00%
Apr-Jun	0.00E+00	0.00E+00%
Jul-Sep	0.00E+00	0.00E+00%
Oct-Dec	4.75E-04	4.75E-03%

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	4.75E-04	2.37E-03%

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	2.23E-02	2.98E-01%
Apr-Jun	2.10E-02	2.80E-01%
Jul-Sep	2.15E-02	2.86E-01%
Oct-Dec	2.27E-02	3.02E-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	8.75E-02	5.83E-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 2014

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	4.89E-14	1.47E-06%
Jul-Sep	0.00E+00	0.00E+00%
Oct-Dec	0.00E+00	0.00E+00%
Jan-Dec	1.22E-14	3.68E-07%

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	2.52E-11	2.52E-06%
Jul-Sep	0.00E+00	0.00E+00%
Oct-Dec	0.00E+00	0.00E+00%
Jan-Dec	6.30E-12	6.30E-07%

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 2014

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	2.89E-07	1.93E-05%
Jul-Sep	0.00E+00	0.00E+00%
Oct-Dec	0.00E+00	0.00E+00%

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	2.89E-07	9.62E-06%

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	8.67E-07	1.73E-05%
Jul-Sep	0.00E+00	0.00E+00%
Oct-Dec	0.00E+00	0.00E+00%

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	8.66E-07	8.66E-06%

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 67.4 cubic meters of spent resins, filter sludges, etc., containing a total activity of about 680 Curies were shipped from PNPS for processing and disposal. Dry activated wastes and contaminated equipment shipped during the period totaled 543 cubic meters and contained 1.66 Curies of radioactivity. There were no shipments of irradiated components during the reporting period. Other wastes (contaminated oil and water) totaled 19.2 cubic meters and contained 0.016 Curies of radioactivity. 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 23 shipments to Energy Solutions' Bear Creek Facility in Oak Ridge, TN; 5 shipments to Energy Solutions' Gallaher Road Facility in Kingston, TN; and 4 shipments to Energy Solutions Erwin Resin Solutions' Facility in Erwin, TN.

Table 7.0
Pilgrim Nuclear Power Station
Annual Radioactive Effluent Release Report
Solid Waste and Irradiated Fuel Shipments
January-December 2014

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 2014		
	Volume - m^3	Curies	Total Error
a. Spent resins, filters, filter sludges, evaporator bottoms, etc.	6.74E+01	6.80 E+02	± 25%
b. Dry activated waste, contaminated equipment, etc.	5.43 E+02	1.66 E+00	± 25%
c. Irradiated components, control rods, etc.	0.00E+00	0.00E+00	N/A
d. Other (describe):	1.92E+01	1.65E-02	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.	Mn-54	18.58%	± 25%
	Fe-55	39.31%	± 25%
	Co-58	1.03%	± 25%
	Co-60	30.00%	± 25%
	Zn-65	7.83%	± 25%
b. Dry activated waste, contaminated equipment, etc.	H-3	9.76%	± 25%
	C-14	1.34%	± 25%
	Mn-54	2.76%	± 25%
	Fe-55	60.24%	± 25%
	Co-60	18.11%	± 25%
	Ni-63	1.23%	± 25%
	Zn-65	3.97%	± 25%
	Cs-137	1.08%	± 25%
c. Irradiated components, control rods, etc.	N/A	N/A	N/A
d. Other (describe): Contaminated oil and water	Mn-54	5.13%	± 25%
	Fe-55	69.86%	± 25%
	Co-60	17.17%	± 25%
	Ni-63	1.47%	± 25%
	Zn-65	4.15%	± 25%
	Cs-137	1.23%	± 25%

[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
23	Tractor-trailer (Hittman Transport)	Energy Solutions, Bear Creek Facility[2] Oak Ridge, TN
5	Tractor-trailer (Hittman Transport)	Energy Solutions, Gallaher Road Facility[2] Kingston, TN
4	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 2014. 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 2014 to various procedures related to the Process Control Program (PCP):

EN-RW-102, "Radioactive Shipping Procedure", Rev.11:

- Step 5.1[9](e): inserted the word "Radioactive" and corrected grammatical error (changed "affects" to "effects")
- Step 5.1[11]: revised step to correct Type B Package types
- Step 5.1[12]: added step for Grand Gulf shipment of waste for free release
- Steps 5.2[14] and 5.2[14](b): corrected procedure reference
- Step 5.2[15]: flow charts are redrawn (no content change) in Microsoft Visio format to enhance editing capability
- Step 5.2[18]: corrected regulatory reference
- Step 6.0[5]: corrected procedure reference
- Section 8.0: updated site-commitments for Grand Gulf, W3 and RBS per Commitment Review response from GGNS and RBS
- Attachment 9.1: added field for document package completion
- Attachment 9.1: added field for disposition of Emergency Response information
- Attachment 9.1 expanded parenthetical in Waste Profile Form to include other companies and deleted empty rows.
- Attachment 9.9 and 9.14: field for recording shipment number is reworded so as to be consistent with other attachments

EN-RW-104, "Scaling Factors", Rev.10:

- This is a complete rewrite of the procedure in order to bring the format into compliance with EN-AD-101-01 and to add instructions for using the new version (version 9.0) of RADMAN software. No change bars are used.

EN-RW-105, "Process Control Program", Rev.4:

- Editorial revision to address the issue identified in CR-HQN-2013-00858, CA-02 (Develop a draft procedure that includes instructions for vendors processing waste still owned by Entergy to comply with the PCP program.)
- Reworded Step 5.1[1](b) to improve clarity: inserted text "processed on-site OR off-site by vendors"

EN-RW-106, "Integrated Transportation Security Plan", Rev. 3:

- Total rewrite in order to accomplish the following:
  - Bring the procedure into compliance with EN-AD-101-01
  - Incorporate changes required by recent revision of 10CFR37
  - Correct internal section references
- The primary change involves replacing section 5.6 for Quantities of Concern in Rev. 2 with a new section 5.7 for Category 1 and Category 2 Quantities in Rev. 3

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"

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 2014

Class A Freq: 0.070

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	2	0	0	0	0	0	0	0	0	0	0	0	1	0	2	6
3.5-7.5	6	18	6	4	5	0	0	0	0	0	2	0	8	39	22	17	127
7.5-12.5	1	0	0	0	1	0	0	0	0	0	0	0	4	8	4	0	18
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	20	6	4	6	0	0	0	0	0	2	0	12	48	26	19	151

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	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	3
3.5-7.5	2	4	3	3	1	0	0	0	0	0	1	0	7	2	2	2	27
7.5-12.5	1	2	1	1	0	0	0	1	1	0	0	0	4	5	1	3	20
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	7	4	4	1	0	0	1	1	0	1	0	12	8	3	5	50

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	2	1	1	0	0	0	0	0	0	0	0	0	0	1	2	1	8
3.5-7.5	1	4	0	2	0	0	0	1	1	0	1	5	13	8	1	4	41
7.5-12.5	4	5	3	3	0	0	0	0	3	3	3	3	3	2	1	3	36
12.5-18.5	0	0	0	0	0	0	0	0	0	1	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	7	10	4	5	0	0	0	1	4	4	4	8	16	11	4	8	86

Class D Freq: 0.491

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	9	11	6	3	5	7	3	2	4	2	14	24	11	10	6	1	118
3.5-7.5	23	25	14	11	10	7	10	7	41	69	57	101	131	50	48	17	621
7.5-12.5	20	44	10	4	1	2	2	1	20	42	20	11	63	29	20	6	295
12.5-18.5	5	9	2	0	0	0	0	0	2	2	3	0	0	0	1	2	26
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	57	89	32	18	16	16	15	10	67	115	94	136	205	89	75	26	1060

Table A-1 (continued)

Jan-Mar 2014

Class E Freq: 0.320

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	1	0	0	1	0	0	0	0	0	2
0.95-3.5	4	5	1	1	2	5	7	28	22	21	27	32	14	15	15	11	210
3.5-7.5	4	11	0	3	17	11	11	22	20	41	59	114	65	17	12	3	410
7.5-12.5	2	8	2	3	0	0	4	10	10	11	4	2	3	4	1	0	64
12.5-18.5	0	0	0	0	0	0	0	0	3	2	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	10	24	3	7	19	16	22	61	55	75	91	148	82	36	28	14	691

Class F Freq: 0.050

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	2	1	7	5	5	14	22	8	5	0	0	69
3.5-7.5	0	0	0	0	0	0	3	6	3	5	17	5	0	0	0	0	39
7.5-12.5	0	0	0	0	0	0	0	0	1	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	2	4	13	9	10	31	27	8	5	0	0	109

Class G Freq: 0.006

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	0	2	2	1	2	1	0	0	0	9
3.5-7.5	0	0	0	0	0	0	1	0	0	0	3	0	0	0	0	0	4
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	2	0	2	2	4	2	1	0	0	0	13

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	1	0	0	1	0	0	0	0	0	2
0.95-3.5	16	20	8	4	7	14	12	37	33	30	56	80	35	33	23	15	423
3.5-7.5	36	62	23	23	33	18	25	36	65	115	140	225	224	116	85	43	1269
7.5-12.5	28	59	16	11	2	2	6	12	35	56	27	16	77	48	27	12	434
12.5-18.5	5	9	2	0	0	0	0	0	5	5	3	0	0	0	1	2	32
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	85	150	49	38	42	34	43	86	138	206	227	321	336	197	136	72	2160

Table A-1 (continued)

Apr-Jun 2014

Class A Freq: 0.115

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	9	10	6	4	8	0	0	0	0	0	0	0	0	1	2	2	42
3.5-7.5	16	23	41	19	15	8	13	1	2	6	2	3	6	10	5	5	175
7.5-12.5	3	2	14	0	0	0	0	4	3	3	0	0	0	1	3	2	35
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	28	35	61	23	23	8	13	5	5	9	2	3	6	12	10	9	252

Class B Freq: 0.037

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	1	3	0	0	0	0	0	0	0	1	1	2	2	15
3.5-7.5	1	1	8	5	6	2	3	0	6	2	6	3	2	3	2	0	50
7.5-12.5	0	1	2	0	0	0	0	0	1	9	0	0	0	0	0	1	14
12.5-18.5	0	0	0	0	0	0	0	0	0	1	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	1	4	13	6	9	2	3	0	7	12	6	3	3	4	4	3	80

Class C Freq: 0.053

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	1	5	4	5	2	2	1	0	2	0	2	0	2	2	2	34
3.5-7.5	0	2	13	6	6	5	3	3	1	5	6	1	2	0	2	2	57
7.5-12.5	0	0	9	0	0	0	0	0	4	6	1	0	0	0	2	0	22
12.5-18.5	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
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	3	27	10	11	7	5	4	7	13	7	3	2	2	6	4	115

Class D Freq: 0.365

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
0.95-3.5	11	17	25	24	26	28	24	15	16	9	10	3	5	6	9	12	240
3.5-7.5	13	24	30	18	18	23	32	23	31	74	30	12	22	19	10	1	380
7.5-12.5	5	7	2	1	2	0	0	0	25	92	5	1	10	4	11	0	165
12.5-18.5	0	0	0	0	0	0	0	0	4	6	1	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	29	48	57	44	46	51	56	38	76	181	46	16	37	29	30	13	797

Table A-1 (continued)

Apr-Jun 2014

Class E Freq: 0.295

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	3	0	2	1	0	0	0	1	0	0	0	1	1	0	0	9
0.95-3.5	9	9	11	27	17	10	22	22	14	12	13	23	18	22	15	8	252
3.5-7.5	13	10	5	5	8	6	4	13	7	58	45	40	34	21	19	11	299
7.5-12.5	0	0	0	0	0	0	5	0	3	32	28	1	0	4	5	1	79
12.5-18.5	0	0	0	0	0	0	0	0	5	1	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	22	22	16	34	26	16	31	35	30	103	86	64	53	48	39	20	645

Class F Freq: 0.099

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	1	1	0	0	0	0	0	1	0	0	0	0	3
0.95-3.5	0	2	1	3	0	3	3	4	1	3	17	41	15	3	4	2	102
3.5-7.5	0	2	7	2	1	0	1	1	1	6	43	20	1	1	3	2	91
7.5-12.5	0	0	0	0	0	0	0	0	0	7	13	1	0	0	0	0	21
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	4	8	5	2	4	4	5	2	16	73	63	16	4	7	4	217

Class G Freq: 0.036

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	0	0	1	4	11	19	4	1	0	0	41
3.5-7.5	0	0	0	2	1	0	0	0	0	1	17	2	0	0	0	0	23
7.5-12.5	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	14
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	3	1	0	0	0	1	5	42	21	4	1	0	0	78

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	3	0	3	2	1	0	0	1	0	0	1	1	1	0	0	13
0.95-3.5	33	41	51	64	59	43	51	42	32	30	51	88	43	36	34	28	726
3.5-7.5	43	62	104	57	55	44	56	41	48	152	149	81	67	54	41	21	1075
7.5-12.5	8	10	27	1	2	0	5	4	36	149	61	3	10	9	21	4	350
12.5-18.5	0	0	0	0	0	0	0	0	11	8	1	0	0	0	0	0	20
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	84	116	182	125	118	88	112	87	128	339	262	173	121	100	96	53	2184

Table A-1 (continued)

Jul-Sep 2014

Class A Freq: 0.074

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	12	16	18	4	8	0	0	0	0	0	0	0	1	6	6	4	75
3.5-7.5	8	27	14	7	10	0	0	0	3	3	1	2	7	0	0	3	85
7.5-12.5	0	0	0	0	0	0	0	0	0	3	1	0	0	0	0	0	4
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	43	32	11	18	0	0	0	3	6	2	2	8	6	6	7	164

Class B Freq: 0.031

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	5	8	1	2	0	0	0	0	0	0	0	0	1	2	7	34
3.5-7.5	0	3	1	1	1	0	2	3	5	6	0	3	2	0	0	0	27
7.5-12.5	0	0	0	0	0	0	0	0	0	6	1	0	0	0	0	0	7
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	9	2	3	0	2	3	5	12	1	3	2	1	2	7	68

Class C Freq: 0.055

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	6	9	3	4	1	2	0	0	1	1	1	2	4	4	8	49
3.5-7.5	0	2	0	3	2	1	0	1	10	23	5	2	3	1	2	1	56
7.5-12.5	0	0	0	0	0	0	0	0	1	14	1	0	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	3	8	9	6	6	2	2	1	11	38	7	3	5	5	6	9	121

Class D Freq: 0.377

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	1	0	0	0	0	0	0	0	0	0	1
0.95-3.5	23	45	45	34	23	19	12	10	7	8	11	2	9	7	18	18	291
3.5-7.5	6	32	9	1	3	17	21	3	64	245	49	16	9	7	3	3	488
7.5-12.5	0	0	0	0	0	0	0	0	1	47	3	0	0	1	0	0	52
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	29	77	54	35	26	36	34	13	72	300	63	18	18	15	21	21	832

Table A-1 (continued)

Jul-Sep 2014

Class E Freq: 0.294

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	2	3	3	4	3	3	3	0	0	5	27
0.95-3.5	17	22	19	20	21	15	19	23	40	27	14	35	27	18	17	13	347
3.5-7.5	4	3	0	0	0	5	1	3	15	119	62	29	10	2	5	1	259
7.5-12.5	0	0	0	0	0	0	0	0	0	12	5	0	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	21	25	19	20	21	21	22	29	58	162	84	67	40	20	22	19	650

Class F Freq: 0.127

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	1	1	1	3	1	0	1	1	0	10
0.95-3.5	1	0	0	4	1	2	1	4	22	40	42	46	13	1	2	1	180
3.5-7.5	0	0	0	0	0	0	0	0	1	21	67	1	0	0	0	0	90
7.5-12.5	0	0	0	0	0	0	0	0	0	0	1	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	1	0	1	4	1	2	1	5	24	62	113	48	13	2	3	1	281

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	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2
0.95-3.5	0	0	0	0	0	0	0	0	0	5	25	27	2	1	0	0	60
3.5-7.5	0	0	0	0	0	0	0	0	0	1	29	0	0	0	0	0	30
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	6	54	27	3	2	0	0	92

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	3	4	4	5	6	4	4	2	1	5	40
0.95-3.5	64	94	99	66	59	37	34	37	69	81	93	111	54	38	49	51	1036
3.5-7.5	18	67	24	12	16	23	24	10	98	418	213	53	31	10	10	8	1035
7.5-12.5	0	0	0	0	0	0	0	0	2	82	12	0	0	1	0	0	97
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	82	161	124	78	75	61	61	51	173	586	324	168	89	51	60	64	2208

Table A-1 (continued)

Oct-Dec 2014

Class A 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	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	4
3.5-7.5	4	3	4	2	0	0	0	0	0	0	0	3	6	8	7	5	42
7.5-12.5	0	3	1	0	1	2	0	1	0	0	0	0	2	0	1	0	11
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	5	7	6	2	1	2	0	1	0	0	0	3	8	8	8	6	57

Class B Freq: 0.031

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	1	0	0	0	0	3
3.5-7.5	1	9	1	1	1	2	0	0	1	1	3	3	11	4	5	2	45
7.5-12.5	1	6	7	1	2	2	0	0	0	2	0	0	0	0	0	0	21
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	15	9	2	4	4	0	0	1	3	3	4	11	4	5	2	69

Class C 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	1	1	0	1	1	2	0	0	0	0	0	0	2	2	0	10
3.5-7.5	0	14	12	4	0	0	1	1	0	1	6	11	10	8	8	5	81
7.5-12.5	1	10	3	6	0	0	0	1	0	0	0	0	0	4	0	1	26
12.5-18.5	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
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	27	16	10	1	1	3	2	0	1	6	11	10	14	10	6	119

Class D Freq: 0.542

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	1	1
0.95-3.5	12	9	9	11	8	4	18	10	16	9	4	11	9	7	11	7	155
3.5-7.5	27	71	37	21	27	9	20	22	51	93	58	82	139	90	63	12	822
7.5-12.5	6	41	10	6	5	8	0	0	11	51	24	3	11	18	8	2	204
12.5-18.5	0	0	0	2	0	0	0	3	1	8	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	45	121	56	40	40	21	38	35	79	161	86	96	159	115	82	22	1196

Table A-1 (continued)

Oct-Dec 2014

Class E Freq: 0.284

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	1	0	0	0	0	0	0	0	0	1
0.95-3.5	3	9	4	5	3	3	12	23	20	25	31	29	10	18	8	6	209
3.5-7.5	0	5	2	7	4	6	7	25	57	46	51	94	55	20	3	1	383
7.5-12.5	0	0	3	2	1	1	0	1	2	14	2	0	2	0	0	0	28
12.5-18.5	0	0	0	2	0	0	0	0	3	1	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	3	14	9	16	8	10	19	50	82	86	84	123	67	38	11	7	627

Class F Freq: 0.055

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	1	0	0	0	0	2
0.95-3.5	0	1	1	1	0	1	1	10	6	11	12	17	8	2	0	0	71
3.5-7.5	0	0	0	0	0	0	0	1	1	3	38	4	1	0	0	0	48
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	1	1	1	0	1	1	11	7	15	50	22	9	2	0	0	121

Class G Freq: 0.009

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	4	6	1	0	0	0	11
3.5-7.5	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	8
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	12	6	1	0	0	0	19

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	1	0	1	0	1	0	0	0	1	4
0.95-3.5	16	21	17	17	13	9	33	43	42	45	51	64	28	29	21	14	463
3.5-7.5	32	102	56	35	32	17	28	49	110	144	164	197	222	130	86	25	1429
7.5-12.5	8	60	24	15	9	13	0	3	13	67	26	3	15	22	9	3	290
12.5-18.5	0	2	0	4	0	0	0	3	4	9	0	0	0	0	0	0	22
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	56	185	97	71	54	39	61	99	169	266	241	265	265	181	116	43	2208

Table A-1 (continued)

Jan-Dec 2014

Class A Freq: 0.071

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	29	25	8	16	0	0	0	0	0	0	0	1	8	8	9	127
3.5-7.5	34	71	65	32	30	8	13	1	5	9	5	8	27	57	34	30	429
7.5-12.5	4	5	15	0	2	2	0	5	3	6	1	0	6	9	8	2	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	61	105	105	40	48	10	13	6	8	15	6	8	34	74	50	41	624

Class B Freq: 0.030

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	8	12	2	6	0	0	0	0	0	0	1	2	3	4	9	55
3.5-7.5	4	17	13	10	9	4	5	3	12	9	10	9	22	9	9	4	149
7.5-12.5	2	9	10	2	2	2	0	1	2	17	1	0	4	5	1	4	62
12.5-18.5	0	0	0	0	0	0	0	0	0	1	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	14	34	35	14	17	6	5	4	14	27	11	10	28	17	14	17	267

Class C Freq: 0.050

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	9	9	16	7	10	4	6	1	0	3	1	3	2	9	10	11	101
3.5-7.5	1	22	25	15	8	6	4	6	12	29	18	19	28	17	13	12	235
7.5-12.5	5	15	15	9	0	0	0	1	8	23	5	3	3	6	3	4	100
12.5-18.5	0	2	0	0	0	0	0	0	2	1	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	15	48	56	31	18	10	10	8	22	56	24	25	33	32	26	27	441

Class D Freq: 0.443

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	3
0.95-3.5	55	82	85	72	62	58	57	37	43	28	39	40	34	30	44	38	804
3.5-7.5	69	152	90	51	58	56	83	55	187	481	194	211	301	166	124	33	2311
7.5-12.5	31	92	22	11	8	10	2	1	57	232	52	15	84	52	39	8	716
12.5-18.5	5	9	2	2	0	0	0	3	7	16	4	0	0	0	1	2	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	160	335	199	137	128	124	143	96	294	757	289	266	419	248	208	82	3885

Table A-1 (continued)

Jan-Dec 2014

Class E Freq: 0.298

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	3	0	2	1	1	2	5	4	4	4	3	4	1	0	5	39
0.95-3.5	33	45	35	53	43	33	60	96	96	85	85	119	69	73	55	38	1018
3.5-7.5	21	29	7	15	29	28	23	63	99	264	217	277	164	60	39	16	1351
7.5-12.5	2	8	5	5	1	1	9	11	15	69	39	3	5	8	6	1	188
12.5-18.5	0	0	0	2	0	0	0	0	11	4	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	56	85	47	77	74	63	94	175	225	426	345	402	242	142	100	60	2613

Class F Freq: 0.083

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	1	1	0	1	1	2	3	3	0	1	1	0	15
0.95-3.5	1	3	2	8	1	8	6	25	34	59	85	126	44	11	6	3	422
3.5-7.5	0	2	7	2	1	0	4	8	6	35	165	30	2	1	3	2	268
7.5-12.5	0	0	0	0	0	0	0	0	1	7	14	1	0	0	0	0	23
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	5	10	10	3	9	10	34	42	103	267	160	46	13	10	5	728

Class G 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	1	1	0	0	2
0.95-3.5	0	0	0	1	0	0	1	0	3	11	41	54	8	2	0	0	121
3.5-7.5	0	0	0	2	1	0	1	0	0	2	57	2	0	0	0	0	65
7.5-12.5	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	14
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	3	1	0	2	0	3	13	112	56	9	3	0	0	202

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	3	1	3	2	2	3	6	5	6	7	6	5	3	1	6	59
0.95-3.5	129	176	175	151	138	103	130	159	176	186	251	343	160	136	127	108	2648
3.5-7.5	129	293	207	127	136	102	133	136	321	829	666	556	544	310	222	97	4808
7.5-12.5	44	129	67	27	13	15	11	19	86	354	126	22	102	80	57	19	1171
12.5-18.5	5	11	2	4	0	0	0	3	20	22	4	0	0	0	1	2	74
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	307	612	452	312	289	222	277	323	608	1397	1054	927	811	529	408	232	8760

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

Jan-Mar 2014

Class A Freq: 0.070

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	2	0	3	0	0	0	0	0	0	0	0	0	0	4	1	4	14
7.5-12.5	5	5	3	0	3	1	0	0	0	1	1	0	3	14	7	4	47
12.5-18.5	3	2	0	1	1	3	0	0	0	0	0	0	6	19	6	4	45
18.5-24	6	0	0	0	0	0	0	0	0	0	0	0	7	14	5	3	35
>24	1	0	0	0	0	0	0	0	0	0	0	0	0	5	4	0	10
TOTAL	17	7	6	1	4	4	0	0	0	1	1	0	16	56	23	15	151

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	0	0	0	0	0	0	0	0	0	0	0
3.5-7.5	1	0	2	1	0	0	0	0	0	0	0	0	1	2	0	0	7
7.5-12.5	1	1	1	1	1	0	0	0	0	0	1	1	2	0	1	1	11
12.5-18.5	1	0	0	0	0	1	0	0	0	0	0	0	5	0	2	0	9
18.5-24	1	0	0	0	0	0	0	2	0	0	0	0	3	0	1	2	9
>24	3	0	1	1	0	0	0	0	0	0	0	0	0	5	2	2	14
TOTAL	7	1	4	3	1	1	0	2	0	0	1	1	11	7	6	5	50

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	0	0	0	0	0	0	0	0	0	0	0	0	0
3.5-7.5	1	1	1	0	1	0	0	0	1	0	0	1	0	1	2	1	10
7.5-12.5	0	0	0	1	0	0	0	0	0	0	0	5	1	4	0	0	11
12.5-18.5	2	0	0	0	0	0	0	1	2	2	2	3	7	3	0	3	25
18.5-24	2	0	0	0	0	0	0	1	0	1	2	0	2	3	0	2	13
>24	7	0	1	5	0	0	0	0	0	1	0	1	3	3	1	5	27
TOTAL	12	1	2	6	1	0	0	2	3	4	4	10	13	14	3	11	86

Class D Freq: 0.491

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	0	1	1	1	0	1	0	0	3	0	0	1	2	14
3.5-7.5	4	6	3	0	4	3	2	0	1	4	3	9	13	3	2	1	58
7.5-12.5	5	7	8	4	5	4	5	4	18	39	44	33	22	7	9	0	214
12.5-18.5	4	5	6	3	2	4	4	5	19	63	38	59	76	45	21	12	366
18.5-24	25	5	2	5	1	2	5	3	2	22	12	9	43	28	30	9	203
>24	49	11	9	3	4	0	0	0	3	5	4	1	19	37	28	32	205
TOTAL	88	35	30	15	17	14	17	12	44	133	101	114	173	120	91	56	1060

Table A-2 (continued)

Jan-Mar 2014

Class E Freq: 0.320

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	0	0	0	0	1	0	0	0	1	1	1	0	0	1	1	9
3.5-7.5	3	2	2	1	4	5	6	3	8	6	6	3	8	11	5	8	81
7.5-12.5	0	6	1	1	8	3	7	7	20	16	18	27	33	12	5	4	168
12.5-18.5	7	2	1	6	5	8	9	10	19	17	38	55	71	20	17	10	295
18.5-24	6	2	0	0	5	0	7	12	11	15	8	9	9	11	4	1	100
>24	11	0	1	3	1	0	0	0	5	2	1	0	3	8	2	1	38
TOTAL	30	12	5	11	23	17	29	32	63	57	72	95	124	62	34	25	691

Class F Freq: 0.050

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	1	0	0	0	0	0	0	0	0	0	0	0	1
0.95-3.5	3	2	0	0	1	2	1	0	1	1	2	0	1	1	1	0	16
3.5-7.5	1	0	0	0	0	2	3	5	1	2	4	0	5	6	3	2	34
7.5-12.5	0	0	0	0	0	0	1	1	8	3	2	5	5	2	2	2	31
12.5-18.5	0	0	0	0	0	0	2	3	4	1	5	2	4	0	0	0	21
18.5-24	0	0	0	0	0	0	4	1	1	0	0	0	0	0	0	0	6
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	4	2	0	0	2	4	11	10	15	7	13	7	15	9	6	4	109

Class G Freq: 0.006

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	1	0	0	1	2	0	0	0	0	0	0	4
3.5-7.5	0	1	0	0	0	0	0	0	0	0	1	0	2	0	0	0	4
7.5-12.5	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2
12.5-18.5	0	0	0	0	0	0	0	1	1	0	1	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	0	1	0	0	0	1	0	1	2	2	2	2	2	0	0	0	13

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	1	0	0	0	0	0	0	0	0	0	0	0	1
0.95-3.5	7	3	2	0	2	5	2	0	3	4	3	4	1	1	3	3	43
3.5-7.5	12	10	11	2	9	10	11	8	11	12	14	13	29	27	13	16	208
7.5-12.5	11	19	13	7	17	8	13	12	46	59	66	73	66	39	24	11	484
12.5-18.5	17	9	7	10	8	16	15	20	45	83	84	119	169	87	46	29	764
18.5-24	40	7	2	5	6	2	16	19	14	38	22	18	64	56	40	17	366
>24	71	11	12	12	5	0	0	0	8	8	5	2	25	58	37	40	294
TOTAL	158	59	47	36	48	41	57	59	127	204	194	229	354	268	163	116	2160

Table A-2 (continued)

Apr-Jun 2014

Class A Freq: 0.115

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	7	8	3	2	1	0	0	0	0	0	0	0	0	0	2	24
7.5-12.5	11	4	14	6	18	4	0	1	1	1	2	2	0	4	2	8	78
12.5-18.5	16	10	20	4	4	10	13	0	5	1	1	0	8	6	3	7	108
18.5-24	4	4	7	0	0	0	2	5	2	3	0	0	0	0	0	3	30
>24	5	0	0	0	0	0	0	0	0	0	0	0	0	0	5	2	12
TOTAL	37	25	49	13	24	15	15	6	8	5	3	2	8	10	10	22	252

Class B Freq: 0.037

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	3	0	3	0	0	0	0	0	0	0	1	2	0	0	11
7.5-12.5	1	1	3	0	2	7	0	0	3	0	3	1	1	1	0	2	25
12.5-18.5	0	0	3	0	2	1	4	0	5	1	5	0	2	2	2	0	27
18.5-24	1	0	3	1	0	0	0	0	0	4	1	0	1	0	0	0	11
>24	1	0	0	0	0	0	0	0	0	4	0	0	0	0	1	0	6
TOTAL	4	2	12	1	7	8	4	0	8	9	9	1	5	5	3	2	80

Class C Freq: 0.053

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	2	5	1	3	1	0	0	0	0	0	1	0	0	0	1	15
7.5-12.5	1	1	2	2	3	4	7	1	1	3	1	2	0	1	1	4	34
12.5-18.5	2	0	14	3	3	2	1	0	5	5	6	1	1	0	2	0	45
18.5-24	0	0	5	2	2	0	0	2	1	2	0	0	0	0	1	1	16
>24	0	0	0	0	0	0	0	0	2	0	0	0	0	0	3	0	5
TOTAL	4	3	26	8	11	7	8	3	9	10	7	4	1	1	7	6	115

Class D Freq: 0.365

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	1	1	2	0	1	2	0	1	0	0	0	0	1	12
3.5-7.5	11	1	15	6	12	27	11	8	4	5	3	0	2	4	9	7	125
7.5-12.5	6	9	20	11	5	21	20	13	17	23	19	5	2	5	3	7	186
12.5-18.5	1	11	18	13	6	15	23	13	28	58	19	6	10	14	5	2	242
18.5-24	10	6	2	7	7	2	4	17	12	68	10	3	4	10	7	5	174
>24	12	0	1	0	0	0	0	0	4	14	2	0	4	5	16	0	58
TOTAL	40	28	58	38	31	67	58	52	67	168	54	14	22	38	40	22	797

Table A-2 (continued)

Apr-Jun 2014

Class E Freq: 0.295

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	1	0	0	0	0	0	0	0	0	0	1
0.95-3.5	1	1	4	3	5	3	2	2	2	2	1	1	1	1	0	0	29
3.5-7.5	5	5	10	2	6	16	8	4	9	8	3	2	2	5	6	3	94
7.5-12.5	8	4	5	1	4	15	13	14	10	17	4	3	4	8	9	7	126
12.5-18.5	11	4	1	0	0	5	6	12	12	33	16	17	22	46	22	11	218
18.5-24	6	0	0	0	0	0	2	5	4	32	31	3	5	13	14	7	122
>24	1	0	0	0	0	0	4	0	5	15	9	0	0	5	11	5	55
TOTAL	32	14	20	6	15	39	36	37	42	107	64	26	34	78	62	33	645

Class F Freq: 0.099

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	1	0	1	3	0	0	1	0	0	1	0	0	8
3.5-7.5	3	4	2	2	0	1	2	2	1	2	3	0	1	4	1	1	29
7.5-12.5	1	2	1	0	0	1	4	1	3	6	7	4	7	11	9	2	59
12.5-18.5	2	1	0	0	0	0	0	2	3	3	6	11	16	17	11	5	77
18.5-24	1	0	0	0	0	0	0	0	0	6	8	7	7	0	2	1	32
>24	0	0	0	0	0	0	0	0	0	2	8	0	0	0	0	2	12
TOTAL	7	7	3	3	1	2	7	8	7	19	33	22	31	33	23	11	217

Class G Freq: 0.036

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	1	1	0	0	0	0	1	0	1	0	1	0	3	11
3.5-7.5	1	2	1	1	0	1	1	1	1	2	0	4	0	1	3	1	20
7.5-12.5	0	0	0	0	0	0	0	1	0	1	1	4	6	3	0	0	16
12.5-18.5	0	0	0	0	0	0	0	0	0	0	2	6	3	0	1	1	13
18.5-24	0	0	0	0	0	0	0	0	0	2	10	4	0	0	0	1	17
>24	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
TOTAL	1	3	3	2	1	1	1	2	1	6	14	19	9	5	4	6	78

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	1	0	0	0	0	0	0	0	0	0	1
0.95-3.5	1	3	8	6	8	5	3	6	4	3	3	2	1	3	0	4	60
3.5-7.5	23	22	44	15	26	47	22	15	15	17	9	7	6	16	19	15	318
7.5-12.5	28	21	45	20	32	52	44	31	35	51	37	21	20	33	24	30	524
12.5-18.5	32	26	56	20	15	33	47	27	58	101	55	41	62	85	46	26	730
18.5-24	22	10	17	10	9	2	8	29	19	117	60	17	17	23	24	18	402
>24	19	0	1	0	0	0	4	0	11	35	20	0	4	10	36	9	149
TOTAL	125	82	171	71	90	139	129	108	142	324	184	88	110	170	149	102	2184

Table A-2 (continued)

Jul-Sep 2014

Class A Freq: 0.074

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	5	8	5	6	2	0	0	0	0	0	1	0	0	4	3	3	37
7.5-12.5	13	12	6	6	2	0	0	0	1	0	0	0	6	3	0	2	51
12.5-18.5	17	9	3	7	10	0	0	1	3	2	0	0	3	1	1	0	57
18.5-24	6	1	0	0	1	0	0	0	1	1	1	0	1	1	0	6	19
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	41	30	14	19	15	0	0	1	5	3	2	0	10	9	4	11	164

Class B Freq: 0.031

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	8	3	3	1	0	0	0	0	0	0	0	0	0	0	2	1	18
7.5-12.5	3	0	2	1	0	1	1	1	2	1	0	1	0	1	0	5	19
12.5-18.5	2	1	1	2	1	0	2	0	8	2	0	1	2	1	0	1	24
18.5-24	0	1	0	0	0	0	0	1	0	3	2	0	0	0	0	0	7
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	13	5	6	4	1	1	3	2	10	6	2	2	2	2	2	7	68

Class C Freq: 0.055

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	0	0	0	0	0	0	0	0	0	0	0	0	1
3.5-7.5	2	4	5	2	0	0	1	0	0	0	2	0	0	3	2	4	25
7.5-12.5	1	1	4	3	3	1	2	1	3	5	1	1	2	4	0	4	36
12.5-18.5	1	1	0	1	0	0	1	1	13	17	3	2	1	2	1	2	46
18.5-24	0	0	0	1	0	0	0	0	2	7	1	0	0	0	0	0	11
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
TOTAL	4	7	9	7	3	1	4	2	18	29	7	3	3	9	4	11	121

Class D Freq: 0.377

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	3	1	4	2	1	0	0	0	0	1	0	0	0	0	1	18
3.5-7.5	13	16	17	9	11	12	3	1	3	9	11	2	1	2	7	3	120
7.5-12.5	5	13	23	8	6	9	19	11	15	39	26	7	1	4	3	10	199
12.5-18.5	10	12	9	16	4	3	11	1	41	170	31	10	10	3	4	10	345
18.5-24	17	9	0	0	9	3	6	0	4	71	5	0	1	7	4	3	139
>24	4	0	0	0	0	1	0	0	0	0	0	0	0	5	0	1	11
TOTAL	54	53	50	37	32	29	39	13	63	289	74	19	13	21	18	28	832

Table A-2 (continued)

Jul-Sep 2014

Class E Freq: 0.294

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	0	2	2	2	2	1	1	0	0	2	0	1	1	1	0	17
3.5-7.5	3	4	7	6	7	23	10	4	1	2	2	3	3	0	2	3	80
7.5-12.5	12	11	10	12	14	7	9	7	14	22	3	8	10	11	13	8	171
12.5-18.5	10	0	2	2	9	2	3	20	8	60	46	17	23	25	12	7	246
18.5-24	3	0	0	0	3	1	1	0	1	54	30	6	1	7	3	7	117
>24	5	0	0	0	0	0	0	0	0	6	4	0	0	0	0	3	18
TOTAL	35	15	21	22	35	35	24	32	24	144	88	34	38	44	31	28	650

Class F Freq: 0.127

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	1	0	1	0	3	0	2	0	0	0	0	0	0	1	10
3.5-7.5	2	0	1	1	1	7	5	6	1	5	0	1	2	0	1	0	33
7.5-12.5	1	1	0	0	1	4	7	9	12	10	5	4	6	8	15	5	88
12.5-18.5	0	0	0	0	0	0	5	12	9	23	29	15	6	27	5	0	131
18.5-24	0	0	0	0	0	0	0	0	0	2	14	1	0	0	0	2	19
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	5	1	2	1	3	11	20	27	24	40	48	21	14	35	21	8	281

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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	1	0	0	2	0	1	0	0	1	1	0	0	1	0	0	1	8
3.5-7.5	0	0	0	0	1	0	1	0	3	4	3	5	2	1	1	0	21
7.5-12.5	0	0	0	0	0	0	1	2	1	1	7	11	14	5	2	0	44
12.5-18.5	0	0	0	0	0	0	0	1	2	2	3	2	4	3	2	0	19
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	0	0	2	1	1	2	3	7	8	13	18	21	9	5	1	92

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	0	0	0	0	1
0.95-3.5	10	4	4	8	5	4	4	1	3	1	3	0	2	1	1	3	54
3.5-7.5	33	35	38	25	22	42	20	11	8	20	19	11	8	10	18	14	334
7.5-12.5	35	38	45	30	26	22	39	31	48	78	42	32	39	36	33	34	608
12.5-18.5	40	23	15	28	24	5	22	36	84	276	112	47	49	62	25	20	868
18.5-24	26	11	0	1	13	4	7	1	8	138	53	7	3	15	7	18	312
>24	9	0	0	0	0	1	0	0	0	6	4	0	0	5	1	5	31
TOTAL	153	111	102	92	90	78	92	80	151	519	234	97	101	129	85	94	2208

Table A-2 (continued)

Oct-Dec 2014

Class A 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	1	0	0	0	0	0	0	0	0	0	0	1	1	0	3
7.5-12.5	3	0	1	0	0	0	0	0	0	0	0	1	1	6	1	2	15
12.5-18.5	3	0	2	1	0	0	0	0	0	0	0	0	4	4	5	3	22
18.5-24	1	0	0	2	0	1	0	1	0	0	0	0	2	0	2	0	9
>24	1	2	1	0	2	0	0	0	0	0	0	0	0	1	1	0	8
TOTAL	8	2	5	3	2	1	0	1	0	0	0	1	7	12	10	5	57

Class B Freq: 0.031

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	0	0	0	0	0	0	0	0	0	0	0	1
7.5-12.5	0	0	1	1	2	2	0	0	0	0	0	5	5	1	1	0	18
12.5-18.5	3	1	1	0	0	0	0	0	1	1	3	0	5	2	1	0	18
18.5-24	0	5	4	1	0	1	0	0	0	0	0	0	0	1	3	1	16
>24	2	6	1	0	2	1	0	0	0	0	0	0	0	1	1	2	16
TOTAL	5	12	8	2	4	4	0	0	1	1	3	5	10	5	6	3	69

Class C 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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.5-7.5	0	1	0	1	0	0	0	0	0	0	0	0	1	1	0	0	4
7.5-12.5	0	0	3	1	2	1	3	0	0	1	1	8	6	2	6	1	35
12.5-18.5	2	3	5	2	0	0	0	0	0	0	2	4	4	3	5	0	30
18.5-24	0	7	4	8	0	0	1	1	0	0	0	0	1	0	4	1	27
>24	6	10	0	0	0	0	0	0	0	0	0	0	0	5	0	2	23
TOTAL	8	21	12	12	2	1	4	1	0	1	3	12	12	11	15	4	119

Class D Freq: 0.542

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	0	0	0	0	0	0	1	0	0	0	0	0	0	0	4
3.5-7.5	4	3	3	12	6	6	5	4	4	3	5	5	1	1	5	3	70
7.5-12.5	5	8	12	6	8	4	14	6	19	24	29	23	17	16	6	6	203
12.5-18.5	12	22	10	9	8	6	17	14	23	87	64	32	79	80	40	9	512
18.5-24	13	21	11	21	6	10	5	5	3	32	19	2	24	37	29	14	252
>24	41	19	10	8	6	0	0	4	0	8	0	0	1	21	20	17	155
TOTAL	77	74	46	56	34	26	41	33	50	154	117	62	122	155	100	49	1196

Table A-2 (continued)

Oct-Dec 2014

Class E Freq: 0.284

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	1	1	1	2	0	1	0	1	1	0	0	2	0	0	12
3.5-7.5	5	4	9	2	1	1	4	4	6	12	4	7	2	7	6	3	77
7.5-12.5	1	4	1	3	4	7	7	13	9	25	28	13	14	23	5	5	162
12.5-18.5	1	1	0	4	4	3	5	41	25	32	29	52	59	34	12	3	305
18.5-24	2	2	1	2	1	0	0	1	2	20	4	5	10	8	1	0	59
>24	0	0	2	5	2	0	0	0	1	1	0	0	0	1	0	0	12
TOTAL	9	13	14	17	13	13	16	60	43	91	66	77	85	75	24	11	627

Class F Freq: 0.055

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	1	0	0	0	0	0	0	0	1	3
3.5-7.5	3	2	0	0	1	0	0	2	1	3	1	3	2	1	0	3	22
7.5-12.5	0	0	0	0	0	2	3	4	0	2	4	1	5	12	2	2	37
12.5-18.5	0	0	0	0	0	0	3	10	3	2	8	15	15	3	0	0	59
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	2	0	0	1	2	6	17	4	7	13	19	22	16	2	6	121

Class G Freq: 0.009

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	1	0	0	1	0	0	0	0	0	2
3.5-7.5	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	4	6
7.5-12.5	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1	4
12.5-18.5	0	0	0	0	0	0	0	0	1	0	5	1	0	0	0	0	7
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	1	2	0	7	2	2	0	0	5	19

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	3	1	1	1	2	0	3	1	1	2	0	0	2	0	1	21
3.5-7.5	12	10	14	15	8	7	9	10	12	18	10	15	7	11	12	13	183
7.5-12.5	9	12	18	11	16	16	27	23	28	52	63	52	49	60	21	17	474
12.5-18.5	21	27	18	16	12	9	25	65	53	122	111	104	166	126	63	15	953
18.5-24	16	35	20	34	7	12	6	8	5	52	23	7	37	46	39	16	363
>24	50	37	14	13	12	1	0	4	1	9	0	0	1	29	22	21	214
TOTAL	111	124	85	90	56	47	67	113	100	254	209	178	260	274	157	83	2208

Table A-2 (continued)

Jan-Dec 2014

Class A Freq: 0.071

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	8	15	17	9	4	1	0	0	0	0	1	0	0	9	5	9	78
7.5-12.5	32	21	24	12	23	5	0	1	2	2	3	3	10	27	10	16	191
12.5-18.5	39	21	25	13	15	13	13	1	8	3	1	0	21	30	15	14	232
18.5-24	17	5	7	2	1	1	2	6	3	4	1	0	10	15	7	12	93
>24	7	2	1	0	2	0	0	0	0	0	0	0	0	6	10	2	30
TOTAL	103	64	74	36	45	20	15	8	13	9	6	3	41	87	47	53	624

Class B Freq: 0.030

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	10	4	9	2	3	0	0	0	0	0	0	0	2	4	2	1	37
7.5-12.5	5	2	7	3	5	10	1	1	5	1	4	8	8	3	2	8	73
12.5-18.5	6	2	5	2	3	2	6	0	14	4	8	1	14	5	5	1	78
18.5-24	2	6	7	2	0	1	0	3	0	7	3	0	4	1	4	3	43
>24	6	6	2	1	2	1	0	0	0	4	0	0	0	6	4	4	36
TOTAL	29	20	30	10	13	14	7	4	19	16	15	9	28	19	17	17	267

Class C Freq: 0.050

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	0	0	0	0	0	0	0	0	0	0	0	0	1
3.5-7.5	4	8	11	4	4	1	1	0	1	0	2	2	1	5	4	6	54
7.5-12.5	2	2	9	7	8	6	12	2	4	9	3	16	9	11	7	9	116
12.5-18.5	7	4	19	6	3	2	2	2	20	24	13	10	13	8	8	5	146
18.5-24	2	7	9	11	2	0	1	4	3	10	3	0	3	3	5	4	67
>24	13	10	1	5	0	0	0	0	2	1	0	1	3	8	5	8	57
TOTAL	28	32	49	33	17	9	16	8	30	44	21	29	29	35	29	32	441

Class D Freq: 0.443

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	6	5	5	4	4	1	1	4	0	2	3	0	0	1	4	48
3.5-7.5	32	26	38	27	33	48	21	13	12	21	22	16	17	10	23	14	373
7.5-12.5	21	37	63	29	24	38	58	34	69	125	118	68	42	32	21	23	802
12.5-18.5	27	50	43	41	20	28	55	33	111	378	152	107	175	142	70	33	1465
18.5-24	65	41	15	33	23	17	20	25	21	193	46	14	72	82	70	31	768
>24	106	30	20	11	10	1	0	4	7	27	6	1	24	68	64	50	429
TOTAL	259	190	184	146	114	136	155	110	224	744	346	209	330	334	249	155	3885

Table A-2 (continued)

Jan-Dec 2014

Class E Freq: 0.298

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	1	0	0	0	1	0	0	0	0	0	2
0.95-3.5	6	3	7	6	8	8	3	4	2	4	5	2	2	4	2	1	67
3.5-7.5	16	15	28	11	18	45	28	15	24	28	15	15	15	23	19	17	332
7.5-12.5	21	25	17	17	30	32	36	41	53	80	53	51	61	54	32	24	627
12.5-18.5	29	7	4	12	18	18	23	83	64	142	129	141	175	125	63	31	1064
18.5-24	17	4	1	2	9	1	10	18	18	121	73	23	25	39	22	15	398
>24	17	0	3	8	3	0	4	0	11	24	14	0	3	14	13	9	123
TOTAL	106	54	60	56	86	104	105	161	172	399	290	232	281	259	151	97	2613

Class F Freq: 0.083

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	1	0	0	0	0	0	0	0	0	0	0	0	1
0.95-3.5	6	2	1	1	3	2	5	4	3	1	3	0	1	2	1	2	37
3.5-7.5	9	6	3	3	2	10	10	15	4	12	8	4	10	11	5	6	118
7.5-12.5	2	3	1	0	1	7	15	15	23	21	18	14	23	33	28	11	215
12.5-18.5	2	1	0	0	0	0	10	27	19	29	48	43	41	47	16	5	288
18.5-24	1	0	0	0	0	0	4	1	1	8	22	8	7	0	2	3	57
>24	0	0	0	0	0	0	0	0	0	2	8	0	0	0	0	2	12
TOTAL	20	12	5	4	7	19	44	62	50	73	107	69	82	93	52	29	728

Class G 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	1	1	2	3	1	2	0	1	2	4	1	1	1	1	0	4	25
3.5-7.5	1	3	1	1	1	1	2	1	5	6	4	9	5	2	4	5	51
7.5-12.5	0	0	0	0	0	0	1	3	1	2	9	18	21	8	2	1	66
12.5-18.5	0	0	0	0	0	0	0	2	4	2	11	9	7	3	3	1	42
18.5-24	0	0	0	0	0	0	0	0	0	2	10	4	0	0	0	1	17
>24	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
TOTAL	2	4	3	4	2	3	3	7	12	16	36	41	34	14	9	12	202

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	1	0	1	0	0	0	1	0	0	0	0	0	3
0.95-3.5	21	13	15	15	16	16	9	10	11	9	11	6	4	7	4	11	178
3.5-7.5	80	77	107	57	65	106	62	44	46	67	52	46	50	64	62	58	1043
7.5-12.5	83	90	121	68	91	98	123	97	157	240	208	178	174	168	102	92	2090
12.5-18.5	110	85	96	74	59	63	109	148	240	582	362	311	446	360	180	90	3315
18.5-24	104	63	39	50	35	20	37	57	46	345	158	49	121	140	110	69	1443
>24	149	48	27	25	17	2	4	4	20	58	29	2	30	102	96	75	688
TOTAL	547	376	405	289	284	305	345	360	520	1301	821	592	825	841	554	395	8760

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 the 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 2014.

A summary of the results of the tritium analyses conducted in 2014 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 13-Jan-2014 contained no detectable tritium, and a minimum detectable concentration of 389 pCi/L was achieved on that sample. The achieved sensitivity of 389 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	27	1	NDA < 311	396
MW202	Nov-2007	5	0	NDA < 353	NDA < 387
MW202-I	Apr-2010	5	3	NDA < 405	1740
MW203	Nov-2007	Well decommissioned in 2013 during construction of ISFSI pad			
MW204	Nov-2007	4	0	NDA < 366	NDA < 406
MW205	Apr-2010	50	23	NDA < 349	1520
MW206	Apr-2010	27	6	NDA < 339	1080
MW207	Apr-2010	4	0	NDA < 365	NDA < 399
MW208-S	Apr-2010	4	0	NDA < 364	NDA < 394
MW208-I	Apr-2010	4	0	NDA < 365	NDA < 387
MW209	Aug-2010	52	52	380	1610
MW210	Aug-2010	4	0	NDA < 371	NDA < 406
MW211	Aug-2010	52	52	616	1440
MW212	Aug-2010	4	3	NDA < 368	624
MW213	Aug-2010	4	0	NDA < 366	NDA < 393
MW214	Aug-2010	4	0	NDA < 338	NDA < 401
MW215	Dec-2011	27	27	667	1280
MW216	Sep-2012	52	52	1050	6610
MW217	Dec-2011	4	0	NDA < 362	NDA < 391
MW218	Nov-2013	52	52	1070	4730
MW219	Dec-2013	53	53	591	20000
MW220	Dec-2014	Well installed late Dec-2014; first sample collected 15-Jan-2015			
MW3	Jul-1987	4	0	NDA < 358	NDA < 395
MW4	Jul-1997	Well decommissioned in 2013 during installation of MW4R			
MW4-R	Nov-2013	14	7	NDA < 339	581
All Wells	--	456	331	NDA < 311	20000
Intake Canal West	--	51	0	NDA < 311	NDA < 416
Intake Canal East	--	4	0	NDA < 368	NDA < 427

Concentrations of tritium detected in the onsite wells ranged from non-detectable at less than 311 pCi/L, up to a maximum concentration of 20,000 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 MW219 (average concentration = 4314 pCi/L) was consumed as drinking water for an entire year, the maximum dose consequence would be less than 0.35 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 2014, 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 430 pCi/L, the annual discharge of tritium into the intake bay under this hypothetical scenario would be 0.00538 Curies. This activity represents less than 0.006% 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 0.00538 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 2014 was 614 billion Liters, yielding an effective concentration of tritium in the intake bay of about 0.0088 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 0.0000000050 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. Although all four samples collected from monitoring well MW204 indicated no detectable activity, for purposes of conservatism the well was assumed to contain tritium at the average of the detection limits achieved on the four quarterly samples.

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	3.81E+02	5.08E+02	5.85E+02	3.74E+02
Annual Segment Tritium Discharge - Ci/yr	6.13E-04	1.10E-03	1.11E-03	2.56E-03
Total Volumetric Discharge - L/yr	1.25E+07			
Total H-3 Discharge - Ci/yr	5.38E-03			
Annual Circulating Water Flow - Liter/yr	6.14E+11			
Discharge Canal H-3 Concentration - Ci/L	8.75E-15			
Discharge Canal H-3 Concentration - pCi/L	8.75E-03			
Max. Indiv. Dose Factor - mrem/yr per Ci/L	5.73E+05			
Maximum Individual Dose - mrem/yr	5.01E-09			

In April 2013, an internal inspection of the neutralizing sump discharge line identified a separation in the line approximately 5-feet below the ground surface where the line exits the foundation of the building. The inspection also identified two additional anomalies in the line closer to where it terminates in Catch Basin #10. The locations of the line separation and the two anomalies were excavated in July 2013 to inspect the condition of the line and collect soil samples for radioactivity analyses. The line was found to be intact at the two anomalies, and soil samples collected in the vicinity of these anomalies was non-detectable for plant-related radioactivity, including tritium, gamma emitters, and hard-to-detect radionuclides. However, in the soil immediately adjacent to the line separation, low levels of plant-related gamma activity were identified in the soil. Tritium was also detected in the water contained in the soil at this location, at concentrations lower than that assumed to have leaked from the line during the March discharge. All of the radiological survey information was entered into Pilgrim Station's 10CFR50.75(g) decommissioning database, and another voluntary notification was made to the NRC and interested stakeholders. Because the neutralizing sump discharge line was still intact at the location of the separation, it was determined that most of the volume discharged during the four permitted releases in March 2013 would have continued to flow down the line to Catch Basin #10, as originally intended. The original bounding calculation assuming over 38,000 gallons of contaminated water entering the groundwater was very conservative, as the actual volume entering the soil at the line separation was much smaller, most likely less than a few hundred gallons. Increased well sampling throughout 2013 at monitoring wells downgradient of the line separation have not identified any increased concentrations of tritium, and no gamma activity has been identified in any well samples. The gamma nuclides identified tend to chemically bind to the soil particles, and likely moved only a few inches from the location of the separation. This would explain why the activity would not reach the groundwater at a depth of about 18-feet below the ground surface, or 13-feet below the line separation. Since there is no evidence of this gamma activity having entered the groundwater, no ingestion exposure pathways exist for this radioactivity.

Additional excavations were performed during 2014 in the vicinity of neutralizing sump discharge line separation, and confirmed that the highest concentrations were immediately adjacent to the separation, and had migrated only a few feet horizontally or vertically from the separation. The additional soil survey results were entered into the 10CFR50.75(g) decommissioning database. Based on the lower concentrations observed during the 2014 soil sampling efforts, it was determined that the assessments and bounding calculations performed during 2013 were conservative, and the actual impact would have been less than that assessed in 2013.

Due to these events involving the neutralizing sump discharge line, two new wells were installed in November and December of 2013 to further characterize the movement of tritiated water along the west side of the building. MW218 was installed downgradient of the line separation to monitor for radioactivity entering the groundwater from this location. MW219 was installed immediately adjacent to Catch Basin #10 to monitor for any potential leakage from this catch basin. Tritium results from these wells are listed in the earlier table. In the case of MW218 downgradient of the neutralizing sump discharge line separation, the tritium concentrations during 2014 ranged from 1070 pCi/L to 4730 pCi/L. The concentrations in this well immediately downgradient of the line separation are significantly less than the concentration of tritium contained in the permitted discharges during 2013. Based on these results, it does not appear that any significant fraction of the discharges actually made it to the groundwater.

In October 2013, a temporary discharge hose was put into place to facilitate continued permitted discharges from the neutralizing sump, since the original discharge line was isolated in March-2013. One such discharge was made in October, and three discharges occurred in December, the latest on 20-Dec-2013, about 9-days after MW219 was installed. The sample collected on 30-Dec from MW219, approximately 10-days following the permitted discharge into Catch Basin #10, indicated a tritium concentration of 69,000 pCi/L. The time delay between the permitted discharge and the elevated tritium result is consistent with the groundwater moving about 4-feet from the catch basin to the well at a rate of about 6-inches/day. The information surrounding this event was entered into Pilgrim Station's 10CFR50.75(g) decommissioning database, and another voluntary notification was made to the NRC and interested stakeholders. No elevated tritium concentrations have been detected at additional wells downgradient of MW219, indicating that the concentration of 69,000 pCi/L is very localized in the vicinity of MW219, and becomes diluted within a short distance of Catch Basin #10. The first sample collected from MW219 during 2014 yielded a concentration of 20,000 pCi/L, indicating the very localized nature of this event and the rapid reduction in concentrations through time. By the fourth quarter of 2014, tritium concentrations in MW219 were ranging between 591 and 1240 pCi/L.

An internal inspection of Catch Basin #10 was performed in 2014 and determined that there was some degradation in the grout seal around the invert pipes entering and exiting the catch basin. An inspection was also performed of Catch Basin #11, which receives the discharge from Catch Basin #11 before ultimately entering the PNPS Discharge Canal. Similar degradation was found in the grout at this catch basin, and the degraded grout in each catch basin was repaired in 2014. As a follow-up activity related to the degraded grout, additional soil excavations were performed in the vicinity of both catch basins to determine if any residual plant-related activity existed. Five excavations were performed at each of the two catch basins. Although several soil samples collected near Catch Basin #10 indicated some low-level Cs-137 and tritium, none of the samples collected near Catch Basin #11 indicated the presence of plant-related radioactivity. The concentrations of tritium in the soil samples at Catch Basin #10 ranged from non-detectable at less than 540 pCi/L, up to a maximum concentration of 2460 pCi/L. Such concentrations are consistent with the tritium concentrations detected in MW219 immediately adjacent to Catch Basin #10. An evaluation of the soil radioactivity determined that there was no need for immediate remediation of the area around Catch Basin #10, and all of the soil analyses were entered into Pilgrim Station's 10CFR50.75(g) decommissioning database.

A bounding calculation was performed in 2014 to assess the potential dose impact from leakage occurring from Catch Basin #10. It is assumed that 280 gallons of water containing tritium at a concentration of 550,000 pCi/L leaked from the catch basin from the discharges that occurred in Dec-2013. Based on groundwater flow rates, it would take approximately 18-months for this tritium to reach the saltwater environment at the Pilgrims Station Intake Canal. Over that time period, the tritium would be diluted by the groundwater flowing through the area, resulting in a maximum diluted concentration of about 170 pCi/L upon entry into the seawater. Since there are no drinking water wells affected by the presumed leak of this wastewater to the groundwater, the dose impact was determined from ingestion of contaminated fish and shellfish that accumulated tritium from the seawater after it had passed through the circulating pumps. Using such worst-case assumptions, the calculated dose from this event was estimated at 0.0000000050 mrem/yr.

In conclusion, the only radionuclide detected in groundwater during the 2014 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 2014, 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

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 (ARERR), with an explanation of why the affected monitor was not returned to operable status in a timely manner. During a review of the ARERRs for 2012 and 2013, it was identified that such instances were not included in the annual reports.

During 2012 the Turbine Building Gaseous Effluent Monitoring System (GEMS, unit C-3003) was inoperable from 27-Feb-2012 through 06-Apr-2012 (40 days). During 2012, the Feed Pump Gaseous Effluent Monitoring System (GEMS, unit C-3004) was inoperable from 14-May-2012 through 24-Jun-2012 (42 days), and again from 16-Aug-2012 through 31-Dec-2012 (138 days). During each of these periods of inoperability, compensatory sampling activities were performed during the duration of the inoperability, including manually sampling the effluent release points twice per week for noble gases, and continuous sampling of the effluent release points twice per week for particulates and radioiodines. In both of these situations, repairs to each of the monitors were delayed due to difficulty in obtaining replacement components necessary to fix the monitor.

During 2013 the Turbine Building GEMS, unit C-3003, was inoperable from 22-Jan-2012 through 31-Dec-2013 (344 days). Also during 2012, the Feed Pump GEMS, unit C-3004, was inoperable for the entire year from 01-Jan-2013 through 31-Dec-2013 (365 days). During each of these periods of inoperability, compensatory sampling activities were performed during the duration of the inoperability, including manually sampling the effluent release points twice per week for noble gases, and continuous sampling of the effluent release points twice per week for particulates and radioiodines. In both of these situations, repairs to each of the monitors were delayed due to difficulty in obtaining replacement components necessary to fix the monitor, and issues related to scheduling the repairs in the station work plan due to higher priority tasks.

APPENDIX D

CHANGES TO PNPS
OFFSITE DOSE CALCULATION MANUAL

No revisions were made to the PNPS Offsite Dose Calculation Manual (ODCM) during calendar year 2014.