Entergy

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

May 13, 2011

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

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

Radioactive Effluent Release Report
for January 1 through December 31, 2010

LETTER NUMBER: 2.11.036

Dear Sir or Madam:

In accordance with Pilgrim Technical Specifications 5.6.3, Entergy Nuclear Operations, Inc. submits the attached Annual Radiological Effluent Release Report for January 1 through December 31, 2010.

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

This letter contains no commitments.

Sincerely,

Joseph R. Lynch

Joseph R. Lynch
Manager, Licensing

JRL/wgl

Attachment: Pilgrim Nuclear Power Station Radioactive Effluent Release Report
January 1 through December 31, 2010

cc:

U.S. Nuclear Regulatory Commission
Region I
475 Allendale Road
King of Prussia, PA 19406

Senior Resident Inspector

Mr. Richard Guzman, Project Manager
Plant Licensing Branch I-1
Division of Operator Reactor Licensing
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
One White Flint North O-8C2
11555 Rockville Pike
Rockville, MD 20852

IE48
NRR

Mr. Robert Maietta
DEP-Division of Watershed Management
627 Main Street, 2nd Floor
Worcester, MA 06108

Radiation Control Program
Commonwealth of Massachusetts
Executive Offices of Health & Human Services
Dept. of Public Health
90 Washington St, 2nd Floor
Dorchester, MA 02121

American Nuclear Insurers
95 Glastonbury Blvd
Glastonbury, CT 06033
Attention: ANI Librarian

Attachment to Entergy Letter No. 2.11.036

Pilgrim Nuclear Power Station Radioactive Effluent Release Report

January 1 through December 31, 2010

(78 pages)

PILGRIM NUCLEAR POWER STATION

Facility Operating License DPR-35

Annual Radioactive Effluent Release Report

January 1 through December 31, 2010

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PILGRIM NUCLEAR POWER STATION
Facility Operating License DPR-35

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

JANUARY 01 THROUGH DECEMBER 31, 2010

Prepared by: _______________ 27 Apr 2011
K.J. Sejkora
Senior HP/Chemistry Specialist

Reviewed by: _______________ 5 May 2011
T.F. McElhinney
Chemistry Superintendent

Reviewed by: _______________ 5/8/11
J.M. Priest
Radiation Protection Manager

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PILGRIM NUCLEAR POWER STATION
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT
JANUARY 01 THROUGH DECEMBER 31, 2010

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, 2010. 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".

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 27.7 Curies. Releases of radioactive iodines and particulates with half-life of greater than 8 days totaled 0.00963 Curies, tritium releases totaled 43.3 Curies, and carbon-14 totaled 8.54 Curies. No gross alpha radioactivity was detected in gaseous effluents.

Noble gases released in gaseous effluents resulted in a maximum total body dose of 0.0078 mrem, with a corresponding skin dose of 0.025 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 0.031 mrem. The maximum hypothetical dose to any organ from radioactive particulates, iodines, tritium, and carbon-14 was about 0.11 mrem. The maximum, hypothetical total body dose from the combined release of all airborne radioactivity in gaseous effluents was 0.12 mrem.

The maximum individual doses from gaseous radioactive effluents were compared to the applicable ODCM dose limits. Noble gas doses were less than 1.1% of the corresponding 10CFR50 dose objectives. Maximum doses resulting from releases of particulates, iodines, tritium, and carbon-14 in gaseous effluents were less than 0.73% of corresponding 10CFR50 objectives.

LIQUID EFFLUENTS

Liquid radioactive releases for the reporting period are quantified in Tables 2.3-A and 2.3-B. Six discharges of liquid effluents containing radioactivity occurred during the reporting period. The resulting maximum total body dose was 0.00197 mrem, with a corresponding organ dose of 0.00997 mrem. All doses from liquid discharges were less than 0.2% of corresponding 10CFR50 objectives.

METEOROLOGICAL DATA

Meteorological joint frequency distributions are listed in Appendix A. Data recovery for the entire annual period was 86.3% for the 33-ft and 97.8% for the 220-ft levels of the tower. The predominant wind direction was from the south-southwest, which occurred approximately 13% of the time during the reporting period. The predominant stability class was Class D, which occurred about 39% of the time during the reporting period

OFFSITE AMBIENT RADIATION MEASUREMENTS

Ambient radiation exposure was evaluated to complete the assessment of radiological impact on humans. A small number of thermoluminescent dosimeters (TLDs) indicated an elevation in ambient radiation exposure on Entergy property in close proximity to the station, when compared to background levels in the region. This elevation is due to nitrogen-16 contained within the plant steam system, as opposed to radioactive effluent released from the plant. The dose to the maximum-exposed member of the public at the PNPS Health Club, even though they are within the owner-controlled area, was estimated as being about 1.8 mrem during 2010. There was no measurable increase during 2010 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 2010 was calculated as being about 0.83 mrem. This amount is about 0.2% of the typical dose of 300 to 400 mrem received each year by an average person from other sources of natural and man-made radiation. Although this calculated collective dose occurs to a maximum-exposed hypothetical individual, it is also well below the NRC dose limit of 100 mrem/yr specified in 10CFR20.1301, as well as the EPA dose limit of 25 mrem/yr specified in 40CFR190. Both of these limits are to be applied to real members of the general public, so the fact that the dose to the hypothetical maximum-exposed individual is within the limits ensures that any dose received by a real member of the public would be smaller and well within any applicable limit.

RADIOACTIVE SOLID WASTE DISPOSAL

Solid radioactive wastes shipped offsite for processing and disposal during the reporting period are described in Table 7.0. Approximately 375 cubic meters of solid waste, containing almost 958 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. This sampling program was continued in 2010, and twelve additional sampling wells were added to the program in 2010. Low levels of tritium, a radioactive isotope of hydrogen, were detected in these onsite wells. No other plant-related radioactivity was detected in the samples. Concentrations of tritium ranged from non-detectable at less than 295 picoCuries per Liter up to 25,552 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 2010, 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: 27.7 Ci, 0.879 μCi/sec
- Iodines and particulates with half-life greater than 8 days: 0.00963 Ci, 0.000305 μCi/sec
- Tritium: 43.3 Ci, 1.37 μCi/sec
- Carbon-14: 8.54 Ci, 0.271 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 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 six 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: 342,000 Liters
- Total Dilution Volume: 615 billion Liters
- Fission/Activation products: 0.0369 Ci, 0.0000000000600 μCi/mL
- Tritium: 2.48 Ci, 0.00000000404 μCi/mL
- Dissolved/entrained noble gases: 0 Ci, 0 μCi/mL

Table 2.1
Pilgrim Nuclear Power Station
Annual Radioactive Effluent Release Report
Supplemental Information
January-December 2010

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 2010	Apr-Jun 2010	Jul-Sep 2010	Oct-Dec 2010	Jan-Dec 2010
a. Liquid Effluents					
1. Total number of releases:	0	5	0	1	6
2. Total time period (minutes):	0.00E+00	3.76E+02	0.00E+00	1.90E+02	5.66E+02
3. Maximum time period (minutes):	0.00E+00	8.60E+01	0.00E+00	1.90E+02	1.90E+02
4. Average time period (minutes):	0.00E+00	7.52E+01	0.00E+00	1.90E+02	9.43E+01
5. Minimum time period (minutes):	0.00E+00	6.50E+01	0.00E+00	1.90E+02	6.50E+01
6. Average stream flow during periods of release of effluents into a flowing stream (Liters/min):	N/A	1.15E+06	N/A	1.18E+06	1.16E+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 2010

RELEASE PERIOD	Jan-Mar 2010	Apr-Jun 2010	Jul-Sep 2010	Oct-Dec 2010	Jan-Dec 2010	Est. Total Error
A. FISSION AND ACTIVATION GASES						
Total Release: Ci	4.24E+00	6.81E+00	1.42E+01	2.43E+00	2.77E+01	±22%
Average Release Rate: µCi/sec	5.38E-01	8.64E-01	1.81E+00	3.08E-01	8.79E-01	
Percent of Effluent Control Limit*	*	*	*	*	*	
B. IODINE-131						
Total Iodine-131 Release: Ci	3.87E-04	5.20E-04	5.63E-04	4.71E-04	1.94E-03	±20%
Average Release Rate: µCi/sec	4.91E-05	6.59E-05	7.14E-05	5.97E-05	6.15E-05	
Percent of Effluent Control Limit*	*	*	*	*	*	
C. PARTICULATES WITH HALF-LIVES > 8 DAYS						
Total Release: Ci	8.03E-04	8.65E-04	9.65E-04	8.24E-04	3.46E-03	±21%
Average Release Rate: µCi/sec	1.02E-04	1.10E-04	1.22E-04	1.05E-04	1.10E-04	
Percent of Effluent Control Limit*	*	*	*	*	*	
Gross Alpha Radioactivity: Ci	NDA	NDA	NDA	NDA	NDA	
D. TRITIUM						
Total Release: Ci	6.56E+00	6.61E+00	1.03E+01	1.99E+01	4.33E+01	±20%
Average Release Rate: µCi/sec	8.32E-01	8.39E-01	1.31E+00	2.52E+00	1.37E+00	
Percent of Effluent Control Limit*	*	*	*	*	*	
E. CARBON-14						
Total Release: Ci	2.12E+00	2.13E+00	2.15E+00	2.14E+00	8.54E+00	N/A
Average Release Rate: µCi/sec	2.68E-01	2.70E-01	2.73E-01	2.72E-01	2.71E-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 7 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 2010

CONTINUOUS MODE RELEASES FROM ELEVATED RELEASE POINT					
Nuclide Released	Jan-Mar 2010	Apr-Jun 2010	Jul-Sep 2010	Oct-Dec 2010	Jan-Dec 2010
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	9.33E-02	0.00E+00	9.33E-02
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	7.75E-01	1.39E-01	9.14E-01
Xe-133m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Xe-135	2.62E-02	0.00E+00	0.00E+00	0.00E+00	2.62E-02
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	4.03E-01	0.00E+00	4.03E-01
Total for Period	2.62E-02	0.00E+00	1.27E+00	1.39E-01	1.44E+00
2. IODINES: Ci					
I-131	1.73E-05	2.52E-05	4.15E-05	2.60E-05	1.10E-04
I-133	1.69E-05	3.93E-05	8.26E-05	3.94E-05	1.78E-04
Total for Period	3.43E-05	6.44E-05	1.24E-04	6.54E-05	2.88E-04
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	4.19E-07	0.00E+00	4.19E-07
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	2.71E-06	9.66E-08	1.31E-06	2.11E-06	6.23E-06
Sr-90	0.00E+00	3.42E-06	0.00E+00	0.00E+00	3.42E-06
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					
Total for Period	2.71E-06	3.52E-06	1.73E-06	2.11E-06	1.01E-05
4. TRITIUM: Ci					
H-3	2.63E-02	3.02E-02	7.21E-02	2.91E-02	1.58E-01
5. CARBON-14: Ci					
C-14	2.05E+00	2.07E+00	2.09E+00	2.08E+00	8.28E+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 2010

BATCH MODE RELEASES FROM ELEVATED RELEASE POINT					
Nuclide Released	Jan-Mar 2010	Apr-Jun 2010	Jul-Sep 2010	Oct-Dec 2010	Jan-Dec 2010
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 2010

CONTINUOUS MODE RELEASES FROM GROUND-LEVEL RELEASE POINT					
Nuclide Released	Jan-Mar 2010	Apr-Jun 2010	Jul-Sep 2010	Oct-Dec 2010	Jan-Dec 2010
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	7.87E-01	0.00E+00	7.87E-01
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	1.91E+00	0.00E+00	1.91E+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	9.20E-01	9.83E-01	1.90E+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	4.21E+00	6.81E+00	9.35E+00	1.31E+00	2.17E+01
Total for period	4.21E+00	6.81E+00	1.30E+01	2.29E+00	2.63E+01
2. IODINES: Ci					
I-131	3.69E-04	4.94E-04	5.21E-04	4.45E-04	1.83E-03
I-133	8.62E-04	7.85E-04	1.23E-03	1.18E-03	4.05E-03
Total for period	1.23E-03	1.28E-03	1.75E-03	1.62E-03	5.88E-03
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	4.31E-06	0.00E+00	0.00E+00	5.36E-07	4.85E-06
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	9.08E-05	6.45E-06	9.36E-05	8.41E-05	2.75E-04
Sr-90	0.00E+00	2.75E-05	5.00E-07	2.36E-06	3.04E-05
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	7.05E-04	8.27E-04	8.70E-04	7.35E-04	3.14E-03
Total for period	8.00E-04	8.61E-04	9.64E-04	8.22E-04	3.45E-03
4. TRITIUM: Ci					
H-3	6.53E+00	6.58E+00	1.02E+01	1.98E+01	4.32E+01
5. CARBON-14: Ci					
C-14	6.35E-02	6.39E-02	6.45E-02	6.43E-02	2.56E-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 2010

BATCH MODE RELEASES FROM GROUND-LEVEL RELEASE POINT					
Nuclide Released	Jan-Mar 2010	Apr-Jun 2010	Jul-Sep 2010	Oct-Dec 2010	Jan-Dec 2010
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 2010

RELEASE PERIOD	Jan-Mar 2010	Apr-Jun 2010	Jul-Sep 2010	Oct-Dec 2010	Jan-Dec 2010	Est. Total Error
A. FISSION AND ACTIVATION PRODUCTS						
Total Release (not including tritium, gases, alpha): Ci	N/A	3.69E-02	N/A	1.70E-05	3.69E-02	±12%
Average Diluted Concentration During Period: µCi/mL	N/A	2.41E-10	N/A	1.09E-13	6.00E-11	
Percent of Effluent Concentration Limit*	N/A	2.69E-03%	N/A	9.26E-06%	6.72E-04%	
B. TRITIUM						
Total Release: Ci	N/A	2.46E+00	N/A	1.83E-02	2.48E+00	±9.4%
Average Diluted Concentration During Period: µCi/mL	N/A	1.61E-08	N/A	1.18E-10	4.40E-09	
Percent of Effluent Concentration Limit*	N/A	1.61E-03%	N/A	1.18E-05%	4.04E-04%	
C. DISSOLVED AND ENTRAINED GASES						
Total Release: Ci	N/A	NDA	N/A	NDA	NDA	±16%
Average Diluted Concentration During Period: µCi/mL	N/A	NDA	N/A	NDA	NDA	
Percent of Effluent Concentration Limit*	N/A	0.00E+00	N/A	0.00E+00	0.00E+00	
D. GROSS ALPHA RADIOACTIVITY						
Total Release: Ci	N/A	NDA	N/A	NDA	NDA	±34%
E. VOLUME OF WASTE RELEASED PRIOR TO DILUTION						
Waste Volume: Liters	N/A	3.11E+05	N/A	3.04E+04	3.42E+05	±5.7%
F. VOLUME OF DILUTION WATER USED DURING PERIOD						
Dilution Volume: Liters	1.52E+11	1.53E+11	1.55E+11	1.55E+11	6.15E+11	±10%

Notes for Table 2.3-A:

* Additional percent of Effluent Control Limit values based on dose assessments are provided in Section 7 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 2010

CONTINUOUS MODE RELEASES					
Nuclide Released	Jan-Mar 2010	Apr-Jun 2010	Jul-Sep 2010	Oct-Dec 2010	Jan-Dec 2010
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 2010

BATCH MODE RELEASES					
Nuclide Released	Jan-Mar 2010	Apr-Jun 2010	Jul-Sep 2010	Oct-Dec 2010	Jan-Dec 2010
1. FISSION AND ACTIVATION PRODUCTS: Ci					
Cr-51	N/A	4.01E-04	N/A	NDA	4.01E-04
Mn-54	N/A	1.80E-02	N/A	1.78E-06	1.80E-02
Fe-55	N/A	5.93E-03	N/A	NDA	5.93E-03
Fe-59	N/A	1.43E-04	N/A	NDA	1.43E-04
Co-58	N/A	2.37E-04	N/A	NDA	2.37E-04
Co-60	N/A	8.06E-03	N/A	1.71E-06	8.06E-03
Zn-65	N/A	1.08E-03	N/A	NDA	1.08E-03
Zn-69m	N/A	NDA	N/A	NDA	NDA
Sr-89	N/A	1.43E-05	N/A	NDA	1.43E-05
Sr-90	N/A	NDA	N/A	7.65E-07	7.65E-07
Zr/Nb-95	N/A	NDA	N/A	NDA	NDA
Mo/Tc-99	N/A	NDA	N/A	NDA	NDA
Ag-110m	N/A	2.51E-03	N/A	NDA	2.51E-03
Sb-124	N/A	NDA	N/A	NDA	NDA
I-131	N/A	NDA	N/A	NDA	NDA
I-133	N/A	NDA	N/A	6.04E-07	6.04E-07
Cs-134	N/A	NDA	N/A	NDA	NDA
Cs-137	N/A	5.86E-05	N/A	1.21E-05	7.07E-05
Ba/La-140	N/A	4.18E-04	N/A	NDA	4.18E-04
Ce-141	N/A	4.54E-05	N/A	NDA	4.54E-05
Ce-144	N/A	NDA	N/A	NDA	NDA
Total for period	N/A	3.69E-02	N/A	1.70E-05	3.69E-02
2. DISSOLVED AND ENTRAINED GASES: Ci					
Xe-133	N/A	NDA	N/A	NDA	NDA
Xe-135	N/A	NDA	N/A	NDA	NDA
Total for period	N/A	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, 39%
- 33-ft Wind Direction (from): South-southwest, 15%
- 33-ft Wind Speed: 3.5-7.5 mph, 56%
- 220-ft Wind Direction (from): West-northwest, 13%
- 220-ft Wind Speed: 12.5-18.5 mph, 35%

A problem was encountered during the first quarter of 2010 due to the failure of the datalogging channels for the lower level sensor that existed for several weeks until replacement electronics were procured. This resulted in a joint data recovery of 86.3% for the 33-ft level, which failed to meet the annual recovery goal of greater than 90%. However, data recovery for the upper level of the 220-ft tower was 97.8%, well in excess of the 90% annual data recovery goal specified by the NRC.

4.0 MAXIMUM INDIVIDUAL DOSES

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

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

4.1 Doses From Noble Gas Releases

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

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

Noble gases released in gaseous effluents from PNPS during 2010 resulted in a maximum total body dose of 0.0078 mrem. The maximum skin dose was 0.025 mrem. Both of these doses occurred to a hypothetical individual, assumed to be present 24 hours per day, 365 days per year, at the site boundary location yielding the highest dose (0.64 km ESE of the Reactor Building). For the more "realistic" individuals at offsite locations, the maximum total body dose was 0.0060 mrem (nearest residence, 0.80 kilometers ESE from the Reactor Building), while the maximum skin dose was 0.018 mrem (nearest residence, 0.80 kilometers ESE from the Reactor Building).

Table 4.1

Maximum Doses From Noble Gas Releases During 2010[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	2.15E-03 (0.64 km ESE)	3.21E-03 (0.64 km ESE)	1.45E-03 (0.64 km ESE)	4.47E-03 (0.64 km ESE)
Apr-Jun	3.48E-03 (0.64 km ESE)	5.19E-03 (0.64 km ESE)	2.34E-03 (0.64 km ESE)	7.22E-03 (0.64 km ESE)
Jul-Sep	5.20E-03 (0.64 km ESE)	9.11E-03 (0.64 km ESE)	3.48E-03 (0.64 km ESE)	1.18E-02 (0.64 km ESE)
Oct-Dec	7.72E-04 (0.64 km ESE)	1.38E-03 (0.64 km ESE)	5.17E-04 (0.64 km ESE)	1.76E-03 (0.64 km ESE)
Jan-Dec	1.16E-02 (0.64 km ESE)	1.89E-02 (0.64 km ESE)	7.78E-03 (0.64 km ESE)	2.53E-02 (0.64 km ESE)

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

4.2 Doses From Gaseous Effluent Releases

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

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

Tables 4.2-A through 4.2-E summarize the maximum total body and organ doses for the adult, teen, child, and infant age classes resulting from the major gaseous exposure pathways. These tables present the dose data according to specific receptor location and the exposure pathways assumed to occur at that location. For example, the second column of the tables presents the information for the hypothetical maximum-exposed at the most restrictive site boundary location, where only inhalation and ground deposition exposure pathways are assumed to occur. Since this is a shoreline location controlled by Entergy, the other pathways of garden vegetable production, milk production, and meat production are assumed not to occur. Doses for other offsite locations not under Entergy control, where other exposure pathways can and do occur, are presented in subsequent columns of the tables, and represent the potential maximum doses to individuals at these locations.

Radioactivity (particulates, radioiodines, tritium, and carbon-14) released in gaseous effluents from PNPS during 2010 resulted in a maximum total body dose (child age class) of 0.0313 mrem (child age class at nearest garden location, 0.87 kilometers SE from the Reactor Building), while the maximum organ dose was 0.109 mrem (child bone at nearest garden location, 0.87 kilometers SE from the Reactor Building). Carbon-14 contributed 0.0178 mrem (57%) of the 0.0313 mrem child total body dose, and 0.0892 mrem (82%) of the 0.109 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 2010

Receptor: Direction: Distance[1]: Pathway[2]:	Bound NNW 0.28 km DI	Resident ESE 0.80 km DI	Garden SE 0.87 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	1.99E-04	1.48E-04	5.98E-03	2.33E-03	2.04E-03	3.53E-03
GI-LLI	8.06E-04	5.46E-04	2.53E-03	5.77E-04	4.73E-04	7.87E-04
Kidney	7.72E-04	5.24E-04	2.45E-03	5.74E-04	4.72E-04	7.82E-04
Liver	7.69E-04	5.22E-04	2.44E-03	5.73E-04	4.71E-04	7.82E-04
Lung	8.56E-04	5.80E-04	2.48E-03	5.73E-04	4.71E-04	7.83E-04
Thyroid	1.67E-03	1.12E-03	4.87E-03	1.31E-03	8.66E-04	9.44E-04
T.Body	7.67E-04	5.21E-04	2.44E-03	5.72E-04	4.71E-04	7.82E-04
Age Class: Teen						
Bone	2.85E-04	2.12E-04	9.63E-03	3.92E-03	3.07E-03	4.99E-03
GI-LLI	8.30E-04	5.64E-04	3.37E-03	9.08E-04	6.86E-04	1.08E-03
Kidney	7.96E-04	5.41E-04	3.29E-03	9.08E-04	6.86E-04	1.08E-03
Liver	7.92E-04	5.39E-04	3.28E-03	9.06E-04	6.84E-04	1.08E-03
Lung	9.35E-04	6.33E-04	3.35E-03	9.06E-04	6.85E-04	1.08E-03
Thyroid	1.93E-03	1.30E-03	5.49E-03	1.99E-03	1.26E-03	1.22E-03
T.Body	7.90E-04	5.37E-04	3.29E-03	9.05E-04	6.84E-04	1.08E-03
Age Class: Child						
Bone	3.93E-04	2.93E-04	2.30E-02	9.45E-03	7.22E-03	1.15E-02
GI-LLI	7.40E-04	5.05E-04	6.45E-03	2.06E-03	1.54E-03	2.41E-03
Kidney	7.29E-04	4.97E-04	6.40E-03	2.06E-03	1.54E-03	2.41E-03
Liver	7.26E-04	4.95E-04	6.40E-03	2.06E-03	1.54E-03	2.41E-03
Lung	8.48E-04	5.76E-04	6.45E-03	2.06E-03	1.54E-03	2.41E-03
Thyroid	2.07E-03	1.39E-03	9.57E-03	4.14E-03	2.63E-03	2.61E-03
T.Body	7.24E-04	4.94E-04	6.42E-03	2.06E-03	1.54E-03	2.41E-03
Age Class: Infant						
Bone	2.89E-04	2.16E-04	1.80E-04	5.92E-03	4.11E-03	7.87E-05
GI-LLI	4.37E-04	2.99E-04	2.25E-04	1.35E-03	9.17E-04	2.62E-05
Kidney	4.35E-04	2.98E-04	2.24E-04	1.36E-03	9.25E-04	2.61E-05
Liver	4.34E-04	2.97E-04	2.24E-04	1.36E-03	9.24E-04	2.61E-05
Lung	5.47E-04	3.72E-04	2.79E-04	1.35E-03	9.18E-04	2.88E-05
Thyroid	1.67E-03	1.11E-03	8.26E-04	6.04E-03	3.35E-03	5.61E-05
T.Body	4.32E-04	2.95E-04	2.23E-04	1.35E-03	9.20E-04	2.60E-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 2010

Receptor: Direction: Distance[1]: Pathway[2]:	Bound NNW 0.28 km DI	Resident ESE 0.80 km DI	Garden SE 0.87 km DIV	Cow/Goat WSW 3.97 km DIVCG	Cow/Meat W 5.77 km DIVCM	Meat S 3.80 km DIVM
Age Class: Adult						
Bone	3.12E-04	2.23E-04	1.17E-02	2.67E-03	2.23E-03	3.92E-03
GI-LLI	8.16E-04	5.53E-04	2.66E-03	5.88E-04	4.81E-04	8.00E-04
Kidney	7.78E-04	5.28E-04	2.47E-03	5.80E-04	4.76E-04	7.88E-04
Liver	7.75E-04	5.26E-04	2.46E-03	5.78E-04	4.75E-04	7.88E-04
Lung	8.95E-04	6.05E-04	2.51E-03	5.78E-04	4.75E-04	7.90E-04
Thyroid	1.87E-03	1.25E-03	5.63E-03	1.55E-03	1.00E-03	1.00E-03
T.Body	7.75E-04	5.26E-04	2.58E-03	5.83E-04	4.78E-04	7.95E-04
Age Class: Teen						
Bone	4.14E-04	2.99E-04	1.72E-02	4.38E-03	3.33E-03	5.49E-03
GI-LLI	8.41E-04	5.71E-04	3.53E-03	9.24E-04	6.96E-04	1.10E-03
Kidney	8.03E-04	5.46E-04	3.32E-03	9.17E-04	6.92E-04	1.08E-03
Liver	7.99E-04	5.43E-04	3.31E-03	9.14E-04	6.90E-04	1.08E-03
Lung	9.95E-04	6.73E-04	3.40E-03	9.14E-04	6.91E-04	1.09E-03
Thyroid	2.17E-03	1.45E-03	6.17E-03	2.35E-03	1.45E-03	1.27E-03
T.Body	7.99E-04	5.43E-04	3.46E-03	9.20E-04	6.94E-04	1.09E-03
Age Class: Child						
Bone	5.43E-04	3.93E-04	3.82E-02	1.04E-02	7.75E-03	1.25E-02
GI-LLI	7.48E-04	5.10E-04	6.61E-03	2.08E-03	1.56E-03	2.43E-03
Kidney	7.36E-04	5.02E-04	6.46E-03	2.08E-03	1.56E-03	2.42E-03
Liver	7.32E-04	4.99E-04	6.45E-03	2.08E-03	1.55E-03	2.42E-03
Lung	9.02E-04	6.12E-04	6.52E-03	2.07E-03	1.55E-03	2.43E-03
Thyroid	2.32E-03	1.56E-03	1.06E-02	4.84E-03	3.01E-03	2.69E-03
T.Body	7.32E-04	5.00E-04	6.76E-03	2.09E-03	1.56E-03	2.44E-03
Age Class: Infant						
Bone	3.50E-04	2.56E-04	2.09E-04	6.07E-03	4.19E-03	8.08E-05
GI-LLI	4.41E-04	3.02E-04	2.27E-04	1.36E-03	9.25E-04	2.64E-05
Kidney	4.39E-04	3.00E-04	2.26E-04	1.38E-03	9.35E-04	2.63E-05
Liver	4.38E-04	3.00E-04	2.26E-04	1.37E-03	9.33E-04	2.63E-05
Lung	5.85E-04	3.97E-04	2.98E-04	1.36E-03	9.26E-04	2.99E-05
Thyroid	1.90E-03	1.27E-03	9.40E-04	7.61E-03	4.17E-03	6.20E-05
T.Body	4.36E-04	2.99E-04	2.25E-04	1.37E-03	9.29E-04	2.63E-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 2010

Receptor: Direction: Distance[1]: Pathway[2]:	Bound NNW 0.28 km DI	Resident ESE 0.80 km DI	Garden SE 0.87 km DIV	Cow/Goat WSW 3.97 km DIVCG	Cow/Meat W 5.77 km DIVCM	Meat S 3.80 km DIVM
Age Class: Adult						
Bone	2.06E-04	1.53E-04	6.19E-03	2.38E-03	2.07E-03	3.60E-03
GI-LLI	1.23E-03	8.32E-04	3.30E-03	6.47E-04	5.18E-04	8.44E-04
Kidney	1.19E-03	8.05E-04	3.20E-03	6.46E-04	5.17E-04	8.39E-04
Liver	1.19E-03	8.03E-04	3.20E-03	6.43E-04	5.15E-04	8.38E-04
Lung	1.29E-03	8.71E-04	3.24E-03	6.43E-04	5.15E-04	8.40E-04
Thyroid	2.46E-03	1.65E-03	6.63E-03	1.70E-03	1.09E-03	1.07E-03
T.Body	1.18E-03	8.01E-04	3.20E-03	6.42E-04	5.15E-04	8.38E-04
Age Class: Teen						
Bone	2.94E-04	2.19E-04	9.95E-03	3.99E-03	3.13E-03	5.08E-03
GI-LLI	1.26E-03	8.53E-04	4.22E-03	9.94E-04	7.38E-04	1.14E-03
Kidney	1.22E-03	8.26E-04	4.14E-03	9.95E-04	7.38E-04	1.14E-03
Liver	1.21E-03	8.23E-04	4.13E-03	9.91E-04	7.36E-04	1.14E-03
Lung	1.38E-03	9.34E-04	4.20E-03	9.91E-04	7.36E-04	1.14E-03
Thyroid	2.83E-03	1.89E-03	7.25E-03	2.54E-03	1.56E-03	1.34E-03
T.Body	1.21E-03	8.20E-04	4.14E-03	9.90E-04	7.35E-04	1.14E-03
Age Class: Child						
Bone	4.05E-04	3.02E-04	2.37E-02	9.62E-03	7.35E-03	1.17E-02
GI-LLI	1.11E-03	7.58E-04	7.65E-03	2.19E-03	1.62E-03	2.51E-03
Kidney	1.10E-03	7.50E-04	7.60E-03	2.20E-03	1.63E-03	2.51E-03
Liver	1.10E-03	7.47E-04	7.59E-03	2.20E-03	1.62E-03	2.51E-03
Lung	1.24E-03	8.42E-04	7.65E-03	2.19E-03	1.62E-03	2.51E-03
Thyroid	3.00E-03	2.01E-03	1.21E-02	5.18E-03	3.20E-03	2.81E-03
T.Body	1.09E-03	7.44E-04	7.62E-03	2.19E-03	1.62E-03	2.51E-03
Age Class: Infant						
Bone	2.98E-04	2.22E-04	1.84E-04	6.03E-03	4.18E-03	8.01E-05
GI-LLI	6.52E-04	4.44E-04	3.32E-04	1.42E-03	9.57E-04	3.23E-05
Kidney	6.51E-04	4.43E-04	3.32E-04	1.44E-03	9.69E-04	3.23E-05
Liver	6.50E-04	4.43E-04	3.31E-04	1.44E-03	9.67E-04	3.23E-05
Lung	7.82E-04	5.30E-04	3.96E-04	1.42E-03	9.58E-04	3.55E-05
Thyroid	2.40E-03	1.60E-03	1.19E-03	8.16E-03	4.48E-03	7.53E-05
T.Body	6.46E-04	4.40E-04	3.29E-04	1.43E-03	9.61E-04	3.22E-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 2010

Receptor:	Bound	Resident	Garden	Cow/Goat	Cow/Meat	Meat
Direction:	NNW	ESE	SE	WSW	W	S
Distance[1]:	0.28 km	0.80 km	0.87 km	3.97 km	5.77 km	3.80 km
Pathway[2]:	DI	DI	DIV[3]	DIVCG[3]	DIVCM[3]	DIVM[3]
Age Class: Adult						
Bone	2.12E-04	1.57E-04	6.54E-03	2.39E-03	2.08E-03	3.60E-03
GI-LLI	2.29E-03	1.55E-03	5.18E-03	8.04E-04	6.11E-04	9.56E-04
Kidney	2.26E-03	1.53E-03	5.09E-03	8.02E-04	6.09E-04	9.50E-04
Liver	2.25E-03	1.52E-03	5.08E-03	8.00E-04	6.08E-04	9.50E-04
Lung	2.35E-03	1.58E-03	5.12E-03	8.00E-04	6.08E-04	9.52E-04
Thyroid	3.38E-03	2.27E-03	8.04E-03	1.69E-03	1.09E-03	1.15E-03
T.Body	2.25E-03	1.52E-03	5.10E-03	8.00E-04	6.08E-04	9.51E-04
Age Class: Teen						
Bone	3.00E-04	2.23E-04	1.04E-02	4.00E-03	3.13E-03	5.09E-03
GI-LLI	2.33E-03	1.58E-03	6.31E-03	1.17E-03	8.40E-04	1.26E-03
Kidney	2.30E-03	1.55E-03	6.22E-03	1.17E-03	8.40E-04	1.26E-03
Liver	2.29E-03	1.55E-03	6.21E-03	1.17E-03	8.38E-04	1.26E-03
Lung	2.44E-03	1.65E-03	6.28E-03	1.17E-03	8.38E-04	1.26E-03
Thyroid	3.72E-03	2.50E-03	8.91E-03	2.48E-03	1.53E-03	1.43E-03
T.Body	2.29E-03	1.55E-03	6.23E-03	1.17E-03	8.38E-04	1.26E-03
Age Class: Child						
Bone	4.12E-04	3.06E-04	2.46E-02	9.64E-03	7.35E-03	1.17E-02
GI-LLI	2.06E-03	1.40E-03	1.05E-02	2.45E-03	1.76E-03	2.67E-03
Kidney	2.05E-03	1.39E-03	1.05E-02	2.45E-03	1.77E-03	2.67E-03
Liver	2.05E-03	1.39E-03	1.05E-02	2.45E-03	1.77E-03	2.67E-03
Lung	2.18E-03	1.47E-03	1.05E-02	2.45E-03	1.76E-03	2.67E-03
Thyroid	3.74E-03	2.51E-03	1.43E-02	4.97E-03	3.10E-03	2.92E-03
T.Body	2.05E-03	1.39E-03	1.05E-02	2.45E-03	1.77E-03	2.67E-03
Age Class: Infant						
Bone	2.99E-04	2.23E-04	1.85E-04	6.01E-03	4.17E-03	7.99E-05
GI-LLI	1.20E-03	8.13E-04	6.06E-04	1.54E-03	1.02E-03	4.73E-05
Kidney	1.20E-03	8.13E-04	6.05E-04	1.56E-03	1.03E-03	4.72E-05
Liver	1.20E-03	8.12E-04	6.05E-04	1.56E-03	1.03E-03	4.72E-05
Lung	1.31E-03	8.89E-04	6.62E-04	1.55E-03	1.02E-03	5.00E-05
Thyroid	2.75E-03	1.84E-03	1.36E-03	7.25E-03	3.98E-03	8.52E-05
T.Body	1.19E-03	8.10E-04	6.03E-04	1.55E-03	1.02E-03	4.71E-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 2010

Receptor: Direction: Distance[1]: Pathway[2]:	Bound NNW 0.28 km DI	Resident ESE 0.80 km DI	Garden SE 0.87 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	9.28E-04	6.82E-04	3.04E-02	9.76E-03	8.41E-03	1.47E-02
GI-LLI	5.14E-03	3.48E-03	1.37E-02	2.62E-03	2.08E-03	3.39E-03
Kidney	5.00E-03	3.38E-03	1.32E-02	2.60E-03	2.07E-03	3.36E-03
Liver	4.98E-03	3.38E-03	1.32E-02	2.59E-03	2.07E-03	3.36E-03
Lung	5.38E-03	3.64E-03	1.33E-02	2.59E-03	2.07E-03	3.36E-03
Thyroid	9.38E-03	6.29E-03	2.52E-02	6.25E-03	4.04E-03	4.16E-03
T.Body	4.98E-03	3.37E-03	1.33E-02	2.60E-03	2.07E-03	3.37E-03
Age Class: Teen						
Bone	1.29E-03	9.53E-04	4.71E-02	1.63E-02	1.27E-02	2.06E-02
GI-LLI	5.26E-03	3.56E-03	1.74E-02	4.00E-03	2.96E-03	4.58E-03
Kidney	5.11E-03	3.47E-03	1.70E-02	3.99E-03	2.96E-03	4.56E-03
Liver	5.10E-03	3.46E-03	1.69E-02	3.98E-03	2.95E-03	4.55E-03
Lung	5.75E-03	3.89E-03	1.72E-02	3.98E-03	2.95E-03	4.57E-03
Thyroid	1.07E-02	7.14E-03	2.78E-02	9.36E-03	5.80E-03	5.26E-03
T.Body	5.09E-03	3.45E-03	1.71E-02	3.98E-03	2.95E-03	4.57E-03
Age Class: Child						
Bone	1.75E-03	1.29E-03	1.09E-01	3.91E-02	2.97E-02	4.75E-02
GI-LLI	4.67E-03	3.17E-03	3.12E-02	8.78E-03	6.48E-03	1.00E-02
Kidney	4.62E-03	3.14E-03	3.09E-02	8.80E-03	6.50E-03	1.00E-02
Liver	4.61E-03	3.13E-03	3.09E-02	8.78E-03	6.49E-03	1.00E-02
Lung	5.17E-03	3.50E-03	3.11E-02	8.77E-03	6.48E-03	1.00E-02
Thyroid	1.11E-02	7.46E-03	4.65E-02	1.91E-02	1.19E-02	1.10E-02
T.Body	4.60E-03	3.13E-03	3.13E-02	8.80E-03	6.49E-03	1.00E-02
Age Class: Infant						
Bone	1.24E-03	9.16E-04	7.58E-04	2.40E-02	1.66E-02	3.19E-04
GI-LLI	2.73E-03	1.86E-03	1.39E-03	5.67E-03	3.82E-03	1.32E-04
Kidney	2.72E-03	1.85E-03	1.39E-03	5.74E-03	3.86E-03	1.32E-04
Liver	2.72E-03	1.85E-03	1.39E-03	5.73E-03	3.85E-03	1.32E-04
Lung	3.23E-03	2.19E-03	1.63E-03	5.67E-03	3.82E-03	1.44E-04
Thyroid	8.71E-03	5.82E-03	4.31E-03	2.91E-02	1.60E-02	2.79E-04
T.Body	2.71E-03	1.84E-03	1.38E-03	5.70E-03	3.83E-03	1.32E-04

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

[2] Pathway designations are as follows:

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

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

4.3 Doses From Liquid Effluent Releases

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

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

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

Radioactivity released in liquid effluents from PNPS during the reporting period resulted in a maximum total body dose (child age class) of 0.00197 mrem. The maximum organ dose (adult age class, GI-LLI) was 0.00997 mrem.

Table 4.3-A

Maximum Individual Organ Doses -- mrem
From Liquid Release Period: Jan-Mar 2010

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

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

Table 4.3-B

Maximum Individual Organ Doses -- mrem
From Liquid Release Period: Apr-Jun 2010

Organ	Age Class Organ Dose – mrem		
	Adult	Teen	Child
Bone	2.26E-03	2.34E-03	2.74E-03
GI-LLI	1.00E-02	6.80E-03	2.45E-03
Kidney	2.00E-03	2.01E-03	1.51E-03
Liver	4.22E-03	4.14E-03	3.61E-03
Lung	6.00E-04	9.62E-04	6.48E-04
Thyroid	6.95E-05	3.75E-04	7.97E-05
T.Body	1.75E-03	1.92E-03	1.98E-03

Table 4.3-C

Maximum Individual Organ Doses -- mrem
From Liquid Release Period: Jul-Sep 2010

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 2010

Organ	Age Class Organ Dose – mrem *		
	Adult	Teen	Child
Bone	7.98E-07	9.46E-07	8.18E-07
GI-LLI	4.57E-07	5.48E-07	1.63E-07
Kidney	2.35E-07	4.70E-07	2.20E-07
Liver	5.75E-07	8.11E-07	5.42E-07
Lung	1.20E-07	3.62E-07	1.22E-07
Thyroid	8.98E-08	3.21E-07	9.73E-08
T.Body	5.04E-07	5.73E-07	2.53E-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 2010

Organ	Age Class Organ Dose – mrem *		
	Adult	Teen	Child
Bone	2.25E-03	2.33E-03	2.73E-03
GI-LLI	9.97E-03	6.77E-03	2.44E-03
Kidney	1.99E-03	2.00E-03	1.50E-03
Liver	4.20E-03	4.13E-03	3.59E-03
Lung	5.98E-04	9.58E-04	6.45E-04
Thyroid	6.92E-05	3.74E-04	7.94E-05
T.Body	1.74E-03	1.91E-03	1.97E-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 215 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 74.2 ± 28.8 mR/yr to 61.4 ± 7.9 mR/yr. Such a corrected dose is not statistically different from the Zone 4 average of 59.8 ± 6.9 mR/yr, and is indicative of natural background radiation.

Although the annual exposure at TLD location OA was 155 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 0.7 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 58.5 ± 8.0 mR (based on continuous occupancy at this location), which compares quite well to the Zone 4 annual average background radiation level of 59.8 ± 6.9 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 2010 is estimated as being about 1.8 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 2010. 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 0.0011 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 2010

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	17.7 ± 7.4	13.4 ± 1.7	13.4 ± 1.9	14.8 ± 2.2
Apr-Jun	19.2 ± 7.8	14.7 ± 1.7	14.0 ± 1.3	15.2 ± 1.8
Jul-Sep	18.8 ± 6.5	14.5 ± 1.8	14.2 ± 1.5	15.4 ± 1.5
Oct-Dec	18.4 ± 7.1	14.1 ± 1.6	13.5 ± 1.3	14.4 ± 1.5
Jan-Dec	74.2 ± 28.8**	56.6 ± 7.0	55.1 ± 5.9	59.8 ± 6.9

* 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 61.4 ± 7.9 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 2010 were a small percentage of the corresponding effluent control.

Table 6.1

Percent of ODCM Effluent Control Limits
for Gaseous Effluent Releases During 2010

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

Period	Value - mrem/yr	Fraction of Limit
Jan-Dec	7.78E-03	1.56E-03%

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	2.53E-02	8.42E-04%

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	1.09E-01	7.30E-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	2.15E-03	4.31E-02%
Apr-Jun	3.48E-03	6.96E-02%
Jul-Sep	5.20E-03	1.04E-01%
Oct-Dec	7.72E-04	1.54E-02%

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

Period	Value - mrad/yr	Fraction of Limit
Jan-Dec	1.16E-02	1.16E-01%

Table 6.1 (continued)

Percent of ODCM Effluent Control Limits
for Gaseous Effluent Releases During 2010

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	3.21E-03	3.21E-02%
Apr-Jun	5.19E-03	5.19E-02%
Jul-Sep	9.11E-03	9.11E-02%
Oct-Dec	1.38E-03	1.38E-02%

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	1.89E-02	9.45E-02%

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

Period	Value - mrem	Fraction of Limit
Jan-Mar	2.30E-02	3.07E-01%
Apr-Jun	3.82E-02	5.09E-01%
Jul-Sep	2.37E-02	3.16E-01%
Oct-Dec	2.46E-02	3.28E-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	1.09E-01	7.30E-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 2010

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

Period	Value - μCi/mL	Fraction of Limit
Jan-Mar	0.00E+00	0.00E+00%
Apr-Jun	2.41E-10	2.69E-03%
Jul-Sep	0.00E+00	0.00E+00%
Oct-Dec	1.09E-13	9.26E-06%
Jan-Dec	6.00E-11	6.72E-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	0.00E+00	0.00E+00%
Apr-Jun	1.61E-08	1.61E-03%
Jul-Sep	0.00E+00	0.00E+00%
Oct-Dec	1.18E-10	1.18E-05%
Jan-Dec	4.04E-09	4.04E-04%

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

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

Table 6.2 (continued)

Percent of ODCM Effluent Control Limits
for Liquid Effluent Releases During 2010

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

Period	Value - mrem	Fraction of Limit
Jan-Mar	0.00E+00	0.00E+00%
Apr-Jun	1.98E-03	1.32E-01%
Jul-Sep	0.00E+00	0.00E+00%
Oct-Dec	5.73E-07	3.82E-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	1.97E-03	6.56E-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	0.00E+00	0.00E+00%
Apr-Jun	1.00E-02	2.00E-01%
Jul-Sep	0.00E+00	0.00E+00%
Oct-Dec	9.46E-07	1.89E-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	9.97E-03	9.97E-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 5.89E+01 cubic meters of spent resins, filter sludges, etc., containing a total activity of about 9.54E+02 Curies were shipped from PNPS for processing and disposal. Dry activated wastes and contaminated equipment shipped during the period totaled 2.98E+02 cubic meters and contained 1.81E+00 Curies of radioactivity. No shipment of irradiated components was shipped during the reporting period containing 0 cubic meters and 0 curies. The "Other" category, made up from "Hi Rad Trash" consisted of 1.79E+01 cubic meters and 1.93E+00 curies. 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 9 shipments to Energy Solutions' Bear Creek Facility; 3 shipments to Energy Solutions' Gallaher Road Facility; 8 shipments to Studsvik in Erwin, TN and 1 shipment to Studsvik/Race in Oak Ridge, TN.

Table 7.0
Pilgrim Nuclear Power Station
Annual Radioactive Effluent Release Report
Solid Waste and Irradiated Fuel Shipments
January-December 2010

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 2010		
	Volume - m^3	Curies	Total Error
a. Spent resins, filters, filter sludges, evaporator bottoms, etc.	5.89E+01	9.54E+02	± 25%
b. Dry activated waste, contaminated equipment, etc.	2.98E+02	1.81E+00	± 25%
c. Irradiated components, control rods, etc.	Not Applicable	Not Applicable	N/A
d. Other (describe): Hi-Rad Trash/Metals	1.79E+01	1.93E+00	±25%

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	13.97%	± 25%
	Fe-55	45.45%	± 25%
	Co-58	1.33%	± 25%
	Co-60	29.17%	± 25%
	Zn-65	4.88%	± 25%
	Cs-137	1.77%	± 25%
b. Dry activated waste, contaminated equipment, etc.	Mn-54	4.73%	± 25%
	Fe-55	78.61%	± 25%
	Co-60	13.32%	± 25%
	Cs-137	1.95%	± 25%
c. Irradiated components, control rods, etc.	Not Applicable	Not Applicable	± 25%
d. Other (describe): Hi-Rad Trash/Metals	Cr-51	3.47%	± 25%
	Mn-54	21.51%	± 25%
	Fe-55	21.71%	± 25%
	Co-60	11.78%	± 25%
	Ni-63	40.04%	± 25%

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

3. Solid Waste Disposition

Number of Shipments	Mode of Transportation	Destination
9	Tractor-trailer (Hittman Transport)	Energy Solutions Bear Creek Facility[2] Oak Ridge, TN
3	Tractor-trailer (Hittman Transport)	Energy Solutions Gallaher Road Facility[2] Kingston, TN
8	Tractor-trailer (Hittman Transport)	Studsvik Processing Facility,[2] Erwin, TN
1	Tractor-trailer (Hittman Transport)	Studsvik/RACE, LLC[2] Memphis, TN

[2] *This processor provides volume reduction services for dry compressible waste, contaminated equipment, etc. Remaining radioactive wastes will be shipped to Chem Nuclear Systems, Inc. in Barnwell, SC, or 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 2010. Information regarding revisions to the ODCM can be found attached as Appendix D of this report.

9.0 PROCESS CONTROL PROGRAM REVISIONS

The following site-specific procedures related to the Process Control Program have been retired and replaced by the Entergy fleet procedures.

Retired PNPS Procedures

Process Control Program: PNPS 1.15.6, PNPS 1.15.4, and PNPS 1.15.3
Shipment of Radioactive Waste: PNPS 6.9-160
10CFR Part 61 Sampling: PNPS 6.9-211

Replacement Entergy Fleet Procedures

Process Control Program: EN-RW-105
Radioactive Shipping Procedure: EN-RW-102
Radioactive Waste Tracking Procedure: EN-RW-103
Scaling Factors: EN-RW-104
Integrated Transportation Security Plan: EN-RW-106

These procedures cover the methods used to accomplish the processing and packaging of radioactive waste at Pilgrim Nuclear Power Station.

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 2010

Class A Freq: 0.111

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	3
3.5-7.5	0	7	10	6	1	1	3	1	3	0	0	2	7	18	15	0	74
7.5-12.5	0	15	0	0	0	0	0	0	1	3	1	0	1	7	2	0	30
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	22	10	6	2	1	3	1	4	3	1	2	8	25	17	1	107

Class B Freq: 0.024

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

Class C Freq: 0.046

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	1	2	0	3
3.5-7.5	0	1	0	2	0	0	2	0	4	1	0	3	9	7	1	2	32
7.5-12.5	0	5	0	0	0	0	0	0	0	1	0	0	1	0	1	1	9
12.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	6	0	2	0	0	2	0	4	2	0	3	10	8	4	3	44

Class D Freq: 0.531

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	2	0	3
0.95-3.5	9	5	3	4	7	3	0	3	2	2	4	2	8	14	5	3	74
3.5-7.5	8	2	3	14	6	7	8	11	3	6	6	31	60	52	31	4	252
7.5-12.5	4	30	14	10	10	1	0	13	6	8	2	0	33	10	13	6	160
12.5-18.5	0	6	2	12	1	0	0	0	0	0	0	0	0	0	0	0	21
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	43	22	40	24	11	8	27	11	16	12	34	101	76	51	13	510

Table A-1 (continued)

Jan-Mar 2010

Class E Freq: 0.219

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
0.95-3.5	1	1	1	5	5	3	1	2	10	4	1	8	9	2	5	3	61
3.5-7.5	1	0	0	2	5	4	3	1	7	9	6	55	17	3	2	0	115
7.5-12.5	0	0	1	1	14	2	0	0	0	7	0	4	0	0	0	0	29
12.5-18.5	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	4
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	2	1	2	9	27	9	4	3	17	20	8	67	26	5	7	3	210

Class F Freq: 0.044

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	0	2	0	0	0	0	0	1	2	5	3	1	1	1	16
3.5-7.5	0	0	0	2	0	1	0	0	0	1	10	6	0	0	0	0	20
7.5-12.5	0	0	0	0	0	0	0	0	0	4	2	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	4	0	1	0	0	0	6	14	11	3	1	1	1	42

Class G Freq: 0.026

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	0	3
3.5-7.5	0	0	0	0	0	0	0	0	0	0	9	2	0	0	0	0	11
7.5-12.5	0	0	0	0	0	0	0	0	0	2	9	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	0	0	0	0	0	0	0	0	1	2	18	4	0	0	0	0	25

Class All Freq: 1.000

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2	0	4
0.95-3.5	11	6	4	11	13	6	1	5	13	7	7	17	20	19	14	8	162
3.5-7.5	10	10	13	27	13	13	16	13	17	17	32	102	94	82	51	6	516
7.5-12.5	4	53	15	11	24	3	0	13	8	27	14	4	35	19	16	7	253
12.5-18.5	0	6	3	13	4	0	0	0	0	0	0	0	0	0	0	0	26
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	25	75	35	62	54	22	17	31	38	51	54	124	149	120	83	21	961

Table A-1 (continued)

Apr-Jun 2010

Class A Freq: 0.154

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	5	3	3	2	0	0	0	0	0	0	0	0	0	2	1	21
3.5-7.5	16	26	25	24	20	15	6	3	3	10	12	14	22	19	13	14	242
7.5-12.5	0	0	1	1	2	0	0	0	6	35	5	1	16	5	0	2	74
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	31	29	28	24	15	6	3	9	45	17	15	38	24	15	17	337

Class B Freq: 0.051

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	1	3	1	2	4	0	0	0	0	0	1	1	4	2	23
3.5-7.5	0	5	3	6	12	10	4	2	1	10	11	6	5	1	2	1	79
7.5-12.5	0	0	0	0	0	0	0	0	1	4	3	1	1	0	0	0	10
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	4	9	13	12	8	2	2	14	14	7	7	2	6	3	112

Class C Freq: 0.065

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	6	6	2	3	0	4	1	0	0	0	0	1	3	0	3	30
3.5-7.5	4	2	5	7	8	6	0	2	9	16	13	10	4	4	1	0	91
7.5-12.5	0	0	0	0	0	0	0	0	1	12	6	0	0	1	0	0	20
12.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	5	8	11	9	11	6	4	3	10	28	19	10	5	8	1	3	141

Class D Freq: 0.339

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	21	23	21	17	17	17	18	20	14	10	6	8	4	7	13	13	229
3.5-7.5	15	6	17	9	23	28	8	7	46	109	55	30	47	15	3	5	423
7.5-12.5	0	0	0	2	1	1	0	0	0	56	18	0	4	1	4	0	87
12.5-18.5	0	0	0	0	0	0	0	0	0	0	2	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	36	29	38	28	41	46	26	27	60	175	81	38	55	23	20	18	741

Table A-1 (continued)

Apr-Jun 2010

Class E Freq: 0.271

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	3
0.95-3.5	12	5	9	16	11	10	20	22	18	9	13	30	28	16	22	6	247
3.5-7.5	2	1	0	2	5	1	2	0	15	78	63	49	43	11	7	4	283
7.5-12.5	0	0	0	0	0	0	0	0	0	22	33	0	0	1	0	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	14	6	9	18	16	11	22	22	33	111	110	79	72	28	30	10	591

Class F Freq: 0.099

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	3
0.95-3.5	1	1	0	9	2	2	2	0	3	4	18	46	15	11	4	4	122
3.5-7.5	0	0	1	1	0	0	0	0	2	8	37	26	3	0	0	0	78
7.5-12.5	0	0	0	0	0	0	0	0	0	2	11	0	0	0	0	0	13
12.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1	1	1	10	2	2	3	0	5	14	66	73	18	12	4	4	216

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	0	0	1	0	0	0	1	0	1	0	0	0	0	0	3
0.95-3.5	0	0	0	0	0	0	0	0	0	0	4	9	2	3	1	0	19
3.5-7.5	0	0	0	0	0	0	0	0	0	0	15	6	1	0	0	0	22
7.5-12.5	0	0	0	0	0	0	0	0	0	1	1	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	0	0	1	0	0	0	1	1	21	15	3	3	1	0	46

Class All Freq: 1.000

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	1	0	1	0	1	0	2	1	1	1	1	0	9
0.95-3.5	43	41	40	50	36	31	48	43	35	23	41	93	51	41	46	29	691
3.5-7.5	37	40	51	49	68	60	20	14	76	231	206	141	125	50	26	24	1218
7.5-12.5	0	0	1	3	3	1	0	0	8	132	77	2	21	8	4	2	262
12.5-18.5	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	4
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	80	81	92	102	108	92	69	57	120	388	328	237	198	100	77	55	2184

Table A-1 (continued)

Jul-Sep 2010

Class A Freq: 0.068

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	4	13	6	4	0	1	0	0	0	0	0	3	4	3	2	48
3.5-7.5	10	15	17	8	4	6	5	1	3	6	3	1	0	7	4	2	92
7.5-12.5	0	0	0	0	0	0	0	0	1	6	3	0	0	0	0	0	10
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	19	30	14	8	6	6	1	4	12	6	1	3	11	7	4	150

Class B 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	1	3	3	3	0	0	1	0	0	0	0	3	6	0	3	1	24
3.5-7.5	1	1	1	7	1	5	1	1	2	16	5	10	3	1	1	1	57
7.5-12.5	0	0	0	0	0	0	0	0	0	10	3	0	0	0	0	0	13
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	4	4	10	1	5	2	1	2	26	8	13	9	1	4	2	94

Class C Freq: 0.061

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	4	0	3	4	2	1	3	0	0	1	3	2	2	8	6	42
3.5-7.5	0	2	2	9	3	1	2	1	9	19	11	7	3	3	2	0	74
7.5-12.5	0	0	0	0	0	0	0	0	1	13	4	0	0	0	0	0	18
12.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	3	6	2	12	7	3	3	4	10	32	16	10	5	5	10	6	134

Class D Freq: 0.305

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	14	11	28	22	15	12	19	20	28	11	2	14	8	4	8	10	226
3.5-7.5	2	9	25	21	6	8	5	3	35	145	51	32	12	14	3	2	373
7.5-12.5	0	1	3	0	0	0	0	0	23	37	11	0	0	0	0	0	75
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	21	56	43	21	20	24	23	86	193	64	46	20	18	11	12	674

Table A-1 (continued)

Jul-Sep 2010

Class E Freq: 0.347

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	5	1	2	0	0	0	0	1	1	1	0	0	0	0	0	0	11
0.95-3.5	8	21	22	22	14	13	13	18	52	22	13	35	19	19	18	18	327
3.5-7.5	4	3	11	3	10	13	0	4	31	134	57	82	19	14	7	3	395
7.5-12.5	0	0	9	0	0	1	0	0	0	13	10	0	0	0	0	0	33
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	17	25	44	25	24	27	13	23	84	170	80	117	38	33	25	21	766

Class F Freq: 0.143

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	1	0	3	1	1	0	0	0	0	0	6
0.95-3.5	5	1	3	3	0	3	3	4	13	21	30	44	16	13	4	5	168
3.5-7.5	1	1	0	1	3	0	0	0	0	24	77	23	4	3	0	1	138
7.5-12.5	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	3
12.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	6	2	3	4	3	3	4	4	16	46	111	67	20	16	4	6	315

Class G Freq: 0.034

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	2	0	1	0	0	0	0	4
0.95-3.5	0	0	0	0	0	0	1	0	2	3	11	15	13	2	0	0	47
3.5-7.5	0	0	0	0	0	0	0	0	0	0	20	3	0	0	0	0	23
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	1	1	2	5	32	19	13	2	0	0	75

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	5	1	2	0	0	0	1	2	4	4	1	1	0	0	0	0	21
0.95-3.5	39	44	69	59	37	30	39	45	95	57	57	114	67	44	44	42	882
3.5-7.5	18	31	56	49	27	33	13	10	80	344	224	158	41	42	17	9	1152
7.5-12.5	0	1	12	0	0	1	0	0	25	79	35	0	0	0	0	0	153
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	62	77	139	108	64	64	53	57	204	484	317	273	108	86	61	51	2208

Table A-1 (continued)

Oct-Dec 2010

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	2	2	2	0	0	0	0	0	0	0	0	0	0	2	4	17
3.5-7.5	5	9	5	0	3	0	0	0	0	0	0	0	11	22	8	7	70
7.5-12.5	0	0	2	0	0	0	0	0	0	0	0	0	1	1	5	0	9
12.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	10	11	9	2	3	0	0	0	0	0	0	0	12	23	15	11	96

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	1	0	0	0	0	0	0	0	1	1	0	1	4
3.5-7.5	2	4	3	0	1	1	1	0	0	3	2	6	13	14	8	2	60
7.5-12.5	0	3	1	0	0	0	0	0	0	0	0	1	4	0	0	0	9
12.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	2	7	4	0	2	1	1	0	0	3	2	7	18	15	8	3	73

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	1	1	0	0	2	0	0	0	0	0	0	0	1	2	0	7
3.5-7.5	1	3	12	0	0	1	1	0	2	1	7	17	18	3	4	4	74
7.5-12.5	1	3	2	1	0	0	0	0	0	0	0	4	4	7	1	1	24
12.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	2	7	15	1	0	3	1	0	2	1	7	21	22	11	7	5	105

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	6	8	6	10	11	0	3	6	2	2	3	3	10	7	12	5	94
3.5-7.5	10	26	44	12	17	27	20	10	38	50	45	76	96	72	62	7	612
7.5-12.5	16	64	20	1	3	1	20	1	16	19	3	14	27	32	49	17	303
12.5-18.5	1	0	4	0	0	0	0	0	2	0	0	0	0	3	0	2	12
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	33	98	74	23	31	28	43	17	58	71	51	93	133	114	123	31	1021

Table A-1 (continued)

Oct-Dec 2010

Class E Freq: 0.329

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	1	0	0	0	1	1	0	1	0	0	0	4
0.95-3.5	4	8	1	3	1	5	11	13	23	26	13	37	33	21	11	4	214
3.5-7.5	4	6	3	0	1	13	14	20	14	39	55	121	72	35	26	2	425
7.5-12.5	1	9	0	0	0	3	5	2	3	12	9	6	15	5	6	0	76
12.5-18.5	1	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	7
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	10	27	6	3	2	22	30	35	40	78	78	164	121	61	43	6	726

Class F Freq: 0.075

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	2	0	0	0	0	0	0	2
0.95-3.5	0	0	0	0	0	0	0	2	23	17	14	14	6	7	1	0	84
3.5-7.5	0	0	0	0	0	0	0	0	2	7	41	18	0	0	0	0	68
7.5-12.5	0	0	0	0	0	0	0	0	0	0	12	0	0	0	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	0	0	0	0	0	0	0	2	25	26	67	32	6	7	1	0	166

Class G Freq: 0.010

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	0	0	0	0	0	0	0	0	4	8	1	1	0	0	14
3.5-7.5	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	6
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	1	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	0	0	11	9	1	1	0	0	22

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	1	0	0	0	3	1	0	1	0	0	0	6
0.95-3.5	15	19	10	15	13	7	14	21	48	45	34	62	51	38	28	14	434
3.5-7.5	22	48	67	12	22	42	36	30	56	100	155	239	210	146	108	22	1315
7.5-12.5	18	79	25	2	3	4	25	3	19	31	25	25	51	45	61	18	434
12.5-18.5	2	4	6	0	0	0	0	0	2	0	1	0	0	3	0	2	20
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	57	150	108	29	38	54	75	54	125	179	216	326	313	232	197	56	2209

Table A-1 (continued)

Jan-Dec 2010

Class A Freq: 0.091

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	11	18	11	7	0	1	0	0	0	0	0	3	4	7	8	89
3.5-7.5	31	57	57	38	28	22	14	5	9	16	15	17	40	66	40	23	478
7.5-12.5	0	15	3	1	2	0	0	0	8	44	9	1	18	13	7	2	123
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	50	83	78	50	37	22	15	5	17	60	24	18	61	83	54	33	690

Class B Freq: 0.040

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	4	4	4	6	2	2	5	0	0	0	0	3	8	3	8	4	53
3.5-7.5	4	10	7	14	15	16	6	3	3	29	19	25	22	18	13	4	208
7.5-12.5	0	6	1	0	0	0	0	0	2	16	6	2	5	2	0	0	40
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	8	20	13	20	17	18	11	3	5	45	25	30	35	23	21	8	302

Class C 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	4	11	7	5	7	4	5	4	0	0	1	3	3	7	12	9	82
3.5-7.5	5	8	19	18	11	8	5	3	24	37	31	37	34	17	8	6	271
7.5-12.5	1	8	2	1	0	0	0	0	2	26	10	4	5	8	2	2	71
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	10	27	28	24	18	12	10	7	26	63	42	44	42	32	22	17	424

Class D Freq: 0.390

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	2	0	3
0.95-3.5	50	47	58	53	50	32	40	49	46	25	15	27	30	32	38	31	623
3.5-7.5	35	43	89	56	52	70	41	31	122	310	157	169	215	153	99	18	1660
7.5-12.5	20	95	37	13	14	3	20	14	45	120	34	14	64	43	66	23	625
12.5-18.5	1	6	6	12	1	0	0	0	2	0	2	0	0	3	0	2	35
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	106	191	190	134	117	105	101	94	215	455	208	211	309	231	205	74	2946

Table A-1 (continued)

Jan-Dec 2010

Class E Freq: 0.303

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	5	1	2	0	0	1	0	1	1	2	3	0	2	0	1	0	19
0.95-3.5	25	35	33	46	31	31	45	55	103	61	40	110	89	58	56	31	849
3.5-7.5	11	10	14	7	21	31	19	25	67	260	181	307	151	63	42	9	1218
7.5-12.5	1	9	10	1	14	6	5	2	3	54	52	10	15	6	6	0	194
12.5-18.5	1	4	2	1	3	0	0	0	0	2	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	43	59	61	55	69	69	69	83	174	379	276	427	257	127	105	40	2293

Class F 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	2	0	3	3	1	1	0	1	0	0	11
0.95-3.5	6	2	3	14	2	5	5	6	39	43	64	109	40	32	10	10	390
3.5-7.5	1	1	1	4	3	1	0	0	4	40	165	73	7	3	0	1	304
7.5-12.5	0	0	0	0	0	0	0	0	0	6	28	0	0	0	0	0	34
12.5-18.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18.5-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	7	3	4	18	5	6	7	6	46	92	258	183	47	36	10	11	739

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	1	0	0	1	1	2	1	1	0	0	0	0	7
0.95-3.5	0	0	0	0	0	0	1	0	3	3	19	34	16	6	1	0	83
3.5-7.5	0	0	0	0	0	0	0	0	0	0	49	12	1	0	0	0	62
7.5-12.5	0	0	0	0	0	0	0	0	0	3	12	0	0	0	0	0	15
12.5-18.5	0	0	0	0	0	0	0	0	0	0	1	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	1	0	1	1	4	8	82	47	17	6	1	0	168

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	5	1	2	0	1	1	2	2	5	7	5	3	2	1	3	0	40
0.95-3.5	108	110	123	135	99	74	102	114	191	132	139	286	189	142	132	93	2169
3.5-7.5	87	129	187	137	130	148	85	67	229	692	617	640	470	320	202	61	4201
7.5-12.5	22	133	53	16	30	9	25	16	60	269	151	31	107	72	81	27	1102
12.5-18.5	2	10	9	13	4	0	0	0	2	2	3	0	0	3	0	2	50
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	224	383	374	301	264	232	214	199	487	1102	915	960	768	538	418	183	7562

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

Jan-Mar 2010

Class A Freq: 0.137

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	3	1	2	1	0	0	0	0	0	0	1	1	3	1	16
7.5-12.5	5	5	4	3	0	0	0	0	0	0	0	3	6	13	5	4	48
12.5-18.5	7	11	3	4	1	1	3	3	2	2	1	3	17	29	18	4	109
18.5-24	5	8	2	0	0	1	0	0	0	1	0	0	6	28	3	7	61
>24	6	8	0	0	0	0	0	0	0	0	0	0	4	10	5	2	35
TOTAL	24	34	12	8	3	3	3	3	2	3	1	6	34	81	34	18	269

Class B Freq: 0.034

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	0	2	2	0	0	0	0	0	0	0	0	2	1	1	11
7.5-12.5	1	0	0	0	1	0	0	0	0	0	0	2	2	2	0	2	10
12.5-18.5	1	0	0	1	3	0	0	0	2	1	0	2	4	4	2	1	21
18.5-24	0	1	0	0	1	3	0	0	0	0	0	0	3	4	0	1	13
>24	1	5	1	0	0	0	0	0	0	0	0	0	1	3	0	1	12
TOTAL	5	7	1	3	7	3	0	0	2	1	0	4	10	15	3	6	67

Class C Freq: 0.057

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	3
3.5-7.5	1	0	0	0	0	1	0	0	0	0	0	0	1	4	1	1	9
7.5-12.5	3	1	1	1	0	1	1	0	4	1	0	2	5	5	0	0	25
12.5-18.5	0	1	1	3	1	1	1	0	4	4	1	2	12	2	0	1	34
18.5-24	1	2	1	0	0	1	0	0	0	0	0	0	3	5	1	2	16
>24	10	5	0	0	0	0	0	0	0	0	0	0	1	1	4	4	25
TOTAL	15	9	4	5	1	4	2	0	8	5	1	4	22	17	6	9	112

Class D Freq: 0.502

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	1	0	0	1	0	0	1	0	2	2	9
3.5-7.5	3	3	3	3	8	7	3	4	7	0	0	1	5	6	5	3	61
7.5-12.5	10	1	3	8	7	8	6	9	10	8	6	14	12	18	9	4	133
12.5-18.5	6	3	2	15	7	3	9	6	3	6	7	28	106	52	17	7	277
18.5-24	2	12	7	14	6	1	3	25	4	7	3	4	35	53	37	12	225
>24	41	39	9	29	13	1	1	15	0	2	0	0	24	53	31	25	283
TOTAL	63	58	25	69	41	20	23	59	24	24	16	47	183	182	101	53	988

Table A-2 (continued)

Jan-Mar 2010

Class E Freq: 0.208

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	1	1	0	2	2	1	0	1	0	1	1	1	3	0	0	3	17
3.5-7.5	2	4	2	3	2	2	3	0	2	5	2	0	3	2	1	0	33
7.5-12.5	0	0	1	1	8	7	5	18	4	4	6	10	18	12	3	4	101
12.5-18.5	5	2	0	1	2	4	4	7	0	1	11	16	59	18	4	2	136
18.5-24	1	2	0	1	2	1	3	1	0	3	0	10	26	10	7	7	74
>24	2	0	0	9	22	1	0	0	0	2	0	0	0	7	4	1	48
TOTAL	11	9	3	17	38	16	15	27	6	16	20	37	109	49	19	17	409

Class F Freq: 0.050

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	3	0	0	1	1	1	0	0	0	0	0	0	3	0	9
3.5-7.5	0	0	0	0	2	1	0	0	1	0	1	4	3	1	0	2	15
7.5-12.5	1	0	0	0	0	0	0	2	0	1	0	6	9	5	3	0	27
12.5-18.5	0	0	0	0	0	0	2	5	3	1	4	6	3	5	0	0	29
18.5-24	0	0	0	0	0	0	0	0	0	2	8	5	0	0	0	0	15
>24	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	4
TOTAL	1	0	3	0	2	2	3	8	4	6	15	21	15	11	6	2	99

Class G Freq: 0.013

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

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	2	1	5	3	2	2	3	2	0	2	1	1	4	0	6	6	40
3.5-7.5	9	10	8	9	16	12	6	4	11	6	3	5	13	16	12	8	148
7.5-12.5	20	7	9	13	16	16	12	29	18	14	13	38	57	55	20	14	351
12.5-18.5	19	17	6	24	14	9	19	21	14	15	26	58	201	110	41	15	609
18.5-24	9	25	10	15	9	7	6	26	4	13	14	23	73	100	48	29	411
>24	60	57	10	38	35	2	1	15	0	6	6	0	30	74	44	33	411
TOTAL	119	117	48	102	92	48	47	97	47	56	63	125	378	355	171	105	1970

Table A-2 (continued)

Apr-Jun 2010

Class A Freq: 0.154

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	2
3.5-7.5	6	14	11	5	3	1	0	0	0	0	0	0	1	1	0	4	46
7.5-12.5	10	8	7	7	13	14	9	2	5	1	3	9	7	6	5	5	111
12.5-18.5	7	4	2	0	0	1	7	2	7	23	10	8	9	7	5	2	94
18.5-24	5	0	2	2	2	1	0	0	4	15	1	0	16	8	2	9	67
>24	0	0	0	0	1	0	0	0	0	0	0	0	6	6	1	3	17
TOTAL	28	26	22	15	20	17	16	4	16	39	14	17	39	28	13	23	337

Class B Freq: 0.051

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
3.5-7.5	4	3	0	2	3	0	0	0	0	0	0	0	1	4	0	0	17
7.5-12.5	1	3	2	2	1	17	6	2	1	5	6	5	4	1	4	1	61
12.5-18.5	0	0	0	0	1	4	2	2	1	5	7	2	1	1	1	0	27
18.5-24	0	0	0	0	0	0	0	0	0	4	1	0	1	0	0	0	6
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	5	6	3	4	5	21	8	4	2	14	14	7	7	6	5	1	112

Class C Freq: 0.065

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	1	1
3.5-7.5	1	6	3	2	2	4	0	0	2	1	1	0	0	1	0	2	25
7.5-12.5	0	5	4	2	0	5	7	5	1	5	6	3	2	1	1	2	49
12.5-18.5	2	1	0	2	1	3	1	0	5	13	5	5	4	0	1	0	43
18.5-24	1	0	0	0	1	0	0	0	0	8	7	0	1	2	0	1	21
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	2
TOTAL	4	12	7	6	4	12	8	5	8	27	19	8	7	5	3	6	141

Class D Freq: 0.339

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	8	7	1	0	0	0	0	0	0	0	0	0	0	0	1	19
3.5-7.5	10	5	8	8	7	10	11	9	3	5	2	3	1	4	4	10	100
7.5-12.5	6	13	10	3	10	24	17	9	26	35	19	11	5	4	6	12	210
12.5-18.5	4	6	2	3	8	13	4	4	20	83	41	13	16	21	3	5	246
18.5-24	7	0	2	4	4	4	3	1	1	58	17	1	20	11	1	9	143
>24	0	0	1	3	0	0	0	0	0	4	3	0	1	6	5	0	23
TOTAL	29	32	30	22	29	51	35	23	50	185	82	28	43	46	19	37	741

Table A-2 (continued)

Apr-Jun 2010

Class E   Freq: 0.271

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	5	4	1	4	0	0	0	1	1	0	1	3	0	1	23
3.5-7.5	4	2	2	1	9	10	3	3	7	5	0	1	2	1	5	3	58
7.5-12.5	12	2	3	1	3	10	9	9	10	16	5	4	3	14	5	5	111
12.5-18.5	5	1	0	0	2	0	6	10	14	41	30	10	27	40	13	13	212
18.5-24	2	0	0	0	0	0	0	1	0	39	50	8	21	18	5	9	153
>24	0	0	0	0	0	0	0	0	0	12	10	0	1	10	1	0	34
TOTAL	23	7	10	6	15	24	18	23	31	114	96	23	55	86	29	31	591

Class F   Freq: 0.099

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	1	1	1	0	0	1	2	3	0	0	0	1	0	0	0	2	12
3.5-7.5	3	1	0	1	1	3	4	0	3	0	1	2	3	2	4	1	29
7.5-12.5	2	0	2	0	1	1	2	2	1	1	3	7	4	14	8	5	53
12.5-18.5	1	0	0	1	0	0	1	2	5	4	6	10	16	18	16	5	85
18.5-24	0	0	0	0	0	0	0	0	0	1	23	7	2	1	0	2	36
>24	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
TOTAL	7	2	3	2	2	5	9	7	9	7	33	27	25	35	28	15	216

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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	1	0	0	1	1	0	0	1	0	0	0	0	0	0	4
3.5-7.5	2	0	0	0	0	0	0	0	1	1	0	0	2	0	0	0	6
7.5-12.5	0	0	0	0	0	0	0	0	4	0	0	1	3	4	2	1	15
12.5-18.5	0	0	0	0	0	0	0	0	1	0	4	3	5	3	1	0	17
18.5-24	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	3
>24	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
TOTAL	2	0	1	0	0	1	1	0	6	2	6	4	12	7	3	1	46

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	11	15	6	2	6	3	3	0	2	1	1	1	3	0	5	62
3.5-7.5	30	31	24	19	25	28	18	12	16	12	4	6	10	13	13	20	281
7.5-12.5	31	31	28	15	28	71	50	29	48	63	42	40	28	44	31	31	610
12.5-18.5	19	12	4	6	12	21	21	20	53	169	103	51	78	90	40	25	724
18.5-24	15	0	4	6	7	5	3	2	5	125	100	16	63	40	8	30	429
>24	0	0	1	3	1	0	0	0	0	17	14	0	8	23	8	3	78
TOTAL	98	85	76	55	75	131	95	66	122	388	264	114	188	213	100	114	2184

Table A-2 (continued)

Jul-Sep 2010

Class A Freq: 0.068

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	5	9	3	3	0	0	0	0	0	0	1	3	2	0	0	27
7.5-12.5	16	3	12	4	5	4	3	0	1	0	3	0	1	5	1	1	59
12.5-18.5	7	0	3	2	1	3	5	1	6	7	2	0	0	8	1	4	50
18.5-24	4	0	0	1	0	0	0	0	0	1	1	0	0	0	0	1	8
>24	5	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	6
TOTAL	33	8	24	10	9	7	8	1	7	9	6	1	4	15	2	6	150

Class B 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	2	3	2	2	0	0	0	0	0	0	1	3	2	0	2	18
7.5-12.5	2	0	1	1	1	2	3	0	0	6	1	5	4	3	1	0	30
12.5-18.5	0	0	0	3	0	1	2	1	6	13	5	4	0	2	1	1	39
18.5-24	0	0	0	1	0	0	0	0	0	1	3	0	0	0	0	0	5
>24	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
TOTAL	3	2	4	7	3	3	5	1	6	22	9	10	7	7	2	3	94

Class C Freq: 0.061

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	0	3	1	2	0	0	0	1	3	1	1	3	4	3	27
7.5-12.5	0	0	2	2	1	7	7	2	7	7	6	5	3	6	2	0	57
12.5-18.5	0	0	0	2	0	0	2	0	5	10	6	2	3	2	0	1	33
18.5-24	0	0	0	1	0	0	0	0	2	6	3	0	1	2	0	0	15
>24	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
TOTAL	4	3	2	8	2	9	9	2	14	24	18	8	8	13	6	4	134

Class D Freq: 0.305

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	5	7	1	1	0	1	0	0	0	0	0	0	0	0	1	18
3.5-7.5	9	5	10	6	12	7	8	6	7	6	4	1	1	4	2	1	89
7.5-12.5	5	5	4	8	6	11	11	28	21	33	17	9	12	4	4	3	181
12.5-18.5	2	2	3	8	5	5	5	5	20	83	45	12	18	13	3	6	235
18.5-24	5	7	6	10	0	1	0	3	21	38	22	2	4	7	2	1	129
>24	3	4	4	2	0	0	0	0	3	1	5	0	0	0	0	0	22
TOTAL	26	28	34	35	24	24	25	42	72	161	93	24	35	28	11	12	674

Table A-2 (continued)

Jul-Sep 2010

Class E Freq: 0.347

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	3	4	2	2	2	1	3	0	1	0	0	0	0	2	24
3.5-7.5	4	6	6	4	9	9	14	6	10	4	1	3	3	1	4	3	87
7.5-12.5	4	11	16	1	6	6	11	13	15	21	6	4	11	9	14	9	157
12.5-18.5	5	2	1	5	1	3	2	23	29	67	41	35	65	27	9	12	327
18.5-24	3	0	6	4	0	5	0	1	4	55	21	1	9	12	7	3	131
>24	2	1	11	8	3	0	0	0	0	3	2	0	0	3	5	2	40
TOTAL	18	24	43	26	21	25	29	44	61	150	72	43	88	52	39	31	766

Class F Freq: 0.143

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	2	1	1	1	0	0	1	0	0	0	0	0	0	0	7
3.5-7.5	1	1	3	0	5	4	4	0	5	4	1	1	1	0	1	2	33
7.5-12.5	3	1	1	2	0	7	6	5	5	7	6	11	6	17	10	9	96
12.5-18.5	5	1	0	0	0	2	3	9	5	12	15	13	30	24	7	4	130
18.5-24	1	0	0	0	0	0	0	0	0	4	16	4	6	11	2	2	46
>24	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	3
TOTAL	11	4	6	5	6	14	13	14	16	27	38	29	43	52	20	17	315

Class G Freq: 0.034

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
0.95-3.5	1	2	1	1	2	0	0	0	1	0	0	0	2	1	0	1	12
3.5-7.5	1	0	1	0	1	0	2	0	2	3	1	1	0	0	3	2	17
7.5-12.5	0	0	0	0	0	0	0	1	2	4	3	6	2	3	1	1	23
12.5-18.5	0	0	0	0	0	0	0	0	0	0	1	3	7	6	0	1	18
18.5-24	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0	0	4
>24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	2	2	2	2	3	0	2	1	5	7	8	11	11	10	4	5	75

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	1	0	0	0	0	0	0	0	0	0	0	0	0	1
0.95-3.5	4	11	13	7	6	3	3	1	5	0	1	0	2	1	0	4	61
3.5-7.5	19	22	32	18	33	22	28	12	24	18	10	9	12	12	14	13	298
7.5-12.5	30	20	36	18	19	37	41	49	51	78	42	40	39	47	33	23	603
12.5-18.5	19	5	7	20	7	14	19	39	71	192	115	69	123	82	21	29	832
18.5-24	13	7	12	17	0	6	0	4	27	105	69	8	20	32	11	7	338
>24	12	6	15	12	3	0	0	0	3	7	7	0	0	3	5	2	75
TOTAL	97	71	115	93	68	82	91	105	181	400	244	126	196	177	84	78	2208

Table A-2 (continued)

Oct-Dec 2010

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	3	1	1	2	0	0	0	0	0	0	0	0	0	0	2	0	9
7.5-12.5	2	4	2	0	0	2	0	0	0	0	0	0	2	7	1	7	27
12.5-18.5	2	1	1	0	0	1	0	0	0	0	0	0	3	14	5	3	30
18.5-24	5	0	0	0	0	0	0	0	0	0	0	0	2	8	2	2	19
>24	0	0	3	0	0	0	0	0	0	0	0	0	1	1	6	0	11
TOTAL	12	6	7	2	0	3	0	0	0	0	0	0	8	30	16	12	96

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	0	0	0	0	0	0	0	0	0	0	0	1	2	1	1	1	6
7.5-12.5	0	0	1	0	1	1	0	0	0	1	2	2	4	5	0	0	17
12.5-18.5	0	3	1	0	0	1	1	0	2	0	0	4	7	3	3	3	28
18.5-24	0	1	2	0	0	0	0	0	0	0	0	0	6	4	5	0	18
>24	3	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	4
TOTAL	3	4	4	0	1	2	1	0	2	1	2	7	19	13	10	4	73

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	1	0	1	0	0	0	0	0	0	0	2	1	0	1	1	0	7
7.5-12.5	0	0	1	0	0	3	0	0	0	1	3	8	5	2	1	0	24
12.5-18.5	0	1	5	0	0	0	1	0	2	0	3	12	6	2	1	3	36
18.5-24	0	2	8	0	0	0	0	0	0	0	0	0	9	2	2	0	23
>24	2	1	0	1	0	0	0	0	0	0	0	0	0	5	4	2	15
TOTAL	3	4	15	1	0	3	1	0	2	1	8	21	20	12	9	5	105

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	3	0	2	1	0	0	0	0	0	0	0	0	0	1	0	4	11
3.5-7.5	1	1	5	6	5	7	3	2	0	2	3	1	1	6	3	1	47
7.5-12.5	3	5	9	5	6	5	5	3	5	7	21	9	6	14	10	2	115
12.5-18.5	7	5	20	6	11	12	17	7	26	48	34	41	58	49	10	5	356
18.5-24	11	10	21	5	4	5	6	1	11	10	3	19	28	37	43	2	216
>24	52	25	12	1	7	0	18	0	5	0	0	0	5	42	81	28	276
TOTAL	77	46	69	24	33	29	49	13	47	67	61	70	98	149	147	42	1021

Table A-2 (continued)

Oct-Dec 2010

Class E Freq: 0.329

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	2	1	1	2	0	1	2	0	1	1	0	1	12
3.5-7.5	1	1	0	2	4	3	5	4	1	0	3	1	3	2	12	1	43
7.5-12.5	3	3	3	1	1	9	12	6	8	12	15	7	16	20	13	9	138
12.5-18.5	4	6	0	0	2	1	13	22	10	23	32	47	60	58	27	3	308
18.5-24	2	2	0	0	3	9	6	3	1	15	13	20	40	29	17	3	163
>24	5	10	2	1	1	0	6	0	0	0	4	0	3	15	12	3	62
TOTAL	15	22	5	4	13	23	43	37	20	51	69	75	123	125	81	20	726

Class F Freq: 0.075

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	1	0	0	1	1	0	0	4
3.5-7.5	0	3	0	1	1	1	2	0	2	2	0	0	2	0	1	2	17
7.5-12.5	3	1	0	0	1	1	15	10	6	6	8	5	8	6	2	0	72
12.5-18.5	0	0	0	0	0	0	1	5	1	4	9	4	16	13	0	4	57
18.5-24	0	0	0	0	0	0	0	0	0	0	6	8	1	0	0	0	15
>24	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
TOTAL	3	4	0	1	3	2	18	15	9	13	24	17	28	20	3	6	166

Class G Freq: 0.010

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	2	0	0	0	0	0	0	0	0	0	3
3.5-7.5	1	2	3	0	0	1	0	0	1	0	0	0	0	0	0	0	8
7.5-12.5	0	0	0	0	0	0	0	0	0	2	1	4	0	0	0	0	7
12.5-18.5	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	2
18.5-24	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
>24	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
TOTAL	1	2	3	1	0	1	2	0	1	3	2	5	0	1	0	0	22

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	0	2	2	3	1	3	2	0	2	2	0	2	3	0	5	30
3.5-7.5	7	8	10	11	10	12	10	6	4	4	8	4	8	10	20	5	137
7.5-12.5	11	13	16	6	9	21	32	19	19	29	50	35	41	54	27	18	400
12.5-18.5	13	16	27	6	13	15	33	34	41	75	79	108	150	140	46	21	817
18.5-24	18	15	31	5	7	14	12	4	12	25	22	48	86	80	69	7	455
>24	62	36	17	3	8	0	24	0	5	1	5	0	9	63	104	33	370
TOTAL	114	88	103	33	50	63	114	65	81	136	166	195	296	350	266	89	2209

Table A-2 (continued)

Jan-Dec 2010

Class A Freq: 0.099

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	2
3.5-7.5	11	22	24	11	8	2	0	0	0	0	0	1	5	4	5	5	98
7.5-12.5	33	20	25	14	18	20	12	2	6	1	6	12	16	31	12	17	245
12.5-18.5	23	16	9	6	2	6	15	6	15	32	13	11	29	58	29	13	283
18.5-24	19	8	4	3	2	2	0	0	4	17	2	0	24	44	7	19	155
>24	11	8	3	0	1	0	0	0	0	1	0	0	11	17	12	5	69
TOTAL	97	74	65	35	32	30	27	8	25	51	21	24	85	154	65	59	852

Class B Freq: 0.040

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
3.5-7.5	7	6	3	6	7	0	0	0	0	0	0	2	6	9	2	4	52
7.5-12.5	4	3	4	3	4	20	9	2	1	12	9	14	14	11	5	3	118
12.5-18.5	1	3	1	4	4	6	5	3	11	19	12	12	12	10	7	5	115
18.5-24	0	2	2	1	1	3	0	0	0	5	4	0	10	8	5	1	42
>24	4	5	1	0	0	0	0	0	0	2	0	0	1	3	1	1	18
TOTAL	16	19	12	14	16	29	14	5	12	38	25	28	43	41	20	14	346

Class C Freq: 0.057

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	2	4
3.5-7.5	5	9	4	5	3	7	0	0	2	2	6	2	2	9	6	6	68
7.5-12.5	3	6	8	5	1	16	15	7	12	14	15	18	15	14	4	2	155
12.5-18.5	2	3	6	7	2	4	5	0	16	27	15	21	25	6	2	5	146
18.5-24	2	4	9	1	1	1	0	0	2	14	10	0	14	11	3	3	75
>24	14	6	0	1	0	0	0	0	0	0	0	0	1	7	9	6	44
TOTAL	26	28	28	20	7	28	20	7	32	57	46	41	57	47	24	24	492

Class D Freq: 0.399

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	13	17	3	1	0	2	0	0	1	0	0	1	1	2	8	57
3.5-7.5	23	14	26	23	32	31	25	21	17	13	9	6	8	20	14	15	297
7.5-12.5	24	24	26	24	29	48	39	49	62	83	63	43	35	40	29	21	639
12.5-18.5	19	16	27	32	31	33	35	22	69	220	127	94	198	135	33	23	1114
18.5-24	25	29	36	33	14	11	12	30	37	113	45	26	87	108	83	24	713
>24	96	68	26	35	20	1	19	15	8	7	8	0	30	101	117	53	604
TOTAL	195	164	158	150	127	124	132	137	193	437	252	169	359	405	278	144	3424

Table A-2 (continued)

Jan-Dec 2010

Class E Freq: 0.291

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	1	7	8	10	7	8	3	4	3	3	5	1	5	4	0	7	76
3.5-7.5	11	13	10	10	24	24	25	13	20	14	6	5	11	6	22	7	221
7.5-12.5	19	16	23	4	18	32	37	46	37	53	32	25	48	55	35	27	507
12.5-18.5	19	11	1	6	7	8	25	62	53	132	114	108	211	143	53	30	983
18.5-24	8	4	6	5	5	15	9	6	5	112	84	39	96	69	36	22	521
>24	9	11	13	18	26	1	6	0	0	17	16	0	4	35	22	6	184
TOTAL	67	62	61	53	87	88	105	131	118	331	257	178	375	312	168	99	2492

Class F Freq: 0.093

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.95-3.5	2	1	6	1	2	3	3	4	1	1	0	1	1	1	3	2	32
3.5-7.5	4	5	3	2	9	9	10	0	11	6	3	7	9	3	6	7	94
7.5-12.5	9	2	3	2	2	9	23	19	12	15	17	29	27	42	23	14	248
12.5-18.5	6	1	0	1	0	2	7	21	14	21	34	33	65	60	23	13	301
18.5-24	1	0	0	0	0	0	0	0	0	7	53	24	9	12	2	4	112
>24	0	1	0	2	0	0	0	0	0	3	3	0	0	0	0	0	9
TOTAL	22	10	12	8	13	23	43	44	38	53	110	94	111	118	57	40	796

Class G Freq: 0.020

mph	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
Calm-0.95	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
0.95-3.5	1	2	2	2	2	1	4	0	1	1	0	0	2	1	1	1	21
3.5-7.5	4	2	4	0	1	1	2	0	5	5	1	1	2	0	4	2	34
7.5-12.5	0	0	0	0	0	0	0	1	6	6	5	12	10	7	3	2	52
12.5-18.5	0	0	0	0	0	0	0	0	1	0	8	7	12	10	1	1	40
18.5-24	0	0	0	0	0	0	0	0	0	0	7	6	2	0	0	0	15
>24	0	0	0	0	0	0	0	0	0	1	5	0	0	0	0	0	6
TOTAL	5	4	6	3	3	2	6	1	13	13	26	26	28	18	9	6	169

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	1	0	0	0	0	0	0	0	0	0	0	0	0	1
0.95-3.5	12	23	35	18	13	12	12	8	5	6	5	2	9	7	6	20	193
3.5-7.5	65	71	74	57	84	74	62	34	55	40	25	24	43	51	59	46	864
7.5-12.5	92	71	89	52	72	145	135	126	136	184	147	153	165	200	111	86	1964
12.5-18.5	70	50	44	56	46	59	92	114	179	451	323	286	552	422	148	90	2982
18.5-24	55	47	57	43	23	32	21	36	48	268	205	95	242	252	136	73	1633
>24	134	99	43	56	47	2	25	15	8	31	32	0	47	163	161	71	934
TOTAL	428	361	342	283	285	324	347	333	431	980	737	560	1058	1095	621	386	8571

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 during the fourth quarter of 2007, and the first samples were collected in late November 2007. All four wells were installed onsite, within the protected area fence. 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. Also, there were no leaks or spills of radioactive material at Pilgrim Station during 2010 that could have affected onsite or offsite groundwater

Two pre-existing wells were incorporated into the groundwater monitoring program in early 2008. Monitoring well MW3 is located in the owner-controlled area near Rocky Hill Road, and was added to the program during the first quarter of 2008. Since monitoring well MW3 is located slightly uphill of Pilgrim Station approximately 0.2 mile southwest of the power block, it is upgradient of the PNPS power block and outside of natural groundwater flow direction. As such, it is considered to be a control well indicative of baseline levels in the vicinity of Pilgrim Station. Monitoring well MW4 is located within the protected area near the main transformer, and was added to the program during the 2nd quarter of 2008 as an additional onsite monitoring well.

In response to recommendations from assessments performed in 2009 by Entergy and NEI, six new monitoring wells were installed within the Pilgrim Station protected area in April 2010 to better characterize groundwater flow characteristics and perform monitoring closer to selected systems, structures and components (SSCs) the contain radioactive material and could lead to groundwater contamination if leaks were to develop. One of the wells MW202-I was an intermediate-level (45-feet deep) well installed adjacent to MW202 that had been installed in 2007. Monitoring well MW205 was a 25-ft well installed slightly down-gradient from the Condensate Storage Tanks (CSTs), and MW206 was a 25-ft well installed near the radwaste truck lock. MW207 was a 25-ft well installed on the southwest corner of the power block. Two additional wells were installed upgradient, approximately 300 yards southeast of the power block; MW208-S was a 25-ft shallow-level well, and was installed adjacent to MW208-I, a 45-ft intermediate level well.

The first samples were collected from these new wells in May-2010, and the radioactivity content was assessed. Analyses of samples from wells MW202-I, MW207, MW208-S, and MW208-I were consistent with the other wells installed in 2007. Tritium levels in MW205 and MW206 were higher than those observed from the wells installed in 2007, and the sampling frequency was changed from the normal quarterly sampling interval to once per week to obtain more information.

Both wells MW205 and MW206 continued to show wide fluctuations during the summer of 2010, and six additional sampling wells were installed in August 2010. All six of the wells installed in August were shallow wells, approximately 25-ft in depth. Monitoring well MW209 was installed on the north side of the reactor building truck lock. Monitoring well MW210 was installed immediately adjacent to the condensate storage tank to provide indication of any CST leakage that would be anticipated to move toward MW205, one of the wells indicating higher concentrations. Monitoring well MW211 was installed on the south side of the reactor building truck lock, in an area that could potentially be affected by storm drain leakage and the underground liquid radwaste discharge line. MW212 was installed between the underground radwaste discharge line and the intake screenhouse, and was intended to monitor for lateral flow of groundwater at the site. MW213 was installed on the north side of the PNPS Warehouse, and was intended to characterize groundwater on the east side of the plant site. Finally, MW214 was installed on the north side of the trash compaction facility to characterize groundwater flows along the northeast boundary of the site.

Additional efforts were undertaken to try to identify potential sources of the elevated tritium detected in the monitoring wells. A technical team was assembled to review various systems and processes that might influence introduction of tritium into groundwater, and Pilgrim Station has contracted the services of a professional hydrogeological firm to assist in the effort. Samples of roof runoff, storm drain runoff, and accumulated water in manholes were collected and analyzed for tritium, but provided inconclusive results. Soil samples were collected from borings performed in the vicinity of wells MW205 and MW206 to determine the possibility of "pockets" of tritium that might be suspended above the water table that could lead to "spikes" of tritium as precipitation percolated through the soil. These results also proved inconclusive, as no detectable tritium was detected in the soil samples. A dye tracer study was conducted in January 2011 on four underground systems to detect any potential for leakage in these systems that might carry tritium to the monitoring wells. However, due to slow rate of water movement through the soil (approximately 6-inches/day), it may take several months for dye to migrate from the underground systems to the monitoring wells. Despite the extensive efforts to date, no likely candidates for the sources of tritium in the groundwater have been identified.

All samples collected were analyzed for tritium, a radioactive isotope of hydrogen, and well as for gamma emitting radionuclides and hard-to-detect beta emitting nuclides. 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. Tritium was the only radionuclide detected in the samples that is attributed to operations of Pilgrim Station. No plant-related gamma emitting radionuclides or hard-to-detect beta emitting radioactivity was detected in any of the samples. Naturally-occurring radioactivity was detected in the samples. 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 demonstrated the ability of the gamma spectroscopy analyses to detect radioactivity in groundwater. If any plant-related gamma activity was contained in the groundwater, the analytical techniques used would be able to detect them.

Results of the tritium analyses are presented in the following tables. In these tables, 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 MW202-I on 11-Jun-2010 contained no detectable tritium, and a minimum detectable concentration of 404 pCi/L was achieved on that sample. The achieved sensitivity of 404 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.

Analyses for hard-to-detect nuclides, such as iron-55 (Fe-55), nickel-63 (Ni-63), strontium-89 (Sr-89), strontium-90 (Sr-90), and gross alpha were performed on the samples collected during the fourth quarter of 2007 and the first quarter of 2008. Analyses for these hard-to-detect radionuclides were also performed on initial samples collected from all of the new wells installed during 2010. Since no plant-related gamma activity and no Fe-55, Ni-63, Sr-89, or Sr-90 was detected in any of these samples, further analyses for these hard-to-detect nuclides will not be performed unless there is a significant increase in tritium levels, or if plant-related gamma activity is detected.

Low levels of tritium, a radioactive isotope of hydrogen, were detected in the onsite wells. Although gamma spectroscopy and gross alpha analyses 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 samples, other than tritium.

Concentrations of tritium detected in the onsite wells ranged from non-detectable at less than 295 pCi/L, up to a maximum concentration of 25,552 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-205 (average concentration = 9550 pCi/L) was consumed as drinking water, the maximum dose consequence would be less than 0.87 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.

The following tables list the tritium concentrations observed in the samples collected from the monitoring wells during 2010.

Sample Date	Tritium Concentration by Monitoring Well - pCi/Liter Value ± 1-sigma uncertainty					
	MW201	MW202	MW202-I	MW203	MW204	MW205
02-Mar-2010	1180 ± 110	1040 ± 110		900 ± 110	930 ± 110	
17-May-2010	910 ± 130	900 ± 130	930 ± 130	1060 ± 130	1230 ± 130	5810 ± 160
11-Jun-2010		589 ± 127	NDA<404			8632 ± 191
21-Jun-2010		660 ± 128	529 ± 126			11072 ± 207
30-Jun-2010		499 ± 126	520 ± 127			8477 ± 190
07-Jul-2010	718 ±127	553 ± 126	471 ± 125	447 ± 124	759 ± 128	25552 ± 282
15-Jul-2010		589 ± 68.5	425 ± 64.5			6870 ± 79.0
22-Jul-2010	731 ± 222	390 ± 209	473 ± 212			12600 ± 495
26-Jul-2010	932 ± 156	580 ± 133	408 ± 121			10800 ± 449
02-Aug-2010	576 ± 163	579 ± 164	NDA<460	NDA<465	794 ± 170	17800 ± 493
09-Aug-2010	961 ± 125	349 ± 107	390 ± 109	480 ± 111	578 ± 114	12700 ± 304
17-Aug-2010	1090 ± 126	371 ± 108	NDA<322	712 ± 137	805 ± 141	7840 ± 233
26-Aug-2010	873 ± 123	364 ± 113	485 ± 116	423 ± 114	383 ± 114	7960 ± 264
30-Aug-2010	974 ± 137	NDA<364	NDA<364	NDA<360	403 ± 125	1390 ± 148
07-Sep-2010	1200 ± 137	352 ± 112	417 ± 101	375 ± 101	455 ± 116	3010 ± 180
13-Sep-2010	1510 ± 167	461 ± 126	652 ± 134	NDA<380	415 ± 129	1840 ± 177
20-Sep-2010	1340 ± 134	NDA<314	341 ± 107	NDA<394	NDA<394	22000 ± 398
27-Sep-2010	958 ± 143	400 ± 126	522 ± 130	NDA<364	596 ± 113	25000 ± 484
04-Oct-2010	1140 ± 124					17300 ± 332
12-Oct-2010	1040 ± 143	NDA<373	NDA<388	NDA<347	646 ± 124	1760 ± 157
18-Oct-2010	966 ± 129					5890 ± 228
25-Oct-2010	1340 ± 160	NDA<390	NDA<390	NDA<322	532 ± 112	2840 ± 194
01-Nov-2010	1020 ± 121					16700 ± 356
15-Nov-2010	909 ± 144	NDA<383	NDA<353	NDA<320	529 ± 113	5730 ± 259
22-Nov-2010	1290 ± 129					1810 ± 141
29-Nov-2010	1060 ± 153	NDA<382	NDA<385	NDA<397	526 ± 114	1960 ± 177
09-Dec-2010	1150 ± 182					2300 ± 225
14-Dec-2010	781 ± 148	579 ± 139	486 ± 144	NDA<372	503 ± 141	17800 ± 532
29-Dec-2010	1190 ± 171	579 ± 147	556 ± 146	NDA<356	372 ± 118	3930 ± 199

Sample Date	Tritium Concentration by Monitoring Well - pCi/Liter Value ± 1-sigma uncertainty					
	MW206	MW207	MW208-S	MW208-I	MW209	MW210
02-Mar-2010						
17-May-2010	1470 ± 130	1090 ± 130	630 ± 130	380 ± 120		
11-Jun-2010						
21-Jun-2010						
30-Jun-2010						
07-Jul-2010	3352 ± 151	488 ± 125	NDA<402	NDA<402		
15-Jul-2010						
22-Jul-2010	1520 ± 251					
26-Jul-2010	2030 ± 213					
02-Aug-2010	1380 ± 190	512 ± 160	NDA<477	NDA<457		
09-Aug-2010	4550 ± 198	394 ± 108	381 ± 108	NDA<315		
17-Aug-2010	5370 ± 201	701 ± 137	NDA<410	NDA<412		
26-Aug-2010	10500 ± 243	453 ± 116	NDA<303	NDA<348	2940 ± 159	1280 ± 131
30-Aug-2010	2790 ± 177	421 ± 112	NDA<322	NDA<357	1780 ± 158	NDA<362
07-Sep-2010	3190 ± 183	329 ± 112	NDA<295	NDA<304	1560 ± 145	589 ± 105
13-Sep-2010	6830 ± 295	NDA<379	NDA<376	NDA<378	1590 ± 168	641 ± 134
20-Sep-2010	8290 ± 242	NDA<394	NDA<390	NDA<394	1390 ± 131	1020 ± 123
27-Sep-2010	5040 ± 238	519 ± 130	NDA<312	413 ± 126	1760 ± 168	816 ± 140
04-Oct-2010	8210 ± 239					
12-Oct-2010	10100 ± 273	NDA<346	NDA<347	NDA<345	1440 ± 151	610 ± 134
18-Oct-2010	5950 ± 229					
25-Oct-2010	12200 ± 343	NDA<321	NDA<320	NDA<321	1710 ± 169	837 ± 145
01-Nov-2010	13600 ± 324					
15-Nov-2010	9250 ± 306	NDA<318	NDA<328	NDA<320	1830 ± 171	1230 ± 155
22-Nov-2010	4720 ± 190					
29-Nov-2010	5290 ± 246	NDA<398	NDA<317	NDA<399	1550 ± 166	NDA<385
09-Dec-2010	5270 ± 225					
14-Dec-2010	10300 ± 413	NDA<360	NDA<365	NDA<370	1940 ± 208	1090 ± 168
29-Dec-2010	8950 ± 353	NDA<350	NDA<365	NDA<340	1870 ± 194	930 ± 161

Sample Date	Tritium Concentration by Monitoring Well - pCi/Liter Value ± 1-sigma uncertainty					
	MW211	MW212	MW213	MW214	MW3	MW4
02-Mar-2010					360 ± 100	590 ± 100
17-May-2010					500 ± 130	830 ± 120
11-Jun-2010						
21-Jun-2010						
30-Jun-2010						
07-Jul-2010					NDA<402	568 ± 126
15-Jul-2010						
22-Jul-2010						
26-Jul-2010						
02-Aug-2010					NDA<460	504 ± 162
09-Aug-2010					NDA<313	491 ± 111
17-Aug-2010					NDA<397	759 ± 134
26-Aug-2010	1540 ± 136	514 ± 117	NDA<346	NDA<345	NDA<345	557 ± 116
30-Aug-2010	1340 ± 148	385 ± 122	NDA<361	NDA<364	NDA<320	573 ± 116
07-Sep-2010	1570 ± 146	655 ± 122	341 ± 99	NDA<297	NDA<331	662 ± 122
13-Sep-2010	1730 ± 173	618 ± 133	NDA<378	NDA<380	NDA<377	398 ± 129
20-Sep-2010	1200 ± 127	462 ± 110	NDA<420	NDA<396	NDA<395	493 ± 128
27-Sep-2010	1090 ± 148	513 ± 111	438 ± 122	NDA<313	400 ± 133	645 ± 114
04-Oct-2010						
12-Oct-2010	1180 ± 146	455 ± 129	415 ± 118	NDA<344	NDA<345	466 ± 118
18-Oct-2010						
25-Oct-2010	870 ± 146	568 ± 137	NDA<321	NDA<318	NDA<321	556 ± 113
01-Nov-2010						
15-Nov-2010	1050 ± 150	745 ± 118	NDA<312	NDA<302	NDA<305	491 ± 107
22-Nov-2010						
29-Nov-2010	717 ± 142	533 ± 136	NDA<398	NDA<318	NDA<317	607 ± 117
09-Dec-2010						
14-Dec-2010	1250 ± 181	620 ± 146	NDA<353	NDA<368	534 ± 143	740 ± 156
29-Dec-2010	1110 ± 136	830 ± 157	NDA<334	NDA<282	NDA<358	NDA<347

Although there are no indications that the groundwater containing low concentrations of 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 2010, 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 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 to 0.002 cm/sec to about 0.0006 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 average concentration of 2380 pCi/L, the annual discharge of tritium into the intake bay under this hypothetical scenario would be 0.0297 Curies. This activity represents less than 0.07% 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 0.0297 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 2010 was 615 billion Liters, yielding an effective concentration of tritium in the intake bay of about 0.048 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 0.000000027 millirem, resulting from tritium incorporated into fish and shellfish. Since the tritium would be incorporated into seawater, there is no drinking water ingestion pathway in the described scenario.

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

Shoreline Segment Number	1	2	3	4
Monitoring Well Number	MW204	MW205	MW202	MW201
Hydraulic Conductivity - cm/sec	1.99E-03	4.27E-03	3.13E-03	5.64E-03
Hydraulic Slope	0.014	0.014	0.014	0.014
Porosity	0.300	0.300	0.300	0.300
Flow Velocity - m/day	8.02E-02	1.72E-01	1.26E-01	2.27E-01
Flow Velocity - ft/yr	9.61E+01	2.06E+02	1.51E+02	2.72E+02
Length of Shoreline Segment – m	61.0	38.1	45.7	91.4
Thickness of Water Layer – m	3.0	3.0	3.0	3.0
Volumetric Discharge - m^3/day	4.40E+00	5.90E+00	5.19E+00	1.87E+01
Volumetric Discharge - Liter/yr	1.61E+06	2.16E+06	1.90E+06	6.84E+06
Annual Average H-3 Concentration - pCi/L	6.30E+02	9.55E+03	5.46E+02	1.03E+03
Annual Segment Tritium Discharge - Ci/yr	1.01E-03	2.06E-02	1.04E-03	7.06E-03
Total Volumetric Discharge - L/yr	1.25E+07			
Total H-3 Discharge - Ci/yr	2.97E-02			
Annual Circulating Water Flow - Liter/yr	6.15E+11			
Discharge Canal H-3 Concentration - Ci/L	4.83E-14			
Discharge Canal H-3 Concentration - pCi/L	4.83E-02			
Max. Indiv. Dose Factor - mrem/yr per Ci/L	5.73E+05			
Maximum Individual Dose - mrem/yr	2.77E-08			

In conclusion, there were no known leaks or spills of radioactive material at Pilgrim Station during 2010 that could have affected onsite or offsite groundwater. The only radionuclide detected in groundwater during the 2010 monitoring effort that is attributable to Pilgrim Station operations is tritium, and all concentrations were well below any reporting criteria established in the Pilgrim Station Offsite Dose Calculation Manual and through EPA safe drinking water standards.

APPENDIX C

CORRECTIONS TO PREVIOUS EFFLUENT REPORTS

Some minor discrepancies were identified in Effluent Release Reports issued in 2008 and 2009. These discrepancies are addressed below.

D.1 Correction to Table 4.3-A from 2009 Effluent Report

The first discrepancy involved confusing wording preceding Table 4.3-A depicting the doses from liquid effluent discharges during the first calendar quarter of 2009. A statement preceding the table of values indicated that "No Liquid Discharges Occurred During This Period". The table correctly reflected the dose consequence from a single discharge which was performed during that quarter, and the doses were correctly characterized in Section 6.2 of the 2009 Report where comparisons were made to ODCM limits. The corrected table is presented below:

Table 4.3-A

Maximum Individual Organ Doses -- mrem
From Liquid Release Period: Jan-Mar 2009

Organ	Age Class Organ Dose – mrem *		
	Adult	Teen	Child
Bone	1.70E-06	2.15E-06	1.74E-06
GI-LLI	1.67E-06	1.74E-06	5.36E-07
Kidney	5.28E-07	1.17E-06	5.02E-07
Liver	1.32E-06	1.96E-06	1.24E-06
Lung	2.72E-07	9.28E-07	2.85E-07
Thyroid	1.60E-07	7.95E-07	1.76E-07
T.Body	1.20E-06	1.47E-06	6.54E-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.

D.2 Correction to Appendix C of 2008 Report Regarding Groundwater Tritium

Calculations were performed regarding the hypothetical release of groundwater containing tritium into the PNPS intake bay due to normal groundwater flow gradient. In the calculations performed in 2008, the estimation of groundwater discharge into the bay did not properly account for the groundwater hydraulic slope and the soil porosity. In the 2008 report, the estimation erroneously assumed the groundwater flow velocity when calculating the total discharge was equal to the hydraulic conductivity of 0.019 cm/sec, resulting in a flow velocity of 16.4 meters/day. When additional wells were installed in 2010 and additional soil and groundwater physical parameters were collected, the error was identified in the groundwater discharge calculation.

The correct calculation for groundwater discharge incorporates hydraulic conductivity, soil porosity, and groundwater hydraulic slope. The correct calculation of groundwater flow velocity is the product of the hydraulic conductivity multiplied by the hydraulic slope and divided by the soil porosity.

Testing of new monitoring wells installed in 2010 indicated an average soil hydraulic conductivity value of 0.00376 cm/sec, a hydraulic slope of 0.014, and a porosity value of 0.3. Therefore, the correct groundwater flow velocity is estimated as:

$$0.00376 \text{ cm/sec} * 0.014 \div 0.3 = 0.000176 \text{ cm/sec, or } 0.152 \text{ meters/day}$$

This value is considerably lower than the value of 16.4 meters/day assumed in the 2008 calculations. When corrected for the proper groundwater flow velocity, the total hypothetical volume of groundwater discharged into the intake bay would be 55 million liters of water, as opposed to the original estimate of 6 billion liters. When the corrected volume of 55 million liters/year is multiplied by the average tritium concentration of 947 pCi/L, the hypothetical discharge of tritium into the intake bay would be 0.052 Curies, as opposed to the original estimate of 5.7 Curies. The resulting dose impact from discharging 0.052 Curies would be 4.84E-8 millirem.

The corrected wording for the 2008 report is shown below, with applicable changes denoted in ***bold*** text:

Although there are no indications that the groundwater containing low concentrations of 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 2008, the annual average concentration of tritium in groundwater in the vicinity of the onsite shorefront of the protected area would be 947 pCi/L. Hydrological characteristics of the compacted backfill onsite indicate the hydraulic conductivity to be about ***0.00376*** *cm/sec,* ***resulting in a groundwater flow velocity of about 0.152*** *meters per day. When coupled with an assumed horizontal interface area 200 meters long by 5 meters deep that could potentially transmit groundwater into the intake bay, the annual discharge of groundwater would be about* ***55 million*** *Liters of water per year. Assuming this volume of* ***55 million*** *liters contained the average concentration of 947 pCi/L, the annual discharge of tritium into the intake bay under this hypothetical scenario would be* ***0.052*** *Curies. This activity represents less than* ***0.1%*** *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 ***0.052*** *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 2008 was 615 billion Liters, yielding an effective concentration of tritium in the intake bay of about* ***0.085*** *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* ***4.84E-8*** *millirem, resulting from 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.*

D.3 Correction to Appendix B of 2009 Report Regarding Groundwater Tritium

The same issues identified in the previous section also applied to the 2009 estimation of groundwater discharge into the intake bay. The correct flow velocity of 0.052 meters/day is considerably lower than the value of 16.4 meters/day assumed in the 2009 calculations. When corrected for the proper groundwater flow velocity, the total hypothetical volume of groundwater discharged into the intake bay would be 55 million liters of water, as opposed to the original estimate of 6 billion liters. When the corrected volume of 55 million liters/year is multiplied by the average tritium concentration of 890 pCi/L, the hypothetical discharge of tritium into the intake bay would be 0.049 Curies, as opposed to the original estimate of 5.3 Curies. The resulting dose impact from discharging 0.049 Curies would be 4.90E-8 millirem.

The corrected wording for the 2009 report is shown below, with applicable changes denoted in ***bold*** text:

Although there are no indications that the groundwater containing low concentrations of 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 2009, the annual average concentration of tritium in groundwater in the vicinity of the onsite shorefront of the protected area would be 890 pCi/L. Hydrological characteristics of the compacted backfill onsite indicate the hydraulic conductivity to be about ***0.00376*** *cm/sec,* ***resulting in a groundwater flow velocity of about 0.152*** *meters per day. When coupled with an assumed horizontal interface area 200 meters long by 5 meters deep that could potentially transmit groundwater into the intake bay, the annual discharge of groundwater would be about* ***55 million*** *Liters of water per year. Assuming this volume of* ***55 million*** *liters contained the average concentration of 890 pCi/L, the annual discharge of tritium into the intake bay under this hypothetical scenario would be* ***0.049*** *Curies. This activity represents less than* ***0.1%*** *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 ***0.049*** *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 2009 was 571 billion Liters, yielding an effective concentration of tritium in the intake bay of about* ***0.085*** *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* ***0.000000049*** *millirem, resulting from 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.*

APPENDIX D

CHANGES TO PNPS
OFFSITE DOSE CALCULATION MANUAL

No revisions were made to the PNPS Offsite Dose Calculation Manual (ODCM) during calendar year 2010.