Entergy

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

Pilgrim Nuclear Power Station

May 15, 2014

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

SUBJECT: Entergy Nuclear Operations, Inc.
Pilgrim Nuclear Power Station
Docket No.: 50-293
License No.: DPR-35

Annual Radiological Environmental Operating Report for
January 1 through December 31, 2013

LETTER NUMBER: 2.14.038

Dear Sir or Madam:

In accordance with Pilgrim Technical Specification 5.6.2, Entergy Nuclear Operations, Inc submits the attached Annual Radiological Environmental Operating Report for January 1, 2013 through December 31, 2013.

This letter contains no commitments.

Should you have questions or require additional information, I can be contacted at (508) 830-8403.

Sincerely,

Joseph R. Lynch
Manager, Regulatory Assurance

Attachment: Pilgrim Annual Radiological Environmental Operating Report for January 1, 2013 through December 31, 2013

cc: U.S. Nuclear Regulatory Commission
Region 1
2100 Renaissance Blvd, Suite 100
King of Prussia, PA 19406-2713

USNRC Senior Resident Inspector
Pilgrim Nuclear Power Station

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IE23
NRR

Attachment 1
Letter Number 2.14.039

Pilgrim Annual Radioactive Effluent Release Report
for January 1, 2013 through December 31, 2013

PILGRIM NUCLEAR POWER STATION

Facility Operating License DPR-35

Annual Radioactive Effluent Release Report

January 1 through December 31, 2013

Entergy

PILGRIM NUCLEAR POWER STATION
Facility Operating License DPR-35

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

JANUARY 01 THROUGH DECEMBER 31, 2013

Prepared by: _____ 06-May-2014
K.J. Sejkora
Senior HP/Chemistry Specialist

Reviewed by: _____ 5-12-14
G.W. Blankenbiller
Chemistry Manager

Reviewed by: _____ 5/7/14
S.E. Brewer
Radiation Protection Manager

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PILGRIM NUCLEAR POWER STATION
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JANUARY 01 THROUGH DECEMBER 31, 2013

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, 2013. 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 0.29 Curies. Releases of radioactive iodines and particulates with half-life of greater than 8 days totaled 0.0027 Curies, tritium releases totaled 64 Curies, and carbon-14 totaled 6.3 Curies. No gross alpha radioactivity was detected in gaseous effluents.

Noble gases released in gaseous effluents resulted in a maximum total body dose of 0.0000021 mrem, with a corresponding skin dose of 0.0000049 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 0.032 mrem. The maximum hypothetical dose to any organ from radioactive particulates, iodines, tritium, and carbon-14 was about 0.066 mrem. The maximum, hypothetical total body dose from the combined release of all airborne radioactivity in gaseous effluents was 0.032 mrem.

The maximum individual doses from gaseous radioactive effluents were compared to the applicable ODCM dose limits. Noble gas doses were less than 0.000065% of the corresponding 10CFR50 dose objectives. Maximum doses resulting from releases of particulates, iodines, tritium, and carbon-14 in gaseous effluents were less than 0.44% of corresponding 10CFR50 objectives.

LIQUID EFFLUENTS

Liquid radioactive releases for the reporting period are quantified in Tables 2.3-A and 2.3-B. Twenty-one discharges of liquid effluents containing radioactivity occurred during the reporting period. These discharges contained 6.2 Curies of tritium, and 0.019 Curies of fission and activation products. The resulting maximum total body dose was 0.0027 mrem, with a corresponding organ dose of 0.0096 mrem. All doses from liquid discharges were less than 0.25% of corresponding 10CFR50 objectives.

METEOROLOGICAL DATA

Meteorological joint frequency distributions are listed in Appendix A. Data recovery for the entire annual period was 89.8% for the 33-ft and 89.8% for the 220-ft levels of the tower. The predominant wind direction was from the south-southwest, which occurred approximately 16% of the time during the reporting period. The predominant stability class was Class D, which occurred about 47% 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 0.9 mrem during 2013. There was no measurable increase during 2013 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 2013 was calculated as being about 0.46 mrem. This amount is about 0.13% 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 1159 cubic meters of solid waste, containing almost 82 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, and 2013. As of the end of 2013, samples are being collected from a total of 22 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. Concentrations of tritium ranged from non-detectable at less than 337 picoCuries per Liter up to 69,000 picoCuries per Liter. The average concentration of tritium detected in these onsite monitoring wells 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. 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 2013, 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: 0.29 Ci, 0.0092 μCi/sec
- Iodines and particulates with half-life greater than 8 days: 0.0027 Ci, 0.000084 μCi/sec
- Tritium: 64.0 Ci, 2.03 μCi/sec
- Carbon-14: 6.3 Ci, 0.20 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 2013 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.

2.3 Liquid Effluent Data

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

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

- Total Effluent Volume: 1,180,000 Liters
- Total Dilution Volume: 565 billion Liters
- Fission/Activation products: 0.0189 Ci, 0.0000000000336 μCi/mL
- Tritium: 6.21 Ci, 0.0000000110 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 2013

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 2013	Apr-Jun 2013	Jul-Sep 2013	Oct-Dec 2013	Jan-Dec 2013
a. Liquid Effluents					
1. Total number of releases:	5.00E+00	1.20E+01	N/A	4.00E+00	2.10E+01
2. Total time period (minutes):	6.29E+02	1.18E+03	N/A	2.36E+03	4.16E+03
3. Maximum time period (minutes):	1.70E+02	1.22E+02	N/A	6.35E+02	6.35E+02
4. Average time period (minutes):	1.26E+02	9.81E+01	N/A	5.89E+02	2.71E+02
5. Minimum time period (minutes):	9.90E+01	7.50E+01	N/A	5.20E+02	7.50E+01
6. Average stream flow during periods of release of effluents into a flowing stream (Liters/min):	1.20E+06	9.39E+05	N/A	1.17E+06	1.11E+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 2013

RELEASE PERIOD	Jan-Mar 2013	Apr-Jun 2013	Jul-Sep 2013	Oct-Dec 2013	Jan-Dec 2013	Est. Total Error
A. FISSION AND ACTIVATION GASES						
Total Release: Ci	0.00E+00	0.00E+00	2.91E-01	0.00E+00	2.91E-01	±22%
Average Release Rate: µCi/sec	0.00E+00	0.00E+00	3.69E-02	0.00E+00	9.23E-03	
Percent of Effluent Control Limit*	*	*	*	*	*	
B. IODINE-131						
Total Iodine-131 Release: Ci	1.84E-04	9.29E-05	5.91E-05	1.71E-04	5.08E-04	±20%
Average Release Rate: µCi/sec	2.34E-05	1.18E-05	7.50E-06	2.17E-05	1.61E-05	
Percent of Effluent Control Limit*	*	*	*	*	*	
C. PARTICULATES WITH HALF-LIVES > 8 DAYS						
Total Release: Ci	2.78E-04	1.72E-04	5.50E-05	1.62E-04	6.67E-04	±21%
Average Release Rate: µCi/sec	3.53E-05	2.18E-05	6.97E-06	2.05E-05	2.12E-05	
Percent of Effluent Control Limit*	*	*	*	*	*	
Gross Alpha Radioactivity: Ci	NDA	NDA	NDA	NDA	NDA	
D. TRITIUM						
Total Release: Ci	6.24E+00	6.44E+00	2.34E+01	2.79E+01	6.40E+01	±20%
Average Release Rate: µCi/sec	7.91E-01	8.17E-01	2.97E+00	3.53E+00	2.03E+00	
Percent of Effluent Control Limit*	*	*	*	*	*	
E. CARBON-14						
Total Release: Ci	1.51E+00	9.73E-01	1.90E+00	1.87E+00	6.26E+00	N/A
Average Release Rate: µCi/sec	1.91E-01	1.23E-01	2.41E-01	2.38E-01	1.98E-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 2013

CONTINUOUS MODE RELEASES FROM ELEVATED RELEASE POINT					
Nuclide Released	Jan-Mar 2013	Apr-Jun 2013	Jul-Sep 2013	Oct-Dec 2013	Jan-Dec 2013
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	2.91E-01	0.00E+00	2.91E-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	2.91E-01	0.00E+00	2.91E-01
2. IODINES: Ci					
I-131	1.24E-05	1.52E-06	4.34E-06	3.90E-06	2.21E-05
I-133	1.14E-05	0.00E+00	0.00E+00	0.00E+00	1.14E-05
Total for Period	2.38E-05	1.52E-06	4.34E-06	3.90E-06	3.35E-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	0.00E+00	0.00E+00
4. TRITIUM: Ci					
H-3	1.53E-02	2.97E-02	5.30E-02	3.77E-02	1.36E-01
5. CARBON-14: Ci					
C-14	1.46E+00	9.43E-01	1.85E+00	1.82E+00	6.07E+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 2013

BATCH MODE RELEASES FROM ELEVATED RELEASE POINT					
Nuclide Released	Jan-Mar 2013	Apr-Jun 2013	Jul-Sep 2013	Oct-Dec 2013	Jan-Dec 2013
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 2013

CONTINUOUS MODE RELEASES FROM GROUND-LEVEL RELEASE POINT					
Nuclide Released	Jan-Mar 2013	Apr-Jun 2013	Jul-Sep 2013	Oct-Dec 2013	Jan-Dec 2013
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	1.72E-04	9.14E-05	5.48E-05	1.68E-04	4.85E-04
I-133	6.23E-04	1.39E-04	1.80E-04	5.21E-04	1.46E-03
Total for period	7.94E-04	2.30E-04	2.35E-04	6.89E-04	1.95E-03
3. PARTICULATES WITH HALF-LIVES > 8 DAYS: Ci					
Cr-51	0.00E+00	2.10E-05	0.00E+00	0.00E+00	2.10E-05
Mn-54	2.84E-06	1.56E-05	5.08E-06	1.42E-05	3.77E-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	0.00E+00	6.34E-05	1.63E-05	2.74E-05	1.07E-04
Zn-65	0.00E+00	1.73E-05	0.00E+00	6.14E-06	2.34E-05
Sr-89	0.00E+00	0.00E+00	1.02E-05	1.96E-05	2.98E-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	2.75E-04	5.47E-05	2.34E-05	9.45E-05	4.48E-04
Total for period	2.78E-04	1.72E-04	5.50E-05	1.62E-04	6.67E-04
4. TRITIUM: Ci					
H-3	6.22E+00	6.41E+00	2.34E+01	2.78E+01	6.38E+01
5. CARBON-14: Ci					
C-14	4.53E-02	2.92E-02	5.71E-02	5.62E-02	1.88E-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 2013

BATCH MODE RELEASES FROM GROUND-LEVEL RELEASE POINT					
Nuclide Released	Jan-Mar 2013	Apr-Jun 2013	Jul-Sep 2013	Oct-Dec 2013	Jan-Dec 2013
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 2013

RELEASE PERIOD	Jan-Mar 2013	Apr-Jun 2013	Jul-Sep 2013	Oct-Dec 2013	Jan-Dec 2013	Est. Total Error
A. FISSION AND ACTIVATION PRODUCTS						
Total Release (not including tritium, gases, alpha): Ci	3.98E-06	1.89E-02	N/A	2.93E-05	1.89E-02	±12%
Average Diluted Concentration During Period: μCi/mL	2.73E-14	1.74E-10	N/A	1.89E-13	3.36E-11	
Percent of Effluent Concentration Limit*	9.11E-08%	2.47E-03%	N/A	1.32E-05%	4.81E-04%	
B. TRITIUM						
Total Release: Ci	8.10E-01	5.25E+00	N/A	1.57E-01	6.21E+00	±9.4%
Average Diluted Concentration During Period: μCi/mL	5.57E-09	4.81E-08	N/A	1.01E-09	1.10E-08	
Percent of Effluent Concentration Limit*	5.57E-04%	4.81E-03%	N/A	1.01E-04%	1.10E-03%	
C. DISSOLVED AND ENTRAINED GASES						
Total Release: Ci	NDA	NDA	N/A	NDA	NDA	±16%
Average Diluted Concentration During Period: μCi/mL	NDA	NDA	N/A	NDA	NDA	
Percent of Effluent Concentration Limit*	0.00E+00%	0.00E+00%	N/A	0.00E+00%	0.00E+00%	
D. GROSS ALPHA RADIOACTIVITY						
Total Release: Ci	NDA	N/A	N/A	N/A	NDA	±34%
E. VOLUME OF WASTE RELEASED PRIOR TO DILUTION						
Waste Volume: Liters	2.11E+05	8.30E+05	N/A	1.37E+05	1.18E+06	±5.7%
F. VOLUME OF DILUTION WATER USED DURING PERIOD						
Dilution Volume: Liters	1.46E+11	1.09E+11	1.55E+11	1.55E+11	5.65E+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 2013

CONTINUOUS MODE RELEASES					
Nuclide Released	Jan-Mar 2013	Apr-Jun 2013	Jul-Sep 2013	Oct-Dec 2013	Jan-Dec 2013
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 2013

BATCH MODE RELEASES					
Nuclide Released	Jan-Mar 2013	Apr-Jun 2013	Jul-Sep 2013	Oct-Dec 2013	Jan-Dec 2013
1. FISSION AND ACTIVATION PRODUCTS: Ci					
Na-24	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00
Cr-51	0.00E+00	4.50E-03	N/A	0.00E+00	4.50E-03
Mn-54	3.98E-06	3.73E-03	N/A	3.02E-06	3.74E-03
Fe-55	0.00E+00	5.72E-04	N/A	0.00E+00	5.72E-04
Fe-59	0.00E+00	1.11E-03	N/A	0.00E+00	1.11E-03
Co-58	0.00E+00	4.89E-04	N/A	0.00E+00	4.89E-04
Co-60	0.00E+00	5.73E-03	N/A	8.86E-06	5.74E-03
Zn-65	0.00E+00	1.57E-03	N/A	0.00E+00	1.57E-03
Zn-69m	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00
Sr-89	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00
Sr-90	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00
Zr/Nb-95	0.00E+00	4.69E-05	N/A	0.00E+00	4.69E-05
Mo/Tc-99	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00
Ag-110m	0.00E+00	1.08E-03	N/A	0.00E+00	1.08E-03
Sb-124	0.00E+00	9.60E-05	N/A	0.00E+00	9.60E-05
I-131	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00
I-133	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00
Cs-134	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00
Cs-137	0.00E+00	0.00E+00	N/A	1.74E-05	1.74E-05
Ba/La-140	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00
Ce-141	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00
Ce-144	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00
Total for period	3.98E-06	1.89E-02	N/A	2.93E-05	1.89E-02
2. DISSOLVED AND ENTRAINED GASES: Ci					
Xe-133	NDA	NDA	N/A	NDA	NDA
Xe-135	NDA	NDA	N/A	NDA	NDA
Total for period	NDA	NDA	N/A	NDA	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, 47%
- 33-ft Wind Direction (from): South-southwest, 17%
- 33-ft Wind Speed: 3.5-7.5 mph, 58%
- 220-ft Wind Direction (from): South-southwest, 15%
- 220-ft Wind Speed: 12.5-18.5 mph, 37%

Joint data recovery for both the 33-ft level and 220-ft level of the tower was 89.8%, which did not meet the 90% annual data recovery goal specified by the NRC. This failure to meet the annual recovery goal was documented in Condition Report CR-PNP-2013-3335. High winds during winter storm Nemo in early February resulted in the elevator cable for the wind sensors breaking. This event resulted in the loss of all meteorological data for 786 hours between 08-Feb-2013 and 13-Mar-2013, and is described in Condition Reports CR-PNP-2013-0916 and CR-PNP-2012-1254. During the refueling outage in April, site power to the meteorological tower was interrupted between 26-Apr and 30-Apr-2013, resulting in the loss of all meteorological data for 96 hours. This event is described in Condition Report CR-PNP-2013-3081.

The failure to meet the 90% data recovery goal for two consecutive years was identified as a concern during the NRC inspection of the Radiological Environmental Monitoring Program in August 2013. That NRC concern was described in Condition Report CR-PNP-2013-5742.

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 2013 resulted in a maximum total body dose of 0.0000021 mrem. The maximum skin dose was 0.0000049 mrem. Both of these doses occurred to a hypothetical individual, assumed to be present 24 hours per day, 365 days per year, at the site boundary location yielding the highest dose (0.63 km SSW of the Reactor Building). For the more "realistic" individuals at offsite locations, the maximum total body dose was 0.0000020 mrem (nearest residence, 0.86 kilometers WNW from the Reactor Building), while the maximum skin dose was 0.0000028 mrem (nearest residence, 0.86 kilometers WNW from the Reactor Building).

Table 4.1

Maximum Doses From Noble Gas Releases During 2013[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	3.25E-06 (0.63 km SSW)	3.10E-06 (0.63 km SSW)	2.14E-06 (0.63 km SSW)	4.87E-06 (0.63 km SSW)
Oct-Dec	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)
Jan-Dec	3.25E-06 (0.63 km SSW)	3.10E-06 (0.63 km SSW)	2.14E-06 (0.63 km SSW)	4.87E-06 (0.63 km SSW)

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

4.2 Doses From Gaseous Effluent Releases

Gaseous effluent release data presented in Tables 2.2-A, 2.2-B, and 2.2-C from this effluent release report were used as input to a dose assessment computer program to calculate radiation doses. These data include gaseous releases from the PNPS main stack, reactor building vent, and turbine building roof exhausters. Meteorological data obtained from the PNPS 220-foot meteorological tower during the 10-year period from 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 2013 resulted in a maximum total body dose of 0.032 mrem (child age class at nearest garden location, 0.84 kilometers SE from the Reactor Building), while the maximum organ dose was 0.066 mrem (child bone at nearest garden location, 0.84 kilometers SE from the Reactor Building). Carbon-14 contributed 0.013 mrem (40%) of the 0.032 mrem child total body dose, and 0.065 mrem (99%) of the 0.066 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 2013

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	1.54E-04	1.03E-04	4.08E-03	1.65E-03	1.44E-03	2.51E-03
GI-LLI	7.61E-04	4.98E-04	2.07E-03	4.34E-04	3.51E-04	5.77E-04
Kidney	7.50E-04	4.91E-04	2.05E-03	4.35E-04	3.51E-04	5.76E-04
Liver	7.48E-04	4.90E-04	2.05E-03	4.34E-04	3.51E-04	5.76E-04
Lung	7.75E-04	5.07E-04	2.06E-03	4.33E-04	3.51E-04	5.76E-04
Thyroid	1.25E-03	8.13E-04	3.23E-03	7.85E-04	5.40E-04	6.55E-04
T.Body	7.47E-04	4.89E-04	2.05E-03	4.33E-04	3.51E-04	5.76E-04
Age Class: Teen						
Bone	2.20E-04	1.48E-04	6.60E-03	2.77E-03	2.18E-03	3.54E-03
GI-LLI	7.80E-04	5.11E-04	2.70E-03	6.74E-04	5.04E-04	7.87E-04
Kidney	7.70E-04	5.04E-04	2.69E-03	6.76E-04	5.05E-04	7.86E-04
Liver	7.68E-04	5.03E-04	2.68E-03	6.74E-04	5.04E-04	7.86E-04
Lung	8.11E-04	5.31E-04	2.70E-03	6.74E-04	5.04E-04	7.87E-04
Thyroid	1.41E-03	9.16E-04	3.77E-03	1.19E-03	7.78E-04	8.56E-04
T.Body	7.66E-04	5.02E-04	2.68E-03	6.74E-04	5.04E-04	7.86E-04
Age Class: Child						
Bone	3.03E-04	2.04E-04	1.58E-02	6.69E-03	5.12E-03	8.17E-03
GI-LLI	7.03E-04	4.61E-04	5.04E-03	1.51E-03	1.12E-03	1.74E-03
Kidney	7.00E-04	4.59E-04	5.04E-03	1.51E-03	1.12E-03	1.74E-03
Liver	6.98E-04	4.58E-04	5.03E-03	1.51E-03	1.12E-03	1.74E-03
Lung	7.35E-04	4.82E-04	5.05E-03	1.51E-03	1.12E-03	1.74E-03
Thyroid	1.47E-03	9.53E-04	6.60E-03	2.50E-03	1.65E-03	1.84E-03
T.Body	6.97E-04	4.57E-04	5.03E-03	1.51E-03	1.12E-03	1.74E-03
Age Class: Infant						
Bone	2.24E-04	1.51E-04	1.26E-04	4.20E-03	2.92E-03	5.60E-05
GI-LLI	4.15E-04	2.72E-04	2.04E-04	9.80E-04	6.64E-04	2.11E-05
Kidney	4.15E-04	2.72E-04	2.04E-04	9.88E-04	6.68E-04	2.11E-05
Liver	4.15E-04	2.72E-04	2.04E-04	9.87E-04	6.67E-04	2.11E-05
Lung	4.48E-04	2.94E-04	2.20E-04	9.81E-04	6.64E-04	2.18E-05
Thyroid	1.12E-03	7.27E-04	5.40E-04	3.22E-03	1.83E-03	3.78E-05
T.Body	4.13E-04	2.71E-04	2.03E-04	9.83E-04	6.65E-04	2.10E-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 2013

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	9.86E-05	6.63E-05	2.63E-03	1.06E-03	9.32E-04	1.62E-03
GI-LLI	7.63E-04	5.00E-04	1.86E-03	3.23E-04	2.53E-04	4.06E-04
Kidney	7.59E-04	4.97E-04	1.80E-03	3.21E-04	2.51E-04	4.01E-04
Liver	7.59E-04	4.96E-04	1.81E-03	3.21E-04	2.51E-04	4.01E-04
Lung	8.25E-04	5.39E-04	1.83E-03	3.21E-04	2.51E-04	4.02E-04
Thyroid	9.64E-04	6.29E-04	2.38E-03	4.96E-04	3.45E-04	4.38E-04
T.Body	7.58E-04	4.96E-04	1.80E-03	3.20E-04	2.51E-04	4.01E-04
Age Class: Teen						
Bone	1.41E-04	9.49E-05	4.26E-03	1.79E-03	1.41E-03	2.28E-03
GI-LLI	7.78E-04	5.09E-04	2.32E-03	4.85E-04	3.54E-04	5.42E-04
Kidney	7.74E-04	5.07E-04	2.26E-03	4.83E-04	3.53E-04	5.38E-04
Liver	7.73E-04	5.06E-04	2.27E-03	4.83E-04	3.53E-04	5.39E-04
Lung	8.71E-04	5.69E-04	2.30E-03	4.82E-04	3.53E-04	5.40E-04
Thyroid	1.03E-03	6.72E-04	2.78E-03	7.41E-04	4.88E-04	5.71E-04
T.Body	7.73E-04	5.06E-04	2.27E-03	4.82E-04	3.52E-04	5.39E-04
Age Class: Child						
Bone	1.95E-04	1.31E-04	1.02E-02	4.32E-03	3.31E-03	5.27E-03
GI-LLI	6.97E-04	4.57E-04	4.01E-03	1.04E-03	7.62E-04	1.17E-03
Kidney	6.97E-04	4.56E-04	3.98E-03	1.04E-03	7.63E-04	1.17E-03
Liver	6.96E-04	4.56E-04	3.99E-03	1.04E-03	7.64E-04	1.17E-03
Lung	7.75E-04	5.07E-04	4.01E-03	1.04E-03	7.61E-04	1.17E-03
Thyroid	9.95E-04	6.48E-04	4.73E-03	1.54E-03	1.02E-03	1.21E-03
T.Body	6.96E-04	4.56E-04	4.00E-03	1.04E-03	7.63E-04	1.17E-03
Age Class: Infant						
Bone	1.44E-04	9.65E-05	8.06E-05	2.71E-03	1.88E-03	3.61E-05
GI-LLI	4.08E-04	2.68E-04	2.00E-04	6.70E-04	4.47E-04	1.73E-05
Kidney	4.09E-04	2.68E-04	2.00E-04	6.72E-04	4.48E-04	1.73E-05
Liver	4.09E-04	2.68E-04	2.00E-04	6.74E-04	4.49E-04	1.73E-05
Lung	4.61E-04	3.02E-04	2.25E-04	6.66E-04	4.45E-04	1.86E-05
Thyroid	6.82E-04	4.44E-04	3.30E-04	1.80E-03	1.03E-03	2.38E-05
T.Body	4.08E-04	2.67E-04	2.00E-04	6.69E-04	4.47E-04	1.73E-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 2013

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	1.92E-04	1.29E-04	5.17E-03	2.08E-03	1.82E-03	3.16E-03
GI-LLI	2.73E-03	1.79E-03	5.67E-03	8.05E-04	5.97E-04	9.14E-04
Kidney	2.73E-03	1.79E-03	5.65E-03	8.04E-04	5.97E-04	9.13E-04
Liver	2.73E-03	1.79E-03	5.65E-03	8.04E-04	5.97E-04	9.13E-04
Lung	2.75E-03	1.80E-03	5.66E-03	8.04E-04	5.97E-04	9.13E-04
Thyroid	2.89E-03	1.89E-03	6.03E-03	9.16E-04	6.57E-04	9.38E-04
T.Body	2.73E-03	1.79E-03	5.66E-03	8.04E-04	5.97E-04	9.13E-04
Age Class: Teen						
Bone	2.75E-04	1.85E-04	8.36E-03	3.50E-03	2.75E-03	4.47E-03
GI-LLI	2.77E-03	1.81E-03	6.80E-03	1.15E-03	8.06E-04	1.19E-03
Kidney	2.77E-03	1.81E-03	6.78E-03	1.15E-03	8.06E-04	1.19E-03
Liver	2.77E-03	1.81E-03	6.78E-03	1.15E-03	8.06E-04	1.19E-03
Lung	2.80E-03	1.83E-03	6.79E-03	1.15E-03	8.06E-04	1.19E-03
Thyroid	2.97E-03	1.94E-03	7.12E-03	1.31E-03	8.93E-04	1.21E-03
T.Body	2.77E-03	1.81E-03	6.78E-03	1.15E-03	8.06E-04	1.19E-03
Age Class: Child						
Bone	3.79E-04	2.55E-04	2.00E-02	8.44E-03	6.47E-03	1.03E-02
GI-LLI	2.47E-03	1.62E-03	1.10E-02	2.33E-03	1.66E-03	2.47E-03
Kidney	2.47E-03	1.62E-03	1.10E-02	2.33E-03	1.66E-03	2.47E-03
Liver	2.47E-03	1.62E-03	1.10E-02	2.33E-03	1.66E-03	2.47E-03
Lung	2.50E-03	1.63E-03	1.10E-02	2.33E-03	1.65E-03	2.47E-03
Thyroid	2.71E-03	1.77E-03	1.15E-02	2.64E-03	1.82E-03	2.50E-03
T.Body	2.47E-03	1.62E-03	1.10E-02	2.33E-03	1.66E-03	2.47E-03
Age Class: Infant						
Bone	2.80E-04	1.88E-04	1.57E-04	5.30E-03	3.68E-03	7.06E-05
GI-LLI	1.44E-03	9.41E-04	7.00E-04	1.45E-03	9.42E-04	5.09E-05
Kidney	1.44E-03	9.42E-04	7.00E-04	1.45E-03	9.43E-04	5.09E-05
Liver	1.44E-03	9.41E-04	7.00E-04	1.45E-03	9.43E-04	5.09E-05
Lung	1.45E-03	9.52E-04	7.08E-04	1.45E-03	9.42E-04	5.13E-05
Thyroid	1.65E-03	1.08E-03	8.03E-04	2.16E-03	1.31E-03	5.60E-05
T.Body	1.44E-03	9.41E-04	7.00E-04	1.45E-03	9.42E-04	5.09E-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 2013

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	1.91E-04	1.28E-04	5.12E-03	2.05E-03	1.80E-03	3.12E-03
GI-LLI	3.25E-03	2.13E-03	6.56E-03	8.74E-04	6.37E-04	9.59E-04
Kidney	3.25E-03	2.12E-03	6.52E-03	8.73E-04	6.36E-04	9.57E-04
Liver	3.24E-03	2.12E-03	6.52E-03	8.73E-04	6.36E-04	9.57E-04
Lung	3.28E-03	2.15E-03	6.53E-03	8.72E-04	6.35E-04	9.57E-04
Thyroid	3.71E-03	2.42E-03	7.65E-03	1.20E-03	8.13E-04	1.03E-03
T.Body	3.24E-03	2.12E-03	6.52E-03	8.72E-04	6.35E-04	9.56E-04
Age Class: Teen						
Bone	2.73E-04	1.83E-04	8.27E-03	3.45E-03	2.71E-03	4.40E-03
GI-LLI	3.29E-03	2.16E-03	7.76E-03	1.22E-03	8.47E-04	1.23E-03
Kidney	3.29E-03	2.15E-03	7.73E-03	1.22E-03	8.47E-04	1.23E-03
Liver	3.29E-03	2.15E-03	7.73E-03	1.22E-03	8.47E-04	1.23E-03
Lung	3.35E-03	2.19E-03	7.75E-03	1.22E-03	8.46E-04	1.23E-03
Thyroid	3.88E-03	2.53E-03	8.76E-03	1.71E-03	1.10E-03	1.30E-03
T.Body	3.29E-03	2.15E-03	7.73E-03	1.22E-03	8.46E-04	1.23E-03
Age Class: Child						
Bone	3.76E-04	2.53E-04	1.98E-02	8.32E-03	6.37E-03	1.02E-02
GI-LLI	2.93E-03	1.92E-03	1.23E-02	2.42E-03	1.70E-03	2.51E-03
Kidney	2.93E-03	1.92E-03	1.23E-02	2.43E-03	1.71E-03	2.51E-03
Liver	2.93E-03	1.92E-03	1.23E-02	2.43E-03	1.71E-03	2.51E-03
Lung	2.98E-03	1.95E-03	1.23E-02	2.42E-03	1.70E-03	2.51E-03
Thyroid	3.63E-03	2.37E-03	1.38E-02	3.36E-03	2.20E-03	2.61E-03
T.Body	2.93E-03	1.92E-03	1.23E-02	2.42E-03	1.71E-03	2.51E-03
Age Class: Infant						
Bone	2.77E-04	1.87E-04	1.56E-04	5.22E-03	3.63E-03	6.95E-05
GI-LLI	1.70E-03	1.11E-03	8.27E-04	1.49E-03	9.60E-04	5.77E-05
Kidney	1.70E-03	1.11E-03	8.28E-04	1.50E-03	9.64E-04	5.77E-05
Liver	1.70E-03	1.11E-03	8.28E-04	1.50E-03	9.64E-04	5.77E-05
Lung	1.74E-03	1.14E-03	8.45E-04	1.49E-03	9.60E-04	5.85E-05
Thyroid	2.34E-03	1.53E-03	1.13E-03	3.61E-03	2.05E-03	7.28E-05
T.Body	1.70E-03	1.11E-03	8.27E-04	1.50E-03	9.61E-04	5.76E-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

[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 2013

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	6.35E-04	4.27E-04	1.70E-02	6.85E-03	6.00E-03	1.04E-02
GI-LLI	7.51E-03	4.91E-03	1.62E-02	2.44E-03	1.84E-03	2.86E-03
Kidney	7.49E-03	4.90E-03	1.60E-02	2.43E-03	1.84E-03	2.85E-03
Liver	7.48E-03	4.90E-03	1.60E-02	2.43E-03	1.83E-03	2.85E-03
Lung	7.63E-03	4.99E-03	1.61E-02	2.43E-03	1.83E-03	2.85E-03
Thyroid	8.80E-03	5.75E-03	1.93E-02	3.40E-03	2.36E-03	3.06E-03
T.Body	7.48E-03	4.89E-03	1.60E-02	2.43E-03	1.83E-03	2.85E-03
Age Class: Teen						
Bone	9.09E-04	6.11E-04	2.75E-02	1.15E-02	9.05E-03	1.47E-02
GI-LLI	7.62E-03	4.99E-03	1.96E-02	3.53E-03	2.51E-03	3.75E-03
Kidney	7.61E-03	4.98E-03	1.94E-02	3.53E-03	2.51E-03	3.74E-03
Liver	7.60E-03	4.97E-03	1.95E-02	3.53E-03	2.51E-03	3.74E-03
Lung	7.83E-03	5.12E-03	1.95E-02	3.52E-03	2.51E-03	3.75E-03
Thyroid	9.28E-03	6.06E-03	2.24E-02	4.95E-03	3.26E-03	3.93E-03
T.Body	7.60E-03	4.97E-03	1.95E-02	3.52E-03	2.51E-03	3.74E-03
Age Class: Child						
Bone	1.25E-03	8.43E-04	6.57E-02	2.78E-02	2.13E-02	3.39E-02
GI-LLI	6.80E-03	4.45E-03	3.24E-02	7.30E-03	5.24E-03	7.89E-03
Kidney	6.80E-03	4.45E-03	3.24E-02	7.31E-03	5.25E-03	7.89E-03
Liver	6.80E-03	4.45E-03	3.24E-02	7.31E-03	5.25E-03	7.89E-03
Lung	6.99E-03	4.57E-03	3.24E-02	7.30E-03	5.24E-03	7.89E-03
Thyroid	8.80E-03	5.74E-03	3.67E-02	1.00E-02	6.69E-03	8.16E-03
T.Body	6.79E-03	4.45E-03	3.24E-02	7.30E-03	5.24E-03	7.89E-03
Age Class: Infant						
Bone	9.25E-04	6.22E-04	5.19E-04	1.74E-02	1.21E-02	2.32E-04
GI-LLI	3.96E-03	2.59E-03	1.93E-03	4.59E-03	3.01E-03	1.47E-04
Kidney	3.96E-03	2.60E-03	1.93E-03	4.61E-03	3.02E-03	1.47E-04
Liver	3.96E-03	2.59E-03	1.93E-03	4.61E-03	3.02E-03	1.47E-04
Lung	4.10E-03	2.68E-03	2.00E-03	4.59E-03	3.01E-03	1.50E-04
Thyroid	5.80E-03	3.78E-03	2.81E-03	1.08E-02	6.23E-03	1.90E-04
T.Body	3.96E-03	2.59E-03	1.93E-03	4.60E-03	3.01E-03	1.47E-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.

Table 4.3-A

Maximum Individual Organ Doses -- mrem
From Liquid Release Period: Jan-Mar 2013

Organ	Age Class Organ Dose – mrem *		
	Adult	Teen	Child
Bone	1.88E-09	1.04E-08	2.18E-09
GI-LLI	1.09E-06	7.85E-07	5.72E-07
Kidney	8.27E-07	6.27E-07	5.31E-07
Liver	8.94E-07	6.90E-07	5.84E-07
Lung	7.99E-07	6.00E-07	5.11E-07
Thyroid	7.99E-07	6.00E-07	5.11E-07
T.Body	8.17E-07	6.18E-07	5.30E-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.

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 0.0027 mrem. The maximum organ dose (adult age class, GI-LLI) was 0.0096 mrem.

Table 4.3-B

Maximum Individual Organ Doses -- mrem
From Liquid Release Period: Apr-Jun 2013

Organ	Age Class Organ Dose – mrem		
	Adult	Teen	Child
Bone	2.48E-03	2.37E-03	2.60E-03
GI-LLI	1.24E-02	8.20E-03	3.09E-03
Kidney	3.74E-03	3.43E-03	2.81E-03
Liver	7.05E-03	6.55E-03	5.72E-03
Lung	4.83E-04	7.81E-04	4.62E-04
Thyroid	6.75E-05	3.42E-04	7.49E-05
T.Body	3.19E-03	3.19E-03	3.50E-03

Table 4.3-C

Maximum Individual Organ Doses -- mrem
From Liquid Release Period: Jul-Sep 2013

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 2013

Organ	Age Class Organ Dose – mrem *		
	Adult	Teen	Child
Bone	5.95E-07	1.16E-06	7.83E-07
GI-LLI	1.76E-06	1.70E-06	5.87E-07
Kidney	5.05E-07	1.01E-06	4.46E-07
Liver	1.05E-06	1.55E-06	9.55E-07
Lung	3.37E-07	8.55E-07	3.03E-07
Thyroid	2.63E-07	7.68E-07	2.31E-07
T.Body	8.53E-07	1.15E-06	5.00E-07

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

Table 4.3-E

Maximum Individual Organ Doses -- mrem
From Liquid Release Period: Jan-Dec 2013

Organ	Age Class Organ Dose – mrem *		
	Adult	Teen	Child
Bone	1.91E-03	1.84E-03	2.01E-03
GI-LLI	9.58E-03	6.34E-03	2.39E-03
Kidney	2.89E-03	2.65E-03	2.17E-03
Liver	5.44E-03	5.06E-03	4.42E-03
Lung	3.74E-04	6.05E-04	3.57E-04
Thyroid	5.32E-05	2.66E-04	5.86E-05
T.Body	2.47E-03	2.47E-03	2.70E-03

* 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 154 mR for the entire year. This location is immediately adjacent to the station proper and overlooks the turbine building, therefore receiving the highest direct ambient and sky shine exposure. When the near-site TLDs (those located within 0.6 km of the Reactor Building) are removed from the calculation of averages, the mean annual exposure in Zone 1 falls from 71.6 ± 21.3 mR/yr to 62.2 ± 8.9 mR/yr. Such a corrected dose is not statistically different from the Zone 4 average of 60.2 ± 10.9 mR/yr, and is indicative of natural background radiation.

Although the annual exposure at TLD location OA was 94 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 0.43 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 62.1 ± 7.7 mR (based on continuous occupancy at this location), which compares quite well to the Zone 4 annual average background radiation level of 60.2 ± 10.9 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 2013 is estimated as being about 0.9 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 2013. 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 0.0016 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 1.0 mrem/year.

Table 5.0

Average TLD Exposures By Distance Zone During 2013

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	17.1 ± 5.1	14.2 ± 2.3	13.8 ± 1.1	14.7 ± 2.9
Apr-Jun	16.5 ± 4.8	13.0 ± 1.9	13.0 ± 1.7	13.9 ± 3.0
Jul-Sep	18.4 ± 5.8	14.8 ± 2.0	14.1 ± 1.7	15.2 ± 2.6
Oct-Dec	19.6 ± 5.2	15.9 ± 2.0	15.9 ± 1.9	16.4 ± 2.5
Jan-Dec	71.6 ± 21.3**	57.8 ± 9.0	56.7 ± 7.6	60.2 ± 10.9

* 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 ± 8.9 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 2013 were a small percentage of the corresponding effluent control.

Table 6.1

Percent of ODCM Effluent Control Limits
for Gaseous Effluent Releases During 2013

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	2.14E-06	4.28E-07%

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	4.87E-06	1.62E-07%

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	6.57E-02	4.38E-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	3.25E-06	6.49E-05%
Oct-Dec	0.00E+00	0.00E+00%

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	3.25E-06	3.25E-05%

Table 6.1 (continued)

Percent of ODCM Effluent Control Limits
for Gaseous Effluent Releases During 2013

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	3.10E-06	3.10E-05%
Oct-Dec	0.00E+00	0.00E+00%

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	3.10E-06	1.55E-05%

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

Period	Value - mrem	Fraction of Limit
Jan-Mar	1.58E-02	2.10E-01%
Apr-Jun	1.02E-02	1.36E-01%
Jul-Sep	2.00E-02	2.67E-01%
Oct-Dec	1.98E-02	2.64E-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	6.57E-02	4.38E-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 2013

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	2.73E-14	9.11E-08%
Apr-Jun	1.74E-10	2.47E-03%
Jul-Sep	0.00E+00	0.00E+00%
Oct-Dec	1.89E-13	1.32E-05%
Jan-Dec	3.36E-11	4.81E-04%

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	5.57E-09	5.57E-04%
Apr-Jun	4.81E-08	4.81E-03%
Jul-Sep	0.00E+00	0.00E+00%
Oct-Dec	1.01E-09	1.01E-04%
Jan-Dec	1.10E-08	1.10E-03%

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 2013

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	8.17E-07	5.45E-05%
Apr-Jun	3.50E-03	2.33E-01%
Jul-Sep	0.00E+00	0.00E+00%
Oct-Dec	1.15E-06	7.66E-05%

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

Period	Value - mrem	Fraction of Limit
Jan-Dec	2.70E-03	9.01E-02%

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	1.09E-06	2.18E-05%
Apr-Jun	1.24E-02	2.48E-01%
Jul-Sep	0.00E+00	0.00E+00%
Oct-Dec	1.76E-06	3.51E-05%

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

Period	Value - mrem	Fraction of Limit
Jan-Dec	9.58E-03	9.58E-02%

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 59.3 cubic meters of spent resins, filter sludges, etc., containing a total activity of about 76.4 Curies were shipped from PNPS for processing and disposal. Dry activated wastes and contaminated equipment shipped during the period totaled 1100 cubic meters and contained 6.08 Curies of radioactivity. No shipment of irradiated components was shipped during the reporting period. No shipments of irradiated fuel were made 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 22 shipments to Energy Solutions' Bear Creek Facility in Oak Ridge, TN; 1 shipment to Energy Solutions' Gallaher Road Facility in Kingston, TN; 9 shipments to Studsvik Processing Facility in Erwin, TN; 4 shipments to Energy Solutions Facility in Memphis, TN; and 2 shipments to Eastern Technologies in Ashford, AL.

Table 7.0
Pilgrim Nuclear Power Station
Annual Radioactive Effluent Release Report
Solid Waste and Irradiated Fuel Shipments
January-December 2013

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 2013		
	Volume - m^3	Curies	Total Error
a. Spent resins, filters, filter sludges, evaporator bottoms, etc.	5.93E+01	7.64E+01	± 25%
b. Dry activated waste, contaminated equipment, etc.	1.10E+03	6.08E+00	± 25%
c. Irradiated components, control rods, etc.	0.00E+00	0.00E+00	N/A
d. Other (describe):	0.00E+00	0.00E+00	N/A

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

Type of waste	Radionuclide	Abundance	Total Error
a. Spent resins, filters, filter sludges, evaporator bottoms, etc.	Mn-54	10.91%	± 25%
	Fe-55	29.78%	± 25%
	Co-60	30.98%	± 25%
	Zn-65	16.47%	± 25%
	Cs-137	7.57%	± 25%
b. Dry activated waste, contaminated equipment, etc.	Mn-54	9.49%	± 25%
	Fe-55	59.67%	± 25%
	Co-60	22.02%	± 25%
	Ni-63	1.02%	± 25%
	Zn-65	6.20%	± 25%
c. Irradiated components, control rods, etc.	Not Applicable	Not Applicable	N/A
d. Other (describe):	Not Applicable	Not Applicable	N/A

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

3. Solid Waste Disposition

Number of Shipments	Mode of Transportation	Destination
22	Tractor-trailer (Hittman Transport)	Energy Solutions Bear Creek Facility[2] Oak Ridge, TN
1	Tractor-trailer (Hittman Transport)	Energy Solutions Gallaher Road Facility[2] Kingston, TN
9	Tractor-trailer (Hittman Transport)	Studsvik Processing Facility,[2] Erwin, TN
4	Tractor-trailer (Hittman Transport)	Energy Solutions Facility Memphis, TN
2	Tractor-trailer (Hittman Transport)	Eastern Technologies Inc. Ashford, AL

[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 2013. Information regarding revisions to the ODCM can be found attached as Appendix D of this report.

9.0 PROCESS CONTROL PROGRAM REVISIONS

There were no significant changes to the PNPS Process Control Program (PCP) during the calendar year of 2013. Although Pilgrim Station adopted the Entergy fleet-wide PCP in 2010 as indicated in the 2010 Annual Effluent Release Report, fleet procedure EN-RW-105, "Process Control Program", was not revised until 2011 to reflect the inclusion of Pilgrim Station under the fleet-wide PCP. This revision was strictly administrative in nature, and did not impact the requirements or conduct of the PCP.

The following list summarizes changes made during 2013 to various procedures related to the Process Control Program:

EN-RW-103, "Radioactive Waste Tracking Procedure", Rev.4: Editorial revision to clarify and update the following items: Adjust the range of densities for metals; Titles in responsibilities section updated; Clarification on liability reports to management.

EN-RW-104, "Scaling Factors", Rev.9: Editorial revision to address the following items: Enhancement to initiate a Condition Report for independent lab result discrepancies as compared to in-house analyses; Enhancement to share waste stream data results to Chemistry/Environmental personnel responsible for effluents.

EN-RW-105, "Process Control Program", Rev.3: Editorial revision to recognize organizational titles at Palisades Nuclear Plant.

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 9, June 2003.

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 2013

Class A Freq: 0.082

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	16	13	3	7	3	2	0	0	0	0	0	0	7	16	16	7	90
7.5-12.5	0	0	0	2	0	0	0	0	0	0	0	0	3	12	2	2	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	16	14	3	9	3	2	0	0	0	0	0	0	10	28	18	9	112

Class B Freq: 0.035

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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
3.5-7.5	3	3	1	2	1	0	0	0	0	0	0	0	9	7	5	3	34
7.5-12.5	0	0	1	1	0	0	0	0	1	0	0	0	8	1	0	0	12
12.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	4	3	3	3	1	0	0	0	1	0	0	0	17	8	5	3	48

Class C Freq: 0.043

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
3.5-7.5	2	3	2	0	1	1	0	0	0	1	1	1	15	10	4	3	44
7.5-12.5	0	0	1	0	0	0	0	0	1	1	0	0	8	2	1	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	2	3	3	0	2	1	0	0	1	2	1	1	23	12	5	3	59

Class D Freq: 0.544

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	1	0	1
0.95-3.5	4	6	8	7	10	7	6	0	1	5	3	11	12	10	13	7	110
3.5-7.5	15	4	5	4	6	8	11	10	15	19	20	50	147	70	28	22	434
7.5-12.5	3	5	7	1	22	3	0	1	4	33	15	12	41	29	4	2	182
12.5-18.5	0	0	1	2	0	0	0	0	3	11	2	0	0	0	0	0	19
18.5-24	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	22	15	21	14	38	18	17	11	25	68	40	73	200	109	46	31	748

Table A-1 (continued)

Jan-Mar 2013

Class E Freq: 0.250

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	1	0	1	0	1	0	0	0	1	1	0	0	1	0	0	6
0.95-3.5	4	3	5	2	3	4	3	8	8	8	16	15	23	12	4	6	124
3.5-7.5	1	1	1	0	1	0	3	8	9	17	38	48	43	20	6	4	200
7.5-12.5	1	0	0	0	1	1	0	1	1	0	4	1	2	1	0	0	13
12.5-18.5	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	6	5	7	3	5	6	6	17	18	26	59	64	68	34	10	10	344

Class F Freq: 0.039

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	0	0	0	0	0	1	2	6	3	11	2	0	0	0	25
3.5-7.5	0	0	0	1	0	0	0	0	0	4	14	9	0	0	0	0	28
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	1	0	0	0	1	2	10	17	20	2	0	0	0	53

Class G Freq: 0.007

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	2	0	0	0	0	0	2
3.5-7.5	0	0	0	0	0	0	0	0	0	0	6	1	0	0	0	0	7
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	0	0	0	0	0	0	0	0	0	0	9	1	0	0	0	0	10

Class All Freq: 1.000

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	1	0	1	0	1	0	0	0	1	1	0	0	1	1	0	7
0.95-3.5	9	10	14	9	14	11	9	9	11	19	24	37	37	22	17	13	265
3.5-7.5	37	24	12	14	12	11	14	18	24	41	79	109	221	123	59	39	837
7.5-12.5	4	5	9	4	23	4	0	2	7	34	20	13	62	45	7	4	243
12.5-18.5	0	0	2	2	0	0	0	0	3	11	2	0	0	0	0	0	20
18.5-24	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	50	40	37	30	49	27	23	29	47	106	126	159	320	191	84	56	1374

Table A-1 (continued)

Apr-Jun 2013

Class A Freq: 0.098

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	2	1	1	0	1	0	0	1	0	0	0	0	0	0	0	0	6
3.5-7.5	20	26	28	24	19	5	2	1	1	2	2	9	10	9	6	10	174
7.5-12.5	0	0	0	5	0	1	0	0	1	6	0	0	8	1	1	0	23
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	22	27	29	29	20	6	2	2	2	9	2	9	18	10	7	10	204

Class B Freq: 0.056

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	1	1	2	1	1	0	0	0	0	0	0	0	0	0	7
3.5-7.5	2	3	2	4	12	7	2	1	2	10	7	7	13	6	1	1	80
7.5-12.5	1	0	0	0	0	0	0	1	5	18	1	1	1	0	0	0	28
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	4	3	3	5	14	8	3	2	7	29	8	8	14	6	1	1	116

Class C Freq: 0.073

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	1	2	1	2	2	1	0	0	0	1	0	2	0	3	0	18
3.5-7.5	0	3	5	8	6	5	6	0	2	14	11	9	12	11	4	2	98
7.5-12.5	0	2	0	0	0	0	0	0	5	23	1	0	2	0	0	0	33
12.5-18.5	0	0	0	0	0	0	0	0	0	2	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	3	6	7	9	8	7	7	0	7	39	13	9	16	11	7	2	151

Class D Freq: 0.462

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	11	19	26	30	13	18	10	9	9	7	6	5	4	7	4	190
3.5-7.5	18	19	27	25	32	34	13	14	57	124	38	36	44	23	14	11	529
7.5-12.5	5	15	6	5	6	3	1	1	18	139	11	1	16	3	1	2	233
12.5-18.5	0	0	0	0	0	0	0	0	3	5	0	0	0	0	0	0	8
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	35	45	52	56	68	50	32	25	87	277	56	43	65	30	22	17	960

Table A-1 (continued)

Apr-Jun 2013

Class E Freq: 0.209

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
0.95-3.5	8	5	4	15	15	19	8	13	16	2	12	12	8	9	9	4	159
3.5-7.5	0	5	9	4	12	2	5	9	19	43	47	29	21	8	8	3	224
7.5-12.5	0	0	0	0	0	0	0	0	2	31	17	0	0	0	0	0	50
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	8	10	13	19	27	21	13	22	37	77	76	41	30	17	17	7	435

Class F Freq: 0.081

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	1	0	0	0	0	1
0.95-3.5	0	0	0	0	2	3	2	3	11	11	7	13	9	7	0	1	69
3.5-7.5	1	0	0	1	1	1	2	1	2	10	56	10	0	2	0	0	87
7.5-12.5	0	0	0	0	0	0	0	0	0	1	10	0	0	0	0	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	1	0	0	1	3	4	4	4	13	22	73	24	9	9	0	1	168

Class G Freq: 0.022

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	0	0	1	0	0	2	0	2	5	6	2	0	0	0	18
3.5-7.5	0	0	0	0	0	0	0	0	0	2	22	2	0	0	0	0	26
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	0	0	0	0	1	0	0	2	0	4	28	8	2	0	0	0	45

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	1	1	0	0	0	2
0.95-3.5	26	18	27	43	53	38	30	29	36	24	32	37	26	20	19	9	467
3.5-7.5	41	56	71	66	82	54	30	26	83	205	183	102	100	59	33	27	1218
7.5-12.5	6	17	6	10	6	4	1	2	31	218	41	2	27	4	2	2	379
12.5-18.5	0	0	0	0	0	0	0	0	3	10	0	0	0	0	0	0	13
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	73	91	104	119	141	96	61	57	153	457	256	142	154	83	54	38	2079

Table A-1 (continued)

Jul-Sep 2013

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	12	13	9	8	2	0	0	0	0	0	0	0	2	0	1	4	51
3.5-7.5	9	38	17	5	5	1	0	0	3	2	1	1	6	5	7	3	103
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	21	51	26	13	7	1	0	0	3	2	1	1	8	5	8	7	154

Class B Freq: 0.019

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	5	1	1	2	0	0	1	0	0	0	0	3	2	2	0	18
3.5-7.5	1	2	5	1	2	0	0	0	1	0	0	1	4	6	1	0	24
7.5-12.5	0	0	0	0	0	0	0	0	0	1	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	2	7	6	2	4	0	0	1	1	1	0	1	7	8	3	0	43

Class C Freq: 0.052

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	4	7	7	5	0	2	1	0	0	1	0	4	5	11	1	52
3.5-7.5	1	5	0	1	1	2	1	0	7	11	7	12	7	2	0	3	60
7.5-12.5	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	3
12.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	5	9	7	8	6	2	3	1	7	14	8	12	11	7	11	4	115

Class D Freq: 0.393

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	31	32	30	44	21	18	9	16	16	12	14	22	13	12	18	331
3.5-7.5	9	49	4	5	10	7	5	1	55	216	92	19	18	4	2	4	500
7.5-12.5	0	0	0	0	0	0	0	0	4	27	6	0	0	0	0	0	37
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	32	80	36	35	54	28	23	10	75	259	110	33	40	17	14	22	868

Table A-1 (continued)

Jul-Sep 2013

Class E Freq: 0.313

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	1	0	0	0	0	2	0	0	1	0	0	0	2	0	2	1	9
0.95-3.5	11	19	15	24	11	12	22	17	27	21	22	45	27	17	19	9	318
3.5-7.5	6	6	0	0	0	0	1	4	24	128	97	50	10	7	7	7	347
7.5-12.5	0	0	0	0	0	0	0	0	1	7	9	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	18	25	15	24	11	14	23	21	53	156	128	95	39	24	28	17	691

Class F Freq: 0.117

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	0	2	0	0	0	4
0.95-3.5	1	0	1	4	0	0	0	3	10	19	19	36	13	9	1	0	116
3.5-7.5	0	0	0	0	0	0	0	0	3	25	96	10	0	0	0	0	134
7.5-12.5	0	0	0	0	0	0	0	0	0	0	4	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	1	0	1	4	0	0	0	4	13	45	119	46	15	9	1	0	258

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	1	1	0	0	0	0	0	1	0	1	0	0	0	0	4
0.95-3.5	0	0	0	0	0	0	0	0	0	4	11	15	10	0	1	0	41
3.5-7.5	0	0	0	0	0	0	0	0	0	0	34	0	0	0	0	0	34
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	1	1	0	0	0	0	0	5	45	16	10	0	1	0	79

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	1	0	1	1	0	2	0	1	1	2	0	1	4	0	2	1	17
0.95-3.5	52	72	65	74	64	33	42	31	53	60	65	110	81	46	47	32	927
3.5-7.5	26	100	26	12	18	10	7	5	93	382	327	93	45	24	17	17	1202
7.5-12.5	0	0	0	0	0	0	0	0	5	38	19	0	0	0	0	0	62
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	79	172	92	87	82	45	49	37	152	482	411	204	130	70	66	50	2208

Table A-1 (continued)

Oct-Dec 2013

Class A Freq: 0.043

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	5	6	5	3	1	0	0	0	0	0	0	0	0	1	1	0	22
3.5-7.5	8	12	17	4	1	0	0	0	0	1	1	0	15	8	3	1	71
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	2	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	13	18	22	7	2	0	0	0	0	3	2	0	15	9	4	1	96

Class B Freq: 0.022

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	4	1	0	0	1	0	0	0	0	0	0	1	1	1	1	10
3.5-7.5	3	2	1	5	4	0	0	0	0	0	2	4	5	7	2	3	38
7.5-12.5	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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	3	6	2	5	4	1	0	0	0	0	2	4	6	9	3	4	49

Class C Freq: 0.025

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	2	1	0	0	0	0	0	0	0	0	1	0	0	8
3.5-7.5	0	0	0	2	0	0	0	0	0	4	4	6	8	4	10	4	42
7.5-12.5	0	0	0	0	0	0	0	0	0	1	1	0	0	3	1	0	6
12.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1	1	2	4	1	0	0	0	0	5	5	6	8	8	11	4	56

Class D Freq: 0.509

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	17	21	28	8	5	3	3	10	4	6	17	14	13	12	27	19	207
3.5-7.5	15	21	12	22	14	16	24	32	22	67	60	90	137	81	101	34	748
7.5-12.5	0	0	0	0	8	4	0	0	15	37	21	3	37	22	12	4	163
12.5-18.5	0	0	0	0	2	1	0	0	0	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	32	42	40	30	29	24	27	42	41	112	98	107	187	115	140	57	1123

Table A-1 (continued)

Oct-Dec 2013

Class E Freq: 0.314

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	2
0.95-3.5	2	13	16	11	9	7	13	20	33	33	35	37	30	12	14	8	293
3.5-7.5	2	3	10	8	0	3	8	15	20	49	64	111	43	5	7	3	351
7.5-12.5	0	0	0	0	1	1	4	1	9	15	6	1	1	1	0	0	40
12.5-18.5	0	0	0	0	1	1	0	2	4	0	0	0	0	0	0	0	8
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	16	26	19	11	12	25	38	66	98	105	150	74	18	21	11	694

Class F 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	2	3	8	23	12	16	8	3	0	0	75
3.5-7.5	0	0	0	0	0	0	0	0	2	7	55	10	2	0	0	0	76
7.5-12.5	0	0	0	0	0	0	0	0	0	1	5	0	0	0	0	0	6
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	3	10	31	72	26	10	3	0	0	157

Class G Freq: 0.015

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	0	1	0	0	0	1	0	2	5	15	1	0	0	0	25
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	1	0	0	0	1	0	2	13	15	1	0	0	0	33

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	1	0	1	0	0	0	0	2
0.95-3.5	25	45	52	25	16	11	18	34	45	64	69	82	53	30	43	28	640
3.5-7.5	28	38	40	41	19	19	32	47	44	128	194	221	210	105	123	45	1334
7.5-12.5	0	0	0	0	9	5	4	1	24	54	34	4	38	27	13	4	217
12.5-18.5	0	0	0	0	3	2	0	2	4	4	0	0	0	0	0	0	15
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	53	83	92	66	47	37	54	84	117	251	297	308	301	162	179	77	2208

Table A-1 (continued)

Jan-Dec 2013

Class A Freq: 0.072

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	19	21	15	11	4	0	0	1	0	0	0	0	2	1	2	4	80
3.5-7.5	53	89	65	40	28	8	2	1	4	5	4	10	38	38	32	21	438
7.5-12.5	0	0	0	7	0	1	0	0	1	6	1	0	11	13	3	2	45
12.5-18.5	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	3
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	72	110	80	58	32	9	2	2	5	14	5	10	51	52	37	27	566

Class B Freq: 0.033

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	9	4	2	4	2	1	1	0	0	0	0	4	3	3	1	37
3.5-7.5	9	10	9	12	19	7	2	1	3	10	9	12	31	26	9	7	176
7.5-12.5	1	0	1	1	0	0	0	1	6	19	1	1	9	2	0	0	42
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	13	19	14	15	23	9	3	3	9	30	10	13	44	31	12	8	256

Class C Freq: 0.048

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	11	10	9	2	3	1	0	0	2	0	6	6	14	1	79
3.5-7.5	3	11	7	11	8	8	7	0	9	30	23	28	42	27	18	12	244
7.5-12.5	0	2	1	0	0	0	0	0	6	28	2	0	10	5	2	0	56
12.5-18.5	0	0	0	0	0	0	0	0	0	2	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	11	19	19	21	17	10	10	1	15	60	27	28	58	38	34	13	381

Class D Freq: 0.470

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	1	0	1
0.95-3.5	56	69	87	71	89	44	45	29	30	36	39	45	52	39	59	48	838
3.5-7.5	57	93	48	56	62	65	53	57	149	426	210	195	346	178	145	71	2211
7.5-12.5	8	20	13	6	36	10	1	2	41	236	53	16	94	54	17	8	615
12.5-18.5	0	0	1	2	2	1	0	0	6	18	2	0	0	0	0	0	32
18.5-24	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	121	182	149	135	189	120	99	88	228	716	304	256	492	271	222	127	3699

Table A-1 (continued)

Jan-Dec 2013

Class E Freq: 0.275

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	1	1	0	1	0	3	0	0	1	2	1	1	3	1	2	1	18
0.95-3.5	25	40	40	52	38	42	46	58	84	64	85	109	88	50	46	27	894
3.5-7.5	9	15	20	12	13	5	17	36	72	237	246	238	117	40	28	17	1122
7.5-12.5	1	0	0	0	2	2	4	2	13	53	36	2	3	2	0	0	120
12.5-18.5	0	0	1	0	1	1	0	2	4	1	0	0	0	0	0	0	10
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	36	56	61	65	54	53	67	98	174	357	368	350	211	93	76	45	2164

Class F Freq: 0.081

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	2	0	0	0	5
0.95-3.5	1	0	1	4	2	3	4	10	31	59	41	76	32	19	1	1	285
3.5-7.5	1	0	0	2	1	1	2	1	7	46	221	39	2	2	0	0	325
7.5-12.5	0	0	0	0	0	0	0	0	0	2	19	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	0	1	6	3	4	6	12	38	108	281	116	36	21	1	1	636

Class G Freq: 0.021

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	1	1	0	0	0	0	0	1	0	1	0	0	0	0	4
0.95-3.5	0	0	0	1	1	0	0	3	0	8	23	36	13	0	1	0	86
3.5-7.5	0	0	0	0	0	0	0	0	0	2	70	3	0	0	0	0	75
7.5-12.5	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2
12.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	1	2	1	0	0	3	0	11	95	40	13	0	1	0	167

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	1	1	1	2	0	3	0	1	1	4	1	3	5	1	3	1	28
0.95-3.5	112	145	158	151	147	93	99	103	145	167	190	266	197	118	126	82	2299
3.5-7.5	132	218	149	133	131	94	83	96	244	756	783	525	576	311	232	128	4591
7.5-12.5	10	22	15	14	38	13	5	5	67	344	114	19	127	76	22	10	901
12.5-18.5	0	0	2	2	3	2	0	2	10	25	2	0	0	0	0	0	48
18.5-24	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	255	386	325	302	319	205	187	207	469	1296	1090	813	905	506	383	221	7869

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

Jan-Mar 2013

Class A Freq: 0.082

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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
7.5-12.5	5	2	0	3	3	1	2	0	0	0	0	0	1	4	5	5	31
12.5-18.5	13	0	0	1	0	0	0	0	0	0	0	0	6	5	8	4	37
18.5-24	2	0	0	2	1	0	0	0	0	0	0	0	3	11	5	4	28
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	9	3	2	14
TOTAL	20	3	1	6	4	1	2	0	0	0	0	0	10	29	21	15	112

Class B Freq: 0.035

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	0	0	0	3
7.5-12.5	1	1	0	0	1	0	0	0	0	0	0	0	4	1	2	0	10
12.5-18.5	3	1	0	1	0	0	0	0	1	0	0	0	5	5	3	1	20
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	2	6
>24	0	0	0	2	0	0	0	0	0	0	0	0	3	3	0	1	9
TOTAL	4	3	0	4	1	0	0	0	1	0	0	0	17	9	5	4	48

Class C Freq: 0.043

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.5-7.5	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	3
7.5-12.5	1	1	0	0	2	1	0	0	0	1	1	1	3	1	1	1	14
12.5-18.5	2	0	0	0	0	0	0	0	0	2	0	0	9	6	3	2	24
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	5	6	1	0	12
>24	0	0	1	0	0	0	0	0	0	0	0	0	0	4	1	0	6
TOTAL	3	2	2	0	2	1	0	0	0	3	1	1	17	17	6	4	59

Class D Freq: 0.544

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	2	0	1	0	0	1	1	0	0	0	0	2	1	9
3.5-7.5	2	0	4	6	5	8	2	2	2	3	2	7	5	4	3	2	57
7.5-12.5	9	4	3	4	6	2	6	4	5	11	6	14	21	18	19	5	137
12.5-18.5	6	0	1	2	4	3	11	5	3	13	24	27	74	34	14	9	230
18.5-24	3	1	6	0	2	0	2	0	4	22	9	12	34	70	21	16	202
>24	2	3	2	4	23	0	0	0	6	14	5	1	5	36	6	6	113
TOTAL	22	8	17	18	40	14	21	11	21	64	46	61	139	162	65	39	748

Table A-2 (continued)

Jan-Mar 2013

Class E Freq: 0.250

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	1	0	0	3	2	1	0	1	0	0	0	9
3.5-7.5	0	1	2	1	0	1	7	4	8	4	4	1	4	6	5	1	49
7.5-12.5	4	1	2	1	1	1	3	1	1	9	7	6	9	17	5	9	77
12.5-18.5	3	1	0	0	1	0	0	11	2	12	19	22	39	22	13	4	149
18.5-24	1	0	0	0	0	1	0	3	2	0	5	8	10	17	3	2	52
>24	1	0	1	0	2	0	0	0	0	0	0	0	0	4	0	0	8
TOTAL	9	3	5	3	4	4	10	19	16	27	36	37	63	66	26	16	344

Class F Freq: 0.039

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
3.5-7.5	0	0	0	0	2	0	2	0	1	1	2	2	3	1	3	0	17
7.5-12.5	0	0	0	0	0	0	0	2	0	4	2	2	7	1	3	0	21
12.5-18.5	0	0	0	0	0	0	0	0	0	0	6	3	4	0	0	0	13
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	0	2	0	2	2	1	6	10	7	14	2	6	0	53

Class G Freq: 0.007

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	1	0	0	0	1
3.5-7.5	0	0	0	0	0	0	0	0	0	2	0	0	0	1	0	0	3
7.5-12.5	0	0	0	0	0	0	0	0	0	1	0	1	2	1	0	0	5
12.5-18.5	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	1	3	0	1	3	2	0	0	10

Class All Freq: 1.000

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	1	0	1	3	0	2	0	0	4	4	1	0	2	0	2	1	21
3.5-7.5	2	4	8	8	7	9	11	6	11	10	8	10	13	12	11	4	134
7.5-12.5	20	9	5	8	13	5	11	7	6	26	16	24	47	43	35	20	295
12.5-18.5	27	2	1	4	5	3	11	16	7	27	49	52	137	72	41	20	474
18.5-24	6	1	6	2	3	1	2	3	6	22	14	20	56	104	30	24	300
>24	3	3	4	6	25	0	0	0	6	14	5	1	8	56	10	9	150
TOTAL	59	19	25	31	53	20	35	32	40	103	93	107	263	287	129	78	1374

Table A-2 (continued)

Apr-Jun 2013

Class A Freq: 0.098

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.5-7.5	1	4	7	4	4	0	0	0	1	0	0	0	2	0	2	0	25
7.5-12.5	4	12	13	7	11	6	1	0	0	1	0	4	3	2	0	4	68
12.5-18.5	12	4	4	2	2	5	2	1	2	4	2	3	8	5	0	5	61
18.5-24	3	4	0	2	6	0	0	0	2	2	0	0	6	5	2	12	44
>24	0	0	0	0	0	0	0	0	0	0	0	0	2	0	3	1	6
TOTAL	20	24	24	15	23	11	3	1	5	7	2	7	21	12	7	22	204

Class B Freq: 0.056

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	1	0	3	1	0	0	0	0	0	0	0	0	0	0	8
7.5-12.5	0	0	1	0	5	13	3	1	0	3	4	6	5	2	0	1	44
12.5-18.5	2	0	0	0	0	2	1	1	7	17	3	2	7	1	0	2	45
18.5-24	0	0	0	1	0	0	0	0	3	5	0	0	1	5	0	1	16
>24	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	3
TOTAL	4	2	2	1	8	16	4	2	11	25	7	8	14	8	0	4	116

Class C Freq: 0.073

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	3	5	1	5	2	1	0	0	0	0	1	1	2	1	0	24
7.5-12.5	2	1	0	0	3	5	2	0	1	2	8	8	8	1	2	0	43
12.5-18.5	0	0	1	3	0	0	6	1	8	17	4	2	3	3	3	1	52
18.5-24	1	0	0	1	0	0	0	0	0	13	1	0	5	4	0	1	26
>24	2	1	0	0	0	0	0	0	0	1	0	0	0	1	1	0	6
TOTAL	7	5	6	5	8	7	9	1	9	33	13	11	17	11	7	2	151

Class D Freq: 0.462

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	0	1	1	0	2	1	0	0	0	0	1	0	1	1	10
3.5-7.5	8	8	12	9	17	12	9	3	3	7	5	5	3	4	7	7	119
7.5-12.5	4	4	5	7	22	22	22	16	12	40	11	16	8	4	1	2	196
12.5-18.5	11	3	13	21	6	14	10	11	32	114	24	13	22	8	5	7	314
18.5-24	8	3	7	10	7	1	2	3	15	100	19	3	16	22	7	5	228
>24	16	7	6	2	8	2	0	0	3	16	0	0	7	13	4	9	93
TOTAL	47	27	43	50	61	51	45	34	65	277	59	37	57	51	25	31	960

Table A-2 (continued)

Apr-Jun 2013

Class E Freq: 0.209

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	2	2	2	2	1	1	3	0	1	1	1	0	0	1	0	0	17
3.5-7.5	1	3	4	8	5	11	5	2	5	2	0	1	1	3	3	0	54
7.5-12.5	7	3	5	3	4	10	15	2	8	7	9	10	4	1	2	7	97
12.5-18.5	2	4	4	2	1	1	8	7	15	22	23	21	17	18	7	1	153
18.5-24	1	1	0	1	0	0	1	3	1	45	14	5	3	12	6	3	96
>24	0	0	0	0	0	0	0	0	0	9	2	1	0	2	2	2	18
TOTAL	13	13	15	16	11	23	32	14	30	86	49	38	25	37	20	13	435

Class F Freq: 0.081

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	1	0	1	1	1	1	2	1	0	0	0	1	0	12
3.5-7.5	2	1	0	2	5	5	1	1	1	2	2	2	1	2	0	0	27
7.5-12.5	1	0	0	0	0	0	7	5	6	3	4	1	2	2	4	3	38
12.5-18.5	0	1	0	0	1	0	0	1	3	5	10	21	7	7	3	2	61
18.5-24	1	0	0	0	0	0	0	0	0	1	19	1	1	2	0	0	25
>24	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	5
TOTAL	5	4	0	3	6	6	9	8	11	13	41	25	11	13	8	5	168

Class G Freq: 0.022

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
3.5-7.5	1	1	1	0	0	0	0	0	0	0	2	1	2	1	0	1	10
7.5-12.5	0	0	0	0	0	0	0	0	3	0	1	6	1	1	0	0	12
12.5-18.5	0	0	0	0	0	0	0	0	3	0	5	2	6	1	0	0	17
18.5-24	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	4
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1	1	1	0	0	0	0	0	6	2	12	9	9	3	0	1	45

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	6	2	4	2	2	6	2	2	5	2	0	1	1	2	1	41
3.5-7.5	16	22	30	24	39	31	16	6	10	11	9	10	10	12	13	8	267
7.5-12.5	18	20	24	17	45	56	50	24	30	56	37	51	31	13	9	17	498
12.5-18.5	27	12	22	28	10	22	27	22	70	179	71	64	70	43	18	18	703
18.5-24	14	8	7	15	13	1	3	6	21	166	57	9	32	50	15	22	439
>24	19	8	6	2	8	2	0	0	4	26	7	1	10	16	10	12	131
TOTAL	97	76	91	90	117	114	102	60	137	443	183	135	154	135	67	78	2079

Table A-2 (continued)

Jul-Sep 2013

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	8	11	6	3	6	0	0	0	0	0	0	0	1	0	0	1	36
7.5-12.5	15	5	8	0	9	0	1	0	3	2	0	1	1	3	2	9	59
12.5-18.5	23	6	2	0	0	1	0	0	0	1	0	0	5	7	3	2	50
18.5-24	6	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	8
>24	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
TOTAL	52	24	16	3	15	1	1	0	3	3	0	1	7	10	6	12	154

Class B Freq: 0.019

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	3	0	0	0	0	0	0	0	0	1	1	0	0	8
7.5-12.5	0	4	0	0	3	0	0	0	2	0	0	1	6	6	0	1	23
12.5-18.5	2	1	3	0	0	0	0	0	0	1	0	0	0	3	0	0	10
18.5-24	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	3	7	4	3	3	0	0	0	2	1	0	1	8	10	0	1	43

Class C Freq: 0.052

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	1	4	2	4	3	0	0	0	0	1	0	0	5	6	3	31
7.5-12.5	1	1	4	0	0	5	4	1	2	3	2	10	10	4	1	1	49
12.5-18.5	1	3	2	0	0	0	0	0	7	6	4	2	2	0	1	2	30
18.5-24	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	3
>24	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
TOTAL	5	6	10	2	4	8	4	1	10	9	7	12	13	9	9	6	115

Class D Freq: 0.393

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	6	3	1	0	0	0	0	1	0	0	0	1	2	1	1	25
3.5-7.5	8	11	11	15	15	21	6	8	4	10	13	3	6	3	7	9	150
7.5-12.5	7	9	12	9	12	18	26	9	19	58	28	21	21	13	8	10	280
12.5-18.5	6	10	2	0	5	2	0	6	30	132	84	12	8	4	4	3	308
18.5-24	12	16	0	0	0	0	0	0	4	29	12	0	0	7	1	0	81
>24	10	4	0	0	0	0	0	0	0	1	0	0	0	0	0	9	24
TOTAL	52	56	28	25	32	41	32	23	58	230	137	36	36	29	21	32	868

Table A-2 (continued)

Jul-Sep 2013

Class E Freq: 0.313

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	3	6	5	2	1	2	3	4	0	0	0	0	1	1	33
3.5-7.5	4	6	4	4	7	10	9	5	4	2	4	9	2	7	5	3	85
7.5-12.5	7	5	2	4	1	5	13	16	11	17	10	16	6	20	10	5	148
12.5-18.5	6	4	0	0	0	0	3	6	15	74	63	33	45	28	10	8	295
18.5-24	3	3	0	0	0	0	0	2	1	42	40	2	0	10	9	12	124
>24	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	3	6
TOTAL	25	19	9	14	13	17	26	31	34	139	119	60	53	65	35	32	691

Class F Freq: 0.117

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	0	0	1	2	0	0	1	1	0	1	0	0	1	0	9
3.5-7.5	2	1	1	1	3	3	1	3	0	1	2	0	2	2	3	6	31
7.5-12.5	0	1	0	0	1	1	1	3	7	6	9	2	4	17	2	9	63
12.5-18.5	1	0	0	0	0	0	2	2	5	16	21	27	23	12	4	1	114
18.5-24	0	0	0	0	0	0	0	1	0	5	29	6	0	0	0	0	41
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	3	4	1	1	5	6	4	9	13	29	61	36	29	31	10	16	258

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	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2
0.95-3.5	0	0	0	0	0	0	0	0	3	2	2	0	0	1	0	1	9
3.5-7.5	1	2	2	2	1	0	0	0	0	2	3	3	0	0	0	3	19
7.5-12.5	0	0	0	0	0	0	0	0	2	3	3	4	4	1	3	4	24
12.5-18.5	0	0	0	0	0	0	0	0	0	0	6	5	11	0	0	0	22
18.5-24	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	3
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1	3	2	2	1	0	0	0	5	7	17	13	15	2	3	8	79

Class All Freq: 1.000

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2
0.95-3.5	13	9	6	7	6	4	1	2	8	7	2	1	1	3	3	3	76
3.5-7.5	26	33	29	30	36	37	16	16	8	15	23	15	12	18	21	25	360
7.5-12.5	30	25	26	13	26	29	45	29	46	89	52	55	52	64	26	39	646
12.5-18.5	39	24	9	0	5	3	5	14	57	230	178	79	94	54	22	16	829
18.5-24	21	21	0	0	0	0	0	3	6	76	83	9	2	17	12	12	262
>24	12	6	0	0	0	0	0	0	0	1	2	0	0	0	0	12	33
TOTAL	141	119	70	50	73	73	67	64	125	418	341	159	161	156	84	107	2208

Table A-2 (continued)

Oct-Dec 2013

Class A Freq: 0.043

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.5-7.5	1	1	5	1	1	0	0	0	0	0	0	0	0	1	0	1	11
7.5-12.5	2	5	9	1	3	0	0	0	0	0	0	0	1	4	2	0	27
12.5-18.5	7	3	5	2	0	0	0	0	0	1	2	0	12	4	1	5	42
18.5-24	5	2	1	1	0	0	0	0	0	0	0	0	1	2	0	1	13
>24	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	3
TOTAL	16	11	20	5	4	0	0	0	0	3	2	0	14	11	3	7	96

Class B Freq: 0.022

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.5-7.5	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1	4
7.5-12.5	1	0	1	1	1	1	0	0	0	0	0	2	0	3	0	0	10
12.5-18.5	1	3	0	2	0	0	0	0	0	0	1	3	4	5	0	3	22
18.5-24	0	1	1	4	0	0	0	0	0	0	0	0	1	0	0	2	9
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	1	4
TOTAL	2	4	2	8	1	1	0	0	0	0	1	5	6	9	3	7	49

Class C Freq: 0.025

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	2	1	0	0	0	0	0	0	0	0	2	0	0	6
7.5-12.5	0	0	2	0	0	0	0	0	0	2	2	4	1	1	0	0	12
12.5-18.5	0	0	0	0	1	0	0	0	0	3	2	2	5	2	4	1	20
18.5-24	0	0	0	1	0	0	0	0	0	0	0	0	2	2	5	3	13
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2	0	5
TOTAL	0	0	3	3	2	0	0	0	0	5	4	6	8	10	11	4	56

Class D Freq: 0.509

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	4	1	1	1	0	0	0	0	0	0	0	1	1	0	12
3.5-7.5	10	5	12	2	2	3	2	2	2	2	5	4	5	4	7	8	75
7.5-12.5	11	4	16	6	2	2	5	6	10	19	39	26	24	18	24	16	228
12.5-18.5	6	3	2	18	7	7	28	21	6	55	37	59	87	39	43	17	435
18.5-24	8	3	1	12	10	1	2	5	10	25	19	6	30	52	53	27	264
>24	12	0	0	0	13	1	0	0	0	3	4	0	12	32	23	9	109
TOTAL	50	15	35	39	35	15	37	34	28	104	104	95	158	146	151	77	1123

Table A-2 (continued)

Oct-Dec 2013

Class E Freq: 0.314

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	1	2	0	1	2	3	0	0	0	1	0	0	0	2	0	12
3.5-7.5	7	1	9	3	7	1	4	1	2	1	1	5	8	5	5	6	66
7.5-12.5	2	8	6	8	11	1	6	16	7	20	27	24	19	18	7	6	186
12.5-18.5	1	3	5	14	4	4	17	17	11	26	52	44	72	22	13	5	310
18.5-24	1	1	5	0	0	1	1	1	6	18	23	3	21	14	0	2	97
>24	0	0	0	0	3	1	5	4	3	0	1	1	0	2	2	1	23
TOTAL	11	14	27	25	26	10	36	39	29	65	105	77	120	61	29	20	694

Class F 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	3	2	1	0	1	0	0	0	0	0	0	1	0	0	0	0	8
3.5-7.5	0	0	0	4	2	0	1	2	2	2	0	2	3	4	2	0	24
7.5-12.5	0	0	0	0	0	1	1	7	6	2	5	4	3	4	5	1	39
12.5-18.5	0	0	0	0	0	0	1	4	5	5	12	23	16	7	0	0	73
18.5-24	0	0	0	0	0	0	0	0	0	2	8	1	1	0	0	0	12
>24	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
TOTAL	3	2	1	4	3	1	3	13	13	11	26	31	23	15	7	1	157

Class G Freq: 0.015

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
0.95-3.5	0	0	1	0	1	1	0	1	0	0	0	1	1	2	2	0	10
3.5-7.5	0	0	0	1	1	1	0	1	0	3	1	0	1	0	0	0	9
7.5-12.5	0	0	0	0	0	0	0	0	0	0	1	1	1	3	0	0	6
12.5-18.5	0	0	0	0	0	0	0	0	1	0	1	0	5	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	1	1	2	2	0	2	1	3	3	2	8	6	2	0	33

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	1	0	0	1
0.95-3.5	6	3	8	1	4	4	3	1	0	0	1	2	1	3	5	0	42
3.5-7.5	18	7	27	14	14	5	7	6	6	8	7	11	18	16	15	16	195
7.5-12.5	16	17	34	16	17	5	12	29	23	43	74	61	49	51	38	23	508
12.5-18.5	15	12	12	36	12	11	46	42	23	90	107	131	201	79	61	31	909
18.5-24	14	7	8	18	10	2	3	6	16	45	50	10	56	70	58	35	408
>24	13	0	0	0	16	2	5	4	3	5	6	1	12	38	29	11	145
TOTAL	82	46	89	85	73	29	76	88	71	191	245	216	337	258	206	116	2208

Table A-2 (continued)

Jan-Dec 2013

Class A Freq: 0.072

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	17	19	8	11	0	0	0	1	0	0	0	3	1	2	2	74
7.5-12.5	26	24	30	11	26	7	4	0	3	3	0	5	6	13	9	18	185
12.5-18.5	55	13	11	5	2	6	2	1	2	6	4	3	31	21	12	16	190
18.5-24	16	7	1	5	7	0	0	0	2	2	0	0	10	18	8	17	93
>24	1	1	0	0	0	0	0	0	0	2	0	0	2	9	6	3	24
TOTAL	108	62	61	29	46	13	6	1	8	13	4	8	52	62	37	56	566

Class B Freq: 0.033

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	4	2	5	3	1	0	0	0	0	0	0	3	1	1	1	23
7.5-12.5	2	5	2	1	10	14	3	1	2	3	4	9	15	12	2	2	87
12.5-18.5	8	5	3	3	0	2	1	1	8	18	4	5	16	14	3	6	97
18.5-24	0	2	1	5	0	0	0	0	3	5	0	0	7	5	0	5	33
>24	1	0	0	2	0	0	0	0	1	0	0	0	4	4	2	2	16
TOTAL	13	16	8	16	13	17	4	2	14	26	8	14	45	36	8	16	256

Class C Freq: 0.048

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	4	5	11	5	10	5	1	0	0	0	1	1	1	9	7	4	64
7.5-12.5	4	3	6	0	5	11	6	1	3	8	13	23	22	7	4	2	118
12.5-18.5	3	3	3	3	1	0	6	1	15	28	10	6	19	11	11	6	126
18.5-24	1	0	0	2	0	0	0	0	1	13	1	0	13	12	7	4	54
>24	3	2	1	0	0	0	0	0	0	1	0	0	0	8	4	0	19
TOTAL	15	13	21	10	16	16	13	2	19	50	25	30	55	47	33	16	381

Class D Freq: 0.470

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	8	8	5	2	2	2	1	2	1	0	0	2	3	5	3	56
3.5-7.5	28	24	39	32	39	44	19	15	11	22	25	19	19	15	24	26	401
7.5-12.5	31	21	36	26	42	44	59	35	46	128	84	77	74	53	52	33	841
12.5-18.5	29	16	18	41	22	26	49	43	71	314	169	111	191	85	66	36	1287
18.5-24	31	23	14	22	19	2	6	8	33	176	59	21	80	151	82	48	775
>24	40	14	8	6	44	3	0	0	9	34	9	1	24	81	33	33	339
TOTAL	171	106	123	132	168	121	135	102	172	675	346	229	390	388	262	179	3699

Table A-2 (continued)

Jan-Dec 2013

Class E Freq: 0.275

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	6	4	7	9	7	6	7	2	7	7	3	0	1	1	3	1	71
3.5-7.5	12	11	19	16	19	23	25	12	19	9	9	16	15	21	18	10	254
7.5-12.5	20	17	15	16	17	17	37	35	27	53	53	56	38	56	24	27	508
12.5-18.5	12	12	9	16	6	5	28	41	43	134	157	120	173	90	43	18	907
18.5-24	6	5	5	1	0	2	2	9	10	105	82	18	34	53	18	19	369
>24	2	0	1	0	5	1	5	4	3	9	5	2	0	8	4	6	55
TOTAL	58	49	56	58	54	54	104	103	109	317	309	212	261	229	110	81	2164

Class F Freq: 0.081

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	6	1	1	2	3	1	1	2	4	1	2	0	0	2	0	31
3.5-7.5	4	2	1	7	12	8	5	6	4	6	6	6	9	9	8	6	99
7.5-12.5	1	1	0	0	1	2	9	17	19	15	20	9	16	24	14	13	161
12.5-18.5	1	1	0	0	1	0	3	7	13	26	49	74	50	26	7	3	261
18.5-24	1	0	0	0	0	0	0	1	0	8	56	8	2	2	0	0	78
>24	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	6
TOTAL	12	10	2	8	16	13	18	32	38	59	138	99	77	61	31	22	636

Class G Freq: 0.021

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	3
0.95-3.5	0	0	1	0	1	1	0	1	3	4	2	1	2	3	2	1	22
3.5-7.5	2	3	3	3	2	1	0	1	0	7	6	4	3	2	0	4	41
7.5-12.5	0	0	0	0	0	0	0	0	5	4	5	12	8	6	3	4	47
12.5-18.5	0	0	0	0	0	0	0	0	5	0	12	7	22	1	0	0	47
18.5-24	0	0	0	0	0	0	0	0	0	0	6	1	0	0	0	0	7
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	2	4	4	3	3	2	0	2	13	15	32	25	35	13	5	9	167

Class All Freq: 1.000

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	3
0.95-3.5	23	18	17	15	12	12	10	5	14	16	6	3	5	7	12	5	180
3.5-7.5	62	66	94	76	96	82	50	34	35	44	47	46	53	58	60	53	956
7.5-12.5	84	71	89	54	101	95	118	89	105	214	179	191	179	171	108	99	1947
12.5-18.5	108	50	44	68	32	39	89	94	157	526	405	326	502	248	142	85	2915
18.5-24	55	37	21	35	26	4	8	18	49	309	204	48	146	241	115	93	1409
>24	47	17	10	8	49	4	5	4	13	46	20	3	30	110	49	44	459
TOTAL	379	260	275	256	316	236	280	244	373	1155	862	617	915	836	486	379	7869

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), and 2013 (3 wells). A total of 22 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 2013.

A summary of the results of the tritium analyses conducted in 2013 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 30-Apr-2013 contained no detectable tritium, and a minimum detectable concentration of 333 pCi/L was achieved on that sample. The achieved sensitivity of 333 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	28	5	NDA < 333	540
MW202	Nov-2007	4	3	NDA < 372	1010
MW202-I	Apr-2010	4	4	474	833
MW203	Nov-2007	2	0	NDA < 422	NDA < 425
MW204	Nov-2007	4	0	NDA < 369	NDA < 427
MW205	Apr-2010	28	22	NDA < 351	3080
MW206	Apr-2010	28	16	NDA < 337	3590
MW207	Apr-2010	4	0	NDA < 366	NDA < 453
MW208-S	Apr-2010	4	0	NDA < 369	NDA < 427
MW208-I	Apr-2010	4	0	NDA < 369	NDA < 426
MW209	Aug-2010	41	40	NDA < 430	1370
MW210	Aug-2010	4	4	428	1580
MW211	Aug-2010	44	44	665	1580
MW212	Aug-2010	4	2	NDA < 373	560
MW213	Aug-2010	4	0	NDA < 367	NDA < 423
MW214	Aug-2010	4	0	NDA < 370	NDA < 437
MW215	Dec-2011	28	28	587	1450
MW216	Sep-2012	52	52	630	8700
MW217	Dec-2011	4	3	NDA < 373	492
MW218	Nov-2013	7	7	2630	5810
MW219	Dec-2013	4	4	2120	69000
MW3	Jul-1987	4	0	NDA < 358	NDA < 426
MW4	Jul-1997	4	4	460	762
MW4-R	Nov-2013	7	7	451	724
All Wells	--	321	245	NDA < 333	69000
Intake Canal West	--	27	0	NDA < 308	NDA < 439
Intake Canal East	--	4	0	NDA < 356	NDA < 432

Concentrations of tritium detected in the onsite wells ranged from non-detectable at less than 333 pCi/L, up to a maximum concentration of 69,000 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 MW-216 (average concentration = 4083 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 2013, 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 571 pCi/L, the annual discharge of tritium into the intake bay under this hypothetical scenario would be 0.00714 Curies. This activity represents less than 0.011% 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 0.00714 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 2013 was 565 billion Liters, yielding an effective concentration of tritium in the intake bay of about 0.013 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 0.0000000072 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	3.79E+02	3.67E+03	9.90E+02	6.50E+02
Annual Segment Tritium Discharge - Ci/yr	6.09E-04	7.91E-03	1.88E-03	4.44E-03
Total Volumetric Discharge - L/yr	1.25E+07			
Total H-3 Discharge - Ci/yr	7.14E-03			
Annual Circulating Water Flow - Liter/yr	5.65E+11			
Discharge Canal H-3 Concentration - Ci/L	1.27E-14			
Discharge Canal H-3 Concentration - pCi/L	1.27E-02			
Max. Indiv. Dose Factor - mrem/yr per Ci/L	5.73E+05			
Maximum Individual Dose - mrem/yr	7.24E-09			

In March 2013, four permitted discharge of radioactive water were made from the neutralizing sump via the neutralizing sump discharge line that exits the west side of the Auxiliary Building and runs underground to storm drain Catch Basin #10. During the fourth discharge on 25-Mar-2013, water was observed emanating from a conduit that enters the Auxiliary Building from the west side of the building. The release was terminated, and water flow from the conduit stopped. A chemical and radiological analysis of the water from the conduit indicated the water chemistry matched that being discharged from the neutralizing sump. Due to the nature of this event, a voluntary communication was made to notify the NRC and stakeholders of this abnormal event. The line was isolated to prevent any additional releases from the line. This event was entered into Pilgrim Station's 10CFR50.75(g) decommissioning database. The only radioactivity detected in this wastewater was tritium. As part of the impact assessment, a worst-case bounding calculation was made that 38,410 gallons of wastewater containing 0.34 Curies of tritium was released into the groundwater. This groundwater was assumed to migrate into the saltwater environment of the Pilgrim Station Intake Canal and Cape Cod Bay. 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 0.00000034 mrem/yr.

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.

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 tables.

In the case of MW218 downgradient of the neutralizing sump discharge line separation, the tritium concentrations have been ranging from 1550 pCi/L to 5810 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. 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.

A bounding calculation was performed 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 0.00000000059 mrem/yr.

In conclusion, the only radionuclide detected in groundwater during the 2013 monitoring effort that is attributable to Pilgrim Station operations is tritium. Even in the case of the three reportable events that occurred in 2013, the total dose impact to a maximally-exposed member of the public would have been much less than 1 mrem/yr.

APPENDIX C

CORRECTIONS TO PREVIOUS EFFLUENT REPORTS

There were no corrections to past effluent reports to include in the 2013 annual report.

APPENDIX D

CHANGES TO PNPS
OFFSITE DOSE CALCULATION MANUAL

No revisions were made to the PNPS Offsite Dose Calculation Manual (ODCM) during calendar year 2013.