FENOC™
FirstEnergy Nuclear Operating Company

Perry Nuclear Power Plant
P.O. Box 97
10 Center Road
Perry, Ohio 44081

Ernest J. Harkness
Vice President

440-280-5382
Fax: 440-280-8029

April 30, 2014
L-14-161

10CFR50.36(a)

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

SUBJECT:
Perry Nuclear Power Plant
Docket No. 50-440
Annual Environmental and Effluent Release Report

Enclosed is the Annual Environmental and Effluent Release Report for the Perry Nuclear Power Plant (PNPP) for the period of January 1, 2013 through December 31, 2013. This document includes the radiological environmental operating report, radioactive effluent release report, and the non-radiological environmental operating report which satisfies the requirements of the PNPP Technical Specifications (TS), the PNPP Offsite Dose Calculation Manual (ODCM), and the Environmental Protection Plan, Appendix B of the PNPP Operating License.

There are no regulatory commitments contained in this letter. If there are any questions or if additional information is required, please contact Mr. Nicola Conicella, Manager – Regulatory Compliance, at (440) 280-5415.

Sincerely,

Ernest J. Harkness

Enclosure:
PNPP 2012 Annual Environmental and Effluent Release Report

cc: NRC Project Manager
NRC Resident Inspector
NRC Region III

IE48
NRR

Enclosure A
L-13-161

PNPP 2013 Annual Environmental and Effluent Release Report

Perry Nuclear Power Plant

Annual Environmental & Effluent Release Report 2013

2013

ANNUAL ENVIRONMENTAL AND EFFLUENT RELEASE REPORT

for the Perry Nuclear Power Plant

PREPARED BY:
CHEMISTRY SECTION
PERRY NUCLEAR POWER PLANT
FIRSTENERGY NUCLEAR OPERATING COMPANY
PERRY, OHIO
APRIL, 2014

TABLE OF CONTENTS

EXECUTIVE SUMMARY 1
Radioactive Effluent Releases 1
Radiological Environmental Monitoring 2
Land Use Census 3
Clam/Mussel Monitoring 3
Herbicide Use 3
Special Reports 3
INTRODUCTION 4
Radiation Fundamentals 4
Radiation and Radioactivity 4
Units of Measure 5
Lower Limit of Detection 6
Background radiation 6
RADIOACTIVE EFFLUENT RELEASES 8
Introduction 8
Regulatory Limits 8
Release Summary 10
Meteorological Data 18
Dose Assessment 18
Carbon-14 Supplemental Information 22
On-Site Groundwater Monitoring Program 24
Corrections to Previous Annual Environmental and Effluent Release Reports 27
Abnormal Releases 27
ODCM Non-Compliances 27
Offsite Dose Calculation Manual Changes 27
Process Control Program Changes 27
RADIOLOGICAL ENVIRONMENTAL MONITORING 28
Introduction 28
Sampling Locations 28
Sample Analysis 33
Sampling Program 34
Inter-Laboratory Cross-Check Comparison Program 41
Land Use Census 42
NORTHWEST DRAIN IMPOUNDMENT 45
CLAM/MUSSEL MONITORING 46
Introduction 46
Corbicula Program 46
Dreissena Program 47
HERBICIDE APPLICATIONS 48
SPECIAL REPORTS 49
Non-Compliances 49
Un-Reviewed Environmental Questions 49

APPENDICES

Appendix A: 2013 Inter-Laboratory Cross Check Comparison Program Results

Appendix B: 2013 REMP Data Summary Reports

Appendix C: 2013 REMP Detailed Data Report

Appendix D: Corrections to Previous AEERR

Appendix E: Abnormal Releases

Appendix F: ODCM Non-Compliances

Appendix G: Changes to the Process Control Program

EXECUTIVE SUMMARY

The Annual Environmental and Effluent Release Report (AEERR) details the results of environmental and effluent monitoring programs conducted at the Perry Nuclear Power Plant (PNPP) from January 01 through December 31, 2013. This report meets all of the requirements in PNPP Technical Specifications, the Offsite Dose Calculation Manual, the Environmental Protection Plan (EPP), and Regulatory Guide 1.21. It incorporates the requirements of the Annual Radioactive Effluent Release Report (ARERR), the Annual Radiological Environmental Operating Report (AREOR) and the Annual Environmental Operating Report (AEOR). Report topics include radioactive effluent releases, radiological environmental monitoring, land use census, clam/mussel monitoring, herbicide use, and special reports. The results of the environmental and effluent programs for 2013 indicate that the operations of the Perry Nuclear Power Plant did not result in any significant environmental impact.

RADIOACTIVE EFFLUENT RELEASES

During the normal operation of a nuclear power plant, small quantities of radioactivity may be released to the environment in liquid and gaseous effluents. Radioactive material may also be released as solid waste. PNPP maintains a comprehensive program to control and monitor the release of radioactive materials from the site in accordance with Nuclear Regulatory Commission (NRC) release regulations.

The dose to the general public from the plant's liquid and gaseous effluents was below the applicable regulatory limits. The calculated hypothetical maximum individual whole body dose potentially received by an individual resulting from PNPP liquid effluents was 7.13E-03 mrem (0.24% of the applicable limit). The calculated hypothetical maximum individual whole body dose potentially received by an individual resulting from PNPP gaseous effluents (excluding C-14) for 2013 was 3.70E-03 mrem (0.074% of the applicable limit).

Radioactivity released to the environment in the form of gaseous Carbon-14 (C-14) was estimated based on plant type and power production. This is based on an industry initiative supported by the Nuclear Energy Institute (NEI) and the NRC. The calculated hypothetical maximum individual whole body dose potentially received by an individual resulting from PNPP gaseous effluents including C-14 is 2.14E-01 mrem. Refer to page 22 for additional Carbon-14 information.

The summation of the hypothetical maximum individual dose from effluents in 2013 is less than 1% of the total dose an individual living in the PNPP area receives from all sources of manmade and background radiation.

Shipments of solid waste consisted of waste generated during water treatment, radioactive material generated during normal daily operations and maintenance, and irradiated components. PNPP complied with applicable regulations governing radioactive shipments of solid radioactive waste.

An additional section covers the groundwater monitoring program. It includes a brief history of groundwater tritium issues at the PNPP, and results from current sampling and monitoring activities.

RADIOLOGICAL ENVIRONMENTAL MONITORING

The Radiological Environmental Monitoring Program (REMP) was established in 1981 to monitor the radiological conditions in the environment around PNPP. The REMP is conducted in accordance with PNPP Technical Specifications and the Offsite Dose Calculation Manual (ODCM). This program includes the collection and analysis of environmental samples and evaluation of results.

The REMP was established at PNPP six (6) years before the plant became operational. This pre-operational program was designed to provide data on background radiation and radioactivity normally present in the area. PNPP has continued to monitor the environment during plant operation by collecting and analyzing samples of air, precipitation, milk, fish, produce, water and sediment, as well as by measuring radiation directly. The results of the REMP program indicate adequate control of radioactivity released from PNPP plant effluents. These results also demonstrate that PNPP complies with applicable federal regulations. The REMP results are divided into four sections: atmospheric monitoring, terrestrial monitoring, aquatic monitoring, and direct radiation monitoring.

Air samples were collected to monitor the radioactivity in the atmosphere; the results were similar to those observed for the pre-operational and operational programs from prior years.

Terrestrial monitoring included the analysis of milk and produce; the results indicated concentrations of radioactivity similar to that found in previous years. Analyses of produce samples detected only natural radioactivity similar to those observed in previous years, and indicated no build-up of radioactivity attributable to the operation of PNPP.

Aquatic monitoring included the collection and analyses of water, fish, and shoreline sediments. The analytical results for water and fish samples showed normal background radionuclide concentrations. The results of sediment sample analyses indicated that the annual average cesium radioactivity was similar to previous years for the control location. Cesium-137 activity was detected in eight (8) of the twelve (12) samples collected. The average cesium-137 radioactivity for all locations was 200.0 pCi/kg and is lower than the highest identified value of 864 pCi/kg established in 1981 which was due to atmospheric nuclear weapons testing.

In 1999, a sediment sample of the Northwest Drain Impoundment (sampling location #64) was analyzed to contain 62 pCi/kg of cobalt-60. Enhanced monitoring activities continued within the boundaries of the impoundment through 2012. Cobalt-60 remains within the organic material located at the top of the spillway. Sampling was done in 2013 to verify no new activity is entering the impoundment or migrating to the shoreline Sample analyses continue to identify cobalt-60 and cesium-137 at levels similar to those found in previous years. Refer to Table 20 for sample results.

Direct radiation measurements showed no discernible change from previous years. The indicator locations averaged 58.6 mrem/year and control locations averaged 57.9 mrem/year. In 2013, radiation dose in the area of PNPP was similar to the radiation dose measured at locations greater than ten (10) miles away from the Plant.

Based on these results, during 2013, the operation of the PNPP resulted in no significant increase in the radionuclide concentrations observed in the environment.

LAND USE CENSUS

In order to estimate radiation dose attributable to the operation of PNPP, the potential pathways through which public exposure can occur must be known. To identify these exposure pathways, an Annual Land Use Census is performed as part of the REMP. During the census, PNPP personnel travel public roads within a five (5) mile radius of the plant to locate key radiological exposure pathways. These key pathways include the nearest resident, garden, and milk animal in each of the ten meteorological land sectors that surround the plant. The information obtained from the census is entered into a computer program, which is used to assess the hypothetical dose to members of the public. The predominant land use within the census area continues to be rural and/or agricultural.

CLAM/MUSSEL MONITORING

Clam and mussel shells can clog plant piping and components that use water from Lake Erie. For this reason, sampling for clams and mussels has been conducted in Lake Erie near PNPP since 1971. The monitoring is specifically for Corbicula (Asiatic clams) since their introduction into the Great Lakes in 1981, and for Dreissena (zebra mussels) since their discovery in Lake Erie in 1989. Since no Corbicula have ever been found at PNPP, routine Corbicula monitoring will provide early detection capability if this pest species arrives at PNPP. The Dreissena program includes both monitoring and control and is directed at minimizing the mussel's impact on plant operation. As in past years, this program has successfully prevented Dreissena from causing any significant operational problems at PNPP.

HERBICIDE USE

The use of herbicides on the PNPP site is monitored to ensure compliance with Ohio Environmental Protection Agency (OEPA) requirements and to protect the site's natural areas. Based on the results of on-site herbicide applications and weekly general site inspections, herbicide use has not had a negative impact on the environment around the plant.

SPECIAL REPORTS

Significant environmental events (for example, spills, releases), noncompliance with environmental regulations [e.g., OEPA discharge limits], and changes in plant design or operation that affect the environment are reported to regulatory agencies as they occur.

There was one report submitted in 2013:

- On July 24, 2013, during daily chlorination activities, it was identified that the NPDES permit limit for Total Residual Chlorine was exceeded between 0840 and 0856 hours. The maximum measured value was 0.24 mg/l, which exceeded the NPDES Maximum Concentration limit of 0.2 mg/l.
- On July 24, 2013 at 1621 hours, a "Non-compliance Notification for Exceedance of a Daily Maximum Discharge Limit" was made to the Ohio Environmental Protection Agency.

INTRODUCTION

Nuclear energy provides an alternative energy source, which is readily available and has very limited impact upon the environment. To more fully understand nuclear energy as a source of generating electricity, one must understand basic radiation concepts and its occurrence in nature.

RADIATION FUNDAMENTALS

Atoms are the basic building blocks of all matter. Simply described, atoms are made up of positively and negatively charged particles, and particles which are neutral. These particles are called protons, electrons, and neutrons, respectively. The relatively large protons and neutrons are packed together in the center of the atom called the nucleus. Orbiting around the nucleus are one or more smaller electrons. In an electrically neutral atom, the positively charged protons in the nucleus balance the negatively charged electrons. Due to their dissimilar charges, the protons and electrons have a strong attraction for each other, which helps hold the atom together. Other attractive forces between the protons and neutrons keep the densely packed protons from repelling each other, and preventing the nucleus from breaking apart.

Atoms with the same number of protons in their nuclei make up an element. The number of neutrons in the nuclei of an element may vary. Atoms with the same number of protons but different numbers of neutrons are called isotopes. All isotopes of the same element have the same chemical properties and many are stable or non-radioactive. An unstable or radioactive isotope of an element is called a radioisotope, or radionuclide. Radionuclides contain an excess amount of energy in the nucleus, which is usually due to an excess number of neutrons.

Radioactive atoms attempt to reach a stable, non-radioactive state through a process known as radioactive decay. Radioactive decay is the release of energy from an atom's nucleus through the emission of radiation. Radionuclides vary greatly in the frequency with which their atoms release radiation. The length of time an atom remains radioactive is defined in terms of its half-life. Half-life is defined as the time required for a radioactive substance to lose half its activity through the process of radioactive decay. Half-lives vary from millionths of a second to millions of years.

RADIATION AND RADIOACTIVITY

Radioactive decay is a process in which the nucleus of an unstable atom becomes more stable by spontaneously emitting energy. Radiation refers to the energy that is released when radioactive decay occurs within the nucleus. This section includes a discussion on the three (3) primary forms of radiation produced by radioactive decay.

Alpha Particles

Alpha particles consist of two protons and two neutrons and have a positive charge. Because of their charge and large size, alpha particles do not travel very far when released (less than 4 inches, in air). They are unable to penetrate any solid material, such as paper or skin, to any significant depth. However, if alpha particles are released inside the body,

they can damage the soft internal tissues because they deposit all their energy in a small area.

Beta Particles

Beta particles have the same characteristics as electrons but originate from the nucleus. They are much smaller than alpha particles and travel at nearly the speed of light. Thus they can travel for longer distances than alpha particles. External beta radiation primarily affects the skin. Because of their electrical charge, paper, plastic or thin metals can stop beta particles.

Gamma Rays

Gamma rays are bundles of electromagnetic energy, called photons, which behave as though they were particles. They are similar to visible light, but of a much higher energy. Gamma rays can travel long distances in air and are often released during radioactive decay, along with alpha and beta particles. Potassium-40 is an example of a naturally occurring radionuclide found in all humans that decays by emitting a gamma ray.

Interaction with Matter

When radiation interacts with other materials, it affects the atoms of those materials principally by knocking the negatively charged electrons out of orbit. This causes an atom to lose its electrical neutrality and become positively charged. An atom that is charged, either positively or negatively, is called an ion and the radiation is called ionizing radiation.

UNITS OF MEASURE

Some of the units of measure used in this report require explanation.

Activity

Activity is the number of atoms in a material that decay per unit of time. Each time an atom decays, radiation is emitted. The curie (Ci) is the unit used to describe the activity of a material and indicates the rate at which the atoms are decaying. One curie of activity indicates the decay of 37 billion atoms per second. Smaller units of the curie are often used in this report. Two common units are the microcurie (μCi), one millionth of a curie, and the picocurie (pCi), one trillionth of a curie. The mass, or weight, of radioactive material, which would result in one (1) curie of activity, depends on the disintegration rate. For example, one gram of radium-226 is equivalent to one (1) curie of activity. It would require about 1.5 million grams of natural uranium, however, to equal one (1) curie.

Dose

Biological damage due to alpha, beta, and gamma radiation may result from the ionization caused by these types of radiation. Some types of radiation, especially alpha particles, which causes dense local ionization, can result in much more biological damage for the same energy imparted than does gamma or beta radiation. Therefore, a quality factor must

be applied to account for the different ionizing capabilities of various types of ionizing radiation. When the quality factor is multiplied by the absorbed dose (as measured in rads), the result is the dose equivalent, which is an estimate of the possible biological damage resulting from exposure to any type of ionizing radiation. The dose equivalent is measured in terms of the Roentgen Equivalent Man (rem). When discussing environmental radiation effects, the rem is a large unit. Therefore, a smaller unit, the millirem (mrem) is often used. One mrem is equivalent to 1/1000 of a rem.

LOWER LIMIT OF DETECTION

Sample results are often reported as below the Lower Limit of Detection ( ). The LLD for an analysis is the smallest amount of radioactive material that will show a positive result for which there can be a 95% confidence that radioactivity is present. This statistical parameter is used as a measure of the sensitivity of a sample analysis. When a measurement is reported as less than the LLD (<LLD), it means that no radioactivity was detected. Had radioactivity been present at (or above) the stated LLD value, it statistically would have been detected. The NRC has established LLD values for environmental and effluent sample analyses.

BACKGROUND RADIATION

Background radiation is a part of nature. Natural background radioactive decay occurs in the soil, water, air, and space. Common sources of radiation that contribute to the natural background radiation includes: the decay of radioactive elements in the earth's crust, a steady stream of high-energy particles from space (called cosmic radiation), naturally-occurring radioactive isotopes in the human body like potassium-40, the decay of radioisotopes used in medical procedures, man-made phosphate fertilizers (phosphates and uranium are often found together in nature), fallout from nuclear weapons testing, and even household items like smoke detectors. In the United States, a person's average annual exposure from background radiation is 360 mrem, and is due to the sources shown in Figure 1 [Source: National Council on Radiation Protection and Measurements].

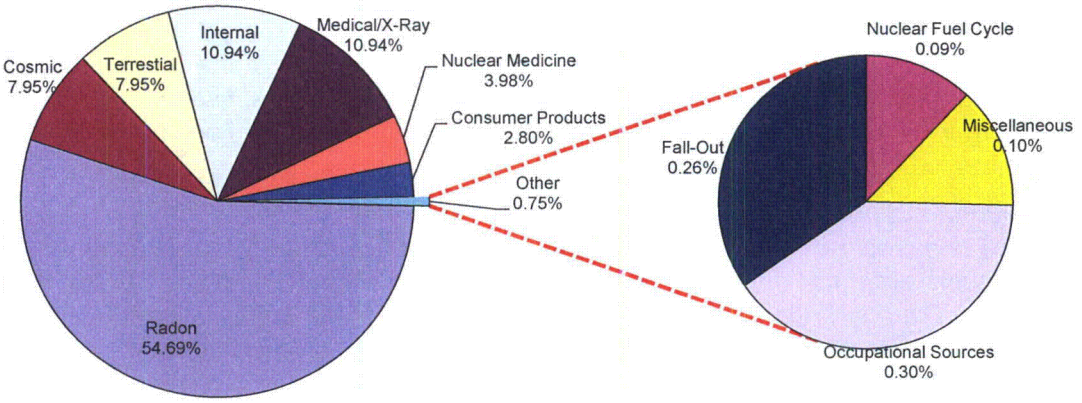


Figure 1: Sources of Background Radiation

Many radionuclides are present in the environment due to sources such as cosmic radiation and fallout from nuclear weapons testing. These radionuclides are expected to be present in many of the environmental samples collected in the vicinity of PNPP. Some of the radionuclides normally present include:

- Beryllium-7, present as a result of the interaction of cosmic radiation with the upper atmosphere,
- Potassium-40, a naturally occurring radionuclide normally found in humans and throughout the environment, and
- Radionuclides from nuclear weapons testing fallout, including tritium and cesium-137. These radionuclides may also be released in minute amounts from nuclear facilities.

Beryllium-7 and potassium-40 are especially common in REMP samples. Since they are naturally occurring and are expected to be present, positive results for these radionuclides are not discussed in the section for the 2013 Sampling Program results. These radionuclides are included; however, in Appendix A, 2013 Inter-Laboratory Cross Check Comparison Program Results.

RADIOACTIVE EFFLUENT RELEASES

INTRODUCTION

The source of radioactive material in a nuclear power plant is the generation of fission products (e.g., noble gas, iodine, and particulate) or neutron activation of water and corrosion products (e.g., tritium and cobalt). The majority of the fission products generated remain within the nuclear fuel pellet and fuel cladding. Most fission products that escape from the fuel cladding, as well as the majority of the activated corrosion products, are removed by plant processing equipment.

During the normal operation of a nuclear power plant, small amounts of radioactive material are released in the form of solids, liquids, and gases. PNPP was designed, and is operated in such a manner as to control and monitor these effluent releases. Effluents are controlled to ensure any radioactivity released to the environment is minimal and within regulatory limits. Effluent release programs include the operation of monitoring systems, in-plant sampling and analysis, quality assurance, and detailed procedures covering all aspects of effluent monitoring.

The liquid and gaseous radioactive waste treatment systems at PNPP are designed to collect and process these wastes in order to remove most of the radioactivity. Effluent monitoring systems are used to provide continuous indication of the radioactivity present and are sensitive enough to measure several orders of magnitude lower than the applicable release limits. This monitoring equipment is equipped with alarms and indicators in the plant control room. The alarms are set to provide warnings to alert plant operators when radioactivity levels reach a small fraction of actual limits. The waste streams are sampled and analyzed to identify and quantify the radionuclides being released to the environment.

Gaseous effluent release data is coupled with on-site meteorological data in order to calculate the dose to the general public. Devices are maintained at various locations around PNPP to constantly sample the air in the surrounding environment. Frequent samples of other environmental media are also taken to determine if any radioactive material deposition has occurred. The Radiological Environmental Monitoring Program (REMP) is described in detail later in this report.

Generation of solid waste is carefully monitored to identify opportunities for minimization. Limiting the amount of material taken into the plant, sorting material as radioactive or non-radioactive waste, and incinerating waste once it is identified help to lower the volume of radioactive solid waste generated. Solid waste is shipped to a licensed burial site.

REGULATORY LIMITS

The Nuclear Regulatory Commission has established limits for liquid and gaseous effluents that comply with:

Title 10 of the Code of Federal Regulations, Part 20 (Standards for Protection Against Radiation) [10CFR20], Appendix B;

Title 10 of the Code of Federal Regulations, Part 50 (Domestic Licensing of Production and Utilization Facilities) [10CFR50], Appendix I; and

Title 40 of the Code of Federal Regulations, Part 190 (Environmental Radiation Protection Standards for Nuclear Power Plants) [40CFR190].

These limits were incorporated into the PNPP Technical Specifications, and subsequently into the PNPP Offsite Dose Calculation Manual (ODCM). The ODCM prescribes the maximum doses and dose rates due to radioactive effluents resulting from the operation of PNPP. These limits are defined in several ways to limit the overall impact on persons living near the plant. Since there are no other fuel sources near the PNPP, the 40CFR190 limits, which are described below, were not exceeded in 2013.

The 40CFR190 limit for whole body dose is 25 mrem. For 2013, the total whole body dose to a member of the general public, considering all sectors, was 2.14E-01 millirems. This value was determined by summing the annual whole body doses from liquid and gaseous radioactive effluents and the annual gaseous Carbon-14 dose. Since the direct radiation dose, as determined by TLD, was indistinguishable from natural background (see Figure 9), it was not included in the calculation.

Liquid Effluents

The concentration of radioactive material released in liquid effluents to unrestricted areas shall be limited to the concentrations specified in 10CFR20, Appendix B, Table 2, Column 2 for radionuclides other than dissolved or entrained noble gases, as required by the ODCM. For dissolved or entrained noble gases, the concentration is limited to a concentration of 2.0E-04 µCi/ml. These values are the maximum effluent concentrations.

The dose or dose commitment to a member of the public from radioactive materials in liquid effluents released to unrestricted areas shall be limited to the following:

During any calendar quarter:

Less than or equal to 1.5 mrem to the whole body, and

Less than or equal to 5 mrem to any organ

During any calendar year:

Less than or equal to 3 mrem to the whole body, and

Less than or equal to 10 mrem to any organ

Gaseous Effluents

The dose rate due to radioactive materials released in gaseous effluents from the site to areas at and beyond the site boundary shall be limited to the following as required by the ODCM:

Noble gases:

Less than or equal to 500 mrem per year to the whole body, and

Less than or equal to 3000 mrem per year to any organ

Iodine-131, Iodine-133, Tritium, and all radionuclides in particulate form with half lives greater than eight days:

Less than or equal to 1500 mrem per year to any organ

Air dose due to noble gases to areas at, and beyond the site boundary, shall be limited to the following:

During any calendar quarter:

Less than or equal to 5 mrad for gamma radiation, and

Less than or equal to 10 mrad for beta radiation

During any calendar year:

Less than or equal to 10 mrad for gamma radiation, and

Less than or equal to 20 mrad for beta radiation

Dose to a member of the public from Iodine-131, Iodine-133, Tritium, and all radionuclides in particulate form with half lives greater than eight days in gaseous effluents released to areas at and beyond the site boundary shall be limited to the following:

Less than or equal to 7.5 mrem to any organ per any calendar quarter, and

Less than or equal to 15 mrem to any organ per any calendar year

The PNPP ODCM does not contain a concentration limit for gaseous effluents. For this reason, effluent concentrations are not used to calculate maximum release rates for gaseous effluents.

RELEASE SUMMARY

Effluents are sampled and analyzed to identify both the type and quantity of radionuclides present. This information is combined with effluent path flow measurements to determine the composition, concentration, and dose contribution of the radioactive effluents.

Liquid Effluents

The PNPP liquid radioactive waste system is designed to collect and treat all radioactive liquid waste produced in the plant. The treatment process used for radioactive liquid waste depends on its physical and chemical properties. It is designed to reduce the concentration of radioactive material in the liquid by filtration to remove suspended solids and demineralization to remove dissolved solids. Normally, the effluent from the liquid radioactive waste system is returned to plant systems. To reduce the volume of water stored in plant systems; however, the processed liquid effluent may be discharged from the plant via a controlled release. In this case, effluent activity and dose calculations are performed prior to, and after discharging this processed water to Lake Erie to ensure regulatory compliance and dose minimization principals are maintained.

Liquid radioactive waste system effluents may be intermittently released, which are considered to be "batch" releases. Table 1 provides information on the number and duration of these releases for 2013.

Table 1: Liquid Batch Releases

	QUARTER 1	QUARTER 2	QUARTER 3	QUARTER 4
Number of batch releases	26	40	26	5
Total time period for batch releases, min	1.28E+04	1.38E+04	7.24E+03	9.20E+02
Maximum time for a batch release, min	3.92E+02	2.69E+02	9.10E+02	2.34E+02
Average time period for a batch release, min	2.46E+02	2.27E+02	2.79E+02	1.84E+02
Minimum time for a batch release, min	6.00E+00	9.00E+00	2.00E+00	1.70E+00
Average stream flow during periods of effluent release into a flowing stream, L/min	1.37E+05	2.13E+05	2.14E+05	1.85E+05

Table 2 provides information on the nuclide composition for the liquid radioactive effluent system releases. If a radionuclide was not present at a level "greater than or equal to the LLD" (≥LLD), then the value is expressed as "less than the LLD" (<LLD). In each case, LLDs were met, or were below the levels required by the ODCM. Table 2a provides information specific to radioactive effluent batch releases and Table 2b provides information specific to continuous radioactive effluent releases.

Table 2: Summation of All Liquid Effluent Releases

	QUARTER 1	QUARTER 2	QUARTER 3	QUARTER 4	EST. TOTAL ERROR, (%)
A. Fission and Activation Products					
1. Total Released, Ci (excluding tritium, gases, alpha)	2.11E-02	7.59E-03	6.32E-02	3.44E-03	1.00E+01
2. Average Diluted Concentration, µCi/mL *	1.48E-09	2.97E-10	2.21E-09	1.74E-10	
3. Percent of Applicable Limit, %	4.22E-02	8.38E-03	6.33E-02	5.52E-03	
B. Tritium					
1. Total Released, Ci	2.11E+01	1.26E+01	3.48E+00	2.23E+00	1.00E+01
2. Average Diluted Concentration, µCi/mL	1.48E-06	4.94E-07	1.22E-07	1.13E-07	
3. Percent of Applicable Limit, %	2.74E-02	1.54E-02	4.02E-02	1.47E-02	
C. Dissolved and Entrained Gases					
1. Total Released, Ci	2.33E-03	<LLD	<LLD	<LLD	1.00E+01
2. Average Diluted Concentration, µCi/mL	1.63E-10	<LLD	<LLD	<LLD	
3. Percent of Applicable Limit, %	8.16E-05	0.00E+00	0.00E+00	0.00E+00	
D. Gross Alpha Activity, Ci	<LLD	<LLD	<LLD	<LLD	1.00E+01
E. Waste Volume Released, Liters (prior to dilution)	3.77E+06	5.80E+06	5.79E+06	1.17E+06	
F. Dilution Water Volume Used, Liters	1.43E+10	2.55E+10	2.86E+10	1.97E+10	

<LLD – Less than the lower limit of detection
**Average diluted concentrations are based on total volume of water released during quarter.*

Table 2a: Summation of Batch Liquid Effluent Releases

	QUARTER 1	QUARTER 2	QUARTER 3	QUARTER 4	EST. TOTAL ERROR, (%)
A. Fission and Activation Products					
Total Released, Ci (excluding tritium, gases, alpha)	2.09E-02	7.44E-03	6.30E-02	3.38E-03	1.00E+01
B. Tritium					
Total Released, Ci	2.05E+01	1.26E+01	3.48E+00	1.39E+00	1.00E+01
C. Dissolved and Entrained Gases					
Total Released, Ci	2.31E-03	<LLD	<LLD	<LLD	1.00E+01
D. Gross Alpha Activity, Ci	<LLD	<LLD	<LLD	<LLD	1.00E+01
E. Waste Volume Released, Liters (prior to dilution)	3.36E+06	5.11E+06	5.39E+06	5.22E+05	NA

<LLD – Less than the lower limit of detection

Table 2b: Summation of Continuous Liquid Effluent Releases

	QUARTER 1	QUARTER 2	QUARTER 3	QUARTER 4	EST. TOTAL ERROR, (%)
A. Fission and Activation Products					
Total Released, Ci (excluding tritium, gases, alpha)	1.28E-04	1.44E-04	1.18E-04	6.09E-05	1.00E+01
B. Tritium					
Total Released, Ci	6.12E-01	3.71E-03	2.07E-03	8.35E-01	1.00E+01
C. Dissolved and Entrained Gases					
Total Released, Ci	<LLD	<LLD	<LLD	<LLD	1.00E+01
D. Gross Alpha Activity, Ci	<LLD	<LLD	<LLD	<LLD	1.00E+01
E. Waste Volume Released, Liters (prior to dilution)	4.10E+05	6.85E+05	3.95E+05	6.45E+05	NA

<LLD – Less than the lower limit of detection

Table 3 lists the total number of curies (Ci) of each radionuclide present in liquid effluent releases for each quarter. If a radionuclide was not present at a level "greater than or equal to the LLD" (≥LLD), then the value is expressed as "less than the LLD" (<LLD). In each case, the LLDs were either met, or were below the levels required by the ODCM.

Table 3: Radioactive Liquid Effluent Nuclide Composition

	UNITS	QUARTER 1	QUARTER 2	QUARTER 3	QUARTER 4	ANNUAL
Tritium	Ci	2.11E+01	1.26E+01	3.48E+00	2.23E+00	3.94E+01
Sodium-24	Ci	3.47E-05	<LLD	4.09E-06	<LLD	3.88E-05
Chromium-51	Ci	6.09E-03	1.39E-04	1.24E-03	<LLD	7.47E-03
Manganese-54	Ci	1.38E-03	9.22E-04	5.90E-03	2.50E-04	8.45E-03
Manganese-56	Ci	7.80E-07	<LLD	1.71E-07	<LLD	9.51E-07
Iron-55	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Iron-59	Ci	1.79E-04	8.47E-05	1.17E-04	<LLD	3.81E-04
Cobalt-58	Ci	3.11E-04	1.61E-04	3.64E-04	<LLD	8.37E-04
Cobalt-60	Ci	9.12E-03	6.04E-03	5.19E-02	3.06E-03	7.01E-02
Zinc-65	Ci	<LLD	<LLD	6.61E-04	7.72E-06	6.69E-04
Zinc-69M	Ci	4.94E-08	<LLD	<LLD	<LLD	4.94E-08
Strontium-89	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Strontium-90	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Strontium-92	Ci	<LLD	<LLD	4.36E-04	1.85E-06	4.38E-04
Niobium-95	Ci	3.91E-04	<LLD	<LLD	<LLD	3.91E-04
Molybdenum-99	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Silver-110m	Ci	9.88E-04	1.91E-04	2.52E-03	8.40E-05	3.78E-03
Iodine-131	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cesium-134	Ci	1.40E-03	<LLD	8.20E-07	1.56E-05	1.42E-03
Cesium-137	Ci	1.16E-03	4.38E-05	4.26E-06	2.70E-05	1.24E-03
Cerium-141	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cerium-144	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Krypton-88	Ci	2.32E-05	<LLD	<LLD	<LLD	2.32E-05
Xenon-133	Ci	2.27E-03	<LLD	<LLD	<LLD	2.27E-03
Xenon-135	Ci	3.81E-05	<LLD	<LLD	<LLD	3.81E-05
Gross Alpha	Ci	<LLD	<LLD	<LLD	<LLD	<LLD

<LLD – Less than the lower limit of detection

Gaseous Effluents

Gaseous effluents are made up of fission and activation gases, iodine and particulate releases. Gaseous effluents from PNPP exit the plant via one of four effluent vents. Each of these four effluent vents contains radiation detectors that continuously monitor the air to ensure that the levels of radioactivity released are below regulatory limits. Samples are also collected and analyzed on a periodic basis to ensure regulatory compliance and dose minimization principals are maintained. Gaseous effluents released from PNPP are considered continuous and at ground level.

PNPP has increased the volume of air captured when sampling for tritium in gaseous effluents. This has increased the detection capability (LLD) by a factor of 20 (greater than is required per NRC guidance). Gaseous effluent tritium releases are now being detected where before they were too dilute to measure. This has resulted in a reported increase in tritium released over previous years. PNPP remains in the bottom quartile for Boiling Water Reactors (lowest quantity) for gaseous tritium released.

A summation of all gaseous radioactive effluent releases is given in Table 4. If a radionuclide was not present at a level "greater than or equal to the LLD" (≥LLD), then the value is expressed as "less than the LLD" (<LLD). In each case, the measured LLDs either met or were below the levels required by the PNPP ODCM.

Table 4: Summation of All Gaseous Effluents

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Est. Total Error, %
A. Fission and Activation Products					
1. Total Released, Ci	6.87E+01	5.01E+00	2.40E+00	0.00E+00	1.00E+01
2. Average Release Rate, µCi/sec	8.83E+00	6.37E-01	3.02E-01	0.00E+00	
3. Percent of Applicable Limit, %	N/A	N/A	N/A	N/A	
B. Iodine					
1. Total Iodine-131 Released, Ci	2.81E-04	4.46E-05	2.32E-05	0.00E+00	1.00E+01
2. Average Release Rate, µCi/sec	3.61E-05	5.67E-06	2.91E-06	0.00E+00	
3. Percent of Applicable Limit, %	N/A	N/A	N/A	N/A	
C. Particulates with Half-Lives > 8 days					
1. Total Released, Ci	5.00E-07	0.00E+00	0.00E+00	0.00E+00	1.00E+01
2. Average Release Rate, µCi/sec	6.43E-08	0.00E+00	0.00E+00	0.00E+00	
3. Percent of Applicable Limit, %	N/A	N/A	N/A	N/A	
D. Alpha Activity, Ci	1.72E-06	8.36E-07	N/A	N/A	1.00E+01
E. Tritium					
1. Total Released, Ci	2.07E+00	1.36E+00	2.43E+00	2.44E+00	1.00E+01
2. Average Release Rate, µCi/sec	2.66E-01	1.73E-01	3.06E-01	3.07E-01	
3. Percent of Applicable Limit, %	N/A	N/A	N/A	N/A	
F. Carbon-14, Ci	3.46E+00	1.83E+00	4.53E+00	4.75E+00	1.00E+01

<LLD – Less than the lower limit of detection N/A – Not Applicable, the ODCM does not have a limit for fission and activation products.

The radionuclide composition of all gaseous radioactive effluents for a continuous-mode, ground-level release is given in Table 5. If a radionuclide was not present at a level "greater than or equal to the LLD" (≥LLD), then the value is expressed as "less than the LLD" (<LLD). In each case, LLDs were met or were below the levels required by the ODCM.

Discussion of Carbon-14 doses is listed on page 22, Carbon-14 supplemental information.

Table 5: Radioactive Gaseous Effluent Nuclide Composition

	UNIT	QUARTER 1	QUARTER 2	QUARTER 3	QUARTER 4	ANNUAL
A. FISSION AND ACTIVATION PRODUCTS						
Tritium	Ci	2.07E+00	1.36E+00	2.43E+00	2.44E+00	8.30E+00
Argon-41	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Krypton-85m	Ci	1.42E+00	5.44E-01	7.72E-03	<LLD	1.97E+00
Krypton-85	Ci	4.95E-02	<LLD	<LLD	<LLD	4.95E-02
Krypton-87	Ci	6.30E-01	5.22E-01	<LLD	<LLD	1.15E+00
Krypton-88	Ci	1.97E+00	5.37E-01	<LLD	<LLD	2.51E+00
Xenon-131m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xenon-133m	Ci	7.30E-01	4.20E-02	2.06E-02	<LLD	7.93E-01
Xenon-133	Ci	4.10E+01	2.37E+00	2.16E+00	<LLD	4.55E+01
Xenon-135m	Ci	3.98E+00	8.04E-02	9.26E-03	<LLD	4.07E+00
Xenon-135	Ci	1.81E+01	5.45E-01	1.77E-01	<LLD	1.88E+01
Xenon-137	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xenon-138	Ci	6.99E-01	3.66E-01	2.60E-02	<LLD	1.09E+00
Total for Period		**7.07E+01**	**6.37E+00**	**4.83E+00**	**2.44E+00**	**8.43E+01**
B. IODINE						
Iodine-131	Ci	2.81E-04	4.46E-05	2.32E-05	<LLD	3.49E-04
Iodine-132	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Iodine-133	Ci	4.88E-04	<LLD	3.34E-05	<LLD	5.21E-04
Iodine-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Iodine-135	Ci	3.47E-04	<LLD	<LLD	<LLD	3.47E-04
Total for Period		**1.12E-03**	**4.46E-05**	**5.65E-05**	**0.00E+00**	**1.22E-03**
C. PARTICULATE						
Chromium-51	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Manganese-54	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Iron-59	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cobalt-58	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cobalt-60	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Zinc-65	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Strontium-89	Ci	5.00E-07	<LLD	<LLD	<LLD	5.00E-07
Strontium-90	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Strontium-92	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Zirconium-95	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Molybdenum-99	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cesium-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cesium-137	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cerium-141	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cerium-144	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Total for Period		**5.00E-07**	<LLD	<LLD	<LLD	**5.00E-07**

<LLD – Less than the lower limit of detection

Solid Waste

All solid radioactive waste from PNPP was processed and combined with waste from several other utilities by intermediate vendors (Energy Solutions, Duratek in Oak Ridge, TN and Studsvik, in Erwin, TN). This waste was ultimately sent to Clive, Utah disposal facilities for burial. The solid radioactive waste summary in Table 6 includes all PNPP shipments for 2013.

Table 6: Solid Waste Shipped Offsite for Burial or Disposal

A. Type of Solid Waste Shipped	Volume (M^3)	Activity (Ci)	Est. Total Error (%)
Resins, Filters and Evaporator Bottoms	1.70E+03	5.77E+02	+/- 25
Dry Active Waste	6.73E+04	1.15E+00	+/- 25
Irradiated components, control rods, etc.	0.00E+00	0.00E+00	+/- 25
Other Waste	0.00E+00	0.00E+00	+/- 25

B. Estimate of Major(1) Nuclide Composition (by type of waste)	Radionuclide	Abundance (%)	Est. Total Error, (%)
Resins, Filters and Evaporator Bottoms	Co-60	68.74	+/- 25
	Fe-55	13.48	
	Mn-54	6.03	
	Zn-65	5.77	
	Sr-89	1.56	
	Co-58	1.52	
	Nb-95	1.08	
Dry Active Waste	Co-60	68.74	+/- 25
	Fe-55	13.48	
	Mn-54	6.03	
	Zn-65	5.77	
	Sr-89	1.56	
	Co-58	1.52	
	Nb-95	1.08	
Irradiated Components, Control Rods, etc.	N/A	N/A	N/A
Other Waste	N/A	N/A	N/A

C. Disposition	Number of Shipments	Mode of Transportation	Destination
Solid Waste(2)	38	Hittman Transport	Energy Solutions, Bear Creek, TN
Solid Waste(2)	16	Hittman Transport	Studsvik, Erwin, TN

N/A – Not Applicable

(1) – "Major" is defined as any individual radionuclide identified as >1% of the waste type abundance.

(2) – This waste was combined with waste from other utilities and disposed of at Clive, Utah.

METEOROLOGICAL DATA

The Meteorological Monitoring System at PNPP consists of a 60-meter tower equipped with two independent systems for measuring wind speed, wind direction, and temperature at both 10-meter and 60-meter heights. The tower also has instrumentation to measure dew point and barometric pressure. Data is logged from the tower through separate data loggers, and transmitted to a common plant computer. This system compiles the data and calculates a variety of atmospheric parameters, communicates with the Meteorological Information Dose Assessment System (MIDAS), and sends data over communication links to the plant Control Room.

A detailed report of the monthly and annual operation of the PNPP Meteorological Monitoring Program is produced under separate cover. For the period of January 1, 2013 through December 31, 2013, the report substantiates the quality and quantity of meteorological data collected in accordance with applicable regulatory guidance.

DOSE ASSESSMENT

The maximum concentration for any radioactive release is controlled by the limits set forth in Title 10 of the Code of Federal Regulations, Part 20 (10CFR20). Sampling, analyzing, processing, and monitoring the effluent stream ensures compliance with these concentration limits. Dose limit compliance is verified through periodic dose assessment calculations. Some dose calculations are conservatively performed for a hypothetical individual who is assumed to reside on the site boundary at the highest potential dose location all year. This person, called the "maximum individual", would incur the maximum potential dose from direct exposure (air plus ground plus water), inhalation, and ingestion of water, milk, vegetation, and fish. Because no one actually meets these criteria, the actual dose received by a real member of the public is significantly less than what is calculated for this hypothetical individual.

Dose calculations for this maximum individual at the site boundary are performed for two cases. First, they are performed using data for a 360° radius around the plant site (land and water based meteorological sectors); even though some of these sectors are over Lake Erie, which has no permanent residents. The second calculation is performed considering only those sectors around the plant in which people reside (land-based meteorological sectors).

The calculated hypothetical, maximum individual dose values at the site boundary are provided in Table 7. This table considers all meteorological sectors around PNPP and provides either the whole body or worst-case, organ dose values. If any radionuclide was not present at a level greater than the LLD, it was not used in the dose calculations.

Table 7: Maximum Individual Site Boundary Dose, Considering All Sectors

TYPE OF DOSE	ORGAN	ESTIMATED DOSE, (MREM)	LIMIT	% OF LIMIT
Liquid Effluent	Whole body	7.13E-03	3.0E+00	2.4E-01
	Liver	1.11E-02	1.0E+01	1.1E-01
Noble Gas	Air Dose Gamma – mrad	2.70E-02	1.0E+01	2.7E-01
	Air Dose Beta – mrad	2.64E-02	2.0E+01	1.3E-01
Noble Gas	Whole body	1.59E-02	5.0E+00	3.2E-01
	Skin	3.37E-02	1.5E+01	2.2E-01
Particulate & Iodine	Thyroid	4.43E-03	1.5E+01	3.0E-02

The calculated hypothetical, maximum 50-mile radius population dose values at the site boundary are provided in Table 8. This table considers all meteorological sectors around PNPP and provides either the whole body or worst-case, organ dose values.

Table 8: Population Dose, Considering All Sectors

	ORGAN	ESTIMATED DOSE (PERSON-REM)
Liquid Effluent	Whole body	1.3E+00
	Thyroid	2.6E-01
Gaseous Effluent	Whole body	3.7E-03
	Thyroid	4.2E-03

Table 9 provides the calculated hypothetical maximum site boundary dose values considering only the land-based sectors. If any radionuclide was not present at a level greater than the LLD, it was not used in the dose calculations.

Table 9: Maximum Individual Site Boundary Dose, Considering Sectors on Land

TYPE OF DOSE	ORGAN	ESTIMATED DOSE, (MREM)	LIMIT	% OF LIMIT
Liquid Effluent	Whole Body	7.13E-03	3.0E+00	2.4E-01
	Liver	1.11E-02	1.0E+01	1.1E-01
Noble Gas	Air Dose Gamma – mrad	1.78E-02	1.0E+01	1.8E-01
	Air Dose Beta – mrad	1.74E-02	2.0E+01	8.7E-02
Noble Gas	Whole Body	3.70E-03	5.0E+00	7.4E-02
	Skin	8.17E-03	1.5E+01	5.4E-02
Particulate & Iodine	Thyroid	7.48E-04	1.5E+01	5.0E-03
Carbon-14 *	Whole Body	2.14E-01	5.0E+00	4.3E+00

*C-14 Dose calculated at nearest garden.

Other dose calculations are performed for a hypothetical individual who is assumed to be inside the site boundary for some specified amount of time. This person would receive the maximum dose during the time spent inside site boundary. Because no one actually meets the criteria established for these conservative calculations, the actual dose received by a member of the public is significantly less than what is calculated for this hypothetical individual. This dose is assessed relative to the offsite dose, and considers dilution, dispersion, and occupancy factors.

The highest hypothetical dose from liquid effluents to a member of the public inside the site boundary is to a person who is fishing on Lake Erie from the shore on PNPP property. The calculations assume that this person will spend 60 hours per year fishing, with a liquid dilution factor of 10. The ratio of the exposure pathway to the doses calculated for offsite locations yields the dose values shown in Table 10.

Table 10: Maximum Site Dose from Liquid Effluents

	WHOLE BODY DOSE, (MREM)	ORGAN DOSE (MREM)
First Quarter	3.1E-04	3.6E-04
Second Quarter	2.1E-04	2.5E-04
Third Quarter	2.6E-03	3.1E-03
Fourth Quarter	1.6E-04	1.9E-04
Annual	3.3E-03	3.9E-03

Although several cases were evaluated to determine the highest hypothetical dose from gaseous effluents to members of the public inside site boundary, the activity inside the site boundary with the highest dose potential is also shoreline fishing. The cases evaluated included traversing a public road within the site boundary, shoreline fishing (assuming fishing 60 hours per year), non-plant related training, car-pooling, and job interviews. The maximum on-site gaseous doses generated are shown in Table 11.

Table 11: Maximum Site Dose from Gaseous Effluents

	WHOLE BODY DOSE, (MREM)	ORGAN DOSE (MREM)
First Quarter	1.8E-03	3.6E-03
Second Quarter	2.0E-04	4.2E-04
Third Quarter	1.6E-04	2.5E-04
Fourth Quarter	1.3E-04	1.3E-04
Annual	2.1E-03	4.1E-03

An average whole body dose to individual members of the public at or beyond the site boundary is then determined by combining the dose from gaseous and liquid radiological effluents. The dose from gaseous radiological effluents is based upon the population that lives within 50 miles of PNPP. The dose from liquid radiological effluents is determined for the population that receives drinking water from intakes within 50 miles of PNPP. The results of this calculation are provided in Table 12.

Table 12: Average Individual Whole Body Dose

	LIQUID EFFLUENTS (MREM)	GASEOUS EFFLUENTS (MREM)
First Quarter	4.0E-04	1.1E-06
Second Quarter	2.7E-05	1.8E-07
Third Quarter	8.8E-05	1.8E-07
Fourth Quarter	2.8E-05	7.1E-08
Annual	5.4E-04	1.5E-06

CARBON-14 SUPPLEMENTAL INFORMATION

Carbon-14 (C-14), with a half-life of 5730 years, is a naturally occurring isotope of carbon produced by cosmic ray interactions in the atmosphere. Nuclear weapons testing in the 1950s and 1960s significantly increased the amount of C-14 in the atmosphere. C-14 is also produced in commercial nuclear reactors, but the amounts produced are much less than those produced naturally or from weapons testing. C-14 is released primarily from BWRs through the off-gas system in the form of carbon dioxide (CO_2). The quantity of gaseous C-14 released to the environment can be estimated using a C-14 source term scaling factor based on power generation.

The U.S. Nuclear Regulatory Commission (NRC) requires an assessment of gaseous C-14 dose impact to a member of the public resulting from routine releases in radiological effluents. Prior to 2011, the industry did not estimate the dose impact of C-14 releases. Since the dose contribution had been considered negligible compared to the dose impact from effluent releases of noble gases, tritium, particulates and radioiodines. At PNPP, improvements over the years in effluent management practices and fuel performance have resulted in a decrease in the concentration and changes in the distribution of gaseous radionuclides released to the environment.

This report contains estimates of the gaseous C-14 radioactivity released in 2013 and the resulting public dose resulting from this release. Because the dose contribution of C-14 from liquid radioactive waste is much less than that contributed by gaseous radioactive waste, evaluation of C-14 in liquid radioactive waste at PNPP is not required. Refer to Table 4 and Table 9 for C-14 estimated release values and doses.

UNDERDRAIN SYSTEM

Introduction

History

In March, 2006, a routine sample of the underdrain system at the PNPP plant showed detectable tritium concentrations. The underdrains are a porous pipe system which drains groundwater from the foundations of the site buildings. As such, it would not be expected to be a contaminated system. Condition Report 06-01477 was submitted and a Root Cause Investigation was conducted. Concurrently, a program of groundwater monitoring was initiated.

It was determined at that time that there was no detectable tritium beyond the boundaries of the underdrain system. Piezometer tubes located both inside and outside of the power block, (i.e., area encompassing equipment used for the generation of electricity) were sampled and analyzed. In 2007, PNPP contracted with Environmental Resource Management (ERM) of Boston, Massachusetts to perform site hydrogeology evaluations, and to facilitate installation of additional groundwater monitoring wells, based on their findings. FirstEnergy fleet chemistry formalized the program with the issuance of fleet procedure NOP-OP-2012, "Groundwater Monitoring."

Cause

The buildings at the PNPP site are designed with seismic spaces between building walls. These would serve to drain plant buildings in the event of an earthquake of sufficient strength to break plant piping, minimizing the flooding of vital equipment areas, and facilitate continued safe operation, or safe shutdown, as conditions warrant.

It was determined that these "rattle spaces" allow the drainage from some plant systems to reach the outside. Since this discovery, the plant has developed a more rigorous stance towards plant observations, and has minimized process water intrusion into the rattle spaces.

It should be noted that no leakage was identified from either the radwaste system, or from the Fuel Handling Building.

Underdrain System

As mentioned earlier, the underdrain system drains water away from plant foundations. It is separate and distinct from the storm drain system, which is designed purely for rain water control. The underdrain system has a number of installed sump pumps, with the ability to gravity-drain and cascade forward should the pumps fail. There are two major branches of underdrains, one for each of the east and west sides of the power block. These branches ultimately flow into 2 underdrain manholes, designated MH-20 and MH-23, before draining to the suction bay of the Emergency Service Water (ESW) pump house. From there, the water is discharged from the plant. Refer to Figure 2 for locations of Manholes 1 through 27.

Sampling Locations

Prior to the installation of monitoring wells, Manholes 20 and 23 were sampled to assess groundwater tritium in-leakage to the system. These manholes were sampled daily through the middle of 2007, and weekly thereafter through the end of the year. Besides tritium, the

samples were also analyzed via gamma spectroscopy to environmental lower limits of detection. No gamma activity was ever detected in any sample.

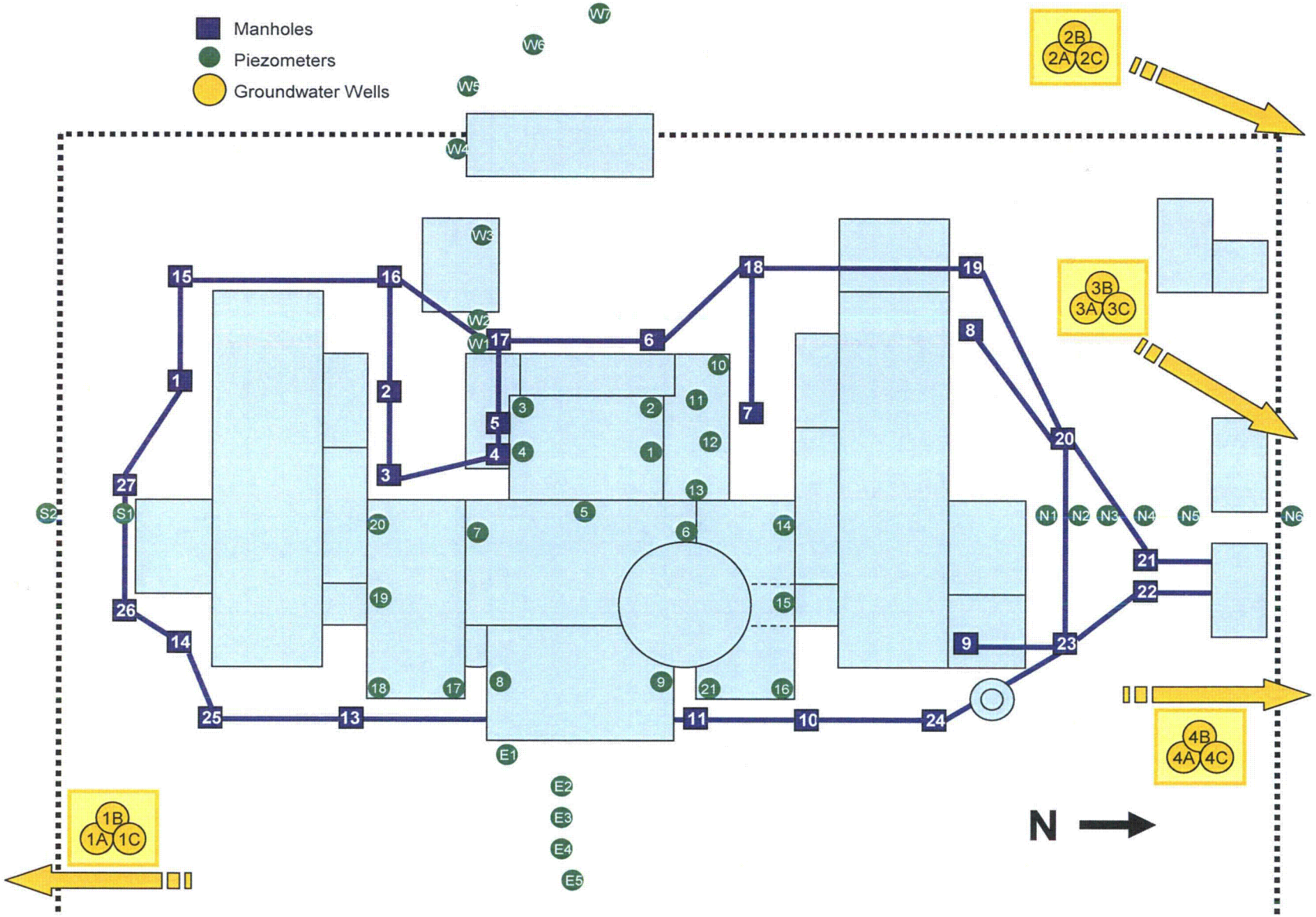
Tritium releases from the station were documented as abnormal releases, and the required dose calculations were completed per the Offsite Dose Calculation Manual (ODCM). Overall, the released tritium represented a very small fraction of the limits prescribed in 10CFR20 Appendix B and 10CFR50.

GROUNDWATER MONITORING PROGRAM

Based on the ERM hydrogeology study, 12 wells were recommended for the site. Since most groundwater flow was anticipated to drain north, towards Lake Erie, the majority of wells are drilled there. A set of control wells was drilled in a more southerly direction, to assess what a typical groundwater profile would be.

There are 4 sets of triplet wells installed at each location. Each triplet has a shallow well (approximately 25 feet), a mid-depth well of approximately 50 feet, and a deep well of approximately 75 feet. These 3 depths are designated A, B and C, from shallowest to deepest, respectively. Refer to Figure 2 for locations of Groundwater wells 1A through 4C. These wells encompass the groundwater monitoring locations at PNPP.

Figure 2: Underdrain System and On-Site Groundwater Wells



State of the Program

Currently, the monitoring wells are sampled twice annually, in spring and fall. The sampling is done under a controlled protocol, and is conducted by personnel from FirstEnergy's BETA Laboratories. The samples are shipped to Midwest Laboratories in Illinois. Midwest analyzes the sample for gamma isotopic and tritium. Any positive result less than 500 pCi/L would be considered as background activity. There was no indication of any releases via groundwater.

Table 13: Summary of Onsite Groundwater Samples

Monitoring Well	H-3 (pCi/L)	Required H-3 LLD (pCi/L)	NEI and FENOC Level for H-3 (pCi/L)	EPA Reporting Level for H-3 (pCi/L)
Spring 2013				
Well 1A	<LLD	< 2000	2000	20000
Well 1B	<LLD	< 2000	2000	20000
Well 1C	<LLD	< 2000	2000	20000
Well 2A	<LLD	< 2000	2000	20000
Well 2B	<LLD	< 2000	2000	20000
Well 2C	<LLD	< 2000	2000	20000
Well 3A	<LLD	< 2000	2000	20000
Well 3B	<LLD	< 2000	2000	20000
Well 3C	<LLD	< 2000	2000	20000
Well 4A	155	< 2000	2000	20000
Well 4B	<LLD	< 2000	2000	20000
Well 4C	<LLD	< 2000	2000	20000
Fall 2013				
Well 1A	<LLD	< 2000	2000	20000
Well 1B	<LLD	< 2000	2000	20000
Well 1C	<LLD	< 2000	2000	20000
Well 2A	<LLD	< 2000	2000	20000
Well 2B	<LLD	< 2000	2000	20000
Well 2C	<LLD	< 2000	2000	20000
Well 3A	184	< 2000	2000	20000
Well 3B	<LLD	< 2000	2000	20000
Well 3C	<LLD	< 2000	2000	20000
Well 4A	250	< 2000	2000	20000
Well 4B	<LLD	< 2000	2000	20000
Well 4C	<LLD	< 2000	2000	20000

CORRECTIONS TO PREVIOUS ANNUAL ENVIRONMENTAL AND EFFLUENT RELEASE REPORTS

See Appendix D for description of corrections to previous Annual Environmental and Effluent Release Reports.

ABNORMAL RELEASES

See Appendix E for description of an Abnormal Release from the Nuclear Closed Cooling (NCC) system.

ODCM NON-COMPLIANCES

See Appendix F for description of ODCM Non-Compliances.

OFFSITE DOSE CALCULATION MANUAL CHANGES

During this reporting period, ODCM revision number 20 was made effective on 3/13/13. Summary of changes:

1. Added potential release pathway due to leakage from the new ADHR system to Section 2.2, Continuous Release.
2. Modified description of releases from M35 Drains.
3. Clarified formulas in Section 2.2 used for determining ESW and Service Water (ADHR) alarm setpoints.
4. Corrected conversion factor typographical error in Section 3.1.4.
5. Deleted duplicate tables 5.1-1, 5.1-2 and 5.1-3.
6. Removed references to Tables 5.1-1 and 5.1-3 from Section 5.1. Section now refers to Tables 3.12.1-1 and 4.12.1-1.
7. Added milk as a sample media for location 18 on Table 5.1.1, ODCM REMP Sample Locations.
8. Added Service Water Radiation Monitor (ADHR) to Table 3.3.7.9-1, Radioactive Liquid Effluent Monitoring Instrumentation.
9. Added Service Water Radiation Monitor (ADHR) to Table 4.3.7.9-1, Radioactive Liquid Effluent Monitoring Instrumentation Surveillance Requirements.
10. Added footnote to Table 4.3.7.9-1 to state that the surveillance requirements for the Service Water (ADHR) are in effect only when the system is in service.
11. Added Service Water to Table 4.11.1.1.1-1, Radioactive Liquid Waste Sampling and Analysis Program.
12. Added table notation "h" to Table 4.11.1.1.1-1, Radioactive Liquid Waste Sampling and Analysis Program.
13. Modified Table 3.12.1-1, Radiological Environmental Monitoring Program. Table now requires two or more samples of commercially and/or recreationally important species of fish to be collected.

PROCESS CONTROL PROGRAM CHANGES

See Appendix G for description of changes to the Process Control Program

RADIOLOGICAL ENVIRONMENTAL MONITORING

INTRODUCTION

The Radiological Environmental Monitoring Program (REMP) was established at PNPP for several reasons. First, it verifies the adequacy of plant design and operation to control radioactive materials and limit effluent releases. Second, it assesses the radiological impact, if any, that the plant has had on the surrounding environment. Third, it ensures compliance with regulatory guidelines. The REMP is conducted in accordance with the PNPP Operating License, Appendix B, Technical Specifications and the ODCM. The Nuclear Regulatory Commission (NRC) established the REMP requirements.

A variety of samples are collected as part of the PNPP REMP. The selection of sample types, locations, and collection frequency are based on many things. Potential pathways for the transfer of radionuclides through the environment to humans, sample availability, local meteorology, population characteristics, land use and NRC requirements are all factors.

To ensure that the REMP data are meaningful and useful, detailed sampling methods and procedures are followed. This ensures that samples are collected in the same manner and from the same locations each time. All samples are packaged on site, and then shipped to an independent vendor laboratory for analysis. The vendor laboratory analyzes the samples and reports results to the PNPP Chemistry Unit staff, the Lake County General Health District, and the State of Ohio Department of Health. Additionally the Lake County General Health District obtains monthly "split" samples of milk, water and vegetation. This permits an independent verification of PNPP's radiological environmental monitoring program.

SAMPLING LOCATIONS

REMP samples are collected at numerous locations, both on site and up to 22 miles away from the plant. Sampling locations are divided into two general categories: indicator and control. Indicator locations are those that monitor for any environmental impact due to plant operations. They are relatively close to the plant. Control locations are those that are unaffected by plant operation; they are a greater distance from the plant and in the least prevalent wind directions. Data obtained from the indicator locations are compared with data from the control locations. This comparison allows naturally occurring background radiation to be taken into account when evaluating any radiological impact PNPP may have had on the environment. Table 14, Figure 3, Figure 4 and Figure 5 identify the PNPP REMP sampling locations.

Many REMP samples are collected in addition to those required by the PNPP ODCM. The ODCM requirements for each sample type are discussed in more detail later in the report. Sample types and locations required by the ODCM are shown in **Bold** in Table 14.

Table 14: REMP Sampling Locations (1)

LOCATION #	DESCRIPTION	MILES	DIRECTION	MEDIA(2)
1	Chapel Road	3.4	ENE	TLD, AIP
2	Kanda Garden	1.9	ENE	Food Products
3	Meteorological Tower	1.0	SE	TLD, AIP
4	Site Boundary	0.7	S	TLD, AIP
5	Quincy Substation	0.6	SW	TLD, AIP
6	Concord Service Center	11.0	SSW	TLD, AIP
7	Site Boundary	0.6	NE	TLD, AIP
8	Site Boundary	0.8	E	TLD
9	Site Boundary	0.7	ESE	TLD
10	Site Boundary	0.8	SSE	TLD
11	Parmly Rd.	0.6	SSW	TLD
12	Site Boundary	0.6	WSW	TLD
13	Madison-on-the-Lake	4.7	ENE	TLD
14	Hubbard Rd.	4.9	E	TLD
15	Eagle St. Substation	5.1	ESE	TLD
16	Eubank Garden	0.9	S	Food Products
18	Kijauskas Farm (goat)	2.5	E	Food Products, Milk
19	Goodfield Dairy	8.7	S	Milk
20	Rainbow Farms	1.9	E	Food Products
21	Hardy Rd.	5.1	WSW	TLD
23	High St. Substation	7.9	WSW	TLD
24	St. Clair Ave.	15.1	SW	TLD
25	Offshore - PNPP discharge	0.6	NNW	Sediment, Fish
26	Offshore - Redbird	4.2	ENE	Sediment
27	Offshore - Fairport Harbor	7.9	WSW	Sediment
28	CEI Ashtabula Plant Intake	22.0	ENE	Water
29	River Rd.	4.3	SSE	TLD
30	Lane Rd.	4.8	SSW	TLD
31	Wood and River Rd.	4.8	SE	TLD
32	Offshore - Mentor	15.8	WSW	Sediment, Fish
33	River Rd.	4.5	S	TLD
34	PNPP Intake	0.7	NW	Water
35	Site Boundary	0.6	E	TLD, AIP
36	Lake County Water Plant	3.9	WSW	TLD, Water
37	Gerlica Farm	1.5	ENE	Food Products
41	Tuttle Farm (goat)	5.8	SSE	Milk
51	Rettger Milk Farm (cow)	9.6	S	Milk
53	Great Lakes Nuclear Services	0.5	WSW	TLD
54	Hale Rd. School	4.6	SW	TLD
55	Center Rd.	2.5	S	TLD
56	Madison High School	4.0	ESE	TLD
58	Antioch Rd.	0.8	ENE	TLD
59	Lake Shoreline at Green Rd.	4.0	ENE	Water
60	Lake Shoreline at Perry Park	1.0	WSW	Water
64	Northwest Drain Mouth	0.09	NW	Sediment
65	Major Stream Mouth	0.18	W	Sediment
70	H&H Farm Stand	16.2	SSW	Food Products

(1) Missing location numbers denote deleted or retired sampling locations.

(2) AIP = Air, Iodine and Particulate
TLD = Thermoluminescent Dosimeter

Figure 3: REMP Sampling Locations Within Two Miles of Plant Site

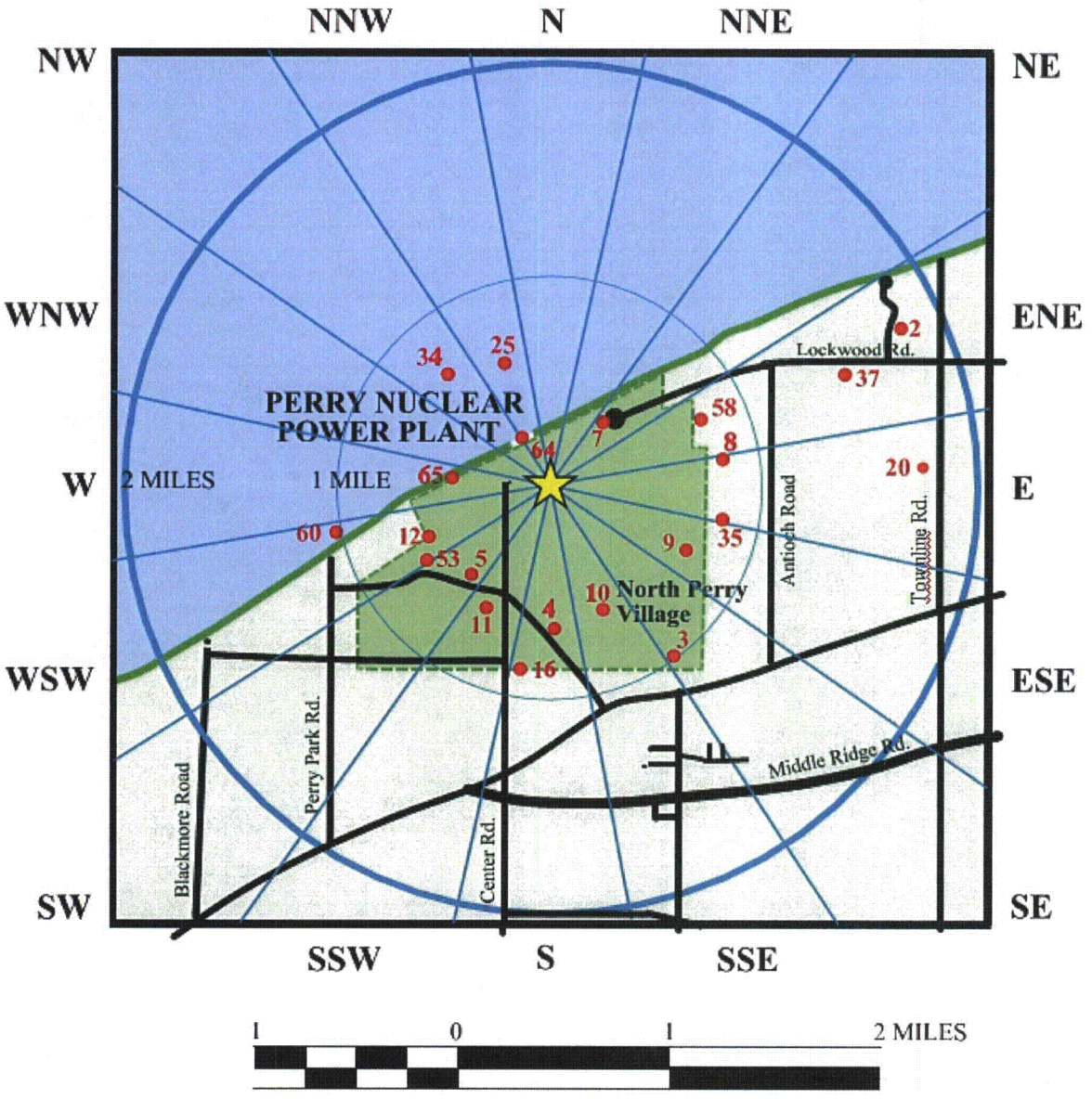


Figure 4: REMP Sampling Locations Between Two and Eight Miles of the Plant Site

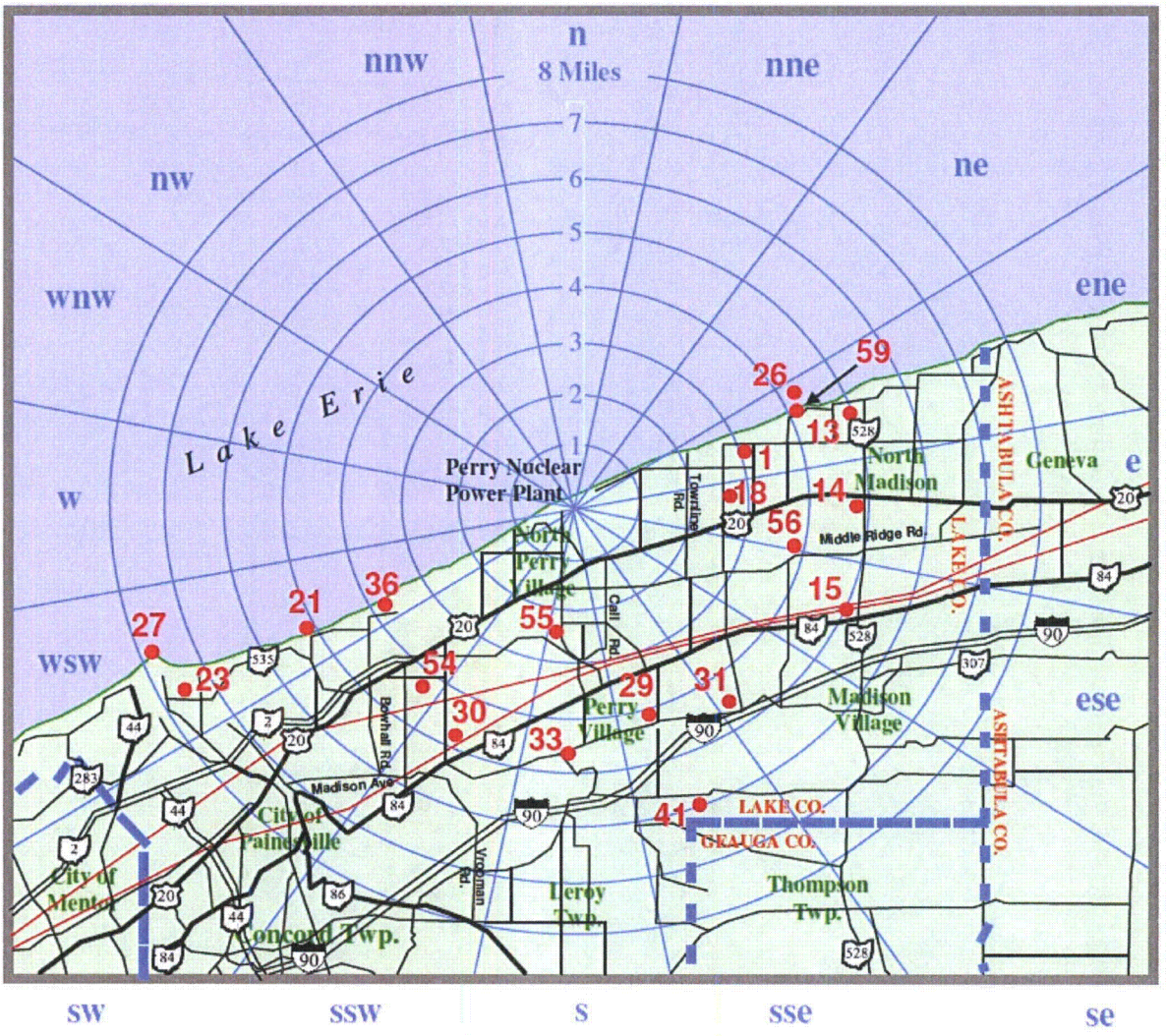
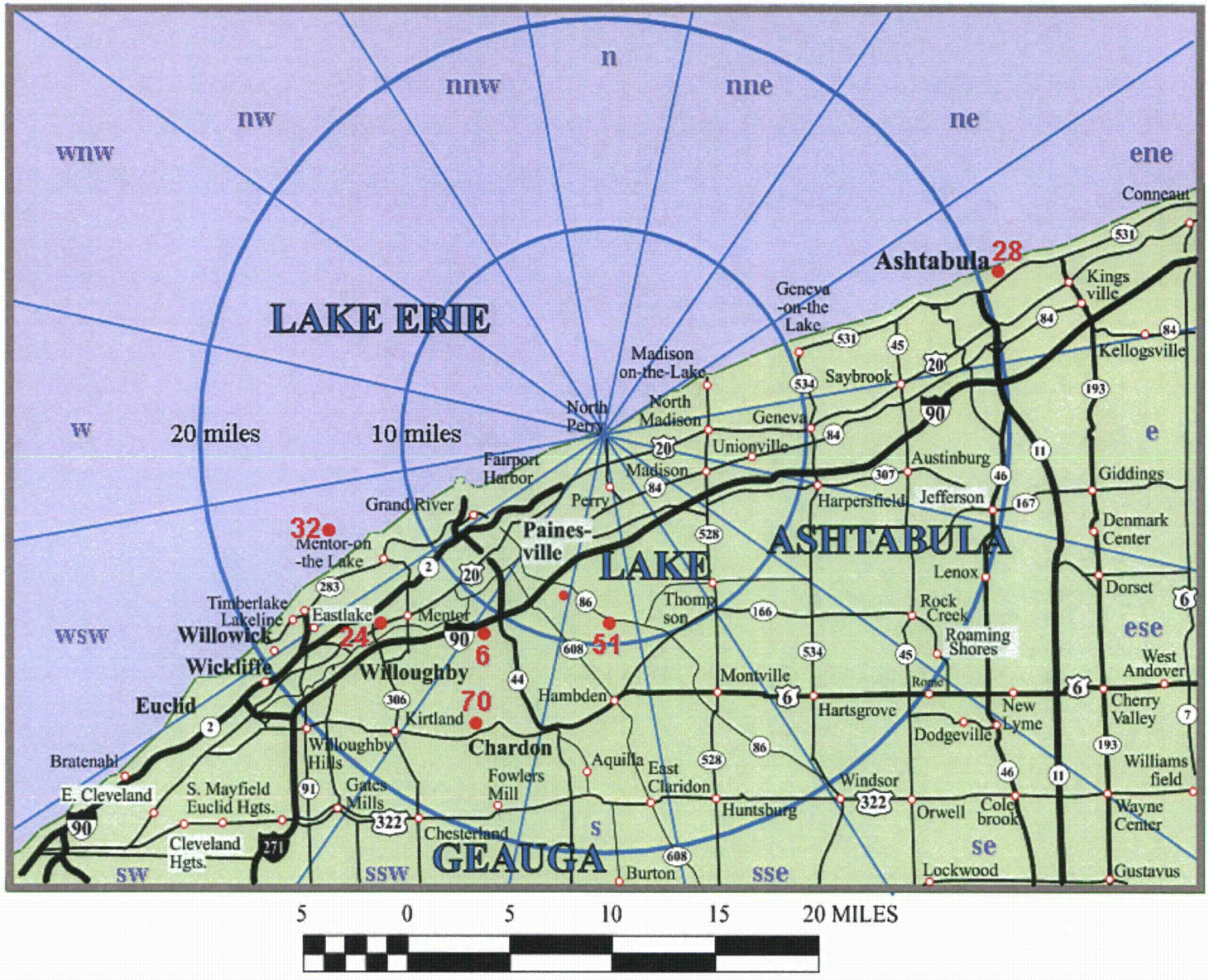


Figure 5: REMP Sampling Locations Greater Than Eight Miles from the Plant Site



SAMPLE ANALYSIS

When environmental samples are analyzed for radioactivity, several types of measurements are performed to provide information about the types of radiation and radionuclides present. The major analyses that are performed are discussed below.

Gross beta activity measures the total amount of beta-emitting radioactivity present in a sample, and acts as a tool to identify samples that may require further analysis. Beta radiation may be released by many different radionuclides. Since beta decay results in a continuous energy spectrum rather than the discrete energy levels, or "peaks", associated with gamma radiation, identification of specific beta-emitting nuclides is more difficult. Therefore, gross beta activity only indicates whether the sample contains normal or abnormal amounts of beta-emitting radioactivity; it does not specifically identify the radionuclides present.

Gamma spectral analysis provides more specific information than does the analysis for gross beta activity. Gamma spectral analysis identifies each radionuclide, and the amount of radioactivity, present in the sample emitting gamma radiation. Each radionuclide has a very specific "fingerprint" that allows for accurate identification and quantification.

Iodine activity analysis measures the amount of radioactive iodine present in a sample. Some media (for example, air sample charcoal cartridges) are analyzed directly by gamma spectral analysis. With other media (for example, milk), the radioiodines are extracted by chemical separation before being analyzed by gamma spectral analysis.

Tritium activity analysis measures the amount of the radionuclide tritium (H-3) present in a sample. Tritium is an isotope of hydrogen that emits low-energy beta particles. Tritium occurs naturally and is also man-made.

Gamma doses received by Thermoluminescent Dosimeters (TLD) while in the field are determined by a special laboratory procedure. Thermoluminescence is a process by which ionizing radiation interacts with the sensitive phosphor material in the TLD. Energy is trapped in the TLD material and can be stored for months or years. This capability provides a method to measure the dose received over long periods of time. The amount of energy that was stored in the TLD as a result of interaction with radiation is released by a controlled heating process and measured in a calibrated reading system. As the TLD is heated, the phosphor releases the stored energy as light. The amount of light is directly proportional to the amount of radiation to which the TLD was exposed. Table 15 provides a list of the analyses performed on environmental samples collected for the PNPP REMP in 2013.

Sample results are often reported as less than the lower limit of detection (< LLD), which is defined as the smallest amount of radioactive material that will show a positive result for which there can be confidence that radioactivity is present. This statistical parameter is used as a measure of the sensitivity of a sample analysis. When a measurement is reported as < LLD, it means that no radioactivity was detected. The required detection limits for samples is determined by the sample media and the radionuclide that is being analyzed for and is listed in the ODCM. The NRC has established LLD values for REMP sample analyses. The vendor laboratory for REMP sample analyses complied with those values in 2013.

Table 15: REMP Sample Analyses

TYPE	SAMPLE	FREQUENCY	ANALYSIS
Atmospheric Monitoring	Airborne Particulates	Weekly & Quarterly	Gross Beta Activity & Gamma Spectral Analysis
	Airborne Radioiodine	Weekly	Iodine-131
Terrestrial Monitoring	Milk	Bi-Monthly	Gamma Spectral Analysis & Iodine-131
	Food Products	Monthly	Gamma Spectral Analysis
Aquatic Monitoring	Water	Monthly	Gross Beta Activity & Gamma Spectral Analysis
		Quarterly	Tritium Activity
	Fish	Annually	Gamma Spectral Analysis
	Sediment	Biannually	Gamma Spectral Analysis
Direct Radiation Monitoring	TLD	Quarterly & Annually	Gamma Dose

SAMPLING PROGRAM

The contribution of radionuclides to the environment resulting from PNPP operation is assessed by comparing results from the environmental monitoring program with pre-operational data (i.e., data from before 1986), operational data from previous years, and control location data. The results for each sample type are discussed below and compared to historical data to determine if there are any observable trends. All results are expressed as concentrations. Refer to Appendix B, 2013 REMP Data Summary Reports for a detailed listing of these results. The NRC requires special reporting whenever sample analysis results exceed set limits. No values exceeded those limits.

Program Changes

None

Missed Samples

On occasion, samples cannot be collected. This can be due to a variety of events, including equipment malfunction, animal husbandry practices, or lost shipments. Events may also occur which prevent a sample from being collected in the normal way, or prevent a complete sample from being collected. The drying period for goats is an annual occurrence, since unlike cows, goats do not normally produce milk year-round. Food products are weather dependent and are susceptible to excessive spring rains or summer drought that can significantly impact the garden harvest. Shoreline lake water samples are collected by grab sample utilizing a container and scoop. During the winter months the shoreline can become inaccessible due to ice and snow buildup, preventing the safe collection of these samples. Shoreline sediment samples are collected with spoon and container. On occasion, the accessibility of these locations and sample collection may be impacted due to high lake levels, shifting lake bottom sediment, bluff erosion and shoreline collapse. There was no impact to the program requirements as a result of any missed samples. Table 16 provides information on missed samples.

Table 16: Missed REMP Samples in 2013

MEDIA	LOCATION	DATE	REASON
Food Products	All	Jan. – Jun, Nov. – Dec.	Insufficient growth/temperature. Die-off/Frost damage.
Lake Water	59, 60	Feb. – Mar.	Sample unavailable due to frozen shoreline
Milk	18	Jan. – Feb.	Drying period for goats/sample availability
	41	Jan. – Mar, Nov. – Dec.	Drying period for goats/sample availability

Atmospheric Monitoring

Air

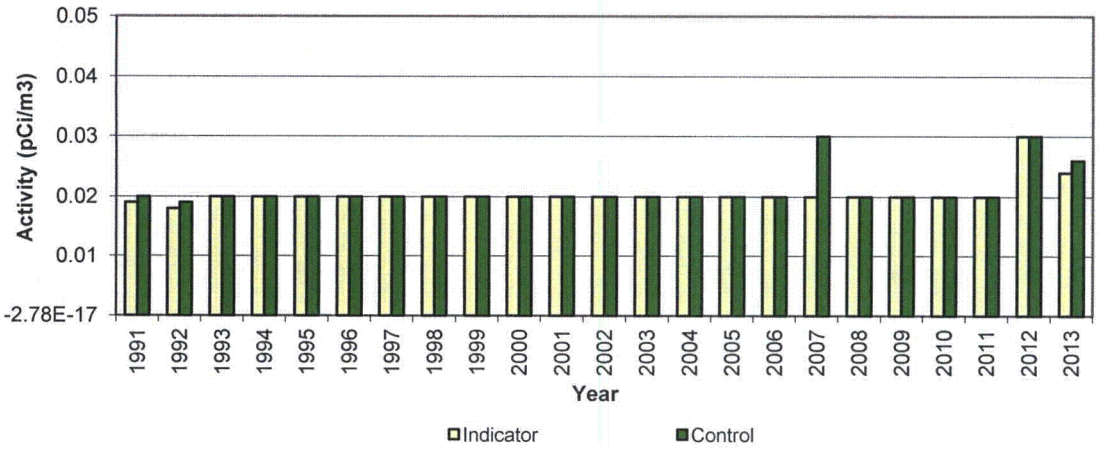
Air sampling is conducted to detect any increase in the concentration of airborne radionuclides. The PNPP REMP maintains an additional 2 air sampling locations above the five locations (four indicators and one control) required by the ODCM. Six (6) of these locations are within four miles of the plant site; the seventh is used as a control location and is eleven miles from PNPP. Air sampling pumps draw continuous samples at a rate of approximately two cubic feet per minute. The air is drawn through glass fiber filters (to collect particulate material) and a charcoal cartridge (to adsorb iodine). The samples are collected on a weekly basis, 52 weeks a year, from each of the seven air sampling stations.

Air samples are analyzed weekly for gross beta activity and radioiodine activity. The air samples are also analyzed by gamma spectral analysis quarterly. A total of 364 air particulate and 364 air radioiodine samples were collected and analyzed in 2013.

Gross beta activity was detected in all the air samples and ranged up to 0.087 pCi/m^3. The average gross beta activity for the indicator locations was 0.024 pCi/m^3 and for the controls it was 0.025 pCi/m^3. Historically, the concentration of gross beta in air has been essentially identical at indicator and control locations. Figure 6 reflects the average gross beta activity for 2013 and the previous years. All radioiodine samples were less than the lower limit of detection for I-131.

Except for naturally occurring beryllium-7, no radionuclides were identified in the gamma quarterly spectral analysis above the LLD values.

Figure 6: Annual Average Gross Beta Activity, in Air



Terrestrial Monitoring

Collecting and analyzing samples of milk and food products provides data to assess the build-up of radionuclides that may be ingested by humans. The historical data from soil and vegetation samples provides information on the atmospheric radionuclide deposition.

Milk

Samples of milk are collected once each month from November through March, and twice each month from April through October. Sampling is increased during the summer because animals usually feed outside on pasture and not on stored feed. The PNPP REMP includes four (4) milk locations located 2.5, 5.8, 8.7 and 9.6 miles away from the plant.

Since the milk sampling locations do not meet the requirements of the ODCM (only one milk-producing animal is located within the required distance vs. two required), food product sampling (discussed below) is done. Milk is collected from the available location to augment food product sampling. If new locations that meet the ODCM requirements are identified in the future, they will be added to the program.

Milk samples are analyzed by gamma spectral analysis for radioiodines and other radionuclides. A total of sixty-eight (68) milk samples were collected in 2013. With the exception of naturally occurring Potassium-40, no other radionuclides were detected

Broadleaf Vegetation

Because there are not a sufficient number of milk sampling locations, the PNPP REMP samples broadleaf vegetation. These samples are collected monthly during the growing season from six (6) gardens in the vicinity of PNPP and one control location 16.2 miles SSW from PNPP.

Sixty-six (66) samples were collected and analyzed by gamma spectral analysis in 2013.

Four (4) vegetation types were grown and collected: Japanese greens, collard greens, turnip greens and Swiss chard. Beryllium-7 and potassium-40, naturally-occurring radionuclides, were found in the samples, which is expected. No other radionuclides were detected above the required LLDs.

Aquatic Monitoring

Radionuclides may be present in Lake Erie from many sources other than the PNPP. These sources include atmospheric deposition, run-off/soil erosion, and releases of radioactivity in liquid effluents from hospitals, universities or other industrial facilities. These sources provide two forms of potential radiation exposure, external and internal. External exposure can occur from contact with water or shoreline sediments, while internal exposure can occur from either direct ingestion of radionuclides or the transfer of radionuclides through the aquatic food chain. Direct ingestion can occur from drinking the water, while the transfer via the aquatic food chain occurs from the eventual consumption of aquatic organisms, such as fish. To monitor these pathways, PNPP samples water, shoreline sediments, and fish.

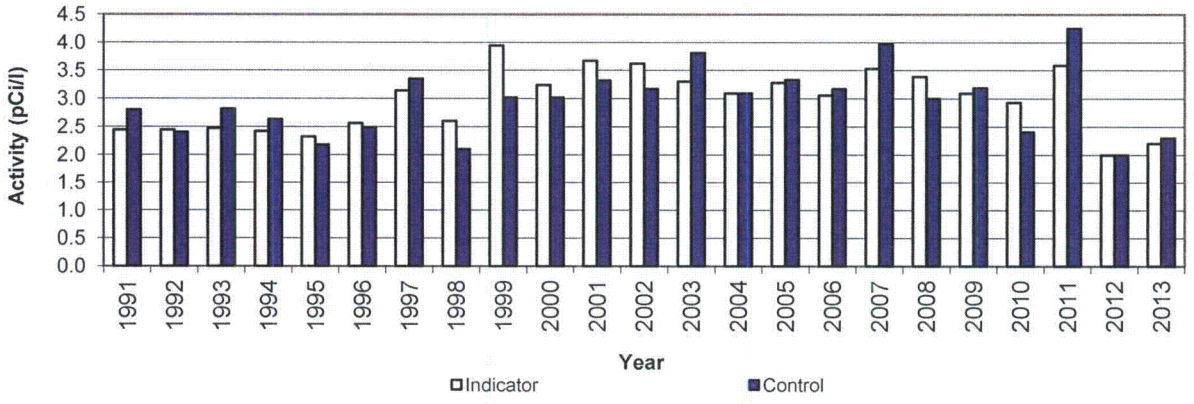
Water

Water is sampled from five (5) locations along Lake Erie in the vicinity of the PNPP as required by the PNPP ODCM. Samples from three (3) locations are collected using composite sample pumps. The pumps are designed to collect water at regular intervals and composite it in a sample container. Samples from the two (2) other locations are manually collected weekly and combined. The containers are emptied monthly and the samples shipped to the vendor laboratory for analysis.

Fifty-six (56) water samples were collected and analyzed for gross beta activity and gamma spectral analysis. From these monthly samples, twenty (20) quarterly composite samples were analyzed for tritium and gamma activity.

Gross beta activity was detected in forty-five (45) of the fifty-six (56) samples collected. The indicator average gross beta activity was 2.2 pCi/L and the control average gross beta activity was 2.3 pCi/L. Refer to Figure 7 for the annual average gross beta activity for both indicator and control locations.

Figure 7: Annual Average Gross Beta Activity, in Water



There were no tritium or radionuclides detected by gamma spectral analysis.

Sediment

Sampling lake bottom sediments can provide an indication of the accumulation of particulate radionuclides which may lead to internal exposure to humans through the ingestion of fish, the re-suspension into drinking water, or as an external radiation source to fishermen and swimmers from shoreline exposure. Sediment is sampled twice each year from six (6) locations.

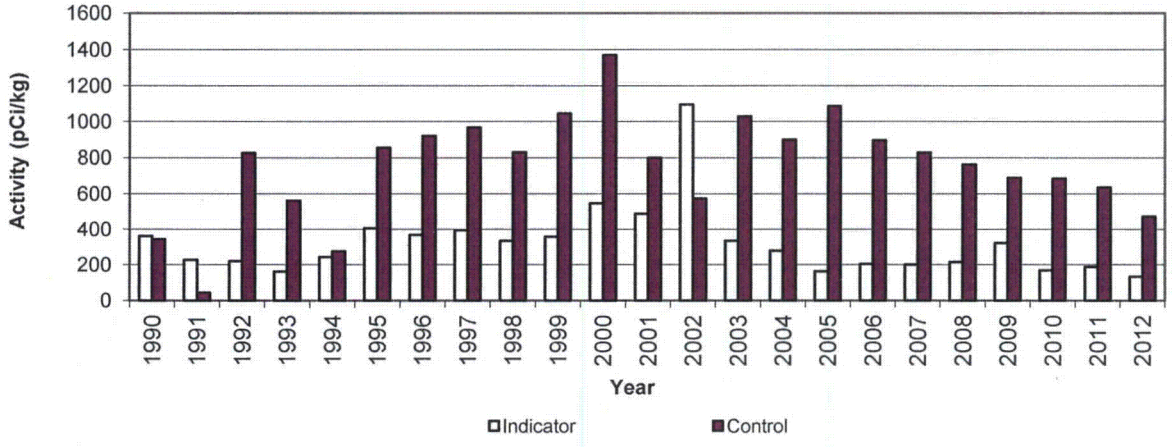
Sediment samples from offshore are collected using a hand dredge. Shoreline samples are collected using a scoop.

Twelve (12) sediment samples were collected in 2013 and analyzed by gamma spectroscopy. The predominant radionuclide detected by gamma spectral analysis was naturally occurring potassium-40.

Cesium-137 activity was detected in eight (8) of the twelve (12) samples collected and ranged from 42.0 pCi/kg to 439.6 pCi/kg. The indicator average cesium-137 activity was 126.2 pCi/kg and the control average was 421.4 pCi/kg. The average cesium-137 radioactivity for all locations was 200.0 pCi/kg and is lower than the highest identified value of 864 pCi/kg established in 1981. Year-to-year variations in lake bottom sediment sample activity is expected and beyond the control of PNPP. For example, cesium-137 activity variations (refer to Figure 8) in the control locations from year-to-year may be contributed to:

1. The movement of sediment on the lake bottom due to wave action and currents.
2. Difficulty in duplicating exact location and composition of bottom sediment sample from year to year even with assistance of GPS.

Figure 8: Annual Average Cesium-137 Concentration in Sediment



Fish

Fish are analyzed primarily to quantify the dietary radionuclide intake by humans, and secondarily to serve as indicators of radioactivity in the aquatic ecosystem. Fish are collected from two (2) locations, annually during the fishing season as required by the ODCM. An important sport or commercial species is targeted, and only the fillets are sent to the laboratory for analysis. Fish sampling was performed for PNPP by a local licensed sport fisherman.

Eight (8) fish samples were collected and analyzed – four (4) indicator and four (4) control. The species were perch, walleye, white bass and white perch. As expected, naturally occurring potassium-40 was found in all samples. No other radionuclides were detected.

Direct Radiation Monitoring

Thermoluminescent Dosimeter (TLD)

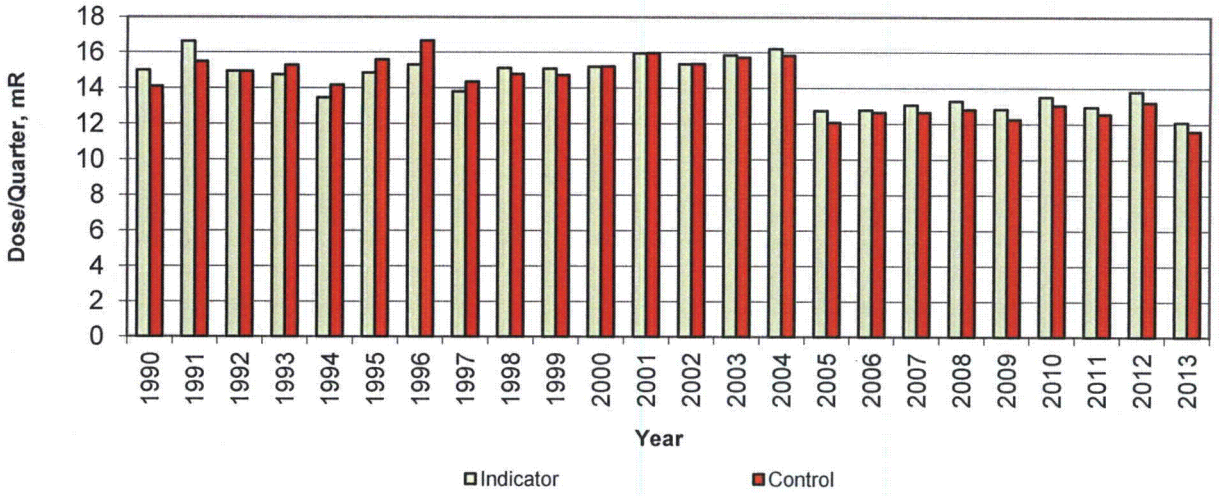
Environmental radiation is measured directly at twenty-eight (28) locations around the PNPP site, two (2) of which are control locations. The locations are positioned in two rings around the plant as well as at the site boundary. The inner ring is within a one-mile radius of the plant site; the outer ring is four miles to five miles from the plant. The control locations are over ten miles from the plant in the two least prevalent wind directions. Each location has three TLDs, two of which are changed quarterly and one is changed annually.

A total of two hundred fifty-two (252) TLDs were collected and analyzed. This includes two hundred twenty-four (224) collected on a quarterly basis and twenty-eight (28) collected annually. Annual TLDs are not required per the ODCM and are used for supplemental data only.

The annual average dose for all indicator locations was 58.6 mrem, and 57.9 mrem for the control locations.

Referring to Figure 9, the average quarterly dose for the indicator locations was 12.1 mrem, and 11.6 mrem for the control locations.

Figure 9: Average Quarterly TLD Dose



Conclusion

Operation of the Perry Nuclear Power Plant is having no detectable radiological effect on the surrounding environment.

INTER-LABORATORY CROSS-CHECK COMPARISON PROGRAM

Introduction

The purpose of the Inter-laboratory Cross-Check Comparison Program (ICCCP) is to provide an independent check on the vendor laboratory's analytical procedures. Samples with a known concentration of specific radionuclides are provided to the vendor laboratory. The vendor laboratory measures and reports the concentration of specified radionuclides. The known values are then compared to the vendor results. Results consistently outside established acceptance criteria indicate a need to check instruments or procedures. Regulatory Guide 4.15 specifically required that contractor laboratories that performed environmental measurement participate in the EPA's Environmental Radioactivity Laboratory Inter-Comparison Studies Program, or an equivalent program.

The EPA's program is no longer funded or offered. The reason that the EPA program was referenced in the regulatory guide is that the EPA standards were traceable to National Bureau of Standards (now known as National Institute Standard Technology). In response to this problem, Teledyne (PNPP vendor lab) incorporated a program offered by Environmental Resource Associates (ERA Company), which covered the same analyses in the same matrix at the same frequency as the EPA program. The ERA Company has received NIST accreditation for its program, as an equivalent program. In addition to comparison cross checks performed with the ERA Company, the vendor laboratory routinely monitors the quality of their analyses by:

- Analyzing "spiked" samples (samples with a specific quantity of radioactive material present in them) and
- Participating in the Department of Energy's Mixed Analyte Performance Program (MAPEP).

See Appendix A, for the vendor Inter-Laboratory Cross-Check Comparison Program Results.

LAND USE CENSUS

Introduction

Each year a Land Use Census (LUC) is conducted to identify the locations of the nearest milk animal, garden (of greater than 500 square feet), and residence in each of the meteorological sectors that is over land. Information gathered during the Land Use Census is used for off-site dose assessment and to update sampling locations for the Radiological Environmental Monitoring Program (REMP). The census is conducted by traveling all roads within a five-mile radius of the plant site, and recording and mapping the location of the nearest resident, milk animal and vegetable garden. The Land Use Census, which was conducted on September 18th 2013 provided the garden, residence and milk animal locations tabulated in Tables 17, 18 and 19 and depicted in Figure 10. Note that the W, WNW, NW, NNW, N, and NNE sectors extend over Lake Erie, and are not included in the survey.

Discussions and Results

In general, the predominant land use within the census area continues to be rural/ agricultural. In recent years however, it has been noted that tracts of land once used for farming are now being developed as mini-industrial parks and residential housing tracts. This is reflected in the loss of available milking animals within a five mile radius of PNPP to support the REMP.

Table 17 identifies the nearest residences, by sector, to the PNPP. There were no changes from last year's LUC identified in 2013.

Table 17: Nearest Residence, By Sector

SECTOR	LOCATION ADDRESS	MILES FROM PNPP	MAP LOCATOR NUMBER
NE	4384 Lockwood	0.7	1
ENE	4602 Lockwood	1.1	2
E	2626 Antioch	1.0	3
ESE	2836 Antioch	1.1	4
SE	4495 North Ridge	1.3	5
SSE	3119 Parmly	0.9	6
S	3121 Center	0.9	7
SSW	3850 Clark	0.9	8
SW	2997 Perry Park	1.2	9
WSW	3460 Parmly	1.0	10

Table 18 identifies the nearest milking animal by sector, to the PNPP. There were no changes from last year's LUC identified in 2013.

Table 18: Nearest Milk Animal, By Sector

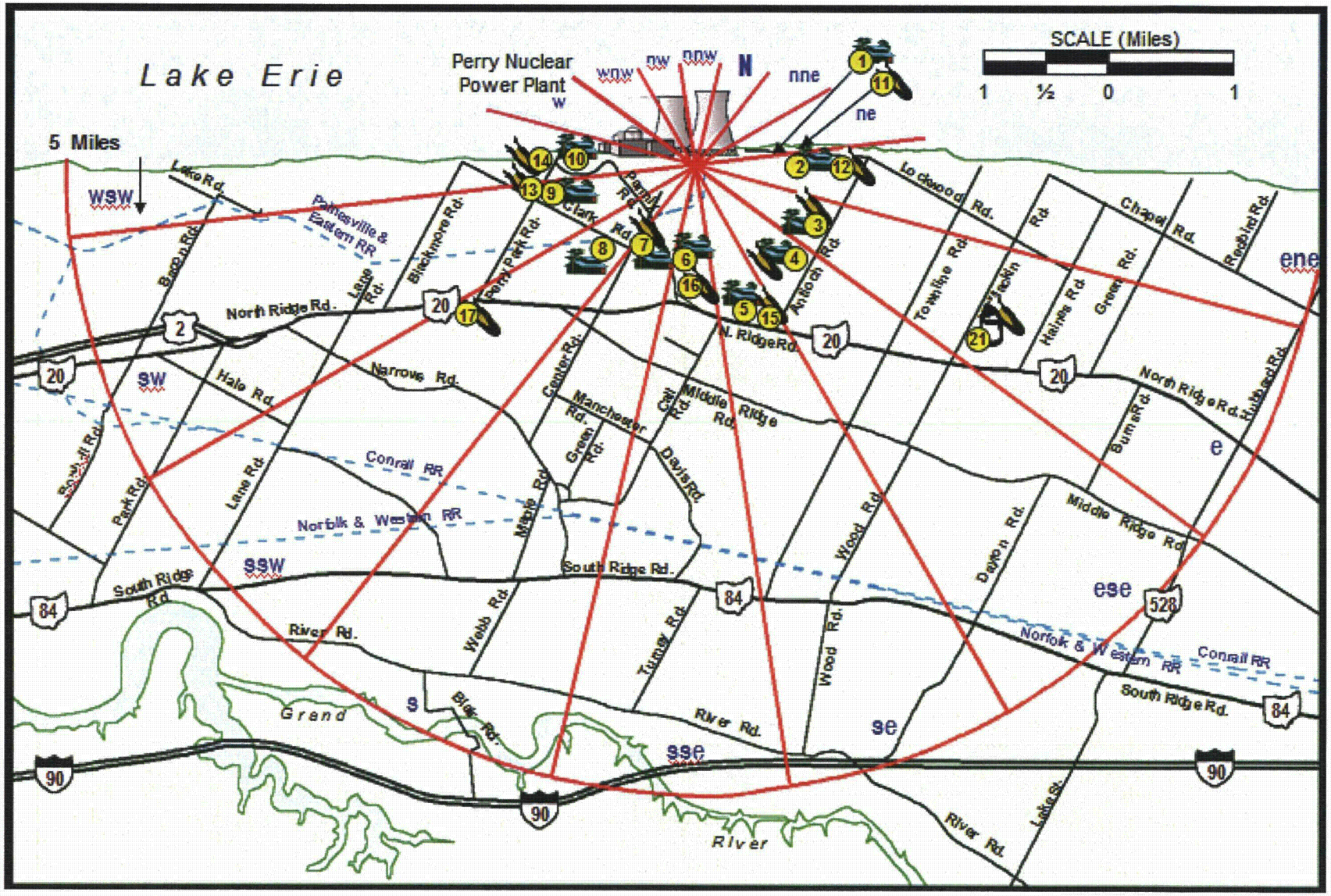
SECTOR	LOCATION ADDRESS	MILES FROM PNPP	MAP LOCATOR NUMBER
E	2591 McMackin Rd.	2.5	21

Table 19 lists the nearest gardens occupying at least 500 square feet identified during the Land Use Census. There were no changes from last year's LUC identified in 2013.

Table 19: Nearest Garden, By Sector

SECTOR	LOCATION ADDRESS	MILES FROM PNPP	MAP LOCATOR NUMBER
NE	2340 Hemlock	0.9	11
ENE	4630 Lockwood	1.1	12
E	2626 Antioch	1.0	3
ESE	2836 Antioch	1.1	4
SE	4671 North Ridge	1.3	15
SSE	4225 Red Mill Valley	1.1	16
S	3121 Center Rd.	0.9	7
SSW	3431 Perry Park	1.9	17
SW	3032 Perry Park	1.3	13
WSW	3460 Parmly	1.0	14

Figure 10: Land Use Census Map



NORTHWEST DRAIN IMPOUNDMENT

In 1999, a sediment sample from location #64 (shoreline discharge point of the Northwest Drain Impoundment) was found to contain trace levels of cobalt-60. Ten (10) additional sample locations were established upstream from location #64 and within the Impoundment to identify the boundary of the cobalt-60 activity and to support supplemental monitoring activities. In recent years, the shoreline adjacent to the impoundment has experienced extensive bluff erosion and collapse, preventing access and sample collection for locations 64-4 and 64-5. Detailed maps of the impoundment, sample locations and sample results are maintained by the PNPP Chemistry unit.

In 2010, during spring sampling, cobalt-58 (a short half-life isotope) was identified at location 64-9. Additionally, increased levels of cobalt-60 were identified at locations 64-6 and 64-9. Condition report 10-79628 was written to document the identification of cobalt-58 which led to subsequent investigation and corrective actions. The investigation identified that source of the newer activity may have been the result of contaminated runoff water from radioactive material movements and transport vehicles within the protected area.

In 2013, sediment samples were taken from the storm drain leading to the impoundment area, the spillway and on the shoreline. The absence of short-lived radionuclides in the storm drain indicates that no new activity is entering the impoundment. Additionally no activity seen on the shoreline sample downstream of the impoundment indicates that activity is not migrating out. The spillway activity is in the same activity range as seen in previous years. Table 20 shows the sample results for 2013.

Table 20: Northwest Drain Impoundment Activity, pCi/kg (dry)

Location	Location ID #	Mn-54	Co-58	Co-60	Cs-137
Shoreline	64	<LLD	<LLD	<LLD	<LLD
Storm Drain	W-25	<LLD	<LLD	22.0	1744
Impoundment Spillway	64-3	<LLD	<LLD	<LLD	82

CLAM/MUSSEL MONITORING

INTRODUCTION

Sampling for macro-invertebrates (clams and mussels) has been conducted in Lake Erie in the vicinity of PNPP, since 1971. The clam/mussel program currently focuses on two species: *Corbicula fluminea* (Asiatic clam) and *Dreissena polymorpha* (zebra mussel).

CORBICULA PROGRAM

Monitoring specifically for Corbicula was initiated in response to a NRC bulletin and concerns of the Atomic Safety and Licensing Board. The 2013 monitoring was done as part of the Environmental Protection Plan (Operating License, Appendix B). The program consists of visually inspecting the raw water systems, when they are opened for maintenance. The purpose of this program is to detect Corbicula, should it appear at PNPP.

No Corbicula have been found in any sample collected from PNPP. Two Corbicula were found in a sample collected from the Eastlake plant located 18 miles WSW of the plant in June, 1987. No Corbicula have been found in any other sample collected since that time. A more detailed program history can be found in the 1986 and 1987 PNPP Annual Environmental Operating Reports.

Monitoring

In 2013, samples were collected from the Service Water (SW) and Emergency Service Water (ESW) pump houses at PNPP and examined for shells and fragments. Samples were either collected by hand scoop or scraper. In addition to sample collections, plant components that use raw water are inspected when opened for maintenance or repair. Sample collection/inspection dates are listed in Table 21.

Table 21: 2013 Corbicula Monitoring

DATE	SAMPLE LOCATION
3/21/2013	1P45D0003 (Discharge spool piece from emergency service water pump discharge strainer)
3/27/2013	1P42B0001A (Emergency Closed Cooling)
3/29/2013	PY-1N71-1B0001 (Cooling Tower)
6/26/2013	1N34B0001A (Lube oil)
7/17/2013	1N34B0001B (Lube oil)
7/18/2013	Turbine Lube Oil Cooler A
8/12/2013	2P54D0761
8/21/2013	1N34B0001A (Lube oil)
8/22/2013	1P44B0001B TBCC Heat Exchanger
8/26/2013	134B0001B (Lube oil)

9/1/2013	Main Lube Oil Cooler
10/11/2013	0P54D0531
12/7/2013	SW Traveling Screen

Conclusions

The sample collected in June, 1987, was the only indication of Corbicula in the vicinity of PNPP. Although the presence of Corbicula was detected at the Eastlake Power Plant, it has not been demonstrated that their presence has created any operational problems there, or at PNPP. As in the past, the 2013 monitoring program did not identify Corbicula in any sample collected.

DREISSENA PROGRAM

Dreissena or Zebra mussels were first discovered at PNPP in September, 1988. The initial collection of nineteen (19) mussels was made as part of the Corbicula monitoring program. The Dreissena monitoring program began in 1989, with monitoring and testing. The current control program was designed and implemented in 1990.

Monitoring

In addition to visually inspecting the plant's raw water systems when they are opened for maintenance or repair, monitoring methods include the use of commercial divers and side-stream monitors. Commercial divers monitor mussel infestation during the inspection of forebays, basins, and the intake and discharge structures. Divers have also been used to take underwater videotapes of the water basins and intake tunnel. Side-stream monitors are flow-through containers that receive water diverted from plant systems and are set up at two in-plant locations during the mussel season.

Treatment

Chemicals used for mussel control in 2013 included sodium hypochlorite and a commercial molluscicide. The chlorine is intermittently injected into the plant service water, emergency service water, and circulating water systems by metering sodium hypochlorite into each system's influent. Sodium bisulfite is added at the plant discharge structure for dechlorination prior to return into Lake Erie.

The Ohio Environmental Protection Agency (OEPA) has approved the use of a commercial molluscicide. The chemical selected for use at the PNPP in 2013 was alkyl-dimethyl-benzyl-ammonium chloride. Treatment was applied once in 2013, on August 20th. The active ingredients were detoxified by adsorption using bentonite clay, prior to discharge into Lake Erie.

Results

The effectiveness of the intermittent biocide treatment has been determined in several ways. First, visual inspections of raw water system components are conducted when systems are open during maintenance or repair. In addition, settlement monitors were inspected for new settlement. No live settlement has been found in any plant component to date.

The effectiveness of the application of the commercial molluscicide was measured by observing mortality of mussels placed in a flow-through container placed in plant service water and subjected to the chemical treatment. The observed mortality rate utilizing the flow-through container for 2013 was 99%.

To date, PNPP has had no significant problems related to zebra mussels.

Conclusions

PNPP has taken the approach that the best method for avoiding problems with zebra mussels is preventive treatment of plant water systems. The current program of monitoring and chemical treatment will be continued to minimize the possibility that PNPP will experience future problems due to zebra mussels.

HERBICIDE APPLICATIONS

Herbicides are used sparingly on the PNPP site. A request must be made to, and approved by the PNPP Chemistry Unit prior to spraying to ensure that only approved chemicals are used, and only in approved areas.

In 2013, four (4) general and four (4) specific herbicide requests were initiated for chemical applications. Each application was in compliance with the Ohio Environmental Protection Agency's rules and regulations. There were no adverse environmental impacts observed during weekly site environmental inspections as a result of these applications. The herbicides approved for use were Round-Up, Round-Up Promax, Trimec 992, Gly Star Pro, and Tempo Ultra. For each application, the type of weed to be treated dictated the herbicide and concentration to be used. Table 22 provides detailed documentation for each application in 2013. The quantity represents the amount of herbicide applied, prior to any dilution.

Table 22: 2013 Herbicide Applications

DATE APPLIED	LOCATION	AMOUNT	CHEMICAL NAME
5/18/2013	Owner Controlled Areas (OCA)	100 oz	Round-up
6/2013	Security Towers, Booths, PAF, Vehicle Trap, SWPH Ladders and Stairs	10 gal	Tempo Ultra
7/2013	Security Towers, Booths, PAF, Vehicle Trap, SWPH Ladders and Stairs	10 gal	Tempo Ultra
8/2013	Security Towers, Booths, PAF, Vehicle Trap, SWPH Ladders and Stairs	10 gal	Tempo Ultra

DATE APPLIED	LOCATION	AMOUNT	CHEMICAL NAME
7/12/2013	Transmission Yard	6 gal	Round-up Promax
7/13/2013	Transmission Yard	6 gal	Round-up Promax
7/2/2013	Transmission Yard	75 gal	Round-up
May – Sept 2013	Through out protected area (PA)	8 gal	Round-up
9/17/2013	Owner Controlled Areas (OCA)	100 oz	Trimec 992
10/4/2013 10/5/2013	Switchyards	200 gal	Gly Star Pro
10/10/2013	Hydrogen / Oxygen Tank farm	2 gal	Round-up

SPECIAL REPORTS

NON-COMPLIANCES

NPDES Permit

The Ohio Environmental Protection Agency (OEPA) issues the National Pollutant Discharge Elimination System (NPDES) permit. It establishes monitoring requirements and limits for discharges from the PNPP. It also specifies the locations from which the plant is allowed to discharge.

There was one report submitted in 2013:

- On July 24, 2013, during daily chlorination activities, it was identified that the NPDES permit limit for Total Residual Chlorine was exceeded between 0840 and 0856 hours. The maximum measured value was 0.24 mg/l, which exceeded the NPDES Maximum Concentration limit of 0.2 mg/l.

Environmental Protection Plan

The Environmental Protection Plan (EPP), which is Appendix B of the PNPP Operating License, requires a non-radiological environmental monitoring and reporting program be established at the PNPP.

Other than the non-compliance NPDES report (mentioned above) no other reports were submitted in 2013.

UN-REVIEWED ENVIRONMENTAL QUESTIONS

All proposed changes to the PNPP design or operation, as well as tests or experiments, must be evaluated for potential environmental impacts in accordance with the EPP and administrative quality assurance procedures. In 2013 there were no proposed changes to

the facility or programs that if performed could have resulted in an adverse environmental impact. Therefore, there were no un-reviewed environmental questions identified.

APPENDIX A

2013 INTER-LABORATORY CROSS CHECK COMPARISON PROGRAM RESULTS

ATI Environmental, Inc.
Midwest Laboratory
700 Landwehr Road • Northbrook, IL 60062-2310
phone (847) 564-0700 • fax (847) 564-4517

APPENDIX A

INTERLABORATORY COMPARISON PROGRAM RESULTS

NOTE: Environmental Inc., Midwest Laboratory participates in intercomparison studies administered by Environmental Resources Associates, and serves as a replacement for studies conducted previously by the U.S. EPA Environmental Monitoring Systems Laboratory, Las Vegas, Nevada. Results are reported in Appendix A. TLD Intercomparison results, in-house spikes, blanks, duplicates and mixed analyte performance evaluation program results are also reported. Appendix A is updated four times a year; the complete Appendix is included in March, June, September and December monthly progress reports only.

January through December, 2013

Appendix A

Interlaboratory Comparison Program Results

Environmental, Inc., Midwest Laboratory has participated in interlaboratory comparison (crosscheck) programs since the formulation of it's quality control program in December 1971. These programs are operated by agencies which supply environmental type samples containing concentrations of radionuclides known to the issuing agency but not to participant laboratories. The purpose of such a program is to provide an independent check on a laboratory's analytical procedures and to alert it of any possible problems.

Participant laboratories measure the concentration of specified radionuclides and report them to the issuing agency. Several months later, the agency reports the known values to the participant laboratories and specifies control limits. Results consistently higher or lower than the known values or outside the control limits indicate a need to check the instruments or procedures used.

Results in Table A-1 were obtained through participation in the environmental sample crosscheck program administered by Environmental Resources Associates, serving as a replacement for studies conducted previously by the U.S. EPA Environmental Monitoring Systems Laboratory, Las Vegas, Nevada.

Table A-2 lists results for thermoluminescent dosimeters (TLDs), via International Intercomparison of Environmental Dosimeters, when available, and internal laboratory testing.

Table A-3 lists results of the analyses on in-house "spiked" samples for the past twelve months. All samples are prepared using NIST traceable sources. Data for previous years available upon request.

Table A-4 lists results of the analyses on in-house "blank" samples for the past twelve months. Data for previous years available upon request.

Table A-5 lists REMP specific analytical results from the in-house "duplicate" program for the past twelve months. Acceptance is based on the difference of the results being less than the sum of the errors. Complete analytical data for duplicate analyses is available upon request.

The results in Table A-6 were obtained through participation in the Mixed Analyte Performance Evaluation Program.

Results in Table A-7 were obtained through participation in the environmental sample crosscheck program administered by Environmental Resources Associates, serving as a replacement for studies conducted previously by the Environmental Measurement Laboratory Quality Assessment Program (EML).

Attachment A lists the laboratory precision at the 1 sigma level for various analyses. The acceptance criteria in Table A-3 is set at ± 2 sigma.

Out-of-limit results are explained directly below the result.

Attachment A

ACCEPTANCE CRITERIA FOR "SPIKED" SAMPLES

LABORATORY PRECISION: ONE STANDARD DEVIATION VALUES FOR VARIOUS ANALYSES[a]

Analysis	Level	One standard deviation for single determination
Gamma Emitters	5 to 100 pCi/liter or kg	5.0 pCi/liter
	> 100 pCi/liter or kg	5% of known value
Strontium-89[b]	5 to 50 pCi/liter or kg	5.0 pCi/liter
	> 50 pCi/liter or kg	10% of known value
Strontium-90[b]	2 to 30 pCi/liter or kg	5.0 pCi/liter
	> 30 pCi/liter or kg	10% of known value
Potassium-40	≥ 0.1 g/liter or kg	5% of known value
Gross alpha	≤ 20 pCi/liter	5.0 pCi/liter
	> 20 pCi/liter	25% of known value
Gross beta	≤ 100 pCi/liter	5.0 pCi/liter
	> 100 pCi/liter	5% of known value
Tritium	≤ 4,000 pCi/liter	$\pm 1\sigma = 169.85 \times (\text{known})^{0.0933}$
	> 4,000 pCi/liter	10% of known value
Radium-226,-228	≥ 0.1 pCi/liter	15% of known value
Plutonium	≥ 0.1 pCi/liter, gram, or sample	10% of known value
Iodine-131, Iodine-129[b]	≤ 55 pCi/liter	6 pCi/liter
	> 55 pCi/liter	10% of known value
Uranium-238, Nickel-63[b] Technetium-99[b]	≤ 35 pCi/liter	6 pCi/liter
	> 35 pCi/liter	15% of known value
Iron-55[b]	50 to 100 pCi/liter	10 pCi/liter
	> 100 pCi/liter	10% of known value
Other Analyses [b]	---	20% of known value

[a] From EPA publication, "Environmental Radioactivity Laboratory Intercomparison Studies Program, Fiscal Year, 1981-1982, EPA-600/4-81-004.

[b] Laboratory limit.

TABLE A-1. Interlaboratory Comparison Crosscheck program, Environmental Resource Associates (ERA)[a].

Lab Code	Date	Concentration (pCi/L)				
		Analysis	Laboratory Result [b]	ERA Result [c]	Control Limits	Acceptance
ERW-76	01/07/13	Ra-226	10.04 ± 0.55	9.91	7.42 - 11.60	Pass
ERW-76	01/07/13	Ra-228	6.11 ± 1.29	5.22	3.14 - 6.96	Pass
ERW-76	01/07/13	Uranium	5.90 ± 0.58	5.96	4.47 - 7.13	Pass
ERW-1593	04/08/13	Sr-89	43.60 ± 4.32	41.30	31.60 - 48.40	Pass
ERW-1593	04/08/13	Sr-90	23.20 ± 1.70	23.90	17.20 - 28.00	Pass
ERW-1596	04/08/13	Ba-133	74.80 ± 4.00	82.10	69.00 - 90.30	Pass
ERW-1596	04/08/13	Co-60	65.50 ± 3.42	65.90	59.30 - 75.00	Pass
ERW-1596	04/08/13	Cs-134	41.10 ± 3.47	42.80	34.20 - 47.10	Pass
ERW-1596	04/08/13	Cs-137	42.30 ± 4.03	41.70	37.00 - 48.80	Pass
ERW-1596	04/08/13	Zn-65	200.3 ± 10.1	189.0	170.0 - 222.0	Pass
ERW-1598	04/08/13	Gr. Alpha	34.30 ± 1.98	40.80	21.10 - 51.90	Pass
ERW-1598	04/08/13	Gr. Beta	18.70 ± 0.98	21.60	13.00 - 29.70	Pass
ERW-1600	04/08/13	I-131	23.00 ± 1.10	23.80	19.70 - 28.30	Pass
ERW-1600	04/08/13	I-131(G)	23.48 ± 9.44	23.80	19.70 - 28.30	Pass
ERW-1605	04/08/13	Ra-226	16.30 ± 0.70	15.40	11.50 - 17.70	Pass
ERW-1605	04/08/13	Ra-228	5.32 ± 1.30	4.36	2.54 - 5.98	Pass
ERW-1605	04/08/13	Uranium	57.30 ± 4.20	61.20	49.80 - 67.90	Pass
ERW-1606	04/08/13	H-3	4041 ± 194	4050	3450 - 4460	Pass
ERW-6009	10/07/13	Sr-89	22.00 ± 2.80	21.90	14.40 ± 28.20	Pass
ERW-6009	10/07/13	Sr-90	17.10 ± 2.55	18.10	12.80 ± 21.50	Pass
ERW-6012	10/07/13	Ba-133	48.20 ± 4.29	54.20	44.70 ± 59.90	Pass
ERW-6012	10/07/13	Co-60	100.8 ± 4.7	102.0	91.80 ± 114.00	Pass
ERW-6012	10/07/13	Cs-134	87.30 ± 4.35	86.70	71.10 ± 95.40	Pass
ERW-6012	10/07/13	Cs-137	199.6 ± 7.4	206.0	185.0 - 228.0	Pass
ERW-6012	10/07/13	Zn-65	356.2 ± 13.2	333.0	300.0 - 389.0	Pass
ERW-6015	10/07/13	Gr. Alpha	30.70 ± 11.90	42.80	22.20 ± 54.30	Pass
ERW-6015	10/07/13	Gr. Beta	25.70 ± 6.48	32.20	20.80 ± 39.90	Pass
ERW-6019	10/07/13	I-131	22.50 ± 1.01	23.60	19.60 ± 28.00	Pass
ERW-6022	10/07/13	Ra-226	12.70 ± 1.62	12.10	9.04 ± 14.00	Pass
ERW-6022 [d]	10/07/13	Ra-228	5.70 ± 0.56	4.02	2.30 ± 5.59	Fail
ERW-6022	10/07/13	Uranium	6.59 ± 0.38	6.24	4.70 ± 7.44	Pass
ERW-6024	10/07/13	H-3	18397 ± 695	17700	15500 - 19500	Pass

[a] Results obtained by Environmental, Inc., Midwest Laboratory as a participant in the crosscheck program for proficiency testing in drinking water conducted by Environmental Resources Associates (ERA).

[b] Unless otherwise indicated, the laboratory result is given as the mean ± standard deviation for three determinations.

[c] Results are presented as the known values, expected laboratory precision (1 sigma, 1 determination) and control limits as provided by ERA.

[d] The reported result was obtained in the first cycle of counting. It can be positively biased due to extra beta counts contributed by Pb-214 and Bi-214 daughters of Rn-222. Result of second cycle of counting 4.47 pCi/L.

TABLE A-2. Thermoluminescent Dosimetry, (TLD, $CaSO_4$: Dy Cards).

Lab Code	Date	Description	Known Value (mR)	Lab Result ± 2 sigma (mR)	Control Limits	Acceptance
Environmental, Inc.						
2013-1	5/6/2013	40 cm.	34.26	39.92 ± 2.67	23.98 - 44.54	Pass
2013-1	5/6/2013	50 cm.	21.93	25.44 ± 3.31	15.35 - 28.51	Pass
2013-1	5/6/2013	60 cm.	15.23	15.88 ± 1.12	10.66 - 19.80	Pass
2013-1	5/6/2013	70 cm.	11.19	10.89 ± 0.66	7.83 - 14.55	Pass
2013-1	5/6/2013	80 cm.	8.57	9.21 ± 0.41	6.00 - 11.14	Pass
2013-1	5/6/2013	90 cm.	6.77	6.52 ± 0.34	4.74 - 8.80	Pass
2013-1	5/6/2013	100 cm.	5.48	5.02 ± 0.53	3.84 - 7.12	Pass
2013-1	5/6/2013	110 cm.	4.53	4.51 ± 0.34	3.17 - 5.89	Pass
2013-1	5/6/2013	120 cm.	3.81	4.28 ± 0.35	2.67 - 4.95	Pass
2013-1	5/6/2013	135 cm.	3.01	2.64 ± 0.18	2.11 - 3.91	Pass
2013-1	5/6/2013	150 cm.	2.44	2.10 ± 0.25	1.71 - 3.17	Pass
2013-1	5/6/2013	180 cm.	1.69	1.78 ± 0.33	1.18 - 2.20	Pass
Environmental, Inc.						
2013-2	11/18/2013	50 cm.	19.93	22.75 ± 3.67	13.95 - 25.91	Pass
2013-2	11/18/2013	60 cm.	13.84	15.75 ± 1.94	9.69 - 17.99	Pass
2013-2	11/18/2013	70 cm.	10.17	11.24 ± 0.88	7.12 - 13.22	Pass
2013-2	11/18/2013	75 cm.	8.86	9.18 ± 1.23	6.20 - 11.52	Pass
2013-2	11/18/2013	80 cm.	7.79	7.81 ± 1.10	5.45 - 10.13	Pass
2013-2	11/18/2013	90 cm.	6.15	5.98 ± 0.90	4.31 - 8.00	Pass
2013-2	11/18/2013	100 cm.	4.98	5.13 ± 0.73	3.49 - 6.47	Pass
2013-2	11/18/2013	110 cm.	4.12	3.87 ± 0.32	2.88 - 5.36	Pass
2013-2	11/18/2013	120 cm.	3.46	3.11 ± 0.39	2.42 - 4.50	Pass
2013-2	11/18/2013	135 cm.	2.73	2.71 ± 0.83	1.91 - 3.55	Pass
2013-2	11/18/2013	150 cm.	2.21	2.11 ± 0.63	1.55 - 2.87	Pass
2013-2	11/18/2013	180 cm.	1.54	1.81 ± 0.10	1.08 - 2.00	Pass

TABLE A-3. In-House "Spiked" Samples

Lab Code [b]	Date	Concentration (pCi/L)[a] Analysis	Laboratory results 2s. n=1 [c]	Known Activity	Control Limits [d]	Acceptance
SPW-66	1/9/2013	Tc-99	1009 ± 5	1078	754.9 - 1402.0	Pass
SPW-1891	1/18/2013	Ra-228	35.60 ± 2.75	30.85	21.60 - 40.11	Pass
SPSO-12313S	1/23/2013	Tc-99	103.5 ± 2.2	107.8	75.46 - 140.14	Pass
SPMI-264	1/25/2013	Cs-134	110.9 ± 6.7	107.5	96.73 - 118.23	Pass
SPMI-264	1/25/2013	Cs-137	82.84 ± 7.47	77.48	67.48 - 87.48	Pass
SPMI-264	1/25/2013	Sr-90	38.19 ± 1.49	40.11	32.09 - 48.13	Pass
SPW-266	1/25/2013	Co-60	46.89 ± 4.68	44.48	34.48 - 54.48	Pass
SPW-266	1/25/2013	Cs-134	105.9 ± 8.0	107.5	96.73 - 118.23	Pass
SPW-266	1/25/2013	Cs-137	42.17 ± 5.65	39.49	29.49 - 49.49	Pass
SPW-266	1/25/2013	Sr-90	39.84 ± 1.65	40.11	32.09 - 48.13	Pass
SPAP-376	2/1/2013	Gr. Beta	44.20 ± 0.11	45.68	27.41 - 63.95	Pass
SPAP-378	2/1/2013	Cs-134	3.71 ± 0.65	3.87	2.32 - 5.42	Pass
SPAP-378	2/1/2013	Cs-137	97.47 ± 2.50	102.9	92.61 - 113.19	Pass
SPW-391	2/1/2013	H-3	63719 ± 703	65626	52501 - 78751	Pass
SPW-380	2/10/2013	Ni-63	217.0 ± 3.7	205.3	143.7 - 266.9	Pass
W-30413	3/4/2013	Gr. Alpha	19.77 ± 0.40	20.00	10.00 - 30.00	Pass
W-30413	3/4/2013	Gr. Beta	30.48 ± 0.34	30.90	20.90 - 40.90	Pass
W-30713	3/7/2013	Ra-226	18.06 ± 0.51	16.70	11.69 - 21.71	Pass
W-42713	4/27/2013	Gr. Alpha	20.67 ± 0.40	20.00	10.00 - 30.00	Pass
W-42713	4/27/2013	Gr. Beta	28.44 ± 0.32	30.90	20.90 - 40.90	Pass
WW-2870	5/7/2013	Co-60	166.1 ± 7.4	161.6	145.4 - 177.8	Pass
WW-2870	5/7/2013	Cs-137	161.2 ± 9.3	149.0	134.1 - 163.9	Pass
WW-2870	5/7/2013	H-3	6853 ± 250	6735	5388 - 8082	Pass
W-53113	5/31/2013	Ra-226	16.83 ± 0.41	16.70	11.69 - 21.71	Pass
SPAP-3332	6/19/2013	Am-241	4.60 ± 0.14	4.00	2.40 - 5.60	Pass
SPW-3334	6/19/2013	Th-230	4.36 ± 0.34	4.00	2.40 - 5.60	Pass
SPW-3458	6/24/2013	C-14	3825 ± 13	4736	2842 - 6630	Pass
SPAP-3529	6/27/2013	Cs-134	3.49 ± 1.26	3.30	1.98 - 4.62	Pass
SPAP-3529	6/27/2013	Cs-137	102.0 ± 2.9	101.1	90.99 - 111.21	Pass
SPAP-3531	6/27/2013	Gr. Beta	45.64 ± 0.11	45.42	27.25 - 63.59	Pass
SPF-3533	6/27/2013	Cs-134	1.31 ± 0.14	1.50	0.90 - 2.10	Pass
SPF-3533	6/27/2013	Cs-137	2.77 ± 0.27	2.43	1.46 - 3.40	Pass
SPW-3535	6/27/2013	Ni-63	204.3 ± 3.5	204.8	143.4 - 266.2	Pass
SPW-3537	6/27/2013	Tc-99	104.5 ± 1.7	107.8	75.46 - 140.14	Pass
SPW-3539	6/27/2013	Fe-55	97015 ± 860	90677	72542 - 108812	Pass
SPW-1893	6/28/2013	Ra-228	30.16 - 2.73	30.85	21.60 - 40.11	Pass

TABLE A-3. In-House "Spiked" Samples

Lab Code [b]	Date	Concentration (pCi/L)[a] Analysis	Laboratory results 2s, n=1 [c]	Known Activity	Control Limits [d]	Acceptance
SPW-72913S	7/29/2013	Tc-99	126.6 ± 2.2	107.8	75.46 ± 140.14	Pass
SPW-4373	7/31/2013	Cs-134	91.71 ± 6.02	90.94	80.94 ± 100.94	Pass
SPW-4373	7/31/2013	Cs-137	83.05 ± 7.20	76.57	66.57 ± 86.57	Pass
SPW-4373	7/31/2013	Sr-90	39.28 ± 1.77	39.64	31.71 ± 47.57	Pass
SPW-4374	7/31/2013	Sr-90	42.17 ± 1.71	39.64	31.71 ± 47.57	Pass
SPMI-4376	7/31/2013	Cs-134	82.22 - 7.23	90.94	80.94 ± 100.94	Pass
SPMI-4376	7/31/2013	Cs-137	83.31 - 8.29	76.57	66.57 ± 86.57	Pass
SPMI-4376A	7/31/2013	Sr-90	35.00 ± 1.63	39.64	31.71 ± 47.57	Pass
W-73113	7/31/2013	Ra-226	17.61 ± 0.41	16.70	11.69 ± 21.71	Pass
SPS-4514	8/5/2013	Sr-90	78.63 ± 2.95	79.28	63.42 ± 95.14	Pass
W-82013	8/20/2013	Gr. Alpha	21.53 ± 0.45	20.00	10.00 ± 30.00	Pass
W-82013	8/20/2013	Gr. Beta	28.03 ± 0.32	30.90	20.90 ± 40.90	Pass
SPW-1894	8/28/2013	Ra-228	32.49 ± 3.00	30.85	21.60 ± 40.11	Pass
W-90913	9/9/2013	Gr. Alpha	19.08 ± 0.51	20.10	10.05 ± 30.15	Pass
W-90913	9/9/2013	Gr. Beta	32.12 ± 0.35	32.10	22.10 ± 42.10	Pass
WW-5623	10/3/2013	Co-60	157.0 ± 7.0	155.3	139.8 - 170.8	Pass
WW-5623	10/3/2013	Cs-137	156.0 ± 8.8	148.1	133.3 - 162.9	Pass
WW-5623	10/3/2013	H-3	6590 ± 245	6322	5058 - 7586	Pass
WW-5750	10/3/2013	Co-60	87.00 ± 7.80	77.40	77.00 ± 97.00	Pass
WW-5750	10/3/2013	Cs-137	82.30 ± 7.80	78.80	68.80 ± 88.80	Pass
WW-5750	10/3/2013	H-3	6181 ± 238	6322	5058 - 7586	Pass
W-102813	10/28/2013	Ra-226	15.69 ± 0.37	16.70	11.69 ± 21.71	Pass
SPW-1898	12/17/2013	Ra-228	28.15 ± 2.37	30.85	21.60 ± 40.11	Pass
W-122313	12/23/2013	Gr. Alpha	20.96 ± 0.47	20.10	10.05 ± 30.15	Pass
W-122313	12/23/2013	Gr. Beta	31.00 ± 0.34	32.10	22.10 ± 42.10	Pass

[a] Liquid sample results are reported in pCi/Liter, air filters(pCi/m^3), charcoal (pCi/charcoal canister), and solid samples (pCi/kg).

[b] Laboratory codes : W (Water), MI (milk), AP (air filter), SO (soil), VE (vegetation), CH (charcoal canister), F (fish), U (urine).

[c] Results are based on single determinations.

[d] Control limits are established from the precision values listed in Attachment A of this report, adjusted to ± 2s.

NOTE: For fish, Jello is used for the Spike matrix. For Vegetation, cabbage is used for the Spike matrix.

TABLE A-4. In-House "Blank" Samples

Lab Code	Sample Type	Date	Analysis[b]	Concentration (pCi/L)[a]		
				Laboratory results (4.66σ)		Acceptance
				LLD	Activity[c]	Criteria (4.66 σ)
SPW-67	Water	1/9/2013	Tc-99	1.10	0.69 ± 0.68	10
SPW-190	Water	1/18/2013	Ra-228	0.74	0.66 ± 0.43	2
SPW-1901	Water	1/18/2013	Ra-228	0.74	0.66 ± 0.43	2
SPMI-263	Milk	1/25/2013	Sr-90	0.64	0.31 ± 0.34	1
SPMI-263	Milk	1/25/2013	Sr-90	0.64	0.31 ± 0.34	1
SPW-265	Water	1/25/2013	Co-60	2.86	2.10 ± 1.72	10
SPW-265	Water	1/25/2013	Cs-134	2.98	2.25 ± 1.57	10
SPW-265	Water	1/25/2013	Cs-137	2.71	0.44 ± 1.61	10
SPW-266	Water	1/25/2013	Sr-90	0.72	-0.12 ± 0.32	1
SPAP-375	Air Filter	2/1/2013	Gr. Beta	0.003	0.016 ± 0.003	0.010
SPAP-377	Air Filter	2/1/2013	Co-60	2.31	-0.34 ± 1.75	100
SPAP-377	Air Filter	2/1/2013	Cs-134	2.72	1.22 ± 1.62	100
SPAP-377	Air Filter	2/1/2013	Cs-137	1.50	-0.52 ± 1.80	100
SPW-391	Water	2/1/2013	H-3	92.04	-29.44 ± 69.24	200
SPW-379	Water	2/10/2013	Ni-63	2.11	0.91 ± 1.30	20
W-30413	Water	3/4/2013	Gr. Alpha	0.35	0.08 ± 0.26	1
W-30413	Water	3/4/2013	Gr. Beta	0.73	0.10 ± 0.51	3.2
W-30713	Water	3/7/2013	Ra-226	0.031	0.032 ± 0.024	1
W-42713	Water	4/27/2013	Gr. Alpha	0.45	-0.14 ± 0.30	1
W-42713	Water	4/27/2013	Gr. Beta	0.72	-0.23 ± 0.50	3.2
W-53113	Water	5/31/2013	Ra-226	0.03	0.01 ± 0.02	1
SPW-3335	Water	6/19/2013	Th-230	0.01	0.01 ± 0.01	1
SPW-3459	Water	6/24/2013	C-14	10.89	10.44 ± 6.82	200
SPAP-3528	Air Filter	6/27/2013	Cs-134	2.10	-0.98 ± 1.11	100
SPAP-3528	Air Filter	6/27/2013	Cs-137	2.71	-0.24 ± 1.36	100
SPAP-3530	Air Filter	6/27/2013	Gr. Beta	0.004	0.018 ± 0.003	0.010
SPF-3532	Fish	6/27/2013	Cs-134	8.38	-1.39 ± 5.69	100
SPF-3532	Fish	6/27/2013	Cs-137	8.37	-1.88 ± 6.41	100
SPW-3534	Water	6/27/2013	Ni-63	2.47	-1.04 ± 1.48	20
SPW-3536	Water	6/27/2013	Tc-99	1.15	-1.11 ± 0.68	10
SPW-3538	water	6/27/2013	Fe-55	170.27	-17.50 ± 102.70	1000
SPW-1903	Water	6/28/2013	Ra-228	0.85	-0.02 ± 0.39	2

TABLE A-4. In-House "Blank" Samples

Lab Code	Sample Type	Date	Analysis[b]	Concentration (pCi/L)[a]		
				Laboratory results (4.66σ)		Acceptance
				LLD	Activity[c]	Criteria (4.66 σ)
SPW-72913B	Water	7/29/2013	Tc-99	1.44	-0.33 ± 0.87	10
SPW-4372	Water	7/31/2013	Co-60	1.41	-1.42 ± 3.00	10
SPW-4372	Water	7/31/2013	Cs-134	3.68	-2.66 ± 3.46	10
SPW-4372	Water	7/31/2013	Cs-137	3.53	0.29 ± 3.31	10
SPMI-4375	Milk	7/31/2013	Co-60	3.92	2.65 ± 2.26	10
SPMI-4375	Milk	7/31/2013	Cs-134	4.67	0.68 ± 2.54	10
SPMI-4375	Milk	7/31/2013	Cs-137	4.79	1.30 ± 2.68	10
SPMI-4375	Milk	7/31/2013	Sr-90	0.57	0.32 ± 0.30	1
W-73113	Water	7/31/2013	Ra-226	0.02	0.04 ± 0.02	1
SPS-4515	Powder	8/5/2013	Sr-90	0.09	-0.01 ± 0.04	1
W-82013	Water	8/20/2013	Gr. Alpha	0.42	-0.15 ± 0.28	1
W-82013	Water	8/20/2013	Gr. Beta	0.74	-0.24 ± 0.51	3.2
SPW-1904	Water	8/28/2013	Ra-228	0.96	0.85 ± 0.56	2
CHW-90913	Water	9/9/2013	Gr. Alpha	0.25	0.20 ± 0.29	1
CHW-90913	Water	9/9/2013	Gr. Beta	0.49	-0.18 ± 0.53	3.2
CHW-102013	Water	10/20/2013	Gr. Alpha	0.29	0.24 ± 0.33	1
CHW-102013	Water	10/20/2013	Gr. Beta	0.54	-0.32 ± 0.54	3.2
W-102813	Water	10/28/2013	Ra-226	0.02	0.02 ± 0.01	1
SPW-1908	Water	12/17/2013	Ra-228	0.69	0.55 ± 0.39	2
CHW-122313	Water	12/23/2013	Gr. Alpha	0.25	-0.09 ± 0.26	1
CHW-122313	Water	12/23/2013	Gr. Beta	0.48	0.05 ± 0.53	3.2
CHW-122713	Water	12/27/2013	Gr. Alpha	0.28	0.04 ± 0.31	1
CHW-122713	Water	12/27/2013	Gr. Beta	0.49	-0.33 ± 0.53	3.2

[a] Liquid sample results are reported in pCi/Liter, air filters(pCi/m^3), charcoal (pCi/charcoal canister), and solid samples (pCi/kg).

[b] I-131(G); iodine-131 as analyzed by gamma spectroscopy.

[c] Activity reported is a net activity result.

TABLE A-5. In-House "Duplicate" Samples

Lab Code	Date	Analysis	Concentration (pCi/L)[a] First Result	Second Result	Averaged Result	Acceptance
CF-41, 42	1/2/2013	Gr. Beta	8.45 ± 0.37	7.90 ± 0.35	8.17 ± 0.26	Pass
CF-41, 42	1/2/2013	Sr-90	0.030 ± 0.015	0.029 ± 0.014	0.030 ± 0.010	Pass
SWT-8243, 8244	1/2/2013	Gr. Beta	1.07 ± 0.54	0.98 ± 0.51	1.03 ± 0.37	Pass
AP-8454, 8455	1/2/2013	Be-7	0.053 ± 0.010	0.042 ± 0.010	0.048 ± 0.007	Pass
AP-8517, 8518	1/3/2013	Be-7	0.051 ± 0.015	0.049 ± 0.017	0.050 ± 0.011	Pass
MI-62, 63	1/8/2013	K-40	1317.70 ± 91.70	1351.90 ± 72.50	1334.80 ± 58.45	Pass
WW-151, 152	1/8/2013	H-3	222.70 ± 81.00	289.70 ± 84.10	256.20 ± 58.38	Pass
SG-107, 108	1/11/2013	Ra-226	55.20 ± 5.53	58.60 ± 5.94	56.90 ± 4.06	Pass
SG-107, 108	1/11/2013	Ra-228	71.60 ± 1.10	74.30 ± 1.70	72.95 ± 1.01	Pass
SG-130, 131	1/14/2013	Ra-226	3.91 ± 0.20	3.45 ± 0.27	3.68 ± 0.17	Pass
SG-130, 131	1/14/2013	Ra-228	2.40 ± 0.33	2.70 ± 0.39	2.55 ± 0.26	Pass
WW-277, 278	1/17/2013	H-3	159.71 ± 77.91	196.57 ± 79.72	178.14 ± 55.73	Pass
WW-256, 257	1/22/2013	H-3	502.70 ± 93.40	483.30 ± 92.60	493.00 ± 65.76	Pass
DW-40010, 40011	1/24/2013	Ra-226	2.55 ± 0.18	2.86 ± 0.20	2.71 ± 0.13	Pass
DW-40010, 40011	1/24/2013	Ra-228	1.78 ± 0.62	2.22 ± 0.62	2.00 ± 0.44	Pass
SWT-361, 362	1/29/2013	Gr. Beta	0.90 ± 0.40	1.01 ± 0.38	0.96 ± 0.28	Pass
DW-484, 485	1/29/2013	Gr. Beta	14.85 ± 1.93	14.81 ± 2.06	14.83 ± 1.41	Pass
S-945, 946	1/29/2013	Cs-137	14.50 ± 0.18	14.45 ± 0.19	14.48 ± 0.13	Pass
S-945, 946	1/29/2013	K-40	7.90 ± 0.74	8.00 ± 0.73	7.95 ± 0.52	Pass
S-340, 341	1/31/2013	Cs-137	0.16 ± 0.05	0.15 ± 0.06	0.15 ± 0.04	Pass
S-340, 341	1/31/2013	K-40	17.35 ± 1.34	19.75 ± 1.25	18.55 ± 0.92	Pass
AP-463, 464	1/31/2013	Be-7	0.27 ± 0.10	0.26 ± 0.10	0.26 ± 0.07	Pass
MI-631, 632	2/13/2013	K-40	1350.50 ± 105.20	1413.70 ± 85.94	1382.10 ± 67.92	Pass
WW-769, 770	2/25/2013	Gr. Beta	1.20 ± 0.33	1.35 ± 0.34	1.28 ± 0.24	Pass
DW-736, 737	2/26/2013	Gr. Beta	1.09 ± 0.54	1.57 ± 0.58	1.33 ± 0.40	Pass
SWU-790, 791	2/26/2013	Gr. Beta	2.68 ± 0.96	2.08 ± 0.95	2.38 ± 0.67	Pass
W-925, 926	2/27/2013	H-3	2265.00 ± 153.00	2329.00 ± 154.00	2297.00 ± 108.54	Pass
AP-1034, 1035	3/7/2013	Be-7	0.17 ± 0.08	0.16 ± 0.09	0.17 ± 0.06	Pass
MI-1076, 1077	3/13/2013	K-40	1347.70 ± 99.32	1396.10 ± 108.00	1371.90 ± 73.36	Pass
CH-1118, 1119	3/14/2013	I-131(G)	109.41 ± 5.69	103.88 ± 7.76	106.65 ± 4.81	Pass
WW-1221, 1222	3/14/2013	H-3	452.11 ± 97.43	403.29 ± 95.46	427.70 ± 68.20	Pass
P-1368, 1369	3/15/2013	H-3	735.24 ± 113.99	666.04 ± 111.41	700.64 ± 79.70	Pass
DW-40017, 40018	3/19/2013	Gr. Alpha	1.43 ± 0.94	1.61 ± 1.00	1.52 ± 0.69	Pass
MI-1473, 1474	4/1/2013	K-40	1618.00 ± 107.00	1767.00 ± 129.00	1692.50 ± 83.80	Pass
AP-2014, 2015	4/1/2013	Be-7	0.055 ± 0.008	0.057 ± 0.006	0.056 ± 0.005	Pass
DW-40023, 40024	4/1/2013	Ra-226	2.29 ± 0.18	2.54 ± 0.20	2.42 ± 0.13	Pass
DW-40023, 40024	4/1/2013	Ra-228	2.99 ± 0.69	2.96 ± 0.67	2.98 ± 0.48	Pass
SWU-736, 737	4/2/2013	Gr. Beta	4.80 ± 0.95	4.43 ± 0.86	4.62 ± 0.64	Pass
AP-2035, 2036	4/2/2013	Be-7	0.070 ± 0.013	0.065 ± 0.013	0.068 ± 0.009	Pass
BS-1680, 1681	4/8/2013	K-40	1995.30 ± 265.70	1992.00 ± 289.40	1993.65 ± 196.44	Pass
SW-1638, 1639	4/9/2013	H-3	1350.77 ± 130.08	1320.45 ± 129.25	1335.61 ± 91.69	Pass

TABLE A-5. In-House "Duplicate" Samples

Lab Code	Date	Analysis	Concentration (pCi/L)[a] First Result	Second Result	Averaged Result	Acceptance
WW-2394, 2395	4/9/2013	H-3	348.08 ± 88.40	302.43 ± 86.41	325.25 ± 61.81	Pass
DW-40035, 40036	4/12/2013	Ra-226	1.36 ± 0.15	1.29 ± 0.13	1.33 ± 0.10	Pass
DW-40035, 40036	4/12/2013	Ra-228	1.22 ± 0.49	1.38 ± 0.53	1.30 ± 0.36	Pass
MI-1825, 1826	4/15/2013	K-40	1290.20 ± 113.80	1378.60 ± 91.99	1334.40 ± 73.17	Pass
MI-1825, 1826	4/15/2013	Sr-90	0.68 ± 0.32	0.46 ± 0.31	0.57 ± 0.22	Pass
DW-40049, 40050	4/15/2013	Gr. Alpha	1.88 ± 0.69	2.51 ± 0.71	2.20 ± 0.50	Pass
WW-1909, 1910	4/16/2013	H-3	2145.68 ± 156.65	2108.32 ± 155.80	2127.00 ± 110.47	Pass
DW-40064, 40065	4/23/2013	Gr. Alpha	1.95 ± 0.79	1.80 ± 0.81	1.88 ± 0.57	Pass
DW-40066, 40067	4/23/2013	Ra-226	1.98 ± 0.17	1.66 ± 0.16	1.82 ± 0.12	Pass
DW-40066, 40067	4/23/2013	Ra-228	2.30 ± 0.59	2.32 ± 0.59	2.31 ± 0.42	Pass
F-2225, 2226	5/1/2013	K-40	2.81 ± 0.37	2.67 ± 0.39	2.74 ± 0.27	Pass
BS-2267, 2268	5/1/2013	K-40	13.46 ± 0.64	13.59 ± 0.62	13.52 ± 0.45	Pass
SG-2235, 2236	5/2/2013	Ac-228	18.30 ± 0.60	18.50 ± 0.60	18.40 ± 0.42	Pass
SG-2235, 2236	5/2/2013	Gr. Alpha	54.00 ± 3.70	51.90 ± 3.40	52.95 ± 2.51	Pass
SG-2235, 2236	5/2/2013	Pb-214	11.30 ± 0.30	11.20 ± 0.20	11.25 ± 0.18	Pass
AP-2288, 2289	5/2/2013	Be-7	0.19 ± 0.10	0.19 ± 0.08	0.19 ± 0.07	Pass
WW-3091, 3092	5/2/2013	H-3	1107.91 ± 153.49	1263.37 ± 157.43	1185.64 ± 109.94	Pass
SW-2373, 2374	5/8/2013	H-3	324.80 ± 86.81	364.61 ± 88.53	344.71 ± 62.00	Pass
W-2352, 2353	5/9/2013	Ra-226	0.91 ± 0.20	1.29 ± 0.22	1.10 ± 0.15	Pass
W-2352, 2353	5/9/2013	Ra-228	1.28 ± 0.87	1.03 ± 0.94	1.16 ± 0.64	Pass
CF-2499, 2500	5/13/2013	K-40	11.52 ± 0.45	12.55 ± 0.61	12.04 ± 0.38	Pass
F-3987, 3988	5/20/2013	K-40	3.07 ± 0.48	3.05 ± 0.43	3.06 ± 0.32	Pass
BS-4113, 4114	5/20/2013	K-40	8.06 ± 0.44	7.99 ± 0.44	8.02 ± 0.31	Pass
SO-2902, 2903	5/22/2013	Th-228	0.57 ± 0.07	0.51 ± 0.06	0.54 ± 0.05	Pass
SO-2902, 2903	5/22/2013	Th-230	0.39 ± 0.06	0.40 ± 0.05	0.40 ± 0.04	Pass
SO-2902, 2903	5/22/2013	Th-232	0.55 ± 0.07	0.62 ± 0.06	0.59 ± 0.05	Pass
WW-2776, 2777	5/23/2013	H-3	261.76 ± 100.85	283.17 ± 101.68	272.46 ± 71.61	Pass
WW-2818, 2819	5/23/2013	H-3	999.35 ± 126.15	880.63 ± 122.43	939.99 ± 87.90	Pass
S-7271, 7272	5/27/2013	Cs-137	2.82 ± 0.10	2.91 ± 0.09	2.86 ± 0.07	Pass
S-7271, 7272	5/27/2013	K-40	21.52 ± 0.97	21.13 ± 1.02	21.32 ± 0.70	Pass
P-2923, 2924	5/29/2013	H-3	441.31 ± 92.75	374.30 ± 89.94	407.80 ± 64.60	Pass
WW-3133, 3134	6/1/2013	H-3	278.42 ± 86.54	209.45 ± 83.44	243.93 ± 60.11	Pass
WW-3049, 3050	6/5/2013	H-3	156.08 ± 79.16	244.66 ± 83.86	200.37 ± 57.66	Pass
DW-40079, 40080	6/5/2013	Ra-226	6.67 ± 0.30	7.03 ± 0.35	6.85 ± 0.23	Pass
DW-40079, 40080	6/5/2013	Ra-228	5.55 ± 0.75	6.11 ± 0.77	5.83 ± 0.54	Pass
DW-40089, 40090	6/5/2013	Gr. Alpha	6.82 ± 0.90	5.64 ± 1.02	6.23 ± 0.68	Pass
DW-40091, 40092	6/5/2013	Ra-226	3.44 ± 0.19	3.66 ± 0.19	3.55 ± 0.13	Pass
DW-40091, 40092	6/5/2013	Ra-228	3.70 ± 0.68	4.69 ± 0.73	4.20 ± 0.50	Pass
DW-40103, 40104	6/5/2013	Ra-226	0.98 ± 0.22	0.62 ± 0.15	0.80 ± 0.13	Pass
MI-3154, 3155	6/12/2013	K-40	1513.00 ± 128.10	1456.70 ± 110.30	1484.85 ± 84.52	Pass
P-3385, 3386	6/14/2013	H-3	236.88 ± 87.87	242.87 ± 88.14	239.88 ± 62.23	Pass
F-3776, 3777	6/16/2013	Cs-137	0.039 ± 0.015	0.048 ± 0.019	0.044 ± 0.012	Pass
F-3776, 3777	6/16/2013	Gr. Beta	4.52 ± 0.09	4.63 ± 0.09	4.57 ± 0.06	Pass
F-3776, 3777	6/16/2013	K-40	3.40 ± 0.41	3.52 ± 0.39	3.46 ± 0.29	Pass

TABLE A-5. In-House "Duplicate" Samples

Lab Code	Date	Analysis	Concentration (pCi/L)[a] First Result	Second Result	Averaged Result	Acceptance
S-3238, 3239	6/17/2013	Be-7	1139.80 ± 215.00	1102.00 ± 194.70	1120.90 ± 145.03	Pass
S-3238, 3239	6/17/2013	Cs-134	26.23 ± 13.23	39.91 ± 11.73	33.07 ± 8.84	Pass
S-3238, 3239	6/17/2013	Cs-137	72.75 ± 25.99	85.91 ± 22.58	79.33 ± 17.21	Pass
S-3238, 3239	6/17/2013	K-40	21847.00 ± 656.50	22158.00 ± 622.80	22002.50 ± 452.46	Pass
SO-3343, 3344	6/17/2013	Cs-137	0.087 ± 0.022	0.084 ± 0.017	0.086 ± 0.014	Pass
SO-3343, 3344	6/17/2013	K-40	8.90 ± 0.53	9.47 ± 0.49	9.19 ± 0.36	Pass
DW-40118, 40119	6/26/2013	Gr. Alpha	3.56 ± 1.07	4.51 ± 0.96	4.04 ± 0.72	Pass
DW-40118, 40119	6/26/2013	Ra-226	2.52 ± 0.22	2.48 ± 0.19	2.50 ± 0.15	Pass
DW-40118, 40119	6/26/2013	Ra-228	2.75 ± 0.71	2.86 ± 0.75	2.81 ± 0.52	Pass
WW-3583, 3584	6/27/2013	H-3	6732.57 ± 246.74	6807.94 ± 247.98	6770.26 ± 174.91	Pass
AP-4092, 4093	6/28/2013	Be-7	0.078 ± 0.015	0.083 ± 0.017	0.080 ± 0.011	Pass
E-3608, 3609	7/1/2013	K-40	1.28 ± 0.13	1.29 ± 0.11	1.28 ± 0.09	Pass
MI-3629, 3630	7/1/2013	K-40	1840.70 ± 130.10	1804.90 ± 143.00	1822.80 ± 96.66	Pass
AP-4050, 4051	7/1/2013	Be-7	0.094 ± 0.009	0.093 ± 0.009	0.093 ± 0.006	Pass
DW-40134, 40135	7/1/2013	Ra-226	1.75 ± 0.15	1.56 ± 0.15	1.66 ± 0.11	Pass
DW-40134, 40135	7/1/2013	Ra-228	2.07 ± 0.60	1.61 ± 0.57	1.84 ± 0.41	Pass
AP-4071, 4072	7/3/2013	Be-7	0.066 ± 0.009	0.069 ± 0.011	0.067 ± 0.007	Pass
DW-40144, 40145	7/9/2013	Gr. Alpha	3.66 ± 0.85	2.85 ± 0.79	3.26 ± 0.58	Pass
DW-40146, 40147	7/9/2013	Ra-226	0.70 ± 0.11	0.72 ± 0.11	0.71 ± 0.08	Pass
DW-40146, 40147	7/9/2013	Ra-228	1.00 ± 0.58	0.70 ± 0.52	0.85 ± 0.39	Pass
VE-3818, 3819	7/9/2013	Be-7	0.41 ± 0.11	0.46 ± 0.18	0.43 ± 0.11	Pass
VE-3818, 3819	7/9/2013	K-40	4.67 ± 0.30	4.52 ± 0.43	4.60 ± 0.26	Pass
XW-4646, 4647	7/15/2013	H-3	465.00 ± 111.00	525.00 ± 114.00	495.00 ± 79.56	Pass
WW-4134, 4135	7/16/2013	H-3	315.86 ± 123.54	264.98 ± 121.78	290.42 ± 86.73	Pass
AP-4155, 4156	7/18/2013	Be-7	0.20 ± 0.11	0.16 ± 0.09	0.18 ± 0.07	Pass
MI-4218, 4219	7/22/2013	K-40	1426.80 ± 117.50	1335.70 ± 110.60	1381.25 ± 80.68	Pass
MI-4218, 4219	7/22/2013	Sr-90	0.62 ± 0.32	0.67 ± 0.32	0.65 ± 0.23	Pass
WW-4239, 4240	7/23/2013	H-3	223.71 ± 92.64	221.74 ± 92.56	222.73 ± 65.48	Pass
WW-4394, 4395	7/30/2013	Gr. Alpha	2.63 ± 1.49	2.57 ± 1.11	2.60 ± 0.93	Pass
WW-4394, 4395	7/30/2013	Gr. Beta	3.72 ± 1.17	2.63 ± 1.29	3.18 ± 0.87	Pass
WW-4394, 4395	7/30/2013	H-3	271.50 ± 91.30	297.60 ± 91.50	284.55 ± 64.63	Pass
SWU-4478, 4479	7/30/2013	Gr. Beta	2.07 ± 0.54	2.24 ± 0.55	2.16 ± 0.39	Pass
DW-40159, 40160	7/31/2013	Ra-226	3.39 ± 0.63	2.39 ± 0.45	2.89 ± 0.39	Pass
DW-40159, 40160	7/31/2013	Ra-228	3.29 ± 0.73	2.94 ± 0.68	3.12 ± 0.50	Pass
VE-4436, 4437	8/1/2013	Be-7	0.98 ± 0.21	0.89 ± 0.17	0.94 ± 0.14	Pass
VE-4436, 4437	8/1/2013	K-40	3.95 ± 0.39	3.75 ± 0.31	3.85 ± 0.25	Pass
G-4457, 4458	8/1/2013	Be-7	0.78 ± 0.19	0.67 ± 0.16	0.72 ± 0.12	Pass
G-4457, 4458	8/1/2013	Gr. Beta	6.15 ± 0.14	6.10 ± 0.14	6.13 ± 0.10	Pass
G-4457, 4458	8/1/2013	K-40	4.25 ± 0.36	4.60 ± 0.41	4.42 ± 0.27	Pass
VE-4520, 4521	8/1/2013	K-40	2.20 ± 0.16	2.09 ± 0.17	2.15 ± 0.12	Pass
WW-4772, 4773	8/6/2013	H-3	143.80 ± 86.70	157.80 ± 87.30	150.80 ± 61.52	Pass

TABLE A-5. In-House "Duplicate" Samples

Lab Code	Date	Analysis	Concentration (pCi/L)[a] First Result	Second Result	Averaged Result	Acceptance
VE-4709, 4710	8/8/2013	Gr. Beta	31.40 ± 1.00	30.70 ± 1.00	31.05 ± 0.71	Pass
VE-4709, 4710	8/8/2013	H-3	1504.00 ± 132.00	1468.00 ± 131.00	1486.00 ± 92.99	Pass
VE-4709, 4710	8/8/2013	U-233/4	0.009 ± 0.002	0.005 ± 0.002	0.007 ± 0.001	Pass
VE-4709, 4710	8/8/2013	U-238	0.005 ± 0.002	0.004 ± 0.001	0.005 ± 0.001	Pass
WW-4562, 4563	8/8/2013	H-3	208.82 ± 105.55	213.13 ± 105.73	210.97 ± 74.70	Pass
SG-4651, 4652	8/13/2013	Gr. Alpha	29.00 ± 3.10	28.80 ± 3.20	28.90 ± 2.23	Pass
SG-4651, 4652	8/13/2013	Gr. Beta	34.10 ± 1.80	34.00 ± 1.80	34.05 ± 1.27	Pass
SG-4651, 4652	8/13/2013	Ra-226	9.00 ± 0.20	8.70 ± 0.20	8.85 ± 0.14	Pass
VE-4835, 4836	8/13/2013	K-40	3.01 ± 0.24	3.08 ± 0.28	3.04 ± 0.19	Pass
WW-4877, 4878	8/14/2013	H-3	217.35 ± 87.57	276.63 ± 90.20	246.99 ± 62.86	Pass
LW-4856, 4857	8/15/2013	Gr. Beta	0.96 ± 0.40	0.94 ± 0.38	0.95 ± 0.28	Pass
W-4982, 4983	8/16/2013	H-3	757.43 ± 112.40	767.56 ± 112.76	762.50 ± 79.60	Pass
VE-4919, 4920	8/19/2013	K-40	4891.90 ± 407.90	4907.40 ± 350.40	4899.65 ± 268.87	Pass
VE-4919, 4920	8/19/2013	Be-7	470.50 ± 159.60	325.10 ± 104.10	397.80 ± 95.27	Pass
DW-40184, 40185	8/19/2013	Ra-228	2.35 ± 0.72	2.53 ± 0.70	2.44 ± 0.50	Pass
DW-40184, 40185	8/19/2013	Ra-228	1.44 ± 0.35	2.30 ± 0.56	1.87 ± 0.33	Pass
AP-5003, 5004	8/22/2013	Be-7	0.23 ± 0.10	0.21 ± 0.10	0.22 ± 0.07	Pass
LW-5229, 5230	8/29/2013	Gr. Beta	1.09 ± 0.86	2.28 ± 0.96	1.69 ± 0.64	Pass
SS-5333, 5334	9/3/2013	Cs-137	89.20 ± 41.60	97.80 ± 34.60	93.50 ± 27.05	Pass
SS-5333, 5334	9/3/2013	K-40	11893.00 ± 681.30	12353.00 ± 778.90	12123.00 ± 517.41	Pass
VE-5313, 5314	9/3/2013	K-40	1.84 ± 0.20	1.85 ± 0.20	1.85 ± 0.14	Pass
VE-5313, 5314	9/3/2013	Gr. Beta	2.38 ± 0.04	2.43 ± 0.04	2.41 ± 0.03	Pass
WW-5617, 5618	9/5/2013	H-3	1987.00 ± 147.00	2094.00 ± 150.00	2040.50 ± 105.01	Pass
AP-5355, 5356	9/5/2013	Be-7	0.22 ± 0.12	0.27 ± 0.14	0.25 ± 0.09	Pass
XW-5694, 5695	9/8/2013	C-14	0.94 ± 0.09	0.78 ± 0.10	0.86 ± 0.07	Pass
VE-5409, 5410	9/9/2013	K-40	3.60 ± 0.26	3.33 ± 0.29	3.46 ± 0.19	Pass
AP-5430, 5431	9/12/2013	Be-7	0.26 ± 0.10	0.26 ± 0.10	0.26 ± 0.07	Pass
MI-5401, 5402	9/12/2013	K-40	1404.60 ± 114.10	1356.10 ± 128.60	1380.35 ± 85.96	Pass
WW-5451, 5452	9/12/2013	H-3	196.66 ± 84.44	200.78 ± 84.64	198.72 ± 59.78	Pass
MI-5484, 5485	9/16/2013	K-40	1398.50 ± 88.93	1364.60 ± 113.30	1381.55 ± 72.02	Pass
WW-5568, 5569	9/17/2013	H-3	274.69 ± 87.95	203.72 ± 84.71	239.20 ± 61.05	Pass
BS-5764, 5765	9/20/2013	Cs-137	0.40 ± 0.03	0.37 ± 0.02	0.39 ± 0.02	Pass
BS-5764, 5765	9/20/2013	K-40	17.97 ± 0.59	17.54 ± 0.55	17.76 ± 0.40	Pass
VE-5638, 5639	9/23/2013	K-40	4.15 ± 0.33	4.46 ± 0.38	4.31 ± 0.25	Pass
WW-5596, 5597	9/23/2013	Gr. Beta	5.97 ± 1.39	5.95 ± 1.45	5.96 ± 1.01	Pass
G-5680, 5681	9/25/2013	Be-7	0.36 ± 0.13	0.35 ± 0.09	0.35 ± 0.08	Pass
G-5680, 5681	9/25/2013	Gr. Beta	3.81 ± 0.11	3.77 ± 0.11	3.79 ± 0.08	Pass
G-5680, 5681	9/25/2013	K-40	3.23 ± 0.32	2.99 ± 0.24	3.11 ± 0.20	Pass
S-5659, 5660	9/26/2013	Ac-228	1.19 ± 0.21	1.06 ± 0.21	1.13 ± 0.15	Pass
S-5659, 5660	9/26/2013	Cs-137	0.13 ± 0.04	0.14 ± 0.05	0.14 ± 0.03	Pass
S-5659, 5660	9/26/2013	K-40	16.08 ± 1.39	16.65 ± 1.46	16.37 ± 1.01	Pass
S-5659, 5660	9/26/2013	Pb-214	0.97 ± 0.15	1.10 ± 0.16	1.04 ± 0.11	Pass
AP-6345, 6346	9/30/2013	Be-7	0.077 ± 0.010	0.081 ± 0.008	0.079 ± 0.006	Pass
AP-6366, 6367	9/30/2013	Be-7	0.078 ± 0.012	0.083 ± 0.014	0.081 ± 0.009	Pass

TABLE A-5. In-House "Duplicate" Samples

Lab Code	Date	Analysis	Concentration (pCi/L)[a] First Result	Second Result	Averaged Result	Acceptance
DW-5701, 5702	9/30/2013	Gr. Beta	14.48 ± 2.04	13.32 ± 1.84	13.90 ± 1.37	Pass
SG-5722, 5723	9/30/2013	Ra-226	12.41 ± 0.47	11.98 ± 0.59	12.20 ± 0.38	Pass
SG-5722, 5723	9/30/2013	Ra-228	7.84 ± 0.71	8.13 ± 0.97	7.99 ± 0.60	Pass
G-5806, 5807	10/1/2013	Be-7	3.26 ± 0.30	3.11 ± 0.13	3.19 ± 0.16	Pass
G-5806, 5807	10/1/2013	K-40	6.65 ± 0.21	6.68 ± 0.50	6.67 ± 0.27	Pass
SG-5827, 5828	10/1/2013	Ac-228	4.08 ± 0.33	3.92 ± 0.40	4.00 ± 0.26	Pass
SG-5827, 5828	10/1/2013	K-40	2.55 ± 0.65	2.37 ± 0.63	2.46 ± 0.45	Pass
SG-5827, 5828	10/1/2013	Pb-214	3.82 ± 0.17	3.93 ± 0.20	3.88 ± 0.13	Pass
VE-5848, 5849	10/1/2013	K-40	1.62 ± 0.16	1.57 ± 0.14	1.60 ± 0.11	Pass
AP-6408, 6409	10/3/2013	Be-7	0.072 ± 0.015	0.063 ± 0.012	0.068 ± 0.010	Pass
f-5954, 5955	10/3/2013	K-40	2.74 ± 0.36	3.02 ± 0.34	2.88 ± 0.25	Pass
P-6035, 6036	10/7/2013	H-3	198.41 ± 85.00	288.60 ± 89.15	243.51 ± 61.59	Pass
SG-6115, 6116	10/8/2013	Ac-228	5.22 ± 0.50	4.87 ± 0.48	5.05 ± 0.35	Pass
SG-6115, 6116	10/8/2013	K-40	5.61 ± 1.08	6.61 ± 1.04	6.11 ± 0.75	Pass
SG-6115, 6116	10/8/2013	Pb-214	4.29 ± 0.24	4.24 ± 0.20	4.27 ± 0.16	Pass
VE-6136, 6137	10/8/2013	Be-7	0.55 ± 0.18	0.60 ± 0.15	0.58 ± 0.12	Pass
VE-6136, 6137	10/8/2013	K-40	2.78 ± 0.35	2.61 ± 0.33	2.69 ± 0.24	Pass
WW-6198, 6199	10/8/2013	H-3	12973.70 ± 332.60	12757.80 ± 330.00	12865.75 ± 234.27	Pass
VE-6240, 6241	10/9/2013	K-40	14.29 ± 0.29	14.95 ± 0.54	14.62 ± 0.31	Pass
W-5996, 5997	10/9/2013	Gr. Alpha	3.87 ± 1.18	4.07 ± 1.08	3.97 ± 0.80	Pass
W-5996, 5997	10/9/2013	Gr. Beta	9.82 ± 0.85	8.53 ± 0.82	9.18 ± 0.59	Pass
W-5996, 5997	10/9/2013	Ra-228	3.42 ± 1.02	3.39 ± 1.01	3.41 ± 0.72	Pass
DW-40224, 40225	10/11/2013	Ra-226	0.62 ± 0.10	0.76 ± 0.10	0.69 ± 0.07	Pass
DW-40224, 40225	10/11/2013	Ra-228	0.87 ± 0.55	1.00 ± 0.54	0.94 ± 0.39	Pass
WW-6219, 6220	10/11/2013	H-3	455.41 ± 111.54	354.66 ± 107.84	405.03 ± 77.57	Pass
CF-6261, 6262	10/14/2013	Be-7	1.97 ± 0.24	2.06 ± 0.22	2.01 ± 0.16	Pass
CF-6261, 6262	10/14/2013	K-40	11.55 ± 0.56	12.06 ± 0.61	11.80 ± 0.41	Pass
MI-6303, 6304	10/14/2013	K-40	1507.30 ± 110.80	1482.40 ± 110.00	1494.85 ± 78.07	Pass
VE-6534, 6535	10/17/2013	K-40	15.96 ± 0.17	16.16 ± 0.36	16.06 ± 0.20	Pass
S-6471, 6472	10/18/2013	Ac-228	0.94 ± 0.19	0.78 ± 0.18	0.86 ± 0.13	Pass
S-6471, 6472	10/18/2013	K-40	12.82 ± 1.05	12.90 ± 1.17	12.86 ± 0.79	Pass
S-6471, 6472	10/18/2013	Pb-214	0.88 ± 0.11	0.72 ± 0.12	0.80 ± 0.08	Pass
VE-6597, 6598	10/22/2013	K-40	2.46 ± 0.22	2.58 ± 0.20	2.52 ± 0.15	Pass
WW-6576, 6577	10/22/2013	H-3	745.60 ± 110.70	663.30 ± 107.60	704.45 ± 77.19	Pass
LW-6681, 6682	10/29/2013	Gr. Beta	2.00 ± 0.92	2.17 ± 0.98	2.09 ± 0.67	Pass
SWU-6765, 6766	10/29/2013	Gr. Beta	3.07 ± 0.61	2.90 ± 0.65	2.99 ± 0.45	Pass
WW-6849, 6850	10/29/2013	H-3	863.00 ± 113.80	826.60 ± 112.50	844.80 ± 80.01	Pass
MI-6786, 6787	10/30/2013	K-40	1370.60 ± 109.60	1449.20 ± 105.50	1409.90 ± 76.06	Pass
SO-6744, 6745	10/30/2013	Ac-228	0.46 ± 0.11	0.51 ± 0.11	0.48 ± 0.08	Pass
SO-6744, 6745	10/30/2013	Bi-214	0.48 ± 0.10	0.30 ± 0.10	0.39 ± 0.07	Pass
SO-6744, 6745	10/30/2013	Cs-137	0.21 ± 0.04	0.24 ± 0.04	0.23 ± 0.03	Pass
SO-6744, 6745	10/30/2013	Gr. Beta	27.40 ± 1.14	27.44 ± 1.11	27.42 ± 0.80	Pass
SO-6744, 6745	10/30/2013	K-40	14.93 ± 0.88	15.20 ± 0.90	15.07 ± 0.63	Pass
SO-6744, 6745	10/30/2013	Pb-212	0.43 ± 0.04	0.40 ± 0.05	0.42 ± 0.03	Pass
SO-6744, 6745	10/30/2013	Ra-226	1.47 ± 0.35	1.31 ± 0.36	1.39 ± 0.25	Pass
SO-6744, 6745	10/30/2013	Tl-208	0.16 ± 0.04	0.16 ± 0.04	0.16 ± 0.03	Pass

TABLE A-5. In-House "Duplicate" Samples

Lab Code	Date	Analysis	Concentration (pCi/L)[a] First Result	Second Result	Averaged Result	Acceptance
DW-40238, 40239	10/31/2013	Ra-228	0.94 ± 0.41	1.60 ± 0.55	1.27 ± 0.34	Pass
WW-7018, 7019	11/1/2013	H-3	593.09 ± 104.72	648.69 ± 106.89	620.89 ± 74.82	Pass
CF-6870, 6871	11/4/2013	K-40	12.67 ± 0.49	13.30 ± 0.47	12.98 ± 0.34	Pass
XW-6828, 6829	11/4/2013	K-40	97.99 ± 55.33	160.21 ± 74.99	129.10 ± 46.60	Pass
BS-6891, 6892	11/5/2013	Cs-137	0.018 ± 0.010	0.018 ± 0.009	0.018 ± 0.007	Pass
BS-6891, 6892	11/5/2013	Gr. Beta	12.41 ± 1.74	9.97 ± 1.57	11.19 ± 1.17	Pass
BS-6891, 6892	11/5/2013	K-40	6.49 ± 0.33	6.28 ± 0.40	6.39 ± 0.26	Pass
WW-6912, 6913	11/5/2013	Gr. Alpha	2.87 ± 1.30	4.46 ± 1.47	3.67 ± 0.98	Pass
WW-6912, 6913	11/5/2013	Gr. Beta	3.18 ± 0.87	3.18 ± 0.87	3.18 ± 0.62	Pass
WW-6912, 6913	11/5/2013	H-3	349.01 ± 101.42	430.14 ± 98.06	389.58 ± 70.54	Pass
SO-6954, 6955	11/6/2013	Cs-137	0.14 ± 0.03	0.12 ± 0.02	0.13 ± 0.02	Pass
SO-6954, 6955	11/6/2013	K-40	15.16 ± 0.72	14.11 ± 0.64	14.64 ± 0.48	Pass
S-6976, 6977	11/13/2013	K-40	22.36 ± 0.69	22.62 ± 0.72	22.49 ± 0.50	Pass
DW-40246, 40247	11/15/2013	Gr. Alpha	15.00 ± 3.41	20.31 ± 4.00	17.65 ± 2.63	Pass
CF-7102, 7103	11/18/2013	Be-7	17.79 ± 0.51	18.09 ± 0.80	17.94 ± 0.48	Pass
DW-40250, 40251	11/18/2013	Ra-226	27.77 ± 2.84	26.15 ± 2.67	26.96 ± 1.95	Pass
DW-40250, 40251	11/18/2013	Ra-228	7.91 ± 0.94	6.32 ± 0.84	7.12 ± 0.63	Pass
WW-7164, 7165	11/19/2013	H-3	266.90 ± 91.10	268.90 ± 91.20	267.90 ± 64.45	Pass
SS-7334, 7335	11/20/2013	K-40	15.51 ± 0.72	14.14 ± 0.80	14.83 ± 0.54	Pass
WW-7558, 7559	11/22/2013	H-3	229.86 ± 83.89	191.77 ± 82.05	210.82 ± 58.67	Pass
LW-7292, 7293	11/26/2013	Gr. Beta	1.92 ± 0.75	2.38 ± 0.77	2.15 ± 0.54	Pass
W-7229, 7230	12/1/2013	Ra-226	0.87 ± 0.23	0.88 ± 0.25	0.88 ± 0.17	Pass
W-7229, 7230	12/1/2013	Ra-228	3.00 ± 0.98	3.27 ± 1.16	3.14 ± 0.76	Pass
SG-7313, 7314	12/2/2013	Ac-228	6.33 ± 0.23	6.69 ± 0.30	6.51 ± 0.19	Pass
SG-7313, 7314	12/2/2013	K-40	5.47 ± 0.61	6.24 ± 0.74	5.86 ± 0.48	Pass
SG-7313, 7314	12/2/2013	Pb-214	5.60 ± 0.14	5.37 ± 0.16	5.49 ± 0.11	Pass
W-7432, 7433	12/4/2013	Gr. Beta	5.35 ± 1.20	3.89 ± 1.23	4.62 ± 0.86	Pass
WW-7516, 7517	12/10/2013	H-3	369.30 ± 95.64	269.22 ± 91.35	319.26 ± 66.13	Pass
SG-7579, 7580	12/20/2013	Ra-226	3.72 ± 0.11	3.85 ± 0.30	3.79 ± 0.16	Pass
SG-7579, 7580	12/20/2013	Ra-228	2.38 ± 0.18	2.77 ± 0.44	2.58 ± 0.24	Pass
LW-7684, 7685	12/23/2013	Gr. Beta	0.84 ± 0.51	1.96 ± 0.61	1.40 ± 0.40	Pass
DW-40261, 40262	12/27/2013	Ra-226	0.54 ± 0.10	0.67 ± 0.10	0.61 ± 0.07	Pass
DW-40261, 40262	12/27/2013	Ra-228	1.09 ± 0.51	1.12 ± 0.43	1.11 ± 0.33	Pass
SWU-7663, 7664	12/30/2013	Gr. Beta	2.85 ± 0.71	3.88 ± 0.77	3.37 ± 0.52	Pass

Note: Duplicate analyses are performed on every twentieth sample received in-house. Results are not listed for those analyses with activities that measure below the LLD.

[a] Results are reported in units of pCi/L, except for air filters (pCi/Filter), food products, vegetation, soil, sediment (pCi/g).

TABLE A-6. Department of Energy's Mixed Analyte PerforMAnce Evaluation Program (MAPEP).

			Concentration [a]			
Lab Code [b]	Date	Analysis	Laboratory result	Known Activity	Control Limits [c]	Acceptance
MAAP-738	02/01/13	Am-241	0.10 ± 0.02	0.10	0.07 - 0.14	Pass
MAAP-738	02/01/13	Co-57	2.58 ± 0.06	2.36	1.65 - 3.07	Pass
MAAP-738	02/01/13	Co-60	0.01 ± 0.03	0.00	0.00 - 0.10	Pass
MAAP-738	02/01/13	Cs-134	1.82 ± 0.13	1.78	1.25 - 2.31	Pass
MAAP-738	02/01/13	Cs-137	2.93 ± 0.10	2.60	1.82 - 3.38	Pass
MAAP-738	02/01/13	Mn-54	4.87 ± 0.13	4.26	2.98 - 5.54	Pass
MAAP-738	02/01/13	Pu-238	0.12 ± 0.02	0.13	0.09 - 0.17	Pass
MAAP-738	02/01/13	Pu-239/40	0.11 ± 0.02	0.12	0.09 - 0.16	Pass
MAAP-738	02/01/13	Sr-90	1.39 ± 0.14	1.49	1.04 - 1.94	Pass
MAAP-738	02/01/13	U-233/4	0.03 ± 0.01	0.03	0.02 - 0.04	Pass
MAAP-738	02/01/13	U-238	0.23 ± 0.03	0.23	0.16 - 0.30	Pass
MAAP-738	02/01/13	Zn-65	3.84 ± 0.20	3.13	2.19 - 4.07	Pass
MAAP-738 [d]	02/01/13	Gr. Alpha	0.14 ± 0.03	1.20	0.36 - 2.04	Fail
MAAP-738	02/01/13	Gr. Beta	0.93 ± 0.06	0.85	0.43 - 1.28	Pass
MAW-806	02/01/13	Am-241	0.71 ± 0.08	0.69	0.48 - 0.90	Pass
MAW-806	02/01/13	Co-57	31.20 ± 0.40	30.90	21.60 - 40.20	Pass
MAW-806	02/01/13	Co-60	19.70 ± 0.30	16.56	13.69 - 25.43	Pass
MAW-806	02/01/13	Cs-134	23.20 ± 0.50	24.40	17.10 - 31.70	Pass
MAW-806	02/01/13	Cs-137	0.03 ± 0.12	0.00	0.00 - 1.00	Pass
MAW-806	02/01/13	Fe-55	34.00 ± 3.30	44.00	30.80 - 57.20	Pass
MAW-806	02/01/13	H-3	511.60 ± 12.50	507.00	355.00 - 659.00	Pass
MAW-806	02/01/13	K-40	2.20 ± 0.90	0.00	0.00 - 5.00	Pass
MAW-806	02/01/13	Mn-54	27.60 ± 0.50	27.40	19.20 - 35.60	Pass
MAW-806	02/01/13	Ni-63	34.30 ± 2.80	33.40	23.40 - 43.40	Pass
MAW-806	02/01/13	Pu-238	0.83 ± 0.10	0.88	0.62 - 1.15	Pass
MAW-806	02/01/13	Pu-239/40	0.02 ± 0.02	0.01	0.00 - 1.00	Pass
MAW-806	02/01/13	Sr-90	9.30 ± 0.80	10.50	7.40 - 13.70	Pass
MAW-806	02/01/13	Tc-99	10.25 ± 0.40	13.10	9.20 - 17.00	Pass
MAW-806	02/01/13	U-233/4	0.31 ± 0.05	0.32	0.22 - 0.41	Pass
MAW-806	02/01/13	U-238	1.91 ± 0.13	1.95	1.37 - 2.54	Pass
MAW-806	02/01/13	Zn-65	31.60 ± 0.80	30.40	21.30 - 39.50	Pass
MAW-811	02/01/13	Gr. Alpha	1.87 ± 0.09	2.31	0.69 - 3.93	Pass
MAW-811	02/01/13	Gr. Beta	13.04 ± 0.13	13.00	6.50 - 19.50	Pass
MAW-811	02/01/13	I-129	4.60 ± 0.19	6.06	4.24 - 7.88	Pass

TABLE A-6. Department of Energy's Mixed Analyte PerforMAnce Evaluation Program (MAPEP).

			Concentration [a]			
Lab Code [b]	Date	Analysis	Laboratory result	Known Activity	Control Limits [c]	Acceptance
MASO-739	02/01/13	Am-241	106.90 ± 11.40	113.00	79.00 - 147.00	Pass
MASO-739	02/01/13	Co-57	0.60 ± 0.50	0.00	0.00 - 5.00	Pass
MASO-739	02/01/13	Co-60	739.20 ± 28.50	691.00	484.00 - 898.00	Pass
MASO-739	02/01/13	Cs-134	863.30 ± 34.10	887.00	621.00 - 1153.00	Pass
MASO-739	02/01/13	Cs-137	661.80 ± 25.70	587.00	411.00 - 763.00	Pass
MASO-739	02/01/13	K-40	745.80 ± 33.30	625.30	437.70 - 812.90	Pass
MASO-739	02/01/13	Mn-54	1.10 ± 1.00	0.00	0.00 - 5.00	Pass
MASO-739	02/01/13	Zn-65	1109.60 ± 44.10	995.00	697.00 - 1294.00	Pass
MASO-744	02/01/13	Ni-63	682.60 ± 16.80	670.00	469.00 - 871.00	Pass
MASO-744	02/01/13	Pu-238	0.20 ± 0.90	0.00	0.00 - 1.00	Pass
MASO-744	02/01/13	Pu-239/40	88.30 ± 9.00	79.50	55.70 - 103.40	Pass
MASO-744 [e]	02/01/13	Sr-90	408.40 ± 14.00	628.00	440.00 - 816.00	Fail
MASO-744	02/01/13	Tc-99	380.50 ± 16.80	444.00	311.00 - 577.00	Pass
MASO-744	02/01/13	U-233/4	53.20 ± 4.80	62.50	43.80 - 81.30	Pass
MASO-744	02/01/13	U-238	242.10 ± 10.20	281.00	197.00 - 365.00	Pass
MAVE-747	02/01/13	Co-57	10.37 ± 0.17	8.68	6.08 - 11.28	Pass
MAVE-747	02/01/13	Co-60	6.48 ± 0.17	5.85	4.10 - 7.61	Pass
MAVE-747	02/01/13	Cs-134	0.02 ± 0.04	0.00	0.00 - 0.10	Pass
MAVE-747	02/01/13	Cs-137	7.79 ± 0.21	6.87	4.81 - 8.93	Pass
MAVE-747	02/01/13	Mn-54	0.00 ± 0.05	0.00	0.00 - 0.10	Pass
MAVE-747	02/01/13	Zn-65	7.29 ± 0.33	6.25	4.38 - 8.13	Pass
MASO-5043	08/01/13	Am-241	1.40 ± 1.70	0.00	0.00 - 5.00	Pass
MASO-5043 [f]	08/01/13	Co-57	699.60 ± 3.90	0.00	0.00 - 5.00	Fail
MASO-5043	08/01/13	Cs-134	1191.70 ± 23.00	1172.00	820.00 - 1524.00	Pass
MASO-5043	08/01/13	Cs-137	1072.00 ± 5.10	977.00	684.00 - 1270.00	Pass
MASO-5043	08/01/13	K-40	760.00 ± 16.20	633.00	443.00 - 823.00	Pass
MASO-5043	08/01/13	Mn-54	753.80 ± 4.90	674.00	472.00 - 876.00	Pass
MASO-5043	08/01/13	Ni-63	560.00 ± 23.70	571.00	400.00 - 742.00	Pass
MASO-5043	08/01/13	Pu-238	68.40 ± 7.50	61.50	43.10 - 80.00	Pass
MASO-5043	08/01/13	Pu-239/40	0.40 ± 0.80	0.36	0.00 - 1.00	Pass
MASO-5043	08/01/13	Sr-90	383.90 ± 14.50	460.00	322.00 - 598.00	Pass
MASO-5043	08/01/13	Tc-99	-1.00 ± 10.50	0.00	0.00 - 5.00	Pass
MASO-5043	08/01/13	U-233/4	23.80 ± 3.30	30.00	21.00 - 39.00	Pass
MASO-5043	08/01/13	U-238	26.80 ± 3.50	34.00	23.80 - 44.20	Pass
MASO-5043	08/01/13	Zn-65	-351.50 ± 5.50	0.00	0.00 - 0.00	Pass

TABLE A-6. Department of Energy's Mixed Analyte PerforMAnce Evaluation Program (MAPEP).

			Concentration [a]			
Lab Code [b]	Date	Analysis	Laboratory result	Known Activity	Control Limits [c]	Acceptance
MAW-5052	08/01/13	I-129	2.75 ± 0.20	3.79	2.65 - 4.93	Pass
MAW-5094	08/01/13	Am-241	0.00 ± 0.01	0.00	0.00 - 5.00	Pass
MAW-5094	08/01/13	Co-57	0.01 ± 0.09	0.00	0.00 - 5.00	Pass
MAW-5094	08/01/13	Co-60	23.20 ± 0.32	23.58	16.51 - 30.65	Pass
MAW-5094	08/01/13	Cs-134	27.60 ± 0.58	30.40	21.00 - 39.00	Pass
MAW-5094	08/01/13	Cs-137	32.31 ± 0.52	31.60	22.10 - 41.10	Pass
MAW-5094	08/01/13	Fe-55	39.20 ± 3.50	53.30	37.30 - 69.30	Pass
MAW-5094	08/01/13	Gr. Alpha	0.54 ± 0.05	0.70	0.21 - 1.19	Pass
MAW-5094	08/01/13	Gr. Beta	5.85 ± 0.09	5.94	2.97 - 8.91	Pass
MAW-5094	08/01/13	H-3	1.20 ± 3.00	0.00	0.00 - 5.00	Pass
MAW-5094	08/01/13	K-40	2.22 ± 0.90	0.00	0.00 - 5.00	Pass
MAW-5094	08/01/13	Mn-54	0.010 ± 0.11	0.00	0.00 - 5.00	Pass
MAW-5094	08/01/13	Ni-63	21.80 ± 3.30	26.40	18.50 - 34.30	Pass
MAW-5094	08/01/13	Pu-238	1.30 ± 0.11	1.22	0.85 - 1.58	Pass
MAW-5094	08/01/13	Pu-239/40	0.98 ± 0.09	1.00	0.70 - 1.30	Pass
MAW-5094	08/01/13	Sr-90	6.40 ± 0.60	7.22	5.05 - 9.39	Pass
MAW-5094	08/01/13	Tc-99	13.10 ± 0.70	16.20	11.30 - 21.10	Pass
MAW-5094	08/01/13	U-233/4	0.080 ± 0.019	0.07	0.00 - 1.00	Pass
MAW-5094	08/01/13	U-238	0.032 ± 0.012	0.03	0.00 - 1.00	Pass
MAW-5094	08/01/13	Zn-65	35.30 ± 0.90	34.60	24.20 - 45.00	Pass
MAVE-5046	08/01/13	Co-57	0.01 ± 0.03	0.00	0.00 - 0.00	Pass
MAVE-5046	08/01/13	Co-60	0.00 ± 0.04	0.00	0.00 - 0.00	Pass
MAVE-5046	08/01/13	Cs-134	5.71 ± 0.23	5.20	3.64 - 6.76	Pass
MAVE-5046	08/01/13	Cs-137	7.64 ± 0.20	6.60	4.62 - 8.58	Pass
MAVE-5046	08/01/13	Mn-54	9.08 ± 0.24	7.88	5.52 - 10.24	Pass
MAVE-5046	08/01/13	Zn-65	2.92 ± 0.25	2.63	1.84 - 3.42	Pass

TABLE A-6. Department of Energy's Mixed Analyte PerforMAnce Evaluation Program (MAPEP).

			Concentration [a]			
Lab Code [b]	Date	Analysis	Laboratory result	Known Activity	Control Limits [c]	Acceptance
MAAP-5046	08/01/13	Am-241	0.01 ± 0.02	0.00	0.02 - 0.04	Pass
MAAP-5046	08/01/13	Co-57	3.48 ± 0.14	3.40	1.90 - 3.50	Pass
MAAP-5046	08/01/13	Co-60	2.44 ± 0.08	3.40	1.60 - 3.00	Pass
MAAP-5046	08/01/13	Cs-134	0.01 ± 0.03	0.00	0.02 - 0.04	Pass
MAAP-5046	08/01/13	Cs-137	3.09 ± 0.13	2.70	1.90 - 3.50	Pass
MAAP-5046	08/01/13	Gr. Alpha	0.28 ± 0.04	0.90	0.27 - 1.53	Pass
MAAP-5046	08/01/13	Gr. Beta	1.90 ± 0.08	1.63	0.82 - 2.45	Pass
MAAP-5046	08/01/13	Mn-54	3.95 ± 0.12	3.50	2.50 - 4.60	Pass
MAAP-5046	08/01/13	Pu-238	0.14 ± 0.028	0.12	0.087 - 0.16	Pass
MAAP-5046	08/01/13	Pu-239/40	0.10 ± 0.022	0.092	0.064 - 0.12	Pass
MAAP-5046	08/01/13	Sr-90	1.69 ± 4.10	1.81	1.27 - 2.35	Pass
MAAP-5046 [g]	08/01/13	U-233/4	0.044 ± 0.012	0.029	0.020 - 0.038	Fail
MAAP-5046	08/01/13	U-238	0.19 ± 0.027	0.21	0.14 - 0.27	Pass
MAAP-5046	08/01/13	Zn-65	3.27 ± 0.18	2.70	2.50 - 4.60	Pass

[a] Results are reported in units of Bq/kg (soil), Bq/L (water) or Bq/total sample (filters, vegetation).

[b] Laboratory codes as follows: MAW (water), MAAP (air filter), MASO (soil), MAVE (vegetation).

[c] MAPEP results are presented as the known values and expected laboratory precision (1 sigma, 1 determination) and control limits as defined by the MAPEP. A known value of "zero" indicates an analysis was included in the testing series as a "false positive". MAPEP does not provide control limits.

[d] The filter was recounted overnight, no significant alpha activity could be detected.

[e] The sample was reanalyzed using additional fuming nitric separations. Result of reanalysis: 574.4 ± 35.2 Bq/kg.

[f] Interference from Eu-152 resulted in misidentification of Co-57.

[g] Result of repeat analysis: 0.031 ± 0.013 pCi/filter.

TABLE A-7. Interlaboratory Comparison Crosscheck program, Environmental Resource Associates (ERA)[a].

Lab Code [b]	Date	Analysis	Concentration (pCi/L) [b] Laboratory Result [c]	ERA Result [d]	Control Limits	Acceptance
ERAP-1174	03/18/13	Am-241	65.2 ± 4.4	66.8	41.2 - 90.4	Pass
ERAP-1174	03/18/13	Co-60	226.5 ± 4.1	214.0	166.0 - 267.0	Pass
ERAP-1174	03/18/13	Cs-134	1101.2 ± 23.6	1110.0	706.0 - 1380.0	Pass
ERAP-1174	03/18/13	Cs-137	1065.6 ± 21.4	940.0	706.0 - 1230.0	Pass
ERAP-1174	03/18/13	Fe-55	178.8 ± 88.0	225.0	69.8 - 440.0	Pass
ERAP-1174	03/18/13	Mn-54	< 3.1	0.0	0.0 - 50.0	Pass
ERAP-1174	03/18/13	Pu-238	50.0 ± 3.0	51.1	34.3 - 65.9	Pass
ERAP-1174	03/18/13	Pu-239/40	65.7 ± 2.6	65.2	47.2 - 85.2	Pass
ERAP-1174	03/18/13	U-233/4	54.0 ± 2.5	59.4	36.8 - 89.6	Pass
ERAP-1174	03/18/13	U-238	55.6 ± 2.6	58.9	38.1 - 81.4	Pass
ERAP-1174	03/18/13	Uranium	112.0 ± 5.6	121.0	67.0 - 184.0	Pass
ERAP-1174	03/18/13	Zn-65	236.6 ± 13.8	199.0	142.0 - 275.0	Pass
ERAP-1175	03/18/13	Gr. Alpha	52.3 ± 2.8	42.3	14.2 - 65.7	Pass
ERAP-1175	03/18/13	Gr. Beta	36.2 ± 2.0	25.1	15.9 - 36.6	Pass
ERSO-1176	03/18/13	Am-241	293.1 ± 97.4	229.0	134.0 - 297.0	Pass
ERSO-1176	03/18/13	Pu-238	909.0 ± 180.0	788.0	474.0 - 1090.0	Pass
ERSO-1176	03/18/13	Pu-239/40	432.0 ± 120.0	366.0	239.0 - 506.0	Pass
ERSO-1176	03/18/13	Sr-90	8050.8 ± 376.0	8530.0	3250.0 - 13500.0	Pass
ERSO-1176	03/18/13	U-233/4	1662.6 ± 150.0	1920.0	1170.0 - 2460.0	Pass
ERSO-1176	03/18/13	U-238	1682.8 ± 160.0	1900.0	1180.0 - 2410.0	Pass
ERSO-1176	03/18/13	Uranium	3404.0 ± 330.5	3920.0	2130.0 - 5170.0	Pass
ERSO-1176	03/18/13	Ac-228	1335.0 ± 132.0	1240.0	795.0 - 1720.0	Pass
ERSO-1176	03/18/13	Bi-212	1420.0 ± 311.0	1240.0	330.0 - 1820.0	Pass
ERSO-1176	03/18/13	Bi-214	2626.0 ± 60.0	3660.0	2200.0 - 5270.0	Pass
ERSO-1176	03/18/13	Co-60	7951.0 ± 45.4	7920.0	5360.0 - 10900.0	Pass
ERSO-1176	03/18/13	Cs-134	5785.0 ± 51.0	6370.0	4160.0 - 7650.0	Pass
ERSO-1176	03/18/13	Cs-137	6106.0 ± 47.9	6120.0	4690.0 - 7870.0	Pass
ERSO-1176	03/18/13	K-40	11756.0 ± 284.3	10300.0	7520.0 - 13800.0	Pass
ERSO-1176	03/18/13	Mn-54	< 28.0	0.0	0.0 - 1000.0	Pass
ERSO-1176	03/18/13	Pb-212	1096.0 ± 29.1	1240.0	812.0 - 1730.0	Pass
ERSO-1176	03/18/13	Pb-214	2875.0 ± 60.0	3660.0	2140.0 - 5460.0	Pass
ERSO-1176	03/18/13	Th-234	2404.0 ± 218.3	1900.0	601.0 - 3570.0	Pass
ERSO-1176	03/18/13	Zn-65	1542.0 ± 56.4	1400.0	1110.0 - 1860.0	Pass

TABLE A-7. Interlaboratory Comparison Crosscheck program, Environmental Resource Associates (ERA)[a].

Lab Code [b]	Date	Analysis	Concentration (pCi/L) [b] Laboratory Result [c]	ERA Result [d]	Control Limits	Acceptance
ERVE-1180	03/18/13	Am-241	569.8 ± 81.7	553.0	338.0 - 735.0	Pass
ERVE-1180	03/18/13	Cm-244	1260.9 ± 107.3	1340.0	657.0 - 2090.0	Pass
ERVE-1180	03/18/13	Co-60	2130.5 ± 48.0	1920.0	1320.0 - 2680.0	Pass
ERVE-1180	03/18/13	Cs-134	1296.5 ± 68.0	1240.0	797.0 - 1610.0	Pass
ERVE-1180	03/18/13	Cs-137	600.1 ± 34.3	544.0	394.0 - 757.0	Pass
ERVE-1180	03/18/13	K-40	34078.0 ± 787.0	31900.0	23000.0 - 44800.0	Pass
ERVE-1180	03/18/13	Mn-54	< 28.7	0.0	0.0 - 300.0	Pass
ERVE-1180	03/18/13	Pu-238	2476.5 ± 259.4	1980.0	1180.0 - 2710.0	Pass
ERVE-1180	03/18/13	Pu-239/40	2659.3 ± 273.2	2260.0	1390.0 - 3110.0	Pass
ERVE-1180	03/18/13	Sr-90	3809.7 ± 420.5	3840.0	2190.0 - 5090.0	Pass
ERVE-1180	03/18/13	U-233/4	2460.6 ± 205.0	2460.0	1620.0 - 3160.0	Pass
ERVE-1180	03/18/13	U-238	2319.1 ± 189.6	2440.0	1630.0 - 3100.0	Pass
ERVE-1180	03/18/13	Uranium	4866.3 ± 375.6	5010.0	3390.0 - 6230.0	Pass
ERVE-1180	03/18/13	Zn-65	1052.5 ± 82.1	878.0	633.0 - 1230.0	Pass
ERW-1184	03/18/13	Am-241	114.5 ± 8.1	118.0	79.5 - 158.0	Pass
ERW-1184	03/18/13	Co-60	2221.8 ± 17.0	2270.0	1970.0 - 2660.0	Pass
ERW-1184	03/18/13	Cs-134	1309.4 ± 58.4	1400.0	1030.0 - 1610.0	Pass
ERW-1184	03/18/13	Cs-137	1865.9 ± 22.0	1880.0	1600.0 - 2250.0	Pass
ERW-1184	03/18/13	Fe-55	503.1 ± 105.0	712.0	424.0 - 966.0	Pass
ERW-1184	03/18/13	Mn-54	< 9.4	0.0	0.0 - 100.0	Pass
ERW-1184	03/18/13	Pu-238	98.4 ± 5.6	98.8	73.1 - 123.0	Pass
ERW-1184	03/18/13	Pu-239/40	184.5 ± 7.7	185.0	144.0 - 233.0	Pass
ERW-1184	03/18/13	Sr-90	125.7 ± 6.0	137.0	89.2 - 181.0	Pass
ERW-1184	03/18/13	U-233/4	44.9 ± 3.4	48.8	36.7 - 62.9	Pass
ERW-1184	03/18/13	U-238	46.5 ± 3.5	48.4	36.9 - 59.4	Pass
ERW-1184	03/18/13	Uranium	93.3 ± 7.1	99.5	73.1 - 129.0	Pass
ERW-1184	03/18/13	Zn-65	412.8 ± 32.0	384.0	320.0 - 484.0	Pass
ERW-1186	03/18/13	Gr. Alpha	109.1 ± 5.7	130.0	46.2 - 201.0	Pass
ERW-1186	03/18/13	Gr. Beta	74.5 ± 6.4	78.9	45.2 - 117.0	Pass
ERW-1188	03/18/13	H-3	12279.0 ± 319.0	12300.0	8240.0 - 17500.0	Pass

[a] Results obtained by Environmental, Inc., Midwest Laboratory as a participant in the crosscheck program for proficiency testing administered by Environmental Resources Associates, serving as a replacement for studies conducted previously by the Environmental Measurements Laboratory Quality Assessment Program (EML).

[b] Laboratory codes as follows: ERW (water), ERAP (air filter), ERSO (soil), ERVE (vegetation). Results are reported in units of pCi/L, except for air filters (pCi/Filter), vegetation and soil (pCi/kg).

[c] Unless otherwise indicated, the laboratory result is given as the mean ± standard deviation for three determinations.

[d] Results are presented as the known values, expected laboratory precision (1 sigma, 1 determination) and control limits as provided by ERA. A known value of "zero" indicates an analysis was included in the testing series as a "false positive". Control limits are not provided.

APPENDIX B
2013 REMP DATA SUMMARY REPORTS

Environmental Radiological Monitoring Program Annual Summary

Perry Nuclear Power Plant Docket Number 50-440/50-441
Lake County, Ohio Reporting Period: 2013

Sample Type and Units	Type and Number of Analyses Performed	Lower Limit (LLD)	Mean of Results from All Locations and Number Detected/Number Collected and Range	Mean of Results from All Indicator Locations and Number Detected/Number Collected and Range	Location with Highest Annual Mean		Mean of Results from All Control Locations and Number Detected/Number Collected and Range
					Location # and Distance and Direction	Mean and Number Detected/Number Collected and Range	
Air pCi/m3	Be-7 28	N/A	0.06 28 / 28 0.049 – 0.073	0.06 24 / 24 0.049 – 0.073	3 1.0 SE	0.063 4 / 4 0.051 – 0.068	0.06 4 / 4 0.055 – 0.068
Air pCi/m3	Co-58 28	N/A	< LLD	–	–	–	–
Air pCi/m3	Co-60 28	N/A	< LLD	–	–	–	–
Air pCi/m3	Cs-134 28	0.037	< LLD	–	–	–	–
Air pCi/m3	Cs-137 28	0.045	< LLD	–	–	–	–
Air pCi/m3	Gross Beta 364	0.0075	0.024 364 / 364 0.009 – 0.087	0.024 312 / 312 0.009 – 0.087	7 0.060 NE	0.026 52 / 52 0.010 – 0.066	0.025 52 / 52 0.011 – 0.066
Air pCi/m3	I-131 364	0.05	< LLD	–	–	–	–
Fish pCi/gm wet	K-40 8	N/A	1594.8 8 / 8 753 – 2737	1308.8 4 / 4 1060 – 1518	32 15.8 WSW	1880.8 4 / 4 783 – 2737	1880.8 4 / 4 783 – 2737
Fish pCi/gm wet	Mn-54 8	94	< LLD	–	–	–	–
Fish pCi/gm wet	Fe-59 8	195	< LLD	–	–	–	–

Environmental Radiological Monitoring Program Annual Summary

Perry Nuclear Power Plant Docket Number 50-440/50-441
Lake County, Ohio Reporting Period: 2013

Sample Type and Units	Type and Number of Analyses Performed	Lower Limit (LLD)	Mean of Results from All Locations and Number Detected/Number Collected and Range	Mean of Results from All Indicator Locations and Number Detected/Number Collected and Range	Location with Highest Annual Mean		Mean of Results from All Control Locations and Number Detected/Number Collected and Range
					Location # and Distance and Direction	Mean and Number Detected/Number Collected and Range	
Fish pCi/gm wet	Co-58 8	97	< LLD	–	–	–	–
Fish pCi/gm wet	Co-60 8	97	< LLD	–	–	–	–
Fish pCi/gm wet	Zn-65 8	195	< LLD	–	–	–	–
Fish pCi/gm wet	Cs-134 8	97	< LLD	–	–	–	–
Fish pCi/gm wet	Cs-137 8	112	< LLD	–	–	–	–
Broadleaf Vegetation pCi/Kg wet	Be-7 66	N/A	393.3 52 / 66 145 – 556	318.6 40 / 53 145 – 556	20 1.9 E	428.0 3 / 4 315 – 502	408.5 12 / 13 312 – 549
Broadleaf Vegetation pCi/Kg wet	K-40 66	N/A	4375.1 66 / 66 2272 – 7104	4209.7 53 / 53 2272 – 7104	18 2.5 E	5095.1 12 / 12 3740 – 6695	5049.3 13 / 13 3874 – 7104
Broadleaf Vegetation pCi/Kg wet	Co-58 66	N/A	< LLD	–	–	–	–
Broadleaf Vegetation pCi/Kg wet	Co-60 66	N/A	< LLD	–	–	–	–
Broadleaf Vegetation pCi/Kg wet	I-131 66	45	< LLD	–	–	–	–

Environmental Radiological Monitoring Program Annual Summary

Perry Nuclear Power Plant Docket Number 50-440/50-441
Lake County, Ohio Reporting Period: 2013

Sample Type and Units	Type and Number of Analyses Performed	Lower Limit (LLD)	Mean of Results from All Locations and Number Detected/Number Collected and Range	Mean of Results from All Indicator Locations and Number Detected/Number Collected and Range	Location with Highest Annual Mean		Mean of Results from All Control Locations and Number Detected/Number Collected and Range
					Location # and Distance and Direction	Mean and Number Detected/Number Collected and Range	
Broadleaf Vegetation pCi/Kg wet	Cs-134 66	45	< LLD	–	–	–	–
Broadleaf Vegetation pCi/Kg wet	Cs-137 66	60	< LLD	–	–	–	–
Milk pCi/L	K-40 68	N/A	1533.5 68 / 68 886 – 2068	1613.7 49 / 49 1170 – 2068	18 2.5 E	1829.2 17 / 17 1465 – 2068	1326.7 19 - 19 886 – 1507
Milk pCi/L	I-131 68	0.8	< LLD	–	–	–	–
Milk pCi/L	Cs-134 68	11	< LLD	–	–	–	–
Milk pCi/L	Cs-137 68	13	< LLD	–	–	–	–
Milk pCi/L	Ba-140 68	45	< LLD	–	–	–	–
Milk pCi/L	La-140 68	11	< LLD	–	–	–	–
Sediment pCi/kg wet	K-40 12	N/A	12924.8 12 / 12 8277 – 18556	11856.8 10 / 10 8277 – 15365	32 15.8 WSW	18265.0 2 / 2 17974 – 18556	18265.0 2 / 2 17974 – 18556
Sediment pCi/kg wet	Co-58 12	50	< LLD	–	–	–	–

Environmental Radiological Monitoring Program Annual Summary

Perry Nuclear Power Plant Docket Number 50-440/50-441
Lake County, Ohio Reporting Period: 2013

Sample Type and Units	Type and Number of Analyses Performed	Lower Limit (LLD)	Mean of Results from All Locations and Number Detected/Number Collected and Range	Mean of Results from All Indicator Locations and Number Detected/Number Collected and Range	Location with Highest Annual Mean		Mean of Results from All Control Locations and Number Detected/Number Collected and Range
					Location # and Distance and Direction	Mean and Number Detected/Number Collected and Range	
Sediment pCi/kg wet	Co-60 12	40	< LLD	–	–	–	–
Sediment pCi/kg wet	Cs-134 12	112	< LLD	–	–	–	–
Sediment pCi/kg wet	Cs-137 12	135	200.0 8 / 12 8277 – 18556	126.2 6 / 10 42.0 – 203.8	32 15.8 WSW	421.4 2 / 2 403.2 – 439.6	421.4 2 / 2 403.2 – 439.6
TLD mR/91 days	Direct 112	1.0	12.3 112 / 112 8.0 – 17.1	12.3 104 / 104 8.0 –17.1	33 4.5 S	15.3 4 / 4 13.2 – 16.6	11.5 8 / 8 10.1 – 13.6
TLD mR/91 days	Direct 112	1.0	11.9 112 / 112 6.6 – 17.5	11.9 104 / 104 6.6 – 17.5	31 4.8 SE	15.6 4 / 4 14.4 – 16.4	11.8 8 / 8 10.8 – 12.7
TLD mR/365 days	Direct 28	1.0	58.6 28 / 28 44.6 – 82.0	58.6 26 / 26 44.6 – 82.0	33 4.5 S	82 1 / 1 82 – 82	57.9 2 / 2 54.2 – 61.6
Water pCi/L	Gross Beta 56	3.0	2.2 45 / 56 0.9 – 3.3	2.2 35 – 44 0.9 – 3.3	60 1.0 WSW	2.4 7 / 10 1.1 – 3.3	2.3 10 / 12 1.1 – 2.9
Water pCi/L	H-3 20	1500	< LLD	–	–	–	–
Water pCi/L	Mn-54 56	11	< LLD	–	–	–	–

Environmental Radiological Monitoring Program Annual Summary

Perry Nuclear Power Plant
Lake County, Ohio

Docket Number 50-440/50-441
Reporting Period: 2013

Sample Type and Units	Type and Number of Analyses Performed	Lower Limit (LLD)	Mean of Results from All Locations and Number Detected/Number Collected and Range	Mean of Results from All Indicator Locations and Number Detected/Number Collected and Range	Location with Highest Annual Mean		Mean of Results from All Control Locations and Number Detected/Number Collected and Range
					Location # and Distance and Direction	Mean and Number Detected/Number Collected and Range	
Water pCi/L	Fe-59 58	22	< LLD	–	–	–	–
Water pCi/L	Co-58 58	11	< LLD	–	–	–	–
Water pCi/L	Co-60 58	11	< LLD	–	–	–	–
Water pCi/L	Zn-65 58	22	< LLD	–	–	–	–
Water pCi/L	Zr-95 58	22	< LLD	–	–	–	–
Water pCi/L	Nb-95 58	11	< LLD	–	–	–	–
Water pCi/L	Cs-134 58	11	< LLD	–	–	–	–
Water pCi/L	Cs-137 58	13	< LLD	–	–	–	–
Water pCi/L	Ba-140 58	45	< LLD	–	–	–	–
Water pCi/L	La-140 58	11	< LLD	–	–	–	–

APPENDIX C
2013 REMP DETAILED DATA REPORT

ATI Environmental, Inc.
Midwest Laboratory
700 Landwehr Road • Northbrook, IL 60062-2310
ph: (847) 564-0700 • fax: (847) 564-4517

MONTHLY PROGRESS REPORT
to
FIRST ENERGY CORPORATION

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM (REMP)
FOR THE
PERRY NUCLEAR POWER PLANT

Reporting Period: January-December, 2013

Prepared and Submitted by
ENVIRONMENTAL, INC.,
MIDWEST LABORATORY

Project Number: 8033

Reviewed and
Approved _____
B. Grab, M.S.
Laboratory Manager

Date 02-14-2014

Distribution: J. Balstad, CCB-125, PNPP
R. Leidy, Ohio Department of Health
J. Lucia, Lake County Health Department

LIST OF TABLES

No.	Title	Page
1	Direct Radiation, Quarterly and Annual	1-1
2	Airborne Particulate Filters and Charcoal Canisters	2-1
3	Airborne Particulate Filters	3-1
4	Lake Water	4-1
5	Milk	5-1
7	Food Products	7-1
9	Fish	9-1
11	Sediments	11-1

1.0 INTRODUCTION

The following constitutes the current 2013 Monthly Progress Report for the Radiological Environmental Monitoring Program conducted at the Perry Nuclear Power Plant in Perry, Ohio. Results of completed analyses are presented in the attached tables.

The data obtained in the program were within ranges previously encountered and to be expected in the environmental media sampled.

All concentrations, except gross beta, are decay corrected to the time of collection. Airborne iodine is decay corrected to the midpoint of the collection period.

All samples were collected within the scheduled period, unless noted otherwise in Table 2.0, Listing of Missed Samples.

2.0 LISTING OF MISSED SAMPLES

Sample Type	Location	Expected Collection Date	Reason
LW	P-59	02-26-13	Shoreline inaccessible.
LW	P-60	02-26-13	Shoreline inaccessible.
LW	P-59	03-28-13	Shoreline inaccessible.
LW	P-60	03-28-13	Shoreline inaccessible.
LW	P-59	12-23-13	Shoreline inaccessible.
LW	P-60	12-23-13	Shoreline inaccessible.

Table 1. Direct Radiation (TLDs), Quarterly Exposure.
Units: mR/91 days

	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
Date Placed	01-08-13	04-04-13	07-11-13	10-04-13
Date Removed	04-04-13	07-11-13	10-04-13	01-13-14
E-1	11.5 ± 0.4	11.6 ± 0.9	11.6 ± 1.2	13.9 ± 1.2
E-3	11.8 ± 1.0	8.7 ± 0.8	11.5 ± 0.9	10.5 ± 1.1
E-4	14.1 ± 0.9	12.1 ± 0.5	13.6 ± 0.7	13.4 ± 0.6
E-5	12.8 ± 0.7	8.0 ± 0.7	12.1 ± 0.6	9.7 ± 0.9
E-6	13.5 ± 1.2	11.7 ± 0.5	13.6 ± 1.1	11.3 ± 1.0
E-7	13.6 ± 0.7	10.1 ± 0.7	13.9 ± 0.9	12.7 ± 0.9
E-8	9.9 ± 0.7	8.3 ± 0.8	9.4 ± 0.8	10.6 ± 0.9
E-9	11.3 ± 0.8	9.3 ± 0.5	10.7 ± 0.6	10.9 ± 0.7
E-10	14.1 ± 1.0	10.6 ± 0.7	13.2 ± 0.8	13.4 ± 1.1
E-11	12.5 ± 0.7	9.4 ± 0.5	12.3 ± 0.8	11.2 ± 1.0
E-12	14.0 ± 0.9	9.6 ± 0.8	15.1 ± 1.2	10.2 ± 0.7
E-13	13.6 ± 0.6	8.8 ± 0.6	13.3 ± 0.9	12.4 ± 0.7
E-14	11.2 ± 0.6	10.6 ± 0.6	10.7 ± 0.9	11.8 ± 0.8
E-15	11.4 ± 0.7	11.2 ± 0.7	10.3 ± 0.7	12.0 ± 1.1
E-21	11.2 ± 0.6	12.4 ± 0.5	11.2 ± 0.7	12.7 ± 1.0
E-23	16.0 ± 0.7	12.2 ± 0.5	16.1 ± 1.0	12.9 ± 0.6
E-24	11.0 ± 0.7	10.1 ± 0.8	10.3 ± 0.7	10.5 ± 1.1
E-29	15.6 ± 0.5	14.7 ± 0.7	15.5 ± 0.8	14.9 ± 1.1
E-30	13.5 ± 0.7	13.9 ± 0.7	13.8 ± 0.6	14.4 ± 0.8
E-31	15.0 ± 0.5	16.1 ± 0.6	15.8 ± 0.9	12.3 ± 1.0
E-33	13.2 ± 1.0	16.3 ± 0.7	15.0 ± 1.3	16.6 ± 0.7
E-35	12.0 ± 0.8	9.5 ± 0.5	13.4 ± 0.6	10.0 ± 0.6
E-36	15.6 ± 0.5	14.8 ± 0.5	17.1 ± 0.9	12.0 ± 0.5
E-53	11.5 ± 0.8	10.6 ± 0.8	12.3 ± 0.8	12.4 ± 1.1
E-54	14.0 ± 0.9	12.2 ± 0.5	15.5 ± 1.2	10.8 ± 0.5
E-55	11.6 ± 1.3	11.3 ± 0.6	12.7 ± 1.6	11.9 ± 1.4
E-56	12.7 ± 0.6	12.4 ± 0.8	13.8 ± 0.6	12.4 ± 0.8
E-58	10.6 ± 0.7	8.5 ± 0.5	11.3 ± 0.6	8.5 ± 0.6
Mean ± s.d.	12.8 ± 1.6	11.3 ± 2.3	13.0 ± 2.0	12.0 ± 1.7
E-Control 1	7.8 ± 0.9	7.8 ± 0.8	8.2 ± 1.1	7.6 ± 0.8
E-Control 2	6.0 ± 0.6	5.4 ± 0.5	6.1 ± 0.6	5.6 ± 0.6

Table 1. Direct Radiation (TLDs), Quarterly Exposure.
Units: mR/91 days

	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
Date Placed	01-08-13	04-04-13	07-11-13	10-04-13
Date Removed	04-04-13	07-11-13	10-04-13	01-13-14
Q-1	12.1 ± 1.2	10.8 ± 1.3	10.8 ± 0.6	7.5 ± 1.3
Q-3	10.9 ± 0.5	10.5 ± 1.4	10.7 ± 0.7	6.6 ± 1.2
Q-4	12.6 ± 0.8	11.8 ± 1.1	12.9 ± 1.0	10.4 ± 1.1
Q-5	9.6 ± 0.6	10.7 ± 1.3	9.4 ± 0.6	9.4 ± 1.3
Q-6	11.4 ± 1.1	11.6 ± 1.0	12.7 ± 1.0	10.8 ± 1.2
Q-7	12.2 ± 0.8	14.2 ± 1.1	12.1 ± 0.7	11.6 ± 1.2
Q-8	11.7 ± 0.7	10.1 ± 1.0	8.7 ± 0.5	10.8 ± 1.2
Q-9	11.5 ± 0.8	9.1 ± 1.0	11.4 ± 0.9	7.4 ± 1.1
Q-10	14.2 ± 1.1	14.4 ± 1.0	14.2 ± 0.9	10.4 ± 1.1
Q-11	12.9 ± 1.4	13.4 ± 1.2	12.1 ± 0.9	12.1 ± 1.1
Q-12	12.7 ± 0.6	10.5 ± 1.3	13.1 ± 0.4	9.6 ± 1.0
Q-13	11.4 ± 0.6	10.1 ± 1.4	11.3 ± 0.5	9.3 ± 1.3
Q-14	10.2 ± 0.7	10.1 ± 1.0	10.9 ± 0.9	9.0 ± 1.2
Q-15	11.5 ± 1.1	9.8 ± 1.1	11.1 ± 0.4	8.8 ± 1.0
Q-21	12.3 ± 0.6	11.7 ± 1.0	12.3 ± 0.5	10.4 ± 1.2
Q-23	13.5 ± 1.0	13.1 ± 1.2	14.0 ± 1.0	11.3 ± 1.2
Q-24	12.3 ± 0.8	11.8 ± 1.0	12.6 ± 1.8	10.8 ± 1.1
Q-29	15.5 ± 0.8	13.8 ± 1.2	16.0 ± 0.7	14.1 ± 1.4
Q-30	14.1 ± 0.8	11.7 ± 1.0	14.3 ± 0.9	10.0 ± 1.0
Q-31	15.6 ± 0.8	15.9 ± 1.1	16.4 ± 1.0	14.4 ± 1.1
Q-33	17.0 ± 1.0	16.6 ± 1.2	12.9 ± 0.7	15.3 ± 1.1
Q-35	12.7 ± 0.7	9.5 ± 1.1	13.0 ± 0.6	8.1 ± 1.1
Q-36	16.0 ± 0.6	13.7 ± 1.1	17.5 ± 0.6	12.5 ± 1.1
Q-53	11.1 ± 0.7	12.7 ± 1.3	11.4 ± 0.5	14.0 ± 1.5
Q-54	12.2 ± 0.7	11.4 ± 1.0	13.2 ± 0.8	14.9 ± 1.3
Q-55	10.9 ± 0.7	11.2 ± 1.1	11.0 ± 0.6	11.0 ± 1.3
Q-56	10.3 ± 0.8	12.7 ± 1.3	10.5 ± 0.7	14.5 ± 1.1
Q-58	8.7 ± 0.9	8.9 ± 1.1	10.1 ± 1.7	9.7 ± 1.0
Mean ± s.d.	12.4 ± 2.0	11.9 ± 2.0	12.4 ± 2.0	10.9 ± 2.4
Q-Control 1	7.7 ± 0.5	6.2 ± 1.0	7.8 ± 0.5	6.4 ± 1.2
Q-Control 2	7.1 ± 0.7	6.7 ± 1.0	6.8 ± 0.7	7.0 ± 1.1

Table 1. Direct Radiation (TLDs), Annual Exposure.
Units: mR/365 days

	2013
Date Placed	01-08-13
Date Removed	01-13-14
A-1	50.1 ± 3.6
A-3	48.7 ± 2.4
A-4	63.0 ± 2.5
A-5	48.0 ± 2.8
A-6	61.6 ± 2.0
A-7	47.0 ± 2.5
A-8	56.4 ± 2.7
A-9	46.8 ± 3.9
A-10	62.9 ± 2.5
A-11	55.2 ± 4.8
A-12	59.5 ± 2.5
A-13	56.1 ± 2.5
A-14	44.6 ± 3.4
A-15	54.8 ± 2.8
A-21	61.8 ± 4.0
A-23	60.5 ± 2.3
A-24	54.2 ± 3.4
A-29	71.5 ± 2.7
A-30	71.3 ± 2.8
A-31	78.2 ± 3.3
A-33	82.0 ± 5.0
A-35	59.3 ± 2.9
A-36	60.7 ± 3.6
A-53	55.9 ± 4.8
A-54	64.9 ± 5.1
A-55	64.2 ± 5.9
A-56	51.8 ± 2.7
A-58	49.0 ± 2.5
Mean ± s.d.	58.6 ± 9.3
A-Control 1	17.2 ± 1.9
A-Control 2	23.4 ± 2.0

Table 2. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131.

Location: P-1
Units: pCi/m^3
Collection: Continuous, weekly exchange.

Date Collected	Volume (m^3)	Gross Beta	I-131	Date Collected	Volume (m^3)	Gross Beta	I-131
Required LLD		0.0075	0.050			0.0075	0.050
01-09-13	429	0.087 ± 0.005	< 0.014 [a]	07-11-13	607	0.019 ± 0.003	< 0.010
01-16-13	626	0.029 ± 0.003	< 0.005	07-18-13	538	0.013 ± 0.003	< 0.007
01-23-13	614	0.023 ± 0.003	< 0.005	07-24-13	423	0.025 ± 0.004	< 0.017
01-31-13	667	0.032 ± 0.002	< 0.009	08-01-13	659	0.013 ± 0.002	< 0.008
02-06-13	527	0.037 ± 0.003	< 0.010	08-07-13	505	0.017 ± 0.003	< 0.006
02-13-13	527	0.032 ± 0.003	< 0.009	08-14-13	592	0.017 ± 0.002	< 0.009
02-21-13	663	0.020 ± 0.002	< 0.008	08-22-13	651	0.028 ± 0.003	< 0.005
02-27-13	507	0.012 ± 0.003	< 0.010	08-28-13	526	0.030 ± 0.003	< 0.007
03-07-13	673	0.013 ± 0.002	< 0.010	09-04-13	552	0.027 ± 0.003	< 0.011
03-13-13	507	0.018 ± 0.003	< 0.009	09-12-13	638	0.035 ± 0.003	< 0.011
03-20-13	584	0.026 ± 0.003	< 0.009	09-19-13	544	0.019 ± 0.003	< 0.006
03-27-13	584	0.010 ± 0.002	< 0.007	09-25-13	463	0.027 ± 0.003	< 0.008
04-03-13	593	0.017 ± 0.003	< 0.008	10-02-13	540	0.021 ± 0.003	< 0.008
1Q 2013	Mean ± s.d.	0.027 ± 0.020	< 0.014	3Q 2013	Mean ± s.d.	0.022 ± 0.007	< 0.017
04-10-13	572	0.024 ± 0.003	< 0.007	10-09-13	530	0.025 ± 0.003	< 0.010
04-18-13	649	0.012 ± 0.002	< 0.006	10-16-13	505	0.025 ± 0.003	< 0.005
04-25-13	659	0.017 ± 0.002	< 0.008	10-23-13	466	0.034 ± 0.004	< 0.006
05-01-13	511	0.024 ± 0.003	< 0.005	10-30-13	574	0.014 ± 0.003	< 0.005
05-08-13	571	0.015 ± 0.003	< 0.011	11-07-13	658	0.030 ± 0.003	< 0.009
05-16-13	607	0.019 ± 0.003	< 0.007	11-14-13	574	0.023 ± 0.003	< 0.012
05-23-13	536	0.021 ± 0.003	< 0.007	11-20-13	480	0.026 ± 0.003	< 0.007
05-30-13	485	0.019 ± 0.003	< 0.010	11-27-13	569	0.023 ± 0.003	< 0.006
06-05-13	408	0.019 ± 0.003	< 0.013	12-04-13	590	0.045 ± 0.003	< 0.011
06-12-13	469	0.020 ± 0.003	< 0.008	12-11-13	546	0.040 ± 0.003	< 0.006
06-20-13	558	0.020 ± 0.003	< 0.012	12-19-13	638	0.043 ± 0.003	< 0.010
06-26-13	453	0.033 ± 0.004	< 0.005	12-26-13	554	0.030 ± 0.003	< 0.006
07-03-13	522	0.013 ± 0.003	< 0.012	01-02-14	552	0.033 ± 0.003	< 0.007
2Q 2013	Mean ± s.d.	0.020 ± 0.005	< 0.013	4Q 2013	Mean ± s.d.	0.030 ± 0.009	< 0.012
				Cumulative Average		0.025	

[a] Air flow indicator failure, volume calculated may not be accurate.

< 0.012

Table 2. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131.

Location: P-3

Units: pCi/m^3

Collection: Continuous, weekly exchange.

Date Collected	Volume (m^3)	Gross Beta	I-131	Date Collected	Volume (m^3)	Gross Beta	I-131
Required LLD		0.0075	0.050			0.0075	0.050
01-09-13	588	0.056 ± 0.004	< 0.011	07-11-13	649	0.022 ± 0.003	< 0.010
01-16-13	605	0.026 ± 0.003	< 0.005	07-18-13	577	0.012 ± 0.003	< 0.006
01-23-13	579	0.025 ± 0.003	< 0.006	07-24-13	511	0.020 ± 0.003	< 0.014
01-31-13	648	0.031 ± 0.002	< 0.009	08-01-13	658	0.014 ± 0.002	< 0.008
02-06-13	511	0.039 ± 0.003	< 0.010	08-07-13	507	0.020 ± 0.003	< 0.006
02-13-13	511	0.027 ± 0.003	< 0.009	08-14-13	590	0.019 ± 0.003	< 0.009
02-21-13	662	0.020 ± 0.002	< 0.008	08-22-13	668	0.027 ± 0.003	< 0.005
02-27-13	482	0.012 ± 0.003	< 0.010	08-28-13	524	0.029 ± 0.003	< 0.007
03-07-13	656	0.015 ± 0.002	< 0.010	09-04-13	559	0.027 ± 0.003	< 0.011
03-13-13	504	0.015 ± 0.003	< 0.009	09-12-13	653	0.036 ± 0.003	< 0.011
03-20-13	578	0.026 ± 0.003	< 0.009	09-19-13	580	0.019 ± 0.003	< 0.005
03-27-13	560	0.010 ± 0.002	< 0.007	09-25-13	488	0.027 ± 0.003	< 0.007
04-03-13	581	0.015 ± 0.002	< 0.008	10-02-13	582	0.026 ± 0.003	< 0.007
1Q 2013	Mean ± s.d.	0.024 ± 0.013	< 0.011	3Q 2013	Mean ± s.d.	0.023 ± 0.007	< 0.014
04-10-13	568	0.024 ± 0.003	< 0.007	10-09-13	557	0.024 ± 0.003	< 0.009
04-18-13	645	0.013 ± 0.002	< 0.006	10-16-13	599	0.022 ± 0.003	< 0.004
04-25-13	626	0.019 ± 0.002	< 0.009	10-23-13	537	0.031 ± 0.003	< 0.005
05-01-13	537	0.020 ± 0.003	< 0.005	10-30-13	605	0.012 ± 0.002	< 0.004
05-08-13	631	0.014 ± 0.002	< 0.010	11-07-13	663	0.029 ± 0.003	< 0.009
05-16-13	725	0.017 ± 0.002	< 0.006	11-14-13	593	0.019 ± 0.003	< 0.011
05-23-13	644	0.019 ± 0.002	< 0.006	11-20-13	482	0.026 ± 0.003	< 0.007
05-30-13	618	0.016 ± 0.002	< 0.008	11-27-13	580	0.027 ± 0.003	< 0.006
06-05-13	538	0.014 ± 0.003	< 0.010	12-04-13	598	0.042 ± 0.003	< 0.011
06-12-13	624	0.014 ± 0.002	< 0.006	12-11-13	554	0.039 ± 0.003	< 0.006
06-20-13	731	0.016 ± 0.002	< 0.009	12-19-13	654	0.041 ± 0.003	< 0.009
06-26-13	532	0.035 ± 0.003	< 0.004	12-26-13	577	0.030 ± 0.003	< 0.006
07-03-13	610	0.012 ± 0.002	< 0.010	01-02-14	572	0.035 ± 0.003	< 0.007
2Q 2013	Mean ± s.d.	0.018 ± 0.006	< 0.010	4Q 2013	Mean ± s.d.	0.029 ± 0.009	< 0.011
				Cumulative Average		0.024	

Table 2. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131.

Location: P-4

Units: pCi/m^3

Collection: Continuous, weekly exchange.

Date Collected	Volume (m^3)	Gross Beta	I-131	Date Collected	Volume (m^3)	Gross Beta	I-131
Required LLD		0.0075	0.050			0.0075	0.050
01-09-13	575	0.066 ± 0.004	< 0.011	07-11-13	627	0.020 ± 0.003	< 0.010
01-16-13	566	0.032 ± 0.003	< 0.006	07-18-13	539	0.013 ± 0.003	< 0.007
01-23-13	546	0.029 ± 0.003	< 0.006	07-24-13	459	0.021 ± 0.003	< 0.015
01-31-13	611	0.035 ± 0.003	< 0.010	08-01-13	638	0.013 ± 0.002	< 0.008
02-06-13	485	0.041 ± 0.004	< 0.011	08-07-13	509	0.020 ± 0.003	< 0.006
02-13-13	485	0.034 ± 0.003	< 0.009	08-14-13	586	0.017 ± 0.002	< 0.009
02-21-13	618	0.026 ± 0.003	< 0.009	08-22-13	645	0.031 ± 0.003	< 0.006
02-27-13	460	0.014 ± 0.003	< 0.010	08-28-13	518	0.027 ± 0.003	< 0.007
03-07-13	622	0.017 ± 0.002	< 0.010	09-04-13	554	0.030 ± 0.003	< 0.011
03-13-13	465	0.019 ± 0.003	< 0.009	09-12-13	631	0.037 ± 0.003	< 0.011
03-20-13	548	0.028 ± 0.003	< 0.009	09-19-13	546	0.018 ± 0.003	< 0.006
03-27-13	537	0.013 ± 0.003	< 0.007	09-25-13	457	0.030 ± 0.003	< 0.008
04-03-13	552	0.019 ± 0.003	< 0.009	10-02-13	561	0.023 ± 0.003	< 0.007
1Q 2013	Mean ± s.d.	0.029 ± 0.014	< 0.011	3Q 2013	Mean ± s.d.	0.023 ± 0.007	< 0.015
04-10-13	530	0.021 ± 0.003	< 0.007	10-09-13	554	0.024 ± 0.003	< 0.009
04-18-13	607	0.016 ± 0.002	< 0.007	10-16-13	595	0.020 ± 0.003	< 0.004
04-25-13	673	0.020 ± 0.002	< 0.008	10-23-13	530	0.029 ± 0.003	< 0.005
05-01-13	574	0.023 ± 0.003	< 0.005	10-30-13	576	0.014 ± 0.003	< 0.005
05-08-13	662	0.013 ± 0.002	< 0.009	11-07-13	661	0.032 ± 0.003	< 0.009
05-16-13	659	0.018 ± 0.002	< 0.007	11-14-13	602	0.020 ± 0.003	< 0.011
05-23-13	526	0.021 ± 0.003	< 0.007	11-20-13	487	0.021 ± 0.003	< 0.007
05-30-13	657	0.015 ± 0.002	< 0.008	11-27-13	579	0.024 ± 0.003	< 0.006
06-05-13	541	0.014 ± 0.003	< 0.010	12-04-13	556	0.047 ± 0.003	< 0.011
06-12-13	644	0.014 ± 0.002	< 0.006	12-11-13	558	0.039 ± 0.003	< 0.006
06-20-13	751	0.015 ± 0.002	< 0.009	12-19-13	615	0.044 ± 0.003	< 0.010
06-26-13	553	0.028 ± 0.003	< 0.004	12-26-13	570	0.026 ± 0.003	< 0.006
07-03-13	563	0.013 ± 0.003	< 0.011	01-02-14	544	0.035 ± 0.003	< 0.007
2Q 2013	Mean ± s.d.	0.018 ± 0.005	< 0.011	4Q 2013	Mean ± s.d.	0.029 ± 0.010	< 0.011
				Cumulative Average		0.025	

Table 2. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131.

Location: P-5

Units: pCi/m^3

Collection: Continuous, weekly exchange.

Date Collected	Volume (m^3)	Gross Beta	I-131	Date Collected	Volume (m^3)	Gross Beta	I-131
Required LLD		0.0075	0.050			0.0075	0.050
01-09-13	575	0.063 ± 0.004	< 0.011	07-11-13	650	0.017 ± 0.002	< 0.010
01-16-13	564	0.030 ± 0.003	< 0.006	07-18-13	575	0.013 ± 0.003	< 0.006
01-23-13	555	0.027 ± 0.003	< 0.006	07-24-13	477	0.020 ± 0.003	< 0.015
01-31-13	626	0.035 ± 0.003	< 0.010	08-01-13	617	0.014 ± 0.002	< 0.008
02-06-13	492	0.046 ± 0.004	< 0.011	08-07-13	484	0.021 ± 0.003	< 0.007
02-13-13	492	0.034 ± 0.003	< 0.009	08-14-13	555	0.019 ± 0.003	< 0.010
02-21-13	620	0.024 ± 0.003	< 0.009	08-22-13	620	0.029 ± 0.003	< 0.006
02-27-13	459	0.014 ± 0.003	< 0.011	08-28-13	497	0.030 ± 0.003	< 0.007
03-07-13	621	0.018 ± 0.002	< 0.010	09-04-13	524	0.029 ± 0.003	< 0.011
03-13-13	459	0.018 ± 0.003	< 0.009	09-12-13	615	0.034 ± 0.003	< 0.011
03-20-13	538	0.028 ± 0.003	< 0.009	09-19-13	548	0.020 ± 0.003	< 0.006
03-27-13	539	0.011 ± 0.003	< 0.007	09-25-13	456	0.026 ± 0.003	< 0.008
04-03-13	560	0.019 ± 0.003	< 0.008	10-02-13	547	0.023 ± 0.003	< 0.007
1Q 2013	Mean ± s.d.	0.028 ± 0.014	< 0.011	3Q 2013	Mean ± s.d.	0.023 ± 0.006	< 0.015
04-10-13	510	0.023 ± 0.003	< 0.008	10-09-13	531	0.029 ± 0.003	< 0.010
04-18-13	608	0.015 ± 0.002	< 0.007	10-16-13	556	0.023 ± 0.003	< 0.005
04-25-13	670	0.018 ± 0.002	< 0.008	10-23-13	525	0.027 ± 0.003	< 0.005
05-01-13	578	0.020 ± 0.003	< 0.005	10-30-13	543	0.013 ± 0.003	< 0.005
05-08-13	586	0.014 ± 0.002	< 0.010	11-07-13	644	0.031 ± 0.003	< 0.010
05-16-13	655	0.016 ± 0.002	< 0.007	11-14-13	563	0.018 ± 0.003	< 0.012
05-23-13	586	0.017 ± 0.002	< 0.007	11-20-13	452	0.026 ± 0.003	< 0.007
05-30-13	584	0.018 ± 0.003	< 0.008	11-27-13	549	0.026 ± 0.003	< 0.006
06-05-13	509	0.015 ± 0.003	< 0.011	12-04-13	536	0.043 ± 0.003	< 0.012
06-12-13	574	0.015 ± 0.003	< 0.007	12-11-13	531	0.041 ± 0.003	< 0.006
06-20-13	651	0.017 ± 0.002	< 0.011	12-19-13	613	0.044 ± 0.003	< 0.010
06-26-13	507	0.030 ± 0.003	< 0.005	12-26-13	528	0.027 ± 0.003	< 0.007
07-03-13	573	0.011 ± 0.002	< 0.011	01-02-14	533	0.036 ± 0.003	< 0.007
2Q 2013	Mean ± s.d.	0.018 ± 0.005	< 0.011	4Q 2013	Mean ± s.d.	0.030 ± 0.009	< 0.012
				Cumulative Average		0.024	
							< 0.012

Table 2. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131.

Location: P-6

Units: pCi/m^3

Collection: Continuous, weekly exchange.

Date Collected	Volume (m^3)	Gross Beta	I-131	Date Collected	Volume (m^3)	Gross Beta	I-131
Required LLD		0.0075	0.050			0.0075	0.050
01-09-13	559	0.066 ± 0.004	< 0.011	07-11-13	624	0.017 ± 0.002	< 0.010
01-16-13	562	0.030 ± 0.003	< 0.006	07-18-13	539	0.015 ± 0.003	< 0.007
01-23-13	540	0.029 ± 0.003	< 0.006	07-24-13	455	0.023 ± 0.003	< 0.015
01-31-13	611	0.038 ± 0.003	< 0.010	08-01-13	571	0.013 ± 0.003	< 0.009
02-06-13	480	0.047 ± 0.004	< 0.011	08-07-13	418	0.023 ± 0.004	< 0.008
02-13-13	480	0.030 ± 0.003	< 0.009	08-14-13	511	0.023 ± 0.003	< 0.011
02-21-13	608	0.025 ± 0.003	< 0.009	08-22-13	693	0.027 ± 0.003	< 0.005
02-27-13	453	0.016 ± 0.003	< 0.011	08-28-13	550	0.028 ± 0.003	< 0.006
03-07-13	618	0.017 ± 0.002	< 0.010	09-04-13	601	0.028 ± 0.003	< 0.010
03-13-13	466	0.018 ± 0.003	< 0.009	09-12-13	709	0.035 ± 0.003	< 0.010
03-20-13	529	0.026 ± 0.003	< 0.010	09-19-13	594	0.017 ± 0.003	< 0.005
03-27-13	540	0.012 ± 0.003	< 0.007	09-25-13	503	0.026 ± 0.003	< 0.007
04-03-13	546	0.016 ± 0.003	< 0.009	10-02-13	592	0.023 ± 0.003	< 0.007
1Q 2013	Mean ± s.d.	0.028 ± 0.015	< 0.011	3Q 2013	Mean ± s.d.	0.023 ± 0.006	< 0.015
04-10-13	522	0.027 ± 0.003	< 0.007	10-09-13	577	0.025 ± 0.003	< 0.009
04-18-13	613	0.014 ± 0.002	< 0.006	10-16-13	592	0.021 ± 0.003	< 0.004
04-25-13	533	0.022 ± 0.003	< 0.010	10-23-13	547	0.028 ± 0.003	< 0.005
05-01-13	454	0.025 ± 0.003	< 0.006	10-30-13	566	0.011 ± 0.003	< 0.005
05-08-13	662	0.011 ± 0.002	< 0.009	11-07-13	654	0.029 ± 0.003	< 0.009
05-16-13	759	0.015 ± 0.002	< 0.006	11-14-13	587	0.020 ± 0.003	< 0.011
05-23-13	636	0.019 ± 0.002	< 0.006	11-20-13	475	0.025 ± 0.003	< 0.007
05-30-13	662	0.013 ± 0.002	< 0.007	11-27-13	573	0.023 ± 0.003	< 0.006
06-05-13	535	0.014 ± 0.003	< 0.010	12-04-13	570	0.046 ± 0.003	< 0.011
06-12-13	599	0.015 ± 0.003	< 0.007	12-11-13	543	0.043 ± 0.003	< 0.006
06-20-13	654	0.019 ± 0.002	< 0.010	12-19-13	627	0.047 ± 0.003	< 0.010
06-26-13	487	0.033 ± 0.003	< 0.005	12-26-13	555	0.027 ± 0.003	< 0.006
07-03-13	548	0.016 ± 0.003	< 0.012	01-02-14	550	0.035 ± 0.003	< 0.007
2Q 2013	Mean ± s.d.	0.019 ± 0.006	< 0.012	4Q 2013	Mean ± s.d.	0.029 ± 0.011	< 0.011
				Cumulative Average		0.025	

Table 2. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131.

Location: P-7

Units: pCi/m^3

Collection: Continuous, weekly exchange.

Date Collected	Volume (m^3)	Gross Beta	I-131	Date Collected	Volume (m^3)	Gross Beta	I-131
Required LLD		0.0075	0.050			0.0075	0.050
01-09-13	540	0.066 ± 0.004	< 0.011	07-11-13	707	0.016 ± 0.002	< 0.009
01-16-13	544	0.031 ± 0.003	< 0.006	07-18-13	660	0.011 ± 0.002	< 0.005
01-23-13	534	0.027 ± 0.003	< 0.006	07-24-13	536	0.020 ± 0.003	< 0.013
01-31-13	593	0.037 ± 0.003	< 0.010	08-01-13	718	0.010 ± 0.002	< 0.007
02-06-13	464	0.045 ± 0.004	< 0.011	08-07-13	511	0.020 ± 0.003	< 0.006
02-13-13	464	0.036 ± 0.004	< 0.010	08-14-13	476	0.017 ± 0.003	< 0.012
02-21-13	605	0.025 ± 0.003	< 0.009	08-22-13	565	0.031 ± 0.003	< 0.006
02-27-13	454	0.014 ± 0.003	< 0.011	08-28-13	431	0.036 ± 0.004	< 0.008
03-07-13	616	0.016 ± 0.002	< 0.010	09-04-13	411	0.032 ± 0.004	< 0.015
03-13-13	456	0.019 ± 0.003	< 0.010	09-12-13	606	0.048 ± 0.003	< 0.011
03-20-13	533	0.028 ± 0.003	< 0.010	09-19-13	525	0.027 ± 0.003	< 0.006
03-27-13	533	0.012 ± 0.003	< 0.007	09-25-13	434	0.037 ± 0.004	< 0.008
04-03-13	543	0.015 ± 0.003	< 0.009	10-02-13	533	0.034 ± 0.003	< 0.008
1Q 2013	Mean ± s.d.	0.029 ± 0.015	< 0.011	3Q 2013	Mean ± s.d.	0.026 ± 0.011	< 0.015
04-10-13	525	0.026 ± 0.003	< 0.007	10-09-13	487	0.036 ± 0.004	< 0.011
04-18-13	598	0.014 ± 0.002	< 0.007	10-16-13	494	0.033 ± 0.003	< 0.005
04-25-13	529	0.020 ± 0.003	< 0.010	10-23-13	475	0.042 ± 0.004	< 0.006
05-01-13	456	0.021 ± 0.003	< 0.006	10-30-13	572	0.010 ± 0.003	< 0.005
05-08-13	523	0.016 ± 0.003	< 0.012	11-07-13	655	0.030 ± 0.003	< 0.009
05-16-13	591	0.018 ± 0.003	< 0.007	11-14-13	564	0.019 ± 0.003	< 0.012
05-23-13	512	0.020 ± 0.003	< 0.007	11-20-13	469	0.024 ± 0.003	< 0.007
05-30-13	532	0.016 ± 0.003	< 0.009	11-27-13	552	0.020 ± 0.003	< 0.006
06-05-13	449	0.015 ± 0.003	< 0.012	12-04-13	560	0.040 ± 0.003	< 0.011
06-12-13	529	0.014 ± 0.003	< 0.007	12-11-13	522	0.037 ± 0.003	< 0.006
06-20-13	603	0.014 ± 0.002	< 0.011	12-19-13	619	0.037 ± 0.003	< 0.010
06-26-13	498	0.026 ± 0.003	< 0.005	12-26-13	535	0.027 ± 0.003	< 0.007
07-03-13	637	0.010 ± 0.002	< 0.010	01-02-14	541	0.035 ± 0.003	< 0.007
2Q 2013	Mean ± s.d.	0.018 ± 0.005	< 0.012	4Q 2013	Mean ± s.d.	0.030 ± 0.009	< 0.012
				Cumulative Average		0.025	

Table 2. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131.

Location: P-35

Units: pCi/m^3

Collection: Continuous, weekly exchange.

Date Collected	Volume (m^3)	Gross Beta	I-131	Date Collected	Volume (m^3)	Gross Beta	I-131
Required LLD		0.0075	0.050			0.0075	0.050
01-09-13	566	0.068 ± 0.004	< 0.009	07-11-13	636	0.017 ± 0.002	< 0.012
01-16-13	561	0.033 ± 0.003	< 0.010	07-18-13	616	0.011 ± 0.002	< 0.008
01-23-13	564	0.027 ± 0.003	< 0.011	07-24-13	509	0.018 ± 0.003	< 0.008
01-31-13	636	0.031 ± 0.003	< 0.009	08-01-13	658	0.012 ± 0.002	< 0.010
02-06-13	496	0.042 ± 0.004	< 0.007	08-07-13	500	0.018 ± 0.003	< 0.032
02-13-13	496	0.030 ± 0.003	< 0.008	08-14-13	583	0.016 ± 0.002	< 0.010
02-21-13	639	0.022 ± 0.002	< 0.012	08-22-13	663	0.027 ± 0.003	< 0.014
02-27-13	484	0.013 ± 0.003	< 0.008	08-28-13	529	0.029 ± 0.003	< 0.009
03-07-13	641	0.016 ± 0.002	< 0.008	09-04-13	567	0.024 ± 0.003	< 0.013
03-13-13	470	0.019 ± 0.003	< 0.012	09-12-13	663	0.031 ± 0.003	< 0.006
03-20-13	543	0.027 ± 0.003	< 0.008	09-19-13	570	0.017 ± 0.003	< 0.007
03-27-13	544	0.013 ± 0.003	< 0.010	09-25-13	483	0.024 ± 0.003	< 0.007
04-03-13	546	0.018 ± 0.003	< 0.013	10-02-13	572	0.022 ± 0.003	< 0.006
1Q 2013	Mean ± s.d.	0.028 ± 0.015	< 0.013	3Q 2013	Mean ± s.d.	0.020 ± 0.006	< 0.032
04-10-13	533	0.022 ± 0.003	< 0.011	10-09-13	554	0.024 ± 0.003	< 0.011
04-18-13	608	0.014 ± 0.002	< 0.011	10-16-13	574	0.021 ± 0.003	< 0.011
04-25-13	731	0.017 ± 0.002	< 0.005	10-23-13	539	0.027 ± 0.003	< 0.013
05-01-13	598	0.017 ± 0.003	< 0.009	10-30-13	583	0.011 ± 0.002	< 0.006
05-08-13	686	0.013 ± 0.002	< 0.016	11-07-13	664	0.028 ± 0.003	< 0.009
05-16-13	720	0.016 ± 0.002	< 0.009	11-14-13	587	0.020 ± 0.003	< 0.009
05-23-13	635	0.020 ± 0.002	< 0.007	11-20-13	496	0.025 ± 0.003	< 0.008
05-30-13	599	0.015 ± 0.002	< 0.006	11-27-13	579	0.024 ± 0.003	< 0.010
06-05-13	553	0.012 ± 0.002	< 0.012	12-04-13	588	0.039 ± 0.003	< 0.013
06-12-13	779	0.011 ± 0.002	< 0.009	12-11-13	543	0.041 ± 0.003	< 0.010
06-20-13	759	0.009 ± 0.002	< 0.013	12-19-13	628	0.040 ± 0.003	< 0.006
06-26-13	671	0.013 ± 0.002	< 0.008	12-26-13	546	0.030 ± 0.003	< 0.006
07-03-13	449	0.014 ± 0.003	< 0.015	01-02-14	552	0.037 ± 0.003	< 0.006
2Q 2013	Mean ± s.d.	0.015 ± 0.004	< 0.016	4Q 2013	Mean ± s.d.	0.028 ± 0.009	< 0.013
				Cumulative Average		0.023	

Table 3. Airborne particulates, analyses for gamma-emitting isotopes.
Collection: Quarterly Composite
Units: pCi/m^3

Location	PE-1				
Quarter	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Req. LLD
Lab Code	PEAP- 2037	PEAP- 4035	PEAP- 6390	PEAP- 7912	
Vol. (m^3)	7499	7002	7238	7236	
Be-7	0.051 ± 0.009	0.073 ± 0.009	0.058 ± 0.009	0.067 ± 0.010	-
Co-58	< 0.0007	< 0.0003	< 0.0004	< 0.0004	-
Co-60	< 0.0003	< 0.0004	< 0.0005	< 0.0002	-
Cs-134	< 0.0003	< 0.0004	< 0.0005	< 0.0006	0.037
Cs-137	< 0.0006	< 0.0002	< 0.0003	< 0.0002	0.045

Location	PE-3				
Lab Code	PEAP- 2038	PEAP- 4036	PEAP- 6391	PEAP- 7913	
Vol. (m^3)	7465	8026	7547	7571	
Be-7	0.051 ± 0.009	0.067 ± 0.009	0.068 ± 0.011	0.065 ± 0.012	-
Co-58	< 0.0003	< 0.0004	< 0.0004	< 0.0008	-
Co-60	< 0.0002	< 0.0003	< 0.0005	< 0.0006	-
Cs-134	< 0.0003	< 0.0003	< 0.0005	< 0.0007	0.037
Cs-137	< 0.0003	< 0.0003	< 0.0003	< 0.0004	0.045

Location	PE-4				
Lab Code	PEAP- 2039	PEAP- 4037	PEAP- 6392	PEAP- 7915	
Vol. (m^3)	7069	7940	7269	7427	
Be-7	0.055 ± 0.010	0.058 ± 0.009	0.059 ± 0.008	0.060 ± 0.009	-
Co-58	< 0.0004	< 0.0005	< 0.0003	< 0.0003	-
Co-60	< 0.0002	< 0.0006	< 0.0002	< 0.0002	-
Cs-134	< 0.0004	< 0.0004	< 0.0004	< 0.0006	0.037
Cs-137	< 0.0003	< 0.0005	< 0.0004	< 0.0002	0.045

Location	PE-5				
Lab Code	PEAP- 2040	PEAP- 4038	PEAP- 6393	PEAP- 7916	
Vol. (m^3)	7099	7591	7165	7103	
Be-7	0.055 ± 0.007	0.068 ± 0.007	0.064 ± 0.010	0.056 ± 0.010	-
Co-58	< 0.0005	< 0.0004	< 0.0002	< 0.0003	-
Co-60	< 0.0003	< 0.0002	< 0.0003	< 0.0003	-
Cs-134	< 0.0002	< 0.0003	< 0.0005	< 0.0006	0.037
Cs-137	< 0.0003	< 0.0004	< 0.0002	< 0.0001	0.045

Table 3. Airborne particulates, analyses for gamma-emitting isotopes.
Collection: Quarterly Composite
Units: pCi/m^3

Location	PE-6				
Quarter	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Req. LLD
Lab Code	PEAP- 2041	PEAP- 4039	PEAP- 6394	PEAP- 7917	
Vol. (m^3)	6992	7665	7360	7418	
Be-7	0.058 ± 0.009	0.055 ± 0.008	0.068 ± 0.010	0.059 ± 0.009	-
Co-58	< 0.0003	< 0.0003	< 0.0003	< 0.0002	-
Co-60	< 0.0002	< 0.0003	< 0.0002	< 0.0003	-
Cs-134	< 0.0002	< 0.0004	< 0.0005	< 0.0005	0.037
Cs-137	< 0.0003	< 0.0005	< 0.0001	< 0.0002	0.045
Location	PE-7				
Lab Code	PEAP- 2042	PEAP- 4040	PEAP- 6395	PEAP- 7918	
Vol. (m^3)	6878	6983	7114	7046	
Be-7	0.049 ± 0.009	0.072 ± 0.009	0.064 ± 0.011	0.059 ± 0.008	-
Co-58	< 0.0005	< 0.0006	< 0.0002	< 0.0004	-
Co-60	< 0.0004	< 0.0006	< 0.0003	< 0.0003	-
Cs-134	< 0.0005	< 0.0005	< 0.0005	< 0.0003	0.037
Cs-137	< 0.0006	< 0.0004	< 0.0002	< 0.0004	0.045
Location	PE-35				
Lab Code	PEAP- 2043	PEAP- 4041	PEAP- 6396	PEAP- 7919	
Vol. (m^3)	7187	8321	7550	7433	
Be-7	0.066 ± 0.010	0.055 ± 0.008	0.050 ± 0.008	0.061 ± 0.009	-
Co-58	< 0.0002	< 0.0002	< 0.0005	< 0.0005	-
Co-60	< 0.0002	< 0.0003	< 0.0004	< 0.0002	-
Cs-134	< 0.0003	< 0.0003	< 0.0005	< 0.0004	0.037
Cs-137	< 0.0004	< 0.0004	< 0.0002	< 0.0004	0.045

Table 4. Lake water, analyses for gross beta and gamma emitting isotopes.

Location: P-28 Collection: Monthly composites Units: pCi/L

Lab Code	PELW- 495	PELW- 936	PELW- 1419	PELW- 2095	
Start Date	12-27-12	01-31-13	02-26-13	03-28-13	Req. LLD
End Date	01-31-13	02-26-13	03-28-13	04-25-13	
Gross beta	2.1 ± 0.8	< 0.9	2.3 ± 1.1	2.5 ± 0.8	3.0
Mn-54	< 3.3	< 2.4	< 2.9	< 1.6	11
Fe-59	< 6.2	< 4.6	< 6.0	< 3.6	22
Co-58	< 2.2	< 1.7	< 4.6	< 3.1	11
Co-60	< 3.3	< 2.3	< 3.4	< 2.2	11
Zn-65	< 3.3	< 4.2	< 8.6	< 3.6	22
Zr-95	< 6.4	< 5.3	< 6.6	< 3.2	22
Nb-95	< 3.3	< 2.8	< 6.2	< 3.0	11
Cs-134	< 3.6	< 2.1	< 4.1	< 3.1	11
Cs-137	< 3.6	< 2.5	< 4.8	< 3.8	13
Ba-140	< 31.8	< 23.1	< 21.1	< 11.6	45
La-140	< 6.8	< 3.3	< 8.3	< 4.4	11

Lab Code	PELW- 2980	PELW- 3573	PELW- 4529	PELW- 5226	
Start Date	04-25-13	05-30-13	06-26-13	07-25-13	Req. LLD
End Date	05-30-13	06-26-13	07-25-13	08-29-13	
Gross beta	1.1 ± 0.6	2.5 ± 0.8	2.2 ± 0.8	< 1.9	3.0
Mn-54	< 2.7	< 2.4	< 3.3	< 3.0	11
Fe-59	< 4.2	< 6.1	< 3.6	< 4.8	22
Co-58	< 2.1	< 2.4	< 3.5	< 3.3	11
Co-60	< 1.8	< 1.9	< 2.5	< 1.6	11
Zn-65	< 2.6	< 3.3	< 3.3	< 4.8	22
Zr-95	< 5.4	< 3.7	< 6.6	< 6.2	22
Nb-95	< 3.9	< 2.7	< 3.8	< 3.5	11
Cs-134	< 3.1	< 2.3	< 3.1	< 2.5	11
Cs-137	< 1.9	< 3.2	< 2.1	< 2.1	13
Ba-140	< 18.3	< 17.1	< 28.4	< 24.6	45
La-140	< 6.9	< 4.4	< 5.1	< 7.5	11

Lab Code	PELW- 5772	PELW- 6678	PELW- 7288	PELW- 7683	
Start Date	08-29-13	09-26-13	10-29-13	11-26-13	Req. LLD
End Date	09-26-13	10-29-13	11-26-13	12-23-13	
Gross beta	2.2 ± 1.1	2.6 ± 1.1	2.9 ± 0.8	2.1 ± 0.7	3.0
Mn-54	< 2.4	< 2.2	< 2.3	< 1.8	11
Fe-59	< 5.7	< 5.2	< 5.4	< 4.9	22
Co-58	< 2.6	< 3.8	< 2.5	< 2.1	11
Co-60	< 3.2	< 1.3	< 1.0	< 1.5	11
Zn-65	< 5.8	< 4.6	< 4.4	< 3.8	22
Zr-95	< 4.5	< 4.4	< 4.2	< 3.0	22
Nb-95	< 4.3	< 2.9	< 2.7	< 2.4	11
Cs-134	< 2.8	< 4.1	< 2.4	< 1.8	11
Cs-137	< 3.1	< 3.4	< 2.1	< 1.9	13
Ba-140	< 17.0	< 13.5	< 12.0	< 22.3	45
La-140	< 2.8	< 1.7	< 1.6	< 3.0	11

Table 4. Lake water, analyses for gross beta and gamma emitting isotopes.

Location: P-34 Collection: Monthly composites Units: pCi/L

Lab Code	PELW- 496	PELW- 937	PELW- 1420	PELW- 2096	
Start Date	12-27-12	01-31-13	02-26-13	03-28-13	Req. LLD
End Date	01-31-13	02-26-13	03-28-13	04-25-13	
Gross beta	2.6 ± 0.7	1.5 ± 0.6	< 1.7	2.2 ± 0.8	3.0
Mn-54	< 2.3	< 2.1	< 2.0	< 2.0	11
Fe-59	< 3.8	< 5.8	< 5.6	< 3.0	22
Co-58	< 3.3	< 2.8	< 3.8	< 1.7	11
Co-60	< 2.3	< 2.1	< 2.7	< 2.7	11
Zn-65	< 3.8	< 2.9	< 5.1	< 6.1	22
Zr-95	< 3.6	< 3.9	< 5.3	< 4.9	22
Nb-95	< 3.5	< 3.0	< 3.8	< 3.6	11
Cs-134	< 2.5	< 2.0	< 2.6	< 3.0	11
Cs-137	< 2.0	< 2.4	< 2.9	< 2.9	13
Ba-140	< 30.7	< 17.2	< 18.8	< 17.9	45
La-140	< 4.8	< 2.6	< 5.5	< 3.8	11

Lab Code	PELW- 2981	PELW- 3574	PELW- 4530	PELW- 5227	
Start Date	04-25-13	05-30-13	06-26-13	07-25-13	Req. LLD
End Date	05-30-13	06-26-13	07-25-13	08-29-13	
Gross beta	1.3 ± 0.5	1.5 ± 0.7	2.4 ± 0.7	< 1.7	3.0
Mn-54	< 2.7	< 2.8	< 2.5	< 1.5	11
Fe-59	< 4.7	< 4.8	< 3.8	< 5.0	22
Co-58	< 1.9	< 2.4	< 1.7	< 2.7	11
Co-60	< 1.5	< 2.8	< 1.5	< 2.1	11
Zn-65	< 4.1	< 2.0	< 3.3	< 3.1	22
Zr-95	< 3.1	< 3.3	< 5.4	< 3.6	22
Nb-95	< 2.6	< 3.1	< 3.8	< 3.4	11
Cs-134	< 2.5	< 2.3	< 2.4	< 2.4	11
Cs-137	< 2.7	< 2.6	< 2.3	< 2.9	13
Ba-140	< 23.0	< 21.0	< 27.9	< 30.9	45
La-140	< 3.8	< 3.7	< 8.5	< 3.5	11

Lab Code	PELW- 5773	PELW- 6679	PELW- 7289	PELW- 7684	
Start Date	08-29-13	09-26-13	10-29-13	11-26-13	Req. LLD
End Date	09-26-13	10-29-13	11-26-13	12-23-13	
Gross beta	< 1.7	2.3 ± 1.0	3.0 ± 0.8	2.0 ± 0.6	3.0
Mn-54	< 3.0	< 1.6	< 2.2	< 2.0	11
Fe-59	< 5.2	< 3.7	< 4.3	< 4.3	22
Co-58	< 2.4	< 2.2	< 2.5	< 2.1	11
Co-60	< 2.6	< 2.9	< 2.0	< 0.9	11
Zn-65	< 3.2	< 4.0	< 3.9	< 3.5	22
Zr-95	< 3.9	< 6.0	< 4.7	< 4.1	22
Nb-95	< 2.4	< 1.9	< 3.1	< 1.6	11
Cs-134	< 2.6	< 3.1	< 2.8	< 1.8	11
Cs-137	< 2.9	< 3.0	< 3.1	< 2.3	13
Ba-140	< 20.9	< 15.4	< 19.7	< 20.8	45
La-140	< 3.5	< 3.5	< 4.2	< 3.5	11

Table 4. Lake water, analyses for gross beta and gamma emitting isotopes.

Location: P-36 Collection: Monthly composites Units: pCi/L

Lab Code	PELW- 497	PELW- 938	PELW- 1421	PELW- 2097	
Start Date	12-27-12	01-31-13	02-26-13	03-28-13	Req. LLD
End Date	01-31-13	02-26-13	03-28-13	04-25-13	
Gross beta	2.1 ± 0.8	< 0.8	< 1.8	2.6 ± 0.7	3.0
Mn-54	< 1.9	< 1.7	< 3.0	< 2.4	11
Fe-59	< 5.3	< 5.3	< 4.4	< 3.7	22
Co-58	< 2.5	< 1.2	< 2.7	< 1.9	11
Co-60	< 2.3	< 1.7	< 2.5	< 2.7	11
Zn-65	< 3.8	< 3.0	< 4.4	< 1.9	22
Zr-95	< 6.8	< 3.5	< 6.9	< 4.3	22
Nb-95	< 4.7	< 2.8	< 4.2	< 2.7	11
Cs-134	< 2.4	< 2.1	< 2.6	< 2.3	11
Cs-137	< 3.3	< 3.2	< 3.0	< 2.4	13
Ba-140	< 16.4	< 14.0	< 16.7	< 15.0	45
La-140	< 5.8	< 3.5	< 4.5	< 2.0	11

Lab Code	PELW- 2982	PELW- 3575	PELW- 4531	PELW- 5228	
Start Date	04-25-13	05-30-13	06-26-13	07-25-13	Req. LLD
End Date	05-30-13	06-26-13	07-25-13	08-29-13	
Gross beta	1.7 ± 0.6	2.0 ± 0.8	1.9 ± 0.8	2.8 ± 1.0	3.0
Mn-54	< 1.5	< 1.5	< 1.9	< 1.9	11
Fe-59	< 4.5	< 4.3	< 6.3	< 4.2	22
Co-58	< 1.5	< 2.6	< 2.4	< 1.8	11
Co-60	< 2.6	< 2.2	< 2.7	< 1.8	11
Zn-65	< 2.4	< 3.4	< 2.4	< 4.3	22
Zr-95	< 5.1	< 2.8	< 4.8	< 6.2	22
Nb-95	< 2.3	< 2.1	< 3.3	< 3.7	11
Cs-134	< 1.9	< 2.5	< 2.0	< 3.2	11
Cs-137	< 2.4	< 3.0	< 3.2	< 3.6	13
Ba-140	< 15.3	< 17.4	< 28.5	< 16.3	45
La-140	< 3.7	< 1.8	< 3.0	< 6.1	11

Lab Code	PELW- 5774	PELW- 6680	PELW- 7290	PELW- 7686	
Start Date	08-29-13	09-26-13	10-29-13	11-26-13	Req. LLD
End Date	09-26-13	10-29-13	11-26-13	12-23-13	
Gross beta	3.0 ± 1.0	2.2 ± 1.0	3.1 ± 0.8	0.9 ± 0.5	3.0
Mn-54	< 2.4	< 3.0	< 2.2	< 3.4	11
Fe-59	< 5.7	< 3.6	< 5.0	< 6.6	22
Co-58	< 3.6	< 2.7	< 2.4	< 2.5	11
Co-60	< 1.6	< 0.9	< 3.0	< 2.0	11
Zn-65	< 4.3	< 4.1	< 4.4	< 4.2	22
Zr-95	< 4.0	< 3.6	< 5.4	< 3.6	22
Nb-95	< 1.9	< 3.1	< 3.6	< 2.6	11
Cs-134	< 2.9	< 3.1	< 2.8	< 2.6	11
Cs-137	< 2.8	< 2.7	< 2.6	< 2.7	13
Ba-140	< 18.8	< 11.6	< 20.9	< 29.9	45
La-140	< 3.0	< 2.2	< 3.4	< 3.4	11

Table 4. Lake water, analyses for gross beta and gamma emitting isotopes.

Location: P-59 Collection: Monthly composites Units: pCi/L

Lab Code	PELW- 498	NS [a]	NS [a]	PELW- 2098	
Start Date	12-27-12	-	-	04-25-13	Req. LLD
End Date	01-31-13	02-26-13	03-28-13	04-25-13	
Gross beta	1.7 ± 0.7	-	-	2.4 ± 0.8	3.0
Mn-54	< 2.4	-	-	< 2.4	11
Fe-59	< 5.3	-	-	< 3.9	22
Co-58	< 2.3	-	-	< 2.1	11
Co-60	< 1.8	-	-	< 3.2	11
Zn-65	< 1.9	-	-	< 3.5	22
Zr-95	< 4.0	-	-	< 4.4	22
Nb-95	< 3.7	-	-	< 3.5	11
Cs-134	< 1.8	-	-	< 2.6	11
Cs-137	< 2.7	-	-	< 2.5	13
Ba-140	< 18.4	-	-	< 22.2	45
La-140	< 3.5	-	-	< 3.8	11

Lab Code	PELW- 2983	PELW- 3576	PELW- 4532	PELW- 5230	
Start Date	04-25-13	05-30-13	06-26-13	07-25-13	Req. LLD
End Date	05-30-13	06-26-13	07-25-13	08-29-13	
Gross beta	1.3 ± 0.6	2.2 ± 0.7	1.9 ± 0.7	2.3 ± 1.0	3.0
Mn-54	< 2.1	< 1.9	< 2.7	< 3.0	11
Fe-59	< 2.8	< 4.8	< 2.8	< 4.9	22
Co-58	< 3.1	< 1.8	< 1.8	< 2.6	11
Co-60	< 2.4	< 1.9	< 2.4	< 2.0	11
Zn-65	< 4.6	< 1.5	< 3.4	< 3.0	22
Zr-95	< 3.0	< 5.7	< 5.8	< 4.1	22
Nb-95	< 3.8	< 1.9	< 2.9	< 5.1	11
Cs-134	< 1.8	< 2.1	< 2.3	< 3.6	11
Cs-137	< 2.1	< 2.2	< 2.0	< 4.0	13
Ba-140	< 12.7	< 18.8	< 24.5	< 30.4	45
La-140	< 4.5	< 2.3	< 3.8	< 4.9	11

Lab Code	PELW- 5775	PELW- 6681	PELW- 7291	NS [a]	
Start Date	08-29-13	09-25-13	10-29-13	-	Req. LLD
End Date	09-25-13	10-29-13	11-26-13	12-23-13	
Gross beta	1.8 ± 0.9	2.0 ± 0.9	2.2 ± 0.7	-	3.0
Mn-54	< 2.2	< 1.0	< 2.1	-	11
Fe-59	< 3.5	< 3.0	< 4.2	-	22
Co-58	< 2.5	< 2.2	< 2.3	-	11
Co-60	< 2.5	< 1.5	< 2.0	-	11
Zn-65	< 4.2	< 4.1	< 4.3	-	22
Zr-95	< 5.2	< 5.5	< 5.2	-	22
Nb-95	< 3.1	< 2.7	< 3.6	-	11
Cs-134	< 2.4	< 2.7	< 3.1	-	11
Cs-137	< 1.9	< 2.8	< 2.9	-	13
Ba-140	< 16.4	< 11.6	< 19.1	-	45
La-140	< 4.1	< 1.1	< 2.0	-	11

[a] No sample available, shoreline inaccessible.

Table 4. Lake water, analyses for gross beta and gamma emitting isotopes.

Location: P-60 Collection: Monthly composites Units: pCi/L

Lab Code	PELW- 499	NS [a]	NS [a]	PELW- 2100	
Start Date	12-27-12	-	-	04-25-13	Req. LLD
End Date	01-31-13	02-26-13	03-28-13	04-25-13	
Gross beta	2.9 ± 0.8	-	-	3.3 ± 0.8	3.0
Mn-54	< 2.2	-	-	< 2.4	11
Fe-59	< 4.9	-	-	< 2.4	22
Co-58	< 2.0	-	-	< 2.5	11
Co-60	< 2.9	-	-	< 2.0	11
Zn-65	< 3.9	-	-	< 3.2	22
Zr-95	< 4.4	-	-	< 2.9	22
Nb-95	< 2.8	-	-	< 2.8	11
Cs-134	< 2.2	-	-	< 2.8	11
Cs-137	< 2.3	-	-	< 2.4	13
Ba-140	< 18.2	-	-	< 17.7	45
La-140	< 4.7	-	-	< 1.4	11

Lab Code	PELW- 2984	PELW- 3577	PELW- 4533	PELW- 5231	
Start Date	04-25-13	05-30-13	06-26-13	07-25-13	Req. LLD
End Date	05-30-13	06-26-13	07-25-13	08-29-13	
Gross beta	1.1 ± 0.5	2.5 ± 0.8	2.9 ± 0.8	2.1 ± 1.0	3.0
Mn-54	< 1.6	< 1.7	< 1.6	< 2.5	11
Fe-59	< 4.6	< 4.6	< 6.8	< 5.2	22
Co-58	< 2.4	< 1.5	< 3.1	< 3.1	11
Co-60	< 2.3	< 2.3	< 2.2	< 1.9	11
Zn-65	< 4.0	< 2.1	< 3.4	< 3.2	22
Zr-95	< 4.8	< 3.2	< 6.6	< 4.7	22
Nb-95	< 3.1	< 1.5	< 3.3	< 3.3	11
Cs-134	< 2.3	< 2.7	< 2.5	< 2.4	11
Cs-137	< 2.3	< 2.3	< 1.8	< 2.9	13
Ba-140	< 18.6	< 15.5	< 31.9	< 21.8	45
La-140	< 2.7	< 2.2	< 3.3	< 7.4	11

Lab Code	PELW- 5776	PELW- 6683	PELW- 7292	NS [a]	
Start Date	08-29-13	09-25-13	10-29-13	-	Req. LLD
End Date	09-25-13	10-29-13	11-26-13	12-23-13	
Gross beta	< 1.8	< 1.8	1.9 ± 0.8	-	3.0
Mn-54	< 2.8	< 1.1	< 2.4	-	11
Fe-59	< 4.1	< 4.5	< 6.3	-	22
Co-58	< 2.2	< 2.1	< 2.1	-	11
Co-60	< 2.8	< 2.0	< 2.4	-	11
Zn-65	< 2.6	< 2.8	< 5.6	-	22
Zr-95	< 3.8	< 3.2	< 6.3	-	22
Nb-95	< 3.1	< 2.6	< 4.3	-	11
Cs-134	< 1.8	< 2.8	< 3.2	-	11
Cs-137	< 2.8	< 3.5	< 3.3	-	13
Ba-140	< 18.4	< 11.2	< 23.9	-	45
La-140	< 2.4	< 2.0	< 6.8	-	11

[a] No sample available, shoreline inaccessible.

Table 4. Lake Water, analysis for tritium.
Collection: Quarterly composites of monthly collections.
Units: pCi/L

Required limit of detection: 1500 pCi/L

Location	P-28			
Period	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
Lab Code	PELW- 1529	PELW- 3791	PELW- 5927	PELW- 7687
H-3	< 150	< 151	< 143	< 149

Location	P-34			
Period	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
Lab Code	PELW- 1530	PELW- 3792	PELW- 5928	PELW- 7688
H-3	< 150	< 151	< 143	< 149

Location	P-36			
Period	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
Lab Code	PELW- 1531	PELW- 3793	PELW- 5929	PELW- 7689
H-3	< 150	< 151	< 143	< 149

Location	P-59			
Period	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
Lab Code	PELW- 1566	PELW- 3794	PELW- 5930	PELW- 7690
H-3	< 151	< 151	< 143	< 150

Location	P-60			
Period	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
Lab Code	PELW- 1567	PELW- 3795	PELW- 5931	PELW- 7691
H-3	< 151	< 151	< 143	< 150

Table 5. Milk, analyses for iodine-131 and gamma-emitting isotopes.
Collection: Semimonthly during grazing season, monthly at other times.

Collection Date	Lab Code	Concentration (pCi/L)					
		I-131	Cs-134	Cs-137	Ba-140	La-140	K-40
Required LLD (pCi/L)		0.8	11	13	45	11	-
P-18							
01-07-13	ND[a]	-	-	-	-	-	-
02-04-13	ND	-	-	-	-	-	-
03-04-13	PEMI- 933	< 0.3	< 2.7	< 3.7	< 16.0	< 2.9	1465 ± 118
04-01-13	PEMI- 1473	< 0.4	< 3.1	< 3.1	< 23.6	< 3.3	1618 ± 107
04-15-13	PEMI- 1829	< 0.3	< 3.4	< 4.8	< 17.7	< 3.6	1755 ± 149
05-06-13	PEMI- 2317	< 0.3	< 4.1	< 3.6	< 26.4	< 7.7	1819 ± 119
05-20-13	PEMI- 2676	< 0.3	< 2.9	< 3.6	< 19.7	< 5.5	1825 ± 122
06-03-13	PEMI- 2974	< 0.3	< 3.0	< 3.5	< 27.1	< 7.6	1926 ± 112
06-17-13	PEMI- 3410	< 0.5	< 3.3	< 3.6	< 15.7	< 5.0	1785 ± 129
07-01-13	PEMI- 3629	< 0.4	< 4.2	< 4.4	< 23.6	< 4.5	1841 ± 130
07-15-13	PEMI- 3995	< 0.2	< 2.4	< 3.8	< 19.3	< 3.8	2068 ± 122
08-05-13	PEMI- 4525	< 0.3	< 2.1	< 4.6	< 20.2	< 1.8	1870 ± 135
08-19-13	PEMI- 4923	< 0.2	< 3.1	< 4.0	< 27.8	< 4.3	2003 ± 132
09-03-13	PEMI- 5240	< 0.3	< 3.0	< 3.7	< 24.7	< 4.4	1860 ± 112
09-16-13	PEMI- 5509	< 0.2	< 3.2	< 3.7	< 18.8	< 3.5	1918 ± 125
10-07-13	PEMI- 6069	< 0.2	< 3.5	< 3.1	< 40.8	< 5.0	1865 ± 121
10-21-13	PEMI- 6543	< 0.3	< 4.0	< 4.1	< 21.1	< 2.9	1998 ± 140
11-04-13	PEMI- 6872	< 0.5	< 4.3	< 3.6	< 18.6	< 2.3	1807 ± 129
12-02-13	PEMI- 7285	< 0.3	< 3.1	< 4.0	< 11.3	< 2.7	1674 ± 105
P-19							
01-07-13	PEMI- 88	< 0.4	< 2.3	< 2.1	< 14.3	< 2.7	1412 ± 71
02-04-13	PEMI- 490	< 0.3	< 3.1	< 4.4	< 28.4	< 7.0	1304 ± 102
03-04-13	PEMI- 934	< 0.3	< 2.8	< 2.1	< 18.6	< 2.5	1352 ± 106
04-01-13	PEMI- 1475	< 0.4	< 3.4	< 4.0	< 24.2	< 4.5	1307 ± 101
04-15-13	PEMI- 1830	< 0.4	< 2.7	< 4.2	< 16.4	< 2.6	1325 ± 106
05-06-13	PEMI- 2318	< 0.3	< 2.9	< 2.0	< 26.9	< 6.1	1367 ± 102
05-20-13	PEMI- 2677	< 0.3	< 2.3	< 3.0	< 23.3	< 3.8	1307 ± 94
06-03-13	PEMI- 2975	< 0.3	< 1.3	< 3.5	< 23.4	< 4.0	1337 ± 110
06-17-13	PEMI- 3411	< 0.3	< 2.0	< 2.2	< 9.1	< 3.4	1212 ± 76
07-01-13	PEMI- 3631	< 0.4	< 1.7	< 3.4	< 19.6	< 4.8	1202 ± 103
07-15-13	PEMI- 3996	< 0.3	< 2.9	< 3.7	< 23.3	< 3.1	1207 ± 111
08-05-13	PEMI- 4526	< 0.3	< 2.6	< 3.0	< 13.3	< 1.8	1375 ± 113
08-19-13	PEMI- 4924	< 0.2	< 2.7	< 3.4	< 25.3	< 4.0	1210 ± 110
09-03-13	PEMI- 5241	< 0.3	< 3.0	< 3.9	< 30.1	< 4.7	1211 ± 111
09-16-13	PEMI- 5510	< 0.2	< 3.0	< 3.5	< 34.9	< 5.2	1170 ± 91
10-07-13	PEMI- 6070	< 0.2	< 2.7	< 2.9	< 22.9	< 6.6	1233 ± 88
10-21-13	PEMI- 6544	< 0.2	< 3.6	< 3.8	< 17.0	< 3.8	1290 ± 107
11-04-13	PEMI- 6873	< 0.3	< 3.6	< 3.0	< 19.4	< 3.5	1242 ± 111
12-02-13	PEMI- 7286	< 0.3	< 3.3	< 2.1	< 14.5	< 2.4	1210 ± 102

[a] ND = No data, no milk available.

Table 5. Milk, analyses for iodine-131 and gamma-emitting isotopes (continued).
Collection: Semimonthly during grazing season, monthly at other times.

Collection Date	Lab Code	Concentration (pCi/L) I-131	Cs-134	Cs-137	Ba-140	La-140	K-40
Required LLD (pCi/L)		0.8	11	13	45	11	-
P-41							
01-07-13	ND [a]	-	-	-	-	-	-
02-04-13	ND	-	-	-	-	-	-
03-04-13	ND	-	-	-	-	-	-
04-01-13	PEMI- 1476	< 0.4	< 3.0	< 3.4	< 27.8	< 2.2	1786 ± 122
04-15-13	PEMI- 1831	< 0.4	< 2.4	< 4.0	< 18.7	< 4.2	2036 ± 141
05-06-13	PEMI- 2319	< 0.3	< 2.5	< 4.9	< 34.0	< 6.3	1730 ± 121
05-20-13	PEMI- 2678	< 0.3	< 3.1	< 2.8	< 34.5	< 6.1	1733 ± 116
06-03-13	PEMI- 2976	< 0.4	< 3.3	< 3.2	< 31.6	< 6.0	1831 ± 107
06-17-13	PEMI- 3412	< 0.4	< 4.3	< 4.5	< 24.1	< 3.8	1736 ± 138
07-01-13	PEMI- 3632	< 0.3	< 2.6	< 3.5	< 17.2	< 1.9	1798 ± 113
07-15-13	PEMI- 3997	< 0.3	< 2.9	< 3.6	< 21.2	< 4.1	1734 ± 120
08-05-13	PEMI- 4527	< 0.4	< 3.1	< 3.5	< 16.4	< 2.0	1831 ± 123
08-19-13	PEMI- 4925	< 0.2	< 3.0	< 3.7	< 18.5	< 2.8	1877 ± 132
09-03-13	PEMI- 5242	< 0.3	< 3.1	< 3.0	< 37.5	< 5.8	1888 ± 120
09-16-13	PEMI- 5511	< 0.3	< 3.1	< 2.5	< 42.2	< 4.8	1941 ± 96
10-07-13	PEMI- 6071	< 0.5	< 2.9	< 3.5	< 17.0	< 5.1	1782 ± 100
10-21-13	ND	-	-	-	-	-	-
P-51							
01-07-13	PEMI- 89	< 0.3	< 1.8	< 2.0	< 18.3	< 3.2	968 ± 65
02-04-13	PEMI- 491	< 0.3	< 2.7	< 3.1	< 36.7	< 5.3	994 ± 87
03-04-13	PEMI- 935	< 0.4	< 2.9	< 3.2	< 16.7	< 1.7	1272 ± 104
04-01-13	PEMI- 1477	< 0.3	< 3.6	< 3.4	< 22.4	< 3.0	886 ± 88
04-15-13	PEMI- 1832	< 0.5	< 3.2	< 3.3	< 15.3	< 2.6	1411 ± 108
05-06-13	PEMI- 2320	< 0.3	< 3.2	< 3.9	< 20.8	< 7.3	1474 ± 117
05-20-13	PEMI- 2679	< 0.5	< 3.5	< 3.7	< 21.8	< 6.3	1445 ± 103
06-03-13	PEMI- 2977	< 0.4	< 2.9	< 2.8	< 27.6	< 6.0	1389 ± 94
06-17-13	PEMI- 3413	< 0.4	< 2.9	< 3.3	< 12.9	< 1.7	1312 ± 113
07-01-13	PEMI- 3633	< 0.3	< 3.2	< 3.3	< 11.0	< 5.1	1370 ± 107
07-15-13	PEMI- 3998	< 0.3	< 2.0	< 2.1	< 34.8	< 4.5	1336 ± 63
08-05-13	PEMI- 4528	< 0.4	< 3.5	< 3.1	< 14.7	< 2.4	1428 ± 118
08-19-13	PEMI- 4926	< 0.2	< 2.2	< 4.0	< 26.2	< 2.8	1421 ± 114
09-04-13	PEMI- 5243	< 0.3	< 2.3	< 3.4	< 11.1	< 2.2	1363 ± 99
09-16-13	PEMI- 5512	< 0.2	< 1.5	< 2.3	< 17.8	< 4.4	1382 ± 52
10-07-13	PEMI- 6072	< 0.5	< 4.3	< 2.9	< 40.5	< 3.5	1442 ± 120
10-21-13	PEMI- 6545	< 0.2	< 3.3	< 3.9	< 34.6	< 8.0	1336 ± 105
11-04-13	PEMI- 6874	< 0.3	< 4.6	< 4.2	< 16.1	< 4.2	1507 ± 123
12-02-13	PEMI- 7287	< 0.3	< 3.9	< 3.3	< 16.9	< 3.3	1472 ± 112

[a] ND = No data, no milk available.

Table 7. Food Products, analyses for gamma emitting isotopes.

Collection: Monthly Units: pCi/kg wet

Location: P-2

Lab Code	PEVE- 3796	PEVE- 4833	PEVE- 4834	PEVE- 4835	
Date Collected	07-09-13	08-13-13	08-13-13	08-13-13	Req. LLD
Sample Type	Japan. Greens	Japan. Greens	Swiss Chard	Collard Greens	
Be-7	315 ± 79	223 ± 82	316 ± 123	< 104	-
K-40	3334 ± 246	2998 ± 264	4081 ± 360	3010 ± 244	-
Co-58	< 8.9	< 6.7	< 6.2	< 7.0	-
Co-60	< 8.3	< 3.9	< 12.4	< 4.9	-
I-131	< 10.9	< 14.6	< 17.8	< 15.8	45
Cs-134	< 6.8	< 9.4	< 11.4	< 8.4	45
Cs-137	< 8.6	< 7.1	< 14.9	< 13.3	60

Lab Code	PEVE- 4837	PEVE- 5536	PEVE- 5537	PEVE- 5538	
Date Collected	08-13-13	09-17-13	09-17-13	09-17-13	Req. LLD
Sample Type	Turnip Greens	Collard Greens	Japan. Greens	Turnip Greens	
Be-7	381 ± 136	169 ± 82	337 ± 107	556 ± 115	-
K-40	4227 ± 315	3588 ± 297	3940 ± 281	4849 ± 325	-
Co-58	< 9.3	< 7.3	< 7.3	< 8.5	-
Co-60	< 6.3	< 8.3	< 10.0	< 6.6	-
I-131	< 11.8	< 18.2	< 11.8	< 15.0	45
Cs-134	< 6.5	< 8.5	< 6.9	< 6.5	45
Cs-137	< 7.9	< 6.6	< 6.1	< 12.7	60

Lab Code	PEVE- 5539	
Date Collected	09-17-13	Req. LLD
Sample Type	Swiss Chard	
Be-7	357 ± 127	-
K-40	4893 ± 366	-
Co-58	< 6.9	-
Co-60	< 10.5	-
I-131	< 15.5	45
Cs-134	< 9.2	45
Cs-137	< 11.2	60

Table 7. Food Products, analyses for gamma emitting isotopes.

Collection: Monthly Units: pCi/kg wet

Location: P-16

Lab Code	PEVE- 3797	PEVE- 3799	PEVE- 3800	PEVE- 3801	
Date Collected	07-09-13	07-09-13	07-09-13	07-09-13	Req. LLD
Sample Type	Japan. Greens	Turnip Greens	Swiss Chard	Collard Greens	
Be-7	145 ± 59	278 ± 137	204 ± 79	< 108	-
K-40	3433 ± 219	3530 ± 379	3634 ± 258	4872 ± 349	-
Co-58	< 5.7	< 8.6	< 4.1	< 10.3	-
Co-60	< 7.1	< 11.0	< 5.8	< 6.9	-
I-131	< 11.5	< 25.5	< 13.4	< 24.7	45
Cs-134	< 5.5	< 11.6	< 4.2	< 7.4	45
Cs-137	< 5.9	< 6.3	< 6.9	< 11.8	60

Lab Code	PEVE- 4838	PEVE- 4839	PEVE- 4840	PEVE- 4841	
Date Collected	08-13-13	08-13-13	08-13-13	08-13-13	Req. LLD
Sample Type	Japan. Greens	Turnip Greens	Swiss Chard	Collard Greens	
Be-7	291 ± 134	192 ± 72	208 ± 87	194 ± 82	-
K-40	4270 ± 318	5027 ± 281	4808 ± 279	3413 ± 288	-
Co-58	< 6.6	< 7.4	< 6.9	< 6.3	-
Co-60	< 8.1	< 7.0	< 6.5	< 10.9	-
I-131	< 13.3	< 9.9	< 15.8	< 18.6	45
Cs-134	< 10.0	< 8.1	< 6.6	< 8.6	45
Cs-137	< 8.8	< 6.9	< 9.2	< 10.6	60

Lab Code	PEVE- 5540	PEVE- 5541	PEVE- 5542	PEVE- 5543	
Date Collected	09-17-13	09-17-13	09-17-13	09-17-13	Req. LLD
Sample Type	Swiss Chard	Japan. Greens	Turnip Greens	Collard Greens	
Be-7	420 ± 113	212 ± 78	375 ± 100	< 86	-
K-40	5851 ± 312	3930 ± 273	5631 ± 354	4275 ± 281	-
Co-58	< 4.7	< 6.4	< 8.1	< 5.9	-
Co-60	< 8.1	< 6.2	< 10.7	< 3.1	-
I-131	< 20.5	< 14.9	< 20.8	< 13.7	45
Cs-134	< 6.6	< 7.3	< 9.3	< 7.7	45
Cs-137	< 7.3	< 6.9	< 8.9	< 7.6	60

Lab Code	PEVE- 6127	PEVE- 6128	PEVE- 6129	PEVE- 6130	
Date Collected	10-08-13	10-08-13	10-08-13	10-08-13	Req. LLD
Sample Type	Japan. Greens	Collard Greens	Swiss Chard	Turnips	
Be-7	534 ± 105	248 ± 111	549 ± 119	240 ± 87	-
K-40	5408 ± 298	3907 ± 250	5492 ± 332	4646 ± 306	-
Co-58	< 6.4	< 4.4	< 7.5	< 4.8	-
Co-60	< 7.4	< 4.0	< 6.0	< 7.0	-
I-131	< 12.0	< 20.7	< 23.4	< 26.0	45
Cs-134	< 7.6	< 8.2	< 9.0	< 8.9	45
Cs-137	< 9.1	< 7.4	< 11.3	< 8.6	60

Table 7. Food Products, analyses for gamma emitting isotopes.

Collection: Monthly Units: pCi/kg wet

Location: P-18

Lab Code	PEVE- 3802	PEVE- 3803	PEVE- 3818	PEVE- 4842	
Date Collected	07-09-13	07-09-13	07-09-13	08-13-13	Req. LLD
Sample Type	Turnip Greens	Collard Greens	Japan. Greens	Japan. Greens	
Be-7	377 ± 91	200 ± 112	406 ± 110	< 130	-
K-40	3740 ± 249	5327 ± 347	4673 ± 301	3955 ± 323	-
Co-58	< 8.1	< 6.3	< 5.7	< 7.2	-
Co-60	< 4.5	< 6.4	< 4.4	< 12.0	-
I-131	< 13.2	< 18.4	< 17.6	< 18.1	45
Cs-134	< 6.0	< 7.0	< 7.9	< 7.7	45
Cs-137	< 7.8	< 10.5	< 8.9	< 12.0	60

Lab Code	PEVE- 4843	PEVE- 5544	PEVE- 5545	PEVE- 5546	
Date Collected	08-13-13	09-17-13	09-17-13	09-17-13	Req. LLD
Sample Type	Collard Greens	Turnip Greens	Swiss Chard	Collard Greens	
Be-7	< 136	339 ± 131	288 ± 89	< 104	-
K-40	4907 ± 359	6695 ± 397	6470 ± 354	5320 ± 348	-
Co-58	< 12.1	< 5.0	< 8.7	< 10.1	-
Co-60	< 9.3	< 9.5	< 7.7	< 10.9	-
I-131	< 21.3	< 19.9	< 15.7	< 13.5	45
Cs-134	< 11.8	< 10.7	< 8.4	< 7.5	45
Cs-137	< 6.5	< 7.8	< 10.9	< 11.3	60

Lab Code	PEVE- 5547	PEVE- 6131	PEVE- 6132	PEVE- 6133	
Date Collected	09-17-13	10-08-13	10-08-13	10-08-13	Req. LLD
Sample Type	Japan. Greens	Collard Greens	Swiss Chard	Jap. Greens	
Be-7	251 ± 111	< 136	357 ± 112	386 ± 112	-
K-40	5702 ± 355	3864 ± 309	5021 ± 371	5467 ± 340	-
Co-58	< 7.3	< 9.9	< 8.6	< 9.1	-
Co-60	< 4.9	< 7.1	< 9.2	< 11.8	-
I-131	< 19.8	< 32.5	< 27.8	< 15.6	45
Cs-134	< 8.1	< 10.0	< 9.0	< 8.7	45
Cs-137	< 8.3	< 10.1	< 6.6	< 9.2	60

Table 7. Food Products, analyses for gamma emitting isotopes.

Collection: Monthly Units: pCi/kg wet

Location: P-20

Lab Code	PEVE- 3804	PEVE- 4844	PEVE- 4845	PEVE- 4846	
Date Collected	07-09-13	08-13-13	08-13-13	08-13-13	Req. LLD
Sample Type	Japan. Greens	Swiss Chard	Japan. Greens	Collard Greens	
Be-7	467 ± 136	502 ± 99	315 ± 104	< 140	-
K-40	4576 ± 312	4129 ± 302	3587 ± 274	3534 ± 350	-
Co-58	< 10.3	< 4.0	< 7.9	< 11.5	-
Co-60	< 6.9	< 6.8	< 9.8	< 7.9	-
I-131	< 18.5	< 15.0	< 17.9	< 18.4	45
Cs-134	< 9.7	< 6.7	< 9.6	< 14.2	45
Cs-137	< 10.9	< 7.5	< 8.5	< 11.7	60

Table 7. Food Products, analyses for gamma emitting isotopes.

Collection: Monthly Units: pCi/kg wet

Location: P-37

Lab Code	PEVE- 3805	PEVE- 3820	PEVE- 4847	PEVE- 4848	
Date Collected	07-09-13	07-09-13	08-13-13	08-13-13	Req. LLD
Sample Type	Japan. Greens	Swiss Chard	Japan. Greens	Collard Greens	
Be-7	198 ± 88	< 69	< 110	< 104	-
K-40	4569 ± 280	3126 ± 212	3544 ± 300	4084 ± 308	-
Co-58	< 5.6	< 4.7	< 6.8	< 7.0	-
Co-60	< 8.7	< 5.7	< 10.4	< 9.8	-
I-131	< 13.1	< 9.7	< 15.0	< 17.1	45
Cs-134	< 6.4	< 5.3	< 8.6	< 9.5	45
Cs-137	< 8.9	< 5.4	< 10.3	< 7.7	60

Lab Code	PEVE- 4849	PEVE- 5392	PEVE- 5393	PEVE- 5394	
Date Collected	08-13-13	09-10-13	09-10-13	09-10-13	Req. LLD
Sample Type	Swiss Chard	Collard greens	Japan. Greens	Swiss Chard	
Be-7	311 ± 88	< 142	185 ± 106	279 ± 129	-
K-40	2693 ± 239	3004 ± 287	4297 ± 313	2691 ± 335	-
Co-58	< 5.1	< 7.9	< 7.1	< 9.4	-
Co-60	< 5.6	< 8.2	< 4.0	< 10.4	-
I-131	< 18.4	< 24.0	< 19.2	< 28.4	45
Cs-134	< 7.3	< 10.1	< 6.2	< 9.7	45
Cs-137	< 8.6	< 12.7	< 8.5	< 15.2	60

Lab Code	PEVE- 6134	PEVE- 6135	PEVE- 6136	PEVE- 6138	
Date Collected	10-08-13	10-08-13	10-08-13	10-08-13	Req. LLD
Sample Type	Turnips	Collard Greens	Swiss Chard	Japan. Greens	
Be-7	336 ± 86	< 99	552 ± 181	249 ± 70	-
K-40	3085 ± 242	2961 ± 268	2775 ± 347	2272 ± 212	-
Co-58	< 5.3	< 9.9	< 12.5	< 3.5	-
Co-60	< 5.8	< 7.8	< 9.6	< 3.5	-
I-131	< 14.7	< 28.3	< 31.4	< 14.6	45
Cs-134	< 7.2	< 9.9	< 15.7	< 7.6	45
Cs-137	< 7.0	< 8.7	< 13.7	< 7.8	60

Table 7. Food Products, analyses for gamma emitting isotopes.

Collection: Monthly Units: pCi/kg wet

Location: P-70

Lab Code	PEVE- 3806	PEVE- 3807	PEVE- 3808	PEVE- 4850	
Date Collected	07-09-13	07-09-13	07-09-13	08-13-13	Req. LLD
Sample Type	Beet Greens	Collard Greens	Turnip Greens	Collard Greens	
Be-7	451 ± 127	340 ± 112	329 ± 129	312 ± 120	-
K-40	5443 ± 396	4773 ± 311	5136 ± 341	3874 ± 301	-
Co-58	< 12.1	< 7.3	< 7.2	< 10.1	-
Co-60	< 10.9	< 8.9	< 6.0	< 6.1	-
I-131	< 25.2	< 17.8	< 19.6	< 16.2	45
Cs-134	< 8.5	< 7.6	< 7.2	< 10.7	45
Cs-137	< 12.1	< 8.1	< 8.5	< 12.8	60

Lab Code	PEVE- 4851	PEVE- 4852	PEVE- 4853	PEVE- 5549	
Date Collected	08-13-13	08-13-13	08-13-13	09-17-13	Req. LLD
Sample Type	Japan. Greens	Turnip Greens	Swiss Chard	Collard Greens	
Be-7	396 ± 105	441 ± 125	336 ± 140	333 ± 85	-
K-40	3947 ± 308	4040 ± 352	5722 ± 435	4776 ± 286	-
Co-58	< 9.0	< 12.1	< 9.4	< 5.5	-
Co-60	< 10.1	< 9.9	< 8.7	< 9.6	-
I-131	< 22.3	< 22.5	< 22.6	< 14.1	45
Cs-134	< 9.3	< 10.6	< 10.6	< 6.3	45
Cs-137	< 11.2	< 12.5	< 14.1	< 6.9	60

Lab Code	PEVE- 5550	PEVE- 5551	PEVE- 6139	PEVE- 6140	
Date Collected	09-17-13	09-17-13	10-08-13	10-08-13	Req. LLD
Sample Type	Turnip Greens	Swiss Chard	Collard Greens	Swiss Chard	
Be-7	522 ± 137	549 ± 117	< 117	409 ± 140	-
K-40	4927 ± 404	7104 ± 415	4397 ± 305	6037 ± 340	-
Co-58	< 7.5	< 11.2	< 11.3	< 6.7	-
Co-60	< 8.5	< 7.9	< 5.4	< 5.3	-
I-131	< 17.6	< 16.2	< 26.8	< 28.7	45
Cs-134	< 9.6	< 9.1	< 9.3	< 11.5	45
Cs-137	< 13.0	< 7.6	< 10.6	< 9.7	60

Lab Code	PEVE- 6141	
Date Collected	10-08-13	Req. LLD
Sample Type	Japan. Greens	
Be-7	484 ± 154	-
K-40	5465 ± 377	-
Co-58	< 11.3	-
Co-60	< 10.8	-
I-131	< 35.8	45
Cs-134	< 11.2	45
Cs-137	< 7.3	60

Table 9. Fish, analyses for gamma emitting isotopes.

Collection: Annually Units: pCi/kg wet

Location	P-25				
Lab Code	PEF- 4401	PEF- 4402	PEF- 6582	PEF- 6583	
Date Collected	07-09-13	07-09-13	10-09-13	10-09-13	Req. LLD
Sample Type	Perch	Walleye	Wh. Bass	Wh. Perch	
K-40	1357 ± 268	1518 ± 268	1060 ± 238	1300 ± 234	-
Mn-54	< 9.1	< 14.0	< 8.6	< 11.4	94
Fe-59	< 30.8	< 44.0	< 38.0	< 35.3	195
Co-58	< 20.0	< 10.2	< 13.0	< 16.7	97
Co-60	< 13.2	< 4.5	< 10.8	< 9.1	97
Zn-65	< 19.1	< 27.5	< 33.6	< 17.5	195
Cs-134	< 10.5	< 9.3	< 12.8	< 12.5	97
Cs-137	< 14.2	< 9.8	< 7.2	< 13.3	112

Location	P-32				
Lab Code	PEF- 4403	PEF- 4404	PEF- 6584	PEF- 6585	
Date Collected	07-09-13	07-09-13	10-10-13	10-10-13	Req. LLD
Sample Type	Perch	Walleye	Wh. Bass	Wh. Perch	
K-40	783 ± 214	1281 ± 251	2722 ± 355	2737 ± 362	-
Mn-54	< 9.1	< 12.9	< 12.8	< 10.8	94
Fe-59	< 36.9	< 48.0	< 39.4	< 40.3	195
Co-58	< 23.0	< 13.3	< 18.1	< 15.8	97
Co-60	< 9.6	< 5.0	< 10.7	< 16.0	97
Zn-65	< 25.2	< 18.1	< 29.9	< 31.2	195
Cs-134	< 15.7	< 10.0	< 16.0	< 13.8	97
Cs-137	< 12.0	< 15.6	< 13.0	< 14.1	112

Table 11. Sediments, analyses for gamma emitting isotopes.

Collection: Semiannually Units: pCi/kg dry

Location	P-25		
Lab Code	PEBS- 4115	PEBS- 5761	
Date Collected	06-05-13	09-20-13	Req. LLD
K-40	13098 ± 636	13803 ± 556	-
Co-58	< 35.5	< 19.4	50
Co-60	< 22.5	< 6.7	40
Cs-134	< 22.2	< 17.1	112
Cs-137	99.5 ± 29.9	203.8 ± 26.2	135

Location	P-26		
Lab Code	PEBS- 4116	PEBS- 5762	
Date Collected	06-05-13	09-20-13	Req. LLD
K-40	12793 ± 542	12975 ± 697	-
Co-58	< 25.9	< 21.5	50
Co-60	< 18.3	< 13.3	40
Cs-134	< 19.0	< 21.0	112
Cs-137	42.0 ± 14.7	110.4 ± 27.2	135

Location	P-27		
Lab Code	PEBS- 4117	PEBS- 5763	
Date Collected	06-05-13	09-20-13	Req. LLD
K-40	15365 ± 504	14553 ± 537	-
Co-58	< 37.5	< 17.5	50
Co-60	< 15.4	< 12.5	40
Cs-134	< 21.0	< 12.8	112
Cs-137	198.9 ± 24.7	102.4 ± 19.8	135

Location	P-32		
Lab Code	PEBS- 4118	PEBS- 5764	
Date Collected	06-05-13	09-20-13	Req. LLD
K-40	18556 ± 614	17974 ± 592	-
Co-58	< 28.3	< 21.4	50
Co-60	< 18.3	< 16.9	40
Cs-134	< 17.9	< 21.4	112
Cs-137	439.6 ± 25.7	403.2 ± 30.2	135

Table 11. Sediments, analyses for gamma emitting isotopes.

Collection: Semiannually Units: pCi/kg dry

Location	P-64		
Lab Code	PEBS- 4119	PEBS- 5766	
Date Collected	06-25-13	09-20-13	Req. LLD
K-40	8277 ± 367	9643 ± 500	-
Co-58	< 16.4	< 16.6	50
Co-60	< 9.4	< 5.1	40
Cs-134	< 10.0	< 12.8	112
Cs-137	< 8.5	< 7.6	135

Location	P-65		
Lab Code	PEBS- 4120	PEBS- 5767	
Date Collected	06-25-13	09-20-13	Req. LLD
K-40	9761 ± 403	8300 ± 453	-
Co-58	< 18.5	< 18.6	50
Co-60	< 13.5	< 13.7	40
Cs-134	< 11.5	< 12.2	112
Cs-137	< 12.4	< 10.0	135

Data Reporting Conventions

1.0. All activities, except gross alpha and gross beta, are decay corrected to collection time or the end of the collection period.

2.0. Single Measurements

Each single measurement is reported as follows: $x \pm s$

where: x = value of the measurement;

$s = 2\sigma$ counting uncertainty (corresponding to the 95% confidence level).

In cases where the activity is less than the lower limit of detection L, it is reported as: $< L$,
where L = the lower limit of detection based on 4.66σ uncertainty for a background sample.

3.0. Duplicate analyses

If duplicate analyses are reported, the convention is as follows. :

3.1 Individual results: For two analysis results; $x_1 \pm s_1$ and $x_2 \pm s_2$

Reported result: $x \pm s$; where $x = (1/2)(x_1 + x_2)$ and $s = (1/2)\sqrt{s_1^2 + s_2^2}$

3.2. Individual results: $< L_1$, $< L_2$ Reported result: $< L$, where L = lower of L_1 and L_2

3.3. Individual results: $x \pm s$, $< L$ Reported result: $x \pm s$ if $x \geq L$; $< L$ otherwise.

4.0. Computation of Averages and Standard Deviations

4.1 Averages and standard deviations listed in the tables are computed from all of the individual measurements over the period averaged; for example, an annual standard deviation would not be the average of quarterly standard deviations. The average $\bar{x}$ and standard deviation "s" of a set of n numbers $x_1, x_2 \ldots x_n$ are defined as follows:

$$\bar{x} = \frac{1}{n} \sum x \qquad s = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}}$$

4.2 Values below the highest lower limit of detection are not included in the average.

4.3 If all values in the averaging group are less than the highest LLD, the highest LLD is reported.

4.4 If all but one of the values are less than the highest LLD, the single value x and associated two sigma error is reported.

4.5 In rounding off, the following rules are followed:

4.5.1. If the number following those to be retained is less than 5, the number is dropped, and the retained numbers are kept unchanged. As an example, 11.443 is rounded off to 11.44.

4.5.2. If the number following those to be retained is equal to or greater than 5, the number is dropped and the last retained number is raised by 1. As an example, 11.445 is rounded off to 11.45.

APPENDIX D

CORRECTIONS TO PREVIOUS ANNUAL ENVIRONMENTAL AND EFFLUENT RELEASE REPORTS

APPENDIX D

CORRECTIONS TO PREVIOUS ANUUAL ENVIRONMENTAL AND EFFLUENT RELEASE REPORTS:

None

APPENDIX E
ABNORMAL RELEASES

APPENDIX E

ABNORMAL RELEASES

In November 2011, radioactivity was detected in the Nuclear Closed Cooling (NCC) system. The source of this activity has been identified as the Reactor Recirculation System. There is some leakage from the NCC system to Service Water and from there to the environment. Conservatively, activity calculations are done assuming that all leakage from the NCC system is going to Service Water. Daily NCC samples are being analyzed and system leakage is being tracked. The calculated activity released from NCC has been included in the total radioactivity released. Feed and bleed evolutions has occurred throughout the year to reduce the radioactive concentration in NCC and thus reduce the activity released to the environment.

	QUARTER 1	QUARTER 2	QUARTER 3	QUARTER 4	ANNUAL
A. Fission and Activation Products (Ci)					
NA24	3.47E-05	<LLD	4.09E-06	<LLD	3.88E-05
MN54	2.63E-05	1.49E-05	8.09E-06	4.63E-08	4.93E-05
MN56	7.80E-07	<LLD	1.71E-07	<LLD	9.51E-07
CO58	4.82E-07	8.12E-07	1.42E-06	<LLD	2.71E-06
CO60	4.15E-05	1.22E-04	9.71E-05	1.83E-05	2.79E-04
ZN65	<LLD	<LLD	2.27E-06	<LLD	2.27E-06
ZN69M	4.94E-08	<LLD	<LLD	<LLD	4.94E-08
CS134	<LLD	<LLD	8.20E-07	1.56E-05	1.64E-05
CS137	2.39E-05	6.34E-06	4.26E-06	2.70E-05	6.15E-05
B. Tritium	5.81E-03	2.63E-03	2.07E-03	3.30E-03	1.38E-02
C. Noble Gasses					
Kr-88	2.32E-05	<LLD	<LLD	<LLD	2.32E-05
D. Gross Alpha Activity, (Ci)	<LLD	<LLD	<LLD	<LLD	<LLD

APPENDIX F
ODCM NON-COMPLIANCES

APPENDIX F

ODCM NON-COMPLIANCES

On 4/11/2013 the Service Water (SW) Auxiliary Decay Heat Removal (ADHR) radiation monitor was declared inoperable. The monitor was returned to service on 7/15/2013. Delay in returning monitor to operable status is due to problems encountered when putting new monitor into service. (CR-2013-07467)

From 5/4/2013 to 5/18/2013 non-representative compensatory samples were obtained from the SW ADHR system when its monitor was out of service. The samples were obtained with the monitor sample pump secured and the non-circulated water was not representative of the system. Sample obtained on 5/19/2013 with the sample pump running showed no gamma emitters. The problem was due to inadequate procedure guidance which has since been corrected. (CR-2013-07812)

On 6/6/13 the Liquid Radwaste High Flow monitor was declared inoperable due to erratic response. The unit was returned to service on 12/13/2013. The delay was due to obsolescence of the old monitor and the need to do an engineering change to replace unit with a newer model. (CR-2013-08823 & 10737)

On 7/1/2013, the Unit 1 Plant Vent effluent radiation monitor was declared inoperable due to taking the monitor out-of-service for a digital upgrade. The unit was returned to service on 8/5/2013. Delays in returning the monitor to service were due to problems associated with the vendor supplied equipment. (CR-2013-11791)

During a self-assessment, it was noted that an Environmental Monitoring TLD was not located in SSE sector; two were located in the South sector – numbers 4 and 10. The discrepancy was found using GPS coordinates. Environmental TLD #10 was relocated to the SSE sector. (CR-2013-14775)

It was identified by the NRC in 2013 that PNPP failed to perform representative fish sampling in years 2010, 2011, and 2012 to accurately assess the ingestion radiation pathway as required by the ODCM. This error was due to misinterpretation of the requirements contained in NUREG 1302, Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Boiling Water Reactors. (CR-2013-14987)

APPENDIX G
CHANGES TO PROCESS CONTROL PROGRAM

APPENDIX G

CHANGES TO THE PROCESS CONTROL PROGRAM

During this reporting period, there were no changes to the Process Control Program.