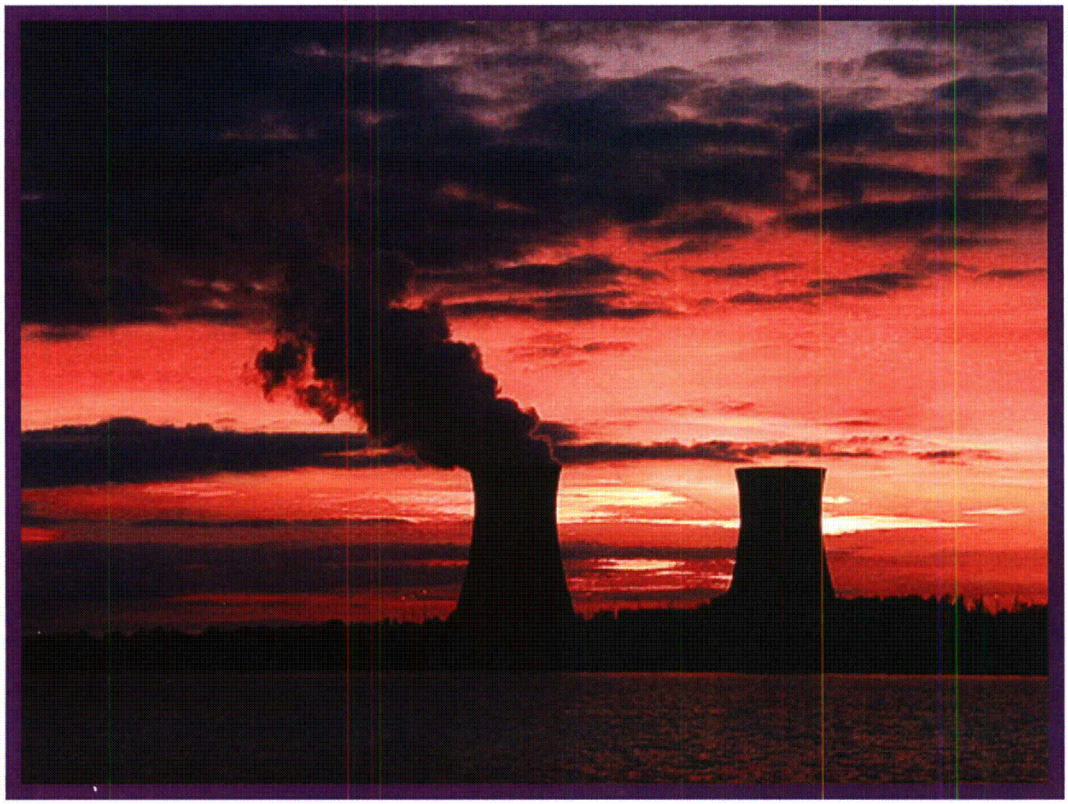
2012

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

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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, 2012. 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 2012 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 2.67E-03 mrem (0.089% 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 2012 was 5.96E-02 mrem (1.2% of the applicable limit).

In 2012, 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 for 2012, including C-14 is 2.54E-01 mrem. Refer to page 21 for additional Carbon-14 information.

The summation of the hypothetical maximum individual dose from effluents in 2012 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 in 2012, making shipments of solid radioactive waste to a licensed burial site.

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 217.7 pCi/kg and is lower than the highest identified value of 864 pCi/kg established in 1981.

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 for 2011. The cobalt-60 remains centered within the organic material located at the top of the spillway, with little or no activity found farther upstream. Sample analyses continue to identify cobalt-60 levels similar to those found in previous years. Refer to Table 20 for detailed sample results.

Direct radiation measurements showed no real change from previous years. The indicator locations averaged 64.9 mrem/year and control locations averaged 61.3 mrem/year. In 2012, 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 2012, 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 when 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 2012:

- On May 6, 2012, during daily chlorination activities, it was identified that the NPDES permit limit for Total Residual Chlorine was exceeded between 0935 and 0947 hours. The maximum measured value was 0.29 mg/l, which exceeded the NPDES Maximum Concentration limit of 0.2 mg/l.
- On May 6, 2012 at 1930 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 are essentially free electrons, which usually carry a negative electrical charge. 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 (LLD). 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].

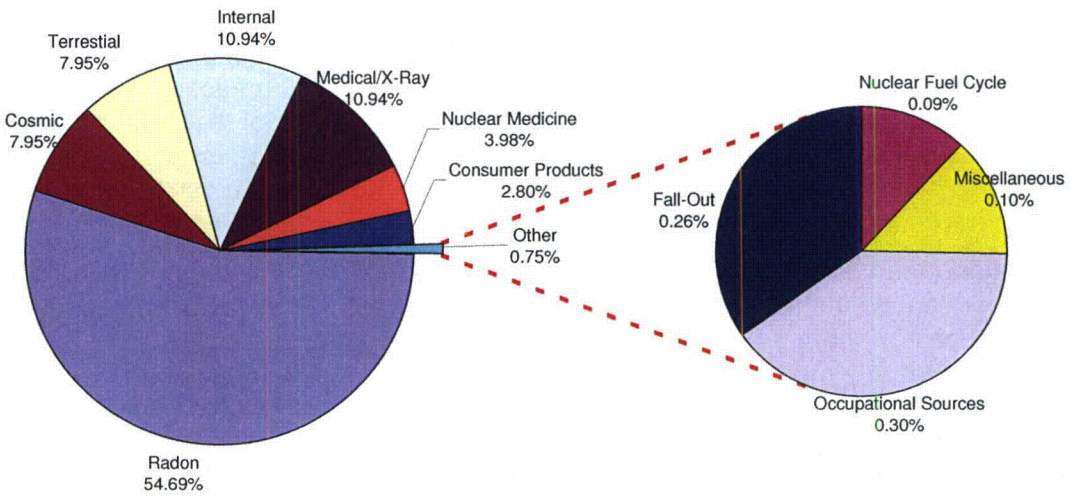


Figure 1: Sources of Background Radiation

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 2012 Sampling Program results. These radionuclides are included; however, in Appendix A, 2012 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 2012.

The 40CFR190 limit for whole body dose is 25 mrem. For 2012, the total whole body dose to a member of the general public, considering all sectors, was 2.54E-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 shall be limited to 2.0E-04 μCi/ml of total activity. 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

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:

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 2012.

Table 1: Liquid Batch Releases

	QUARTER 1	QUARTER 2	QUARTER 3	QUARTER 4
Number of batch releases	23	19	39	7
Total time period for batch releases, min	5.17E+03	3.40E+03	8.84E+03	2.16E+03
Maximum time for a batch release, min	2.42E+02	2.31E+02	2.51E+02	4.58E+02
Average time period for a batch release, min	2.25E+02	1.79E+02	2.27E+02	3.09E+02
Minimum time for a batch release, min	2.15E+02	2.00E+00	2.21E+02	2.07E+02
Average stream flow during periods of effluent release into a flowing stream, L/min	1.21E+05	2.35E+05	2.16E+05	1.68E+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 while 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)	1.24E-02	5.64E-03	4.27E-03	1.06E-02	1.00E+01
2. Average Diluted Concentration, µCi/mL *	7.52E-10	2.05E-10	1.47E-10	5.87E-10	
3. Percent of Applicable Limit, %	1.94E-02	5.72E-03	3.90E-03	1.74E-02	
B. Tritium					
1. Total Released, Ci	4.52E+00	4.25E+00	1.17E+01	2.66E+00	1.00E+01
2. Average Diluted Concentration, µCi/mL	2.74E-07	1.54E-07	4.02E-07	1.47E-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	6.93E-07	1.72E-04	4.90E-06	<LLD	1.00E+01
2. Average Diluted Concentration, µCi/mL	4.20E-14	6.25E-12	1.68E-13	NA	
3. Percent of Applicable Limit, %	2.10E-08	3.12E-06	8.42E-08	NA	
D. Gross Alpha Activity, Ci	<LLD	<LLD	<LLD	<LLD	1.00E+01
E. Waste Volume Released, Liters (prior to dilution)	4.50E+06	3.62E+06	7.36E+06	2.15E+06	
F. Dilution Water Volume Used, Liters	1.65E+10	2.75E+10	2.91E+10	1.81E+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)	1.05E-02	3.28E-03	3.08E-03	9.89E-03	1.00E+01
B. Tritium					
Total Released, Ci	4.49E+00	4.25E+00	1.17E+01	2.66E+00	1.00E+01
C. Dissolved and Entrained Gases					
Total Released, Ci	<LLD	1.72E-04	<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)	2.99E+06	1.70E+06	4.86E+06	1.38E+06	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)	1.86E-03	2.35E-03	1.20E-03	6.89E-04	1.00E+01
B. Tritium					
Total Released, Ci	3.28E-02	5.49E-03	6.22E-03	4.69E-03	1.00E+01
C. Dissolved and Entrained Gases					
Total Released, Ci	6.93E-07	6.10E-08	4.90E-06	<LLD	1.00E+01
D. Gross Alpha Activity, Ci	<LLD	<LLD	<LLD	<LLD	1.00E+01
E. Waste Volume Released, Liters (prior to dilution)	1.51E+06	1.92E+06	2.51E+06	7.62E+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
Tritium	Ci	4.52E+00	4.25E+00	1.17E+01	2.66E+00
Sodium-24	Ci	3.91E-04	9.57E-05	2.68E-04	1.74E-04
Chromium-51	Ci	5.47E-04	1.39E-04	2.19E-05	6.70E-05
Manganese-54	Ci	7.98E-04	3.55E-04	2.74E-04	8.11E-04
Manganese-56	Ci	1.20E-05	1.76E-06	1.81E-05	4.28E-06
Iron-59	Ci	5.92E-06	3.59E-06	1.08E-06	3.23E-06
Cobalt-58	Ci	3.81E-04	2.63E-04	4.12E-05	4.60E-05
Cobalt-60	Ci	8.68E-03	4.45E-03	3.10E-03	9.18E-03
Zinc-65	Ci	9.20E-04	2.70E-04	9.15E-06	1.79E-04
Zinc-69M	Ci	4.71E-07	<LLD	<LLD	<LLD
Strontium-92	Ci	<LLD	2.57E-07	5.21E-05	<LLD
Niobium-95	Ci	<LLD	4.71E-07	<LLD	<LLD
Yttrium-95m	Ci	<LLD	<LLD	4.41E-07	<LLD
Technetium-99m	Ci	<LLD	5.05E-08	1.86E-07	<LLD
Silver-110m	Ci	2.55E-04	5.19E-05	4.92E-04	1.13E-04
Antimony-124	Ci	8.19E-05	<LLD	<LLD	<LLD
Antimony-125	Ci	2.93E-04	<LLD	<LLD	<LLD
Xenon-133	Ci	<LLD	1.72E-04	3.66E-06	<LLD
Xenon-135	Ci	6.93E-07	6.10E-08	1.24E-06	<LLD
Cesium-137	Ci	8.75E-06	<LLD	<LLD	1.55E-08
Gold-199	Ci	2.09E-05	<LLD	5.32E-07	1.60E-06

<LLD – Less than the lower limit of detection

Gaseous Effluents

Gaseous effluents are made up of fission and activation gases, iodine and particulate releases. The fission and activation gas releases are primarily a result of containment purge operations, small steam leaks, and offgas system operation. The iodine and particulate releases are primarily a result of small steam leaks. 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. The majority of gaseous effluents released from PNPP are considered continuous and at ground level.

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.

Discussion of Carbon-14 doses is listed on page 21, Carbon-14 supplemental information.

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	1.84E-01	1.00E+02	2.05E+00	7.54E-01	1.00E+01
2. Average Release Rate, µCi/sec	2.34E-02	1.28E+01	2.58E-01	9.49E-02	
3. Percent of Applicable Limit, %	N/A	N/A	N/A	N/A	
B. Iodine					
1. Total Iodine-131 Released, Ci	2.37E-06	5.74E-05	<LLD	<LLD	1.00E+01
2. Average Release Rate, µCi/sec	3.02E-07	7.30E-06	<LLD	<LLD	
3. Percent of Applicable Limit, %	N/A	N/A	N/A	N/A	
C. Particulates with Half-Lives > 8 days					
1. Total Released, Ci	4.78E-08	1.43E-05	<LLD	<LLD	1.00E+01
2. Average Release Rate, µCi/sec	6.08E-09	1.81E-06	<LLD	<LLD	
3. Percent of Applicable Limit, %	N/A	N/A	N/A	N/A	
D. Alpha Activity, Ci	<LLD	<LLD	<LLD	<LLD	1.00E+01
E. Tritium					
1. Total Released, Ci	<LLD	<LLD	9.77E-01	2.63E+00	1.00E+01
2. Average Release Rate, µCi/sec	<LLD	<LLD	1.23E-01	3.31E-01	
3. Percent of Applicable Limit, %	N/A	N/A	N/A	N/A	
F. Carbon-14, Ci	4.55	4.52	4.78	4.78	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.

Table 5: Radioactive Gaseous Effluent Nuclide Composition

	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4
A. Fission and Activation Products					
Tritium	Ci	<LLD	<LLD	9.77E-01	2.63E+00
Argon-41	Ci	<LLD	<LLD	<LLD	<LLD
Krypton-85m	Ci	<LLD	5.11E-01	1.31E-01	3.62E-02
Krypton-85	Ci	<LLD	<LLD	<LLD	3.23E-03
Kryton-87	Ci	<LLD	1.18E-01	<LLD	<LLD
Krypton-88	Ci	<LLD	5.57E-01	<LLD	<LLD
Xenon-131m	Ci	<LLD	<LLD	<LLD	<LLD
Xenon-133m	Ci	<LLD	1.19E+00	<LLD	<LLD
Xenon-133	Ci	<LLD	8.53E+01	4.99E-02	1.30E-01
Xenon-135m	Ci	<LLD	2.15E+00	<LLD	<LLD
Xenon-135	Ci	<LLD	1.03E+01	1.87E+00	5.85E-01
Xenon-137	Ci	<LLD	<LLD	<LLD	<LLD
Xenon-138	Ci	1.84E-01	2.82E-01	<LLD	<LLD
Total for Period		**1.84E-01**	**1.00E+02**	**3.03E+00**	**3.38E+00**
B. Iodine					
Iodine-131	Ci	2.37E-06	5.74E-05	<LLD	<LLD
Iodine-132	Ci	<LLD	<LLD	<LLD	<LLD
Iodine-133	Ci	<LLD	6.74E-05	<LLD	<LLD
Iodine-134	Ci	<LLD	<LLD	<LLD	<LLD
Iodine-135	Ci	<LLD	<LLD	<LLD	<LLD
Total for Period		**2.37E-06**	**1.25E-04**	**<LLD**	**<LLD**
C. Particulate					
Chromium-51	Ci	<LLD	<LLD	<LLD	<LLD
Manganese-54	Ci	<LLD	<LLD	<LLD	<LLD
Iron-59	Ci	<LLD	<LLD	<LLD	<LLD
Cobalt-58	Ci	<LLD	<LLD	<LLD	<LLD
Cobalt-60	Ci	<LLD	<LLD	<LLD	<LLD
Zinc-65	Ci	<LLD	<LLD	<LLD	<LLD
Rubidium-88	Ci	<LLD	<LLD	<LLD	<LLD
Rubidium-89	Ci	<LLD	<LLD	<LLD	<LLD
Strontium-89	Ci	4.78E-08	7.42E-07	<LLD	<LLD
Strontium-90	Ci	<LLD	<LLD	<LLD	<LLD
Yttrium-91m	Ci	<LLD	<LLD	<LLD	<LLD
Strontium-92	Ci	<LLD	<LLD	<LLD	<LLD
Zirconium-95	Ci	<LLD	<LLD	<LLD	<LLD
Molybdenum-99	Ci	<LLD	<LLD	<LLD	<LLD
Cesium-137	Ci	<LLD	<LLD	<LLD	<LLD
Cesium-138	Ci	<LLD	1.35E-05	<LLD	<LLD
Barium-139	Ci	<LLD	<LLD	<LLD	<LLD
Barium-140	Ci	<LLD	<LLD	<LLD	<LLD
Lanthanum-140	Ci	<LLD	<LLD	<LLD	<LLD
Total for Period		**4.78E-08**	**1.43E-05**	**<LLD**	**<LLD**

<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 2012.

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	1.17E+02	2.78E+02	+/- 25
Dry Active Waste	1.86E+03	4.45E-01	+/- 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	Fe-55 Co-60 Ni-63 Cs-137	31.49 62.42 2.12 2.32	+/- 25
Dry Active Waste	H-3 Mn-54 Fe-55 Co-60 Ni-63	1.60 6.52 26.64 62.89 1.02	+/- 25
Irradiated Components, Control Rods, etc.	None	0	
Other Waste	None	0	

C. Disposition	Number of Shipments	Mode of Transportation	Destination
Solid Waste(2)	26	Public Highway	Studsvik, Erwin, TN
Solid Waste(2)	41	Public Highway	Energy Solutions, Bear Creek, 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, 2012 through December 31, 2012, 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	2.67E-03	3.0E+00	8.9E-02
	Liver	3.77E-03	1.0E+01	3.8E-02
Noble Gas - gamma air	N/A	9.87E-02	1.0E+01	9.9E-01
Noble Gas - beta air	N/A	1.77E-01	2.0E+01	8.9E-01
Noble Gas	Whole body	5.96E-02	5.0E+00	1.2E+00
	Skin	1.48E-01	1.5E+01	9.8E-01
Particulate & Iodine	Thyroid	2.65E-03	1.5E+01	1.8E-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	3.5E-01
	Thyroid	1.9E-01
Gaseous Effluent	Whole body	1.5E-03
	Thyroid	1.5E-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	2.67E-03	3.0E+00	8.9E-02
	Liver	3.77E-03	1.0E+01	3.8E-02
Noble Gas - gamma air	N/A	1.55E-03	1.0E+01	1.6E-02
- beta air	N/A	2.69E-03	2.0E+01	1.3E-02
Noble Gas	Whole Body	5.04E-04	5.0E+00	1.0E-02
	Skin	1.23E-03	1.5E+01	8.2E-03
Particulate & Iodine	Thyroid	1.94E-04	1.5E+01	1.3E-03
Carbon-14 *	Whole Body	2.54E-01	5.0E+00	5.1E+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	8.2E-04	9.5E-04
Second Quarter	3.3E-04	3.8E-04
Third Quarter	1.8E-04	2.1E-04
Fourth Quarter	5.9E-04	6.9E-04
Annual	2.0E-03	2.2E-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	5.3E-07	1.0E-06
Second Quarter	4.8E-05	1.3E-04
Third Quarter	1.8E-04	3.7E-04
Fourth Quarter	1.5E-04	1.8E-04
Annual	6.6E-03	1.6E-02

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	7.1E-05	7.5E-10
Second Quarter	2.3E-05	4.6E-07
Third Quarter	2.6E-05	8.3E-08
Fourth Quarter	2.6E-05	9.6E-08
Annual	1.5E-04	6.3E-07

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.

PNPP's 2012 Annual Environmental Effluent Release Report (AEERR) contains estimates of C-14 radioactivity released in 2012, and estimates of public dose resulting from the C-14 effluent. 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.

ON-SITE GROUNDWATER MONITORING PROGRAM

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 surmised that these "rattle spaces" also 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.

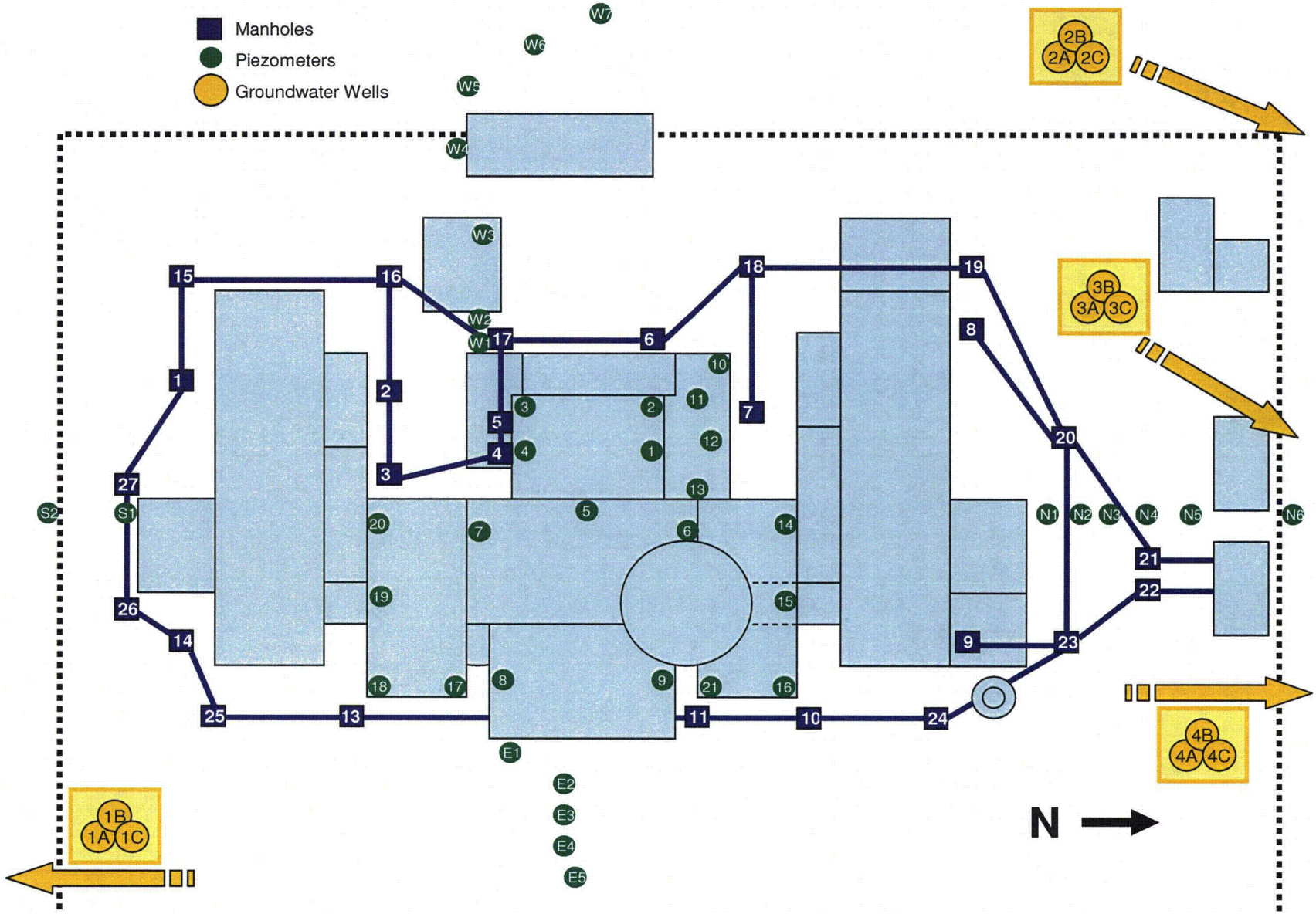
Tritium releases from the station were documented as abnormal releases, and the required dose calculations were completed per the Offsite Dose Calculation Manual (ODCM). Overall, the released tritium represented a very small fraction of the limits prescribed in 10CFR20 Appendix B and 10CFR50.

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.

Besides these wells, there are a number of plant piezometers which date back to early plant construction. Outside of the power block, these are located directionally along the 4 major compass points. There are also piezometers inside the plant buildings in numerous locations. Refer to Figure 2 for locations of Piezometers.

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.

Table 13: Summary of Onsite Groundwater Samples

Monitoring Well	H-3 MAX. (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)
First Half 2012				
Well 1A	<153	< 2000	2000	20000
Well 1B	<153	< 2000	2000	20000
Well 1C	<153	< 2000	2000	20000
Well 2A	<153	< 2000	2000	20000
Well 2B	<153	< 2000	2000	20000
Well 2C	<153	< 2000	2000	20000
Well 3A	200	< 2000	2000	20000
Well 3B	<153	< 2000	2000	20000
Well 3C	<153	< 2000	2000	20000
Well 4A	<153	< 2000	2000	20000
Well 4B	<153	< 2000	2000	20000
Well 4C	<153	< 2000	2000	20000
Second Half 2012				
Well 1A	<147	< 2000	2000	20000
Well 1B	<147	< 2000	2000	20000
Well 1C	<147	< 2000	2000	20000
Well 2A	<150	< 2000	2000	20000
Well 2B	<147	< 2000	2000	20000
Well 2C	<147	< 2000	2000	20000
Well 3A	156	< 2000	2000	20000
Well 3B	<147	< 2000	2000	20000
Well 3C	<147	< 2000	2000	20000
Well 4A	159	< 2000	2000	20000
Well 4B	<147	< 2000	2000	20000
Well 4C	<147	< 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 19 was made effective on 12/10/12. Summary of changes:

1. Revised sections 6.9.1.6 & 7 to state that the Annual Reports shall be submitted by May 1 of each year. This was done to match the wording contained in Technical Specifications sections 5.6.2 and 5.6.3.

2. Modified first footnote and added second footnote to Tables 5.1-2 and 3.12.1-2, Reporting Levels for Radioactivity Concentrations in Environmental Samples, to match the footnotes contained in NUREG 1302 (Supplement No. 1 to Generic Letter 89-01). These changes allow for higher reporting levels for H-3 and/or I-131 if the sample was taken from a non-drinking water pathway. (CR-2011-02282)

3. Added table number to ODCM REMP Sample Locations table (Table 5.1-4) and added table number to table of contents.

4. Modified first footnote to Table 5.1-4; removed the term "chronologically" from the beginning of the sentence to clarify meaning.

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 which would be most likely to display effects caused by plant operation. They are relatively close to the plant. Control locations are those which are considered to be unaffected by plant operation. Typically, they are a greater distance from the plant, 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	**Neff Perkins**	**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

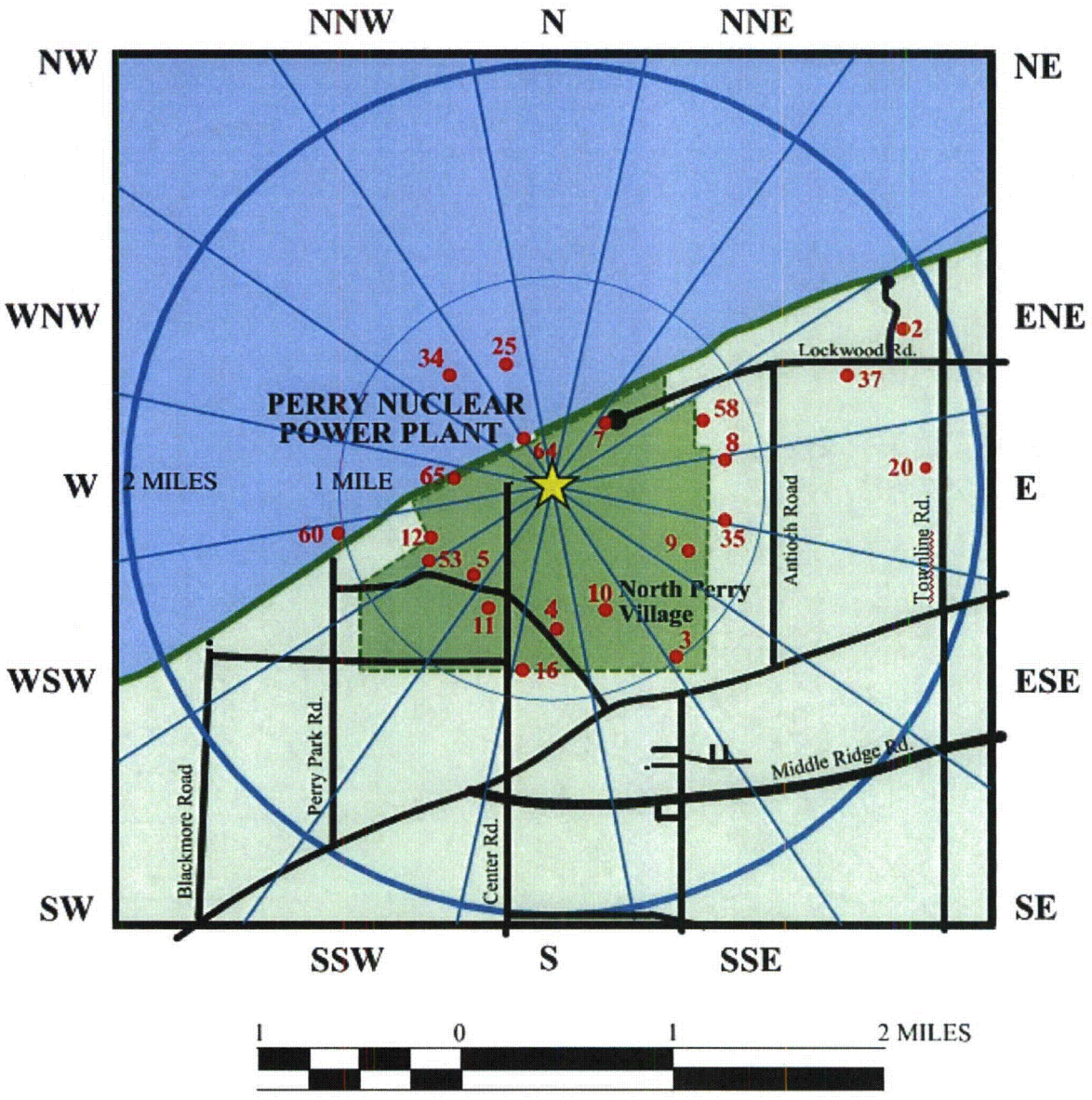


Figure 4: REMP Sampling Locations Between Two and Eight Miles of the Plant Site

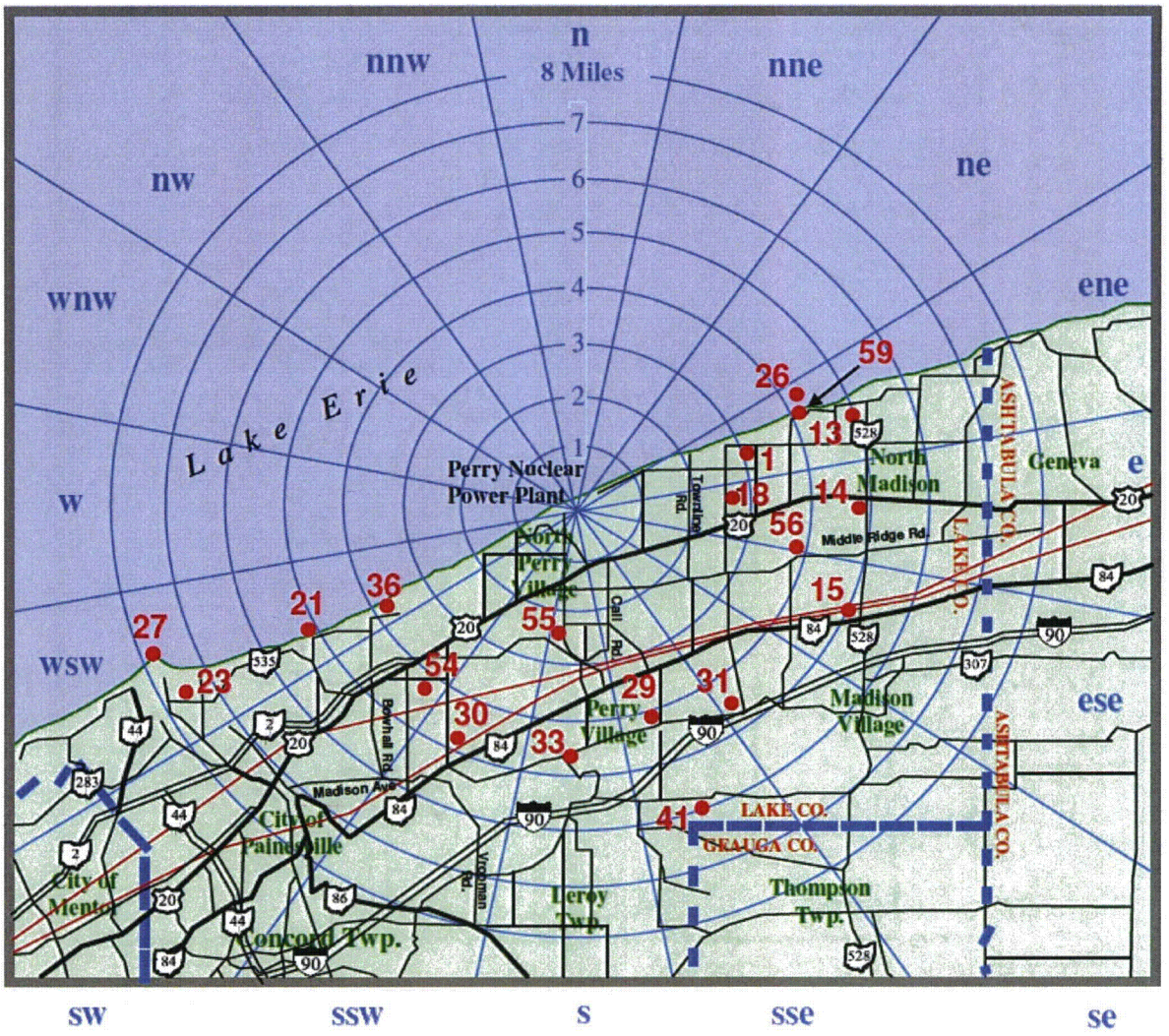
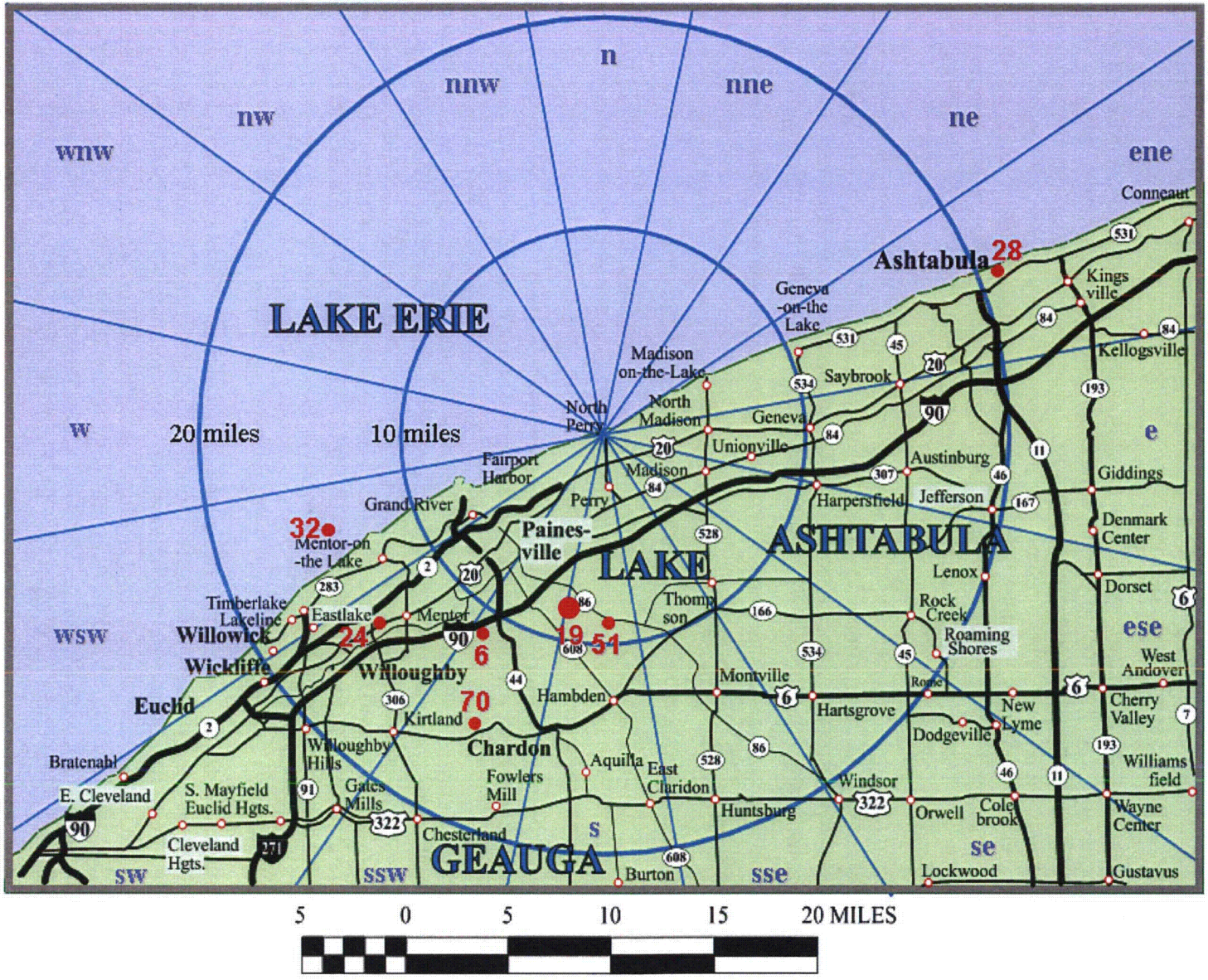


Figure 5: REMP Sampling Locations Greater Than Eight Miles from the Plant Site



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. The reading process also zeroes the TLD and prepares it for reuse. Table 15 provides a list of the analyses performed on environmental samples collected for the PNPP REMP in 2012.

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 at a value above, or equal to the appropriate ODCM table value. The NRC has established LLD values for REMP sample analyses. The vendor laboratory for REMP sample analyses complied with those values in 2012.

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

2012 SAMPLING PROGRAM

The contribution of radionuclides to the environment resulting from PNPP operation is assessed by comparing results from the 2012 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, 2012 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 these reporting levels in 2012.

Program Changes

Discontinued collecting milk from the Keller Milk Farm, location number 61; they are no longer providing milk.

Discontinued collecting shoreline sediment from location number 63. Due to beach and bluff erosion, that location is no longer accessible.

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. For 2012, there was no impact to the program requirements as a result of any missed samples. Table 16 provides information on samples missed during 2012.

Table 16: Missed REMP Samples in 2012

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

Atmospheric Monitoring

Air

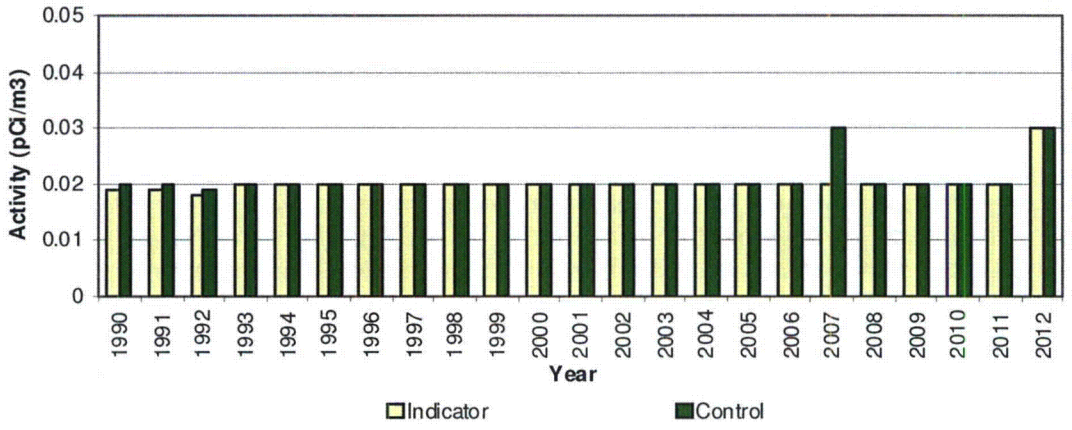
Air sampling is conducted to detect any increase in the concentration of airborne radionuclides. The PNPP REMP maintains an additional 2 air sampling locations above the five locations (four indicators and one control) required by the ODCM. Six (6) of these locations are within four miles of the plant site; the seventh is used as a control location and is eleven miles from PNPP. Air sampling pumps are used to 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 371 air particulate and 371 air radioiodine samples were collected and analyzed in 2012.

Gross beta activity was detected in all the air samples and ranged up to 0.058 pCi/m^3. The average gross beta activity for the indicator locations was 0.025 pCi/m^3 and for the controls it was 0.026 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 2012 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 performed. 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-four (64) milk samples were collected in 2012. 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.

A total of eighty-two (82) samples were collected and analyzed by gamma spectral analysis in 2012.

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 several 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.

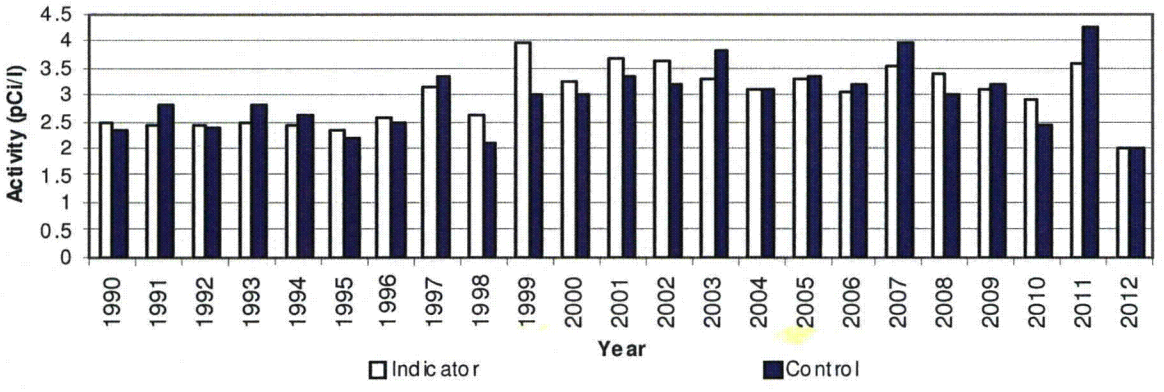
Water

Water is sampled from five (5) locations along Lake Erie in the vicinity of the PNPP as required by the PNPP ODCM. Samples from two (2) locations are collected using composite sample pumps. The pumps are designed to collect water at regular intervals and composite it in a sample container. One (1) sample is collected from a slow continuous feed to a collection 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-eight (58) water samples were collected and analyzed for gross beta activity and gamma spectral analysis. From these monthly samples, twenty (20) quarterly composite samples were obtained and analyzed for tritium and gamma activity.

Gross beta activity was detected in fifty-one (51) of the fifty-eight (58) samples collected. The indicator average gross beta activity was 2.0 pCi/L and the control average gross beta activity was 2.0 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 of 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.

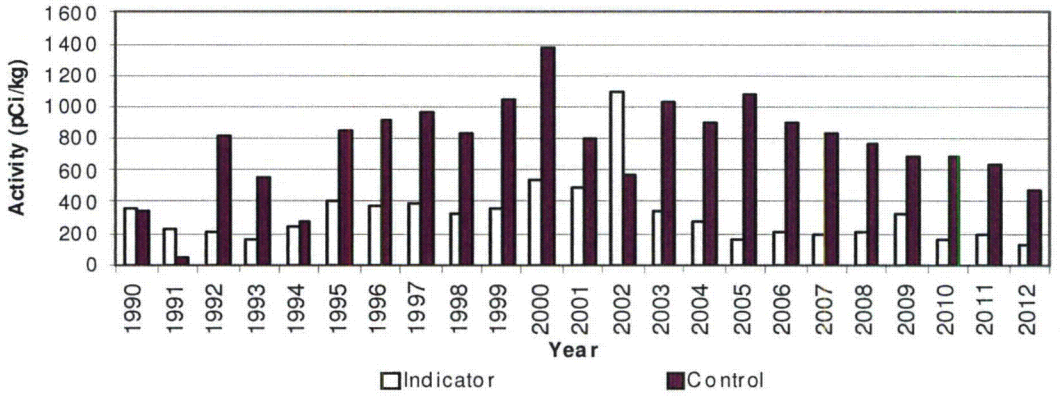
Sediment samples from offshore are collected using a hand dredge. Shoreline samples are collected using a scoop.

Twelve (12) sediment samples were collected in 2012 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 35.7 pCi/kg to 529.6 pCi/kg. The indicator average cesium-137 activity was 132.9 pCi/kg and the control average was 472.2 pCi/kg. The average cesium-137 radioactivity for all locations was 217.7 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. In 2012, fish sampling was performed for PNPP by a local licensed sport fisherman.

Three (3) fish samples including (1) Yellow Perch, and (2) Freshwater Drum were collected and analyzed by gamma spectral analysis in 2012. As expected, naturally occurring potassium-40 was found in all samples. No other radionuclides were detected above the LLD.

Direct Radiation Monitoring

Thermoluminescent Dosimeter (TLD)

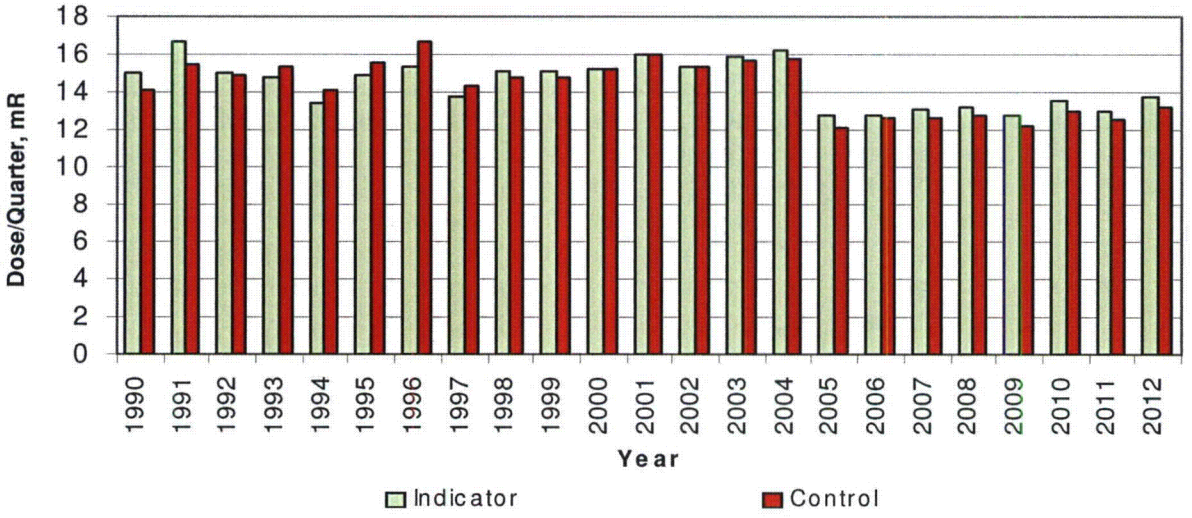
Environmental radiation is measured directly at twenty-eight (28) locations around the PNPP site, two (2) of which are control locations. The locations are positioned in two rings around the plant as well as at the site boundary. The inner ring is within a one-mile radius of the plant site; the outer 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 is equipped with 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 in 2012. 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.

For 2012, the annual average dose for all indicator locations was 64.9 mrem, and 61.3 mrem for the control locations.

Referring to Figure 9, the average quarterly dose for all indicator locations was 13.8 mrem, and 13.2 mrem for all control locations. Please refer to Appendix C, 2012 REMP Detailed Data Report for all TLD results. Prior to 1988, the TLD results were higher due to a change in the vendor laboratory services. A comprehensive explanation of this difference was provided in the 1988 Annual Environmental Operating Report.

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 vendor 2012 Inter-Laboratory Cross-Check Comparison Program Results.

LAND USE CENSUS

Introduction

Each year a Land Use Census, which is required by Section 5.2 of the PNPP ODCM, 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 2012 Land Use Census, which was conducted on September 21st 2012 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 some fractional changes for the "Miles from PNPP" distances due to using GPS coordinates instead of a map.

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. During the 2012 Land Use Census, no additional new milking animals were identified.

Table 18: Nearest Milk Animal, By Sector

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

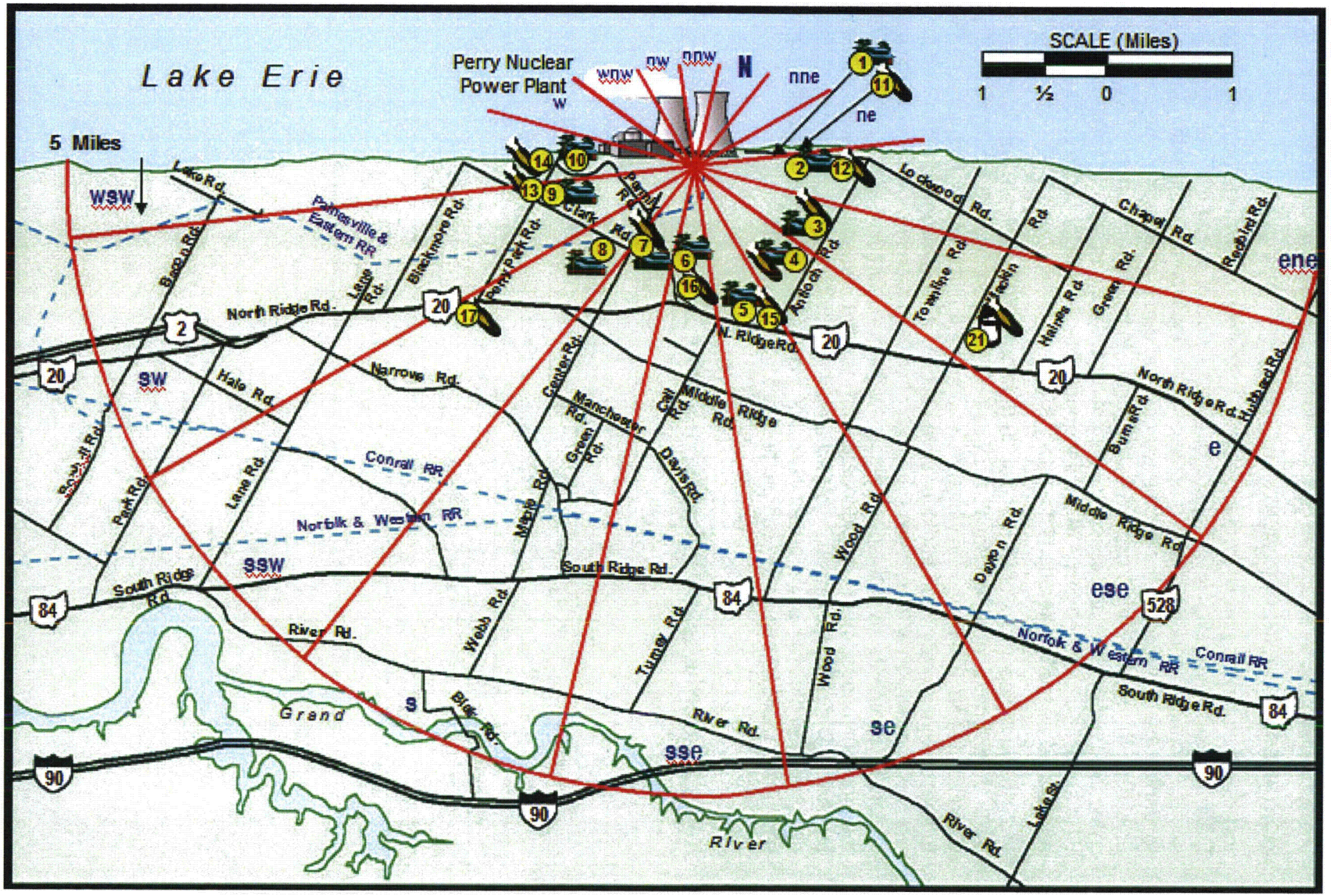
There were two (2) changes for the nearest gardens identified during this year's census.

Table 19 lists the nearest gardens occupying at least 500 square feet identified during the Land Use Census. Two new garden locations were identified in the SSW and WSW sectors. There were also some fractional changes for in the "Miles from PNPP" distances due to using GPS coordinates instead of a map.

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



Garden Residence Milking Animal

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. For 2012, results from the nine (9) impoundment sample locations shows that the activity remains within the Northwest Drain Impoundment. Co-58 was not detected in 2012. Additionally, the shoreline sediment samples exhibiting no activity demonstrate that activity is not migrating to the shoreline. Table 20 shows the sample results for 2012.

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

LOCATION	MAY 2012		SEPTEMBER 2012	
	Co-60	Cs-137	Co-60	Cs-137
64	<LLD	<LLD	<LLD	<LLD
64-1	<LLD	29.0	<LLD	<LLD
64-2	<LLD	345	<LLD	604
64-3	<LLD	140	57	85
64-6	85.9	1002	131	1505
64-7	72.1	1154	112	1573
64-8	50.8	613	<LLD	723
64-9	185	1177	190	1247
64-10	152	1188	145	1322
64-11	27.8	481	40	417

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 2012 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 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 2012, 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: 2012 Corbicula Monitoring

DATE	SAMPLE LOCATION
6/29/2012	1N34B0001A – Lube Oil Cooler
7/27/2012	N43B0001B – Lube Oil Cooler
8/17/2012	1P54F5263 – Fire Water
8/29/2012	N43B0001B – Lube Oil Cooler
10/01/2012	P43B0001B – Nuclear Closed Cooling
10/24/2012	1P54F0722 – Fire Water

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 2012 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 2012 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 use of a commercial molluscicide has been approved by the Ohio Environmental Protection Agency (OEPA). The chemical selected for use at the PNPP in 2012 was alkyl-dimethyl-benzyl-ammonium chloride. Treatment was applied once in 2012, on October 16th. 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 2012 was 20%.

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 2012, four (4) general and three (3) 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 in the Owner-Controlled Area are Round-Up, Round-Up Promax, Accord, Polaris, Kingpin, Tempo Ultra, Oust, Escort, Super Signal Blue Concentrate and Razor. 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 2012. The quantity represents the amount of herbicide applied, prior to any dilution.

Table 22: 2012 Herbicide Applications

DATE APPLIED	LOCATION	AMOUNT	CHEMICAL NAME
4/26/12	Security Towers, Booths, PAF, Vehicle Trap, SWPH Ladders and Stairs	14 gal	Tempo Ultra
5/30/12	Per field Security Zone	24 gal	Round-Up Promax
6/4/12	Per field Security Zone	24 gal	Round-Up Promax
6/14/12	Switch Yard	2 gal 6 pints 2 gal	Oust Razor Escort
7/9/12	Security Towers, Booths, PAF, Vehicle Trap, SWPH Ladders and Stairs	10 gal	Tempo Ultra
9/5/12	Security Towers, Booths, PAF, Vehicle Trap, SWPH Ladders and Stairs	12 gal	Tempo Ultra
9/5/12	Service Building Office Areas	1 qt	Dupont Arilon
9/6/12	Transmission Yard Right of Ways	900 gal	Accord / Polaris

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 2012:

- On May 6, 2012, during daily chlorination activities, it was identified that the NPDES permit limit for Total Residual Chlorine was exceeded between 0935 and 0947 hours. The maximum measured value was 0.29 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 2012.

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 2012 there was one new test evaluated for environmental impacts. A new chemical, Trasar®, was approved to be utilized at the NPDES outfall 004, discharge tunnel. The chemical will pose no environmental threats to Lake Erie. The chemical has been approved for use by the Ohio Environmental Protection Agency to test the integrity of the underground service water dechlorination feed line. This chemical was reviewed under environmental evaluation, 2012-001.

APPENDIX A

2012 INTER-LABORATORY CROSS CHECK COMPARISON PROGRAM RESULTS

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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, 2012 through December, 2012

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 > 100 pCi/liter or kg	5.0 pCi/liter 5% of known value
Strontium-89[b]	5 to 50 pCi/liter or kg > 50 pCi/liter or kg	5.0 pCi/liter 10% of known value
Strontium-90[b]	2 to 30 pCi/liter or kg > 30 pCi/liter or kg	5.0 pCi/liter 10% of known value
Potassium-40	≥ 0.1 g/liter or kg	5% of known value
Gross alpha	≤ 20 pCi/liter > 20 pCi/liter	5.0 pCi/liter 25% of known value
Gross beta	≤ 100 pCi/liter > 100 pCi/liter	5.0 pCi/liter 5% of known value
Tritium	≤ 4,000 pCi/liter > 4,000 pCi/liter	± 1σ = $169.85 \times (\text{known})^{0.0933}$ 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 > 55 pCi/liter	6 pCi/liter 10% of known value
Uranium-238, Nickel-63[b] Technetium-99[b]	≤ 35 pCi/liter > 35 pCi/liter	6 pCi/liter 15% of known value
Iron-55[b]	50 to 100 pCi/liter > 100 pCi/liter	10 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-1783	04/09/12	Sr-89	62.2 ± 6.0	58.5	46.9 - 66.3	Pass
ERW-1783	04/09/12	Sr-90	33.7 ± 2.1	37.4	27.4 - 43.1	Pass
ERW-1786	04/09/12	Ba-133	75.7 ± 4.1	82.3	69.1 - 90.5	Pass
ERW-1786	04/09/12	Co-60	71.9 ± 4.0	72.9	65.6 - 82.6	Pass
ERW-1786	04/09/12	Cs-134	70.0 ± 4.3	74.2	60.6 - 81.6	Pass
ERW-1786	04/09/12	Cs-137	151.5 ± 6.1	155.0	140.0 - 172.0	Pass
ERW-1786	04/09/12	Zn-65	108.3 ± 89.0	105.0	94.5 - 125.0	Pass
ERW-1789	04/09/12	Gr. Alpha	55.0 ± 2.4	62.9	33.0 - 78.0	Pass
ERW-1789 [d]	04/09/12	Gr. Beta	76.2 ± 1.8	44.2	29.6 - 51.5	Fail
ERW-1795	04/09/12	Ra-226	6.4 ± 0.4	5.7	4.3 - 6.9	Pass
ERW-1795	04/09/12	Ra-228	5.4 ± 1.2	4.6	2.7 - 6.3	Pass
ERW-1795	04/09/12	Uranium	56.2 ± 2.6	61.5	50.0 - 68.2	Pass
ERW-1798	04/09/12	H-3	16023 ± 355	15800	13800 - 17400	Pass
ERW-6283	10/05/12	Sr-89	41.5 ± 4.1	39.1	29.7 - 46.1	Pass
ERW-6283	10/05/12	Sr-90	19.7 ± 1.6	20.1	14.4 - 23.8	Pass
ERW-6286	10/05/12	Ba-133	82.7 ± 4.4	84.8	71.3 - 93.3	Pass
ERW-6286	10/05/12	Co-60	77.2 ± 3.7	78.3	70.5 - 88.5	Pass
ERW-6286	10/05/12	Cs-134	74.4 ± 1.5	76.6	62.6 - 84.3	Pass
ERW-6286	10/05/12	Cs-137	183.0 ± 6.2	183.0	165.0 - 203.0	Pass
ERW-6286	10/05/12	Zn-65	211.0 ± 9.9	204.0	184.0 - 240.0	Pass
ERW-6288	10/05/12	Gr. Alpha	47.0 ± 2.3	58.6	30.6 - 72.9	Pass
ERW-6288	10/05/12	Gr. Beta	33.4 ± 1.2	39.2	26.0 - 46.7	Pass
ERW-6290	10/05/12	I-131	23.3 ± 1.0	24.8	20.6 - 29.4	Pass
ERW-6295 [e]	10/05/12	Ra-226	17.5 ± 0.7	15.0	11.2 - 17.2	Fail
ERW-6295 [e]	10/05/12	Ra-228	7.4 ± 1.5	4.6	2.7 - 6.2	Fail
ERW-6295	10/05/12	Uranium	61.2 ± 1.8	62.5	50.8 - 69.3	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] Result of reanalysis: 38.3 ± 1.3 pCi/L. Sample dilution problem suspected. A new dilution was prepared.

[e] Results of reanalyses, original submission (pCi/L): Ra-226, 16.5 ± 0.7 Ra-228, 4.9 ± 1.1
A new test was ordered from Environmental Resources Associates, results will be updated for first quarter, 2013.

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.						
2012-1	2/7/2012	30 cm.	74.87	87.22 ± 2.86	52.41 - 97.33	Pass
2012-1	2/7/2012	40 cm.	42.12	53.70 ± 4.53	29.48 - 54.76	Pass
2012-1	2/7/2012	50 cm.	26.95	33.04 ± 1.96	18.87 - 35.04	Pass
2012-1	2/7/2012	70 cm.	13.75	13.26 ± 1.15	9.63 - 17.88	Pass
2012-1	2/7/2012	75 cm.	11.98	13.38 ± 1.68	8.39 - 15.57	Pass
2012-1	2/7/2012	80 cm.	10.53	11.27 ± 0.95	7.37 - 13.69	Pass
2012-1	2/7/2012	90 cm.	8.32	7.79 ± 0.83	5.82 - 10.82	Pass
2012-1	2/7/2012	100 cm.	6.74	5.91 ± 0.25	4.72 - 8.76	Pass
2012-1	2/7/2012	110 cm.	5.57	4.63 ± 0.83	3.90 - 7.24	Pass
2012-1	2/7/2012	120 cm.	4.68	3.96 ± 1.68	3.28 - 6.08	Pass
2012-1	2/7/2012	150 cm.	2.99	2.41 ± 0.08	2.09 - 3.89	Pass
2012-1	2/7/2012	180 cm.	2.08	2.02 ± 0.25	1.46 - 2.70	Pass
Environmental, Inc.						
2012-2	9/11/2012	40 cm.	33.75	43.74 ± 1.31	23.63 - 43.88	Pass
2012-2	9/11/2012	50 cm.	21.6	25.37 ± 0.82	15.12 - 28.08	Pass
2012-2	9/11/2012	60 cm.	15	16.63 ± 0.45	10.50 - 19.50	Pass
2012-2	9/11/2012	70 cm.	11.02	10.58 ± 0.20	7.71 - 14.33	Pass
2012-2	9/11/2012	80 cm.	8.44	8.55 ± 1.18	5.91 - 10.97	Pass
2012-2	9/11/2012	90 cm.	6.67	5.75 ± 0.33	4.67 - 8.67	Pass
2012-2	9/11/2012	100 cm.	5.4	4.44 ± 0.22	3.78 - 7.02	Pass
2012-2	9/11/2012	110 cm.	4.46	3.85 ± 0.05	3.12 - 5.80	Pass
2012-2	9/11/2012	120 cm.	3.75	3.03 ± 0.71	2.63 - 4.88	Pass
2012-2	9/11/2012	150 cm.	2.4	1.82 ± 0.10	1.68 - 3.12	Pass
2012-2	9/11/2012	180 cm.	1.67	1.19 ± 0.34	1.17 - 2.17	Pass

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

Lab Code [b]	Date	Analysis	Concentration (pCi/L) [a] Laboratory results 2s, n=1 [c]	Known Activity	Control Limits [d]	Acceptance
SPW-41824	2/15/2012	Ra-228	24.85 ± 2.14	28.75	20.13 - 37.38	Pass
W-22712	2/27/2012	Gr. Alpha	14.59 ± 0.34	20.00	10.00 - 30.00	Pass
W-22712	2/27/2012	Gr. Alpha	43.57 ± 0.40	41.70	20.85 - 62.55	Pass
SPAP-1032	3/5/2012	Cs-134	7.06 ± 1.71	5.26	0.00 - 15.26	Pass
SPAP-1032	3/5/2012	Cs-137	102.63 ± 3.13	104.24	93.82 - 114.66	Pass
SPAP-1034	3/5/2012	Gr. Beta	44.30 ± 0.11	46.88	28.13 - 65.63	Pass
SPW-1036	3/5/2012	Cs-134	43.23 ± 3.84	39.42	29.42 - 49.42	Pass
SPW-1036	3/5/2012	Cs-137	57.44 ± 4.60	52.12	42.12 - 62.12	Pass
SPW-1036	3/5/2012	Sr-90	60.51 ± 1.93	61.52	49.22 - 73.82	Pass
SPMI-1038	3/5/2012	Cs-134	37.79 ± 4.06	39.42	29.42 - 49.42	Pass
SPMI-1038	3/5/2012	Cs-137	54.75 ± 5.09	52.12	42.12 - 62.12	Pass
SPW-1045	3/5/2012	H-3	68022 ± 746	69048	55238 - 82858	Pass
SPW-1047	3/5/2012	Ni-63	217.10 ± 3.64	206.64	144.65 - 268.63	Pass
SPW-1049	3/5/2012	C-14	3858.90 ± 12.79	4738.80	2843.28 - 6634.32	Pass
W-31412	3/14/2012	Ra-226	13.13 ± 0.36	16.70	11.69 - 21.71	Pass
SPW-1520	3/23/2012	U-238	45.67 ± 2.02	41.70	29.19 - 54.21	Pass
SPW-41825	4/10/2012	Ra-228	28.48 ± 2.51	28.35	19.85 - 36.86	Pass
WW-1547	4/16/2012	Ba-133	18.99 ± 4.67	26.70	16.70 - 36.70	Pass
WW-1547	4/16/2012	Cs-134	9.28 ± 2.82	8.68	0.00 - 18.68	Pass
WW-1547	4/16/2012	Cs-137	27.77 ± 4.49	29.70	19.70 - 39.70	Pass
W-51712	5/17/2012	Ra-226	17.29 ± 0.43	16.70	11.69 - 21.71	Pass
W-61112	6/11/2012	Gr. Alpha	22.16 ± 0.45	20.00	10.00 - 30.00	Pass
W-61112	6/11/2012	Gr. Beta	43.57 ± 0.40	45.20	35.20 - 55.20	Pass
SPAP-4418	7/25/2012	Gr. Beta	43.74 ± 0.11	46.50	27.90 - 65.10	Pass
SPAP-4420	7/25/2012	Cs-134	4.54 ± 0.73	4.60	2.76 - 6.44	Pass
SPAP-4420	7/25/2012	Cs-137	104.70 ± 2.77	103.30	92.97 - 113.63	Pass
SPMI-4422	7/25/2012	Co-60	31.43 ± 2.12	31.62	21.62 - 41.62	Pass
SPMI-4422	7/25/2012	Cs-134	16.50 ± 1.17	16.15	6.15 - 26.15	Pass
SPMI-4422	7/25/2012	Cs-137	29.60 ± 2.61	26.64	16.64 - 36.64	Pass
SPMI-4422	7/25/2012	Sr-90	31.60 ± 1.35	30.47	24.38 - 36.56	Pass
SPW-4424	7/25/2012	Co-60	38.52 ± 1.76	37.95	27.95 - 47.95	Pass
SPW-4424	7/25/2012	Cs-137	33.23 ± 2.27	32.01	22.01 - 42.01	Pass
SPW-4424	7/25/2012	Sr-90	36.56 ± 1.58	40.60	32.48 - 48.72	Pass
SPF-4426	7/25/2012	Cs-134	947.50 ± 42.50	1025.00	922.50 - 1127.50	Pass
SPF-4426	7/25/2012	Cs-137	2692.00 ± 62.40	2480.00	2232.00 - 2728.00	Pass
SPW-4428	7/25/2012	C-14	4325.70 ± 15.80	4738.80	2843.28 - 6634.32	Pass
SPW-4430	7/25/2012	H-3	70119.40 ± 773.40	67570.00	54056.00 - 81084.00	Pass
SPW-4432	7/25/2012	Ni-63	187.20 ± 3.85	206.80	144.76 - 268.84	Pass
W-81712	8/17/2012	Ra-226	14.94 ± 0.40	16.70	11.69 - 21.71	Pass
SPW-5407	8/29/2012	U-238	42.95 ± 0.11	41.70	29.19 - 54.21	Pass
SPW-18022	9/10/2012	Ra-228	29.03 ± 2.80	28.21	19.75 - 36.67	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
W-91012	9/10/2012	Gr. Alpha	19.95 ± 0.42	20.00	10.00 - 30.00	Pass
W-91012	9/10/2012	Gr. Beta	43.47 ± 0.40	45.20	35.20 - 55.20	Pass
W-100312	10/3/2012	Gr. Alpha	19.95 ± 0.41	20.00	10.00 - 30.00	Pass
W-100312	10/3/2012	Gr. Beta	44.21 ± 0.40	45.20	35.20 - 55.20	Pass
W-101812	10/18/2012	Ra-226	18.80 ± 0.43	16.70	11.69 - 21.71	Pass
ESO-7235	12/6/2012	Sr-90	138.79 ± 2.67	161.05	128.84 - 193.26	Pass
SPW-7753	12/6/2012	U-238	45.55 ± 5.05	41.70	29.19 - 54.21	Pass
SPW-18023	12/18/2012	Ra-228	31.59 ± 2.99	25.98	18.19 - 33.77	Pass

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

[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 ± 2 σ.

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-41814	Water	2/15/2012	Ra-228	0.65	0.49 ± 0.36	2
W-22712	Water	2/27/2012	Gr. Alpha	0.42	-0.04 ± 0.29	1
W-22712	Water	2/27/2012	Gr. Beta	0.74	-0.54 ± 0.50	3.2
SPAP-1031	Air Filter	3/5/2012	Cs-134	1.89	-	100
SPAP-1031	Air Filter	3/5/2012	Cs-137	1.16	-	100
SPAP-1033	Air Filter	3/5/2012	Gr. Beta	0.003	0.013 ± 0.003	0.01
SPW-1035	Water	3/5/2012	Cs-134	2.40	-	10
SPW-1035	Water	3/5/2012	Cs-137	2.88	-	10
SPW-1035	Water	3/5/2012	I-131(G)	2.35	-	20
SPW-1035	Water	3/5/2012	Sr-90	0.60	-0.11 ± 0.26	1
SPMI-1037	Milk	3/5/2012	Cs-134	2.85	-	10
SPMI-1037	Milk	3/5/2012	Cs-137	3.73	-	10
SPMI-1037	Milk	3/5/2012	I-131(G)	3.24	-	20
SPW-1044	Water	3/5/2012	H-3	146.10	37.10 ± 74.40	200
SPW-1046	Water	3/5/2012	Ni-63	19.07	8.30 ± 11.79	20
SPW-1048	Water	3/5/2012	C-14	5.70	2.99 ± 3.04	200
SPW-1166	water	3/9/2012	C-14	6.79	1.11	200
W-31412	Water	3/14/2012	Ra-226	0.034	0.043 ± 0.027	1
SPW-1521	Water	3/23/2012	U-238	0.10	0.09 ± 0.11	1
W-51712	Water	4/24/2012	Ra-226	0.04	0.04 ± 0.03	1
W-61112	Water	6/11/2012	Gr. Alpha	0.47	-0.14 ± 0.32	1
W-61112	Water	6/11/2012	Gr. Beta	0.71	0.29 ± 0.51	3.2
SPW-41815	Water	7/7/2011	Ra-228	0.77	0.52 ± 0.42	2
SPAP-4417	Air Filter	7/25/2012	Gr. Beta	0.001	0.021 ± 0.003	0.01
SPMI-4421	Milk	7/25/2012	Co-60	4.29	-	10
SPMI-4421	Milk	7/25/2012	Cs-134	3.58	-	10
SPMI-4421	Milk	7/25/2012	Cs-137	4.60	-	10
SPMI-4421	Milk	7/25/2012	Sr-90	0.45	0.53 ± 0.27	1
SPW-4423	Water	7/25/2012	Co-60	1.88	-	10
SPW-4423	Water	7/25/2012	Cs-134	2.38	-	10
SPW-4423	Water	7/25/2012	Cs-137	2.80	-	10
SPW-4423	water	7/25/2012	Sr-90	0.45	0.08 ± 0.22	1
SPF-4425	Fish	7/25/2012	Co-60	6.74	-	100
SPF-4425	Fish	7/25/2012	Cs-134	7.47	-	100
SPF-4425	Fish	7/25/2012	Cs-137	9.62	-	100
SPW-4427	Water	7/25/2012	C-14	10.93	3.54 ± 5.84	200
SPW-4431	Water	7/25/2012	Ni-63	19.00	5.50 ± 11.70	20
W-81712	Water	8/17/2012	Ra-226	0.038	0.035 ± 0.030	1
SPW-5408	Water	8/29/2012	U-238	0.039	0.015 ± 0.057	1

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-18032	Water	9/10/2012	Ra-228	0.78	0.85 ± 0.46	2
W-91012	Water	9/10/2012	Gr. Alpha	0.42	0.027 ± 0.29	1
W-91012	Water	9/10/2012	Gr. Beta	0.75	-0.13 ± 0.52	3.2
W-100312	Water	10/3/2012	Gr. Beta	0.77	-0.32 ± 0.53	3.2
W-100312	Water	10/3/2012	Gr. Beta	0.43	0.06 ± 0.30	3.2
W-101812	Water	10/18/2012	Ra-226	0.04	0.038 ± 0.031	1
SPW-7754	Water	12/6/2012	U-238	0.10	0.022 ± 0.075	1
SPW-18033	Water	12/18/2012	Ra-228	0.98	0.43 ± 0.50	2

[a] Liquid sample results are reported in pCi/Liter, air filters(pCi/filter), 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. For gamma spectroscopic analysis, activity detected below the LLD value is not reported.

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

Lab Code	Date	Analysis	Concentration (pCi/L)[a] First Result	Second Result	Averaged Result	Acceptance
CF-20, 21	1/3/2012	Gr. Beta	14.50 ± 0.29	15.02 ± 0.30	14.76 ± 0.21	Pass
CF-20, 21	1/3/2012	K-40	12.88 ± 0.55	12.40 ± 0.53	12.64 ± 0.38	Pass
CF-20, 21	1/3/2012	Sr-90	0.01 ± 0.01	0.01 ± 0.01	0.01 ± 0.00	Pass
P-9133, 9134	1/3/2012	H-3	108.86 ± 83.03	206.60 ± 86.38	157.73 ± 59.91	Pass
U-302, 303	1/17/2012	Beta (-K40)	6.84 ± 2.91	5.24 ± 2.56	6.04 ± 1.94	Pass
S-386, 387	1/23/2012	Ac-228	0.77 ± 0.11	0.79 ± 0.14	0.78 ± 0.09	Pass
S-386, 387	1/23/2012	Bi-214	0.80 ± 0.07	0.73 ± 0.11	0.77 ± 0.07	Pass
S-386, 387	1/23/2012	Pb-214	0.74 ± 0.06	0.75 ± 0.11	0.75 ± 0.06	Pass
S-386, 387	1/23/2012	Tl-208	0.21 ± 0.02	0.21 ± 0.04	0.21 ± 0.02	Pass
S-386, 387	1/23/2012	U-235	0.05 ± 0.02	0.12 ± 0.05	0.09 ± 0.03	Pass
WW-619, 620	1/31/2012	H-3	257.20 ± 86.00	305.80 ± 88.30	281.50 ± 61.63	Pass
MI-702, 703	2/6/2012	K-40	1337.00 ± 123.00	1460.40 ± 102.00	1398.70 ± 79.90	Pass
WW-892, 893	2/17/2012	Gr. Beta	3.46 ± 0.56	3.77 ± 0.59	3.61 ± 0.41	Pass
S-850, 851	2/22/2012	Cs-134	0.14 ± 0.02	0.13 ± 0.02	0.14 ± 0.01	Pass
S-850, 851	2/22/2012	Cs-137	0.21 ± 0.03	0.22 ± 0.03	0.22 ± 0.02	Pass
W-1251, 1252	3/6/2012	Gr. Alpha	1.20 ± 0.62	1.27 ± 0.92	1.24 ± 0.55	Pass
W-1251, 1252	3/6/2012	Gr. Beta	16.86 ± 1.43	15.14 ± 1.34	16.00 ± 0.98	Pass
W-1251, 1252	3/6/2012	H-3	5235.52 ± 230.91	4893.24 ± 224.55	5064.38 ± 161.05	Pass
W-1251, 1252	3/6/2012	Tc-99	19.67 ± 3.60	14.46 ± 3.51	17.07 ± 2.51	Pass
AP-1209, 1210	3/8/2012	Be-7	0.24 ± 0.12	0.20 ± 0.11	0.22 ± 0.08	Pass
XWW-1564, 1565	3/14/2012	H-3	308.00 ± 88.00	293.00 ± 87.00	300.50 ± 61.87	Pass
SG-1438, 1439	3/19/2012	Ac-228	6.01 ± 0.30	6.23 ± 0.31	6.12 ± 0.22	Pass
SG-1438, 1439	3/19/2012	Pb-214	4.69 ± 0.49	5.20 ± 0.54	4.95 ± 0.36	Pass
WW-1585, 1586	3/19/2012	H-3	3124.50 ± 176.96	2982.38 ± 173.62	3053.44 ± 123.96	Pass
AP-2103, 2104	3/28/2012	Be-7	0.080 ± 0.016	0.076 ± 0.013	0.078 ± 0.010	Pass
AP-2166, 2167	3/28/2012	Be-7	0.061 ± 0.020	0.071 ± 0.016	0.066 ± 0.013	Pass
AP-1632, 1633	3/29/2012	Be-7	0.26 ± 0.12	0.24 ± 0.12	0.25 ± 0.08	Pass
E-1653, 1654	4/2/2012	Gr. Beta	1.53 ± 0.05	1.55 ± 0.04	1.54 ± 0.03	Pass
E-1653, 1654	4/2/2012	K-40	1.34 ± 0.13	1.36 ± 0.14	1.35 ± 0.10	Pass
SG-1677, 1678	4/2/2012	Ac-228	6.63 ± 0.37	6.49 ± 0.33	6.56 ± 0.25	Pass
SG-1677, 1678	4/2/2012	Pb-214	4.77 ± 0.16	5.07 ± 0.14	4.92 ± 0.11	Pass
SWU-1719, 1720	4/3/2012	Gr. Beta	1.16 ± 0.41	1.53 ± 0.44	1.35 ± 0.30	Pass
W-1698, 1699	4/5/2012	Gr. Beta	10.86 ± 1.49	9.42 ± 1.32	10.14 ± 1.00	Pass
W-1698, 1699	4/5/2012	Ra-226	0.41 ± 0.15	0.67 ± 0.18	0.54 ± 0.12	Pass
W-1698, 1699	4/5/2012	Ra-228	1.46 ± 0.76	1.48 ± 0.74	1.47 ± 0.53	Pass
SG-1761, 1762	4/10/2012	Ac-228	16.26 ± 0.53	16.55 ± 0.44	16.41 ± 0.34	Pass
SG-1761, 1762	4/10/2012	Pb-214	14.16 ± 1.44	15.40 ± 1.56	14.78 ± 1.06	Pass
AP-2019, 2020	4/12/2012	Be-7	0.17 ± 0.10	0.17 ± 0.08	0.17 ± 0.07	Pass
DW-2272, 2273	4/20/2012	I-131	0.52 ± 0.24	0.49 ± 0.27	0.51 ± 0.18	Pass
DW-2356, 2357	4/24/2012	Gr. Beta	12.82 ± 2.01	9.47 ± 1.74	11.14 ± 1.33	Pass

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

Lab Code	Date	Analysis	Concentration (pCi/L)[a] First Result	Second Result	Averaged Result	Acceptance
G-2403, 2404	5/1/2012	Be-7	1.77 ± 0.21	1.55 ± 0.33	1.66 ± 0.20	Pass
G-2403, 2404	5/1/2012	K-40	6.38 ± 0.50	6.93 ± 0.72	6.66 ± 0.44	Pass
BS-2445, 2446	5/1/2012	Gr. Beta	8.92 ± 1.52	9.29 ± 1.63	9.11 ± 1.11	Pass
BS-2445, 2446	5/1/2012	K-40	5.86 ± 0.38	6.22 ± 0.48	6.04 ± 0.31	Pass
SWU-2550, 2551	5/1/2012	Gr. Beta	2.07 ± 0.65	1.59 ± 0.62	1.83 ± 0.45	Pass
WW-2614, 2615	5/1/2012	Gr. Beta	2.03 ± 1.04	2.36 ± 1.14	2.20 ± 0.77	Pass
WW-2614, 2615	5/1/2012	H-3	750.60 ± 106.20	653.20 ± 102.30	701.90 ± 73.73	Pass
BS-2656, 2657	5/2/2012	Cs-137	0.13 ± 0.07	0.07 ± 0.04	0.10 ± 0.04	Pass
BS-2656, 2657	5/2/2012	K-40	10.15 ± 0.97	11.13 ± 0.90	10.64 ± 0.66	Pass
SO-2635, 2636	5/3/2012	Cs-137	0.046 ± 0.024	0.050 ± 0.027	0.048 ± 0.018	Pass
SO-2635, 2636	5/3/2012	K-40	13.20 ± 0.74	14.01 ± 0.67	13.61 ± 0.50	Pass
MI-2677, 2678	5/7/2012	K-40	1415.30 ± 131.40	1348.10 ± 109.00	1381.70 ± 85.36	Pass
VE-2719, 2720	5/7/2012	K-40	4.15 ± 0.36	4.19 ± 0.38	4.17 ± 0.26	Pass
SWU-3221, 3222	5/8/2012	Gr. Beta	1.67 ± 0.47	1.39 ± 0.45	1.53 ± 0.33	Pass
SWU-3221, 3222	5/8/2012	H-3	236.90 ± 101.90	281.90 ± 103.70	259.40 ± 72.69	Pass
WW-3073, 3074	5/14/2012	H-3	339.12 ± 145.45	337.23 ± 98.19	338.18 ± 87.74	Pass
AP-2968, 2969	5/17/2012	Be-7	0.25 ± 0.12	0.21 ± 0.09	0.23 ± 0.07	Pass
F-3031, 3032	5/22/2012	H-3	11291.00 ± 372.80	11167.00 ± 315.00	11229.00 ± 244.03	Pass
F-3031, 3032	5/22/2012	K-40	3528.90 ± 372.80	3677.20 ± 392.40	3603.05 ± 270.63	Pass
G-3094, 3095	5/23/2012	Gr. Beta	7.89 ± 0.16	8.01 ± 0.16	7.95 ± 0.11	Pass
F-3412, 3413	5/23/2012	Gr. Beta	3.46 ± 0.10	3.33 ± 0.10	3.40 ± 0.07	Pass
F-3412, 3413	5/23/2012	K-40	2.40 ± 0.38	2.55 ± 0.43	2.48 ± 0.29	Pass
MI-3067, 3068	5/24/2012	K-40	1267.20 ± 105.00	1305.70 ± 109.80	1286.45 ± 75.96	Pass
SO-3305, 3306	5/30/2012	Cs-137	0.024 ± 0.013	0.030 ± 0.015	0.027 ± 0.010	Pass
SO-3305, 3306	5/30/2012	Gr. Beta	10.95 ± 0.89	10.86 ± 0.89	10.91 ± 0.63	Pass
SO-3305, 3306	5/30/2012	Tl-208	0.068 ± 0.018	0.062 ± 0.017	0.065 ± 0.012	Pass
LW-3454, 3455	5/31/2012	Gr. Beta	2.12 ± 0.86	2.27 ± 0.77	2.20 ± 0.58	Pass
BS-3697, 3698	6/14/2012	Be-7	2.05 ± 0.19	2.27 ± 0.38	2.16 ± 0.21	Pass
BS-3697, 3698	6/14/2012	Cs-137	2.32 ± 0.39	2.26 ± 0.66	2.29 ± 0.38	Pass
BS-3697, 3698	6/14/2012	K-40	6.67 ± 0.28	6.64 ± 0.42	6.66 ± 0.25	Pass
VE-3798, 3799	6/20/2012	K-40	5.93 ± 0.38	6.03 ± 0.37	5.98 ± 0.26	Pass
WW-4790, 4791	6/20/2012	H-3	251.33 ± 86.51	372.48 ± 92.27	311.90 ± 63.24	Pass
DW-30103, 30104	6/27/2012	Ra-226	0.30 ± 0.08	0.42 ± 0.09	0.36 ± 0.06	Pass
DW-30103, 30104	6/27/2012	Ra-228	0.76 ± 0.54	0.78 ± 0.54	0.77 ± 0.38	Pass
LW-3970, 3971	6/28/2012	Gr. Beta	1.49 ± 1.06	0.72 ± 0.53	1.11 ± 0.59	Pass
DW-3949, 3950	6/29/2012	I-131	0.54 ± 0.26	0.25 ± 0.26	0.40 ± 0.18	Pass
SG-4075, 4076	7/2/2012	Ac-228	0.33 ± 0.09	0.34 ± 0.06	0.34 ± 0.05	Pass
SG-4075, 4076	7/2/2012	K-40	6.71 ± 0.58	7.20 ± 0.32	6.96 ± 0.33	Pass
SG-4075, 4076	7/2/2012	Pb-214	0.46 ± 0.05	0.49 ± 0.03	0.48 ± 0.03	Pass
AP-4390, 4391	7/3/2012	Be-7	0.09 ± 0.02	0.09 ± 0.01	0.09 ± 0.01	Pass
AP-4390, 4391	7/3/2012	Be-7	0.11 ± 0.02	0.10 ± 0.01	0.11 ± 0.01	Pass
AP-4012, 4013	7/5/2012	Be-7	0.27 ± 0.09	0.29 ± 0.16	0.28 ± 0.09	Pass
SW-4033, 4034	7/5/2012	H-3	614.99 ± 107.99	512.31 ± 103.83	563.65 ± 74.91	Pass

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

Lab Code	Date	Analysis	Concentration (pCi/L)[a] First Result	Second Result	Averaged Result	Acceptance
VE-4054, 4055	7/9/2012	K-40	7.28 ± 0.56	7.42 ± 0.63	7.35 ± 0.42	Pass
VE-4222, 4223	7/13/2012	Be-7	0.16 ± 0.08	0.22 ± 0.09	0.19 ± 0.06	Pass
VE-4222, 4223	7/13/2012	K-40	7.20 ± 0.30	6.60 ± 0.30	6.90 ± 0.21	Pass
DW-30113, 30114	7/13/2012	Ra-228	1.93 ± 0.66	1.03 ± 0.53	1.48 ± 0.42	Pass
DW-30115, 30116	7/13/2012	Gr. Alpha	7.46 ± 1.21	7.02 ± 1.14	7.24 ± 0.83	Pass
DW-30124, 30125	7/13/2012	Ra-226	1.16 ± 0.15	0.90 ± 0.12	1.03 ± 0.10	Pass
DW-30124, 30125	7/13/2012	Ra-228	1.38 ± 0.56	1.72 ± 0.60	1.55 ± 0.41	Pass
DW-30126, 30127	7/13/2012	Gr. Alpha	6.23 ± 1.16	6.75 ± 1.29	6.49 ± 0.87	Pass
AP-4433, 4434	7/19/2012	Be-7	0.17 ± 0.09	0.21 ± 0.10	0.19 ± 0.07	Pass
SG-4475, 4476	7/19/2012	Gr. Alpha	17.03 ± 4.17	15.56 ± 3.96	16.30 ± 2.88	Pass
SG-4475, 4476	7/19/2012	Gr. Beta	13.23 ± 2.61	14.36 ± 2.47	13.80 ± 1.80	Pass
WW-4685, 4686	7/24/2012	H-3	289.00 ± 99.00	375.00 ± 103.00	332.00 ± 71.43	Pass
AP-4706, 4707	7/26/2012	Be-7	0.28 ± 0.14	0.24 ± 0.14	0.26 ± 0.10	Pass
SO-4748, 4749	7/26/2012	Gr. Beta	20.45 ± 1.04	19.22 ± 0.94	19.84 ± 0.70	Pass
SO-4748, 4749	7/26/2012	U-233/4	0.11 ± 0.02	0.10 ± 0.01	0.11 ± 0.01	Pass
SO-4748, 4749	7/26/2012	U-238	0.12 ± 0.02	0.11 ± 0.01	0.12 ± 0.01	Pass
VE-4832, 4833	8/1/2012	K-40	4.06 ± 0.22	4.08 ± 0.24	4.07 ± 0.16	Pass
DW-30149, 30150	8/1/2012	Ra-226	2.69 ± 0.22	2.79 ± 0.22	2.74 ± 0.16	Pass
DW-30149, 30150	8/1/2012	Ra-228	2.77 ± 0.75	1.61 ± 0.57	2.19 ± 0.47	Pass
SG-4916, 4917	8/3/2012	Ac-228	11.03 ± 0.33	11.08 ± 0.44	11.06 ± 0.28	Pass
SG-4916, 4917	8/3/2012	K-40	6.39 ± 0.80	6.98 ± 0.88	6.69 ± 0.59	Pass
F-5313, 5314	8/9/2012	Cs-137	0.05 ± 0.02	0.05 ± 0.02	0.05 ± 0.01	Pass
F-5313, 5314	8/9/2012	Gr. Beta	4.12 ± 0.08	4.10 ± 0.08	4.11 ± 0.06	Pass
F-5313, 5314	8/9/2012	K-40	3.07 ± 0.42	3.14 ± 0.40	3.11 ± 0.29	Pass
VE-5166, 5167	8/15/2012	K-40	4.26 ± 0.28	3.66 ± 0.47	3.96 ± 0.27	Pass
VE-5376, 5377	8/22/2012	Gr. Beta	7.72 ± 0.17	7.61 ± 0.16	7.67 ± 0.12	Pass
VE-5334, 5335	8/27/2012	K-40	1.65 ± 0.17	1.72 ± 0.15	1.68 ± 0.12	Pass
VE-5481, 5482	8/28/2012	Be-7	2.52 ± 0.19	2.65 ± 0.21	2.59 ± 0.14	Pass
VE-5481, 5482	8/28/2012	K-40	5.05 ± 0.37	4.79 ± 0.39	4.92 ± 0.27	Pass
VE-5481, 5482	8/28/2012	Sr-90	0.01 ± 0.00	0.01 ± 0.01	0.01 ± 0.00	Pass
DW-30164, 30165	8/30/2012	Ra-226	1.33 ± 0.15	1.59 ± 0.17	1.46 ± 0.11	Pass
DW-30164, 30165	8/30/2012	Ra-228	2.76 ± 0.66	1.54 ± 0.56	2.15 ± 0.43	Pass
VE-5166, 5167	9/4/2012	K-40	2.05 ± 0.32	2.53 ± 0.36	2.29 ± 0.24	Pass
ME-5607, 5608	9/4/2012	Gr. Beta	2.92 ± 0.08	2.89 ± 0.08	2.90 ± 0.06	Pass
ME-5607, 5608	9/4/2012	K-40	2.06 ± 0.32	2.53 ± 0.36	2.29 ± 0.24	Pass
SW-5901, 5902	9/17/2012	H-3	10909.00 ± 311.00	10817.00 ± 310.00	10863.00 ± 219.56	Pass
BS-6048, 6049	9/24/2012	K-40	1.24 ± 0.20	1.18 ± 0.21	1.21 ± 0.14	Pass
AP-6482, 6483	9/27/2012	Be-7	0.09 ± 0.02	0.09 ± 0.03	0.09 ± 0.02	Pass

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

Lab Code	Date	Analysis	Concentration (pCi/L)[a] First Result	Second Result	Averaged Result	Acceptance
G-6090, 6091	10/1/2012	Be-7	3.74 ± 0.33	3.54 ± 0.30	3.64 ± 0.22	Pass
G-6090, 6091	10/1/2012	Gr. Beta	10.81 ± 0.34	10.72 ± 0.33	10.77 ± 0.24	Pass
G-6090, 6091	10/1/2012	K-40	5.99 ± 0.47	5.45 ± 0.44	5.72 ± 0.32	Pass
SO-6111, 6112	10/1/2012	Cs-137	0.06 ± 0.03	0.04 ± 0.02	0.05 ± 0.02	Pass
SO-6111, 6112	10/1/2012	K-40	19.66 ± 0.84	20.09 ± 0.80	19.88 ± 0.58	Pass
W-6795, 6796	10/1/2012	H-3	215.20 ± 88.00	292.80 ± 91.60	254.00 ± 63.51	Pass
AP-6461, 6462	10/2/2012	Be-7	0.07 ± 0.01	0.07 ± 0.02	0.07 ± 0.01	Pass
WW-6279, 6280	10/3/2012	Gr. Beta	1.54 ± 0.68	1.67 ± 0.75	1.61 ± 0.51	Pass
W-6346, 6347	10/3/2012	Ra-226	0.30 ± 0.10	0.36 ± 0.10	0.33 ± 0.07	Pass
VE-6503, 6504	10/9/2012	K-40	5.23 ± 0.83	6.00 ± 0.45	5.04 ± 0.27	Pass
WW-6606, 6607	10/10/2012	Gr. Beta	3.18 ± 1.31	2.42 ± 1.27	2.80 ± 0.91	Pass
WW-6606, 6607	10/10/2012	H-3	273.10 ± 85.70	219.80 ± 83.10	246.45 ± 59.69	Pass
WW-7237, 7238	10/12/2012	H-3	175.44 ± 99.84	180.75 ± 100.03	178.10 ± 70.66	Pass
F-6627, 6628	10/15/2012	K-40	3.05 ± 0.39	3.23 ± 0.37	3.14 ± 0.27	Pass
VE-6669, 6670	10/16/2012	Be-7	0.48 ± 0.26	0.50 ± 0.13	0.49 ± 0.15	Pass
VE-6669, 6670	10/16/2012	K-40	4.06 ± 0.28	3.68 ± 0.26	3.87 ± 0.19	Pass
SS-6711, 6712	10/16/2012	Ac-228	0.16 ± 0.05	0.17 ± 0.06	0.17 ± 0.04	Pass
SS-6711, 6712	10/16/2012	Bi-214	0.13 ± 0.03	0.16 ± 0.03	0.14 ± 0.02	Pass
SS-6711, 6712	10/16/2012	Gr. Beta	14.20 ± 0.89	12.67 ± 0.88	13.44 ± 0.63	Pass
SS-6711, 6712	10/16/2012	Pb-212	0.15 ± 0.06	0.13 ± 0.02	0.14 ± 0.03	Pass
SS-6711, 6712	10/16/2012	Tl-208	0.06 ± 0.02	0.04 ± 0.02	0.05 ± 0.01	Pass
WW-7258, 7259	10/22/2012	H-3	214.69 ± 85.42	314.60 ± 90.25	264.65 ± 62.13	Pass
WW-7655, 7656	10/25/2012	H-3	159.00 ± 86.10	159.00 ± 86.10	159.00 ± 60.88	Pass
WW-7747, 7748	10/25/2012	H-3	156.50 ± 84.70	170.20 ± 85.30	163.35 ± 60.10	Pass
MI-6963, 6964	10/28/2012	K-40	1384.60 ± 111.70	1421.60 ± 107.60	1403.10 ± 77.55	Pass
MI-7174, 7175	11/5/2012	K-40	1283.60 ± 97.45	1293.20 ± 91.37	1288.40 ± 66.79	Pass
SG-7221, 7222	11/9/2012	Pb-214	31.49 ± 0.70	30.11 ± 0.80	30.80 ± 0.53	Pass
DW-30216, 30217	11/9/2012	Gr. Alpha	2.23 ± 0.86	2.31 ± 0.92	2.27 ± 0.63	Pass
DW-30216, 30217	11/9/2012	Ra-226	0.72 ± 0.12	0.82 ± 0.14	0.77 ± 0.09	Pass
DW-30216, 30217	11/9/2012	Ra-228	0.92 ± 0.52	1.26 ± 0.53	1.09 ± 0.37	Pass
MI-7363, 7364	11/13/2012	K-40	1304.40 ± 103.30	1496.10 ± 121.30	1400.25 ± 79.66	Pass
CF-7384, 7385	11/13/2012	K-40	11.75 ± 0.52	10.94 ± 0.59	11.35 ± 0.39	Pass
VE-7489, 7490	11/16/2012	K-40	2.22 ± 0.23	1.91 ± 0.22	2.06 ± 0.16	Pass
AP-7531, 7532	11/21/2012	Be-7	0.19 ± 0.10	0.29 ± 0.17	0.24 ± 0.10	Pass
BS-7573, 7574	11/24/2012	K-40	7.21 ± 0.41	7.57 ± 0.39	7.39 ± 0.28	Pass
LW-7865, 7866	12/5/2012	Gr. Beta	2.16 ± 0.56	1.64 ± 0.62	1.90 ± 0.42	Pass
SG-8095, 8096	12/19/2012	Ac-228	25.15 ± 0.73	25.47 ± 0.54	25.31 ± 0.45	Pass
SG-8095, 8096	12/19/2012	Gamma	26.98 ± 2.72	28.68 ± 2.89	27.83 ± 1.98	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
STW-1670	02/01/12	I-129	9.31 ± 0.31	12.29	8.60 - 15.98	Pass
STSO-1766 [d]	02/01/12	Am-241	88.50 ± 8.30	159.00	111.00 - 207.00	Fail
STSO-1766	02/01/12	Co-57	1352.10 ± 4.00	1179.00	825.00 - 1533.00	Pass
STSO-1766	02/01/12	Co-60	1.70 ± 0.70	1.56	1.00 - 2.00	Pass
STSO-1766	02/01/12	Cs-134	842.20 ± 4.30	828.00	580.00 - 1076.00	Pass
STSO-1766	02/01/12	Cs-137	0.40 ± 0.90	0.00	0.00 - 1.00	Pass
STSO-1766	02/01/12	K-40	1729.60 ± 22.20	1491.00	1044.00 - 1938.00	Pass
STSO-1766	02/01/12	Mn-54	647.60 ± 4.20	558.00	391.00 - 725.00	Pass
STSO-1766	02/01/12	Ni-63	781.50 ± 9.70	862.00	603.00 - 1121.00	Pass
STSO-1766	02/01/12	Pu-238	142.40 ± 9.70	136.00	97.00 - 177.00	Pass
STSO-1766	02/01/12	Pu-239/40	66.10 ± 6.40	65.80	46.10 - 85.50	Pass
STSO-1766	02/01/12	Sr-90	383.20 ± 15.30	392.00	274.00 - 510.00	Pass
STSO-1766	02/01/12	Tc-99	289.60 ± 10.90	374.00	262.00 - 486.00	Pass
STSO-1766	02/01/12	U-233/4	63.20 ± 5.40	68.10	47.70 - 88.50	Pass
STSO-1766	02/01/12	U-238	310.80 ± 12.10	329.00	230.00 - 428.00	Pass
STSO-1766	02/01/12	Zn-65	766.70 ± 6.70	642.00	449.00 - 835.00	Pass
STAP-1772	02/01/12	Am-241	0.062 ± 0.02	0.073	0.051 - 0.10	Pass
STAP-1772	02/01/12	Co-57	0.010 ± 0.01	0.00	0.000 - 1.00	Pass
STAP-1772	02/01/12	Co-60	2.40 ± 0.08	2.18	1.53 - 2.84	Pass
STAP-1772	02/01/12	Cs-134	2.33 ± 0.13	2.38	1.67 - 3.09	Pass
STAP-1772	02/01/12	Cs-137	2.07 ± 0.10	1.79	1.25 - 2.33	Pass
STAP-1772	02/01/12	Mn-54	3.77 ± 0.14	3.24	2.27 - 4.21	Pass
STAP-1772	02/01/12	Pu-238	0.003 ± 0.004	0.002	0.000 - 0.10	Pass
STAP-1772	02/01/12	Pu-239/40	0.098 ± 0.017	0.097	0.07 - 0.13	Pass
STAP-1772	02/01/12	Sr-90	-0.010 ± 0.060	0.000	-0.10 - 0.13	Pass
STAP-1772 [e]	02/01/12	U-233/4	0.016 ± 0.006	0.019	0.013 - 0.024	Pass
STAP-1772	02/01/12	U-238	0.11 ± 0.02	0.12	0.09 - 0.16	Pass
STAP-1772	02/01/12	Zn-65	3.67 ± 0.20	2.99	2.09 - 3.89	Pass
STAP-1773	02/01/12	Gr. Alpha	0.51 ± 0.05	1.20	0.40 - 2.00	Pass
STAP-1773	02/01/12	Gr. Beta	2.75 ± 0.10	2.40	1.20 - 3.60	Pass
STVE-1776	02/01/12	Co-57	14.57 ± 0.28	12.00	8.40 - 15.60	Pass
STVE-1776	02/01/12	Co-60	6.45 ± 0.23	6.05	4.24 - 7.87	Pass
STVE-1776	02/01/12	Cs-134	8.39 ± 0.29	8.43	5.90 - 10.96	Pass
STVE-1776	02/01/12	Cs-137	0.01 ± 0.09	0.00	0.00 - 0.10	Pass
STVE-1776	02/01/12	Mn-54	0.03 ± 0.08	0.00	0.00 - 0.10	Pass
STVE-1776	02/01/12	Zn-65	10.31 ± 0.67	8.90	6.23 - 11.57	Pass
STW-1960	02/01/12	Gr. Alpha	1.68 ± 0.09	2.14	0.64 - 3.64	Pass
STW-1960	02/01/12	Gr. Beta	6.33 ± 0.10	6.36	3.18 - 9.54	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
STW-1964	02/01/12	Am-241	1.28 ± 0.12	1.63	1.14 - 2.12	Pass
STW-1964	02/01/12	Co-57	33.30 ± 0.40	32.90	23.00 - 42.80	Pass
STW-1964	02/01/12	Co-60	23.20 ± 0.40	23.72	16.60 - 30.84	Pass
STW-1964	02/01/12	Cs-134	0.30 ± 3.00	0.00	0.00 - 1.00	Pass
STW-1964	02/01/12	Cs-137	40.10 ± 0.60	39.90	27.90 - 51.90	Pass
STW-1964 [f]	02/01/12	Fe-55	65.10 ± 9.50	81.90	57.30 - 106.50	Pass
STW-1964	02/01/12	H-3	460.00 ± 12.10	437.00	306.00 - 568.00	Pass
STW-1964	02/01/12	K-40	153.00 ± 4.20	142.00	99.00 - 185.00	Pass
STW-1964	02/01/12	Mn-54	32.70 ± 0.60	31.80	22.30 - 41.30	Pass
STW-1964	02/01/12	Ni-63	49.80 ± 2.90	60.00	42.00 - 78.00	Pass
STW-1964	02/01/12	Pu-238	0.58 ± 0.06	0.63	0.44 - 0.82	Pass
STW-1964	02/01/12	Pu-239/40	1.30 ± 0.15	1.34	0.94 - 1.74	Pass
STW-1964	02/01/12	Sr-90	0.10 ± 0.20	0.00	0.00 - 1.00	Pass
STW-1964	02/01/12	Tc-99	23.70 ± 0.80	27.90	19.50 - 36.30	Pass
STW-1964	02/01/12	U-233/4	0.40 ± 0.05	0.39	0.27 - 0.51	Pass
STW-1964	02/01/12	U-238	2.67 ± 0.13	2.76	1.93 - 3.59	Pass
STW-1964	02/01/12	Zn-65	0.01 ± 0.20	0.00	0.00 - 1.00	Pass
STW-5391	08/01/12	I-129	5.73 ± 0.28	6.82	4.77 - 8.87	Pass
STSO-5392	08/01/12	Am-241	129.30 ± 12.70	111.00	78.00 - 144.00	Pass
STSO-5392	08/01/12	Ni-63	376.20 ± 20.60	406.00	284.00 - 528.00	Pass
STSO-5392	08/01/12	Pu-238	118.70 ± 9.30	105.80	74.10 - 137.50	Pass
STSO-5392	08/01/12	Pu-239/40	140.70 ± 9.90	134.00	94.00 - 174.00	Pass
STSO-5392	08/01/12	Sr-90	483.52 ± 16.47	508.00	356.00 - 660.00	Pass
STSO-5392	08/01/12	Tc-99	432.50 ± 23.10	469.00	328.00 - 610.00	Pass
STSO-5394	08/01/12	Co-57	1528.00 ± 4.10	1316.00	921.00 - 1711.00	Pass
STSO-5394	08/01/12	Co-60	592.00 ± 3.20	531.00	372.00 - 690.00	Pass
STSO-5394	08/01/12	Cs-134	933.60 ± 5.82	939.00	657.00 - 1221.00	Pass
STSO-5394	08/01/12	Cs-137	1319.80 ± 5.50	1150.00	805.00 - 1495.00	Pass
STSO-5394	08/01/12	K-40	737.30 ± 17.70	632.00	442.00 - 822.00	Pass
STSO-5394	08/01/12	Mn-54	1083.20 ± 5.20	920.00	644.00 - 1196.00	Pass
STSO-5394	08/01/12	U-233/4	55.80 ± 4.20	60.30	42.20 - 78.40	Pass
STSO-5394	08/01/12	U-238	231.20 ± 8.60	263.00	184.00 - 342.00	Pass
STSO-5394	08/01/12	Zn-65	696.10 ± 7.00	606.00	424.00 - 788.00	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
STVE-5395 [g]	08/01/12	Co-57	7.44 ± 0.17	5.66	3.96 - 7.36	Fail
STVE-5395	08/01/12	Co-60	5.90 ± 0.15	5.12	3.58 - 6.66	Pass
STVE-5395	08/01/12	Cs-134	7.40 ± 0.31	6.51	4.56 - 8.46	Pass
STVE-5395	08/01/12	Cs-137	5.45 ± 0.18	4.38	3.07 - 5.69	Pass
STVE-5395	08/01/12	Mn-54	4.06 ± 0.21	3.27	2.29 - 4.25	Pass
STAP-5398	08/01/12	Gr. Alpha	0.41 ± 0.05	0.97	0.29 - 1.65	Pass
STAP-5398	08/01/12	Gr. Beta	2.11 ± 0.09	1.92	0.96 - 2.88	Pass
STAP-5401 [h]	08/01/12	Am-241	0.12 ± 0.02	0.08	0.05 - 0.10	Fail
STAP-5403	08/01/12	Co-57	1.96 ± 0.05	1.91	1.34 - 2.48	Pass
STAP-5403	08/01/12	Co-60	1.76 ± 0.07	1.73	1.21 - 2.25	Pass
STAP-5403	08/01/12	Cs-134	2.74 ± 0.18	2.74	1.92 - 3.56	Pass
STAP-5403	08/01/12	Cs-137	0.00 ± 0.03	0.00	-0.01 - 0.01	Pass
STAP-5403	08/01/12	Mn-54	2.52 ± 0.10	2.36	1.65 - 3.07	Pass
STAP-5403	08/01/12	Pu-238	0.050 ± 0.015	0.063	0.044 - 0.081	Pass
STAP-5403	08/01/12	Pu-239/40	0.001 ± 0.004	0.00081	0.000 - 0.010	Pass
STAP-5403 [i]	08/01/12	U-233/4	0.009 ± 0.011	0.014	0.010 - 0.018	Fail
STAP-5403	08/01/12	U-238	0.08 ± 0.02	0.10	0.070 - 0.130	Pass
STAP-5403	08/01/12	Zn-65	0.01 ± 0.06	0.00	-0.010 - 0.010	Pass
STW-5445	08/01/12	Fe-55	79.80 ± 4.10	89.30	62.50 - 116.10	Pass
STW-5445	08/01/12	Ni-63	74.30 ± 3.40	66.30	46.40 - 86.20	Pass
STW-5445	08/01/12	U-233/4	0.46 ± 0.05	0.45	0.32 - 0.59	Pass
STW-5445	08/01/12	U-238	3.14 ± 0.14	3.33	2.33 - 4.33	Pass
STW-5445 [j]	08/01/12	Am-241	0.64 ± 0.04	1.06	0.74 - 1.38	Fail

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

[b] Laboratory codes as follows: STW (water), STAP (air filter), STSO (soil), STVE (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] Investigation was inconclusive, there was not enough sample for reanalysis. ERA results (A-7) for the same matrix were acceptable.

[e] No errors found in calculation or procedure, original analysis result; 0.010 ± 0.010 Bq/filter.

[f] Reanalysis results were within limits, but low. ERA results (A-7) for the same matrix were acceptable. The efficiency factor was recalculated for the second round of MAPEP testing. Original analysis results 55.8 ± 12.6 Bq/L.

[g] Result of reanalysis; 6.74 ± 0.15 Bq/sample. Gamma emitters for the vegetation matrix exhibited a high bias, only Co-57 exceeded acceptance limits. Recounted using a geometry more closely matched to the MAPEP sample size.

[h] Result of reanalysis; 0.070 ± 0.013 Bq/filter.

[i] Result of reanalysis; 0.013 ± 0.005 pCi/filter. A larger sample size was used to reduce the counting error.

[j] Result of reanalysis 1.07 ± 0.06 pCi/L. The analyses of the MAPEP sample matrix resulted in recovery factors greater than 100%. A correction was made using recovery based on analysis of blank samples. A new tracer solution is on order, future samples for MAPEP testing will include batch spike and blank samples.

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-1393	03/19/12	Co-60	917.5 ± 7.0	880.0	681.0 - 1100.0	Pass
ERAP-1393	03/19/12	Cs-134	586.6 ± 7.4	656.0	417.0 - 814.0	Pass
ERAP-1393	03/19/12	Cs-137	1255.9 ± 9.4	1130.0	849.0 - 1480.0	Pass
ERAP-1393	03/19/12	Mn-54	< 3.4	0.0	-	Pass
ERAP-1393	03/19/12	Zn-65	1085.2 ± 18.0	897.0	642.0 - 1240.0	Pass
ERAP-1394	03/19/12	Am-241	86.9 ± 2.9	68.8	42.4 - 93.1	Pass
ERAP-1394	03/19/12	Pu-238	70.2 ± 3.6	63.2	43.3 - 83.1	Pass
ERAP-1394	03/19/12	Pu-239/40	66.0 ± 1.0	63.0	45.6 - 82.4	Pass
ERAP-1394	03/19/12	Sr-90	112.5 ± 15.4	89.6	43.8 - 134.0	Pass
ERAP-1394	03/19/12	U-233/4	43.4 ± 0.8	47.5	29.4 - 71.6	Pass
ERAP-1394	03/19/12	U-238	44.0 ± 1.2	47.1	30.4 - 65.1	Pass
ERAP-1394	03/19/12	Uranium	89.1 ± 2.2	96.7	53.5 - 147.0	Pass
ERAP-1396	03/19/12	Gr. Alpha	81.1 ± 1.5	77.8	26.1 - 121.0	Pass
ERAP-1396	03/19/12	Gr. Beta	68.4 ± 0.7	52.5	33.2 - 76.5	Pass
ERSO-1397	03/19/12	Ac-228	1303.4 ± 89.3	1570.0	1010.0 - 2180.0	Pass
ERSO-1397	03/19/12	Am-241	856.0 ± 123.7	938.0	549.0 - 1220.0	Pass
ERSO-1397	03/19/12	Bi-212	1379.2 ± 247.2	1550.0	413.0 - 2280.0	Pass
ERSO-1397	03/19/12	Bi-214	965.2 ± 38.4	1100.0	665.0 - 1590.0	Pass
ERSO-1397	03/19/12	Co-60	3693.6 ± 32.1	3500.0	2370.0 - 4820.0	Pass
ERSO-1397	03/19/12	Cs-134	2257.3 ± 45.4	2180.0	1420.0 - 2620.0	Pass
ERSO-1397	03/19/12	Cs-137	9444.5 ± 58.4	8770.0	6720.0 - 11300.0	Pass
ERSO-1397	03/19/12	K-40	11277.0 ± 275.1	11600.0	8470.0 - 15600.0	Pass
ERSO-1397	03/19/12	Mn-54	< 21.0	0.0	-	Pass
ERSO-1397	03/19/12	Pb-212	1208.4 ± 26.3	1510.0	992.0 - 2110.0	Pass
ERSO-1397	03/19/12	Pb-214	1041.6 ± 46.9	1110.0	647.0 - 1650.0	Pass
ERSO-1397	03/19/12	Pu-238	921.0 ± 112.6	984.0	592.0 - 1360.0	Pass
ERSO-1397	03/19/12	Pu-239/40	1028.0 ± 112.6	879.0	575.0 - 1210.0	Pass
ERSO-1397	03/19/12	Sr-90	8128.0 ± 329.0	8800.0	3360.0 - 13900.0	Pass
ERSO-1397	03/19/12	Th-234	2711.3 ± 253.6	2000.0	632.0 - 3760.0	Pass
ERSO-1397	03/19/12	U-233/4	1859.3 ± 126.6	1960.0	1200.0 - 2510.0	Pass
ERSO-1397	03/19/12	U-238	2003.3 ± 130.3	2000.0	1240.0 - 2540.0	Pass
ERSO-1397	03/19/12	Uranium	3939.5 ± 283.8	4030.0	2190.0 - 5320.0	Pass
ERSO-1397	03/19/12	Zn-65	4200.4 ± 65.9	3650.0	2910.0 - 4850.0	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-1400	03/19/12	Am-241	4194.8 ± 199.5	4540.0	2780.0 - 6040.0	Pass
ERVE-1400	03/19/12	Cm-244	1471.2 ± 113.1	1590.0	779.0 - 2480.0	Pass
ERVE-1400	03/19/12	Co-60	2347.8 ± 47.9	2210.0	1520.0 - 3090.0	Pass
ERVE-1400	03/19/12	Cs-134	2847.5 ± 64.0	2920.0	1880.0 - 3790.0	Pass
ERVE-1400	03/19/12	Cs-137	1503.5 ± 52.5	1340.0	972.0 - 1860.0	Pass
ERVE-1400	03/19/12	K-40	34105.7 ± 745.3	28600.0	20700.0 - 40100.0	Pass
ERVE-1400	03/19/12	Mn-54	< 26.8	0.0	-	Pass
ERVE-1400	03/19/12	Pu-238	2509.0 ± 213.6	2350.0	1400.0 - 3220.0	Pass
ERVE-1400	03/19/12	Pu-239/40	2690.4 ± 208.9	2570.0	1580.0 - 3540.0	Pass
ERVE-1400	03/19/12	Sr-90	7881.5 ± 470.8	8520.0	4860.0 - 11300.0	Pass
ERVE-1400	03/19/12	U-233/4	3149.6 ± 165.2	3610.0	2370.0 - 4640.0	Pass
ERVE-1400	03/19/12	U-238	3203.6 ± 166.5	3580.0	2390.0 - 4550.0	Pass
ERVE-1400	03/19/12	Uranium	6463.7 ± 363.2	7350.0	4980.0 - 9150.0	Pass
ERVE-1400	03/19/12	Zn-65	2701.9 ± 105.5	2310.0	1670.0 - 3240.0	Pass
ERW-1403	03/19/12	Am-241	119.9 ± 3.2	135.0	91.0 - 181.0	Pass
ERW-1403	03/19/12	Fe-55	713.7 ± 127.4	863.0	514.0 - 1170.0	Pass
ERW-1403	03/19/12	Pu-238	131.9 ± 6.4	135.0	99.9 - 168.0	Pass
ERW-1403	03/19/12	Pu-239/40	108.9 ± 10.2	112.0	86.9 - 141.0	Pass
ERW-1403	03/19/12	U-233/4	93.1 ± 7.9	105.0	78.9 - 135.0	Pass
ERW-1403	03/19/12	U-238	96.9 ± 5.5	104.0	79.3 - 128.0	Pass
ERW-1403	03/19/12	Uranium	190.0 ± 13.8	214.0	157.0 - 277.0	Pass
ERW-1405	03/19/12	Co-60	858.7 ± 5.6	875.0	760.0 - 1020.0	Pass
ERW-1405	03/19/12	Cs-134	560.4 ± 4.4	609.0	447.0 - 700.0	Pass
ERW-1405	03/19/12	Cs-137	1239.9 ± 7.4	1250.0	1060.0 - 1500.0	Pass
ERW-1405	03/19/12	Mn-54	< 7.4	0.0	-	Pass
ERW-1405	03/19/12	Sr-90	944.3 ± 26.2	989.0	644.0 - 1310.0	Pass
ERW-1405	03/19/12	Zn-65	786.9 ± 20.6	749.0	624.0 - 945.0	Pass
ERW-1406	03/19/12	Gr. Alpha	85.9 ± 3.0	103.0	36.6 - 160.0	Pass
ERW-1406	03/19/12	Gr. Beta	45.7 ± 1.6	43.7	25.0 - 64.7	Pass
ERW-1409	03/19/12	H-3	9045.0 ± 284.0	9150.0	6130.0 - 13000.0	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: STW (water), STAP (air filter), STSO (soil), STVE (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
2012 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: 2012

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	0.065 28 / 28 0.047 – 0.085	0.065 24 / 24 0.047 – 0.085	4 0.7 S	0.067 4 / 4 0.051 – 0.074	0.064 4 / 4 0.054 – 0.075
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 371	0.0075	0.025 371 / 371 0.009 - 0.058	0.025 318 / 318 0.009 – 0.058	6 11.0 SSW	0.026 53 / 53 0.010 – 0.053	0.026 53 / 53 0.010 – 0.053
Air pCi/m3	I-131 371	0.05	< LLD	-	-	-	-
Fish pCi/gm wet	K-40 3	N/A	1265.3 3 – 3 959 - 1580	1269.5 2 / 2 959 - 1580	25 0.6 NNW	1269.5 2 / 2 959 - 1580	1257 1 / 1 1257 - 1257
Fish pCi/gm wet	Mn-54 3	94	< LLD				
Fish pCi/gm wet	Fe-59 3	195	< LLD	-	-	-	-

Environmental Radiological Monitoring Program Annual Summary

Perry Nuclear Power Plant Docket Number 50-440/50-441
Lake County, Ohio Reporting Period: 2012

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 3	97	< LLD	-	-	-	-
Fish pCi/gm wet	Co-60 3	97	< LLD	-	-	-	-
Fish pCi/gm wet	Zn-65 3	195	< LLD	-	-	-	-
Fish pCi/gm wet	Cs-134 3	97	< LLD	-	-	-	-
Fish pCi/gm wet	Cs-137 3	112	< LLD	-	-	-	-
Broadleaf Vegetation pCi/Kg wet	Be-7 82	N/A	458.5 66 / 82 73 – 2038	411.6 50 / 64 106 – 870	70 16.2 SSW	605.4 16 / 18 73 – 2038	605.4 16 / 18 73 – 2038
Broadleaf Vegetation pCi/Kg wet	K-40 82	N/A	5211.1 82 / 82 3016 – 9645	4912.3 64 / 64 3016 – 9645	18 2.5 E	6383.8 12 / 12 4146 – 9645	6273.3 18 / 18 4059 – 9190
Broadleaf Vegetation pCi/Kg wet	Co-58 82	N/A	< LLD	-	-	-	-
Broadleaf Vegetation pCi/Kg wet	Co-60 82	N/A	< LLD	-	-	-	-
Broadleaf Vegetation pCi/Kg wet	I-131 82	45	< LLD	-	-	-	-

Environmental Radiological Monitoring Program Annual Summary

Perry Nuclear Power Plant Docket Number 50-440/50-441
Lake County, Ohio Reporting Period: 2012

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 82	45	< LLD	-	-	-	-
Broadleaf Vegetation pCi/Kg wet	Cs-137 82	60	< LLD	-	-	-	-
Milk pCi/L	K-40 64	N/A	1409.0 64 / 64 626 – 2028	1612.5 45 / 45 1255 – 2028	41 5.8 SSE	1828.3 12 / 12 1630 – 1927	926.8 19 / 19 626 - 1397
Milk pCi/L	I-131 64	0.8	< LLD	-	-	-	-
Milk pCi/L	Cs-134 64	11	< LLD	-	-	-	-
Milk pCi/L	Cs-137 64	13	< LLD	-	-	-	-
Milk pCi/L	Ba-140 64	45	< LLD	-	-	-	-
Milk pCi/L	La-140 64	11	< LLD	-	-	-	-
Sediment pCi/kg wet	K-40 12	N/A	13097.0 12 / 12 7853 – 20844	11936.4 10 / 10 7853 – 16892	32 15.8 WSW	18900.0 2 / 2 16956 - 20844	18900.0 2 / 2 16956 - 20844
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: 2012

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	217.7 8 / 12 35.7 – 529.6	132.9 6 / 10 35.7 – 271.4	32 15.8 WSW	472.2 2 / 2 414.7 – 529.6	472.2 2 / 2 414.7 – 529.6
TLD mR/91 days	Direct 112	1.0	13.5 112 / 112 9.0 – 18.2	13.5 104 / 104 9.0 – 18.2	33 4.5 S	17.4 4 / 4 16.5 – 18.2	13.1 8 / 8 12.3 – 14.6
TLD mR/91 days	Direct 112	1.0	14.0 112 / 112 9.4 – 20.6	14.0 104 / 104 9.4 – 20.6	33 4.5 S	18.0 4 / 4 16.0 – 20.6	13.2 8 / 8 10.5 – 15.8
TLD mR/365 days	Direct 28	1.0	64.7 28 / 28 52.2 – 81.5	64.9 26 / 26 52.2 – 81.5	36 3.9 WSW	81.5 1 / 1 81.5 – 81.5	61.3 2 / 2 59.3 – 63.2
Water pCi/L	Gross Beta 58	3.0`````	2.0 51 / 58 0.9 – 3.7	2.0 40 / 46 0.9 – 3.7	60 1.0 WSW	2.3 8 / 11 1.2 – 3.7	2.0 11 / 12 1.2 – 2.6
Water pCi/L	H-3 20	1500	<LLD	-	-	-	-
Water pCi/L	Mn-54 58	11	<LLD	-	-	-	-

Environmental Radiological Monitoring Program Annual Summary

Perry Nuclear Power Plant Docket Number 50-440/50-441
Lake County, Ohio Reporting Period: 2012

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
2012 REMP DETAILED DATA REPORT

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

	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
Date Placed	01-06-12	04-16-12	07-17-12	09-25-12
Date Removed	04-16-12	07-17-12	09-25-12	01-08-13
E-1	11.5 ± 0.9	10.3 ± 0.8	10.3 ± 1.3	11.8 ± 1.2
E-3	11.9 ± 1.0	11.7 ± 0.7	11.4 ± 1.2	13.1 ± 1.0
E-4	13.4 ± 0.8	13.1 ± 0.7	12.0 ± 1.1	14.3 ± 0.9
E-5	11.9 ± 0.8	12.3 ± 0.6	10.9 ± 0.9	13.8 ± 0.9
E-6	13.9 ± 1.0	13.5 ± 0.6	12.6 ± 0.8	14.6 ± 0.9
E-7	13.3 ± 0.6	13.4 ± 0.7	12.0 ± 0.9	14.6 ± 0.9
E-8	11.9 ± 0.6	12.6 ± 0.6	11.1 ± 1.0	14.4 ± 1.5
E-9	11.2 ± 0.7	11.6 ± 0.6	11.3 ± 0.8	12.9 ± 0.6
E-10	14.3 ± 0.7	14.9 ± 1.1	15.2 ± 1.4	15.8 ± 0.9
E-11	14.2 ± 0.8	13.3 ± 0.4	14.4 ± 1.7	14.4 ± 0.7
E-12	12.8 ± 0.9	12.8 ± 0.6	12.6 ± 1.2	13.8 ± 1.3
E-13	12.9 ± 0.7	12.4 ± 0.9	12.3 ± 0.9	13.1 ± 1.0
E-14	11.5 ± 0.9	11.6 ± 0.5	10.3 ± 1.1	12.2 ± 0.7
E-15	11.1 ± 0.6	9.0 ± 0.6	9.8 ± 0.8	9.6 ± 0.8
E-21	13.4 ± 0.8	13.7 ± 0.6	13.0 ± 1.0	13.8 ± 0.6
E-23	14.6 ± 0.6	14.2 ± 0.7	14.1 ± 0.8	14.6 ± 0.8
E-24	12.4 ± 0.7	12.3 ± 0.8	12.3 ± 1.7	13.2 ± 1.0
E-29	16.3 ± 0.7	16.3 ± 0.6	16.1 ± 1.1	16.9 ± 0.9
E-30	15.0 ± 0.7	15.4 ± 0.5	14.8 ± 0.9	16.0 ± 0.8
E-31	15.2 ± 0.8	17.3 ± 0.6	15.0 ± 0.9	17.8 ± 0.9
E-33	16.8 ± 0.9	18.0 ± 0.7	16.5 ± 1.1	18.2 ± 1.0
E-35	12.2 ± 0.8	12.7 ± 0.5	11.6 ± 0.8	13.5 ± 0.7
E-36	15.7 ± 0.8	16.8 ± 0.6	17.6 ± 0.7	16.7 ± 0.8
E-53	13.2 ± 0.6	14.3 ± 0.6	14.7 ± 0.8	14.3 ± 1.0
E-54	12.6 ± 0.9	13.1 ± 0.4	14.1 ± 1.2	13.5 ± 0.7
E-55	13.5 ± 1.4	14.2 ± 0.6	16.5 ± 1.0	13.9 ± 1.0
E-56	12.9 ± 0.6	13.5 ± 0.5	13.7 ± 0.9	13.2 ± 0.9
E-58	10.7 ± 0.6	11.2 ± 0.6	10.9 ± 1.4	11.1 ± 0.7
Mean ± s.d.	13.2 ± 1.6	13.4 ± 2.0	13.1 ± 2.1	14.1 ± 1.9
E-Control 1	7.0 ± 0.8	7.6 ± 0.5	7.0 ± 0.9	6.9 ± 0.3
E-Control 2	6.6 ± 0.7	7.3 ± 0.5	6.5 ± 0.6	6.8 ± 0.2

Direct Radiation (TLDs), Quarterly Exposure.
Collection: Quarterly Composite

Units: pCi/m^3	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
Date Placed	01-06-12	04-16-12	07-17-12	09-25-12
Date Removed	04-16-12	07-17-12	09-25-12	01-08-13
Q-1	10.4 ± 1.1	9.4 ± 1.2	12.4 ± 2.4	10.6 ± 1.1
Q-3	12.3 ± 0.5	9.9 ± 0.9	14.5 ± 2.2	11.3 ± 1.1
Q-4	13.1 ± 0.5	12.2 ± 0.8	15.0 ± 2.3	13.9 ± 1.1
Q-5	13.0 ± 0.4	10.9 ± 1.2	15.5 ± 2.1	12.6 ± 1.2
Q-6	13.5 ± 0.9	11.7 ± 0.8	15.8 ± 2.1	13.5 ± 0.8
Q-7	14.1 ± 0.3	13.9 ± 1.2	16.6 ± 2.2	15.0 ± 0.8
Q-8	12.3 ± 0.4	12.1 ± 0.7	14.9 ± 2.2	13.3 ± 1.1
Q-9	12.2 ± 0.6	12.5 ± 3.2	15.3 ± 2.3	12.9 ± 0.9
Q-10	14.7 ± 0.8	14.0 ± 1.0	18.0 ± 2.3	15.4 ± 0.9
Q-11	13.0 ± 0.3	13.0 ± 0.8	16.6 ± 2.8	14.4 ± 0.9
Q-12	13.1 ± 0.3	12.4 ± 1.0	16.7 ± 2.4	13.7 ± 1.1
Q-13	12.7 ± 0.3	12.2 ± 0.8	15.1 ± 2.2	13.2 ± 1.2
Q-14	11.5 ± 0.4	11.3 ± 0.8	13.6 ± 2.2	12.5 ± 0.8
Q-15	10.9 ± 0.5	9.7 ± 0.8	12.9 ± 2.2	11.3 ± 0.9
Q-21	13.9 ± 0.5	12.5 ± 0.9	16.2 ± 2.2	13.5 ± 0.9
Q-23	13.9 ± 0.4	13.1 ± 1.1	16.6 ± 2.3	13.6 ± 1.1
Q-24	13.2 ± 1.3	10.5 ± 0.7	15.4 ± 2.5	12.1 ± 0.9
Q-29	16.5 ± 0.4	15.4 ± 1.1	19.4 ± 2.3	16.4 ± 1.2
Q-30	15.4 ± 0.4	13.4 ± 0.7	18.4 ± 2.2	14.5 ± 0.8
Q-31	16.6 ± 0.6	14.7 ± 1.1	19.6 ± 2.2	16.5 ± 1.0
Q-33	17.6 ± 0.8	16.0 ± 1.1	20.6 ± 2.2	17.6 ± 0.9
Q-35	13.0 ± 0.4	11.2 ± 0.8	15.1 ± 2.3	13.1 ± 0.9
Q-36	16.4 ± 0.6	15.1 ± 0.8	19.5 ± 2.2	16.4 ± 1.0
Q-53	13.8 ± 0.4	13.0 ± 0.8	16.2 ± 2.1	14.0 ± 1.0
Q-54	13.5 ± 0.5	12.5 ± 0.7	16.2 ± 2.2	14.0 ± 0.8
Q-55	13.9 ± 0.9	13.5 ± 0.9	16.3 ± 2.2	14.6 ± 1.0
Q-56	13.5 ± 0.8	12.6 ± 1.0	15.1 ± 2.3	13.8 ± 1.1
Q-58	11.0 ± 0.6	10.3 ± 0.7	12.9 ± 2.4	11.5 ± 0.9
Mean ± s.d.	13.5 ± 1.8	12.5 ± 1.7	16.1 ± 2.1	13.8 ± 1.7
Q-Control 1	7.7 ± 0.3	7.0 ± 0.9	9.0 ± 2.1	7.3 ± 0.8
Q-Control 2	7.9 ± 0.4	7.3 ± 0.8	9.3 ± 2.2	7.1 ± 0.8

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

	2012
Date Placed	01-06-12
Date Removed	01-08-13
A-1	52.2 ± 3.2
A-3	56.7 ± 1.9
A-4	62.8 ± 1.9
A-5	59.0 ± 2.6
A-6	63.2 ± 2.8
A-7	62.4 ± 3.1
A-8	58.6 ± 3.1
A-9	55.5 ± 1.7
A-10	70.1 ± 2.1
A-11	64.5 ± 2.4
A-12	63.4 ± 2.1
A-13	61.5 ± 2.9
A-14	57.4 ± 2.6
A-15	53.0 ± 2.3
A-21	67.8 ± 5.1
A-23	64.9 ± 3.1
A-24	59.3 ± 3.4
A-29	77.2 ± 4.1
A-30	69.3 ± 2.6
A-31	75.4 ± 4.0
A-33	79.3 ± 2.8
A-35	60.0 ± 1.6
A-36	81.5 ± 1.9
A-53	69.7 ± 2.1
A-54	67.4 ± 2.2
A-55	72.0 ± 2.2
A-56	69.0 ± 2.8
A-58	57.4 ± 2.6
Mean ± s.d.	64.7 ± 7.8
A-Control 1	23.6 ± 1.3
A-Control 2	23.2 ± 1.0

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
01-04-12	577	0.020 ± 0.003	< 0.010	07-10-12	578	0.030 ± 0.003	< 0.004
01-11-12	581	0.025 ± 0.003	< 0.009	07-17-12	589	0.025 ± 0.003	< 0.004
01-18-12	568	0.020 ± 0.003	< 0.011	07-25-12	647	0.027 ± 0.003	< 0.011
01-25-12	601	0.030 ± 0.003	< 0.011	08-01-12	578	0.019 ± 0.003	< 0.009
02-01-12	568	0.027 ± 0.003	< 0.006				
				08-08-12	580	0.026 ± 0.003	< 0.005
02-07-12	507	0.026 ± 0.003	< 0.009	08-15-12	578	0.018 ± 0.003	< 0.006
02-15-12	647	0.021 ± 0.002	< 0.006	08-23-12	652	0.023 ± 0.003	< 0.008
02-22-12	578	0.025 ± 0.003	< 0.010	08-29-12	493	0.037 ± 0.003	< 0.010
02-29-12	574	0.020 ± 0.003	< 0.010				
				09-05-12	585	0.027 ± 0.003	< 0.012
03-07-12	563	0.024 ± 0.003	< 0.011	09-11-12	490	0.023 ± 0.003	< 0.004
03-13-12	498	0.023 ± 0.003	< 0.008	09-19-12	667	0.029 ± 0.003	< 0.011
03-21-12	644	0.022 ± 0.002	< 0.009	09-26-12	565	0.023 ± 0.003	< 0.013
03-29-12	655	0.020 ± 0.002	< 0.008	10-03-12	559	0.021 ± 0.003	< 0.007
1Q 2012	Mean ± s.d.	0.023 ± 0.003	< 0.011	3Q 2012	Mean ± s.d.	0.025 ± 0.005	< 0.013
04-05-12	570	0.015 ± 0.003	< 0.004	10-10-12	572	0.032 ± 0.003	< 0.008
04-11-12	472	0.020 ± 0.003	< 0.013	10-17-12	552	0.027 ± 0.003	< 0.005
04-18-12	570	0.018 ± 0.003	< 0.006	10-24-12	558	0.035 ± 0.003	< 0.013
04-25-12	554	0.019 ± 0.003	< 0.010	11-01-12	642	0.018 ± 0.002	< 0.011
05-02-12	561	0.021 ± 0.003	< 0.007				
				11-08-12	542	0.016 ± 0.003	< 0.010
05-09-12	580	0.019 ± 0.003	< 0.007	11-14-12	457	0.048 ± 0.004	< 0.009
05-16-12	589	0.019 ± 0.003	< 0.011	11-21-12	553	0.051 ± 0.004	< 0.009
05-23-12	589	0.017 ± 0.003	< 0.010	11-28-12	538	0.041 ± 0.003	< 0.016
05-30-12	578	0.028 ± 0.003	< 0.010				
				12-05-12	552	0.058 ± 0.004	< 0.007
06-06-12	580	0.012 ± 0.002	< 0.006	12-12-12	538	0.023 ± 0.003	< 0.008
06-13-12	576	0.016 ± 0.003	< 0.008	12-20-12	615	0.055 ± 0.003	< 0.025
06-20-12	587	0.021 ± 0.003	< 0.005	12-26-12	444	0.028 ± 0.004	< 0.007
06-26-12	480	0.022 ± 0.003	< 0.007	01-02-13	499	0.036 ± 0.003	< 0.010
07-03-12	576	0.029 ± 0.003	< 0.005				
2Q 2012	Mean ± s.d.	0.020 ± 0.005	< 0.013	4Q 2012	Mean ± s.d.	0.036 ± 0.014	< 0.025
				Cumulative Average		0.026	

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
01-04-12	569	0.023 ± 0.003	< 0.010	07-10-12	570	0.029 ± 0.003	< 0.004
01-11-12	578	0.027 ± 0.003	< 0.009	07-17-12	582	0.026 ± 0.003	< 0.004
01-18-12	582	0.020 ± 0.003	< 0.011	07-25-12	648	0.023 ± 0.003	< 0.011
01-25-12	592	0.032 ± 0.003	< 0.011	08-01-12	574	0.021 ± 0.003	< 0.009
02-01-12	565	0.025 ± 0.003	< 0.006				
				08-08-12	573	0.025 ± 0.003	< 0.005
02-07-12	504	0.022 ± 0.003	< 0.009	08-15-12	569	0.020 ± 0.003	< 0.006
02-15-12	644	0.022 ± 0.002	< 0.006	08-23-12	646	0.022 ± 0.003	< 0.008
02-22-12	584	0.028 ± 0.003	< 0.010	08-29-12	481	0.035 ± 0.003	< 0.010
02-29-12	573	0.021 ± 0.003	< 0.010				
				09-05-12	578	0.029 ± 0.003	< 0.012
03-07-12	551	0.020 ± 0.003	< 0.011	09-11-12	467	0.022 ± 0.003	< 0.004
03-13-12	497	0.022 ± 0.003	< 0.008	09-19-12	661	0.026 ± 0.002	< 0.011
03-21-12	643	0.020 ± 0.002	< 0.009	09-26-12	551	0.022 ± 0.003	< 0.013
03-29-12	642	0.017 ± 0.002	< 0.009	10-03-12	533	0.019 ± 0.003	< 0.007
1Q 2012	Mean ± s.d.	0.023 ± 0.004	< 0.011	3Q 2012	Mean ± s.d.	0.025 ± 0.004	< 0.013
04-05-12	554	0.014 ± 0.003	< 0.004	10-10-12	554	0.027 ± 0.003	< 0.009
04-11-12	468	0.020 ± 0.003	< 0.013	10-17-12	544	0.027 ± 0.003	< 0.006
04-18-12	564	0.017 ± 0.003	< 0.006	10-24-12	556	0.037 ± 0.003	< 0.013
04-25-12	543	0.018 ± 0.003	< 0.010	11-01-12	635	0.018 ± 0.002	< 0.011
05-02-12	543	0.021 ± 0.003	< 0.008				
				11-08-12	539	0.015 ± 0.003	< 0.010
05-09-12	578	0.021 ± 0.003	< 0.007	11-14-12	500	0.040 ± 0.004	< 0.008
05-16-12	584	0.020 ± 0.003	< 0.011	11-21-12	626	0.038 ± 0.003	< 0.008
05-23-12	594	0.017 ± 0.003	< 0.010	11-28-12	596	0.041 ± 0.003	< 0.014
05-30-12	577	0.029 ± 0.003	< 0.010				
				12-05-12	612	0.045 ± 0.003	< 0.006
06-06-12	554	0.011 ± 0.003	< 0.006	12-12-12	586	0.017 ± 0.003	< 0.007
06-13-12	580	0.015 ± 0.003	< 0.008	12-20-12	675	0.041 ± 0.003	< 0.024
06-20-12	585	0.019 ± 0.003	< 0.005	12-26-12	505	0.023 ± 0.003	< 0.007
06-26-12	483	0.020 ± 0.003	< 0.007	01-02-13	581	0.031 ± 0.003	< 0.009
07-03-12	572	0.025 ± 0.003	< 0.005				
2Q 2012	Mean ± s.d.	0.019 ± 0.004	< 0.013	4Q 2012	Mean ± s.d.	0.031 ± 0.010	< 0.024
				Cumulative Average		0.024	

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
01-04-12	580	0.021 ± 0.003	< 0.010	07-10-12	544	0.033 ± 0.003	< 0.005
01-11-12	576	0.027 ± 0.003	< 0.009	07-17-12	563	0.028 ± 0.003	< 0.005
01-18-12	622	0.026 ± 0.003	< 0.010	07-25-12	646	0.025 ± 0.003	< 0.011
01-25-12	635	0.033 ± 0.003	< 0.010	08-01-12	550	0.019 ± 0.003	< 0.009
02-01-12	610	0.028 ± 0.003	< 0.006				
				08-08-12	552	0.027 ± 0.003	< 0.006
02-07-12	529	0.027 ± 0.003	< 0.009	08-15-12	550	0.017 ± 0.003	< 0.006
02-15-12	703	0.021 ± 0.002	< 0.005	08-23-12	630	0.023 ± 0.003	< 0.008
02-22-12	585	0.028 ± 0.003	< 0.010	08-29-12	458	0.037 ± 0.004	< 0.011
02-29-12	587	0.023 ± 0.003	< 0.010				
				09-05-12	561	0.028 ± 0.003	< 0.013
03-07-12	588	0.026 ± 0.003	< 0.010	09-11-12	459	0.026 ± 0.003	< 0.004
03-13-12	536	0.023 ± 0.003	< 0.007	09-19-12	642	0.029 ± 0.003	< 0.011
03-21-12	695	0.022 ± 0.002	< 0.008	09-26-12	547	0.022 ± 0.003	< 0.013
03-29-12	736	0.019 ± 0.002	< 0.008	10-03-12	530	0.018 ± 0.003	< 0.007
1Q 2012	Mean ± s.d.	0.025 ± 0.004	< 0.010	3Q 2012	Mean ± s.d.	0.026 ± 0.006	< 0.013
04-05-12	590	0.015 ± 0.002	< 0.004	10-10-12	552	0.030 ± 0.003	< 0.009
04-11-12	526	0.019 ± 0.003	< 0.011	10-17-12	545	0.025 ± 0.003	< 0.006
04-18-12	627	0.016 ± 0.002	< 0.005	10-24-12	551	0.034 ± 0.003	< 0.013
04-25-12	604	0.019 ± 0.003	< 0.009	11-01-12	630	0.017 ± 0.002	< 0.011
05-02-12	615	0.022 ± 0.003	< 0.007				
				11-08-12	527	0.013 ± 0.003	< 0.010
05-09-12	559	0.021 ± 0.003	< 0.007	11-14-12	497	0.041 ± 0.004	< 0.008
05-16-12	583	0.017 ± 0.003	< 0.011	11-21-12	580	0.048 ± 0.003	< 0.009
05-23-12	566	0.016 ± 0.003	< 0.011	11-28-12	572	0.037 ± 0.003	< 0.015
05-30-12	571	0.026 ± 0.003	< 0.010				
				12-05-12	585	0.051 ± 0.003	< 0.007
06-06-12	553	0.009 ± 0.002	< 0.006	12-12-12	555	0.023 ± 0.003	< 0.008
06-13-12	549	0.018 ± 0.003	< 0.008	12-20-12	623	0.047 ± 0.003	< 0.024
06-20-12	565	0.021 ± 0.003	< 0.005	12-26-12	488	0.026 ± 0.003	< 0.007
06-26-12	464	0.024 ± 0.003	< 0.007	01-02-13	573	0.032 ± 0.003	< 0.009
07-03-12	544	0.031 ± 0.003	< 0.005				
2Q 2012	Mean ± s.d.	0.020 ± 0.005	< 0.011	4Q 2012	Mean ± s.d.	0.033 ± 0.012	< 0.024
				Cumulative Average		0.026	

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
01-04-12	545	0.024 ± 0.003	< 0.011	07-10-12	578	0.033 ± 0.003	< 0.004
01-11-12	547	0.025 ± 0.003	< 0.009	07-17-12	591	0.027 ± 0.003	< 0.004
01-18-12	562	0.029 ± 0.003	< 0.011	07-25-12	654	0.027 ± 0.003	< 0.011
01-25-12	561	0.033 ± 0.003	< 0.012	08-01-12	583	0.019 ± 0.003	< 0.009
02-01-12	536	0.031 ± 0.003	< 0.007				
				08-08-12	581	0.028 ± 0.003	< 0.005
02-07-12	467	0.030 ± 0.003	< 0.010	08-15-12	586	0.020 ± 0.003	< 0.006
02-15-12	618	0.023 ± 0.002	< 0.006	08-23-12	656	0.023 ± 0.002	< 0.008
02-22-12	545	0.029 ± 0.003	< 0.011	08-29-12	499	0.036 ± 0.003	< 0.010
02-29-12	548	0.023 ± 0.003	< 0.011				
				09-05-12	586	0.026 ± 0.003	< 0.012
03-07-12	533	0.026 ± 0.003	< 0.011	09-11-12	496	0.026 ± 0.003	< 0.004
03-13-12	469	0.026 ± 0.003	< 0.008	09-19-12	676	0.030 ± 0.003	< 0.010
03-21-12	614	0.024 ± 0.003	< 0.009	09-26-12	570	0.021 ± 0.003	< 0.013
03-29-12	634	0.018 ± 0.002	< 0.009	10-03-12	573	0.022 ± 0.003	< 0.007
1Q 2012	Mean ± s.d.	0.026 ± 0.004	< 0.012	3Q 2012	Mean ± s.d.	0.026 ± 0.005	< 0.013
04-05-12	543	0.016 ± 0.003	< 0.004	10-10-12	585	0.029 ± 0.003	< 0.008
04-11-12	464	0.020 ± 0.003	< 0.013	10-17-12	581	0.026 ± 0.003	< 0.005
04-18-12	553	0.020 ± 0.003	< 0.006	10-24-12	587	0.037 ± 0.003	< 0.012
04-25-12	541	0.016 ± 0.003	< 0.010	11-01-12	663	0.019 ± 0.002	< 0.010
05-02-12	540	0.027 ± 0.003	< 0.008				
				11-08-12	560	0.016 ± 0.003	< 0.009
05-09-12	580	0.019 ± 0.003	< 0.007	11-14-12	495	0.041 ± 0.004	< 0.008
05-16-12	592	0.021 ± 0.003	< 0.011	11-21-12	581	0.047 ± 0.003	< 0.009
05-23-12	586	0.014 ± 0.002	< 0.010	11-28-12	575	0.040 ± 0.003	< 0.015
05-30-12	579	0.028 ± 0.003	< 0.009				
				12-05-12	582	0.051 ± 0.003	< 0.007
06-06-12	585	0.012 ± 0.002	< 0.006	12-12-12	564	0.021 ± 0.003	< 0.008
06-13-12	583	0.018 ± 0.003	< 0.008	12-20-12	607	0.052 ± 0.003	< 0.013
06-20-12	586	0.020 ± 0.003	< 0.005	12-26-12	455	0.028 ± 0.003	< 0.007
06-26-12	510	0.023 ± 0.003	< 0.007	01-02-13	560	0.034 ± 0.003	< 0.009
07-03-12	579	0.029 ± 0.003	< 0.005				
2Q 2012	Mean ± s.d.	0.020 ± 0.005	< 0.013	4Q 2012	Mean ± s.d.	0.034 ± 0.012	< 0.015
				Cumulative Average		0.026	

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
01-04-12	575	0.022 ± 0.003	< 0.010	07-10-12	541	0.031 ± 0.003	< 0.005
01-11-12	567	0.029 ± 0.003	< 0.009	07-17-12	566	0.023 ± 0.003	< 0.005
01-18-12	572	0.021 ± 0.003	< 0.011	07-25-12	613	0.028 ± 0.003	< 0.012
01-25-12	586	0.030 ± 0.003	< 0.011	08-01-12	548	0.024 ± 0.003	< 0.010
02-01-12	552	0.027 ± 0.003	< 0.006				
				08-08-12	543	0.027 ± 0.003	< 0.006
02-07-12	494	0.027 ± 0.003	< 0.009	08-15-12	544	0.020 ± 0.003	< 0.006
02-15-12	637	0.023 ± 0.002	< 0.006	08-23-12	618	0.026 ± 0.003	< 0.008
02-22-12	574	0.027 ± 0.003	< 0.010	08-29-12	461	0.042 ± 0.004	< 0.010
02-29-12	574	0.022 ± 0.003	< 0.010				
				09-05-12	545	0.028 ± 0.003	< 0.013
03-07-12	557	0.021 ± 0.003	< 0.011	09-11-12	451	0.024 ± 0.003	< 0.004
03-13-12	497	0.031 ± 0.003	< 0.008	09-19-12	644	0.031 ± 0.003	< 0.011
03-21-12	614	0.022 ± 0.003	< 0.009	09-26-12	529	0.028 ± 0.003	< 0.014
03-29-12	639	0.021 ± 0.002	< 0.009	10-03-12	533	0.022 ± 0.003	< 0.007
1Q 2012	Mean ± s.d.	0.025 ± 0.004	< 0.011	3Q 2012	Mean ± s.d.	0.027 ± 0.006	< 0.014
04-05-12	534	0.015 ± 0.003	< 0.004	10-10-12	542	0.027 ± 0.003	< 0.009
04-11-12	466	0.019 ± 0.003	< 0.013	10-17-12	537	0.029 ± 0.003	< 0.006
04-18-12	568	0.016 ± 0.003	< 0.006	10-24-12	554	0.034 ± 0.003	< 0.013
04-25-12	545	0.019 ± 0.003	< 0.010	11-01-12	623	0.014 ± 0.002	< 0.011
05-02-12	566	0.020 ± 0.003	< 0.007				
				11-08-12	519	0.016 ± 0.003	< 0.010
05-09-12	565	0.021 ± 0.003	< 0.007	11-14-12	494	0.044 ± 0.004	< 0.008
05-16-12	578	0.021 ± 0.003	< 0.011	11-21-12	581	0.050 ± 0.003	< 0.009
05-23-12	570	0.016 ± 0.003	< 0.011	11-28-12	554	0.041 ± 0.003	< 0.015
05-30-12	564	0.027 ± 0.003	< 0.010				
				12-05-12	582	0.053 ± 0.004	< 0.007
06-06-12	554	0.010 ± 0.003	< 0.006	12-12-12	556	0.019 ± 0.003	< 0.008
06-13-12	547	0.018 ± 0.003	< 0.008	12-20-12	628	0.047 ± 0.003	< 0.018
06-20-12	549	0.020 ± 0.003	< 0.005	12-26-12	474	0.030 ± 0.003	< 0.007
06-26-12	472	0.025 ± 0.003	< 0.007	01-02-13	565	0.033 ± 0.003	< 0.009
07-03-12	554	0.028 ± 0.003	< 0.005				
2Q 2012	Mean ± s.d.	0.020 ± 0.005	< 0.013	4Q 2012	Mean ± s.d.	0.034 ± 0.013	< 0.018
				Cumulative Average		0.026	

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
01-04-12	589	0.026 ± 0.003	< 0.010	07-10-12	527	0.028 ± 0.003	< 0.005
01-11-12	584	0.025 ± 0.003	< 0.009	07-17-12	590	0.024 ± 0.003	< 0.004
01-18-12	574	0.020 ± 0.003	< 0.011	07-25-12	645	0.023 ± 0.003	< 0.011
01-25-12	592	0.028 ± 0.003	< 0.011	08-01-12	577	0.018 ± 0.003	< 0.009
02-01-12	573	0.025 ± 0.003	< 0.006				
				08-08-12	577	0.024 ± 0.003	< 0.005
02-07-12	508	0.032 ± 0.003	< 0.009	08-15-12	574	0.018 ± 0.003	< 0.006
02-15-12	649	0.018 ± 0.002	< 0.006	08-23-12	627	0.022 ± 0.003	< 0.008
02-22-12	578	0.030 ± 0.003	< 0.010	08-29-12	477	0.037 ± 0.004	< 0.010
02-29-12	577	0.020 ± 0.003	< 0.010				
				09-05-12	554	0.026 ± 0.003	< 0.013
03-07-12	568	0.022 ± 0.003	< 0.011	09-11-12	464	0.022 ± 0.003	< 0.004
03-13-12	501	0.023 ± 0.003	< 0.008	09-19-12	665	0.027 ± 0.002	< 0.011
03-21-12	642	0.019 ± 0.002	< 0.009	09-26-12	571	0.021 ± 0.003	< 0.013
03-29-12	657	0.016 ± 0.002	< 0.008	10-03-12	567	0.016 ± 0.003	< 0.007
1Q 2012	Mean ± s.d.	0.023 ± 0.005	< 0.011	3Q 2012	Mean ± s.d.	0.024 ± 0.005	< 0.013
04-05-12	560	0.016 ± 0.003	< 0.004	10-10-12	581	0.024 ± 0.003	< 0.008
04-11-12	466	0.019 ± 0.003	< 0.013	10-17-12	576	0.024 ± 0.003	< 0.005
04-18-12	569	0.021 ± 0.003	< 0.006	10-24-12	582	0.032 ± 0.003	< 0.012
04-25-12	545	0.021 ± 0.003	< 0.010	11-01-12	658	0.016 ± 0.002	< 0.011
05-02-12	568	0.022 ± 0.003	< 0.007				
				11-08-12	563	0.012 ± 0.003	< 0.009
05-09-12	582	0.018 ± 0.003	< 0.007	11-14-12	480	0.035 ± 0.004	< 0.009
05-16-12	592	0.020 ± 0.003	< 0.011	11-21-12	579	0.047 ± 0.003	< 0.009
05-23-12	588	0.014 ± 0.002	< 0.010	11-28-12	558	0.039 ± 0.003	< 0.015
05-30-12	580	0.024 ± 0.003	< 0.009				
				12-05-12	561	0.054 ± 0.004	< 0.007
06-06-12	587	0.011 ± 0.002	< 0.006	12-12-12	540	0.018 ± 0.003	< 0.008
06-13-12	584	0.016 ± 0.003	< 0.008	12-20-12	620	0.044 ± 0.003	< 0.025
06-20-12	588	0.018 ± 0.003	< 0.005	12-26-12	441	0.027 ± 0.004	< 0.007
06-26-12	505	0.019 ± 0.003	< 0.007	01-02-13	540	0.032 ± 0.003	< 0.009
07-03-12	575	0.026 ± 0.003	< 0.005				
2Q 2012	Mean ± s.d.	0.019 ± 0.004	< 0.013	4Q 2012	Mean ± s.d.	0.031 ± 0.013	< 0.025
				Cumulative Average		0.024	

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
01-04-12	580	0.020 ± 0.003	< 0.013	07-10-12	578	0.028 ± 0.003	< 0.012
01-11-12	586	0.024 ± 0.003	< 0.011	07-17-12	590	0.023 ± 0.003	< 0.008
01-18-12	571	0.022 ± 0.003	< 0.012	07-25-12	630	0.025 ± 0.003	< 0.013
01-25-12	604	0.030 ± 0.003	< 0.010	08-01-12	563	0.020 ± 0.003	< 0.012
02-01-12	575	0.024 ± 0.003	< 0.009				
				08-08-12	573	0.027 ± 0.003	< 0.007
02-07-12	508	0.024 ± 0.003	< 0.013	08-15-12	540	0.018 ± 0.003	< 0.005
02-15-12	649	0.019 ± 0.002	< 0.008	08-23-12	617	0.026 ± 0.003	< 0.008
02-22-12	582	0.025 ± 0.003	< 0.007	08-29-12	458	0.036 ± 0.004	< 0.016
02-29-12	577	0.020 ± 0.003	< 0.005				
				09-05-12	545	0.027 ± 0.003	< 0.006
03-07-12	576	0.021 ± 0.003	< 0.009	09-11-12	456	0.026 ± 0.003	< 0.015
03-13-12	503	0.022 ± 0.003	< 0.008	09-19-12	623	0.027 ± 0.003	< 0.012
03-21-12	646	0.019 ± 0.002	< 0.009	09-26-12	527	0.023 ± 0.003	< 0.015
03-29-12	660	0.018 ± 0.002	< 0.005	10-03-12	523	0.019 ± 0.003	< 0.005
1Q 2012	Mean ± s.d.	0.022 ± 0.003	< 0.013	3Q 2012	Mean ± s.d.	0.025 ± 0.005	< 0.016
04-05-12	575	0.013 ± 0.002	< 0.008	10-10-12	536	0.031 ± 0.003	< 0.006
04-11-12	482	0.018 ± 0.003	< 0.014	10-17-12	533	0.027 ± 0.003	< 0.008
04-18-12	573	0.016 ± 0.003	< 0.012	10-24-12	539	0.037 ± 0.003	< 0.015
04-25-12	546	0.018 ± 0.003	< 0.011	11-01-12	621	0.017 ± 0.002	< 0.008
05-02-12	560	0.022 ± 0.003	< 0.009				
				11-08-12	524	0.015 ± 0.003	< 0.014
05-09-12	582	0.019 ± 0.003	< 0.008	11-14-12	465	0.041 ± 0.004	< 0.014
05-16-12	589	0.021 ± 0.003	< 0.013	11-21-12	553	0.051 ± 0.004	< 0.019
05-23-12	580	0.015 ± 0.003	< 0.014	11-28-12	537	0.044 ± 0.004	< 0.012
05-30-12	576	0.026 ± 0.003	< 0.009				
				12-05-12	555	0.051 ± 0.004	< 0.013
06-06-12	573	0.012 ± 0.002	< 0.010	12-12-12	537	0.021 ± 0.003	< 0.015
06-13-12	580	0.018 ± 0.003	< 0.008	12-20-12	619	0.050 ± 0.003	< 0.028
06-20-12	578	0.019 ± 0.003	< 0.010	12-26-12	461	0.026 ± 0.003	< 0.018
06-26-12	493	0.020 ± 0.003	< 0.009	01-02-13	563	0.032 ± 0.003	< 0.009
07-03-12	576	0.026 ± 0.003	< 0.009				
2Q 2012	Mean ± s.d.	0.019 ± 0.004	< 0.014	4Q 2012	Mean ± s.d.	0.034 ± 0.013	< 0.028
				Cumulative Average		0.025	

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- 2173	PEAP- 4439	PEAP- 6492	PEAP- 8477	
Vol. (m^3)	7558	7861	7561	7062	
Be-7	0.058 ± 0.008	0.073 ± 0.009	0.065 ± 0.009	0.062 ± 0.009	-
Co-58	< 0.0006	< 0.0003	< 0.0003	< 0.0004	-
Co-60	< 0.0003	< 0.0002	< 0.0006	< 0.0004	-
Cs-134	< 0.0004	< 0.0004	< 0.0002	< 0.0003	0.037
Cs-137	< 0.0002	< 0.0003	< 0.0003	< 0.0003	0.045

Location	PE-3				
Lab Code	PEAP- 2174	PEAP- 4440	PEAP- 6493	PEAP- 8478	
Vol. (m^3)	7524	7780	7433	7509	
Be-7	0.060 ± 0.009	0.085 ± 0.011	0.071 ± 0.010	0.049 ± 0.009	-
Co-58	< 0.0004	< 0.0003	< 0.0004	< 0.0003	-
Co-60	< 0.0003	< 0.0002	< 0.0006	< 0.0004	-
Cs-134	< 0.0003	< 0.0003	< 0.0003	< 0.0004	0.037
Cs-137	< 0.0004	< 0.0003	< 0.0002	< 0.0004	0.045

Location	PE-4				
Lab Code	PEAP- 2175	PEAP- 4441	PEAP- 6494	PEAP- 8479	
Vol. (m^3)	7938	7914	7234	7278	
Be-7	0.067 ± 0.009	0.074 ± 0.011	0.074 ± 0.009	0.051 ± 0.008	-
Co-58	< 0.0004	< 0.0002	< 0.0004	< 0.0003	-
Co-60	< 0.0004	< 0.0002	< 0.0006	< 0.0002	-
Cs-134	< 0.0005	< 0.0003	< 0.0002	< 0.0003	0.037
Cs-137	< 0.0003	< 0.0002	< 0.0003	< 0.0003	0.045

Location	PE-5				
Lab Code	PEAP- 2176	PEAP- 4442	PEAP- 6495	PEAP- 8480	
Vol. (m^3)	7178	7820	7630	7395	
Be-7	0.061 ± 0.009	0.080 ± 0.009	0.065 ± 0.010	0.047 ± 0.009	-
Co-58	< 0.0003	< 0.0004	< 0.0003	< 0.0005	-
Co-60	< 0.0003	< 0.0003	< 0.0006	< 0.0005	-
Cs-134	< 0.0003	< 0.0003	< 0.0003	< 0.0004	0.037
Cs-137	< 0.0005	< 0.0005	< 0.0004	< 0.0002	0.045

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- 2177	PEAP- 4443	PEAP- 6496	PEAP- 8481	
Vol. (m^3)	7437	7632	7136	7209	
Be-7	0.053 ± 0.009	0.077 ± 0.009	0.072 ± 0.009	0.051 ± 0.010	-
Co-58	< 0.0004	< 0.0004	< 0.0003	< 0.0003	-
Co-60	< 0.0002	< 0.0003	< 0.0003	< 0.0004	-
Cs-134	< 0.0004	< 0.0003	< 0.0003	< 0.0003	0.037
Cs-137	< 0.0002	< 0.0004	< 0.0004	< 0.0003	0.045

Location	PE-7				
Lab Code	PEAP- 2178	PEAP- 4444	PEAP- 6497	PEAP- 8482	
Vol. (m^3)	7594	7891	7415	7279	
Be-7	0.069 ± 0.010	0.070 ± 0.008	0.066 ± 0.008	0.055 ± 0.010	-
Co-58	< 0.0003	< 0.0002	< 0.0003	< 0.0004	-
Co-60	< 0.0002	< 0.0002	< 0.0003	< 0.0004	-
Cs-134	< 0.0005	< 0.0003	< 0.0004	< 0.0002	0.037
Cs-137	< 0.0003	< 0.0003	< 0.0006	< 0.0003	0.045

Location	PE-35				
Lab Code	PEAP- 2179	PEAP- 4445	PEAP- 6498	PEAP- 8483	
Vol. (m^3)	7616	7863	7224	7043	
Be-7	0.057 ± 0.007	0.071 ± 0.010	0.075 ± 0.010	0.054 ± 0.009	-
Co-58	< 0.0003	< 0.0004	< 0.0004	< 0.0003	-
Co-60	< 0.0002	< 0.0005	< 0.0006	< 0.0005	-
Cs-134	< 0.0003	< 0.0002	< 0.0003	< 0.0003	0.037
Cs-137	< 0.0003	< 0.0004	< 0.0002	< 0.0002	0.045

Lake water, analyses for gross beta and gamma emitting isotopes.
Location: P-28 Collection: Monthly composites Units: pCi/L

Lab Code	PELW- 569	PELW- 988	PELW- 1659	PELW- 2461	
Start Date	12-29-11	01-26-12	02-23-12	03-29-12	Req. LLD
End Date	01-26-12	02-23-12	03-29-12	04-26-12	
Gross beta	2.4 ± 1.1	2.0 ± 0.8	2.6 ± 1.1	< 1.9	3.0
Mn-54	< 1.5	< 2.2	< 1.8	< 2.2	11
Fe-59	< 3.1	< 4.0	< 5.1	< 3.3	22
Co-58	< 2.6	< 1.5	< 1.9	< 1.9	11
Co-60	< 1.7	< 2.0	< 1.5	< 2.1	11
Zn-65	< 2.6	< 2.1	< 2.1	< 3.4	22
Zr-95	< 2.8	< 5.8	< 4.9	< 5.0	22
Nb-95	< 3.0	< 3.0	< 1.9	< 3.0	11
Cs-134	< 2.0	< 1.6	< 2.4	< 2.3	11
Cs-137	< 2.4	< 3.4	< 2.6	< 2.3	13
Ba-140	< 18.0	< 15.6	< 12.1	< 10.4	45
La-140	< 3.4	< 2.4	< 4.6	< 2.5	11

Lab Code	PELW- 3454	PELW- 3966	PELW- 4711	PELW- 5560	
Start Date	04-26-12	05-31-12	06-28-12	07-26-12	Req. LLD
End Date	05-31-12	06-28-12	07-26-12	08-30-12	
Gross beta	2.1 ± 0.9	1.5 ± 0.6	2.5 ± 1.1	1.2 ± 0.6	3.0
Mn-54	< 1.8	< 1.4	< 1.5	< 3.4	11
Fe-59	< 5.5	< 4.4	< 3.6	< 5.9	22
Co-58	< 2.4	< 1.1	< 2.3	< 1.7	11
Co-60	< 1.6	< 2.1	< 1.7	< 1.9	11
Zn-65	< 3.8	< 3.1	< 1.7	< 4.8	22
Zr-95	< 6.1	< 4.5	< 3.5	< 4.9	22
Nb-95	< 3.6	< 3.4	< 1.9	< 3.3	11
Cs-134	< 2.1	< 1.8	< 1.9	< 3.1	11
Cs-137	< 2.6	< 1.7	< 2.0	< 3.2	13
Ba-140	< 11.3	< 34.5	< 17.7	< 18.1	45
La-140	< 6.4	< 6.7	< 4.3	< 2.1	11

Lab Code	PELW- 6083	PELW- 7143	PELW- 7810	PELW- 8255	
Start Date	08-30-12	09-26-12	10-25-12	11-29-12	Req. LLD
End Date	09-26-12	10-25-12	11-29-12	12-27-12	
Gross beta	2.3 ± 1.2	1.5 ± 0.6	2.6 ± 1.1	1.4 ± 0.6	3.0
Mn-54	< 2.4	< 2.7	< 2.0	< 2.1	11
Fe-59	< 6.0	< 6.4	< 4.5	< 4.6	22
Co-58	< 3.1	< 2.6	< 2.0	< 2.0	11
Co-60	< 2.9	< 2.3	< 2.6	< 1.7	11
Zn-65	< 4.8	< 3.1	< 5.5	< 1.3	22
Zr-95	< 4.8	< 5.3	< 3.7	< 2.4	22
Nb-95	< 4.4	< 3.4	< 3.1	< 2.7	11
La-140	< 5.8	< 4.5	< 3.7	< 2.3	11

Lake water, analyses for gross beta and gamma emitting isotopes.
Location: P-34 Collection: Monthly composites Units: pCi/L

Lab Code	PELW- 570	PELW- 989	PELW- 1660	PELW- 2462	
Start Date	12-29-11	01-26-12	02-23-12	03-29-12	Req. LLD
End Date	01-26-12	02-23-12	03-29-12	04-26-12	
Gross beta	1.9 ± 0.9	2.5 ± 0.7	1.9 ± 1.0	< 1.6	3.0
Mn-54	< 4.1	< 2.5	< 2.9	< 2.9	11
Fe-59	< 6.1	< 8.6	< 6.9	< 5.5	22
Co-58	< 3.1	< 3.8	< 3.2	< 3.1	11
Co-60	< 2.3	< 3.7	< 2.6	< 3.2	11
Zn-65	< 3.1	< 5.7	< 2.6	< 5.9	22
Zr-95	< 5.7	< 6.5	< 7.5	< 4.9	22
Nb-95	< 4.9	< 3.5	< 3.1	< 4.2	11
Cs-134	< 3.7	< 2.2	< 3.4	< 2.9	11
Cs-137	< 2.2	< 5.0	< 3.2	< 4.2	13
Ba-140	< 12.5	< 26.5	< 17.4	< 22.5	45
La-140	< 3.2	< 5.5	< 4.9	< 7.7	11

Lab Code	PELW- 3456	PELW- 3967	PELW- 4712	PELW- 5561	
Start Date	04-26-12	05-31-12	06-28-12	07-26-12	Req. LLD
End Date	05-31-12	06-28-12	07-26-12	08-30-12	
Gross beta	2.3 ± 0.8	1.2 ± 0.5	1.9 ± 0.9	1.4 ± 0.6	3.0
Mn-54	< 2.7	< 1.8	< 1.9	< 2.1	11
Fe-59	< 6.0	< 4.0	< 4.1	< 4.3	22
Co-58	< 2.6	< 2.2	< 1.8	< 2.9	11
Co-60	< 1.9	< 1.1	< 1.5	< 2.6	11
Zn-65	< 5.7	< 1.7	< 2.0	< 2.1	22
Zr-95	< 5.4	< 3.6	< 3.3	< 4.8	22
Nb-95	< 2.5	< 3.0	< 2.8	< 3.9	11
Cs-134	< 1.9	< 1.5	< 1.8	< 2.1	11
Cs-137	< 3.9	< 2.1	< 2.1	< 3.1	13
Ba-140	< 24.0	< 21.2	< 19.4	< 21.3	45
La-140	< 2.6	< 5.5	< 4.8	< 4.6	11

Lab Code	PELW- 6084	PELW- 7144	PELW- 7811	PELW- 8256	
Start Date	08-30-12	09-26-12	10-25-12	11-29-12	Req. LLD
End Date	09-26-12	10-25-12	11-29-12	12-27-12	
Gross beta	2.1 ± 0.9	1.2 ± 0.5	2.5 ± 1.1	1.3 ± 0.5	3.0
Mn-54	< 2.2	< 3.2	< 2.1	< 2.4	11
Fe-59	< 4.8	< 5.0	< 4.4	< 3.9	22
Co-58	< 2.4	< 3.4	< 1.0	< 2.8	11
Co-60	< 2.4	< 2.8	< 2.1	< 2.0	11
Zn-65	< 4.6	< 2.3	< 3.0	< 3.4	22
Zr-95	< 4.5	< 3.2	< 3.8	< 4.4	22
Nb-95	< 3.5	< 5.1	< 3.0	< 1.4	11
Cs-134	< 2.7	< 2.4	< 2.1	< 2.9	11
Cs-137	< 1.8	< 2.4	< 2.9	< 2.8	13
Ba-140	< 25.8	< 31.7	< 16.5	< 14.4	45
La-140	< 3.5	< 8.1	< 3.3	< 4.2	11

Lake water, analyses for gross beta and gamma emitting isotopes.
Location: P-36 Collection: Monthly composites Units: pCi/L

Lab Code	PELW- 571	PELW- 990	PELW- 1661	PELW- 2463	
Start Date	12-29-11	01-26-12	02-23-12	03-29-12	Req. LLD
End Date	01-26-12	02-23-12	03-29-12	04-26-12	
Gross beta	3.1 ± 1.1	2.4 ± 0.8	2.4 ± 1.0	2.7 ± 1.0	3.0
Mn-54	< 2.8	< 3.1	< 1.4	< 2.2	11
Fe-59	< 5.5	< 8.5	< 3.2	< 5.4	22
Co-58	< 2.6	< 2.2	< 1.6	< 1.8	11
Co-60	< 1.9	< 2.7	< 1.9	< 2.3	11
Zn-65	< 4.1	< 6.8	< 2.3	< 4.6	22
Zr-95	< 6.9	< 7.3	< 2.9	< 5.6	22
Nb-95	< 3.9	< 2.6	< 1.4	< 4.4	11
Cs-134	< 2.5	< 2.9	< 1.5	< 2.2	11
Cs-137	< 3.8	< 4.6	< 1.6	< 3.3	13
Ba-140	< 19.6	< 13.1	< 8.3	< 18.9	45
La-140	< 3.6	< 4.6	< 3.2	< 2.3	11

Lab Code	PELW- 3457	PELW- 3968	PELW- 4713	PELW- 5562	
Start Date	04-26-12	05-31-12	06-28-12	07-26-12	Req. LLD
End Date	05-31-12	06-28-12	07-26-12	08-30-12	
Gross beta	2.3 ± 0.7	1.0 ± 0.5	2.0 ± 1.0	1.1 ± 0.5	3.0
Mn-54	< 2.0	< 2.2	< 1.6	< 1.9	11
Fe-59	< 3.7	< 5.3	< 3.7	< 7.5	22
Co-58	< 2.0	< 2.6	< 1.5	< 1.8	11
Co-60	< 2.2	< 1.4	< 1.7	< 2.9	11
Zn-65	< 3.9	< 3.5	< 1.9	< 4.5	22
Zr-95	< 3.7	< 4.3	< 2.6	< 3.7	22
Nb-95	< 4.6	< 4.0	< 2.5	< 3.7	11
Cs-134	< 2.3	< 2.4	< 1.4	< 2.6	11
Cs-137	< 3.3	< 2.9	< 1.5	< 3.3	13
Ba-140	< 20.7	< 33.6	< 14.8	< 19.9	45
La-140	< 2.6	< 9.6	< 2.9	< 2.5	11

Lab Code	PELW- 6085	PELW- 7145	PELW- 7812	PELW- 8257	
Start Date	08-30-12	09-26-12	10-25-12	11-29-12	Req. LLD
End Date	09-26-12	10-25-12	11-29-12	12-27-12	
Gross beta	2.4 ± 1.0	1.0 ± 0.5	2.5 ± 1.0	0.9 ± 0.5	3.0
Mn-54	< 1.4	< 2.4	< 2.0	< 2.2	11
Fe-59	< 5.0	< 7.5	< 6.7	< 3.7	22
Co-58	< 2.4	< 3.1	< 2.3	< 2.2	11
Co-60	< 1.4	< 1.6	< 2.0	< 2.0	11
Zn-65	< 3.5	< 4.3	< 3.3	< 2.4	22
Zr-95	< 4.9	< 4.3	< 5.5	< 3.3	22
Nb-95	< 2.9	< 4.5	< 3.5	< 2.5	11
Cs-134	< 2.2	< 3.3	< 2.8	< 2.2	11
Cs-137	< 3.2	< 3.5	< 2.2	< 2.6	13
Ba-140	< 30.3	< 24.4	< 25.9	< 15.1	45
La-140	< 5.2	< 5.4	< 4.3	< 2.9	11

Lake water, analyses for gross beta and gamma emitting isotopes.
Location: P-59 Collection: Monthly composites Units: pCi/L

Lab Code	NS [a]	PELW- 991	PELW- 1662	PELW- 2464	
Start Date	-	01-26-12	02-23-12	03-29-12	Req. LLD
End Date	01-27-11	02-23-12	03-29-12	04-26-12	
Gross beta	-	2.5 ± 0.7	2.9 ± 1.0	2.1 ± 0.9	3.0
Mn-54	-	< 2.7	< 2.3	< 2.0	11
Fe-59	-	< 2.8	< 4.7	< 3.3	22
Co-58	-	< 2.3	< 1.9	< 3.3	11
Co-60	-	< 2.2	< 2.7	< 1.9	11
Zn-65	-	< 2.8	< 4.8	< 4.4	22
Zr-95	-	< 3.4	< 6.4	< 5.8	22
Nb-95	-	< 2.8	< 2.8	< 2.9	11
Cs-134	-	< 2.0	< 1.9	< 3.1	11
Cs-137	-	< 2.8	< 2.5	< 3.3	13
Ba-140	-	< 16.1	< 24.1	< 19.4	45
La-140	-	< 3.7	< 2.4	< 2.1	11

Lab Code	PELW- 3458	PELW- 3969	PELW- 4714	PELW- 5563	
Start Date	04-26-12	05-31-12	06-28-12	07-26-12	Req. LLD
End Date	05-31-12	06-28-12	07-26-12	08-29-12	
Gross beta	2.1 ± 0.8	1.4 ± 0.5	1.9 ± 0.9	1.5 ± 0.6	3.0
Mn-54	< 2.3	< 1.1	< 1.8	< 3.0	11
Fe-59	< 3.6	< 2.7	< 4.6	< 2.6	22
Co-58	< 1.7	< 0.7	< 1.3	< 2.9	11
Co-60	< 1.0	< 0.9	< 1.9	< 2.9	11
Zn-65	< 4.5	< 2.3	< 2.9	< 2.7	22
Zr-95	< 4.7	< 2.6	< 4.3	< 5.0	22
Nb-95	< 3.3	< 1.9	< 2.9	< 3.7	11
Cs-134	< 3.2	< 0.9	< 2.0	< 1.7	11
Cs-137	< 2.8	< 1.3	< 2.6	< 2.8	13
Ba-140	< 15.3	< 12.6	< 19.5	< 22.5	45
La-140	< 2.6	< 4.0	< 4.2	< 2.9	11

Lab Code	PELW- 6086	PELW- 7146	PELW- 7813	PELW- 8258	
Start Date	08-29-12	09-26-12	10-24-12	11-28-12	Req. LLD
End Date	09-26-12	10-24-12	11-28-12	12-27-12	
Gross beta	< 1.6	< 0.9	2.4 ± 0.9	1.2 ± 0.5	3.0
Mn-54	< 2.8	< 2.3	< 2.8	< 1.7	11
Fe-59	< 5.2	< 3.1	< 3.0	< 3.2	22
Co-58	< 1.4	< 2.7	< 2.7	< 2.4	11
Co-60	< 2.6	< 2.4	< 2.2	< 2.2	11
Zn-65	< 3.7	< 3.8	< 3.9	< 2.3	22
Zr-95	< 5.8	< 2.1	< 4.4	< 4.8	22
Nb-95	< 3.1	< 3.2	< 2.7	< 2.5	11
Cs-134	< 2.2	< 2.5	< 1.8	< 2.0	11
Cs-137	< 2.5	< 2.2	< 2.2	< 2.5	13
Ba-140	< 21.4	< 31.7	< 12.5	< 17.1	45
La-140	< 4.3	< 8.9	< 3.3	< 3.4	11

[a] No sample available, shoreline frozen.

Lake water, analyses for gross beta and gamma emitting isotopes.
Location: P-60 Collection: Monthly composites Units: pCi/L

Lab Code	NS [a]	PELW- 992	PELW- 1663	PELW- 2465	
Start Date	-	01-26-12	02-23-12	03-29-12	Req. LLD
End Date	01-27-11	02-23-12	03-29-12	04-26-12	
Gross beta	-	3.7 ± 0.8	3.1 ± 1.1	< 1.8	3.0
Mn-54	-	< 2.6	< 2.3	< 3.4	11
Fe-59	-	< 3.7	< 3.5	< 2.2	22
Co-58	-	< 2.7	< 2.0	< 3.4	11
Co-60	-	< 1.1	< 2.6	< 2.5	11
Zn-65	-	< 3.9	< 5.8	< 3.4	22
Zr-95	-	< 2.2	< 3.6	< 3.6	22
Nb-95	-	< 2.3	< 2.1	< 3.2	11
Cs-134	-	< 2.2	< 3.1	< 2.6	11
Cs-137	-	< 3.1	< 3.1	< 3.3	13
Ba-140	-	< 18.2	< 12.2	< 24.0	45
La-140	-	< 2.3	< 5.9	< 2.7	11

Lab Code	PELW- 3459	PELW- 3971	PELW- 4715	PELW- 5564	
Start Date	04-26-12	05-31-12	06-28-12	07-26-12	Req. LLD
End Date	05-31-12	06-28-12	07-26-12	08-29-12	
Gross beta	1.2 ± 0.4	< 1.9	< 1.8	1.8 ± 0.6	3.0
Mn-54	< 2.3	< 1.4	< 4.4	< 2.8	11
Fe-59	< 4.0	< 2.4	< 3.6	< 3.8	22
Co-58	< 2.5	< 1.9	< 2.4	< 0.8	11
Co-60	< 1.6	< 1.5	< 3.0	< 2.5	11
Zn-65	< 3.6	< 3.1	< 4.5	< 2.4	22
Zr-95	< 6.9	< 2.4	< 5.2	< 3.6	22
Nb-95	< 4.6	< 2.1	< 1.9	< 3.2	11
Cs-134	< 3.0	< 1.5	< 2.9	< 2.8	11
Cs-137	< 3.0	< 1.6	< 3.1	< 3.0	13
Ba-140	< 18.8	< 14.4	< 23.2	< 17.1	45
La-140	< 6.7	< 6.3	< 3.8	< 3.9	11

Lab Code	PELW- 6087	PELW- 7147	PELW- 7814	PELW- 8259	
Start Date	08-29-12	09-26-12	10-24-12	11-28-12	Req. LLD
End Date	09-26-12	10-24-12	11-28-12	12-27-12	
Gross beta	1.9 ± 1.0	1.4 ± 0.6	3.5 ± 1.0	1.6 ± 0.6	3.0
Mn-54	< 2.8	< 2.2	< 2.5	< 2.0	11
Fe-59	< 2.5	< 6.0	< 4.8	< 1.9	22
Co-58	< 2.0	< 3.9	< 2.7	< 1.4	11
Co-60	< 1.6	< 1.9	< 2.5	< 2.1	11
Zn-65	< 2.0	< 3.2	< 4.3	< 3.8	22
Zr-95	< 3.3	< 3.4	< 5.3	< 3.4	22
Nb-95	< 3.0	< 3.3	< 2.6	< 1.7	11
Cs-134	< 2.1	< 3.2	< 2.4	< 1.6	11
Cs-137	< 2.5	< 2.6	< 3.1	< 2.2	13
Ba-140	< 19.9	< 23.0	< 12.5	< 11.3	45
La-140	< 4.3	< 6.8	< 4.5	< 2.8	11

[a] No sample available, shoreline frozen.

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- 1692	PELW- 4197	PELW- 6257	PELW- 8281
H-3	< 144	< 149	< 150	< 139

Location	P-34			
Period	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
Lab Code	PELW- 1693	PELW- 4198	PELW- 6258	PELW- 8282
H-3	< 144	< 149	< 150	< 139

Location	P-36			
Period	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
Lab Code	PELW- 1694	PELW- 4199	PELW- 6260	PELW- 8283
H-3	< 144	< 149	< 150	< 139

Location	P-59			
Period	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
Lab Code	PELW- 1695	PELW- 4200	PELW- 6261	PELW- 8284
H-3	< 144	< 149	< 150	< 139

Location	P-60			
Period	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
Lab Code	PELW- 1696	PELW- 4201	PELW- 6262	PELW- 8285
H-3	< 144	< 149	< 150	< 139

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							
01-03-12	ND[a]	-	-	-	-	-	-
02-06-12	ND	-	-	-	-	-	-
03-05-12	ND	-	-	-	-	-	-
04-02-12	PEMI- 1684	< 0.3	< 2.6	< 3.1	< 15.5	< 2.4	1281 ± 111
04-16-12	PEMI- 2095	< 0.3	< 3.1	< 4.1	< 22.9	< 2.5	1620 ± 124
05-07-12	PEMI- 2679	< 0.4	< 3.2	< 3.2	< 11.8	< 3.3	1634 ± 114
05-22-12	PEMI- 3084	< 0.2	< 3.0	< 4.0	< 16.7	< 4.4	1781 ± 119
06-04-12	PEMI- 3447	< 0.4	< 3.0	< 3.8	< 25.1	< 1.9	1720 ± 135
06-18-12	PEMI- 3678	< 0.2	< 3.2	< 4.2	< 24.2	< 6.5	1813 ± 111
07-02-12	PEMI- 3956	< 0.4	< 2.9	< 3.3	< 24.0	< 7.1	1891 ± 125
07-16-12	PEMI- 4205	< 0.4	< 4.2	< 4.8	< 29.2	< 2.4	1641 ± 118
08-06-12	PEMI- 4939	< 0.2	< 3.5	< 4.0	< 39.8	< 5.2	1822 ± 117
08-20-12	PEMI- 5261	< 0.3	< 2.5	< 3.9	< 20.7	< 1.4	1841 ± 114
09-04-12	PEMI- 5556	< 0.2	< 2.9	< 4.5	< 18.1	< 4.7	1872 ± 117
09-17-12	PEMI- 5903	< 0.4	< 3.2	< 2.9	< 25.4	< 3.3	1911 ± 106
10-02-12	PEMI- 6209	< 0.4	< 2.3	< 3.4	< 39.7	< 4.5	1909 ± 123
10-15-12	PEMI- 6690	< 0.5	< 3.0	< 3.0	< 28.0	< 5.7	2028 ± 117
11-05-12	ND	-	-	-	-	-	-
12-03-12	ND	-	-	-	-	-	-
P-19							
01-03-12	PEMI- 65	< 0.4	< 3.3	< 3.5	< 28.1	< 3.5	1289 ± 107
02-06-12	PEMI- 721	< 0.3	< 2.8	< 2.7	< 18.3	< 2.5	1369 ± 92
03-05-12	PEMI- 1147	< 0.3	< 2.5	< 2.9	< 18.4	< 4.1	1403 ± 102
04-02-12	PEMI- 1656	< 0.2	< 2.8	< 4.2	< 14.8	< 2.6	1277 ± 115
04-16-12	PEMI- 2096	< 0.4	< 3.6	< 3.9	< 19.7	< 1.9	1453 ± 116
05-07-12	PEMI- 2680	< 0.4	< 2.7	< 3.9	< 22.1	< 1.9	1359 ± 112
05-21-12	PEMI- 3085	< 0.2	< 2.9	< 3.3	< 23.0	< 1.8	1421 ± 109
06-04-12	PEMI- 3448	< 0.3	< 2.5	< 3.8	< 19.4	< 2.5	1255 ± 106
06-18-12	PEMI- 3679	< 0.2	< 2.7	< 3.2	< 25.0	< 4.8	1369 ± 101
07-02-12	PEMI- 3957	< 0.3	< 2.6	< 3.0	< 18.5	< 4.0	1400 ± 102
07-16-12	PEMI- 4206	< 0.2	< 2.7	< 3.8	< 27.4	< 2.9	1439 ± 114
08-06-12	PEMI- 4940	< 0.3	< 2.7	< 3.0	< 27.1	< 6.1	1376 ± 87
08-20-12	PEMI- 5262	< 0.3	< 2.7	< 2.3	< 21.7	< 3.4	1376 ± 113
09-04-12	PEMI- 5557	< 0.2	< 2.9	< 3.2	< 15.6	< 2.8	1413 ± 95
11-05-12	PEMI- 7170	< 0.3	< 3.5	< 3.9	< 10.5	< 2.4	1316 ± 97
12-03-12	PEMI- 7774	< 0.5	< 3.3	< 4.1	< 20.9	< 3.7	1321 ± 108

a ND = No data, no milk available.

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							
01-03-12	ND [a]	-	-	-	-	-	-
02-06-12	ND	-	-	-	-	-	-
03-05-12	ND	-	-	-	-	-	-
04-02-12	PEMI- 1657	< 0.2	< 4.1	< 4.8	< 20.2	< 4.2	1630 ± 126
04-16-12	PEMI- 2097	< 0.3	< 3.6	< 4.4	< 10.9	< 4.7	1868 ± 123
05-07-12	PEMI- 2681	< 0.4	< 2.5	< 3.4	< 17.1	< 2.7	1776 ± 129
05-21-12	PEMI- 3086	< 0.2	< 2.1	< 3.4	< 10.6	< 1.8	1810 ± 120
06-04-12	PEMI- 3449	< 0.3	< 2.1	< 3.7	< 11.1	< 1.7	1828 ± 130
06-18-12	PEMI- 3680	< 0.2	< 2.7	< 4.0	< 36.2	< 5.3	1847 ± 119
07-02-12	PEMI- 3958	< 0.3	< 3.2	< 4.1	< 26.2	< 4.2	1801 ± 113
07-16-12	PEMI- 4207	< 0.3	< 3.0	< 3.5	< 22.7	< 8.1	1825 ± 121
08-06-12	PEMI- 4941	< 0.4	< 2.6	< 3.4	< 35.1	< 4.3	1927 ± 113
08-20-12	PEMI- 5263	< 0.3	< 4.9	< 3.8	< 34.8	< 3.2	1904 ± 139
09-04-12	PEMI- 5558	< 0.2	< 3.2	< 3.8	< 19.4	< 2.8	1800 ± 135
09-17-12	PEMI- 5905	< 0.4	< 3.2	< 4.6	< 38.5	< 7.9	1924 ± 121
10-02-12	ND	-	-	-	-	-	-
10-15-12	ND	-	-	-	-	-	-
11-05-12	ND	-	-	-	-	-	-
12-03-12	ND	-	-	-	-	-	-
P-51							
01-03-12	PEMI- 66	< 0.3	< 2.7	< 4.1	< 25.4	< 3.6	1051 ± 90
02-06-12	PEMI- 722	< 0.3	< 3.0	< 4.1	< 16.8	< 4.4	802 ± 83
03-05-12	PEMI- 1148	< 0.3	< 2.2	< 3.1	< 11.2	< 2.6	848 ± 73
04-02-12	PEMI- 1658	< 0.2	< 2.5	< 2.8	< 18.0	< 3.7	810 ± 90
04-16-12	PEMI- 2098	< 0.2	< 1.6	< 2.9	< 16.3	< 3.7	851 ± 85
05-07-12	PEMI- 2682	< 0.4	< 3.0	< 3.4	< 11.5	< 3.9	946 ± 96
05-21-12	PEMI- 3087	< 0.5	< 2.8	< 3.8	< 11.0	< 2.2	972 ± 101
06-04-12	PEMI- 3450	< 0.4	< 2.9	< 2.3	< 21.0	< 1.9	1004 ± 96
06-18-12	PEMI- 3681	< 0.2	< 2.2	< 2.8	< 31.4	< 3.5	921 ± 80
07-02-12	PEMI- 3959	< 0.3	< 2.4	< 2.3	< 14.5	< 3.6	775 ± 66
07-16-12	PEMI- 4208	< 0.3	< 2.4	< 2.8	< 32.8	< 5.1	1377 ± 102
08-06-12	PEMI- 4942	< 0.3	< 2.1	< 2.9	< 30.1	< 5.0	1397 ± 93
08-20-12	PEMI- 5264	< 0.3	< 3.0	< 3.7	< 29.7	< 5.5	927 ± 98
09-04-12	PEMI- 5559	< 0.2	< 3.6	< 3.0	< 18.4	< 2.5	956 ± 97
09-17-12	PEMI- 5906	< 0.3	< 2.3	< 1.6	< 31.4	< 6.3	818 ± 85
10-02-12	PEMI- 6211	< 0.4	< 2.5	< 2.6	< 29.0	< 6.1	804 ± 74
10-15-12	PEMI- 6693	< 0.4	< 2.8	< 1.8	< 28.1	< 3.2	738 ± 77
11-05-12	PEMI- 7171	< 0.3	< 4.3	< 3.9	< 18.0	< 1.8	987 ± 94
12-03-12	PEMI- 7775	< 0.5	< 4.9	< 5.3	< 31.9	< 2.5	626 ± 103

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

Food Products, analyses for gamma emitting isotopes.
Collection: Monthly
Location: P-2

Units: pCi/kg wet

Lab Code	PEVE- 4222	PEVE- 4224	PEVE- 5164	PEVE- 5165	
Date Collected	07-13-12	07-13-12	08-15-12	08-15-12	Req. LLD
Sample Type	Swiss Chard	Japan. Greens	Turnip Greens	Japan. Greens	
Be-7	163 ± 82	306 ± 81	562 ± 149	510 ± 120	-
K-40	7230 ± 324	4641 ± 244	4522 ± 378	3711 ± 282	-
Co-58	< 6.3	< 6.3	< 9.9	< 8.3	-
Co-60	< 8.0	< 6.8	< 7.6	< 4.8	-
I-131	< 16.2	< 14.0	< 13.0	< 21.7	45
Cs-134	< 7.6	< 6.9	< 11.6	< 6.6	45
Cs-137	< 9.1	< 8.2	< 11.7	< 7.9	60

Lab Code	PEVE- 5166	PEVE- 5168	PEVE- 5833	PEVE- 5834	
Date Collected	08-15-12	08-15-12	09-12-12	09-12-12	Req. LLD
Sample Type	Collard Greens	Swiss Chard	Japan. Greens	Collard Greens	
Be-7	< 77	255 ± 85	563 ± 99	210 ± 120	-
K-40	4260 ± 277	4924 ± 286	3421 ± 222	4209 ± 284	-
Co-58	< 7.7	< 4.7	< 8.9	< 8.3	-
Co-60	< 4.8	< 7.2	< 4.5	< 7.1	-
I-131	< 12.7	< 13.5	< 28.5	< 35.0	45
Cs-134	< 6.6	< 5.5	< 4.8	< 8.3	45
Cs-137	< 9.0	< 8.6	< 6.7	< 8.1	60

Lab Code	PEVE- 5835	PEVE- 5836	PEVE- 6667	PEVE- 6668	
Date Collected	09-12-12	09-12-12	10-16-12	10-16-12	Req. LLD
Sample Type	Swiss Chard	Turnips	Japan. Greens	Turnip Greens	
Be-7	361 ± 85	582 ± 95	870 ± 127	859 ± 128	-
K-40	5582 ± 302	4516 ± 233	4537 ± 306	6370 ± 347	-
Co-58	< 6.4	< 7.4	< 9.5	< 7.1	-
Co-60	< 4.9	< 4.8	< 10.0	< 5.9	-
I-131	< 20.4	< 26.8	< 35.1	< 28.3	45
Cs-134	< 7.6	< 4.6	< 6.2	< 6.5	45
Cs-137	< 8.8	< 6.4	< 9.1	< 8.7	60

Lab Code	PEVE- 6669	PEVE- 6671	
Date Collected	10-16-12	10-16-12	Req. LLD
Sample Type	Collard Greens	Swiss Chard	
Co-58	< 7.0	< 8.4	-
Co-60	< 8.4	< 7.5	-
I-131	< 33.6	< 42.8	45
Cs-134	< 8.6	< 8.3	45
Cs-137	< 8.6	< 12.2	60

Food Products, analyses for gamma emitting isotopes.
Collection: Monthly
Location: P-16

Units: pCi/kg wet

Lab Code	PEVE- 3798	PEVE- 3800	PEVE- 3801	PEVE- 4225	
Date Collected	06-20-12	06-20-12	06-20-12	07-13-12	Req. LLD
Sample Type	Japan. Greens	Swiss Chard	Collard Greens	Collard Greens	
Be-7	< 102	< 127	< 96	< 79	-
K-40	5931 ± 377	7174 ± 452	5107 ± 333	4746 ± 279	-
Co-58	< 6.9	< 7.9	< 12.3	< 8.0	-
Co-60	< 3.5	< 12.3	< 11.1	< 7.2	-
I-131	< 11.9	< 20.9	< 19.1	< 17.3	45
Cs-134	< 6.1	< 8.1	< 7.1	< 7.4	45
Cs-137	< 9.4	< 13.8	< 7.9	< 8.9	60

Lab Code	PEVE- 4226	PEVE- 4227	PEVE- 5169	PEVE- 5170	
Date Collected	07-13-12	07-13-12	08-15-12	08-15-12	Req. LLD
Sample Type	Japan. Greens	Swiss Chard	Collard Greens	Swiss Chard	
Be-7	314 ± 91	213 ± 99	< 75	215 ± 115	-
K-40	5339 ± 291	5498 ± 275	3788 ± 253	5652 ± 387	-
Co-58	< 7.4	< 8.9	< 6.1	< 7.1	-
Co-60	< 10.9	< 7.8	< 6.0	< 10.4	-
I-131	< 10.9	< 14.7	< 11.5	< 16.3	45
Cs-134	< 4.8	< 7.5	< 5.6	< 11.0	45
Cs-137	< 8.4	< 10.5	< 6.9	< 9.7	60

Lab Code	PEVE- 5171	PEVE- 5837	PEVE- 5838	PEVE- 5840	
Date Collected	08-15-12	09-12-12	09-12-12	09-12-12	Req. LLD
Sample Type	Japan. Greens	Japan. Greens	Swiss Chard	Collard Greens	
Be-7	336 ± 77	501 ± 83	300 ± 84	< 91	-
K-40	4967 ± 320	4394 ± 239	4964 ± 282	3780 ± 293	-
Co-58	< 4.6	< 5.9	< 8.1	< 8.3	-
Co-60	< 6.8	< 5.8	< 7.0	< 3.7	-
I-131	< 11.6	< 17.8	< 26.7	< 24.3	45
Cs-134	< 8.1	< 5.1	< 6.2	< 8.1	45
Cs-137	< 9.9	< 7.0	< 9.1	< 7.3	60

Lab Code	PEVE- 6672	PEVE- 6673	PEVE- 6674		
Date Collected	10-16-12	10-16-12	10-16-12		Req. LLD
Sample Type	Swiss Chard	Japan. Greens	Collard Greens		
Be-7	736 ± 142	749 ± 151	598 ± 116		-
K-40	5018 ± 357	6092 ± 359	3320 ± 273		-
Co-58	< 7.6	< 10.8	< 5.5		-
Co-60	< 7.0	< 12.2	< 7.4		-
I-131	< 24.6	< 27.3	< 31.8		45
Cs-134	< 7.9	< 10.2	< 9.8		45
Cs-137	< 13.0	< 8.2	< 7.2		60

Food Products, analyses for gamma emitting isotopes.
Collection: Monthly
Location: P-18

Units: pCi/kg wet

Lab Code	PEVE- 3802	PEVE- 4228	PEVE- 4229	PEVE- 5172	
Date Collected	06-20-12	07-13-12	07-13-12	08-15-12	Req. LLD
Sample Type	Japan. Greens	Japan. Greens	Swiss Chard	Collard Greens	
Be-7	443 ± 152	307 ± 61	290 ± 86	177 ± 68	-
K-40	7999 ± 494	6843 ± 256	9645 ± 358	4974 ± 317	-
Co-58	< 12.8	< 5.8	< 12.5	< 7.1	-
Co-60	< 15.9	< 5.6	< 10.3	< 7.9	-
I-131	< 20.4	< 10.8	< 16.6	< 15.6	45
Cs-134	< 13.9	< 5.4	< 6.4	< 5.4	45
Cs-137	< 11.2	< 6.6	< 7.8	< 8.8	60

Lab Code	PEVE- 5173	PEVE- 5174	PEVE- 5841	PEVE- 5842	
Date Collected	08-15-12	08-15-12	09-12-12	09-12-12	Req. LLD
Sample Type	Swiss Chard	Japan. Greens	Swiss Chard	Japan. Greens	
Be-7	372 ± 93	401 ± 99	452 ± 85	395 ± 81	-
K-40	5404 ± 301	5127 ± 323	7473 ± 325	5899 ± 304	-
Co-58	< 5.4	< 6.3	< 8.4	< 6.6	-
Co-60	< 4.1	< 6.6	< 7.6	< 7.6	-
I-131	< 14.1	< 13.9	< 19.0	< 24.4	45
Cs-134	< 6.2	< 8.0	< 6.7	< 6.8	45
Cs-137	< 8.7	< 8.5	< 6.6	< 6.2	60

Lab Code	PEVE- 5843	PEVE- 6675	PEVE- 6676	PEVE- 6677	
Date Collected	09-12-12	10-16-12	10-16-12	10-16-12	Req. LLD
Sample Type	Collard Greens	Collard Greens	Japan. Greens	Swiss Chard	
Be-7	288 ± 84	430 ± 110	570 ± 113	660 ± 144	-
K-40	4146 ± 250	5823 ± 287	5993 ± 349	7279 ± 419	-
Co-58	< 6.8	< 7.2	< 6.7	< 7.3	-
Co-60	< 7.2	< 7.0	< 5.7	< 9.7	-
I-131	< 21.8	< 18.4	< 25.6	< 37.9	45
Cs-134	< 5.2	< 5.2	< 8.2	< 6.4	45
Cs-137	< 7.2	< 7.0	< 12.5	< 11.5	60

Food Products, analyses for gamma emitting isotopes.
Collection: Monthly
Location: P-20

Units: pCi/kg wet

Lab Code	PEVE- 4230	PEVE- 5175	PEVE- 5176	PEVE- 5177	
Date Collected	07-13-12	08-15-12	08-15-12	08-15-12	Req. LLD
Sample Type	Japan. Greens	Japan. Greens	Turnip Greens	Collard Greens	
Be-7	251 ± 77	262 ± 79	337 ± 90	< 143	-
K-40	4611 ± 230	3260 ± 269	4063 ± 299	3439 ± 332	-
Co-58	< 5.4	< 5.1	< 8.0	< 5.9	-
Co-60	< 7.5	< 6.8	< 9.0	< 7.5	-
I-131	< 14.9	< 17.0	< 12.9	< 25.3	45
Cs-134	< 5.5	< 9.2	< 7.4	< 7.7	45
Cs-137	< 7.0	< 9.2	< 10.5	< 11.1	60

Lab Code	PEVE- 5844	PEVE- 5845	PEVE- 6678	PEVE- 6679	
Date Collected	09-12-12	09-12-12	10-16-12	10-16-12	Req. LLD
Sample Type	Collard Greens	Japan. Greens	Japan. Greens	Collard Greens	
Be-7	239 ± 76	429 ± 75	850 ± 135	301 ± 107	-
K-40	4027 ± 219	3839 ± 250	5547 ± 362	4016 ± 301	-
Co-58	< 5.9	< 5.9	< 5.2	< 11.4	-
Co-60	± 6.7	< 7.6	< 12.0	< 7.1	-
I-131	< 23.1	< 17.0	< 39.5	< 36.2	45
Cs-134	< 4.5	< 5.6	< 7.8	< 10.3	45
Cs-137	< 5.0	< 4.1	< 12.0	< 6.9	60

Food Products, analyses for gamma emitting isotopes.
Collection: Monthly
Location: P-37

Units: pCi/kg wet

Lab Code	PEVE- 3803	PEVE- 3804	PEVE- 3805	PEVE- 4231	
Date Collected	06-20-12	06-20-12	06-20-12	07-11-12	Req. LLD
Sample Type	Japan. Greens	Swiss Chard	Collard Greens	Japan. Greens	
Be-7	< 95	< 98	< 92	216 ± 57	-
K-40	4942 ± 291	4358 ± 369	4011 ± 322	3604 ± 214	-
Co-58	< 6.5	< 6.7	< 6.5	< 4.7	-
Co-60	< 7.5	< 2.7	< 3.9	< 5.5	-
I-131	< 12.6	< 15.4	< 12.0	< 10.5	45
Cs-134	< 7.1	< 4.5	< 7.7	< 6.0	45
Cs-137	< 8.9	< 9.1	< 9.1	< 8.8	60

Lab Code	PEVE- 4232	PEVE- 4233	PEVE- 5178	PEVE- 5179	
Date Collected	07-11-12	07-11-12	08-15-12	08-15-12	Req. LLD
Sample Type	Collard Greens	Swiss Chard	Swiss Chard	Japan. Greens	
Be-7	< 74	287 ± 81	386 ± 108	296 ± 132	-
K-40	3636 ± 255	3100 ± 236	3282 ± 314	5366 ± 449	-
Co-58	< 4.0	< 8.0	< 5.1	< 7.4	-
Co-60	< 7.4	< 4.4	< 5.1	< 6.6	-
I-131	< 10.1	< 14.0	< 19.8	< 14.0	45
Cs-134	< 7.6	< 8.0	< 9.9	< 9.5	45
Cs-137	< 9.2	< 9.4	< 9.8	< 12.2	60

Lab Code	PEVE- 5180	PEVE- 5846	PEVE- 5847	PEVE- 5848	
Date Collected	08-15-12	09-12-12	09-12-12	09-12-12	Req. LLD
Sample Type	Collard Greens	Swiss Chard	Collard Greens	Japan. Greens	
Be-7	< 111	246 ± 86	< 74	150 ± 64	-
K-40	5160 ± 327	3802 ± 247	3724 ± 180	3781 ± 221	-
Co-58	< 8.2	< 4.1	< 4.5	< 7.0	-
Co-60	< 10.4	< 4.2	< 4.6	< 3.2	-
I-131	< 23.9	< 23.7	< 18.4	< 25.5	45
Cs-134	< 7.5	< 6.2	< 4.3	< 5.4	45
Cs-137	< 11.0	< 8.1	< 6.8	< 7.0	60

Lab Code	PEVE- 6680	PEVE- 6681	PEVE- 6682		
Date Collected	10-16-12	10-16-12	10-16-12		Req. LLD
Sample Type	Swiss Chard	Collard Greens	Japan. Greens		
Be-7	602 ± 125	106 ± 58	412 ± 49		-
K-40	3016 ± 243	4388 ± 169	4754 ± 164		-
Co-58	< 8.8	< 3.9	< 5.7		-
Co-60	< 9.1	< 4.9	< 5.3		-
I-131	< 25.7	< 20.7	< 21.7		45
Cs-134	< 7.2	< 4.4	< 4.9		45
Cs-137	< 10.2	< 6.3	< 5.5		60

Food Products, analyses for gamma emitting isotopes.
Collection: Monthly
Location: P-70

Units: pCi/kg wet

Lab Code	PEVE- 3806	PEVE- 3807	PEVE- 3808	PEVE- 3809	
Date Collected	06-20-12	06-20-12	06-20-12	06-20-12	Req. LLD
Sample Type	Japan. Greens	Swiss Chard	Turnip Greens	Collard Greens	
Be-7	227 ± 99	167 ± 72	333 ± 96	< 76	-
K-40	5673 ± 347	8047 ± 427	6642 ± 413	7014 ± 364	-
Co-58	< 7.0	< 4.3	< 6.8	< 5.5	-
Co-60	< 7.5	< 5.3	< 6.5	< 5.2	-
I-131	< 16.7	< 13.3	< 16.0	< 13.3	45
Cs-134	< 8.4	< 7.0	< 5.7	< 8.5	45
Cs-137	< 10.0	< 8.7	< 8.8	< 7.4	60

Lab Code	PEVE- 4234	PEVE- 4235	PEVE- 4236	PEVE- 4237	
Date Collected	07-13-12	07-13-12	07-13-12	07-13-12	Req. LLD
Sample Type	Swiss Chard	Japan. Greens	Collard Greens	Turnip Greens	
Be-7	333 ± 95	557 ± 92	269 ± 98	739 ± 99	-
K-40	9190 ± 385	6273 ± 271	5581 ± 275	6864 ± 281	-
Co-58	< 10.2	< 4.4	< 8.4	< 5.8	-
Co-60	< 8.6	< 6.0	< 7.1	< 4.3	-
I-131	< 13.2	< 10.9	< 9.0	< 11.6	45
Cs-134	< 6.3	< 6.6	< 7.4	< 6.8	45
Cs-137	< 10.4	< 6.2	< 8.7	< 8.5	60

Lab Code	PEVE- 5181	PEVE- 5182	PEVE- 5183	PEVE- 5184	
Date Collected	08-15-12	08-15-12	08-15-12	08-15-12	Req. LLD
Sample Type	Japan. Greens	Turnip Greens	Collard Greens	Swiss Chard	
Be-7	1028 ± 128	2038 ± 358	< 75	450 ± 121	-
K-40	5432 ± 337	5014 ± 304	4630 ± 318	6647 ± 393	-
Co-58	< 10.3	< 12.8	< 7.5	< 6.1	-
Co-60	< 6.3	< 6.2	< 6.0	< 11.3	-
I-131	< 13.0	< 0.0	< 9.4	< 14.2	45
Cs-134	< 7.1	< 7.2	< 7.1	< 8.6	45
Cs-137	< 10.4	< 8.6	< 9.7	< 10.6	60

Lab Code	PEVE- 5849	PEVE- 5850	PEVE- 5851	PEVE- 6683	
Date Collected	09-12-12	09-12-12	09-12-12	10-16-12	Req. LLD
Sample Type	Collard Greens	Swiss Chard	Turnips	Collard Greens	
Be-7	150 ± 75	406 ± 124	715 ± 100	73 ± 41	-
K-40	4774 ± 324	7941 ± 407	5954 ± 278	4059 ± 145	-
Co-58	< 6.9	< 12.0	< 7.2	< 4.5	-
Co-60	< 9.6	< 4.8	< 7.3	< 4.1	-
I-131	< 36.8	< 31.2	< 21.8	< 13.2	45
Cs-134	< 8.8	< 7.6	< 5.2	< 4.1	45
Cs-137	< 10.2	< 10.6	< 7.1	< 5.2	60

Food Products, analyses for gamma emitting isotopes.
Collection: Monthly
Location: P-70

Units: pCi/kg wet

Lab Code	PEVE- 6684	PEVE- 6685	
Date Collected	10-16-12	10-16-12	Req. LLD
Sample Type	Turnip Greens	Swiss Chard	
Be-7	1356 ± 160	845 ± 142	-
K-40	5522 ± 329	7663 ± 396	-
Co-58	< 7.5	< 7.5	-
Co-60	< 7.8	< 11.1	-
I-131	< 29.5	< 39.7	45
Cs-134	< 7.1	< 9.1	45
Cs-137	< 6.0	< 11.7	60

Fish, analyses for gamma emitting isotopes.

Collection: Annually

Units: pCi/kg wet

Location	P-25		
Lab Code	PEF- 5373	PEF- 5374	
Date Collected	08-23-12	08-23-12	Req. LLD
Sample Type	Yellow Perch	Freshwater Drum	
K-40	1580 ± 325	959 ± 277	-
Mn-54	< 17.2	< 19.4	94
Fe-59	< 40.2	< 46.4	195
Co-58	< 11.9	< 10.9	97
Co-60	< 7.2	< 7.8	97
Zn-65	< 16.5	< 32.1	195
Cs-134	< 13.5	< 11.2	97
Cs-137	< 13.8	< 14.2	112

Location	P-32	
Lab Code	PEF- 5375	
Date Collected	08-20-12	Req. LLD
Sample Type	Freshwater Drum	
K-40	1257 ± 311	-
Mn-54	< 14.2	94
Fe-59	< 46.7	195
Co-58	< 13.3	97
Co-60	< 13.7	97
Zn-65	< 21.0	195
Cs-134	< 17.7	97
Cs-137	< 19.9	112

Sediments, analyses for gamma emitting isotopes.
Collection: Semiannually Units: pCi/kg dry

Location	P-25		
Lab Code	PEBS- 3810	PEBS- 6184	
Date Collected	06-19-12	09-11-12	Req. LLD
K-40	11635 ± 557	14554 ± 632	-
Co-58	< 20.2	< 21.2	50
Co-60	< 9.8	< 15.5	40
Cs-134	< 14.5	< 17.2	112
Cs-137	81.5 ± 17.2	271.4 ± 22.2	135

Location	P-26		
Lab Code	PEBS- 3811	PEBS- 6185	
Date Collected	06-19-12	09-11-12	Req. LLD
K-40	12029 ± 441	12807 ± 602	-
Co-58	< 21.1	< 26.1	50
Co-60	< 11.2	< 18.5	40
Cs-134	< 12.7	< 15.3	112
Cs-137	35.7 ± 11.7	75.4 ± 27.7	135

Location	P-27		
Lab Code	PEBS- 3812	PEBS- 6186	
Date Collected	06-19-12	09-11-12	Req. LLD
K-40	16892 ± 767	16579 ± 666	-
Co-58	< 26.7	< 14.8	50
Co-60	< 22.0	< 14.1	40
Cs-134	< 24.3	< 17.2	112
Cs-137	152.2 ± 30.4	181.3 ± 27.2	135

Location	P-32		
Lab Code	PEBS- 3813	PEBS- 6187	
Date Collected	06-19-12	09-11-12	Req. LLD
K-40	16956 ± 487	20844 ± 807	-
Co-58	< 19.2	< 29.2	50
Co-60	< 21.2	< 8.4	40
Cs-134	< 13.7	< 20.0	112
Cs-137	414.7 ± 21.6	529.6 ± 41.1	135

Sediments, analyses for gamma emitting isotopes.
Collection: Semiannually Units: pCi/kg dry

Location	P-64		
Lab Code	PEBS- 2972	PEBS- 6188	
Date Collected	05-15-12	09-17-12	Req. LLD
K-40	9384 ± 512	8464 ± 445	-
Co-58	< 20.1	< 15.3	50
Co-60	< 12.0	< 11.4	40
Cs-134	< 11.7	< 12.0	112
Cs-137	< 14.8	< 11.0	135

Location	P-65		
Lab Code	PEBS- 2973	PEBS- 6189	
Date Collected	05-15-12	09-17-12	Req. LLD
K-40	9167 ± 501	7853 ± 440	-
Co-58	< 16.6	< 14.7	50
Co-60	< 6.4	< 12.1	40
Cs-134	< 14.0	< 11.9	112
Cs-137	< 13.4	< 13.6	135

APPENDIX D

CORRECTIONS TO PREVIOUS ANNUAL ENVIRONMENTAL AND EFFLUENT RELEASE REPORTS

APPENDIX D

CORRECTIONS TO PREVIOUS ANUUAL ENVIRONMENTAL AND EFFLUENT RELEASE REPORTS:

2011 ANNUAL ENVIRONMENTAL AND EFFLUENT RELEASE REPORT

1. There was an inadvertent inclusion of 3.73E-01 Ci of Xenon 138 for first quarter in Table 5. There was no Xenon 138 released in the first quarter of 2011
2. The Report contained two pages that were numbered 8.
3. Some activities were not included when effluents released and doses were determined. When corrected, multiple tables were affected. Changes were less than 10% of what was originally reported. Included with Appendix D are the corrected pages that can be inserted directly into the 2011 report.

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 2011.

Table 1: Liquid Batch Releases

	QUARTER 1	QUARTER 2	QUARTER 3	QUARTER 4	ANNUAL TOTAL
Number of batch releases	22	72	37	16	147
Total time period for batch releases, min	4.91+E03	1.60E+04	8.26E+03	3.55E+03	3.25E+04
Maximum time for a batch release, min	2.28E+02	3.84E+02	2.30E+02	2.27E+02	3.84E+02
Average time period for a batch release, min	2.23E+02	2.22E+02	2.23E+02	2.22E+02	2.23E+02
Minimum time for a batch release, min	2.02E+02	6.00E+00	2.02E+02	2.05E+02	6.00E+00
Average stream flow during periods of effluent release into a flowing stream, L/min	1.14E+05	2.04E+05	2.33E+05	1.67E+05	1.80E+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 while 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)	1.43E-03	2.55E-02	5.21E-03	5.34E-03	1.00E+01
2. Average Diluted Concentration, µCi/mL *	8.80E-11	8.68E-10	1.61E-10	2.63E-10	NA
3. Percent of Applicable Limit, %	2.56E-03	2.10E-02	4.75E-03	8.14E-03	NA
B. Tritium					
1. Total Released, Ci	1.08E+01	1.49E+01	6.51E+00	3.59E+00	1.00E+01
2. Average Diluted Concentration, µCi/mL	6.63E-07	5.07E-07	2.02E-07	1. 77E-07	
3. Percent of Applicable Limit, %	6.63E-02	5.07E-02	2.02E-02	1.77E-02	
C. Dissolved and Entrained Gases					
1. Total Released, Ci	<LLD	<LLD	<LLD	1.62E-07	1.00E+01
2. Average Diluted Concentration, µCi/mL	<LLD	<LLD	<LLD	7.96E-15	NA
3. Percent of Applicable Limit, %	N/A	N/A	N/A	3.99E-09	NA
D. Gross Alpha Activity, Ci	<LLD	<LLD	<LLD	<LLD	1.00E+01
E. Waste Volume Released, Liters (prior to dilution)	2.86E+06	8.72E+06	6.33E+06	2.74E+06	NA
F. Dilution Water Volume Used, Liters	1.63E+10	2.94E+10	3.23E+10	2.03E+10	NA

<LLD – Less than the lower limit of detection
N/A – Not Applicable, the ODCM does not have a limit for fission and activation products.
**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)	1.43E-03	2.55E-02	5.21E-03	5.07E-03	1.00E+01
B. Tritium					
Total Released, Ci	1.08E+01	1.49E+01	6.51E+00	3.59E+00	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)	2.86E+06	8.72E+06	4.80E+06	2.34E+06	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)	<LLD	<LLD	<LLD	2.65E-04	1.00E+01
B. Tritium					
Total Released, Ci	<LLD	2.57E-04	1.55E-03	4.87E-03	1.00E+01
C. Dissolved and Entrained Gases					
Total Released, Ci	<LLD	<LLD	<LLD	1.62E-07	1.00E+01
D. Gross Alpha Activity, Ci	<LLD	<LLD	<LLD	<LLD	1.00E+01
E. Waste Volume Released, Liters (prior to dilution)	0.00E+00	0.00E+00	1.53E+06	4.01E+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 Total
Tritium	Ci	1.08E+01	1.49E+01	6.51E+00	3.59E+00	3.51E+01
Sodium-24	Ci	<LLD	<LLD	<LLD	1.24E-04	9.25E-05
Chromium-51	Ci	<LLD	2.26E-03	<LLD	<LLD	2.26E-03
Manganese-54	Ci	1.49E-04	2.76E-03	1.18E-04	1.02E-04	3.12E-03
Manganese-56	Ci	<LLD	<LLD	<LLD	1.83E-06	1.09E-06
Iron-55	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Iron-59	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cobalt-58	Ci	<LLD	7.09E-04	<LLD	3.41E-04	1.05E-03
Cobalt-60	Ci	1.23E-03	1.67E-02	4.25E-03	4.71E-03	2.69E-02
Zinc-65	Ci	<LLD	9.35E-04	2.45E-04	<LLD	1.18E-03
Zinc-69M	Ci	<LLD	<LLD	<LLD	2.38E-07	2.38E-07
Strontium-92	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Zirconium-95	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Niobium-95	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Technetium-99M	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Rhuthenium-105	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Silver-110m	Ci	<LLD	1.38E-04	3.29E-04	<LLD	1.71E-03
Antimony-124	Ci	<LLD	2.09E-04	<LLD	<LLD	2.09E-04
Antimony-125	Ci	5.30E-05	5.03E-04	2.70E-04	<LLD	8.26E-04
Iodine-131	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xenon-135	Ci	<LLD	<LLD	<LLD	1.62E-07	1.62E-07
Cesium-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cesium-137	Ci	<LLD	<LLD	<LLD	5.92E-05	5.27E-05
Cesium-138	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Lanthanum-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Gold-199	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Total for Period		**1.08E+01**	**1.49E+01**	**6.51E+00**	**3.34E+00**	**3.52E+01**

<LLD – Less than the lower limit of detection

Gaseous Effluents

Gaseous effluents are made up of fission and activation gases, iodine and particulate releases. The fission and activation gas releases are primarily a result of containment purge operations, small steam leaks, and offgas system operation. The iodine and particulate releases are primarily a result of small steam leaks. 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. The majority of gaseous effluents released from PNPP are considered continuous and at ground level.

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.

Discussion of Carbon-14 doses is listed on page 20, Carbon-14 supplemental information.

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	0.00E+00	1.75E-01	0.00E+00	1.19E-02	1.00E+01
2. Average Release Rate, µCi/sec	0.00E+00	2.23E-02	0.00E+00	1.50E-03	
3. Percent of Applicable Limit, %	N/A	N/A	N/A	N/A	
B. Iodine					
1. Total Iodine-131 Released, Ci	0.00E+00	1.84E-06	1.87E-05	2.11E-05	1.00E+01
2. Average Release Rate, µCi/sec	0.00E+00	2.34E-07	2.35E-06	2.65E-06	
3. Percent of Applicable Limit, %	N/A	N/A	N/A	N/A	
C. Particulates with Half-Lives > 8 days					
1. Total Released, Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E+01
2. Average Release Rate, µCi/sec	0.00E+00	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	4.31E-07	1.16E-07	6.43E-08	6.04E-07	1.00E+01
E. Tritium					
1. Total Released, Ci	3.73E-01	2.17E+00	0.00E+00	0.00E+00	1.00E+01
2. Average Release Rate, µCi/sec	4.80E-02	2.76E-01	0.00E+00	0.00E+00	
3. Percent of Applicable Limit, %	N/A	N/A	N/A	N/A	
F. Carbon-14	4.58	1.84	4.72	3.81	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.

Table 5: Radioactive Gaseous Effluent Nuclide Composition

	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual Total
A. Fission and Activation Gases						
Tritium	Ci	3.73E-01	2.17E+00	<LLD	<LLD	2.54E+00
Argon-41	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Krypton-85m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Krypton-85	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kryton-87	Ci	<LLD	2.21E-02	<LLD	<LLD	2.21E-02
Krypton-88	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xenon-131m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xenon-133m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xenon-133	Ci	<LLD	5.44E-03	<LLD	<LLD	5.44E-03
Xenon-135m	Ci	<LLD	3.21E-02	<LLD	<LLD	3.21E-02
Xenon-135	Ci	<LLD	4.04E-02	<LLD	2.57E-03	4.30E-02
Xenon-137	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xenon-138	Ci	<LLD	7.54E-02	<LLD	9.34E-03	8.47E-02
Total for Period		**3.73E-01**	**2.35E+00**	**0.00E+00**	**1.19E-02**	**2.73E+00**
B. Iodine						
Iodine-131	Ci	<LLD	1.84E-06	1.87E-05	2.11E-05	4.16E-05
Iodine-132	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Iodine-133	Ci	<LLD	4.31E-06	2.70E-04	1.60E-04	4.34E-04
Iodine-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Iodine-135	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Total for Period		**0.00E+00**	**6.15E-06**	**2.88E-04**	**1.81E-04**	**4.76E-04**
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
Rubidium-88	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Rubidium-89	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Strontium-89	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Strontium-90	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Yttrium-91m	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-137	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cesium-138	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Barium-139	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Barium-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Lanthanum-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Total for Period		**<LLD**	**<LLD**	**<LLD**	**<LLD**	**<LLD**

<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 2011.

Table 6: Solid Waste Shipped Offsite for Burial or Disposal

A. Type of Solid Waste Shipped	Volume (m3)	Activity (Ci)	Period	Est. Total Error (%)
Spent resin, filter sludge, evaporator bottoms, etc.	7.36E+01	2.15 E+02	1/1/2011-12/31/2011	+/- 25
Dry compressible waste, contaminated equipment, etc.	1.09E+03	5.88 E+00	1/1/2011-12/31/2011	+/- 25
Irradiated components, control rods, etc.	0	0	1/1/2011-12/31/2011	
Other (Standby Liquid Control Waste Water)	0	0	1/1/2011-12/31/2011	

B. Estimate of Major(1) Nuclide Composition (by type of waste)	Radionuclide	Abundance (%)	Est. Total Error, (%)
Spent Resin, Filter Sludge, Evaporator Bottoms, etc.	Mn-54 Fe-55 Co-60 Zn-65	5.30 29.50 62.02 1.64	+/- 25
Dry Compressible Waste, Contaminated Equipment, etc.	Mn-54 Fe-55 Co-60 Zn-65	8.01 22.80 66.51 1.12	+/- 25
Irradiated Components, Control Rods, etc.	None	0	
Other (Standby Liquid Control Waste Water)	None	0	

C. Disposition	Number of Shipments	Mode of Transportation	Destination
Solid Waste(2)	16	Public Highway	Studsvik, Erwin, TN
Solid Waste(2)	27	Public Highway	Energy Solutions, Bear Creek, TN
Irradiated Fuel Shipments	0	N/A	N/A

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, 2011 through December 31, 2011, 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	2.59E-03	3.0E+00	8.6E-02
	Liver	3.37E-03	1.0E+01	3.4E-02
Noble Gas - gamma air	N/A	4.97E-04	1.0E+01	5.0E-03
Noble Gas - beta air	N/A	3.37E-04	2.0E+01	1.7E-03
Noble Gas	Whole body	2.75E-04	5.0E+00	5.5E-03
	Skin	5.74E-04	1.5E+01	3.8E-03
Particulate & Iodine	Thyroid	1.36E-03	1.5E+01	9.1E-04

The calculated hypothetical, maximum 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	4.2E-01
	Thyroid	2.6E-01
Gaseous Effluent	Whole body	3.7E-04
	Thyroid	6.1E-04

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	2.59E-03	3.0E+00	8.2E-02
	Liver	3.37E-03	1.0E+01	3.3E-02
Noble Gas - gamma air	N/A	3.49E-05	1.0E+01	3.5E-04
- beta air	N/A	2.51E-05	2.0E+01	1.3E-04
Noble Gas	Whole Body	2.68E-06	5.0E+00	5.7E-05
	Skin	5.23E-06	1.5E+01	3.7E-05
Particulate & Iodine	Thyroid	6.21 E-05	1.5E+01	3.4E-04
Carbon-14	Whole Body	1.60E-01	5.0E+00	3.2E+00

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 real 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	1.1E-04	1.3E-04
Second Quarter	9.3E-04	1.1E-03
Third Quarter	2.0E-04	2.3E-04
Fourth Quarter	3.3E-04	3.8E-04
Annual	1.6E-03	1.8E-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	1.4E-05	1.4E-05
Second Quarter	1.2E-04	1.6E-04
Third Quarter	2.2E-07	4.5E-05
Fourth Quarter	1.4E-06	9.4E-06
Annual	1.4E-04	2.1E-04

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	3.8E-05	1.5E-08
Second Quarter	7.1E-05	1.4E-07
Third Quarter	2.0E-05	4.6E-11
Fourth Quarter	4.2E-05	3.1E-10
Annual	1.8E-04	1.5E-07

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) is now requiring 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 Perry, 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.

Perry's 2011 Annual Environmental Effluent Release Report (ARERR) contains estimates of C-14 radioactivity released in 2011, and estimates of public dose resulting from the C-14 effluent. 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 Perry is not required. Refer to Table 4 and Table 9 for C-14 estimated release values.

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. Repair of NCC heat exchangers has reduced the leak rate to environment by about a factor of five. Repairs to isolate the source of reactor water leakage into the NCC system are planned for the PNPP 2013 refueling outage.

	QUARTER 1	QUARTER 2	QUARTER 3	QUARTER 4
A. Fission and Activation Products (Ci)				
NA24	3.91E-04	9.57E-05	2.68E-04	1.74E-04
CR51	5.47E-04	1.39E-04	2.19E-05	6.70E-05
MN54	1.86E-04	2.02E-04	7.59E-05	5.79E-05
MN56	1.20E-05	1.76E-06	1.81E-05	4.28E-06
FE59	5.92E-06	3.59E-06	1.08E-06	3.23E-06
CO58	7.56E-05	9.61E-05	4.12E-05	4.60E-05
CO60	6.09E-04	1.79E-03	7.56E-04	3.19E-04
ZN65	7.74E-06	1.80E-05	9.15E-06	1.62E-05
ZN69M	4.71E-07	<LLD	<LLD	<LLD
SR92	<LLD	2.57E-07	3.73E-06	<LLD
NB95	<LLD	4.71E-07	<LLD	<LLD
Y91M	<LLD	<LLD	4.41E-07	<LLD
TC99M	<LLD	5.05E-08	1.86E-07	<LLD
AG110M	<LLD	<LLD	<LLD	<LLD
SB124	<LLD	<LLD	<LLD	<LLD
SB125	<LLD	<LLD	<LLD	<LLD
CS137	8.75E-06	<LLD	<LLD	1.55E-08
AU199	2.09E-05	<LLD	5.32E-07	1.60E-06
B. Tritium	3.28E-02	5.49E-03	6.22E-03	4.69E-03
C. Dissolved and Entrained Gases (Ci)				
Xe-133	<LLD	<LLD	3.66E-06	<LLD
Xe-135	6.93E-07	6.10E-08	1.24E-06	<LLD
D. Gross Alpha Activity, (Ci)	<LLD	<LLD	<LLD	<LLD

APPENDIX F
ODCM NON-COMPLIANCES

APPENDIX F

ODCM NON-COMPLIANCES

Following an upgrade to the Unit 2 Plant Vent Effluent Monitor, the monitor was out of service for greater than 30 days; from 4/15/2012 to 6/01/2012. Delay in returning monitor to service was due to spiking. Troubleshooting identified source of spiking and condition was corrected. No further problems were experienced.

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.