Enclosure A
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PNPP 2008 Annual Environmental and Effluent Release Report

# 2008

# ANNUAL ENVIRONMENTAL AND EFFLUENT RELEASE REPORT

## for the Perry Nuclear Power Plant

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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, 2008. This report meets all of the requirements in PNPP Technical Specifications, 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 2008, 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 2.21E-3 mrem (0.08 % of the applicable limit). The calculated hypothetical maximum individual whole body dose potentially received by an individual resulting from PNPP gaseous effluents was 1.54E-8 mrem (<0.0000003% of the applicable limit). The summation of the hypothetical maximum individual dose from effluents in 2008 is equivalent to < 0.1 % of the total dose an individual living in the PNPP area receives from all sources of 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 2008, making shipments of solid radioactive waste to a licensed burial site.

An additional section was added this year which covers the groundwater monitoring program. It includes a brief history of groundwater tritium issues at the Perry Plant, 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.

There were over 2900 radioactivity analyses performed on the 1280 radiological environmental samples collected in 2008. The results of the REMP indicate the adequacy of the control of the release of radioactivity in the effluents from PNPP. 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.

Samples of air were collected to monitor the radioactivity in the atmosphere. The 2008 results were similar to those observed for the pre-operational and operational programs from prior years. Only natural background environmental radioactivity was detected.

Terrestrial monitoring included the analysis of milk and produce. The PNPP ODCM does not require vegetation or soil samples to be included in the monitoring program. The results of the sample analyses in 2008 indicated concentrations of radioactivity similar to that found in previous years. Analyses of other terrestrial samples also detected concentrations of 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 2008 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 five (5) of the twelve (12) samples collected. The average cesium-137 radioactivity for all locations was 433.16 pCi/kg and is within the maximum 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. During 2008, enhanced monitoring activities continued within the boundaries of the impoundment. 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 17 for detailed sample results.

Direct radiation measurements showed no change from previous years. The indicator locations averaged 59.55 mrem/year and control locations averaged 57.01 mrem/year. In 2008, 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 2008, 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 every public road 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 sixteen meteorological sectors. 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. 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 Radiological Environmental Monitoring Program (REMP). For 2008, the predominant land use within the census area continues to be rural/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 in the vicinity of 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., Ohio Environmental Protection Agency (OEPA) discharge limits], and changes in plant design or operation that affect the environment are reported to regulatory agencies as they occur.

No special reports were submitted in 2008.

# 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].

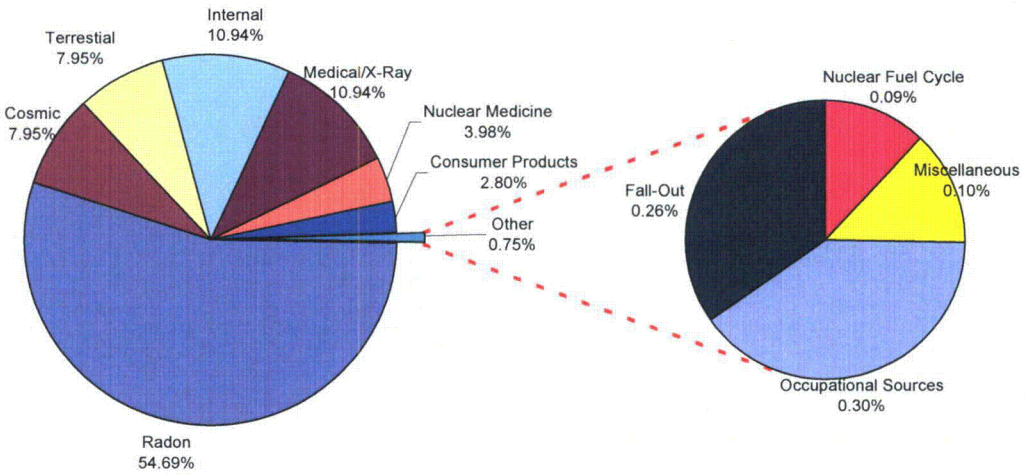



**Figure 1: Sources of Background Radiation**

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 2008 Sampling Program results. These radionuclides are included; however, in Appendix A, 2008 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 in the next section.

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 2008.

The 40CFR190 limit for total direct-radiation dose is 25 mrem. For 2008, the total whole body dose to a member of the general public, considering all sectors, was 6.70E-1 mrem. This value was determined by summing the annual whole body doses from liquid and gaseous radioactive effluents, the annual gaseous and liquid organ dose (refer to Table 8) and the maximum, direct-radiation dose. Since the direct radiation dose, as determined by TLD, was indistinguishable from natural background (refer to 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 reference 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 2008.

### Table 1: Liquid Batch Releases

| | QUARTER 1 | QUARTER 2 | QUARTER 3 | QUARTER 4 | ANNUAL TOTAL |
|---|---|---|---|---|---|
| Number of batch releases | 1 | 2 | 4 | 26 | 33 |
| Total time period for batch releases, min | 2.18E+02 | 4.34E+02 | 1.15E+03 | 9.77E+03 | 1.16E+04 |
| Maximum time for a batch release, min | 2.18E+02 | 2.20E+02 | 3.74E+02 | 6.06E+02 | 6.06E+02 |
| Average time period for a batch release, min | 2.18E+02 | 2.17E+02 | 2.88E+02 | 3.76E+02 | 3.51E+02 |
| Minimum time for a batch release, min | 2.18E+02 | 2.14E+02 | 2.49E+02 | 3.00E+00 | 3.00E+00 |
| Average stream flow during periods of effluent release into a flowing stream, L/min | 1.78E+05 | 2.51E+05 | 2.19E+05 | 1.42E+05 | 1.98E+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) | 0.00E+00 | 0.00E+00 | 7.68E-04 | 1.39E-02 | 1.00E+01 |
| 2. Average Diluted Concentration, µCi/mL * | 0.00E+00 | 0.00E+00 | 1.97E-11 | 7.02E-10 | |
| 3. Percent of Applicable Limit, % | N/A | N/A | N/A | N/A | |
| B. Tritium | | | | | |
| 1. Total Released, Ci | 2.86E-01 | 1.40E+00 | 4.25E+00 | 1.48E+01 | 1.00E+01 |
| 2. Average Diluted Concentration, µCi/mL | 1.00E-08 | 3.88E-08 | 1.09E-07 | 7.47E-07 | |
| 3. Percent of Applicable Limit, % | 1.00E-03 | 3.88E-03 | 1.09E-02 | 7.47E-02 | |
| C. Dissolved and Entrained Gases | | | | | |
| 1. Total Released, Ci | <LLD | <LLD | <LLD | <LLD | 1.00E+01 |
| 2. Average Diluted Concentration, µCi/mL | <LLD | <LLD | <LLD | <LLD | |
| 3. Percent of Applicable Limit, % | N/A | N/A | N/A | N/A | |
| D. Gross Alpha Activity, Ci | <LLD | <LLD | <LLD | <LLD | 1.00E+01 |
| E. Waste Volume Released, Liters (prior to dilution) | 1.30E+05 | 1.54E+06 | 5.22E+06 | 4.07E+06 | 1.00E+01 |
| F. Dilution Water Volume Used, Liters | 2.83E+10 | 3.61E+10 | 3.89E+10 | 1.98E+10 | 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.*
**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) | 0.00E+00 | 0.00E+00 | 7.68E-04 | 1.39E-02 | 1.00E+01 |
| B. Tritium | | | | | |
| Total Released, Ci | 2.84E-01 | 1.40E+00 | 4.24E+00 | 1.48E+01 | 1.00E+01 |
| C. Dissolved and Entrained Gases | | | | | |
| Total Released, Ci | <LLD | <LLD | <LLD | <LLD | 1.00E+01 |
| D. Gross Alpha Activity, Ci | <LLD | <LLD | <LLD | <LLD | 1.00E+01 |
| E. Waste Volume Released, Liters (prior to dilution) | 1.30E+05 | 2.57E+05 | 2.60E+05 | 3.02E+06 | 1.00E+01 |

*<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 | <LLD | 1.00E+01 |
| B. Tritium | | | | | |
| Total Released, Ci | 2.26E-03 | 4.29E-05 | 9.62E-03 | 2.91E-03 | 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) | 1.30E+05 | 1.28E+06 | 4.96E+06 | 1.05E+06 | 1.00E+01 |

*<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 - Batch**

| | UNIT | QUARTER 1 | QUARTER 2 | QUARTER 3 | QUARTER 4 | ANNUAL TOTAL |
|---|---|---|---|---|---|---|
| Tritium | Ci | 2.84E-01 | 1.40E+00 | 4.24E+00 | 1.48E+01 | 2.07E+01 |
| Chromium-51 | Ci | <LLD | <LLD | <LLD | 7.45E-05 | 7.45E-05 |
| Manganese-54 | Ci | <LLD | <LLD | 3.98E-05 | 1.13E-03 | 1.17E-03 |
| Iron-55 | 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 | 7.29E-04 | 1.23E-02 | 1.30E-02 |
| Zinc-65 | Ci | <LLD | <LLD | <LLD | <LLD | <LLD |
| 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 | <LLD | <LLD | <LLD | <LLD |
| Antimony-124 | Ci | <LLD | <LLD | <LLD | <LLD | <LLD |
| Antimony-125 | Ci | <LLD | <LLD | <LLD | <LLD | <LLD |
| Iodine-131 | Ci | <LLD | <LLD | <LLD | <LLD | <LLD |
| Xenon-133 | Ci | <LLD | <LLD | <LLD | <LLD | <LLD |
| Cesium-134 | Ci | <LLD | <LLD | <LLD | <LLD | <LLD |
| Cesium-137 | Ci | <LLD | <LLD | <LLD | <LLD | <LLD |
| 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** | **Ci** | **2.84E-01** | **1.40E+00** | **4.24E+00** | **1.48E+01** | **2.07E+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 well below regulatory limits. Samples are also collected and analyzed on a routine 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.

**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 | 1.38E-01 | 2.22E+00 | 1.87E-02 | 1.00E+01 |
| 2. Average Release Rate, µCi/sec | 0.00E+00 | 1.76E-02 | 2.79E-01 | 2.36E-03 | |
| 3. Percent of Applicable Limit, % | N/A | N/A | N/A | N/A | |
| B. Iodine | | | | | |
| 1. Total Iodine-131 Released, Ci | < LLD | < LLD | < LLD | < LLD | 1.00E+01 |
| 2. Average Release Rate, µCi/sec | N/A | N/A | N/A | N/A | |
| 3. Percent of Applicable Limit, % | N/A | N/A | N/A | N/A | |
| C. Particulates with Half-Lives > 8 days | | | | | |
| 1. Total Released, Ci | < LLD | < LLD | 2.68E-07 | 1.55E-05 | 1.00E+01 |
| 2. Average Release Rate, µCi/sec | N/A | < LLD | 3.37E-08 | 1.95E-06 | |
| 3. Percent of Applicable Limit, % | N/A | N/A | N/A | N/A | |
| D. Alpha Activity, Ci | 6.33E-07 | 3.28E-07 | 5.22E-08 | 4.16E-07 | |
| E. Tritium | | | | | |
| 1. Total Released, Ci | < LLD | < LLD | < LLD | < LLD | 1.00E+01 |
| 2. Average Release Rate, µCi/sec | N/A | N/A | N/A | N/A | |
| 3. Percent of ODCM Limit, % | N/A | N/A | N/A | N/A | |

*<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 | <LLD | <LLD | <LLD | <LLD | <LLD |
| 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 | <LLD | <LLD | <LLD | <LLD |
| 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 | 2.28E-02 | <LLD | <LLD | 2.28E-02 |
| Xenon-135m | Ci | <LLD | 6.15E-02 | <LLD | <LLD | 6.15E-02 |
| Xenon-135 | Ci | <LLD | 5.42E-02 | 2.22E+00 | 1.87E-02 | 2.29E+00 |
| Xenon-137 | Ci | <LLD | <LLD | <LLD | <LLD | <LLD |
| Xenon-138 | Ci | <LLD | <LLD | <LLD | <LLD | <LLD |
| **Total for Period** | **Ci** | **<LLD** | **1.39E-01** | **2.22E+00** | **1.87E-02** | **2.38E+00** |
| **B. IODINE** | | | | | | |
| Iodine-131 | Ci | <LLD | <LLD | <LLD | <LLD | <LLD |
| Iodine-132 | Ci | <LLD | <LLD | <LLD | <LLD | <LLD |
| Iodine-133 | Ci | <LLD | <LLD | <LLD | <LLD | <LLD |
| Iodine-134 | Ci | <LLD | <LLD | <LLD | <LLD | <LLD |
| Iodine-135 | Ci | <LLD | <LLD | <LLD | <LLD | <LLD |
| **Total for Period** | **Ci** | **<LLD** | **<LLD** | **<LLD** | **<LLD** | **<LLD** |
| **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 | 2.68E-07 | 1.55E-05 | 1.58E-05 |
| Strontium-90 | Ci | <LLD | <LLD | <LLD | <LLD | <LLD |
| Strontium-91 | 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** | **Ci** | **<LLD** | **<LLD** | **2.68E-07** | **1.55E-05** | **1.58E-05** |

*<LLD – Less than the lower limit of detection*

**Solid Waste**

There was 1 shipment of PNPP solid radioactive waste transported, by truck, directly to the Barnwell, South Carolina disposal facility for burial. Other 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 the Barnwell, South Carolina, or Clive, Utah, disposal facilities for burial. The solid radioactive waste summary in Table 6 includes all PNPP shipments for 2008.

**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. | 6.57E+1 | 1.42E+3 | 1/1/2008-12/31/2008 | +/- 25 |
| Dry compressible waste, contaminated equipment, etc. | 8.90E+2 | 9.93E-1 | 1/1/2008-12/31/2008 | +/- 25 |
| Irradiated components, control rods, etc. | 1.61E-1 | 4.29E+3 | 1/1/2008-12/31/2008 | +/- 25 |
| Other (Standby Liquid Control Waste Water) | 1.46E+1 | 6.44E-1 | 1/1/2008-12/31/2008 | +/- 25 |

| 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 | 4.9 | +/- 25 |
| | Fe-55 | 58.7 | |
| | Zn-65 | 2.4 | |
| | Co-60 | 32.5 | |
| Dry Compressible Waste, Contaminated Equipment, etc. | Mn-54 | 3.1 | +/- 25 |
| | Fe-55 | 72.9 | |
| | Co-60 | 22.8 | |
| Irradiated Components, Control Rods, etc. | Fe-55 | 6.2 | +/- 25 |
| | Co-60 | 27.5 | |
| | Ni-63 | 4.3 | |
| | Zr-95 | 13.7 | |
| | Nb-95 | 14.1 | |
| | Sn-119m | 19.7 | |
| | Sb-125 | 12.5 | |
| | Te-125m | 1.3 | |
| Other (Standby Liquid Control Waste Water) | Mn-54 | 3.8 | +/- 25 |
| | Fe-55 | 23.6 | |
| | Co-58 | 3.9 | |
| | Co-60 | 30.7 | |
| | Zn-65 | 35.5 | |
| | Ce-144 | 1.1 | |

| C. DISPOSITION | NUMBER OF SHIPMENTS | MODE OF TRANSPORTATION | DESTINATION |
|---|---|---|---|
| Solid Waste(2) | 20 | Public Highway | Studsvik, Erwin, TN |
| Solid Waste(2) | 18 | Public Highway | Duratek, Oak Ridge, TN |
| Solid Waste | 1 | Public Highway | Barnwell, Barnwell, S.C. |
| 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 Barnwell, SC or 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, 2008 through December 31, 2008, the report substantiates the quality and quantity of meteorological date 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 | 3.57E-03 | 3.0E+00 | 1.2E-01 |
| | Liver | 4.73E-03 | 1.0E+01 | 4.7E-02 |
| Noble Gas - gamma air | N/A | 1.40E-03 | 1.0E+01 | 1.4E-02 |
| - beta air | N/A | 1.79E-03 | 2.0E+01 | 9.0E-03 |
| Noble Gas | Whole body | 9.10E-04 | 5.0E+00 | 1.8E-02 |
| | Skin | 2.40E-03 | 1.5E+01 | 1.6E-02 |
| Particulate & Iodine | Thyroid | 5.83E-05 | 1.5E+01 | 3.9E-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 | 6.70E-01 |
| | Thyroid | 4.60E-01 |
| Gaseous Effluent | Whole body | ~1.10E-04 |
| | Thyroid | 1.10E-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 | 2.21E-03 | 3.0E+00 | 7.4E-02 |
| | Liver | 3.15E-03 | 1.0E+01 | 3.2E-02 |
| Noble Gas - gamma air | N/A | 2.78E-08 | 1.0E+01 | 2.8E-07 |
| - beta air | N/A | 3.56E-08 | 2.00E+01 | 1.8E-07 |
| Noble Gas | Whole body | 1.54E-08 | 5.0E+00 | 3.1E-07 |
| | Skin | 4.05E-08 | 1.5E+01 | 2.7E-07 |
| Particulate & Iodine | Thyroid | 5.26E-05 | 1.5E+01 | 3.5E-04 |

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 | 0.0E+0 | 0.0E+0 |
| Second Quarter | 0.0E+0 | 0.0E+0 |
| Third Quarter | 2.5E-5 | 2.9E-5 |
| Fourth Quarter | 6.9E-4 | 8.1E-4 |
| Annual | 7.2E-4 | 8.4E-4 |

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 | 0.0E+0 | 0.0E+0 |
| Second Quarter | 6.6E-6 | 1.3E-5 |
| Third Quarter | 9.5E-5 | 2.5E-4 |
| Fourth Quarter | 6.2E-6 | 1.6E-5 |
| Annual | 9.8E-5 | 2.6E-4 |

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 (2,420,000 people). The dose from liquid radiological effluents is determined for the population that receives drinking water from intakes within 50 miles of PNPP (1,820,000 people). 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 | 6.2E-10 | 0.0E+0 |
| Second Quarter | 2.6E-9 | 5.4E-13 |
| Third Quarter | 1.0E-7 | 4.1E-11 |
| Fourth Quarter | 1.7E-7 | 7.4E-14 |
| Annual | 2.8E-7 | 4.5E-11 |

## ON-SITE GROUNDWATER MONITORING PROGRAM

### Introduction

*History*

In March, 2006, a routine sample of the underdrain system at the Perry plant showed detectable tritium concentration. 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. A 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, (area encompassing equipment utilized for the generation of electricity) were sampled and analyzed. In 2007, Perry 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-LP-2012, "Groundwater Monitoring."

*Cause*

The buildings at the Perry 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 Spent Fuel 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 23.

**Sampling Locations**

Prior to the installation of monitoring wells, Manholes 20 and 23 were sampled to assess groundwater tritium in-leakage to the system. This continued through July 2007, and sampling frequency was established at weekly thereafter. 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.

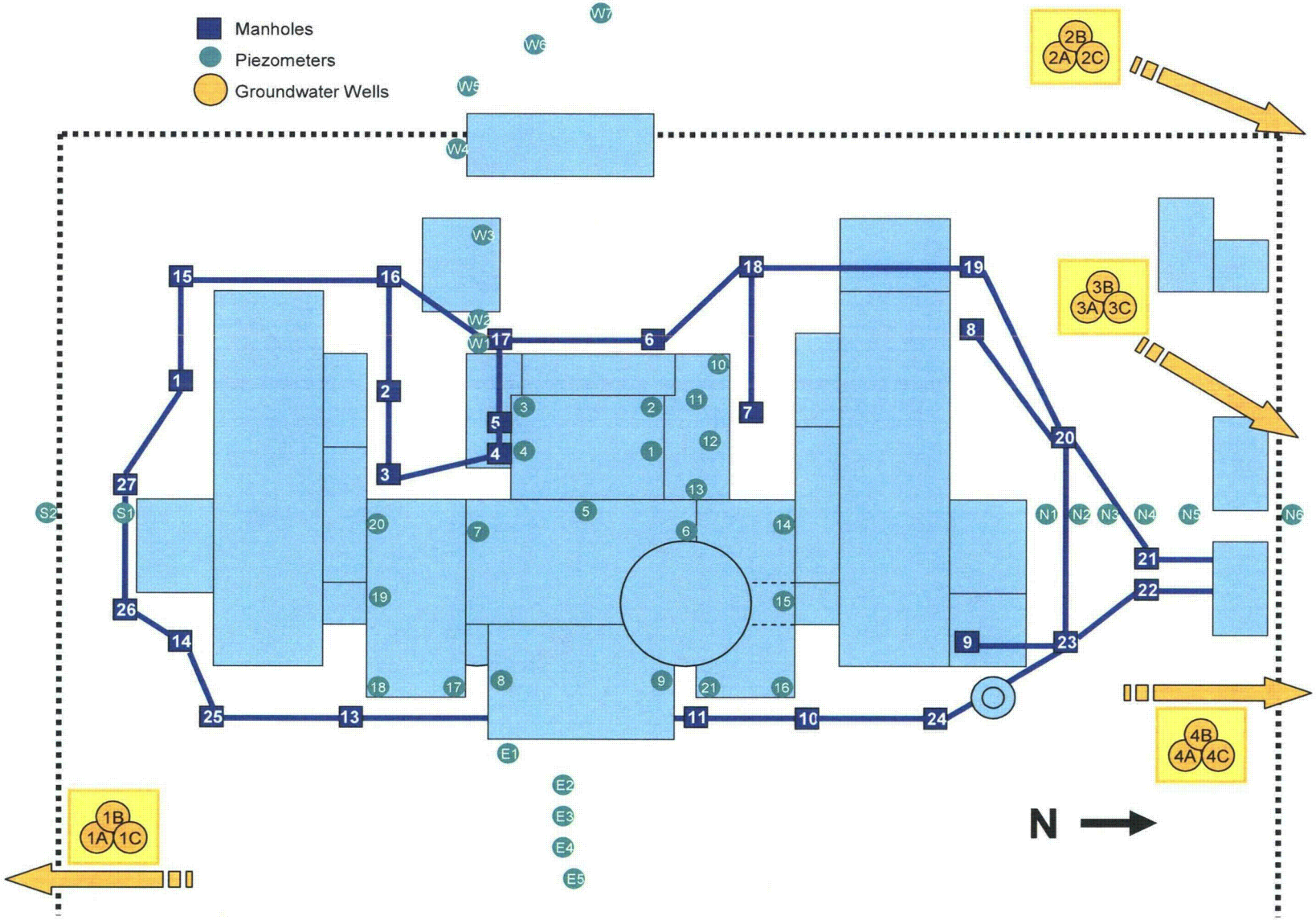
Manholes 20 and 23 were sampled daily through the middle of 2007, and weekly thereafter through the end of the year. Tritium releases from the station were documented as abnormal releases, and the required dose calculations were completed per the Offsite Dose Calculation Manual (ODCM). Overall, the released 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. Selected plant piezometers are also sampled.

The samples are analyzed for shipping purposes, and are then shipped to Midwest Laboratories in Illinois. Midwest analyzes the sample for gamma isotopic and tritium. On alternate samples, Perry has also requested analysis of "hard-to-detect" isotopes such as Sr-89/90. Ni-63 and Fe-55.

**Sample Analysis**

The May 2008 sample set showed no detectable tritium or gamma isotopic activity at any of the 12 installed monitoring wells. The November 2008 sample set showed no gamma activity and tritium activity was barely over the LLD for one well site at 229 pCi/liter. Analyses for the hard-to-detect nuclides were negative, nothing detected.

*Significant Items*

A fleet level procedure was implemented for notifications in the event that detectable tritium reaches 10% of the EPA-mandated trigger level of 20,000 pCi/liter. This formalized the protocol for any groundwater contamination issues.

A fleet self-assessment was conducted to verify alignment with NEI 07-07, the Groundwater Protection Initiative. There were minor items noted, but no substantial shortfalls in compliance with the NEI document.

**Table 13: Summary of Onsite Groundwater Samples**

| | H-3 MAX. (PCI/L) | H-3 MIN. (PCI/L) | H-3 AVG. (PCI/L) | TYPICAL H-3 LLD (PCI/L) | REQUIRED H-3 LLD (PCI/L) | PRE-OPERATIONAL (DEVELOPED) MEAN FOR H-3 (PCI/L) | H-3 ANALYSES > PRE-OPERATIONAL MEAN FOR H-3? | NEI AND FENOC LEVEL FOR H-3 (PCI/L) | EPA REPORTING LEVEL FOR H-3 (PCI/L) |
|---|---|---|---|---|---|---|---|---|---|
| First Half 2008 | N/A | N/A | N/A | < 200 | < 2000 | 400 | No | 2000 | 20000 |
| Second Half 2008 | 229 | N/A | N/A | < 200 | < 2000 | 400 | No | 2000 | 20000 |

## ABNORMAL RELEASES

There were two abnormal radioactive release events during 2008. On December 8, and December 28, 2008, routine analysis of the particulate filters from the Waste Abatement and Reclamation Facility (WARF) identified gross alpha presence. There was no work in progress at the WARF which could have produced alpha contamination. The alpha could potentially been due to radon daughters from naturally-occurring background radiation. Based on the ventilation flow, this would have equated to a release of 2.59E-09 curies.

## NON-COMPLIANCES

There was one non-compliance to the ODCM Controls requirements in 2008.

**The Service Water Flow Monitor was inoperable greater than 30 days. Total days inoperable (71) days.**

The Service Water Flow Monitor, (OP41-N0443) was declared inoperable on 6/30/08 due to failed channel check. Troubleshooting the Service Water flow monitor it was found to have a defective and obsolete sensor with no parts replacement available. A new replacement flow monitor (Millenium LL-1101) was ordered with an Ultrasonic sensor. The new instrumentation was installed and the Service Water Flow Monitor was returned to service on 9/9/2008.

## OFFSITE DOSE CALCULATION MANUAL CHANGES

During this reporting period, there were three (3) revisions to the Offsite Dose Calculation Manual. The descriptions of the particular revisions are listed below:

**Rev. 15 -**

1. Corrected erroneous MPL designation for Combustible Gas Control System in Table 4.11.2.1.2-1 Item A.
2. Established Action Note 124 to provide more frequent monitoring if P680 annunciator is locked in, potentially masking other alarms.
3. Revised wording in Table 5.1.1.4b to provide for sampling of more than one species of fish / invertebrates.
4. Revised Table of data for Figures 5.1-1, 5.1-2 and 5.1-3 to reflect new location [72] based on 2008 Land Use Census.
5. Revised Figure 5.1-2 to add point 72 per the 2008 Land Use Census.

**Rev. 16 -**

1. Revised Table of data on page 84 in its entirety to reflect only ODCM-required sample locations and media; removed Kanda Garden from list {no longer sampling), removed inclusions from Land Use Census which were not required by the ODCM (16, 22, 26, 27, 41, 51, 61, 63, 64, 65, 72). Removed footnote (3) from table.
2. Revised Figures 5.1-1 and 5.1-2 in their entirety to reflect only ODCM-required sample locations; removed references for locations from the Land Use Census which were not required by the ODCM. Included mileage bars.
3. Removed legacy change bars from Table 5.1-1 Note 6, Figure 5.1-1 and Figure 5.1-3.
4. Made changes to address concerns listed in CA 08-46049-003.

**Rev. 17 -**

1. Added reference to Section 2.1.1.3 for the low-flow discharge header flow valve which had been erroneously removed in revisions 9 and 13 to CHI-ODCM.
2. Added reference to Kanda garden in REMP sample locations on page 84 and Figure 5.1-1.

## PROCESS CONTROL PROGRAM CHANGES

During this reporting period, there were no (0) 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 wide variety of samples are collected as part of the PNPP REMP. The selection of sample types, sampling locations, and sample 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 considered.

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.

The REMP began in 1981 with 24 direct radiation monitoring locations, four sediment locations, and two fish sampling locations. In 1982, collections of air, water, milk, food products, and feed/silage were added. Vegetation, precipitation and soil were added in 1985. Although the NRC did not require these last three media, they were incorporated into the program to establish baseline data. In 1993, feed/silage sampling was dropped from the program, based on ten years worth of data. For the same reason, strontium analyses were deleted from the program in 1994, gross beta and tritium were deleted from precipitation analyses in 1995, and precipitation sampling was deleted entirely in 1996. In 1999, grass and soil sampling were dropped from the 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 below. 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. | 0.8 | S | Food Products |
| **20** | **Rainbow Farms** | **1.9** | **E** | **Food Products** |
| **21** | **Hardy Rd.** | **5.1** | **WSW** | **TLD** |
| 22 | Corfias Farm (goat) | 4.9 | S | Milk |
| **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 |
| 61 | Keller Milk Farm (goat) | 7.4 | SE | Milk |
| 63 | Minor Stream Mouth | 0.08 | NNE | Sediment |
| 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) chronologically 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**

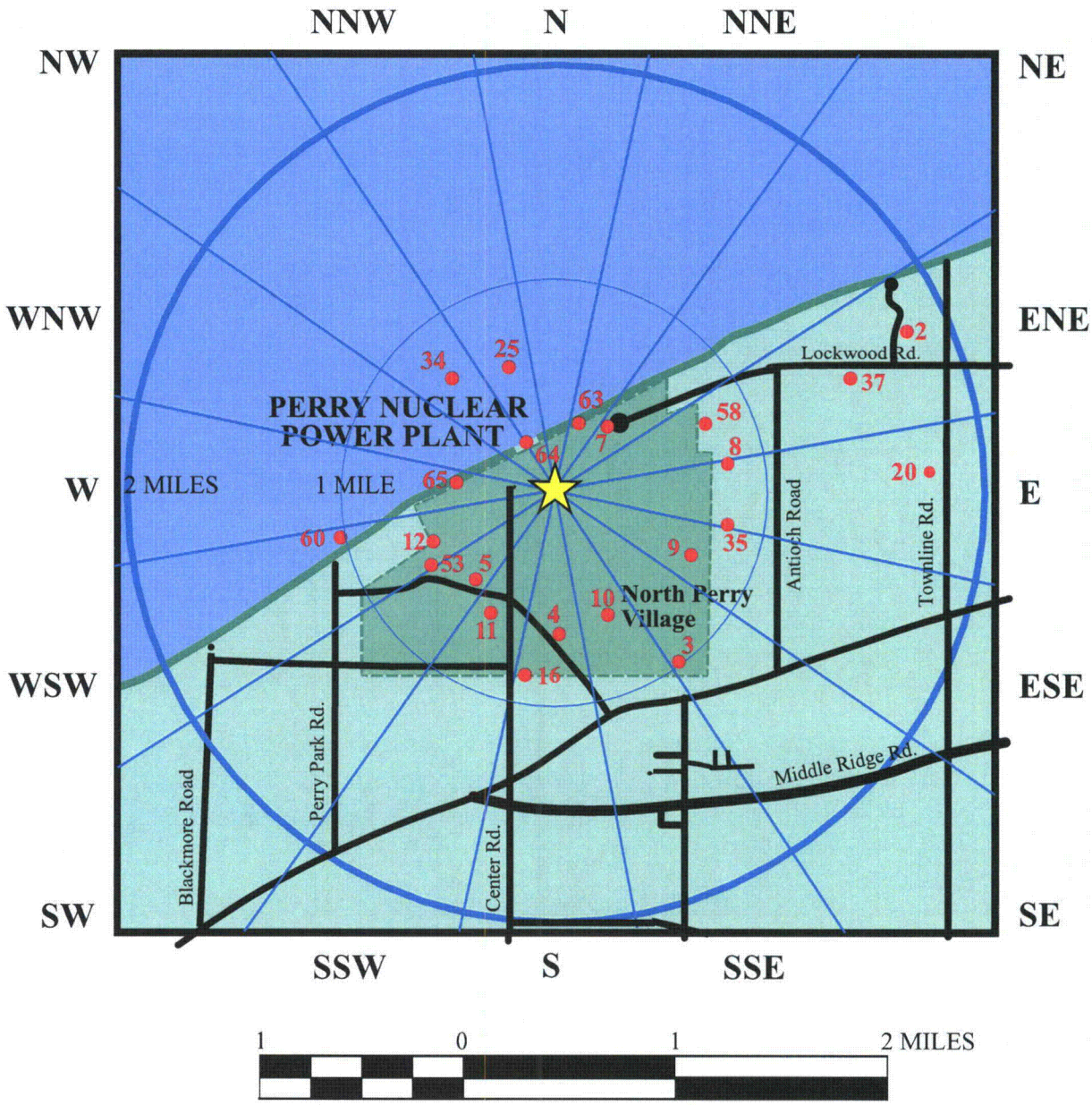


**Figure 4: REMP Sampling Locations Between Two and Eight Miles of the Plant Site**

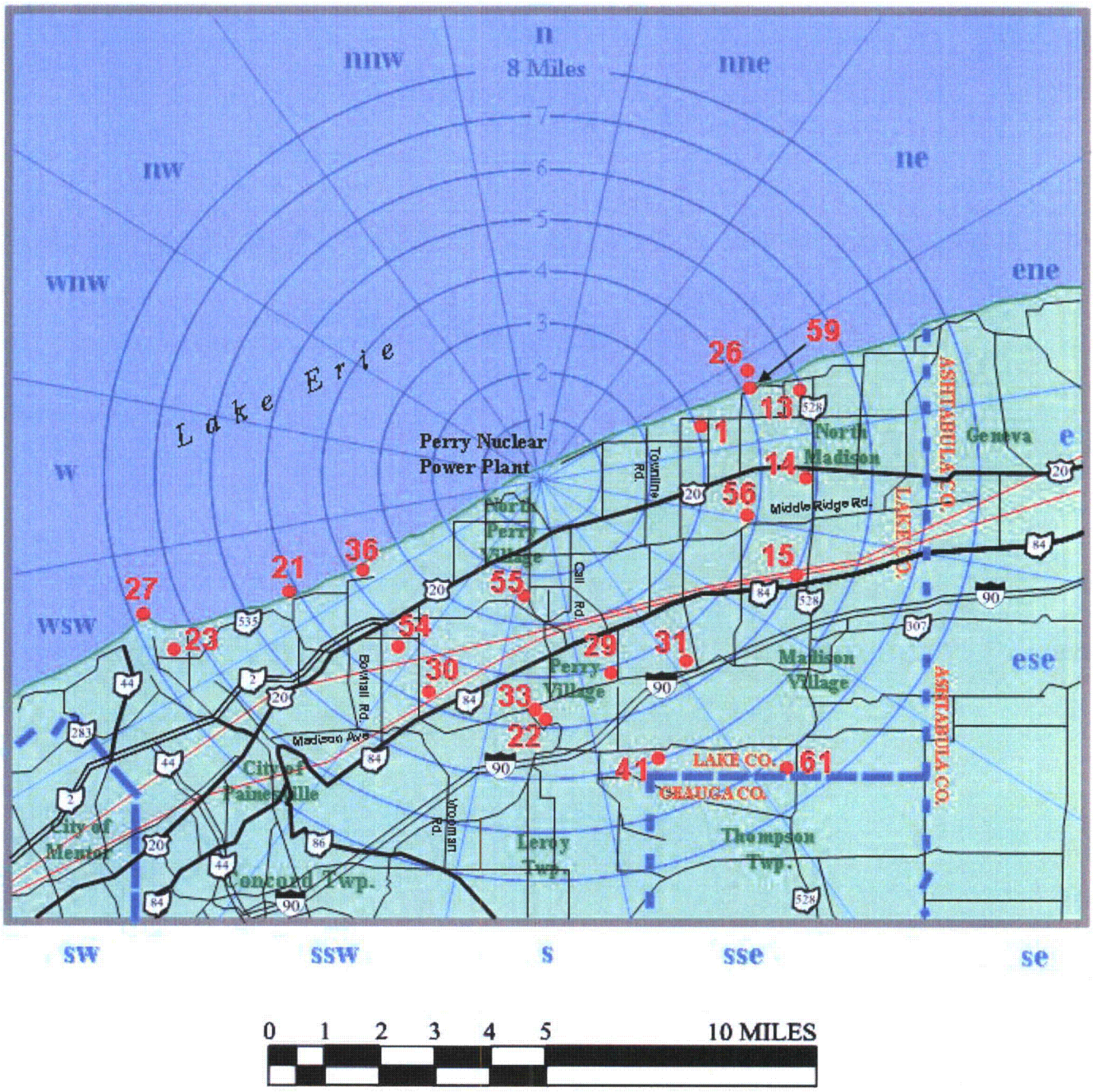


**Figure 5: REMP Sampling Locations Greater Than Eight Miles from the Plant Site**

## 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 much 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 an excellent 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 2008.

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 2008.

**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 |

## 2008 SAMPLING PROGRAM

The contribution of radionuclides to the environment resulting from PNPP operation is assessed by comparing results from the 2008 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, 2008 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 2008.

### Program Changes

The Corfias Farm (milk location 22), did not participate during all of 2008 and subsequently was dropped from the program.

### 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 cannot 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 sand or bluff erosion and shoreline collapse. Table 16 provides information on samples missed during 2008.

**Table 16: Missed REMP Samples in 2008**

| MEDIA | LOCATION | DATE | REASON |
|---|---|---|---|
| Air Samples | N/A | N/A | N/A |
| Food Products | All | April, May, Nov. 2008 | Insufficient growth caused by lower than normal spring temperatures. Die-off/frost damage in the fall. |
| | 16, 37, 70 | June | Insufficient growth |
| Lake Water | 59, 60 | Jan., Feb., Mar., Dec. 2008 | Sample unavailable due to frozen shoreline |
| Milk | 22 | Year 2008 | Not participating/dropped from the program |
| | 41, 61 | Jan, Feb., Mar., Nov., & Dec. 2008 | Drying period for goats/sample availability |
| Sediment | 63 | June and September 2008 | Bluff collapse/shoreline erosion. Location inaccessible |

**Atmospheric Monitoring**

*Air*

Air sampling is conducted to detect any increase in the concentration of airborne radionuclides. The PNPP ODCM requires five locations (four indicators and one control). 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 seven air sampling stations. 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.

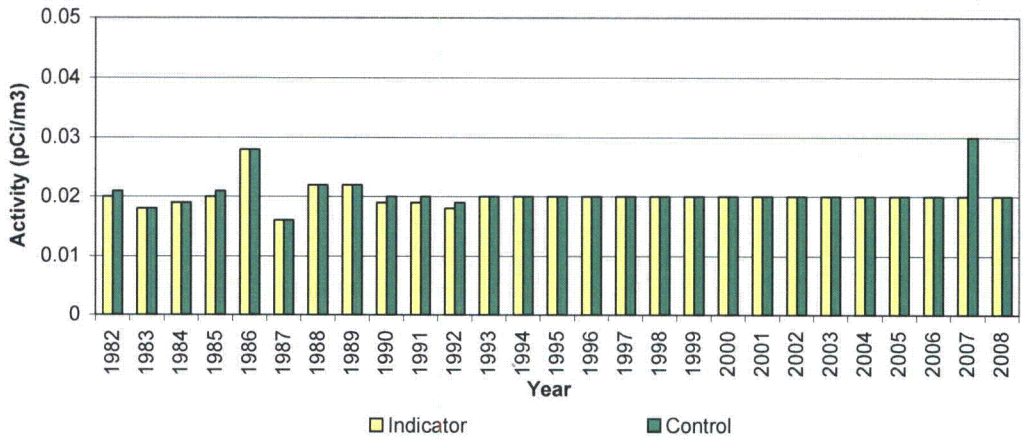
On occasion, air sample locations can experience power losses associated with storms and/or malfunctioning equipment. On 1/23/08, ODCM location #1 was found not running during the weekly sample collection. It was determined that the sample pump had stopped mid-week due to an electrical short within the pump's wiring. The sample and available data was collected, the pump replaced the same day and the sampler returned to service. No sample was lost due to this malfunction. Adequate sample was obtained for laboratory analysis. Condition report 08-34109 was generated for documentation purposes.

Air samples are analyzed weekly for gross beta activity and radioiodine activity. The air samples are also analyzed by gamma spectral analysis quarterly. A total of 364 air particulate and 364 air radioiodine samples were collected and analyzed in 2008.

Gross beta activity was detected in 363 of 364 air samples and ranged up to 0.06 pCi/m$^3$. The average gross beta activity at both indicator and control locations was 0.02 pCi/m$^3$ for 2008. 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 2008 and the previous years.

Except for naturally occurring beryllium-7, no radionuclides were identified in the gamma spectral analysis above the LLD values. Iodine-131 was not detected in any sample above the LLD of 0.05 pCi/m$^3$.

**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. The PNPP ODCM requires neither vegetation nor soil samples.

*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. For 2008 the PNPP REMP included three (3) milk locations located 5.8, 7.4 and 9.6 miles away from the plant. Location 22, 4.9 miles away from the plant in the South sector did not participate again in 2008. Subsequently, they were dropped from the program at the end of the 2008 season. Since the milk sampling locations do not meet the requirements of the ODCM (no milk-producing animals located within the required areas), food product sampling (discussed below) was performed. Milk is collected from the available locations, even though they do not meet the ODCM requirements. 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 forty six (46) milk samples were collected in 2008. Iodine was not detected in any of the samples above the LLD of 0.75 pCi/ L. The concentrations of all radionuclides, except naturally occurring potassium-40, were below LLDs in all samples collected.

*Food Products*

Food products can provide a direct pathway to humans by ingestion. They can absorb radionuclides from atmospheric deposition on soil or from irrigation water drawn from a lake or pond receiving airborne or liquid effluents. Also, radionuclides in the soil may be absorbed by the roots of the plants and become incorporated into the edible portions. Because there is not a sufficient number of dependable milk sampling locations, the PNPP REMP is required to include two food product indicator locations and one control location. Food products are collected monthly during the growing

season from five gardens in the vicinity of PNPP. The control location for food products is 16.2 miles from PNPP.

A total of fifty two (52) food product samples were collected and analyzed by gamma spectral analysis in 2008. Limiting factors for the 2008 growing season included unseasonably cold spring and fall temperatures accounting for the missed samples referenced in Table 16. Four (4)) food products were collected which included: beet greens, collard greens, turnip greens and swiss chard. Beryllium-7 and potassium-40, naturally-occurring radionuclides, were found in several samples, as 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.

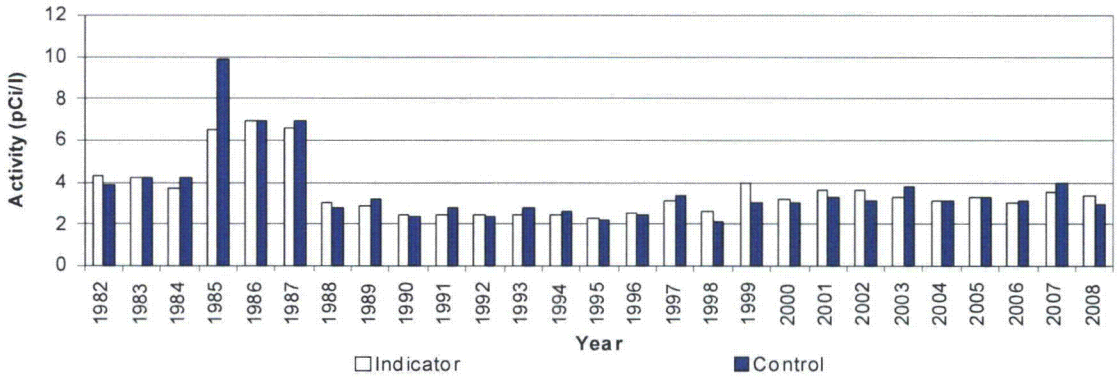
*Water*

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

Fifty-two (52) water samples were collected and analyzed for gross beta activity and gamma spectral analysis in 2008. From these monthly samples, a quarterly composite sample was obtained and analyzed for tritium activity. Refer to Table 16 for an explanation of any missed samples.

Gross beta activity was detected in three (3) of the fifty-two (52) samples collected. For 2008, the detectable gross beta activity was 3.39 pCi/L vs. the lab LLD value of 3.00 pCi/L. Refer to Figure 7 for the annual average gross beta activity for both indicator and control locations. The significant difference between the pre-1988 data and post-1988 data has been attributed to a change in vendor laboratories in 1987/1988. A comprehensive explanation for the observed difference is provided in the 1988 Annual Environmental Operating Report.

**Figure 7: Annual Average Gross Beta Activity, in Water**



There were no radionuclides detected by gamma spectral analysis above the LLD. Tritium was not detected above the LLD value in any of the eighteen (18) samples analyzed. These results are well within the range of those measured in previous years, which have ranged from below the LLD to 2,200 pCi/L.

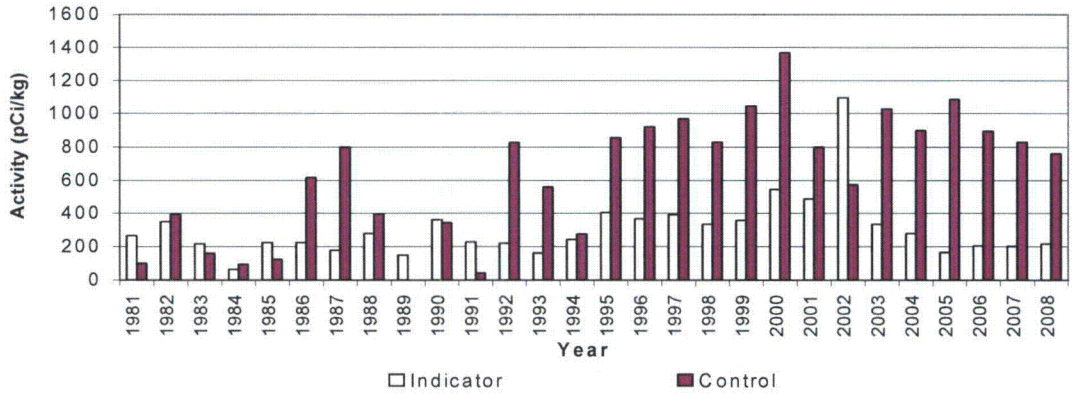
*Sediment*

Sampling lake bottom sediments can provide an indication of the accumulation of particulate radionuclides which may lead to internal exposure to humans through the ingestion of fish, the re-suspension into drinking water, or as an external radiation source to fishermen and swimmers from shoreline exposure. Although the PNPP ODCM requires only one location, sediment is sampled twice each year from seven (7) locations. Two (2) of the sampling locations are also fish sampling 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 2008 and analyzed by gamma spectroscopy. Beginning in 2006, access to sample location 63 was prevented due to ongoing shoreline erosion which resulted in a bluff collapse. No samples were collected for this location. Shoreline erosion continues to prevent safe access. The predominant radionuclide detected by gamma spectral analysis was naturally-occurring potassium-40. Potassium-40 has been detected in all samples, since the program began in 1981.

Cesium-137 activity was detected in five (5) of the twelve (12) samples collected and ranged from 157.35 pCi/kg to 825.41 pCi/kg. The annual average cesium-137 activity was 214.17 pCi/kg at the indicator locations and 761.65 pCi/kg at the control location. The average cesium-137 radioactivity for all locations was 433.16 pCi/kg and is within the maximum 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**




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. For 2008, sample results for cobalt-60 from eight (8) locations confirm that no activity was identified at the discharge point (Location #64), and continues to remain within the Northwest Drain Impoundment with an activity range of <8.66 pCi/kg to 156 +/- 31 pCi/kg (Refer to Table 17). For informational purposes, Cesium-137 activity within the impoundment is reflected in Table 18.

**Table 17: Northwest Drain Impoundment Cobalt-60 Activity, pCi/kg** (dry)

| LOCATION | 06/25/08 | 06/27/08 | 09/19/08 |
|---|---|---|---|
| 64 | <8.66 | <17.2 | <20.41 |
| 64-1 | | <29.0 | <11.5 |
| 64-2 | | <15.5 | <17.0 |
| 64-3 | | 100 +/- 25 | <15.9 |
| 64-4 | | * | * |
| 64-5 | | * | * |
| 64-6 | | 156 +/- 31 | 121 +/- 42 |
| 64-7 | | 150 +/- 31 | 117 +/- 40 |
| 64-8 | | <24.2 | <8.6 |
| 64-9 | | 135 +/- 36 | 149 +/- 40 |
| 64-10 | | 120 +/- 28 | 116 +/- 29 |

** No sample available or insufficient sample for analysis*

**Table 18: Northwest Drain Impoundment Cesium-137 Activity, pCi/kg** (dry)

| LOCATION | 06/25/08 | 06/27/08 | 09/19/08 |
|---|---|---|---|
| 64 | <13.64 | ** | <21.64 |
| 64-1 | | 47 +/- 26 | 34 +/- 14 |
| 64-2 | | 379 +/- 40 | 532 +/- 45 |
| 64-3 | | 408 +/- 36 | 75 +/- 23 |
| 64-4 | | * | * |
| 64-5 | | * | * |
| 64-6 | | 360 +/- 46 | 1478 +/- 99 |
| 64-7 | | 2045 +/- 98 | 1919 +/- 98 |
| 64-8 | | 444 +/- 46 | 752 +/- 35 |
| 64-9 | | 1632 +/- 127 | 2440 +/- 97 |
| 64-10 | | 1093 +/- 59 | 1212 +/- 62 |

* *No sample available or insufficient sample for analysis*
** *No sample collected on this date*

*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 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 2008, fish sampling was performed for PNPP by a local licensed sport fisherman.

Six (6) fish samples (yellow perch, white bass and walleye) were collected and analyzed by gamma spectral analysis in 2008. As expected, naturally occurring potassium-40 was found in all samples. No other radionuclides were detected above the LLD.

**Direct Radiation Monitoring**

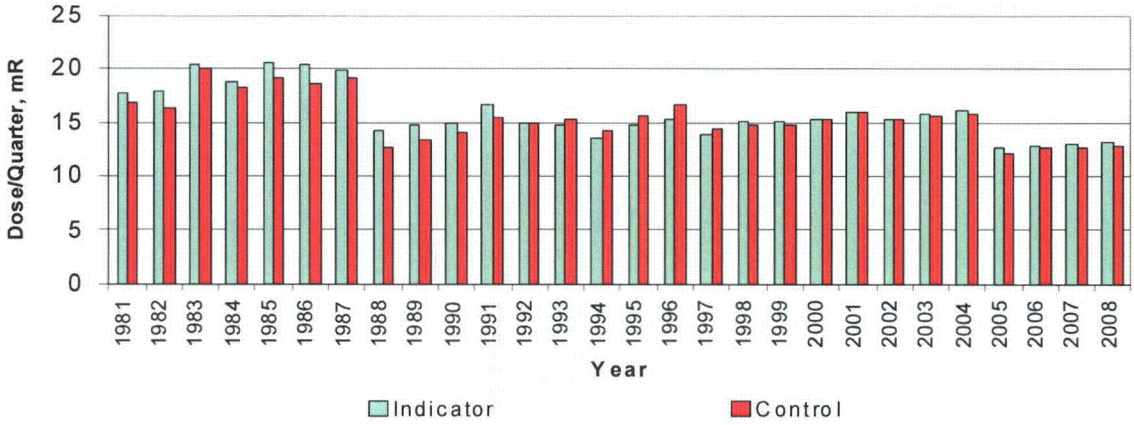
*Thermoluminescent Dosimeter (TLD)*

Environmental radiation is measured directly at twenty-eight locations around the PNPP site, two 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 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 252 TLDs were collected and analyzed in 2008. This includes 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 2008, the annual average dose for all indicator locations was 59.55 mrem, and 57.01 mrem for the control locations. The indicator annual average dose is believed to be influenced by location #36 (Figure 4) which has been consistently higher in dose than TLDs positioned closer to the plant (Figure 3). Referring to Figure 9, the average quarterly dose for all indicator locations was 13.27 mrem, and 12.81 mrem for all control locations. Please refer to Appendix B, 2008 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

Sediment samples continue to confirm cobalt-60 in the northwest drain impoundment. Additional monitoring is being performed to monitor this location. An environmental evaluation determined that there would be less impact upon the environment by leaving this material in place. Atmospheric monitoring results were consistent with past results. The prevalent radionuclide in air was beryllium-7, which is naturally occurring. Naturally occurring potassium-40 was detected in all terrestrial samples, as expected.

Finally, direct radiation measurements are consistent with past data.

## 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).

Through 2004, Teledyne also participated in the Environmental Measurements Laboratory Quality Assessment Program (EML). This program was discontinued in 2005.

### Conclusion

Appendix A, 2008 Inter-Laboratory Cross-Check Comparison Program Results, includes results from both the above referenced programs and the ERA Company cross-check program.

1) The vendor laboratory sample analysis results for Table A-1, Environmental Resource Associates (ERA) Interlaboratory Comparison Crosscheck Program and Table A-2, Vendor Laboratory's Cross-Check testing of Thermoluminescent Dosimetry were found to be within the expected control limits.

2) Laboratory analysis results for Table A-3, In-House "Spike" Samples were within their expected control limits.

3) Analysis results for Table A-4, In-House "Blank" Samples identified milk sample SPMI-7060 to be outside the program acceptance criteria. Levels of Sr-90 remain in the environment and concentrations of (1-5 pCi/l) found in milk is not unusual.

4) Laboratory analysis of Ra-226 sample DW-80155, 80156 for Table A-5, In-House "Duplicate" Samples failed. This was documented per the vendor laboratories program deviation report dated 7/29/2008.

5) Table A-6, Department of Energy MAPEP: Vendor laboratory sample analyses of air samples STAP-1139 (U-233/4) and (U-238) initially failed. Re-analysis was within control limits.

   Initial laboratory results for water sample STW-1162 (Am-241), (Ni-63) (Pu-238) and (Tc-99) initially failed. Re-analyses for Am-241 and Ni-63 were within control limits. The initial result

for Pu-238 was below the known activity. The reason for the deviation is unknown. Re-analysis was found to be within the control limit. The initial analysis of Tc-99 was also lower than the known activity. This was due to a background calculation error. The corrected result sample was within the control limit.

6) The vendor laboratory results for Table A-7, Interlaboratory Comparison Crosscheck Program Environmental Resource Associates (ERA) laboratory were all within their control limits.

## 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. 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 2008 Land Use Census, which was conducted July 23rd and 24th provided the garden, residence and milk animal locations tabulated in Tables 19, 20 and 21 and depicted in Figure 10. Note that the W, WNW, NW, NNW, N, and NNE sectors extend over Lake Erie, and therefore, 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 Radiological Environmental Monitoring Program (REMP). The 2008 Land Use Survey used the 1999 survey map produced by the Commercial Survey Co. of Cleveland. GPS units are also used for more accurate location identification.

Table 19 identifies the nearest residences, by sector, to the PNPP. The table is updated annually to reflect any changes identified during the annual Land Use Census. For 2008, there were no changes noted for the "nearest residence".

### Table 19: Nearest Residence, By Sector

| SECTOR | LOCATION ADDRESS | MILES FROM PNPP | X/Q VALUE, (SEC/M3) | MAP LOCATOR NUMBER |
|---|---|---|---|---|
| NE | 4384 Lockwood | 0.7 | 2.66E-06 | 1 |
| ENE | 4412 Lockwood | 0.7 | 1.96E-06 | 2 |
| E | 2626 Antioch | 1.1 | 6.77E-07 | 3 |
| ESE | 2836 Antioch | 1.0 | 8.57E-07 | 4 |
| SE | 4537 North Ridge | 1.3 | 3.44E-07 | 5 |
| SSE | 4225 Redmill Valley Rd. | 1.1 | 5.52E-06 | 6 |
| S | 3119 Parmly | 0.9 | 2.25E-06 | 7 |
| SSW | 3121 Center | 1.0 | 9.49E-07 | 8 |
| SW | 3440 Clark | 1.3 | 4.42E-07 | 9 |
| WSW | 3462 Parmly | 1.1 | 8.67E-07 | 10 |

**Figure 10: Land Use Census Map**

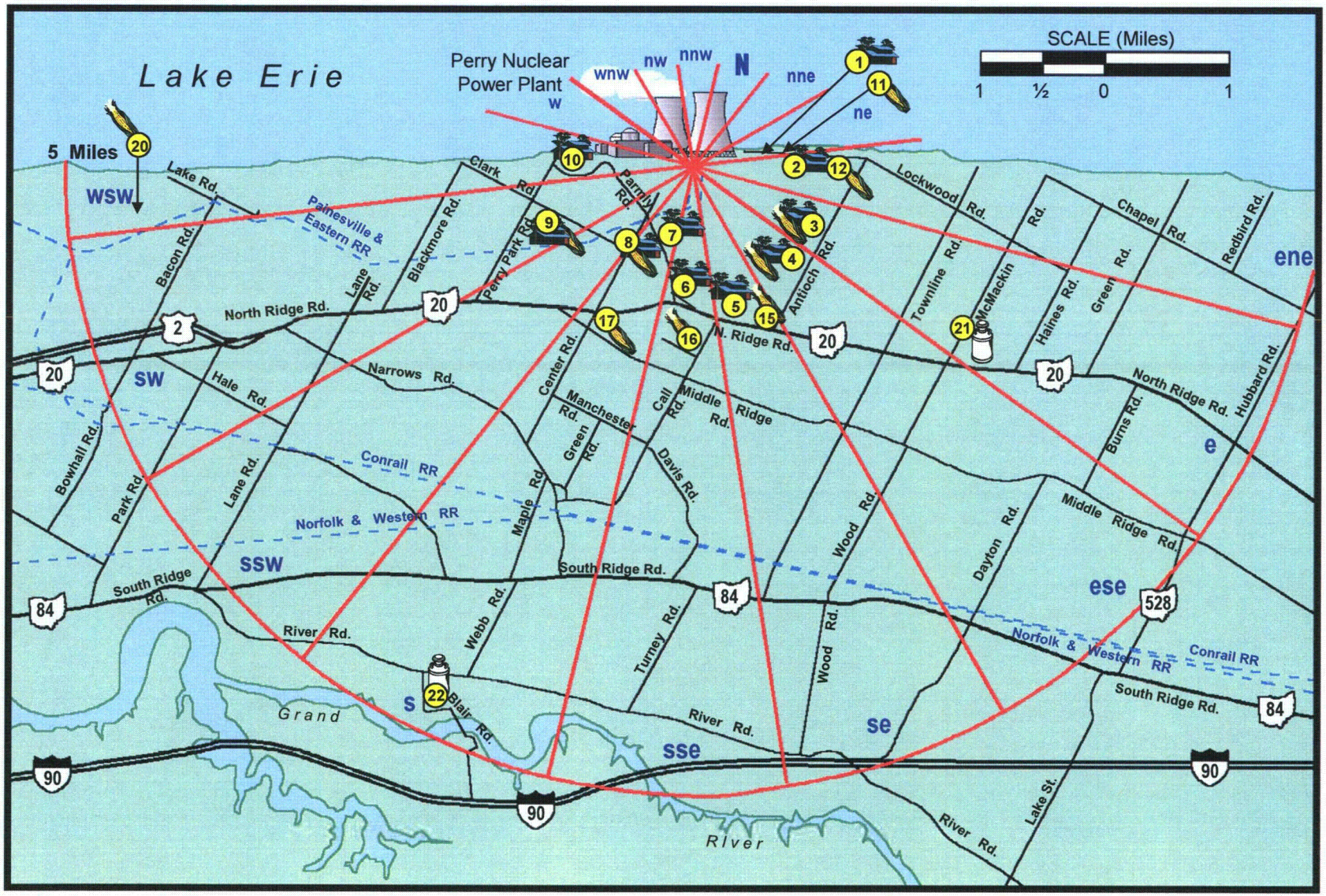


Table 20 identifies the nearest milking animal by sector, to the PNPP. During the 2008 Land Use Census, a new milk animal was identified in the East sector. Conversations with the owner were positive for program participation in 2009. The milking animal identified in the S sector was a participant in the REMP program beginning in June 2006. The owners did not participate in 2007 or 2008. Efforts to contact them were unsuccessful. A visual observation of the property indicates that the fencing and shelter have been removed. Subsequently, the location has been dropped from the program for 2009.

**Table 20: Nearest Milk Animal, By Sector**

| SECTOR | LOCATION ADDRESS | MILES FROM PNPP | MAP LOCATOR NUMBER |
|---|---|---|---|
| S | 5245 Blair Rd. | 4.9 | 22 |
| E | 2591 McMacken Rd. | 2.51 | 21 |

There was one (1) change in the nearest garden for the WSW sector during this year's census. Changes can include either the loss of the previous year's garden or the addition of a new garden identified in this year's census. The garden identified in past years for this sector was not planted. Table 21 lists the nearest gardens occupying at least 500 square feet identified during the 2008 Land Use Census.

**Table 21: Nearest Garden, By Sector**

| SECTOR | LOCATION ADDRESS | MILES FROM PNPP | D/Q VALUE, ($M^{-2}$) | MAP LOCATOR NUMBER |
|---|---|---|---|---|
| NE | 2330 Lakehurst | 0.9 | 8.91E-09 | 11 |
| ENE | 4630 Lockwood | 1.1 | 4.77E-09 | 12 |
| E | 2626 Antioch | 1.1 | 5.29E-09 | 3 |
| ESE | 2836 Antioch | 1.0 | 3.96E-09 | 4 |
| SE | 3040 Antioch | 1.3 | 1.01E-09 | 15 |
| SSE | 3288 Call Rd. | 1.4 | 2.04E-09 | 16 |
| S | 3964 North Ridge | 1.4 | 2.73E-09 | 17 |
| SSW | 3121 Center | 1.0 | 4.66E-09 | 8 |
| SW | 3440 Clark | 1.3 | 1.95E-09 | 9 |
| WSW | 971 Midway Blvd. | 4.7 | 2.29E-10 | 20 |

# 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 2008 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 2008, 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 22.

### Table 22: 2008 Corbicula Monitoring

| DATE | SAMPLE LOCATION |
|---|---|
| 1/3/08 | Emergency Service Water B pump strainer |
| 4/1/08 | Lube oil cooler 1N34B0001B |
| 5/1/08 | Fire pump strainer 1P54D1240 |
| 5/29/08 | Fire hydrant #37 |
| 7/1/08 | Lube oil cooler 1N34B0001B |
| 7/2/08 | Fire system valve 1P54F0705 |
| 8/6/08 | Lube oil cooler 1N34B0001B |

### 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 2008 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 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. The side-stream monitors are fitted with slides and inspected for veliger settlement and growth of adult mussels.

**Treatment**

Chemicals used for mussel control in 2008 included chlorine 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 2008 was alkyl-dimethyl-benzyl-ammonium chloride. Treatment was applied twice in 2008, on June 4 and September 23. The active ingredients were detoxified by adsorption using bentonite clay, prior to discharge into Lake Erie.

**Results**

The effectiveness of the intermittent chlorination 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 2008 was 98% and 89%. To date, PNPP has had no significant problems related to zebra mussels.

## CONCLUSIONS

Perry Nuclear Power Plant 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 2008, two (2) general and one (1) 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, Karmex, Pramitol, Polaris, Tempo, and Oust. For each application, the type of weed to be treated dictated the herbicide and concentration to be used. Table 23 provides detailed documentation for each application in 2008. The quantity represents the amount of herbicide applied, after any dilution.

**Table 23: 2008 Herbicide Applications**

| DATE APPLIED | LOCATION | AMOUNT (OZ) | CHEMICAL NAME |
|---|---|---|---|
| 4/24/08 | Transmission Yard | 684.7 | Polaris |
| 4/24/08 | Transmission Yard | 24.3 | Oust |
| 4/29/08 | Admin., IPC, P&R Buildings and Gravel along main roads | 2.1 | Round-up |
| 5/6/08 | Admin., Training Buildings, OCA landscape beds/Gravel Areas, and Contractor parking lot | 60 | Round-up |
| 5/28/08 | Hydrogen/Gravel Area, WHSE 6, and Weld shop | 144 | Round-up |
| 5/29/08 | Admin., Training, WHSE, IPC P&R Buildings | 954 | Round-up |
| 6/11/08 | OCA perimeter, Cooling towers, and roadways | 1320 | Round-up |
| 6/12/08 | Protected Area NE,NW,SE,SW, Quadrant | 1620 | Round-up |
| 6/19/08 | WHSE, P&R Building and Gravel Areas | 900 | Round-up |
| 7/7/08 | Landscape beds/Gravel Areas | 120 | Round-up |
| 7/29/08 | Admin., Training Buildings and Hydrogen/Gravel Area | 300 | Round-up |
| 7/31/08 | Protected Area NE, NW Quadrant and Landscape beds/Gravel Areas | 1200 | Round-up |
| 8/6/08 | Admin., P&R Buildings and Fire Training Grounds | 900 | Round-up |
| 8/7/08 | Protected Area Perimeter and Landscape beds/Gravel Areas | 1500 | Round-up |
| 8/12/08 | OCA Perimeter | 300 | Round-up |
| 8/18/08 | Admin., Training, WHSE, IPC P&R Buildings, Contractor Parking Lot and Landscape beds/Gravel Areas | 240 | Round-up |
| 8/26/08 | Admin., Training, WHSE, IPC Buildings and Landscape beds/Gravel Areas | 60 | Round-up |
| 8/27/08 | Hydrogen/Gravel Area and WHSE 6 | 602 | Round-up |
| 9/3/08 | Gravel along Roadways | 54 | Round-up |
| 9/16/08 | Admin., Training, WHSE, IPC, P&R Buildings | 60 | Round-up |
| 9/22/08 | Hydrogen/Gravel Area and WHSE 6 | 990 | Round-up |
| 9/23/08 | Landscape beds/Gravel Areas | 600 | Round-up |
| 9/24/08 | Protected Area NE,NW,SE,SW, Quadrant | 602 | Round-up |
| 9/25/08 | Landscape beds/Gravel Areas | 600 | Round-up |
| 10/14/08 | Training Building and OCA Perimeter | 78 | Round-up |

# SPECIAL REPORTS

## NON-COMPLIANCES

### NPDES Permit

The National Pollutant Discharge Elimination System (NPDES) permit is issued by the Ohio Environmental Protection Agency (OEPA). 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 were no NPDES non-compliance issues identified in 2008.

### 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. There were no instances of an EPP non-compliance identified in 2008.

## UNREVIEWED 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 2008 there were no proposed changes to the facility or programs that if performed, could have resulted in an adverse environmental impact. Therefore, there were no unreviewed environmental questions identified.

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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, 2008 through December, 2008

## 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.

The results in Table A-2 list 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<br>> 100 pCi/liter or kg | 5.0 pCi/liter<br>5% of known value |
| Strontium-89[b] | 5 to 50 pCi/liter or kg<br>> 50 pCi/liter or kg | 5.0 pCi/liter<br>10% of known value |
| Strontium-90[b] | 2 to 30 pCi/liter or kg<br>> 30 pCi/liter or kg | 5.0 pCi/liter<br>10% of known value |
| Potassium-40 | ≥ 0.1 g/liter or kg | 5% of known value |
| Gross alpha | ≤ 20 pCi/liter<br>> 20 pCi/liter | 5.0 pCi/liter<br>25% of known value |
| Gross beta | ≤ 100 pCi/liter<br>> 100 pCi/liter | 5.0 pCi/liter<br>5% of known value |
| Tritium | ≤ 4,000 pCi/liter<br><br>> 4,000 pCi/liter | $\pm 1\sigma$ =<br>$169.85 \times (\text{known})^{0.0933}$<br>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,<br>Iodine-129[b] | ≤ 55 pCi/liter<br>> 55 pCi/liter | 6 pCi/liter<br>10% of known value |
| Uranium-238,<br>Nickel-63[b]<br>Technetium-99[b] | ≤ 35 pCi/liter<br>> 35 pCi/liter | 6 pCi/liter<br>15% of known value |
| Iron-55[b] | 50 to 100 pCi/liter<br>> 100 pCi/liter | 10 pCi/liter<br>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 | Analysis | Concentration (pCi/L) Laboratory Result[b] | ERA Result[c] | Control Limits | Acceptance |
|---|---|---|---|---|---|---|
| STW-1148 | 03/24/08 | Sr-89 | 50.6 ± 2.4 | 60.4 | 48.6 - 68.2 | Pass |
| STW-1148 | 03/24/08 | Sr-90 | 42.4 ± 1.4 | 39.2 | 28.8 - 45.1 | Pass |
| STW-1149 | 03/24/08 | Ba-133 | 56.9 ± 5.4 | 58.3 | 48.3 - 64.3 | Pass |
| STW-1149 | 03/24/08 | Co-60 | 73.9 ± 1.6 | 76.6 | 68.9 - 86.7 | Pass |
| STW-1149 | 03/24/08 | Cs-134 | 50.2 ± 1.9 | 46.6 | 37.4 - 51.3 | Pass |
| STW-1149 | 03/24/08 | Cs-137 | 97.7 ± 2.2 | 102.0 | 91.8 - 115.0 | Pass |
| STW-1149 | 03/24/08 | Zn-65 | 109.9 ± 5.8 | 106.0 | 95.4 - 126.0 | Pass |
| STW-1150 | 03/24/08 | Gr. Alpha | 43.7 ± 7.5 | 50.8 | 26.5 - 63.7 | Pass |
| STW-1150 | 03/24/08 | Gr. Beta | 36.4 ± 1.8 | 51.4 | 35.0 - 58.4 | Pass |
| STW-1151 | 03/24/08 | I-131 | 29.3 ± 1.4 | 28.7 | 23.9 - 33.6 | Pass |
| STW-1152 | 03/24/08 | Ra-226 | 15.0 ± 1.1 | 15.3 | 11.4 - 17.6 | Pass |
| STW-1152 | 03/24/08 | Ra-228 | 18.4 ± 1.8 | 17.0 | 11.4 - 20.4 | Pass |
| STW-1152 | 03/24/08 | Uranium | 23.4 ± 1.3 | 24.6 | 19.8 - 27.6 | Pass |
| STW-1153 | 03/24/08 | H-3 | 12551.0 ± 207.0 | 12000.0 | 10400.0 - 13200.0 | Pass |
| STW-1154 | 07/07/08 | Sr-89 | 24.9 ± 3.5 | 28.7 | 20.4 - 35.3 | Pass |
| STW-1154 | 07/07/08 | Sr-90 | 39.7 ± 0.5 | 40.0 | 29.4 - 46.0 | Pass |
| STW-1155 | 07/07/08 | Ba-133 | 45.0 ± 1.2 | 46.6 | 38.1 - 51.8 | Pass |
| STW-1155 | 07/07/08 | Co-60 | 24.9 ± 3.0 | 25.7 | 22.3 - 31.0 | Pass |
| STW-1155 | 07/07/08 | Cs-134 | 90.4 ± 5.3 | 93.2 | 76.6 - 102.0 | Pass |
| STW-1155 | 07/07/08 | Cs-137 | 57.1 ± 2.8 | 54.6 | 49.1 - 62.9 | Pass |
| STW-1155 | 07/07/08 | Zn-65 | 102.9 ± 7.3 | 98.8 | 88.9 - 118.0 | Pass |
| STW-1156 | 07/07/08 | Gr. Alpha | 24.8 ± 1.6 | 30.7 | 15.7 - 40.0 | Pass |
| STW-1156 | 07/07/08 | Gr. Beta | 23.9 ± 0.9 | 25.8 | 16.1 - 33.7 | Pass |
| STW-1157 | 07/07/08 | Ra-226 | 8.0 ± 0.6 | 8.1 | 6.1 - 9.5 | Pass |
| STW-1157 | 07/07/08 | Ra-228 | 7.7 ± 0.8 | 7.4 | 4.7 - 9.5 | Pass |
| STW-1157 | 07/07/08 | Uranium | 11.2 ± 0.3 | 11.3 | 8.9 - 13.0 | Pass |
| STW-1164 | 10/06/08 | Sr-89 | 42.2 ± 3.2 | 48.7 | 38.2 - 56.1 | Pass |
| STW-1164 | 10/06/08 | Sr-90 | 35.4 ± 1.2 | 33.6 | 24.6 - 38.8 | Pass |
| STW-1165 | 10/06/08 | Ba-133 | 56.9 ± 1.0 | 63.5 | 52.8 - 69.9 | Pass |
| STW-1165 | 10/06/08 | Co-60 | 47.6 ± 1.3 | 49.1 | 44.2 - 56.6 | Pass |
| STW-1165 | 10/06/08 | Cs-134 | 26.4 ± 4.0 | 25.6 | 19.7 - 28.4 | Pass |
| STW-1165 | 10/06/08 | Cs-137 | 24.3 ± 0.7 | 25.6 | 21.6 - 31.2 | Pass |
| STW-1165 | 10/06/08 | Zn-65 | 72.0 ± 2.9 | 68.6 | 61.2 - 83.0 | Pass |
| STW-1166 | 10/06/08 | Gr. Alpha | 24.2 ± 4.8 | 26.9 | 13.6 - 35.5 | Pass |
| STW-1166 | 10/06/08 | Gr. Beta | 32.6 ± 1.0 | 38.0 | 25.1 - 45.5 | Pass |
| STW-1167 | 10/06/08 | I-131 | 29.0 ± 0.3 | 28.1 | 23.4 - 33.0 | Pass |
| STW-1168 | 10/06/08 | Ra-226 | 15.0 ± 1.0 | 16.1 | 12.0 - 18.4 | Pass |
| STW-1168 | 10/06/08 | Ra-228 | 16.0 ± 1.0 | 14.1 | 9.4 - 17.1 | Pass |
| STW-1168 | 10/06/08 | Uranium | 47.8 ± 2.0 | 50.3 | 40.8 - 55.9 | Pass |
| STW-1169 | 10/06/08 | H-3 | 2357.0 ± 66.0 | 2220.0 | 1830.0 - 2460.0 | 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.

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

| Lab Code | Date | Description | Known Value (mR) | Lab Result ± 2 sigma (mR) | Control Limits (mR) | Acceptance |
|---|---|---|---|---|---|---|
| Environmental, Inc. | | | | | | |
| 2008-1 | 6/16/2008 | 40 cm. | 30.23 | 33.87 ± 1.17 | 21.16 - 39.30 | Pass |
| 2008-1 | 6/16/2008 | 50 cm. | 19.35 | 23.13 ± 0.57 | 13.55 - 25.16 | Pass |
| 2008-1 | 6/16/2008 | 60 cm. | 13.44 | 16.25 ± 1.10 | 9.41 - 17.47 | Pass |
| 2008-1 | 6/16/2008 | 70 cm. | 9.87 | 10.39 ± 0.52 | 6.91 - 12.83 | Pass |
| 2008-1 | 6/16/2008 | 80 cm. | 7.56 | 7.44 ± 0.51 | 5.29 - 9.83 | Pass |
| 2008-1 | 6/16/2008 | 90 cm. | 5.97 | 5.80 ± 1.04 | 4.18 - 7.76 | Pass |
| 2008-1 | 6/16/2008 | 100 cm. | 4.84 | 4.32 ± 0.43 | 3.39 - 6.29 | Pass |
| 2008-1 | 6/16/2008 | 120 cm. | 3.36 | 2.69 ± 0.15 | 2.35 - 4.37 | Pass |
| 2008-1 | 6/16/2008 | 150 cm. | 2.15 | 2.05 ± 0.69 | 1.51 - 2.80 | Pass |
| 2008-1 | 6/16/2008 | 180 cm. | 1.49 | 1.23 ± 0.80 | 1.04 - 1.94 | Pass |
| Environmental, Inc. | | | | | | |
| 2008-2 | 11/17/2008 | 30 cm. | 63.05 | 73.10 ± 1.84 | 44.14 - 81.97 | Pass |
| 2008-2 | 11/17/2008 | 40 cm. | 35.46 | 40.80 ± 2.30 | 24.82 - 46.10 | Pass |
| 2008-2 | 11/17/2008 | 50 cm. | 22.7 | 24.10 ± 0.58 | 15.89 - 29.51 | Pass |
| 2008-2 | 11/17/2008 | 60 cm. | 15.76 | 15.98 ± 0.55 | 11.03 - 20.49 | Pass |
| 2008-2 | 11/17/2008 | 60 cm. | 15.76 | 19.49 ± 0.93 | 11.03 - 20.49 | Pass |
| 2008-2 | 11/17/2008 | 70 cm. | 11.58 | 11.97 ± 0.54 | 8.11 - 15.05 | Pass |
| 2008-2 | 11/17/2008 | 75 cm. | 10.09 | 9.45 ± 0.28 | 7.06 - 13.12 | Pass |
| 2008-2 | 11/17/2008 | 80 cm. | 8.87 | 9.30 ± 0.18 | 6.21 - 11.53 | Pass |
| 2008-2 | 11/17/2008 | 90 cm. | 7.01 | 7.19 ± 0.43 | 4.91 - 9.11 | Pass |
| 2008-2 | 11/17/2008 | 90 cm. | 7.01 | 6.84 ± 0.42 | 4.91 - 9.11 | Pass |
| 2008-2 | 11/17/2008 | 100 cm. | 5.67 | 5.47 ± 0.19 | 3.97 - 7.37 | Pass |
| 2008-2 | 11/17/2008 | 110 cm. | 4.69 | 3.98 ± 0.27 | 3.28 - 6.10 | Pass |
| 2008-2 | 11/17/2008 | 120 cm. | 3.94 | 3.09 ± 0.21 | 2.76 - 5.12 | Pass |
| 2008-2 | 11/17/2008 | 120 cm. | 3.94 | 3.12 ± 0.34 | 2.76 - 5.12 | Pass |
| 2008-2 | 11/17/2008 | 150 cm. | 2.52 | 2.55 ± 0.12 | 1.76 - 3.28 | Pass |
| 2008-2 | 11/17/2008 | 150 cm. | 2.52 | 2.24 ± 0.08 | 1.76 - 3.28 | Pass |
| 2008-2 | 11/17/2008 | 180 cm. | 1.75 | 1.36 ± 0.08 | 1.23 - 2.28 | Pass |

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

| Lab Code [b] | Date | Analysis | Concentration (pCi/L)[a] Laboratory results 2s, n=1 [c] | Known Activity | Control Limits [d] | Acceptance |
|---|---|---|---|---|---|---|
| SPW-111 | 1/14/2008 | Tc-99 | 32.20 ± 0.85 | 32.34 | 20.34 - 44.34 | Pass |
| SPW-298 | 1/31/2008 | Ni-63 | 213.55 ± 3.07 | 212.58 | 148.81 - 276.35 | Pass |
| W-11708 | 1/17/2008 | Ra-226 | 11.34 ± 0.43 | 12.69 | 8.88 - 16.50 | Pass |
| SPW-711 | 2/25/2008 | U-238 | 33.56 ± 1.74 | 41.70 | 29.19 - 54.21 | Pass |
| SPAP-881 | 3/11/2008 | Cs-134 | 19.29 ± 1.53 | 20.09 | 10.09 - 30.09 | Pass |
| SPAP-881 | 3/11/2008 | Cs-137 | 114.04 ± 3.03 | 113.90 | 102.51 - 125.29 | Pass |
| SPAP-883 | 3/11/2008 | Gr. Beta [e] | 54.56 ± 0.12 | 51.64 | 30.98 - 72.30 | Pass |
| SPMI-885 | 3/11/2008 | Sr-90 | 45.93 ± 1.60 | 45.13 | 36.10 - 54.16 | Pass |
| SPW-887 | 3/11/2008 | Sr-90 | 38.82 ± 1.60 | 45.13 | 36.10 - 54.16 | Pass |
| SPW-889 | 3/11/2008 | H-3 | 67325.00 ± 725.00 | 67384.00 | 53907.20 - 80860.80 | Pass |
| W-31808 | 3/18/2008 | Gr. Alpha | 19.51 ± 0.40 | 20.08 | 10.04 - 30.12 | Pass |
| W-31808 | 3/18/2008 | Gr. Beta | 47.20 ± 0.42 | 45.67 | 35.67 - 55.67 | Pass |
| SPMI-885 | 3/24/2008 | Cs-134 | 40.93 ± 1.55 | 39.69 | 29.69 - 49.69 | Pass |
| SPMI-885 | 3/24/2008 | Cs-137 | 61.36 ± 2.82 | 56.91 | 46.91 - 66.91 | Pass |
| SPW-887 | 3/24/2008 | Cs-134 | 40.68 ± 1.44 | 39.69 | 29.69 - 49.69 | Pass |
| SPW-887 | 3/24/2008 | Cs-137 | 58.52 ± 2.93 | 56.91 | 46.91 - 66.91 | Pass |
| SPW-1282 | 4/2/2008 | U-238 | 41.30 ± 1.78 | 41.70 | 29.19 - 54.21 | Pass |
| W-40308 | 4/3/2008 | Ra-226 | 15.17 ± 0.50 | 12.69 | 8.88 - 16.50 | Pass |
| SPW-5580 | 4/7/2008 | H-3 | 211.02 ± 7.71 | 240.00 | 0.00 - 806.46 | Pass |
| SPW-1562 | 4/8/2008 | Ra-228 | 28.93 ± 2.09 | 30.51 | 21.36 - 39.66 | Pass |
| SPW-1560 | 4/10/2008 | Tc-99 | 29.74 ± 0.84 | 32.34 | 20.34 - 44.34 | Pass |
| SPW-1621 | 4/16/2008 | Fe-55 | 27205.80 ± 982.90 | 28370.00 | 22696.00 - 34044.00 | Pass |
| W-51508 | 5/15/2008 | Gr. Alpha | 24.01 ± 0.41 | 20.08 | 10.04 - 30.12 | Pass |
| W-51508 | 5/15/2008 | Gr. Beta | 47.97 ± 0.41 | 45.68 | 35.68 - 55.68 | Pass |
| SPAP-2673 | 6/2/2008 | Cs-134 | 17.39 ± 1.32 | 18.60 | 8.60 - 28.60 | Pass |
| SPAP-2673 | 6/2/2008 | Cs-137 | 106.82 ± 3.42 | 113.30 | 101.97 - 124.63 | Pass |
| SPAP-2674 | 6/2/2008 | Gr. Beta [e] | 53.57 ± 0.13 | 51.40 | 30.84 - 71.96 | Pass |
| SPF-2745 | 6/2/2008 | Cs-134 | 0.34 ± 0.02 | 0.37 | 0.22 - 0.52 | Pass |
| SPF-2745 | 6/2/2008 | Cs-137 | 2.06 ± 0.04 | 2.27 | 1.36 - 3.18 | Pass |
| SPMI-2677 | 6/3/2008 | Cs-137 | 53.99 ± 6.15 | 56.66 | 46.66 - 66.66 | Pass |
| SPMI-2677A | 6/3/2008 | I-131 | 26.64 ± 0.59 | 28.58 | 16.58 - 40.58 | Pass |
| SPW-2677 | 6/3/2008 | Cs-134 | 40.30 ± 3.35 | 37.21 | 27.21 - 47.21 | Pass |
| SPW-2677 | 6/3/2008 | I-131(G) | 25.92 ± 4.48 | 28.58 | 18.58 - 38.58 | Pass |
| SPMI-2679 | 6/3/2008 | Cs-134 | 35.02 ± 2.93 | 37.21 | 27.21 - 47.21 | Pass |
| SPMI-2679 | 6/3/2008 | Cs-137 | 58.49 ± 6.05 | 56.66 | 46.66 - 66.66 | Pass |
| SPMI-2679 | 6/3/2008 | I-131(G) | 25.30 ± 4.97 | 28.58 | 18.58 - 38.58 | Pass |
| SPMI-2679A | 6/3/2008 | I-131 | 30.37 ± 0.50 | 28.58 | 16.58 - 40.58 | Pass |
| SPVE-2681 | 6/3/2008 | I-131(G) | 1.11 ± 0.06 | 0.95 | 0.57 - 1.33 | Pass |
| SPW-2683 | 6/2/2008 | Ni-63 | 2151.70 ± 10.22 | 2119.30 | 1483.51 - 2755.09 | Pass |
| SPW-2685 | 6/2/2008 | H-3 | 64927.20 ± 704.80 | 66540.80 | 53232.64 - 79848.96 | Pass |
| SPW-2689 | 6/2/2008 | C-14 | 4405.40 ± 15.21 | 4742.00 | 2845.20 - 6638.80 | Pass |

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

| Lab Code [b] | Date | Analysis | Concentration (pCi/L)[a] Laboratory results 2s, n=1 | Known Activity | Control Limits[c] | Acceptance |
|---|---|---|---|---|---|---|
| W-81408 | 8/14/2008 | Ra-226 | 12.98 ± 0.35 | 12.69 | 8.88 - 16.50 | Pass |
| SPW-1562 | 8/14/2008 | Ra-228 | 29.09 ± 2.46 | 30.51 | 21.36 - 39.66 | Pass |
| SPW-81808 | 8/18/2008 | U-238 | 42.59 ± 1.96 | 41.70 | 29.19 - 54.21 | Pass |
| W-81808 | 8/18/2008 | Gr. Alpha | 21.36 ± 0.42 | 20.08 | 10.04 - 30.12 | Pass |
| W-81808 | 8/18/2008 | Gr. Beta | 49.33 ± 1.01 | 45.68 | 35.68 - 55.68 | Pass |
| W-112008 | 11/20/2008 | Gr. Alpha | 20.13 ± 0.40 | 20.08 | 10.04 - 30.12 | Pass |
| W-112008 | 11/20/2008 | Gr. Beta | 48.28 ± 0.42 | 45.60 | 35.60 - 55.60 | Pass |
| SPAP-6839 | 12/5/2008 | Cs-134 | 15.39 ± 2.72 | 15.68 | 5.68 - 25.68 | Pass |
| SPAP-6839 | 12/5/2008 | Cs-137 | 111.45 ± 9.85 | 112.00 | 100.80 - 123.20 | Pass |
| SPAP-6841 | 12/5/2008 | Gr. Beta [e] | 49.26 ± 0.12 | 50.72 | 30.43 - 71.01 | Pass |
| SPW-6843 | 12/5/2008 | C-14 | 19377.50 ± 55.27 | 23708.00 | 14224.80 - 33191.20 | Pass |
| SPW-6845 | 12/5/2008 | Fe-55 | 7068.30 ± 692.30 | 6028.00 | 4822.40 - 7233.60 | Pass |
| SPW-6847 | 12/5/2008 | Tc-99 | 37.71 ± 1.33 | 32.34 | 20.34 - 44.34 | Pass |
| SPW-6849 | 12/5/2008 | Ni-63 | 232.56 ± 3.26 | 211.34 | 147.94 - 274.74 | Pass |
| SPW-6851 | 12/5/2008 | H-3 | 63664.00 ± 8745.00 | 64674.00 | 51739.20 - 77608.80 | Pass |
| SPF-6859 | 12/5/2008 | Cs-134 | 0.63 ± 0.02 | 0.63 | 0.38 - 0.88 | Pass |
| SPF-6859 | 12/5/2008 | Cs-137 | 2.35 ± 0.01 | 2.24 | 1.34 - 3.14 | Pass |
| SPW-7059 | 12/19/2008 | Sr-90 | 49.19 ± 2.62 | 44.33 | 35.46 - 53.20 | Pass |
| SPMI-7061 | 12/19/2008 | Sr-90 | 39.39 ± 2.19 | 44.33 | 35.46 - 53.20 | 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 as follows: W (water), MI (milk), AP (air filter), SO (soil), VE (vegetation), CH (charcoal canister), F (fish).

[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 ± 2σ.

[e] Control limits based on the laboratory limit, Attachment A ("Other Analyses").

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) LLD | Activity[c] | Acceptance Criteria (4.66 σ) |
|---|---|---|---|---|---|---|
| SPW-17 | Water | 1/3/2008 | U-238 | 0.09 | 0.01 ± 0.07 | 1 |
| SPW-112 | Water | 1/14/2008 | Tc-99 | 4.70 | -0.06 ± 2.85 | 10 |
| W-11408 | Water | 1/14/2008 | Ra-226 | 0.05 | 0.05 ± 0.04 | 1 |
| SPAP-880 | Air Filter | 3/11/2008 | Cs-134 | 0.91 | - | 100 |
| SPAP-880 | Air Filter | 3/11/2008 | Cs-137 | 1.13 | - | 100 |
| SPW-888 | Water | 3/11/2008 | H-3 | 159.99 | -78.90 ± 80.40 | 200 |
| W-31808 | Water | 3/18/2008 | Gr. Alpha | 0.42 | -0.05 ± 0.29 | 1 |
| W-31808 | Water | 3/18/2008 | Gr. Beta | 0.72 | 0.09 ± 0.51 | 3.2 |
| SPMI-884 | Milk | 3/24/2008 | Cs-134 | 2.79 | - | 10 |
| SPMI-884 | Milk | 3/24/2008 | Cs-137 | 3.36 | - | 10 |
| W-40308 | Water | 4/3/2008 | Ra-226 | 0.04 | 0.05 ± 0.03 | 1 |
| SPW-1563 | Water | 4/8/2008 | Ra-228 | 0.57 | 0.31 ± 0.30 | 2 |
| SPW-1561 | Water | 4/10/2008 | Tc-99 | 4.77 | -3.42 ± 2.85 | 10 |
| SPW-1621 | Water | 4/16/2008 | Fe-55 | 668.50 | -170.70 ± 397.20 | 1000 |
| SPW-2451 | Water | 5/22/2008 | U-238 | 0.21 | 0.35 ± 0.24 | 1 |
| SPW-2676 | Water | 6/2/2008 | Cs-134 | 2.03 | - | 10 |
| SPW-2676 | Water | 6/2/2008 | Cs-134 | 3.60 | - | 10 |
| SPW-2676 | Water | 6/2/2008 | Cs-137 | 2.38 | - | 10 |
| SPW-2677 | Water | 6/2/2008 | Cs-134 | 2.78 | - | 10 |
| SPW-2677 | Water | 6/2/2008 | I-131(G) | 3.49 | - | 20 |
| SPW-2677 | Water | 6/2/2008 | I-131(G) | 5.25 | - | 20 |
| SPF-2744 | Fish | 6/2/2008 | Cs-134 | 5.48 | - | 100 |
| SPF-2744 | Fish | 6/2/2008 | Cs-137 | 4.83 | - | 100 |
| SPW-2676 | Water | 6/3/2008 | I-131 | 0.18 | 0.01 ± 0.11 | 0.5 |
| SPMI-2678 | Milk | 6/3/2008 | I-131 | 0.22 | 0.12 ± 0.15 | 0.5 |
| SPVE-2680 | Vegetation | 6/3/2008 | I-131(G) | 0.01 | - | 20 |
| SPW-3581 | Water | 7/14/2008 | U-238 | 0.10 | 0.13 ± 0.12 | 1 |
| W-80708 | Water | 8/7/2008 | Gr. Alpha | 0.63 | -0.02 ± 0.44 | 1 |
| W-80708 | Water | 8/7/2008 | Gr. Beta | 1.43 | -0.47 ± 0.99 | 3.2 |
| W-81408 | Water | 8/14/2008 | Ra-226 | 0.06 | 0.14 ± 0.04 | 1 |
| SPW-1563 | Water | 8/14/2008 | Ra-228 | 0.79 | 0.89 ± 0.47 | 2 |
| SPW-81808 | Water | 8/18/2008 | U-238 | 0.18 | 0.04 ± 0.13 | 1 |

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

| Lab Code | Sample Type | Date | Analysis[b] | Concentration (pCi/L)[a] Laboratory results (4.66σ) LLD | Activity[c] | Acceptance Criteria (4.66 σ) |
|---|---|---|---|---|---|---|
| W-112008 | Water | 11/20/2008 | Gr. Alpha | 0.40 | 0.02 ± 0.28 | 1 |
| W-112008 | Water | 11/20/2008 | Gr. Beta | 0.75 | -0.16 ± 0.52 | 3.2 |
| SPAP-6838 | Air Filter | 12/5/2008 | Cs-134 | 1.01 | - | 100 |
| SPAP-6838 | Air Filter | 12/5/2008 | Cs-137 | 0.95 | - | 100 |
| SPAP-6840 | Air Filter | 12/5/2008 | Gr. Beta | 0.96 | 2.69 ± 0.64 | 3.2 |
| SPW-6842 | Water | 12/5/2008 | C-14 | 7.79 | -3.04 ± 4.05 | 200 |
| SPW-6844 | Water | 12/5/2008 | Fe-55 | 715.10 | 21.70 ± 435.10 | 1000 |
| SPW-6846 | Water | 12/5/2008 | Tc-99 | 1.36 | -0.47 ± 0.82 | 10 |
| SPW-6848 | Water | 12/5/2008 | Ni-63 | 1.94 | 3.08 ± 1.23 | 20 |
| SPF-6858 | Fish | 12/5/2008 | Cs-134 | 1.53 | - | 100 |
| SPF-6858 | Fish | 12/5/2008 | Cs-137 | 3.92 | - | 100 |
| SPW-7058 | Water | 12/19/2008 | Cs-134 | 2.62 | - | 10 |
| SPW-7058 | Water | 12/19/2008 | Cs-137 | 2.39 | - | 10 |
| SPW-7058 | Water | 12/19/2008 | Sr-90 | 0.65 | -0.28 ± 0.26 | 1 |
| SPMI-7060 | Milk | 12/19/2008 | Cs-134 | 2.18 | - | 10 |
| SPMI-7060 | Milk | 12/19/2008 | Cs-137 | 3.87 | - | 10 |
| SPMI-7060 | Milk | 12/19/2008 | I-131(G) | 2.80 | - | 20 |
| SPMI-7060 [d] | Milk | 12/19/2008 | Sr-90 | 0.53 | 0.76 ± 0.34 | 1 |

[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.

[d] Low levels of Sr-90 are still detected in the environment. A concentration of (1-5 pCi/L) in milk is not unusual.

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

| Lab Code | Date | Analysis | Concentration (pCi/L)[a] First Result | Second Result | Averaged Result | Acceptance |
|---|---|---|---|---|---|---|
| AP-8809, 8810 | 1/2/2008 | Be-7 | 0.06 ± 0.02 | 0.06 ± 0.01 | 0.06 ± 0.01 | Pass |
| CF-42, 43 | 1/2/2008 | Gr. Beta | 8.88 ± 0.19 | 8.99 ± 0.19 | 8.94 ± 0.13 | Pass |
| CF-42, 43 | 1/2/2008 | K-40 | 5.08 ± 0.29 | 5.19 ± 0.30 | 5.14 ± 0.21 | Pass |
| DW-80020, 80021 | 1/7/2008 | Gr. Alpha | 2.28 ± 0.84 | 1.98 ± 0.86 | 2.13 ± 0.60 | Pass |
| U-169, 170 | 1/10/2008 | Beta-K40 | 7.50 ± 5.50 | 11.70 ± 5.10 | 9.60 ± 3.75 | Pass |
| SO-8836, 8837 | 1/14/2008 | Cs-137 | 0.80 ± 0.05 | 0.75 ± 0.05 | 0.77 ± 0.03 | Pass |
| SO-8836, 8837 | 1/14/2008 | Gr. Alpha | 13.30 ± 4.31 | 15.58 ± 4.10 | 14.44 ± 2.98 | Pass |
| SO-8836, 8837 | 1/14/2008 | Gr. Alpha | 33.68 ± 3.73 | 29.21 ± 3.10 | 31.45 ± 2.43 | Pass |
| SO-8836, 8837 | 1/14/2008 | K-40 | 12.31 ± 0.74 | 12.96 ± 0.73 | 12.64 ± 0.52 | Pass |
| DW-80045, 80046 | 1/15/2008 | Gr. Alpha | 2.94 ± 1.13 | 3.41 ± 1.04 | 3.17 ± 0.77 | Pass |
| DW-80045, 80046 | 1/15/2008 | Gr. Beta | 1.86 ± 0.66 | 1.36 ± 0.63 | 1.61 ± 0.45 | Pass |
| MI-138, 139 | 1/15/2008 | K-40 | 1262.40 ± 81.70 | 1396.20 ± 154.20 | 1329.30 ± 87.25 | Pass |
| LW-190, 191 | 1/16/2008 | Gr. Beta | 2.85 ± 1.07 | 1.64 ± 1.02 | 2.24 ± 0.74 | Pass |
| DW-8008, 8009 | 1/16/2008 | Ra-226 | 2.77 ± 0.20 | 3.11 ± 0.22 | 2.94 ± 0.15 | Pass |
| DW-8008, 8009 | 1/16/2008 | Ra-228 | 3.95 ± 0.74 | 3.96 ± 0.77 | 3.96 ± 0.53 | Pass |
| DW-80057, 80058 | 1/21/2008 | Gr. Alpha | 6.77 ± 0.66 | 7.91 ± 1.73 | 7.34 ± 0.92 | Pass |
| DW-80057, 80058 | 1/21/2008 | Gr. Beta | 13.83 ± 0.97 | 14.78 ± 1.01 | 14.31 ± 0.70 | Pass |
| SWU-479, 480 | 1/29/2008 | Gr. Beta | 4.49 ± 1.13 | 3.13 ± 1.14 | 3.81 ± 0.80 | Pass |
| W-920, 921 | 2/4/2008 | Gr. Beta | 4.20 ± 1.30 | 3.30 ± 1.30 | 3.75 ± 0.92 | Pass |
| SW-540, 541 | 2/12/2008 | Gr. Alpha | 2.75 ± 1.16 | 4.01 ± 1.18 | 3.38 ± 0.83 | Pass |
| SW-540, 541 | 2/12/2008 | Gr. Beta | 6.46 ± 1.11 | 6.71 ± 1.03 | 6.59 ± 0.76 | Pass |
| DW-80155, 80156 | 2/12/2008 | Ra-226 | 2.55 ± 0.22 | 2.01 ± 0.16 | 2.28 ± 0.14 | Fail |
| DW-80155, 80156 | 2/12/2008 | Ra-228 | 1.86 ± 0.70 | 1.53 ± 0.67 | 1.70 ± 0.48 | Pass |
| DW-80165, 80166 | 2/20/2008 | Gr. Alpha | 1.51 ± 0.90 | 0.80 ± 1.05 | 1.16 ± 0.69 | Pass |
| DW-80166, 80167 | 2/20/2008 | Ra-226 | 0.40 ± 0.09 | 0.46 ± 0.09 | 0.43 ± 0.06 | Pass |
| DW-80166, 80167 | 2/20/2008 | Ra-228 | 1.44 ± 0.52 | 1.42 ± 0.57 | 1.43 ± 0.39 | Pass |
| DW-80166, 80167 | 2/20/2008 | Uranium | 0.69 ± 0.25 | 0.69 ± 0.26 | 0.69 ± 0.18 | Pass |
| W-1413, 1414 | 3/3/2008 | Gr. Beta | 7.50 ± 3.00 | 3.70 ± 2.60 | 5.60 ± 1.98 | Pass |
| DW-80189, 80190 | 3/11/2008 | Ra-226 | 4.41 ± 0.30 | 4.09 ± 0.25 | 4.25 ± 0.20 | Pass |
| DW-80189, 80190 | 3/11/2008 | Ra-228 | 1.99 ± 0.65 | 2.17 ± 0.66 | 2.08 ± 0.46 | Pass |
| MI-1006, 1007 | 3/12/2008 | K-40 | 1451.90 ± 112.80 | 1409.50 ± 111.40 | 1430.70 ± 79.27 | Pass |
| MI-1006, 1007 | 3/12/2008 | Sr-90 | 0.48 ± 0.31 | 0.97 ± 0.38 | 0.72 ± 0.24 | Pass |
| DW-80205, 80206 | 3/14/2008 | Gr. Alpha | 3.64 ± 0.80 | 3.39 ± 0.82 | 3.52 ± 0.57 | Pass |
| DW-80202, 80203 | 3/14/2008 | Ra-226 | 3.16 ± 0.21 | 3.00 ± 0.19 | 3.08 ± 0.14 | Pass |
| DW-80202, 80203 | 3/14/2008 | Ra-228 | 2.40 ± 1.00 | 2.07 ± 0.69 | 2.24 ± 0.61 | Pass |
| DW-80208, 80209 | 3/14/2008 | U-233/4 | 1.32 ± 0.25 | 1.29 ± 0.36 | 1.31 ± 0.22 | Pass |
| SG-1080, 1081 | 3/18/2008 | Pb-214 | 3.99 ± 0.30 | 4.15 ± 0.29 | 4.07 ± 0.21 | Pass |
| SO-1195, 1196 | 3/18/2008 | U-233/4 | 0.14 ± 0.02 | 0.14 ± 0.02 | 0.14 ± 0.01 | Pass |
| SO-1195, 1196 | 3/18/2008 | U-238 | 0.13 ± 0.02 | 0.13 ± 0.02 | 0.13 ± 0.01 | Pass |
| WW-1242, 1243 | 3/24/2008 | Gr. Beta | 10.36 ± 1.63 | 9.06 ± 1.55 | 9.71 ± 1.13 | Pass |
| AP-1519, 1520 | 4/2/2008 | Be-7 | 0.07 ± 0.01 | 0.08 ± 0.01 | 0.08 ± 0.01 | Pass |
| W-1565, 1566 | 4/2/2008 | Gr. Alpha | 0.82 ± 0.64 | 1.58 ± 0.72 | 1.20 ± 0.48 | Pass |
| W-1565, 1566 | 4/2/2008 | Gr. Beta | 3.73 ± 0.86 | 5.51 ± 1.09 | 4.62 ± 0.69 | Pass |

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

| Lab Code | Date | Analysis | Concentration (pCi/L)[a] First Result | Second Result | Averaged Result | Acceptance |
|---|---|---|---|---|---|---|
| DW-80255, 80256 | 4/8/2008 | Ra-226 | 0.19 ± 0.08 | 0.28 ± 0.11 | 0.24 ± 0.07 | Pass |
| DW-80255, 80256 | 4/8/2008 | Ra-228 | 1.79 ± 0.57 | 1.32 ± 0.55 | 1.56 ± 0.40 | Pass |
| DW-80259, 80260 | 4/8/2008 | Gr. Alpha | 3.39 ± 0.82 | 3.62 ± 0.82 | 3.51 ± 0.58 | Pass |
| DW-80301, 80302 | 4/11/2008 | Ra-226 | 0.47 ± 0.09 | 0.47 ± 0.09 | 0.47 ± 0.06 | Pass |
| DW-80301, 80302 | 4/11/2008 | Ra-228 | 1.02 ± 0.42 | 0.82 ± 0.45 | 0.92 ± 0.31 | Pass |
| SO-1913, 1914 | 4/15/2008 | K-40 | 12.79 ± 0.73 | 13.88 ± 0.85 | 13.34 ± 0.56 | Pass |
| DW-80313, 80314 | 4/16/2008 | Ra-226 | 3.39 ± 0.22 | 3.28 ± 0.21 | 3.34 ± 0.15 | Pass |
| DW-80313, 80314 | 4/16/2008 | Ra-228 | 4.27 ± 0.72 | 5.14 ± 0.77 | 4.71 ± 0.53 | Pass |
| SWU-2087, 2088 | 4/29/2008 | Gr. Beta | 2.20 ± 0.60 | 3.50 ± 0.90 | 2.85 ± 0.54 | Pass |
| LW-2297, 2298 | 4/30/2008 | Gr. Beta | 1.41 ± 0.43 | 1.02 ± 0.40 | 1.22 ± 0.30 | Pass |
| LW-2321, 2322 | 4/30/2008 | Gr. Beta | 1.33 ± 0.54 | 1.23 ± 0.54 | 1.28 ± 0.38 | Pass |
| BS-2063, 2064 | 5/1/2008 | Gr. Beta | 13.71 ± 2.06 | 17.60 ± 2.49 | 15.66 ± 1.62 | Pass |
| SG-2229, 2230 | 5/5/2008 | Ac-228 | 26.25 ± 2.70 | 24.90 ± 2.55 | 25.58 ± 1.86 | Pass |
| W-2792, 2793 | 5/5/2008 | Gr. Beta | 7.20 ± 2.30 | 7.00 ± 2.50 | 7.10 ± 1.70 | Pass |
| SG-2229, 2230 | 5/5/2008 | Pb-214 | 23.28 ± 0.30 | 23.54 ± 0.33 | 23.41 ± 0.22 | Pass |
| F-2850, 2851 | 5/7/2008 | Cs-137 | 3.37 ± 0.21 | 3.16 ± 0.19 | 3.27 ± 0.14 | Pass |
| DW-80376, 80377 | 5/9/2008 | Ra-226 | 0.94 ± 0.13 | 1.07 ± 0.13 | 1.01 ± 0.09 | Pass |
| DW-80376, 80377 | 5/9/2008 | Ra-228 | 2.05 ± 0.57 | 1.40 ± 0.51 | 1.73 ± 0.38 | Pass |
| MI-2363, 2364 | 5/14/2008 | K-40 | 1335.40 ± 111.20 | 1510.70 ± 124.30 | 1423.05 ± 83.39 | Pass |
| SG-2752, 2753 | 5/14/2008 | Be-7 | 264.60 ± 83.90 | 222.80 ± 93.10 | 243.70 ± 62.66 | Pass |
| SG-2752, 2753 | 5/14/2008 | Cs-137 | 64.80 ± 6.00 | 68.90 ± 5.80 | 66.85 ± 4.17 | Pass |
| SG-2752, 2753 | 5/14/2008 | Gr. Alpha | 19.35 ± 3.48 | 22.88 ± 4.04 | 21.12 ± 2.67 | Pass |
| SG-2752, 2753 | 5/14/2008 | Gr. Beta | 30.53 ± 2.40 | 33.31 ± 2.71 | 31.92 ± 1.81 | Pass |
| SG-2752, 2753 | 5/14/2008 | K-40 | 9121.90 ± 191.80 | 9183.70 ± 194.20 | 9152.80 ± 136.47 | Pass |
| DW-80389, 80390 | 5/14/2008 | Ra-226 | 2.99 ± 0.36 | 2.58 ± 0.31 | 2.79 ± 0.24 | Pass |
| DW-80389, 80390 | 5/14/2008 | Ra-228 | 2.87 ± 0.68 | 1.73 ± 0.57 | 2.30 ± 0.44 | Pass |
| DW-80392, 80393 | 5/14/2008 | Gr. Alpha | 19.94 ± 1.30 | 17.89 ± 1.26 | 18.92 ± 0.91 | Pass |
| DW-80394, 80395 | 5/14/2008 | U-233/4 | 2.03 ± 0.27 | 2.54 ± 0.39 | 2.29 ± 0.24 | Pass |
| BS-2490, 2491 | 5/16/2008 | Cs-137 | 6.81 ± 1.20 | 6.76 ± 1.23 | 6.78 ± 0.86 | Pass |
| WW-2462, 2463 | 5/19/2008 | H-3 | 158.61 ± 80.90 | 205.63 ± 83.06 | 182.12 ± 57.97 | Pass |
| W-2826, 2827 | 5/27/2008 | Gr. Alpha | 3.47 ± 2.23 | 4.22 ± 2.20 | 3.84 ± 1.57 | Pass |
| W-2826, 2827 | 5/27/2008 | Gr. Beta | 10.67 ± 1.92 | 9.43 ± 1.76 | 10.05 ± 1.30 | Pass |
| SG-3378, 3379 | 6/2/2008 | Gr. Alpha | 6.51 ± 1.15 | 7.83 ± 1.32 | 7.17 ± 0.88 | Pass |
| SG-3378, 3379 | 6/2/2008 | Gr. Beta | 16.23 ± 0.95 | 15.76 ± 1.06 | 16.00 ± 0.71 | Pass |
| SG-3393, 3394 | 6/4/2008 | Be-7 | 0.82 ± 0.23 | 0.66 ± 0.33 | 0.74 ± 0.20 | Pass |
| SG-3393, 3394 | 6/4/2008 | Cs-137 | 0.07 ± 0.01 | 0.07 ± 0.01 | 0.07 ± 0.01 | Pass |
| SG-3393, 3394 | 6/4/2008 | Gr. Alpha | 18.96 ± 3.49 | 16.96 ± 3.34 | 17.96 ± 2.42 | Pass |
| SG-3393, 3394 | 6/4/2008 | Gr. Beta | 30.01 ± 2.49 | 30.17 ± 2.56 | 30.09 ± 1.79 | Pass |
| SG-3393, 3394 | 6/4/2008 | K-40 | 9.78 ± 0.30 | 10.00 ± 0.28 | 9.89 ± 0.21 | Pass |
| LW-2939, 2940 | 6/12/2008 | Gr. Beta | 1.46 ± 0.59 | 1.74 ± 0.59 | 1.60 ± 0.42 | Pass |
| WW-3053, 3054 | 6/17/2008 | Gr. Beta | 4.28 ± 0.83 | 5.27 ± 0.91 | 4.77 ± 0.61 | Pass |
| SW-3154, 3155 | 6/24/2008 | Gr. Beta | 2.15 ± 1.01 | 2.79 ± 0.97 | 2.47 ± 0.70 | Pass |

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

| Lab Code | Date | Analysis | Concentration (pCi/L)[a] First Result | Second Result | Averaged Result | Acceptance |
|---|---|---|---|---|---|---|
| BS-3245, 3246 | 6/27/2008 | Co-60 | 108.84 ± 44.14 | 91.10 ± 22.32 | 99.97 ± 24.73 | Pass |
| BS-3245, 3246 | 6/27/2008 | Cs-137 | 952.18 ± 52.78 | 941.56 ± 13.61 | 946.87 ± 27.25 | Pass |
| XW-1080, 1081 | 6/30/2008 | Fe-55 | 2.96 ± 0.32 | 2.71 ± 0.30 | 2.84 ± 0.22 | Pass |
| XW-3786, 3787 | 6/30/2008 | Fe-55 | 2.96 ± 0.32 | 2.71 ± 0.30 | 2.84 ± 0.22 | Pass |
| G-3274, 3275 | 7/1/2008 | Gr. Beta | 7.65 ± 0.24 | 7.44 ± 0.24 | 7.55 ± 0.17 | Pass |
| SL-3295, 3296 | 7/1/2008 | Gr. Beta | 3.76 ± 0.24 | 3.64 ± 0.24 | 3.70 ± 0.17 | Pass |
| AP-3531, 3532 | 7/1/2008 | Be-7 | 0.10 ± 0.01 | 0.08 ± 0.01 | 0.09 ± 0.01 | Pass |
| AP-3663, 3664 | 7/2/2008 | Be-7 | 0.08 ± 0.01 | 0.08 ± 0.02 | 0.08 ± 0.01 | Pass |
| AP-3690, 3691 | 7/2/2008 | Be-7 | 0.07 ± 0.01 | 0.07 ± 0.01 | 0.07 ± 0.01 | Pass |
| W-4333, 4334 | 7/7/2008 | Gr. Beta | 7.20 ± 1.90 | 7.70 ± 1.70 | 7.45 ± 1.27 | Pass |
| W-4840, 4841 | 7/7/2008 | Gr. Beta | 6.70 ± 1.60 | 6.70 ± 1.80 | 6.70 ± 1.20 | Pass |
| DW-80415, 80416 | 7/7/2008 | Ra-226 | 2.81 ± 0.47 | 2.00 ± 0.34 | 2.41 ± 0.29 | Pass |
| SG-3964, 3965 | 7/9/2008 | Be-7 | 1.35 ± 0.23 | 1.51 ± 0.22 | 1.43 ± 0.16 | Pass |
| SG-3964, 3965 | 7/9/2008 | Cs-137 | 0.04 ± 0.01 | 0.04 ± 0.01 | 0.04 ± 0.00 | Pass |
| SG-3964, 3965 | 7/9/2008 | Gr. Alpha | 23.17 ± 3.39 | 18.76 ± 3.24 | 20.97 ± 2.34 | Pass |
| SG-3964, 3965 | 7/9/2008 | Gr. Beta | 28.99 ± 2.12 | 29.25 ± 2.31 | 29.12 ± 1.57 | Pass |
| SG-3964, 3965 | 7/9/2008 | K-40 | 6.86 ± 0.19 | 6.84 ± 0.17 | 6.85 ± 0.13 | Pass |
| DW-80427, 80428 | 7/9/2008 | Ra-226 | 3.25 ± 0.24 | 3.27 ± 0.20 | 3.26 ± 0.16 | Pass |
| DW-80427, 80428 | 7/9/2008 | Ra-228 | 2.65 ± 0.67 | 3.25 ± 0.72 | 2.95 ± 0.49 | Pass |
| DW-80451, 80452 | 7/15/2008 | Ra-226 | 1.02 ± 0.10 | 0.96 ± 0.12 | 0.99 ± 0.08 | Pass |
| DW-80451, 80452 | 7/15/2008 | Ra-228 | 1.09 ± 0.62 | 1.14 ± 0.60 | 1.12 ± 0.43 | Pass |
| DW-80481, 80482 | 7/16/2008 | Ra-226 | 1.20 ± 0.13 | 1.40 ± 0.14 | 1.30 ± 0.10 | Pass |
| DW-80481, 80482 | 7/16/2008 | Ra-228 | 1.69 ± 0.68 | 1.65 ± 0.77 | 1.67 ± 0.51 | Pass |
| MI-3842, 3843 | 7/21/2008 | K-40 | 1282.60 ± 108.30 | 1379.00 ± 111.40 | 1330.80 ± 77.68 | Pass |
| MI-3892, 3893 | 7/28/2008 | K-40 | 1371.50 ± 102.90 | 1501.20 ± 111.80 | 1436.35 ± 75.97 | Pass |
| DW-4067, 4068 | 7/29/2008 | Gr. Beta | 10.46 ± 2.37 | 14.25 ± 2.78 | 12.36 ± 1.83 | Pass |
| SWT-4158, 4159 | 7/29/2008 | Gr. Beta | 1.58 ± 0.45 | 1.80 ± 0.47 | 1.69 ± 0.33 | Pass |
| LW-4221, 4222 | 7/31/2008 | Gr. Beta | 1.35 ± 0.56 | 0.91 ± 0.52 | 1.13 ± 0.38 | Pass |
| LW-4242, 4243 | 7/31/2008 | Gr. Beta | 1.36 ± 0.56 | 1.18 ± 0.53 | 1.27 ± 0.38 | Pass |
| VE-4046, 4047 | 8/4/2008 | Be-7 | 0.77 ± 0.13 | 0.82 ± 0.19 | 0.80 ± 0.12 | Pass |
| VE-4046, 4047 | 8/4/2008 | Gr. Beta | 8.81 ± 0.36 | 8.34 ± 0.31 | 8.58 ± 0.24 | Pass |
| VE-4046, 4047 | 8/4/2008 | K-40 | 5.17 ± 0.34 | 5.33 ± 0.42 | 5.25 ± 0.27 | Pass |
| W-4821, 4822 | 8/4/2008 | Gr. Alpha | 1.70 ± 0.80 | 1.70 ± 0.90 | 1.70 ± 0.60 | Pass |
| W-4821, 4822 | 8/4/2008 | Gr. Beta | 3.90 ± 0.80 | 3.70 ± 0.90 | 3.80 ± 0.60 | Pass |
| W-4801, 4802 | 8/5/2008 | Gr. Alpha | 4.40 ± 2.40 | 4.80 ± 2.30 | 4.60 ± 1.66 | Pass |
| W-4801, 4802 | 8/5/2008 | Gr. Beta | 13.20 ± 1.30 | 14.50 ± 1.40 | 13.85 ± 0.96 | Pass |
| DW-80522, 80523 | 8/5/2008 | Ra-226 | 0.50 ± 0.12 | 0.28 ± 0.12 | 0.39 ± 0.08 | Pass |
| DW-80522, 80523 | 8/5/2008 | Ra-228 | 1.23 ± 0.60 | 1.09 ± 0.57 | 1.16 ± 0.41 | Pass |

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

| Lab Code | Date | Analysis | Concentration (pCi/L)[a] First Result | Second Result | Averaged Result | Acceptance |
|---|---|---|---|---|---|---|
| DW-80531, 80532 | 8/5/2008 | Gr. Alpha | 18.90 ± 1.86 | 17.80 ± 1.96 | 18.35 ± 1.35 | Pass |
| DW-80534, 80535 | 8/5/2008 | Ra-226 | 3.01 ± 0.18 | 3.33 ± 0.18 | 3.17 ± 0.13 | Pass |
| DW-80534, 80535 | 8/5/2008 | Ra-228 | 2.24 ± 0.59 | 2.12 ± 0.59 | 2.18 ± 0.42 | Pass |
| SG-4584, 4585 | 8/6/2008 | Be-7 | 7.11 ± 0.20 | 7.44 ± 0.37 | 7.27 ± 0.21 | Pass |
| SG-4584, 4585 | 8/6/2008 | Cs-137 | 0.05 ± 0.01 | 0.04 ± 0.01 | 0.04 ± 0.00 | Pass |
| SG-4584, 4585 | 8/6/2008 | K-40 | 7.88 ± 10.18 | 8.02 ± 0.21 | 7.95 ± 5.09 | Pass |
| SG-4584, 4585 | 8/6/2008 | Ra-226 | 3.94 ± 0.18 | 3.74 ± 0.22 | 3.84 ± 0.14 | Pass |
| SG-4573, 4574 | 8/13/2008 | Gr. Alpha | 240.72 ± 8.74 | 251.53 ± 9.56 | 246.13 ± 6.48 | Pass |
| SG-4573, 4574 | 8/13/2008 | Gr. Beta | 201.60 ± 4.28 | 206.88 ± 4.71 | 204.24 ± 3.18 | Pass |
| SG-4584, 4585 | 8/13/2008 | Gr. Alpha | 14.07 ± 3.10 | 12.97 ± 3.04 | 13.52 ± 2.17 | Pass |
| SG-4584, 4585 | 8/13/2008 | Gr. Beta | 22.08 ± 2.36 | 23.02 ± 2.34 | 22.55 ± 1.66 | Pass |
| DW-80547, 80548 | 8/13/2008 | Gr. Alpha | 3.33 ± 1.11 | 3.88 ± 1.07 | 3.61 ± 0.77 | Pass |
| DW-80551, 80552 | 8/13/2008 | U-233/4 | 2.57 ± 0.48 | 2.13 ± 0.46 | 2.35 ± 0.33 | Pass |
| DW-80553, 80554 | 8/13/2008 | Ra-226 | 0.92 ± 0.14 | 1.21 ± 0.17 | 1.07 ± 0.11 | Pass |
| DW-80553, 80554 | 8/13/2008 | Ra-228 | 2.20 ± 0.61 | 1.64 ± 0.56 | 1.92 ± 0.41 | Pass |
| DW-80566, 80567 | 8/20/2008 | Ra-226 | 1.10 ± 0.11 | 1.10 ± 0.10 | 1.10 ± 0.07 | Pass |
| DW-80566, 80567 | 8/20/2008 | Ra-228 | 2.01 ± 0.58 | 1.74 ± 0.58 | 1.88 ± 0.41 | Pass |
| VE-4647, 4648 | 8/27/2008 | K-40 | 1.97 ± 0.17 | 2.00 ± 0.21 | 1.99 ± 0.14 | Pass |
| SL-4690, 4691 | 9/2/2008 | Gr. Beta | 2.28 ± 0.25 | 2.35 ± 0.24 | 2.32 ± 0.17 | Pass |
| ME-4732, 4733 | 9/2/2008 | Gr. Beta | 2.86 ± 0.09 | 2.70 ± 0.09 | 2.78 ± 0.06 | Pass |
| ME-4732, 4733 | 9/2/2008 | K-40 | 2.44 ± 0.37 | 2.82 ± 0.51 | 2.63 ± 0.32 | Pass |
| SG-5180, 5181 | 9/3/2008 | Be-7 | 15.50 ± 0.43 | 15.54 ± 0.38 | 15.52 ± 0.29 | Pass |
| SG-5180, 5181 | 9/3/2008 | Cs-137 | 0.07 ± 0.01 | 0.07 ± 0.01 | 0.07 ± 0.01 | Pass |
| SG-5180, 5181 | 9/3/2008 | Gr. Alpha | 18.74 ± 3.33 | 17.61 ± 3.15 | 18.18 ± 2.29 | Pass |
| SG-5180, 5181 | 9/3/2008 | Gr. Beta | 29.19 ± 2.10 | 28.49 ± 2.15 | 28.84 ± 1.50 | Pass |
| SG-5180, 5181 | 9/3/2008 | K-40 | 8.55 ± 0.32 | 8.11 ± 0.27 | 8.33 ± 0.21 | Pass |
| SG-5187, 5188 | 9/3/2008 | Be-7 | 6.18 ± 0.54 | 5.90 ± 0.77 | 6.04 ± 0.47 | Pass |
| SG-5187, 5188 | 9/3/2008 | K-40 | 7.16 ± 0.60 | 7.29 ± 0.60 | 7.23 ± 0.42 | Pass |
| SG-5193, 5194 | 9/3/2008 | Gr. Alpha | 5.80 ± 1.30 | 7.00 ± 1.50 | 6.40 ± 0.99 | Pass |
| SG-5193, 5194 | 9/3/2008 | Gr. Beta | 15.60 ± 1.10 | 15.60 ± 1.10 | 15.60 ± 0.78 | Pass |
| DW-4871, 4872 | 9/5/2008 | I-131 | 1.15 ± 0.27 | 1.16 ± 0.31 | 1.16 ± 0.21 | Pass |
| VE-5022, 5023 | 9/10/2008 | K-40 | 1.27 ± 0.14 | 1.11 ± 0.06 | 1.19 ± 0.08 | Pass |
| DW-5337, 5338 | 9/10/2008 | Gr. Beta | 3.00 ± 1.07 | 2.19 ± 1.05 | 2.60 ± 0.75 | Pass |
| WW-4977, 4978 | 9/17/2008 | Gr. Beta | 3.71 ± 1.10 | 2.32 ± 1.11 | 3.01 ± 0.78 | Pass |
| BS-5088, 5089 | 9/19/2008 | K-40 | 10493 ± 607 | 10299 ± 470 | 10396 ± 384 | Pass |
| DW-80584, 80585 | 9/19/2008 | U-233/4 | 3.01 ± 0.52 | 2.44 ± 0.47 | 2.73 ± 0.35 | Pass |
| DW-80584, 80585 | 9/19/2008 | U-238 | 0.70 ± 0.25 | 0.27 ± 0.18 | 0.49 ± 0.15 | Pass |
| DW-80579, 80580 | 9/25/2008 | Gr. Alpha | 10.69 ± 1.31 | 12.84 ± 1.51 | 11.77 ± 1.00 | Pass |
| DW-80579, 80580 | 9/25/2008 | Ra-226 | 3.13 ± 0.22 | 2.89 ± 0.21 | 3.01 ± 0.15 | Pass |
| DW-80579, 80580 | 9/25/2008 | Ra-228 | 3.03 ± 0.73 | 1.98 ± 0.69 | 2.51 ± 0.50 | Pass |
| G-5389, 5390 | 10/1/2008 | Be-7 | 1.49 ± 0.32 | 1.36 ± 0.28 | 1.43 ± 0.21 | Pass |
| G-5389, 5390 | 10/1/2008 | Gr. Beta | 10.86 ± 0.24 | 11.18 ± 0.25 | 11.02 ± 0.17 | Pass |
| G-5389, 5390 | 10/1/2008 | K-40 | 7.42 ± 0.67 | 8.06 ± 0.63 | 7.74 ± 0.46 | Pass |

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

| Lab Code | Date | Analysis | Concentration (pCi/L)[a] First Result | Second Result | Averaged Result | Acceptance |
|---|---|---|---|---|---|---|
| AP-5814, 5815 | 10/1/2008 | Be-7 | 0.08 ± 0.01 | 0.08 ± 0.01 | 0.08 ± 0.01 | Pass |
| SG-6111, 6112 | 10/6/2008 | Gr. Alpha | 9.34 ± 1.82 | 8.95 ± 1.67 | 9.15 ± 1.24 | Pass |
| SG-6111, 6112 | 10/6/2008 | Gr. Beta | 17.46 ± 1.46 | 18.86 ± 1.35 | 18.16 ± 0.99 | Pass |
| DW-80592, 80593 | 10/7/2008 | Gr. Alpha | 2.30 ± 1.14 | 1.57 ± 0.88 | 1.94 ± 0.72 | Pass |
| DW-80594, 80595 | 10/7/2008 | Ra-228 | 1.41 ± 0.55 | 1.22 ± 0.50 | 1.32 ± 0.37 | Pass |
| DW-80650, 80651 | 10/8/2008 | Gr. Alpha | 1.30 ± 0.86 | 0.12 ± 0.79 | 0.71 ± 0.58 | Pass |
| DW-80650, 80651 | 10/8/2008 | Gr. Beta | 2.92 ± 0.69 | 3.03 ± 0.64 | 2.98 ± 0.47 | Pass |
| DW-80629, 80630 | 10/13/2008 | Ra-226 | 3.12 ± 0.18 | 2.87 ± 0.17 | 3.00 ± 0.12 | Pass |
| DW-80629, 80630 | 10/13/2008 | Ra-228 | 2.71 ± 0.80 | 3.28 ± 0.81 | 3.00 ± 0.57 | Pass |
| DW-80663, 80664 | 10/13/2008 | Gr. Alpha | 5.91 ± 1.70 | 3.14 ± 1.44 | 4.53 ± 1.11 | Pass |
| MI-5572, 5573 | 10/14/2008 | K-40 | 1391.00 ± 97.39 | 1443.90 ± 110.60 | 1417.45 ± 73.68 | Pass |
| MI-5603, 5604 | 10/14/2008 | K-40 | 1412.80 ± 109.30 | 1413.80 ± 110.50 | 1413.30 ± 77.71 | Pass |
| DW-80676, 80677 | 10/20/2008 | Gr. Alpha | 12.20 ± 1.48 | 11.87 ± 1.54 | 12.04 ± 1.07 | Pass |
| DW-80676, 80677 | 10/20/2008 | Ra-226 | 5.04 ± 0.25 | 5.10 ± 0.25 | 5.07 ± 0.18 | Pass |
| DW-80676, 80677 | 10/20/2008 | Ra-228 | 5.87 ± 0.86 | 6.98 ± 0.95 | 6.43 ± 0.64 | Pass |
| SW-80687, 80688 | 10/22/2008 | Gr. Alpha | 3.42 ± 1.03 | 2.98 ± 1.01 | 3.20 ± 0.72 | Pass |
| DW-80729, 80730 | 10/30/2008 | Gr. Alpha | 8.40 ± 1.45 | 7.76 ± 2.00 | 8.08 ± 1.24 | Pass |
| DW-80729, 80730 | 10/30/2008 | Gr. Beta | 16.94 ± 1.45 | 15.41 ± 1.37 | 16.18 ± 1.00 | Pass |
| DW-80738, 80739 | 10/31/2008 | U-233/4 | 2.94 ± 0.50 | 3.06 ± 0.63 | 3.00 ± 0.40 | Pass |
| DW-80747, 80748 | 10/31/2008 | Ra-226 | 0.60 ± 0.09 | 0.50 ± 0.08 | 0.55 ± 0.06 | Pass |
| DW-80747, 80748 | 10/31/2008 | Ra-228 | 1.33 ± 0.59 | 1.38 ± 0.60 | 1.36 ± 0.42 | Pass |
| BS-6271, 6272 | 11/3/2008 | Gr. Beta | 12.26 ± 1.69 | 13.78 ± 1.84 | 13.02 ± 1.25 | Pass |
| SS-6593, 6594 | 11/19/2008 | K-40 | 12.35 ± 0.57 | 13.10 ± 0.76 | 12.73 ± 0.48 | Pass |
| MI-7046, 7047 | 12/16/2008 | K-40 | 1380.10 ± 109.80 | 1477.30 ± 98.32 | 1428.70 ± 73.69 | Pass |
| DW-80698, 80699 | 12/23/2008 | Ra-226 | 3.13 ± 0.22 | 3.21 ± 0.23 | 3.17 ± 0.16 | Pass |
| DW-80698, 80699 | 12/23/2008 | Ra-228 | 5.48 ± 0.91 | 5.86 ± 0.93 | 5.67 ± 0.65 | Pass |
| SW-7281, 7282 | 12/30/2008 | Gr. Beta | 0.87 ± 0.54 | 1.35 ± 0.54 | 1.11 ± 0.38 | 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)[a].

| Lab Code[c] | Date | Analysis | Concentration[b] Laboratory result | Known Activity | Control Limits[d] | Acceptance |
|---|---|---|---|---|---|---|
| STW-1137 | 01/01/08 | Am-241 | 1.27 ± 0.06 | 1.23 | 0.86 - 1.60 | Pass |
| STW-1137 | 01/01/08 | Co-57 | 23.80 ± 0.60 | 22.80 | 16.00 - 29.60 | Pass |
| STW-1137 | 01/01/08 | Co-60 | 8.60 ± 0.50 | 8.40 | 5.88 - 10.92 | Pass |
| STW-1137 | 01/01/08 | Cs-134 | -0.02 ± 0.10 | 0.00 | -1.00 - 1.00 | Pass |
| STW-1137 | 01/01/08 | Cs-137 | 0.00 ± 0.10 | 0.00 | -1.00 - 1.00 | Pass |
| STW-1137 | 01/01/08 | Fe-55 | 32.60 ± 11.60 | 36.50 | 25.60 - 47.50 | Pass |
| STW-1137 | 01/01/08 | H-3 | 515.10 ± 12.70 | 472.00 | 330.00 - 614.00 | Pass |
| STW-1137 | 01/01/08 | Mn-54 | 12.90 ± 0.80 | 12.10 | 8.50 - 15.70 | Pass |
| STW-1137 | 01/01/08 | Ni-63 | 29.50 ± 2.30 | 30.70 | 21.50 - 39.90 | Pass |
| STW-1137 | 01/01/08 | Pu-238 | 0.60 ± 0.06 | 0.73 | 0.51 - 0.95 | Pass |
| STW-1137 | 01/01/08 | Pu-239/40 | 0.019 ± 0.015 | 0.01 | 0.00 - 1.00 | Pass |
| STW-1137 | 01/01/08 | Sr-90 | 12.00 ± 1.50 | 11.40 | 7.98 - 14.82 | Pass |
| STW-1137 | 01/01/08 | Tc-99 | 9.40 ± 1.70 | 11.20 | 7.80 - 14.60 | Pass |
| STW-1137 | 01/01/08 | U-233/4 | 3.37 ± 0.20 | 3.63 | 2.54 - 4.72 | Pass |
| STW-1137 | 01/01/08 | U-238 | 3.63 ± 0.21 | 3.74 | 2.62 - 4.86 | Pass |
| STW-1137 | 01/01/08 | Zn-65 | 16.90 ± 1.40 | 16.30 | 11.40 - 21.20 | Pass |
| STW-1138 | 01/01/08 | Gr. Alpha | 0.96 ± 0.14 | 1.40 | 0.00 - 2.80 | Pass |
| STW-1138 | 01/01/08 | Gr. Beta | 2.30 ± 0.15 | 2.43 | 1.22 - 3.65 | Pass |
| STAP-1139 | 01/01/08 | Co-57 | 3.90 ± 0.07 | 3.55 | 2.49 - 4.62 | Pass |
| STAP-1139 | 01/01/08 | Co-60 | 1.43 ± 0.07 | 1.31 | 0.92 - 1.70 | Pass |
| STAP-1139 | 01/01/08 | Cs-134 | 2.59 ± 0.16 | 2.52 | 1.76 - 3.28 | Pass |
| STAP-1139 | 01/01/08 | Cs-137 | 3.05 ± 0.12 | 2.70 | 1.89 - 3.51 | Pass |
| STAP-1139 | 01/01/08 | Mn-54 | 0.43 ± 0.58 | 0.00 | 0.00 - 1.00 | Pass |
| STAP-1139 | 01/01/08 | Pu-238 | 0.080 ± 0.016 | 0.11 | 0.07 - 0.14 | Pass |
| STAP-1139 | 01/01/08 | Pu-239/40 | 0.12 ± 0.02 | 0.11 | 0.08 - 0.15 | Pass |
| STAP-1139 | 01/01/08 | Sr-90 | 1.30 ± 0.27 | 1.55 | 1.08 - 2.01 | Pass |
| STAP-1139[e] | 01/01/08 | U-233/4 | 0.43 ± 0.03 | 0.22 | 0.15 - 0.28 | Fail |
| STAP-1139[e] | 01/01/08 | U-238 | 0.44 ± 0.03 | 0.23 | 0.16 - 0.29 | Fail |
| STAP-1139 | 01/01/08 | Zn-65 | 2.36 ± 0.18 | 2.04 | 1.43 - 2.65 | Pass |
| STAP-1140 | 01/01/08 | Gr. Alpha | 0.11 ± 0.03 | 0.35 | 0.00 - 0.70 | Pass |
| STAP-1140 | 01/01/08 | Gr. Beta | 0.34 ± 0.04 | 0.29 | 0.14 - 0.43 | Pass |
| STVE-1141 | 01/01/08 | Co-57 | 8.30 ± 0.18 | 6.89 | 4.82 - 8.96 | Pass |
| STVE-1141 | 01/01/08 | Co-60 | 3.03 ± 0.13 | 2.77 | 1.94 - 3.60 | Pass |
| STVE-1141 | 01/01/08 | Cs-134 | 6.53 ± 0.29 | 6.28 | 4.40 - 8.16 | Pass |
| STVE-1141 | 01/01/08 | Cs-137 | 3.90 ± 0.19 | 3.41 | 2.39 - 4.43 | Pass |
| STVE-1141 | 01/01/08 | Mn-54 | 5.43 ± 0.21 | 4.74 | 3.32 - 6.16 | Pass |
| STVE-1141 | 01/01/08 | Zn-65 | 0.033 ± 0.10 | 0.00 | 0.00 - 1.00 | Pass |

TABLE A-6. Department of Energy's Mixed Analyte Performance Evaluation Program (MAPEP)[a].

| | | Concentration [b] | | | | |
|---|---|---|---|---|---|---|
| Lab Code[c] | Date | Analysis | Laboratory result | Known Activity | Control Limits [d] | Acceptance |
| STSO-1142 | 01/01/08 | Co-57 | 483.00 ± 3.00 | 421.00 | 295.00 - 547.00 | Pass |
| STSO-1142 | 01/01/08 | Co-60 | 3.00 ± 0.80 | 2.90 | 0.00 - 5.00 | Pass |
| STSO-1142 | 01/01/08 | Cs-134 | 896.50 ± 7.40 | 854.00 | 598.00 - 1110.00 | Pass |
| STSO-1142 | 01/01/08 | Cs-137 | 624.40 ± 4.10 | 545.00 | 382.00 - 709.00 | Pass |
| STSO-1142 | 01/01/08 | Mn-54 | 667.20 ± 3.80 | 570.00 | 399.00 - 741.00 | Pass |
| STSO-1142 | 01/01/08 | Ni-63 | 536.00 ± 15.50 | 640.00 | 448.00 - 832.00 | Pass |
| STSO-1142 | 01/01/08 | Pu-238 | 78.60 ± 4.80 | 72.80 | 51.00 - 94.60 | Pass |
| STSO-1142 | 01/01/08 | Pu-239/40 | 89.10 ± 4.50 | 90.10 | 63.10 - 117.10 | Pass |
| STSO-1142 | 01/01/08 | U-233/4 | 134.41 ± 5.40 | 142.00 | 99.00 - 185.00 | Pass |
| STSO-1142 | 01/01/08 | U-238 | 139.00 ± 5.50 | 148.00 | 104.00 - 192.00 | Pass |
| STSO-1142 | 01/01/08 | Zn-65 | 0.093 ± 0.91 | 0.00 | 0.00 - 1.00 | Pass |
| STSO-1158 | 08/01/08 | Am-241 | 57.73 ± 4.78 | 69.10 | 48.40 - 89.80 | Pass |
| STSO-1158 | 08/01/08 | Co-57 | 353.02 ± 2.01 | 333.00 | 233.00 - 433.00 | Pass |
| STSO-1158 | 08/01/08 | Co-60 | 151.99 ± 1.58 | 145.00 | 102.00 - 189.00 | Pass |
| STSO-1158 | 08/01/08 | Cs-134 | 499.72 ± 2.65 | 581.00 | 407.00 - 755.00 | Pass |
| STSO-1158 | 08/01/08 | Cs-137 | 2.54 ± 0.25 | 2.80 | 0.00 - 5.00 | Pass |
| STSO-1158 | 08/01/08 | K-40 | 643.94 ± 15.50 | 570.00 | 399.00 - 741.00 | Pass |
| STSO-1158 | 08/01/08 | Mn-54 | 452.14 ± 2.96 | 415.00 | 291.00 - 540.00 | Pass |
| STSO-1158 | 08/01/08 | Ni-63 | 803.09 ± 17.01 | 760.00 | 532.00 - 988.00 | Pass |
| STSO-1158 | 08/01/08 | Pu-238 | 0.12 ± 0.54 | 0.00 | 0.00 - 5.00 | Pass |
| STSO-1158 | 08/01/08 | Pu-239/40 | 60.88 ± 5.89 | 55.60 | 38.90 - 72.30 | Pass |
| STSO-1158 | 08/01/08 | Sr-90 | 1.95 ± 2.04 | 0.00 | 0.00 - 5.00 | Pass |
| STSO-1158 [f] | 08/01/08 | Tc-99 | 337.00 ± 17.30 | 335.00 | 235.00 - 436.00 | Pass |
| STSO-1158 | 08/01/08 | U-238 | 315.67 ± 11.29 | 303.00 | 212.00 - 394.00 | Pass |
| STSO-1158 | 08/01/08 | Zn-65 | 0.10 ± 2.04 | 0.00 | 0.00 - 5.00 | Pass |
| STVE-1159 | 08/01/08 | Co-57 | 8.52 ± 0.23 | 7.10 | 5.00 - 9.20 | Pass |
| STVE-1159 | 08/01/08 | Co-60 | 5.08 ± 0.19 | 4.70 | 3.30 - 6.10 | Pass |
| STVE-1159 | 08/01/08 | Cs-134 | 5.26 ± 0.18 | 5.50 | 3.90 - 7.20 | Pass |
| STVE-1159 | 08/01/08 | Cs-137 | 0.01 ± 0.14 | 0.00 | 0.00 - 1.00 | Pass |
| STVE-1159 | 08/01/08 | Mn-54 | 6.39 ± 0.28 | 5.80 | 4.10 - 7.50 | Pass |
| STVE-1159 | 08/01/08 | Zn-65 | 7.73 ± 0.45 | 6.90 | 4.80 - 9.00 | Pass |

TABLE A-6. Department of Energy's Mixed Analyte Performance Evaluation Program (MAPEP)[a].

| Lab Code[c] | Date | Analysis | Concentration[b] Laboratory result | Known Activity | Control Limits[d] | Acceptance |
|---|---|---|---|---|---|---|
| STW-1162[g] | 08/01/08 | Am-241 | 0.20 ± 0.06 | 0.00 | 0.00 - 0.10 | Fail |
| STW-1162 | 08/01/08 | Co-57 | 0.03 ± 0.16 | 0.00 | 0.00 - 5.00 | Pass |
| STW-1162 | 08/01/08 | Co-60 | 11.27 ± 0.23 | 11.60 | 8.10 - 15.10 | Pass |
| STW-1162 | 08/01/08 | Cs-134 | 17.93 ± 0.52 | 19.50 | 13.70 - 25.40 | Pass |
| STW-1162 | 08/01/08 | Cs-137 | 23.72 ± 0.43 | 23.60 | 16.50 - 30.70 | Pass |
| STW-1162 | 08/01/08 | Fe-55 | 43.36 ± 16.81 | 46.20 | 32.30 - 60.10 | Pass |
| STW-1162 | 08/01/08 | H-3 | 385.15 ± 8.93 | 341.00 | 239.00 - 443.00 | Pass |
| STW-1162 | 08/01/08 | Mn-54 | 13.87 ± 0.37 | 13.70 | 9.60 - 17.80 | Pass |
| STW-1162[h] | 08/01/08 | Ni-63 | 10.77 ± 2.01 | 0.00 | 0.00 - 5.00 | Fail |
| STW-1162[i] | 08/01/08 | Pu-238 | 0.33 ± 0.06 | 0.50 | 0.40 - 0.70 | Fail |
| STW-1162 | 08/01/08 | Pu-239/40 | 0.14 ± 0.15 | 0.00 | 0.00 - 0.20 | Pass |
| STW-1162 | 08/01/08 | Sr-90 | 6.49 ± 1.12 | 6.45 | 4.52 - 8.39 | Pass |
| STW-1162[j] | 08/01/08 | Tc-99 | 1.80 ± 0.62 | 3.76 | 2.63 - 4.89 | Fail |
| STW-1162 | 08/01/08 | U-233/4 | 3.33 ± 0.18 | 3.44 | 2.41 - 4.47 | Pass |
| STW-1162 | 08/01/08 | U-238 | 3.38 ± 0.18 | 3.55 | 2.49 - 4.62 | Pass |
| STW-1162 | 08/01/08 | Zn-65 | 17.64 ± 0.61 | 17.10 | 12.00 - 22.20 | Pass |
| STW-1163 | 08/01/08 | Gr. Alpha | 0.08 ± 0.04 | 0.00 | 0.00 - 0.56 | Pass |
| STW-1163 | 08/01/08 | Gr. Beta | 0.12 ± 0.05 | 0.00 | 0.00 - 1.85 | Pass |

[a] Results obtained by Environmental, Inc., Midwest Laboratory as a participant in the Department of Energy's Mixed Analyte Performance Evaluation Program, Idaho Operations office, Idaho Falls, Idaho

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

[c] Laboratory codes as follows: STW (water), STAP (air filter), STSO (soil), STVE (vegetation).

[d] MAPEP results are presented as the known values and expected laboratory precision (1 sigma, 1 determination) and control limits as defined by the MAPEP.

[e] The results of a repeat analysis were still unacceptable. A spiked air filter was prepared (known activity 4.17 pCi/filter) to verify the methodology; results of the spike analysis were acceptable, 4.64 pCi/filter.

[f] Corrected result. An error in calculation was found.

[g] Included in the testing series as a "false positive". Result of reanalysis, 0.04 ± 0.01 Bq/L.

[h] Included in the testing series as a "false positive". Result of reanalysis, 3.78 ± 2.03 Bq/L.

[i] The reason for the deviation is unknown. Result of the original sample recount: 0.47 ± 0.07 Bq/L. The analysis was then repeated from the beginning. Result of reanalysis: 0.51 ± 0.07 Bq/L.

[j] The lower result was due to a higher than average background count used in the calculation. Average background result:, 4.11 ± 0.6

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

| Lab Code [b] | Date | Analysis | Concentration (pCi/L) Laboratory Result [c] | ERA Result [d] | Control Limits | Acceptance |
|---|---|---|---|---|---|---|
| STAP-1143 | 03/24/08 | Am-241 | 60.48 ± 3.52 | 50.1 | 29.3 - 68.7 | Pass |
| STAP-1143 | 03/24/08 | Co-60 | 650.72 ± 3.00 | 730.0 | 565.0 - 912.0 | Pass |
| STAP-1143 | 03/24/08 | Cs-134 | 467.50 ± 5.53 | 523.0 | 341.0 - 647.0 | Pass |
| STAP-1143 | 03/24/08 | Cs-137 | 1375.90 ± 25.41 | 1450.0 | 1090.0 - 1900.0 | Pass |
| STAP-1143 | 03/24/08 | Fe-55 | 145.60 ± 28.94 | 241.0 | 106.0 - 375.0 | Pass |
| STAP-1143 [e] | 03/24/08 | Mn-54 | 0.00 ± 0.00 | 0.0 | 0.0 - 10.0 | Pass |
| STAP-1143 | 03/24/08 | Pu-238 | 53.65 ± 1.54 | 46.8 | 32.1 - 61.5 | Pass |
| STAP-1143 | 03/24/08 | Pu-239/40 | 70.44 ± 3.11 | 64.1 | 46.5 - 83.0 | Pass |
| STAP-1143 | 03/24/08 | Sr-90 | 157.60 ± 7.70 | 152.0 | 66.9 - 236.0 | Pass |
| STAP-1143 | 03/24/08 | U-233/4 | 62.15 ± 3.41 | 66.7 | 42.0 - 98.8 | Pass |
| STAP-1143 | 03/24/08 | U-238 | 64.11 ± 3.29 | 66.2 | 42.4 - 94.0 | Pass |
| STAP-1143 | 03/24/08 | Uranium | 128.40 ± 3.29 | 136.0 | 69.5 - 216.0 | Pass |
| STAP-1143 | 03/24/08 | Zn-65 | 889.90 ± 15.90 | 872.0 | 604.0 - 1210.0 | Pass |
| STAP-1144 | 03/24/08 | Gr. Alpha | 13.08 ± 1.09 | 8.8 | 4.56 - 13.2 | Pass |
| STAP-1144 | 03/24/08 | Gr. Beta | 99.90 ± 3.09 | 92.2 | 56.80 - 135.0 | Pass |
| STSO-1145 | 03/24/08 | Ac-228 | 1269.02 ± 36.81 | 1180.0 | 757.0 - 1660.0 | Pass |
| STSO-1145 | 03/24/08 | Am-241 | 1268.50 ± 85.80 | 1230.0 | 735.0 - 1580.0 | Pass |
| STSO-1145 | 03/24/08 | Bi-212 | 1407.10 ± 56.64 | 1360.0 | 357.0 - 2030.0 | Pass |
| STSO-1145 | 03/24/08 | Bi-214 | 2145.50 ± 305.63 | 1790.0 | 1100.0 - 2570.0 | Pass |
| STSO-1145 | 03/24/08 | Co-60 | 5219.70 ± 90.30 | 5130.0 | 3730.0 - 6890.0 | Pass |
| STSO-1145 | 03/24/08 | Cs-134 | 5427.30 ± 102.94 | 5640.0 | 3630.0 - 6790.0 | Pass |
| STSO-1145 | 03/24/08 | Cs-137 | 6346.60 ± 201.80 | 6010.0 | 4600.0 - 7810.0 | Pass |
| STSO-1145 | 03/24/08 | K-40 | 11052.70 ± 181.80 | 11000.0 | 7980.0 - 14900.0 | Pass |
| STSO-1145 [e] | 03/24/08 | Mn-54 | 0.00 ± 0.00 | 0.0 | 0.0 - 10.0 | Pass |
| STSO-1145 | 03/24/08 | Pb-212 | 1198.20 ± 96.58 | 1080.0 | 697.0 - 1520.0 | Pass |
| STSO-1145 | 03/24/08 | Pb-214 | 2253.30 ± 291.60 | 2020.0 | 1210.0 - 3010.0 | Pass |
| STSO-1145 | 03/24/08 | Sr-90 | 6407.00 ± 277.00 | 5360.0 | 1940.0 - 8750.0 | Pass |
| STSO-1145 | 03/24/08 | Th-234 | 2421.80 ± 321.00 | 2030.0 | 644.0 - 3870.0 | Pass |
| STSO-1145 [f] | 03/24/08 | U-233/4 | 1227.93 ± 91.52 | 2050.0 | 1240.0 - 2580.0 | Fail |
| STSO-1145 | 03/24/08 | U-238 | 1319.90 ± 48.81 | 2030.0 | 1240.0 - 2580.0 | Pass |
| STSO-1145 | 03/24/08 | Uranium | 2592.00 ± 140.50 | 4180.0 | 2380.0 - 5640.0 | Pass |
| STSO-1145 | 03/24/08 | Zn-65 | 2936.20 ± 73.50 | 2660.0 | 2110.0 - 3570.0 | Pass |

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

| Lab Code [b] | Date | Analysis | Concentration (pCi/L) Laboratory Result [c] | ERA Result [d] | Control Limits | Acceptance |
|---|---|---|---|---|---|---|
| STVE-1146 | 03/24/08 | Am-241 | 1261.50 ± 73.90 | 1260.0 | 718.0 - 1730.0 | Pass |
| STVE-1146 | 03/24/08 | Cm-244 | 1152.50 ± 57.44 | 1200.0 | 591.0 - 1870.0 | Pass |
| STVE-1146 | 03/24/08 | Co-60 | 912.41 ± 13.59 | 888.0 | 600.0 - 1280.0 | Pass |
| STVE-1146 | 03/24/08 | Cs-134 | 1547.70 ± 38.81 | 1540.0 | 882.0 - 2130.0 | Pass |
| STVE-1146 | 03/24/08 | Cs-137 | 1163.80 ± 20.62 | 1100.0 | 807.0 - 1530.0 | Pass |
| STVE-1146 | 03/24/08 | K-40 | 22186.00 ± 339.40 | 24600.0 | 17700.0 - 34800.0 | Pass |
| STVE-1146 [e] | 03/24/08 | Mn-54 | 0.00 ± 0.00 | 0.0 | 0.0 - 10.0 | Pass |
| STVE-1146 | 03/24/08 | Sr-90 | 3825.90 ± 140.66 | 4130.0 | 2310.0 - 5480.0 | Pass |
| STVE-1146 | 03/24/08 | U-233/4 | 2753.30 ± 227.90 | 3070.0 | 2110.0 - 4070.0 | Pass |
| STVE-1146 | 03/24/08 | U-238 | 2697.10 ± 143.20 | 3050.0 | 2140.0 - 3850.0 | Pass |
| STVE-1146 | 03/24/08 | Uranium | 5586.10 ± 455.20 | 6260.0 | 4300.0 - 8080.0 | Pass |
| STVE-1146 | 03/24/08 | Zn-65 | 1676.80 ± 43.00 | 1430.0 | 1030.0 - 1960.0 | Pass |
| STW-1147 | 03/24/08 | Am-241 | 97.56 ± 1.02 | 90.9 | 62.0 - 124.0 | Pass |
| STW-1147 | 03/24/08 | Co-60 | 1430.00 ± 33.33 | 1420.0 | 1240.0 - 1680.0 | Pass |
| STW-1147 | 03/24/08 | Cs-134 | 730.18 ± 33.39 | 751.0 | 555.0 - 862.0 | Pass |
| STW-1147 | 03/24/08 | Cs-137 | 1947.80 ± 13.80 | 1990.0 | 1690.0 - 2380.0 | Pass |
| STW-1147 | 03/24/08 | Fe-55 | 1422.70 ± 172.16 | 2080.0 | 1210.0 - 2780.0 | Pass |
| STW-1147 [e] | 03/24/08 | Mn-54 | 0.00 ± 0.00 | 0.0 | 0.0 - 10.0 | Pass |
| STW-1147 | 03/24/08 | Pu-238 | 144.16 ± 4.54 | 135.0 | 102.0 - 168.0 | Pass |
| STW-1147 | 03/24/08 | Pu-239/40 | 82.16 ± 2.50 | 80.7 | 62.4 - 99.8 | Pass |
| STW-1147 | 03/24/08 | Sr-90 | 512.03 ± 43.37 | 512.0 | 325.0 - 684.0 | Pass |
| STW-1147 | 03/24/08 | U-233/4 | 74.40 ± 1.20 | 81.0 | 61.0 - 104.0 | Pass |
| STW-1147 | 03/24/08 | U-238 | 75.10 ± 1.35 | 80.3 | 61.3 - 99.5 | Pass |
| STW-1147 | 03/24/08 | Uranium | 152.10 ± 2.55 | 165.0 | 119.0 - 220.0 | Pass |
| STW-1147 | 03/24/08 | Zn-65 | 708.90 ± 29.00 | 694.0 | 588.0 - 865.0 | Pass |
| STW-1120 | 03/19/07 | Uranium | 339.60 ± 10.66 | 391.0 | 282.0 - 521.0 | Pass |
| STW-1120 | 03/19/07 | Zn-65 | 2009.00 ± 36.40 | 1910.0 | 1600.0 - 2410.0 | 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).

[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.

[e] Included in the testing series as a "false positive". No activity expected.

[f] The analysis was repeated by leaching and total dissolution methods. Total dissolution yielded results within expected range. Results of the reanalysis: U-233,4, 1655 ± 95 pCi/kg. U-238 1805 ± 97 pCi/kg.

# APPENDIX B
# 2008 REMP DATA SUMMARY REPORTS

APPENDIX B

**Air Gamma Spectral Summary Report 2008**

Radiological Environmental Monitoring Program Data Summary

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

| 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: Location # and Distance and Direction | Location with Highest Annual Mean: Mean and Number Detected/Number Collected and Range | Mean of Results from All Control Locations and Number Detected/Number Collected and Range |
|---|---|---|---|---|---|---|---|
| Air<br>pCi/m3 | Be-7<br>28 | N/A | 0.07<br>21 / 28<br>0.05 - 0.09 | 0.07<br>18 / 24<br>0.05 - 0.09 | 4<br>0.70<br>S | 0.08<br>3 / 20<br>0.05 - 0.09 | 0.07<br>3 / 4<br>0.06 - 0.08 |
| Air<br>pCi/m3 | Co-58<br>28 | N/A | LLD | - | - | - | - |
| Air<br>pCi/m3 | Co-60<br>28 | N/A | LLD | - | - | - | - |
| Air<br>pCi/m3 | Cs-134<br>28 | 0.04 | LLD | - | - | - | - |
| Air<br>pCi/m3 | Cs-137<br>28 | 0.05 | LLD | - | - | - | - |

APPENDIX B

**Air Gross Beta Summary Report 2008**

Radiological Environmental Monitoring Program Data Summary

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

| 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: Location # and Distance and Direction | Location with Highest Annual Mean: Mean and Number Detected/Number Collected and Range | Mean of Results from All Control Locations and Number Detected/Number Collected and Range |
|---|---|---|---|---|---|---|---|
| Air<br>pCi/m3 | Gross Beta<br>364 | 0.01 | 0.02<br>363 / 364<br>0.01 - 0.06 | 0.02<br>312 / 312<br>0.01 - 0.06 | 6<br>11.00<br>SSW | 0.02<br>51 / 52<br>0.01 - 0.05 | 0.02<br>51 / 52<br>0.01 - 0.05 |

APPENDIX B

**Air Iodine Summary Report 2008**

Radiological Environmental Monitoring Program Data Summary

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

| 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 | I-131 364 | 0.05 | LLD | - | - | - | - |

APPENDIX B

**Fish Gamma Spectral Summary Report 2008**

Radiological Environmental Monitoring Program Data Summary

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

| 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: Location # and Distance and Direction | Location with Highest Annual Mean: Mean and Number Detected/Number Collected and Range | Mean of Results from All Control Locations and Number Detected/Number Collected and Range |
|---|---|---|---|---|---|---|---|
| Fish<br>pCi/kg wet | Co-58<br>6 | 97.00 | LLD | - | - | - | - |
| Fish<br>pCi/kg wet | Co-60<br>6 | 97.00 | LLD | - | - | - | - |
| Fish<br>pCi/kg wet | Cs-134<br>6 | 97.00 | LLD | - | - | - | - |
| Fish<br>pCi/kg wet | Cs-137<br>6 | 112.00 | LLD | - | - | - | - |
| Fish<br>pCi/kg wet | Fe-59<br>6 | 195.00 | LLD | - | - | - | - |
| Fish<br>pCi/kg wet | K-40<br>6 | N/A | 1,405.05<br>6 / 6<br>1,202.60 - 1,518.60 | 1,329.97<br>3 / 3<br>1,202.60 - 1,468.20 | 32<br>15.80<br>WSW | 1,480.13<br>3 / 24<br>1,438.60 - 1,518.60 | 1,480.13<br>3 / 3<br>1,438.60 - 1,518.60 |
| Fish<br>pCi/kg wet | Mn-54<br>6 | 97.00 | LLD | - | - | - | - |
| Fish<br>pCi/kg wet | Zn-65<br>6 | 195.00 | LLD | - | - | - | - |

APPENDIX B

**Food Products Gamma Spectral Summary Report 2008**

Radiological Environmental Monitoring Program Data Summary

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

| 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: Location # and Distance and Direction | Location with Highest Annual Mean: Mean and Number Detected/Number Collected and Range | Mean of Results from All Control Locations and Number Detected/Number Collected and Range |
|---|---|---|---|---|---|---|---|
| Food Products<br>pCi/kg wet | Be-7<br>52 | N/A | 375.36<br>29 / 52<br>144.49 - 1,228.90 | 406.52<br>22 / 43<br>144.49 - 1,228.90 | 20<br>1.90<br>E | 662.83<br>5 / 70<br>311.72 - 1,228.90 | 277.41<br>7 / 9<br>168.97 - 400.71 |
| Food Products<br>pCi/kg wet | Co-58<br>52 | N/A | LLD | - | - | - | - |
| Food Products<br>pCi/kg wet | Co-60<br>52 | N/A | LLD | - | - | - | - |
| Food Products<br>pCi/kg wet | Cs-134<br>52 | 45.00 | LLD | - | - | - | - |
| Food Products<br>pCi/kg wet | Cs-137<br>52 | 60.00 | LLD | - | - | - | - |
| Food Products<br>pCi/kg wet | I-131<br>52 | 45.00 | LLD | - | - | - | - |
| Food Products<br>pCi/kg wet | K-40<br>52 | N/A | 4,812.32<br>52 / 52<br>2,598.25 - 6,763.50 | 4,854.74<br>43 / 43<br>2,598.25 - 6,763.50 | 2<br>1.90<br>ENE | 5,360.99<br>9 / 63<br>4,614.30 - 5,974.10 | 4,609.67<br>9 / 9<br>3,717.20 - 6,182.70 |

APPENDIX B

**Milk Gamma Spectral Summary Report 2008**

Radiological Environmental Monitoring Program Data Summary

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

| 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: Location # and Distance and Direction | Location with Highest Annual Mean: Mean and Number Detected/Number Collected and Range | Mean of Results from All Control Locations and Number Detected/Number Collected and Range |
|---|---|---|---|---|---|---|---|
| Milk<br>pCi/L | Ba-140<br>46 | 45.00 | LLD | - | - | - | - |
| Milk<br>pCi/L | Cs-134<br>46 | 11.00 | LLD | - | - | - | - |
| Milk<br>pCi/L | Cs-137<br>46 | 13.00 | LLD | - | - | - | - |
| Milk<br>pCi/L | K-40<br>46 | N/A | 1,507.36<br>46 / 46<br>419.16 - 1,962.90 | 1,730.21<br>27 / 27<br>1,496.70 - 1,962.90 | 61<br>7.40<br>SE | 1,798.72<br>13 / 65<br>1,496.70 - 1,962.90 | 1,190.68<br>19 / 19<br>419.16 - 1,397.60 |
| Milk<br>pCi/L | La-140<br>46 | 11.00 | LLD | - | - | - | - |

APPENDIX B

**Milk Iodine Summary Report 2008**

Radiological Environmental Monitoring Program Data Summary

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

| 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 | |
| Milk pCi/L | I-131 46 | 0.75 | LLD | - | - | - | - |

**Sediment Gamma Spectral Summary Report 2008**
Radiological Environmental Monitoring Program Data Summary
Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

| 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: Location # and Distance and Direction | Location with Highest Annual Mean: Mean and Number Detected/Number Collected and Range | Mean of Results from All Control Locations and Number Detected/Number Collected and Range |
|---|---|---|---|---|---|---|---|
| Sediment pCi/kg drv | Co-58 12 | 50.00 | LLD | - | - | - | - |
| Sediment pCi/kg drv | Co-60 12 | 40.00 | LLD | - | - | - | - |
| Sediment pCi/kg drv | Cs-134 12 | 112.00 | LLD | - | - | - | - |
| Sediment pCi/kg drv | Cs-137 12 | 135.00 | 433.16<br>5 / 12<br>157.35 - 825.41 | 214.17<br>3 / 10<br>157.35 - 273.00 | 32<br>15.80<br>WSW | 761.65<br>2 / 10<br>697.89 - 825.41 | 761.65<br>2 / 2<br>697.89 - 825.41 |
| Sediment pCi/kg drv | K-40 12 | N/A | 14,482.98<br>12 / 12<br>7,502.50 - 26,303.00 | 12,352.47<br>10 / 10<br>7,502.50 - 16,530.00 | 32<br>15.80<br>WSW | 25,135.50<br>2 / 10<br>23,968.00 - 26,303.00 | 25,135.50<br>2 / 2<br>23,968.00 - 26,303.00 |

APPENDIX B

**TLD Gamma Dose Summary Report 2008**

Radiological Environmental Monitoring Program Data Summary

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

| 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: Location # and Distance and Direction | Location with Highest Annual Mean: Mean and Number Detected/Number Collected and Range | Mean of Results from All Control Locations and Number Detected/Number Collected and Range |
|---|---|---|---|---|---|---|---|
| TLD<br>mR/91 days | Direct<br>112 | 1.00 | 13.44<br>112 / 112<br>7.97 - 18.07 | 13.45<br>104 / 104<br>7.97 - 18.07 | 33<br>4.50<br>S | 16.98<br>4 / 4<br>15.98 - 17.87 | 13.21<br>8 / 8<br>12.12 - 15.19 |
| TLD<br>mR/91 days | Direct<br>112 | 1.00 | 13.03<br>112 / 112<br>8.04 - 17.93 | 13.08<br>104 / 104<br>8.04 - 17.93 | 33<br>4.50<br>S | 16.75<br>4 / 4<br>14.35 - 17.93 | 12.41<br>8 / 8<br>9.65 - 14.80 |
| TLD<br>mR/365 days | Direct<br>28 | 1.00 | 59.37<br>28 / 28<br>47.84 - 74.83 | 59.55<br>26 / 26<br>47.84 - 74.83 | 33<br>4.50<br>S | 74.83<br>1 / 1<br>74.83 - 74.83 | 57.01<br>2 / 2<br>55.61 - 58.40 |

**Water Gamma Spectral Summary Report 2008**

Radiological Environmental Monitoring Program Data Summary

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

| 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: Location # and Distance and Direction | Location with Highest Annual Mean: Mean and Number Detected/Number Collected and Range | Mean of Results from All Control Locations and Number Detected/Number Collected and Range |
|---|---|---|---|---|---|---|---|
| Water pCi/L | Ba-140 52 | 45.00 | LLD | - | - | - | - |
| Water pCi/L | Co-58 52 | 11.00 | LLD | - | - | - | - |
| Water pCi/L | Co-60 52 | 11.00 | LLD | - | - | - | - |
| Water pCi/L | Cs-134 52 | 11.00 | LLD | - | - | - | - |
| Water pCi/L | Cs-137 52 | 13.00 | LLD | - | - | - | - |
| Water pCi/L | Fe-59 52 | 22.00 | LLD | - | - | - | - |
| Water pCi/L | La-140 52 | 11.00 | LLD | - | - | - | - |
| Water pCi/L | Mn-54 52 | 11.00 | LLD | - | - | - | - |
| Water pCi/L | Nb-95 52 | 11.00 | LLD | - | - | - | - |
| Water pCi/L | Zn-65 52 | 22.00 | LLD | - | - | - | - |

APPENDIX B

**Water Gamma Spectral Summary Report 2008**
Radiological Environmental Monitoring Program Data Summary
Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

| 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 | Zr-95 52 | 22.00 | LLD | - | - | - | - |

APPENDIX B

**Water Gross Beta Summary Report 2008**

Radiological Environmental Monitoring Program Data Summary

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

| 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: Location # and Distance and Direction | Location with Highest Annual Mean: Mean and Number Detected/Number Collected and Range | Mean of Results from All Control Locations and Number Detected/Number Collected and Range |
|---|---|---|---|---|---|---|---|
| Water<br>pCi/L | Gross Beta<br>52 | 3.00 | 3.39<br>3 / 52<br>3.01 - 3.98 | 3.39<br>3 / 40<br>3.01 - 3.98 | 36<br>3.90<br>WSW | 3.58<br>2 / 12<br>3.18 - 3.98 | LLD<br>0 / 12 |

APPENDIX B

**Water Tritium Summary Report 2008**

Radiological Environmental Monitoring Program Data Summary

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

| 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 | H-3 18 | 1,500.00 | LLD | - | - | - | - |

# APPENDIX C
# 2008 REMP DETAILED DATA REPORT

APPENDIX C

# Air Gamma Spectral Detail Report 2008

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Quarterly Results in pCi/m3 +/- 2 Sigma

| Location | Sample Type | Collection Date | Be-7 | Co-58 | Co-60 | Cs-134 | Cs-137 |
|---|---|---|---|---|---|---|---|
| 1 | Air | 4/2/2008 | 0.057 +/- 0.009 | < 0.000 | < 0.000 | < 0.000 | < 0.000 |
| 1 | Air | 7/2/2008 | < 0.000 | < 0.000 | < 0.000 | < 0.000 | < 0.000 |
| 1 | Air | 10/1/2008 | 0.091 +/- 0.011 | < 0.000 | < 0.001 | < 0.000 | < 0.000 |
| 1 | Air | 2/31/2008 | 0.060 +/- 0.006 | < 0.000 | < 0.000 | < 0.000 | < 0.000 |
| 3 | Air | 4/2/2008 | 0.062 +/- 0.008 | < 0.000 | < 0.000 | < 0.000 | < 0.000 |
| 3 | Air | 7/2/2008 | < 0.000 | < 0.000 | < 0.000 | < 0.000 | < 0.000 |
| 3 | Air | 10/1/2008 | 0.082 +/- 0.011 | < 0.000 | < 0.000 | < 0.001 | < 0.000 |
| 3 | Air | 2/31/2008 | 0.058 +/- 0.009 | < 0.000 | < 0.000 | < 0.000 | < 0.001 |
| 4 | Air | 4/2/2008 | 0.083 +/- 0.011 | < 0.000 | < 0.001 | < 0.001 | < 0.001 |
| 4 | Air | 7/2/2008 | < 0.000 | < 0.000 | < 0.000 | < 0.000 | < 0.000 |

APPENDIX C

# Air Gamma Spectral Detail Report 2008

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Quarterly Results in pCi/m3 +/- 2 Sigma

| Location | Sample Type | Collection Date | Be-7 | Co-58 | Co-60 | Cs-134 | Cs-137 |
|---|---|---|---|---|---|---|---|
| 4 | Air | 10/1/2008 | 0.094 +/- 0.011 | < 0.001 | < 0.001 | < 0.001 | < 0.000 |
| 4 | Air | 2/31/2008 | 0.051 +/- 0.008 | < 0.000 | < 0.000 | < 0.000 | < 0.000 |
| 5 | Air | 4/2/2008 | 0.055 +/- 0.008 | < 0.000 | < 0.000 | < 0.000 | < 0.000 |
| 5 | Air | 7/2/2008 | < 0.000 | < 0.000 | < 0.000 | < 0.000 | < 0.000 |
| 5 | Air | 10/1/2008 | 0.082 +/- 0.010 | < 0.000 | < 0.000 | < 0.000 | < 0.000 |
| 5 | Air | 2/31/2008 | 0.050 +/- 0.009 | < 0.000 | < 0.000 | < 0.000 | < 0.000 |
| 6 | Air | 4/2/2008 | 0.062 +/- 0.008 | < 0.000 | < 0.000 | < 0.000 | < 0.000 |
| 6 | Air | 7/2/2008 | < 0.000 | < 0.000 | < 0.000 | < 0.000 | < 0.000 |
| 6 | Air | 10/1/2008 | 0.077 +/- 0.010 | < 0.000 | < 0.000 | < 0.000 | < 0.000 |
| 6 | Air | 2/31/2008 | 0.057 +/- 0.010 | < 0.000 | < 0.000 | < 0.000 | < 0.000 |

APPENDIX C

**Air Gamma Spectral Detail Report 2008**

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Quarterly Results in pCi/m3 +/- 2 Sigma

| Location | Sample Type | Collection Date | Be-7 | Co-58 | Co-60 | Cs-134 | Cs-137 |
|---|---|---|---|---|---|---|---|
| 7 | Air | 4/2/2008 | 0.076 +/- 0.010 | < 0.000 | < 0.001 | < 0.000 | < 0.000 |
| 7 | Air | 7/2/2008 | < 0.000 | < 0.000 | < 0.000 | < 0.000 | < 0.000 |
| 7 | Air | 10/1/2008 | 0.073 +/- 0.012 | < 0.000 | < 0.000 | < 0.000 | < 0.000 |
| 7 | Air | 2/31/2008 | 0.047 +/- 0.008 | < 0.000 | < 0.000 | < 0.000 | < 0.000 |
| 35 | Air | 4/2/2008 | 0.067 +/- 0.009 | < 0.000 | < 0.000 | < 0.000 | < 0.000 |
| 35 | Air | 7/2/2008 | < 0.000 | < 0.000 | < 0.000 | < 0.000 | < 0.000 |
| 35 | Air | 10/1/2008 | 0.075 +/- 0.011 | < 0.000 | < 0.000 | < 0.000 | < 0.000 |
| 35 | Air | 2/31/2008 | 0.049 +/- 0.009 | < 0.000 | < 0.000 | < 0.000 | < 0.000 |

APPENDIX C

# Air Gross Beta Detail Report 2008

Radiological Environmental Monitoring Program Data Summary

Perry Nuclear Power Plant, Lake County Ohio  Docket no. : 50-440/50-441

Sample Frequency is: Weekly  Results in pCi/m3 +/- 2 Sigma

| | | Location | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 3 | 4 | 5 | 6 |
| Collection Date | Sample Type | 7 | 35 | | | |
| 1/9/2008 | Air | 0.020 +/- 0.003 | 0.020 +/- 0.003 | 0.023 +/- 0.003 | 0.021 +/- 0.003 | 0.026 +/- 0.004 |
| | | 0.019 +/- 0.003 | 0.022 +/- 0.003 | | | |
| 1/16/2008 | Air | 0.028 +/- 0.003 | 0.026 +/- 0.003 | 0.033 +/- 0.003 | 0.034 +/- 0.003 | 0.036 +/- 0.004 |
| | | 0.030 +/- 0.003 | 0.029 +/- 0.003 | | | |
| 1/23/2008 | Air | 0.031 +/- 0.005 | 0.026 +/- 0.003 | 0.028 +/- 0.003 | 0.028 +/- 0.003 | 0.037 +/- 0.003 |
| | | 0.031 +/- 0.003 | 0.027 +/- 0.003 | | | |
| 1/30/2008 | Air | 0.047 +/- 0.003 | 0.040 +/- 0.003 | 0.045 +/- 0.003 | 0.040 +/- 0.003 | 0.047 +/- 0.003 |
| | | 0.050 +/- 0.003 | 0.043 +/- 0.003 | | | |
| 2/6/2008 | Air | 0.025 +/- 0.003 | 0.023 +/- 0.003 | 0.022 +/- 0.003 | 0.023 +/- 0.003 | 0.027 +/- 0.003 |
| | | 0.024 +/- 0.003 | 0.025 +/- 0.003 | | | |
| 2/13/2008 | Air | 0.033 +/- 0.003 | 0.029 +/- 0.003 | 0.032 +/- 0.003 | 0.028 +/- 0.003 | 0.030 +/- 0.003 |
| | | 0.035 +/- 0.003 | 0.028 +/- 0.003 | | | |
| 2/20/2008 | Air | 0.031 +/- 0.003 | 0.031 +/- 0.003 | 0.037 +/- 0.003 | 0.030 +/- 0.003 | 0.030 +/- 0.003 |
| | | 0.034 +/- 0.003 | 0.033 +/- 0.003 | | | |
| 2/27/2008 | Air | 0.019 +/- 0.003 | 0.017 +/- 0.003 | 0.021 +/- 0.003 | 0.020 +/- 0.003 | 0.019 +/- 0.003 |
| | | 0.023 +/- 0.003 | 0.019 +/- 0.003 | | | |
| 3/5/2008 | Air | 0.025 +/- 0.003 | 0.024 +/- 0.003 | 0.024 +/- 0.003 | 0.021 +/- 0.003 | 0.026 +/- 0.003 |
| | | 0.026 +/- 0.003 | 0.024 +/- 0.003 | | | |
| 3/12/2008 | Air | 0.028 +/- 0.003 | 0.025 +/- 0.003 | 0.027 +/- 0.003 | 0.024 +/- 0.003 | 0.030 +/- 0.003 |
| | | 0.026 +/- 0.003 | 0.028 +/- 0.003 | | | |
| 3/19/2008 | Air | 0.024 +/- 0.003 | 0.018 +/- 0.003 | 0.021 +/- 0.003 | 0.018 +/- 0.003 | 0.016 +/- 0.003 |
| | | 0.019 +/- 0.003 | 0.017 +/- 0.003 | | | |
| 3/26/2008 | Air | 0.022 +/- 0.003 | 0.029 +/- 0.004 | 0.021 +/- 0.003 | 0.020 +/- 0.003 | 0.021 +/- 0.003 |
| | | 0.022 +/- 0.003 | 0.022 +/- 0.003 | | | |
| 4/2/2008 | Air | 0.017 +/- 0.003 | 0.022 +/- 0.003 | 0.022 +/- 0.003 | 0.019 +/- 0.003 | 0.021 +/- 0.003 |
| | | 0.018 +/- 0.003 | 0.019 +/- 0.003 | | | |
| 4/9/2008 | Air | 0.017 +/- 0.003 | 0.016 +/- 0.003 | 0.015 +/- 0.003 | 0.016 +/- 0.003 | 0.019 +/- 0.003 |
| | | 0.018 +/- 0.003 | 0.016 +/- 0.003 | | | |

APPENDIX C

# Air Gross Beta Detail Report 2008

Radiological Environmental Monitoring Program Data Summary

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Weekly Results in pCi/m3 +/- 2 Sigma

| | | Location | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 3 | 4 | 5 | 6 |
| Collection Date | Sample Type | 7 | 35 | | | |
| 4/16/2008 | Air | 0.011 +/- 0.002<br>0.012 +/- 0.003 | 0.010 +/- 0.002<br>0.012 +/- 0.002 | 0.011 +/- 0.003 | 0.011 +/- 0.003 | 0.013 +/- 0.003 |
| 4/23/2008 | Air | 0.029 +/- 0.003<br>0.027 +/- 0.003 | 0.027 +/- 0.003<br>0.026 +/- 0.003 | 0.028 +/- 0.003 | 0.033 +/- 0.003 | 0.024 +/- 0.003 |
| 4/30/2008 | Air | 0.021 +/- 0.003<br>0.022 +/- 0.003 | 0.020 +/- 0.003<br>0.024 +/- 0.003 | 0.023 +/- 0.003 | 0.022 +/- 0.003 | 0.023 +/- 0.003 |
| 5/7/2008 | Air | 0.031 +/- 0.003<br>0.026 +/- 0.003 | 0.026 +/- 0.003<br>0.026 +/- 0.003 | 0.027 +/- 0.003 | 0.028 +/- 0.003 | 0.027 +/- 0.003 |
| 5/14/2008 | Air | 0.014 +/- 0.003<br>0.014 +/- 0.003 | 0.014 +/- 0.003<br>0.014 +/- 0.003 | 0.017 +/- 0.003 | 0.015 +/- 0.003 | 0.015 +/- 0.003 |
| 5/21/2008 | Air | 0.012 +/- 0.003<br>0.014 +/- 0.003 | 0.012 +/- 0.003<br>0.013 +/- 0.003 | 0.013 +/- 0.003 | 0.013 +/- 0.003 | 0.013 +/- 0.003 |
| 5/28/2008 | Air | 0.008 +/- 0.003<br>0.009 +/- 0.003 | 0.008 +/- 0.002<br>0.009 +/- 0.003 | 0.008 +/- 0.003 | 0.009 +/- 0.002 | LLD |
| 6/4/2008 | Air | 0.019 +/- 0.003<br>0.019 +/- 0.003 | 0.020 +/- 0.003<br>0.022 +/- 0.003 | 0.024 +/- 0.003 | 0.018 +/- 0.003 | 0.018 +/- 0.003 |
| 6/11/2008 | Air | 0.014 +/- 0.003<br>0.014 +/- 0.003 | 0.013 +/- 0.003<br>0.014 +/- 0.003 | 0.014 +/- 0.003 | 0.013 +/- 0.003 | 0.015 +/- 0.003 |
| 6/18/2008 | Air | 0.019 +/- 0.003<br>0.017 +/- 0.003 | 0.017 +/- 0.003<br>0.018 +/- 0.003 | 0.020 +/- 0.003 | 0.019 +/- 0.003 | 0.018 +/- 0.003 |
| 6/25/2008 | Air | 0.015 +/- 0.003<br>0.015 +/- 0.003 | 0.014 +/- 0.003<br>0.016 +/- 0.003 | 0.016 +/- 0.003 | 0.015 +/- 0.003 | 0.015 +/- 0.003 |
| 7/2/2008 | Air | 0.018 +/- 0.003<br>0.020 +/- 0.003 | 0.017 +/- 0.003<br>0.016 +/- 0.003 | 0.018 +/- 0.003 | 0.021 +/- 0.003 | 0.019 +/- 0.003 |
| 7/9/2008 | Air | 0.017 +/- 0.003<br>0.016 +/- 0.003 | 0.015 +/- 0.003<br>0.016 +/- 0.003 | 0.019 +/- 0.003 | 0.017 +/- 0.003 | 0.015 +/- 0.003 |
| 7/16/2008 | Air | 0.019 +/- 0.003<br>0.014 +/- 0.003 | 0.015 +/- 0.003<br>0.016 +/- 0.003 | 0.017 +/- 0.003 | 0.016 +/- 0.003 | 0.018 +/- 0.003 |

APPENDIX C

# Air Gross Beta Detail Report 2008

Radiological Environmental Monitoring Program Data Summary

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Weekly Results in pCi/m3 +/- 2 Sigma

| | | Location | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 3 | 4 | 5 | 6 |
| Collection Date | Sample Type | 7 | 35 | | | |
| 7/23/2008 | Air | 0.038 +/- 0.003<br>0.038 +/- 0.003 | 0.036 +/- 0.003<br>0.037 +/- 0.003 | 0.037 +/- 0.003 | 0.041 +/- 0.003 | 0.041 +/- 0.003 |
| 7/30/2008 | Air | 0.023 +/- 0.003<br>0.026 +/- 0.003 | 0.023 +/- 0.003<br>0.025 +/- 0.003 | 0.024 +/- 0.003 | 0.028 +/- 0.003 | 0.027 +/- 0.003 |
| 8/6/2008 | Air | 0.022 +/- 0.003<br>0.025 +/- 0.003 | 0.021 +/- 0.003<br>0.022 +/- 0.003 | 0.025 +/- 0.003 | 0.022 +/- 0.003 | 0.024 +/- 0.003 |
| 8/13/2008 | Air | 0.016 +/- 0.002<br>0.015 +/- 0.002 | 0.014 +/- 0.002<br>0.013 +/- 0.002 | 0.014 +/- 0.002 | 0.016 +/- 0.002 | 0.015 +/- 0.002 |
| 8/20/2008 | Air | 0.022 +/- 0.003<br>0.022 +/- 0.003 | 0.021 +/- 0.002<br>0.021 +/- 0.002 | 0.023 +/- 0.003 | 0.024 +/- 0.003 | 0.020 +/- 0.003 |
| 8/27/2008 | Air | 0.022 +/- 0.003<br>0.025 +/- 0.003 | 0.025 +/- 0.003<br>0.020 +/- 0.003 | 0.025 +/- 0.003 | 0.026 +/- 0.003 | 0.026 +/- 0.003 |
| 9/3/2008 | Air | 0.025 +/- 0.003<br>0.029 +/- 0.003 | 0.024 +/- 0.003<br>0.031 +/- 0.003 | 0.028 +/- 0.003 | 0.033 +/- 0.003 | 0.028 +/- 0.003 |
| 9/10/2008 | Air | 0.022 +/- 0.003<br>0.023 +/- 0.003 | 0.023 +/- 0.003<br>0.024 +/- 0.003 | 0.028 +/- 0.003 | 0.029 +/- 0.003 | 0.028 +/- 0.003 |
| 9/17/2008 | Air | 0.017 +/- 0.002<br>0.014 +/- 0.002 | 0.015 +/- 0.002<br>0.015 +/- 0.002 | 0.018 +/- 0.002 | 0.018 +/- 0.003 | 0.016 +/- 0.002 |
| 9/24/2008 | Air | 0.028 +/- 0.003<br>0.025 +/- 0.003 | 0.027 +/- 0.003<br>0.026 +/- 0.003 | 0.033 +/- 0.003 | 0.031 +/- 0.003 | 0.026 +/- 0.003 |
| 10/1/2008 | Air | 0.025 +/- 0.003<br>0.026 +/- 0.003 | 0.027 +/- 0.003<br>0.029 +/- 0.003 | 0.028 +/- 0.003 | 0.030 +/- 0.003 | 0.025 +/- 0.003 |
| 10/8/2008 | Air | 0.016 +/- 0.002<br>0.015 +/- 0.003 | 0.014 +/- 0.002<br>0.014 +/- 0.002 | 0.017 +/- 0.003 | 0.016 +/- 0.002 | 0.016 +/- 0.003 |
| 10/15/2008 | Air | 0.030 +/- 0.003<br>0.029 +/- 0.003 | 0.026 +/- 0.003<br>0.031 +/- 0.003 | 0.032 +/- 0.003 | 0.033 +/- 0.003 | 0.034 +/- 0.003 |
| 10/22/2008 | Air | 0.016 +/- 0.002<br>0.016 +/- 0.002 | 0.014 +/- 0.002<br>0.015 +/- 0.002 | 0.014 +/- 0.002 | 0.015 +/- 0.002 | 0.014 +/- 0.002 |

APPENDIX C

# Air Gross Beta Detail Report 2008

Radiological Environmental Monitoring Program Data Summary

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Weekly Results in pCi/m3 +/- 2 Sigma

| | | Location | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 3 | 4 | 5 | 6 |
| Collection Date | Sample Type | 7 | 35 | | | |
| 10/29/2008 | Air | 0.015 +/- 0.002 | 0.013 +/- 0.002 | 0.012 +/- 0.002 | 0.014 +/- 0.002 | 0.014 +/- 0.002 |
| | | 0.013 +/- 0.002 | 0.014 +/- 0.002 | | | |
| 11/5/2008 | Air | 0.047 +/- 0.003 | 0.048 +/- 0.003 | 0.057 +/- 0.003 | 0.054 +/- 0.003 | 0.050 +/- 0.003 |
| | | 0.046 +/- 0.003 | 0.045 +/- 0.003 | | | |
| 11/12/2008 | Air | 0.024 +/- 0.003 | 0.021 +/- 0.002 | 0.023 +/- 0.003 | 0.023 +/- 0.002 | 0.024 +/- 0.003 |
| | | 0.024 +/- 0.003 | 0.023 +/- 0.003 | | | |
| 11/19/2008 | Air | 0.020 +/- 0.003 | 0.018 +/- 0.002 | 0.019 +/- 0.002 | 0.018 +/- 0.002 | 0.019 +/- 0.002 |
| | | 0.019 +/- 0.003 | 0.019 +/- 0.002 | | | |
| 11/26/2008 | Air | 0.018 +/- 0.003 | 0.014 +/- 0.002 | 0.015 +/- 0.003 | 0.016 +/- 0.002 | 0.016 +/- 0.003 |
| | | 0.018 +/- 0.003 | 0.015 +/- 0.003 | | | |
| 12/3/2008 | Air | 0.021 +/- 0.003 | 0.023 +/- 0.003 | 0.021 +/- 0.003 | 0.024 +/- 0.003 | 0.023 +/- 0.003 |
| | | 0.023 +/- 0.003 | 0.025 +/- 0.003 | | | |
| 12/10/2008 | Air | 0.022 +/- 0.003 | 0.018 +/- 0.002 | 0.019 +/- 0.003 | 0.021 +/- 0.003 | 0.020 +/- 0.003 |
| | | 0.022 +/- 0.003 | 0.022 +/- 0.003 | | | |
| 12/17/2008 | Air | 0.030 +/- 0.003 | 0.026 +/- 0.003 | 0.025 +/- 0.003 | 0.026 +/- 0.003 | 0.025 +/- 0.003 |
| | | 0.029 +/- 0.003 | 0.026 +/- 0.003 | | | |
| 12/24/2008 | Air | 0.033 +/- 0.003 | 0.032 +/- 0.003 | 0.031 +/- 0.003 | 0.035 +/- 0.003 | 0.035 +/- 0.003 |
| | | 0.034 +/- 0.003 | 0.033 +/- 0.003 | | | |
| 12/31/2008 | Air | 0.037 +/- 0.003 | 0.035 +/- 0.003 | 0.036 +/- 0.003 | 0.038 +/- 0.003 | 0.035 +/- 0.003 |
| | | 0.035 +/- 0.003 | 0.035 +/- 0.003 | | | |

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# Air Iodine Detail Report 2008

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Weekly Results in pCi/m3 +/- 2 Sigma

| Location | Sample Type | Collection Date | I-131 |
|---|---|---|---|
| 1 | Air | 1/9/2008 | < 0.006 |
| 1 | Air | 1/16/2008 | < 0.006 |
| 1 | Air | 1/23/2008 | < 0.010 |
| 1 | Air | 1/30/2008 | < 0.008 |
| 1 | Air | 2/6/2008 | < 0.003 |
| 1 | Air | 2/13/2008 | < 0.007 |
| 1 | Air | 2/20/2008 | < 0.006 |
| 1 | Air | 2/27/2008 | < 0.010 |
| 1 | Air | 3/5/2008 | < 0.005 |
| 1 | Air | 3/12/2008 | < 0.007 |
| 1 | Air | 3/19/2008 | < 0.006 |
| 1 | Air | 3/26/2008 | < 0.008 |
| 1 | Air | 4/2/2008 | < 0.007 |
| 1 | Air | 4/9/2008 | < 0.008 |
| 1 | Air | 4/16/2008 | < 0.006 |
| 1 | Air | 4/23/2008 | < 0.008 |
| 1 | Air | 4/30/2008 | < 0.009 |
| 1 | Air | 5/7/2008 | < 0.008 |
| 1 | Air | 5/14/2008 | < 0.006 |
| 1 | Air | 5/21/2008 | < 0.006 |
| 1 | Air | 5/28/2008 | < 0.009 |
| 1 | Air | 6/4/2008 | < 0.009 |
| 1 | Air | 6/11/2008 | < 0.009 |
| 1 | Air | 6/18/2008 | < 0.004 |
| 1 | Air | 6/25/2008 | < 0.007 |
| 1 | Air | 7/2/2008 | < 0.006 |
| 1 | Air | 7/9/2008 | < 0.008 |
| 1 | Air | 7/16/2008 | < 0.007 |
| 1 | Air | 7/23/2008 | < 0.006 |
| 1 | Air | 7/30/2008 | < 0.009 |
| 1 | Air | 8/6/2008 | < 0.004 |
| 1 | Air | 8/13/2008 | < 0.005 |
| 1 | Air | 8/20/2008 | < 0.007 |
| 1 | Air | 8/27/2008 | < 0.006 |

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# Air Iodine Detail Report 2008

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Weekly Results in pCi/m3 +/- 2 Sigma

| Location | Sample Type | Collection Date | I-131 |
|---|---|---|---|
| 1 | Air | 9/3/2008 | < 0.008 |
| 1 | Air | 9/10/2008 | < 0.007 |
| 1 | Air | 9/17/2008 | < 0.006 |
| 1 | Air | 9/24/2008 | < 0.000 |
| 1 | Air | 10/1/2008 | < 0.000 |
| 1 | Air | 10/8/2008 | < 0.007 |
| 1 | Air | 0/15/2008 | < 0.006 |
| 1 | Air | 0/22/2008 | < 0.006 |
| 1 | Air | 0/29/2008 | < 0.009 |
| 1 | Air | 11/5/2008 | < 0.008 |
| 1 | Air | 1/12/2008 | < 0.006 |
| 1 | Air | 1/19/2008 | < 0.005 |
| 1 | Air | 1/26/2008 | < 0.011 |
| 1 | Air | 12/3/2008 | < 0.007 |
| 1 | Air | 2/10/2008 | < 0.007 |
| 1 | Air | 2/17/2008 | < 0.010 |
| 1 | Air | 2/24/2008 | < 0.009 |
| 1 | Air | 2/31/2008 | < 0.012 |
| 3 | Air | 1/9/2008 | < 0.006 |
| 3 | Air | 1/16/2008 | < 0.006 |
| 3 | Air | 1/23/2008 | < 0.005 |
| 3 | Air | 1/30/2008 | < 0.008 |
| 3 | Air | 2/6/2008 | < 0.003 |
| 3 | Air | 2/13/2008 | < 0.007 |
| 3 | Air | 2/20/2008 | < 0.006 |
| 3 | Air | 2/27/2008 | < 0.010 |
| 3 | Air | 3/5/2008 | < 0.005 |
| 3 | Air | 3/12/2008 | < 0.007 |
| 3 | Air | 3/19/2008 | < 0.006 |
| 3 | Air | 3/26/2008 | < 0.012 |
| 3 | Air | 4/2/2008 | < 0.009 |
| 3 | Air | 4/9/2008 | < 0.009 |
| 3 | Air | 4/16/2008 | < 0.007 |
| 3 | Air | 4/23/2008 | < 0.009 |

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Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Weekly Results in pCi/m3 +/- 2 Sigma

| Location | Sample Type | Collection Date | I-131 |
|---|---|---|---|
| 3 | Air | 4/30/2008 | < 0.009 |
| 3 | Air | 5/7/2008 | < 0.008 |
| 3 | Air | 5/14/2008 | < 0.006 |
| 3 | Air | 5/21/2008 | < 0.006 |
| 3 | Air | 5/28/2008 | < 0.008 |
| 3 | Air | 6/4/2008 | < 0.008 |
| 3 | Air | 6/11/2008 | < 0.009 |
| 3 | Air | 6/18/2008 | < 0.004 |
| 3 | Air | 6/25/2008 | < 0.007 |
| 3 | Air | 7/2/2008 | < 0.006 |
| 3 | Air | 7/9/2008 | < 0.008 |
| 3 | Air | 7/16/2008 | < 0.007 |
| 3 | Air | 7/23/2008 | < 0.006 |
| 3 | Air | 7/30/2008 | < 0.009 |
| 3 | Air | 8/6/2008 | < 0.004 |
| 3 | Air | 8/13/2008 | < 0.004 |
| 3 | Air | 8/20/2008 | < 0.006 |
| 3 | Air | 8/27/2008 | < 0.006 |
| 3 | Air | 9/3/2008 | < 0.008 |
| 3 | Air | 9/10/2008 | < 0.007 |
| 3 | Air | 9/17/2008 | < 0.006 |
| 3 | Air | 9/24/2008 | < 0.000 |
| 3 | Air | 10/1/2008 | < 0.000 |
| 3 | Air | 10/8/2008 | < 0.007 |
| 3 | Air | 0/15/2008 | < 0.006 |
| 3 | Air | 0/22/2008 | < 0.006 |
| 3 | Air | 0/29/2008 | < 0.009 |
| 3 | Air | 11/5/2008 | < 0.007 |
| 3 | Air | 1/12/2008 | < 0.005 |
| 3 | Air | 1/19/2008 | < 0.005 |
| 3 | Air | 1/26/2008 | < 0.009 |
| 3 | Air | 12/3/2008 | < 0.006 |
| 3 | Air | 2/10/2008 | < 0.006 |
| 3 | Air | 2/17/2008 | < 0.009 |
| 3 | Air | 2/24/2008 | < 0.008 |

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Radiological Environmental Monitoring Program Detail Data
Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441
Sample Frequency is: Weekly Results in pCi/m3 +/- 2 Sigma

| Location | Sample Type | Collection Date | I-131 |
|---|---|---|---|
| 3 | Air | 2/31/2008 | < 0.010 |
| 4 | Air | 1/9/2008 | < 0.007 |
| 4 | Air | 1/16/2008 | < 0.005 |
| 4 | Air | 1/23/2008 | < 0.005 |
| 4 | Air | 1/30/2008 | < 0.008 |
| 4 | Air | 2/6/2008 | < 0.003 |
| 4 | Air | 2/13/2008 | < 0.008 |
| 4 | Air | 2/20/2008 | < 0.007 |
| 4 | Air | 2/27/2008 | < 0.011 |
| 4 | Air | 3/5/2008 | < 0.005 |
| 4 | Air | 3/12/2008 | < 0.007 |
| 4 | Air | 3/19/2008 | < 0.006 |
| 4 | Air | 3/26/2008 | < 0.009 |
| 4 | Air | 4/2/2008 | < 0.007 |
| 4 | Air | 4/9/2008 | < 0.009 |
| 4 | Air | 4/16/2008 | < 0.007 |
| 4 | Air | 4/23/2008 | < 0.009 |
| 4 | Air | 4/30/2008 | < 0.009 |
| 4 | Air | 5/7/2008 | < 0.008 |
| 4 | Air | 5/14/2008 | < 0.006 |
| 4 | Air | 5/21/2008 | < 0.006 |
| 4 | Air | 5/28/2008 | < 0.009 |
| 4 | Air | 6/4/2008 | < 0.009 |
| 4 | Air | 6/11/2008 | < 0.009 |
| 4 | Air | 6/18/2008 | < 0.004 |
| 4 | Air | 6/25/2008 | < 0.007 |
| 4 | Air | 7/2/2008 | < 0.006 |
| 4 | Air | 7/9/2008 | < 0.008 |
| 4 | Air | 7/16/2008 | < 0.007 |
| 4 | Air | 7/23/2008 | < 0.006 |
| 4 | Air | 7/30/2008 | < 0.009 |
| 4 | Air | 8/6/2008 | < 0.004 |
| 4 | Air | 8/13/2008 | < 0.005 |
| 4 | Air | 8/20/2008 | < 0.007 |

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Radiological Environmental Monitoring Program Detail Data
Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441
Sample Frequency is: Weekly Results in pCi/m3 +/- 2 Sigma

| Location | Sample Type | Collection Date | I-131 |
|---|---|---|---|
| 4 | Air | 8/27/2008 | < 0.006 |
| 4 | Air | 9/3/2008 | < 0.008 |
| 4 | Air | 9/10/2008 | < 0.007 |
| 4 | Air | 9/17/2008 | < 0.006 |
| 4 | Air | 9/24/2008 | < 0.000 |
| 4 | Air | 10/1/2008 | < 0.000 |
| 4 | Air | 10/8/2008 | < 0.007 |
| 4 | Air | 0/15/2008 | < 0.006 |
| 4 | Air | 0/22/2008 | < 0.006 |
| 4 | Air | 0/29/2008 | < 0.009 |
| 4 | Air | 11/5/2008 | < 0.007 |
| 4 | Air | 1/12/2008 | < 0.006 |
| 4 | Air | 1/19/2008 | < 0.005 |
| 4 | Air | 1/26/2008 | < 0.010 |
| 4 | Air | 12/3/2008 | < 0.006 |
| 4 | Air | 2/10/2008 | < 0.007 |
| 4 | Air | 2/17/2008 | < 0.009 |
| 4 | Air | 2/24/2008 | < 0.008 |
| 4 | Air | 2/31/2008 | < 0.011 |
| 5 | Air | 1/9/2008 | < 0.006 |
| 5 | Air | 1/16/2008 | < 0.005 |
| 5 | Air | 1/23/2008 | < 0.005 |
| 5 | Air | 1/30/2008 | < 0.008 |
| 5 | Air | 2/6/2008 | < 0.003 |
| 5 | Air | 2/13/2008 | < 0.007 |
| 5 | Air | 2/20/2008 | < 0.006 |
| 5 | Air | 2/27/2008 | < 0.010 |
| 5 | Air | 3/5/2008 | < 0.005 |
| 5 | Air | 3/12/2008 | < 0.007 |
| 5 | Air | 3/19/2008 | < 0.006 |
| 5 | Air | 3/26/2008 | < 0.008 |
| 5 | Air | 4/2/2008 | < 0.007 |
| 5 | Air | 4/9/2008 | < 0.008 |
| 5 | Air | 4/16/2008 | < 0.007 |

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Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Weekly Results in pCi/m3 +/- 2 Sigma

| Location | Sample Type | Collection Date | I-131 |
|---|---|---|---|
| 5 | Air | 4/23/2008 | < 0.009 |
| 5 | Air | 4/30/2008 | < 0.009 |
| 5 | Air | 5/7/2008 | < 0.008 |
| 5 | Air | 5/14/2008 | < 0.006 |
| 5 | Air | 5/21/2008 | < 0.006 |
| 5 | Air | 5/28/2008 | < 0.008 |
| 5 | Air | 6/4/2008 | < 0.008 |
| 5 | Air | 6/11/2008 | < 0.009 |
| 5 | Air | 6/18/2008 | < 0.004 |
| 5 | Air | 6/25/2008 | < 0.007 |
| 5 | Air | 7/2/2008 | < 0.006 |
| 5 | Air | 7/9/2008 | < 0.008 |
| 5 | Air | 7/16/2008 | < 0.007 |
| 5 | Air | 7/23/2008 | < 0.006 |
| 5 | Air | 7/30/2008 | < 0.009 |
| 5 | Air | 8/6/2008 | < 0.004 |
| 5 | Air | 8/13/2008 | < 0.005 |
| 5 | Air | 8/20/2008 | < 0.007 |
| 5 | Air | 8/27/2008 | < 0.006 |
| 5 | Air | 9/3/2008 | < 0.008 |
| 5 | Air | 9/10/2008 | < 0.007 |
| 5 | Air | 9/17/2008 | < 0.006 |
| 5 | Air | 9/24/2008 | < 0.000 |
| 5 | Air | 10/1/2008 | < 0.000 |
| 5 | Air | 10/8/2008 | < 0.007 |
| 5 | Air | 0/15/2008 | < 0.006 |
| 5 | Air | 0/22/2008 | < 0.006 |
| 5 | Air | 0/29/2008 | < 0.008 |
| 5 | Air | 11/5/2008 | < 0.007 |
| 5 | Air | 1/12/2008 | < 0.005 |
| 5 | Air | 1/19/2008 | < 0.005 |
| 5 | Air | 1/26/2008 | < 0.010 |
| 5 | Air | 12/3/2008 | < 0.006 |
| 5 | Air | 2/10/2008 | < 0.007 |
| 5 | Air | 2/17/2008 | < 0.009 |

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Radiological Environmental Monitoring Program Detail Data
Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441
Sample Frequency is: Weekly Results in pCi/m3 +/- 2 Sigma

| Location | Sample Type | Collection Date | I-131 |
|---|---|---|---|
| 5 | Air | 2/24/2008 | < 0.008 |
| 5 | Air | 2/31/2008 | < 0.010 |
| 6 | Air | 1/9/2008 | < 0.008 |
| 6 | Air | 1/16/2008 | < 0.006 |
| 6 | Air | 1/23/2008 | < 0.006 |
| 6 | Air | 1/30/2008 | < 0.008 |
| 6 | Air | 2/6/2008 | < 0.003 |
| 6 | Air | 2/13/2008 | < 0.007 |
| 6 | Air | 2/20/2008 | < 0.006 |
| 6 | Air | 2/27/2008 | < 0.010 |
| 6 | Air | 3/5/2008 | < 0.005 |
| 6 | Air | 3/12/2008 | < 0.007 |
| 6 | Air | 3/19/2008 | < 0.006 |
| 6 | Air | 3/26/2008 | < 0.008 |
| 6 | Air | 4/2/2008 | < 0.007 |
| 6 | Air | 4/9/2008 | < 0.009 |
| 6 | Air | 4/16/2008 | < 0.007 |
| 6 | Air | 4/23/2008 | < 0.009 |
| 6 | Air | 4/30/2008 | < 0.008 |
| 6 | Air | 5/7/2008 | < 0.008 |
| 6 | Air | 5/14/2008 | < 0.006 |
| 6 | Air | 5/21/2008 | < 0.006 |
| 6 | Air | 5/28/2008 | < 0.009 |
| 6 | Air | 6/4/2008 | < 0.009 |
| 6 | Air | 6/11/2008 | < 0.009 |
| 6 | Air | 6/18/2008 | < 0.004 |
| 6 | Air | 6/25/2008 | < 0.007 |
| 6 | Air | 7/2/2008 | < 0.006 |
| 6 | Air | 7/9/2008 | < 0.008 |
| 6 | Air | 7/16/2008 | < 0.007 |
| 6 | Air | 7/23/2008 | < 0.006 |
| 6 | Air | 7/30/2008 | < 0.010 |
| 6 | Air | 8/6/2008 | < 0.005 |
| 6 | Air | 8/13/2008 | < 0.005 |

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Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Weekly Results in pCi/m3 +/- 2 Sigma

| Location | Sample Type | Collection Date | I-131 |
|---|---|---|---|
| 6 | Air | 8/20/2008 | < 0.007 |
| 6 | Air | 8/27/2008 | < 0.007 |
| 6 | Air | 9/3/2008 | < 0.008 |
| 6 | Air | 9/10/2008 | < 0.007 |
| 6 | Air | 9/17/2008 | < 0.006 |
| 6 | Air | 9/24/2008 | < 0.000 |
| 6 | Air | 10/1/2008 | < 0.000 |
| 6 | Air | 10/8/2008 | < 0.007 |
| 6 | Air | 0/15/2008 | < 0.006 |
| 6 | Air | 0/22/2008 | < 0.006 |
| 6 | Air | 0/29/2008 | < 0.009 |
| 6 | Air | 11/5/2008 | < 0.008 |
| 6 | Air | 1/12/2008 | < 0.006 |
| 6 | Air | 1/19/2008 | < 0.005 |
| 6 | Air | 1/26/2008 | < 0.010 |
| 6 | Air | 12/3/2008 | < 0.007 |
| 6 | Air | 2/10/2008 | < 0.007 |
| 6 | Air | 2/17/2008 | < 0.009 |
| 6 | Air | 2/24/2008 | < 0.009 |
| 6 | Air | 2/31/2008 | < 0.011 |
| 7 | Air | 1/9/2008 | < 0.007 |
| 7 | Air | 1/16/2008 | < 0.005 |
| 7 | Air | 1/23/2008 | < 0.005 |
| 7 | Air | 1/30/2008 | < 0.008 |
| 7 | Air | 2/6/2008 | < 0.003 |
| 7 | Air | 2/13/2008 | < 0.008 |
| 7 | Air | 2/20/2008 | < 0.007 |
| 7 | Air | 2/27/2008 | < 0.010 |
| 7 | Air | 3/5/2008 | < 0.005 |
| 7 | Air | 3/12/2008 | < 0.007 |
| 7 | Air | 3/19/2008 | < 0.006 |
| 7 | Air | 3/26/2008 | < 0.009 |
| 7 | Air | 4/2/2008 | < 0.007 |
| 7 | Air | 4/9/2008 | < 0.009 |

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Radiological Environmental Monitoring Program Detail Data
Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441
Sample Frequency is: Weekly Results in pCi/m3 +/- 2 Sigma

| Location | Sample Type | Collection Date | I-131 |
|---|---|---|---|
| 7 | Air | 4/16/2008 | < 0.007 |
| 7 | Air | 4/23/2008 | < 0.009 |
| 7 | Air | 4/30/2008 | < 0.009 |
| 7 | Air | 5/7/2008 | < 0.008 |
| 7 | Air | 5/14/2008 | < 0.006 |
| 7 | Air | 5/21/2008 | < 0.006 |
| 7 | Air | 5/28/2008 | < 0.009 |
| 7 | Air | 6/4/2008 | < 0.009 |
| 7 | Air | 6/11/2008 | < 0.009 |
| 7 | Air | 6/18/2008 | < 0.004 |
| 7 | Air | 6/25/2008 | < 0.007 |
| 7 | Air | 7/2/2008 | < 0.006 |
| 7 | Air | 7/9/2008 | < 0.008 |
| 7 | Air | 7/16/2008 | < 0.007 |
| 7 | Air | 7/23/2008 | < 0.006 |
| 7 | Air | 7/30/2008 | < 0.009 |
| 7 | Air | 8/6/2008 | < 0.005 |
| 7 | Air | 8/13/2008 | < 0.005 |
| 7 | Air | 8/20/2008 | < 0.007 |
| 7 | Air | 8/27/2008 | < 0.006 |
| 7 | Air | 9/3/2008 | < 0.008 |
| 7 | Air | 9/10/2008 | < 0.007 |
| 7 | Air | 9/17/2008 | < 0.007 |
| 7 | Air | 9/24/2008 | < 0.000 |
| 7 | Air | 10/1/2008 | < 0.000 |
| 7 | Air | 10/8/2008 | < 0.007 |
| 7 | Air | 0/15/2008 | < 0.006 |
| 7 | Air | 0/22/2008 | < 0.006 |
| 7 | Air | 0/29/2008 | < 0.009 |
| 7 | Air | 11/5/2008 | < 0.007 |
| 7 | Air | 1/12/2008 | < 0.006 |
| 7 | Air | 1/19/2008 | < 0.005 |
| 7 | Air | 1/26/2008 | < 0.011 |
| 7 | Air | 12/3/2008 | < 0.007 |
| 7 | Air | 2/10/2008 | < 0.007 |

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# Air Iodine Detail Report 2008

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Weekly Results in pCi/m3 +/- 2 Sigma

| Location | Sample Type | Collection Date | I-131 |
|---|---|---|---|
| 7 | Air | 2/17/2008 | < 0.010 |
| 7 | Air | 2/24/2008 | < 0.009 |
| 7 | Air | 2/31/2008 | < 0.011 |
| 35 | Air | 1/9/2008 | < 0.009 |
| 35 | Air | 1/16/2008 | < 0.008 |
| 35 | Air | 1/23/2008 | < 0.004 |
| 35 | Air | 1/30/2008 | < 0.008 |
| 35 | Air | 2/6/2008 | < 0.010 |
| 35 | Air | 2/13/2008 | < 0.008 |
| 35 | Air | 2/20/2008 | < 0.007 |
| 35 | Air | 2/27/2008 | < 0.009 |
| 35 | Air | 3/5/2008 | < 0.005 |
| 35 | Air | 3/12/2008 | < 0.009 |
| 35 | Air | 3/19/2008 | < 0.008 |
| 35 | Air | 3/26/2008 | < 0.006 |
| 35 | Air | 4/2/2008 | < 0.008 |
| 35 | Air | 4/9/2008 | < 0.006 |
| 35 | Air | 4/16/2008 | < 0.003 |
| 35 | Air | 4/23/2008 | < 0.006 |
| 35 | Air | 4/30/2008 | < 0.005 |
| 35 | Air | 5/7/2008 | < 0.007 |
| 35 | Air | 5/14/2008 | < 0.006 |
| 35 | Air | 5/21/2008 | < 0.006 |
| 35 | Air | 5/28/2008 | < 0.005 |
| 35 | Air | 6/4/2008 | < 0.005 |
| 35 | Air | 6/11/2008 | < 0.011 |
| 35 | Air | 6/18/2008 | < 0.008 |
| 35 | Air | 6/25/2008 | < 0.005 |
| 35 | Air | 7/2/2008 | < 0.009 |
| 35 | Air | 7/9/2008 | < 0.006 |
| 35 | Air | 7/16/2008 | < 0.006 |
| 35 | Air | 7/23/2008 | < 0.006 |
| 35 | Air | 7/30/2008 | < 0.006 |
| 35 | Air | 8/6/2008 | < 0.006 |

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Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Weekly Results in pCi/m3 +/- 2 Sigma

| Location | Sample Type | Collection Date | I-131 |
|---|---|---|---|
| 35 | Air | 8/13/2008 | < 0.007 |
| 35 | Air | 8/20/2008 | < 0.008 |
| 35 | Air | 8/27/2008 | < 0.007 |
| 35 | Air | 9/3/2008 | < 0.006 |
| 35 | Air | 9/10/2008 | < 0.008 |
| 35 | Air | 9/17/2008 | < 0.006 |
| 35 | Air | 9/24/2008 | < 0.000 |
| 35 | Air | 10/1/2008 | < 0.000 |
| 35 | Air | 10/8/2008 | < 0.007 |
| 35 | Air | 0/15/2008 | < 0.009 |
| 35 | Air | 0/22/2008 | < 0.006 |
| 35 | Air | 0/29/2008 | < 0.011 |
| 35 | Air | 11/5/2008 | < 0.008 |
| 35 | Air | 1/12/2008 | < 0.008 |
| 35 | Air | 1/19/2008 | < 0.008 |
| 35 | Air | 1/26/2008 | < 0.009 |
| 35 | Air | 12/3/2008 | < 0.007 |
| 35 | Air | 2/10/2008 | < 0.005 |
| 35 | Air | 2/17/2008 | < 0.011 |
| 35 | Air | 2/24/2008 | < 0.012 |
| 35 | Air | 2/31/2008 | < 0.007 |

APPENDIX C

# Fish Gamma Spectral Detail Report 2008

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Bi-Annually Results in pCi/kg wet +/- 2 Sigma

| Location | Sample Type | Collection Date | Co-58<br>K-40 | Co-60<br>Mn-54 | Cs-134<br>Zn-65 | Cs-137 | Fe-59 |
|---|---|---|---|---|---|---|---|
| 25 | walleye | 7/28/2008 | < 11.25<br>1,468.20 +/- 280.90 | < 15.19<br>< 14.79 | < 13.19<br>< 11.54 | < 12.37 | < 35.34 |
| 25 | white bass | 7/28/2008 | < 17.77<br>1,202.60 +/- 297.50 | < 14.86<br>< 15.41 | < 14.32<br>< 21.67 | < 18.55 | < 42.01 |
| 25 | yellow perch | 7/28/2008 | < 14.14<br>1,319.10 +/- 262.60 | < 10.19<br>< 9.85 | < 5.87<br>< 11.00 | LLD | < 28.96 |
| 32 | walleye | 7/28/2008 | < 20.16<br>1,438.60 +/- 320.40 | < 13.89<br>< 11.22 | < 12.13<br>< 26.92 | < 18.55 | < 17.02 |
| 32 | white bass | 7/28/2008 | < 8.68<br>1,483.20 +/- 277.90 | < 10.04<br>< 11.17 | < 8.04<br>< 13.35 | < 11.28 | < 25.26 |
| 32 | yellow perch | 7/28/2008 | < 11.08<br>1,518.60 +/- 279.70 | < 17.50<br>< 16.26 | < 16.51<br>< 29.66 | < 15.23 | < 32.16 |

APPENDIX C

# Food Products Gamma Spectral Detail Report 2008

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Monthly Results in pCi/kg wet +/- 2 Sigma

| Location | Sample Type | Collection Date | Be-7<br>I-131 | Co-58<br>K-40 | Co-60 | Cs-134 | Cs-137 |
|---|---|---|---|---|---|---|---|
| 2 | collard greens | 6/24/2008 | < 132.13<br>< 17.63 | < 8.33<br>5,333.80 +/- 366.80 | < 9.14 | < 9.93 | < 12.26 |
| 2 | collard greens | 7/22/2008 | < 121.79<br>< 15.46 | < 11.48<br>4,658.50 +/- 351.80 | < 10.40 | < 9.41 | < 13.40 |
| 2 | swiss chard | 7/22/2008 | < 117.54<br>< 17.05 | < 7.72<br>4,999.80 +/- 312.40 | < 10.13 | < 9.22 | < 11.74 |
| 2 | turnip greens | 7/22/2008 | 367.40 +/- 120.20<br>< 13.64 | < 8.94<br>5,974.10 +/- 357.00 | < 7.00 | < 9.83 | < 11.31 |
| 2 | collard greens | 8/20/2008 | < 92.50<br>< 13.60 | < 4.58<br>4,614.30 +/- 295.10 | < 6.98 | < 6.39 | < 7.69 |
| 2 | swiss chard | 8/20/2008 | 163.43 +/- 80.91<br>< 16.99 | < 11.23<br>5,657.70 +/- 358.70 | < 11.06 | < 9.93 | < 10.09 |
| 2 | turnip greens | 8/20/2008 | 258.49 +/- 104.60<br>< 13.65 | < 6.74<br>5,341.20 +/- 379.40 | < 10.16 | < 11.67 | < 7.75 |
| 2 | turnip greens | 9/16/2008 | 693.79 +/- 172.90<br>< 22.30 | < 7.79<br>5,768.40 +/- 518.10 | < 19.28 | < 12.86 | < 18.76 |
| 2 | turnip greens | 0/14/2008 | 599.49 +/- 124.20<br>< 14.71 | < 9.82<br>5,901.10 +/- 363.70 | < 8.53 | < 9.40 | < 12.11 |
| 16 | collard greens | 7/22/2008 | < 94.18<br>< 9.35 | < 9.42<br>5,175.90 +/- 374.80 | < 10.35 | < 7.87 | < 11.55 |

APPENDIX C

# Food Products Gamma Spectral Detail Report 2008

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Monthly Results in pCi/kg wet +/- 2 Sigma

| Location | Sample Type | Collection Date | Be-7<br>I-131 | Co-58<br>K-40 | Co-60 | Cs-134 | Cs-137 |
|---|---|---|---|---|---|---|---|
| 16 | swiss chard | 7/22/2008 | 251.44 +/- 101.10<br>< 12.79 | < 6.54<br>4,405.90 +/- 315.60 | < 8.91 | < 7.33 | < 8.94 |
| 16 | turnip greens | 7/22/2008 | 444.98 +/- 142.40<br>< 14.29 | < 10.97<br>4,869.50 +/- 388.50 | < 14.11 | < 13.23 | < 10.92 |
| 16 | collard greens | 8/20/2008 | < 51.84<br>< 15.23 | < 4.43<br>5,184.60 +/- 313.60 | < 6.60 | < 7.85 | < 6.97 |
| 16 | swiss chard | 8/20/2008 | < 101.27<br>< 18.26 | < 8.18<br>4,942.50 +/- 290.10 | < 8.92 | < 5.90 | < 7.69 |
| 16 | turnip greens | 8/20/2008 | 315.05 +/- 84.76<br>< 14.01 | < 6.94<br>6,106.00 +/- 365.70 | < 8.98 | < 7.18 | < 8.70 |
| 16 | beet greens | 9/16/2008 | 274.67 +/- 131.60<br>< 13.40 | < 9.78<br>6,192.70 +/- 384.40 | < 9.89 | < 9.54 | < 11.56 |
| 16 | collard greens | 9/16/2008 | < 130.76<br>< 25.17 | < 11.98<br>4,841.20 +/- 416.40 | < 15.01 | < 10.78 | < 10.94 |
| 16 | swiss chard | 9/16/2008 | < 168.49<br>< 19.02 | < 7.44<br>4,686.00 +/- 287.18 | < 12.49 | < 10.05 | < 9.29 |
| 16 | beet greens | 0/14/2008 | < 97.84<br>< 11.57 | < 8.74<br>4,783.40 +/- 311.90 | < 9.33 | < 10.02 | < 9.08 |
| 16 | swiss chard | 0/14/2008 | 176.17 +/- 70.16<br>< 14.21 | < 4.95<br>5,148.30 +/- 294.80 | < 8.75 | < 8.53 | < 8.76 |
| 16 | turnip greens | 0/14/2008 | 274.33 +/- 140.90<br>< 16.78 | < 12.15<br>4,680.30 +/- 401.00 | < 9.09 | < 12.40 | < 11.28 |

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**Food Products Gamma Spectral Detail Report 2008**

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Monthly Results in pCi/kg wet +/- 2 Sigma

| Location | Sample Type | Collection Date | Be-7<br>I-131 | Co-58<br>K-40 | Co-60 | Cs-134 | Cs-137 |
|---|---|---|---|---|---|---|---|
| 20 | collard greens | 6/24/2008 | < 147.83<br>< 25.65 | < 8.01<br>5,060.60 +/- 467.80 | < 13.71 | < 12.74 | < 12.91 |
| 20 | turnip greens | 6/24/2008 | 311.72 +/- 154.30<br>< 20.55 | < 12.90<br>4,843.60 +/- 390.40 | < 9.45 | < 12.73 | < 10.85 |
| 20 | collard greens | 7/22/2008 | < 190.93<br>< 25.11 | < 12.10<br>4,004.50 +/- 649.20 | < 13.14 | < 14.18 | < 16.15 |
| 20 | turnip greens | 7/22/2008 | 593.23 +/- 116.30<br>< 13.28 | < 6.84<br>4,049.20 +/- 281.40 | < 8.13 | < 6.12 | < 10.61 |
| 20 | collard greens | 8/20/2008 | < 84.82<br>< 13.55 | < 5.44<br>3,857.30 +/- 290.50 | < 9.36 | < 7.81 | < 7.66 |
| 20 | turnip greens | 8/20/2008 | 712.47 +/- 139.00<br>< 16.81 | < 8.64<br>5,652.40 +/- 362.80 | < 8.56 | < 9.53 | < 9.60 |
| 20 | collard greens | 9/16/2008 | < 173.19<br>< 24.97 | < 15.28<br>4,067.70 +/- 492.10 | < 15.15 | < 13.28 | < 11.30 |
| 20 | turnip greens | 9/16/2008 | 1,228.90 +/- 213.70<br>< 42.20 | < 21.52<br>5,397.10 +/- 508.10 | < 16.33 | < 11.18 | < 18.12 |
| 20 | collard greens | 0/14/2008 | < 72.88<br>< 11.20 | < 6.60<br>4,201.20 +/- 285.00 | < 7.00 | < 6.73 | < 9.45 |
| 20 | turnip greens | 0/14/2008 | 467.84 +/- 102.30<br>< 13.79 | < 8.26<br>5,020.80 +/- 347.30 | < 10.74 | < 8.87 | < 12.37 |

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# Food Products Gamma Spectral Detail Report 2008

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Monthly Results in pCi/kg wet +/- 2 Sigma

| Location | Sample Type | Collection Date | Be-7<br>I-131 | Co-58<br>K-40 | Co-60 | Cs-134 | Cs-137 |
|---|---|---|---|---|---|---|---|
| 37 | beet greens | 7/22/2008 | 274.51 +/- 99.67<br>< 17.11 | < 13.58<br>4,274.80 +/- 365.90 | < 11.16 | < 13.21 | < 10.36 |
| 37 | collard greens | 7/22/2008 | < 98.93<br>< 20.58 | < 12.85<br>3,904.10 +/- 335.50 | < 8.03 | < 11.58 | < 11.70 |
| 37 | swiss chard | 7/22/2008 | < 187.18<br>< 8.99 | < 9.55<br>2,598.25 +/- 214.05 | < 5.48 | < 8.06 | < 5.15 |
| 37 | collard greens | 8/20/2008 | < 89.55<br>< 14.73 | < 9.61<br>2,829.90 +/- 268.40 | < 12.36 | < 8.78 | < 13.19 |
| 37 | swiss chard | 8/20/2008 | 144.49 +/- 81.14<br>< 11.12 | < 4.82<br>3,105.90 +/- 245.10 | < 6.28 | < 7.04 | < 9.17 |
| 37 | turnip greens | 8/20/2008 | 462.39 +/- 141.80<br>< 13.87 | < 13.36<br>5,520.50 +/- 371.00 | < 8.31 | < 9.96 | < 15.19 |
| 37 | beet greens | 9/16/2008 | 278.27 +/- 105.70<br>< 16.26 | < 5.61<br>5,941.60 +/- 375.60 | < 12.70 | < 10.07 | < 12.50 |
| 37 | collard greens | 9/16/2008 | < 182.66<br>< 24.49 | < 11.16<br>3,465.80 +/- 452.00 | < 17.43 | < 12.63 | < 15.20 |
| 37 | swiss chard | 9/16/2008 | < 149.18<br>< 23.02 | < 14.24<br>4,939.70 +/- 475.90 | < 16.16 | < 11.92 | < 15.74 |
| 37 | beet greens | 0/14/2008 | 281.57 +/- 102.50<br>< 13.91 | < 12.02<br>6,763.50 +/- 425.00 | < 10.30 | < 10.10 | < 9.64 |
| 37 | swiss chard | 0/14/2008 | < 101.54<br>< 12.00 | < 9.07<br>4,964.50 +/- 323.70 | < 9.69 | < 10.40 | < 9.42 |

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# Food Products Gamma Spectral Detail Report 2008

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Monthly Results in pCi/kg wet +/- 2 Sigma

| Location | Sample Type | Collection Date | Be-7<br>I-131 | Co-58<br>K-40 | Co-60 | Cs-134 | Cs-137 |
|---|---|---|---|---|---|---|---|
| 37 | turnip greens | 0/14/2008 | 368.82 +/- 77.61<br>< 11.17 | < 8.30<br>5,025.60 +/- 300.40 | < 8.56 | < 7.68 | < 9.98 |
| 70 | beet greens | 7/22/2008 | 316.83 +/- 176.20<br>< 15.61 | < 11.67<br>6,182.70 +/- 516.90 | < 12.36 | < 14.64 | < 18.45 |
| 70 | collard greens | 7/22/2008 | < 89.12<br>< 18.45 | < 6.10<br>4,239.00 +/- 295.60 | < 7.35 | < 9.59 | < 7.37 |
| 70 | swiss chard | 7/22/2008 | 204.16 +/- 76.65<br>< 18.30 | < 7.86<br>5,096.40 +/- 323.20 | < 9.14 | < 8.91 | < 8.56 |
| 70 | collard greens | 8/20/2008 | < 135.98<br>< 20.47 | < 13.76<br>4,167.80 +/- 360.20 | < 15.16 | < 9.95 | < 12.46 |
| 70 | swiss chard | 8/20/2008 | 277.74 +/- 103.10<br>< 14.17 | < 11.54<br>6,016.10 +/- 432.60 | < 11.08 | < 10.06 | < 6.88 |
| 70 | collard greens | 9/16/2008 | 320.82 +/- 153.80<br>< 21.75 | < 11.26<br>4,501.20 +/- 339.20 | < 11.87 | < 9.55 | < 8.99 |
| 70 | swiss chard | 9/16/2008 | 400.71 +/- 227.90<br>< 22.43 | < 20.38<br>3,717.20 +/- 495.60 | < 15.39 | < 16.46 | < 13.96 |
| 70 | collard greens | 0/14/2008 | 252.64 +/- 103.60<br>< 11.74 | < 9.59<br>3,740.00 +/- 333.30 | < 7.05 | < 12.37 | < 9.55 |
| 70 | swiss chard | 0/14/2008 | 168.97 +/- 91.95<br>< 14.37 | < 4.42<br>3,826.60 +/- 241.60 | < 7.86 | < 7.93 | < 5.75 |

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**Milk Gamma Spectral Detail Report 2008**

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Bi-Monthly Results in pCi/L +/- 2 Sigma

| Location | Sample Type | Collection Date | Ba-140 | Cs-134 | Cs-137 | K-40 | La-140 |
|---|---|---|---|---|---|---|---|
| 41 | Milk | 4/21/2008 | < 11 | < 4 | < 3 | 1,621 +/- 118 | < 2 |
| 41 | Milk | 5/5/2008 | < 20 | < 3 | < 4 | 1,573 +/- 116 | < 4 |
| 41 | Milk | 5/20/2008 | < 18 | < 3 | < 3 | 1,551 +/- 131 | < 1 |
| 41 | Milk | 6/2/2008 | < 16 | < 3 | < 4 | 1,624 +/- 124 | < 3 |
| 41 | Milk | 6/16/2008 | < 16 | < 3 | < 5 | 1,568 +/- 125 | < 1 |
| 41 | Milk | 7/7/2008 | < 13 | < 3 | < 3 | 1,533 +/- 116 | < 2 |
| 41 | Milk | 7/21/2008 | < 14 | < 3 | < 4 | 1,776 +/- 121 | < 4 |
| 41 | Milk | 8/4/2008 | < 17 | < 3 | < 4 | 1,700 +/- 132 | < 3 |
| 41 | Milk | 8/18/2008 | < 14 | < 2 | < 4 | 1,757 +/- 119 | < 3 |
| 41 | Milk | 9/8/2008 | < 32 | < 3 | < 5 | 1,707 +/- 126 | < 9 |
| 41 | Milk | 9/15/2008 | < 12 | < 2 | < 3 | 1,734 +/- 109 | < 4 |

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# Milk Gamma Spectral Detail Report 2008

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Bi-Monthly Results in pCi/L +/- 2 Sigma

| Location | Sample Type | Collection Date | Ba-140 | Cs-134 | Cs-137 | K-40 | La-140 |
|---|---|---|---|---|---|---|---|
| 41 | Milk | 10/6/2008 | < 21 | < 6 | < 5 | 1,669 +/- 172 | < 4 |
| 41 | Milk | 0/22/2008 | < 18 | < 3 | < 3 | 1,733 +/- 110 | < 2 |
| 41 | Milk | 11/3/2008 | < 13 | < 3 | < 3 | 1,788 +/- 96 | < 2 |
| 51 | Milk | 1/7/2008 | < 26 | < 3 | < 4 | 1,240 +/- 101 | < 4 |
| 51 | Milk | 2/4/2008 | < 19 | < 3 | < 4 | 1,209 +/- 106 | < 3 |
| 51 | Milk | 3/3/2008 | < 14 | < 2 | < 4 | 1,302 +/- 76 | < 1 |
| 51 | Milk | 4/7/2008 | < 16 | < 3 | < 4 | 1,385 +/- 104 | < 2 |
| 51 | Milk | 4/21/2008 | < 14 | < 3 | < 5 | 1,353 +/- 124 | < 1 |
| 51 | Milk | 5/5/2008 | < 19 | < 2 | < 2 | 1,166 +/- 106 | < 2 |
| 51 | Milk | 5/20/2008 | < 14 | < 2 | < 3 | 1,038 +/- 71 | < 2 |

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# Milk Gamma Spectral Detail Report 2008

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Bi-Monthly Results in pCi/L +/- 2 Sigma

| Location | Sample Type | Collection Date | Ba-140 | Cs-134 | Cs-137 | K-40 | La-140 |
|---|---|---|---|---|---|---|---|
| 51 | Milk | 6/2/2008 | < 14 | < 3 | < 3 | 1,264 +/- 110 | < 3 |
| 51 | Milk | 6/17/2008 | < 10 | < 3 | < 3 | 1,256 +/- 105 | < 2 |
| 51 | Milk | 7/7/2008 | < 22 | < 3 | < 6 | 1,174 +/- 101 | < 2 |
| 51 | Milk | 7/21/2008 | < 14 | < 2 | < 3 | 1,244 +/- 112 | < 2 |
| 51 | Milk | 8/4/2008 | < 12 | < 3 | < 2 | 419 +/- 90 | < 3 |
| 51 | Milk | 8/18/2008 | < 14 | < 3 | < 3 | 1,229 +/- 101 | < 4 |
| 51 | Milk | 9/8/2008 | < 21 | < 3 | < 3 | 1,320 +/- 104 | < 6 |
| 51 | Milk | 9/15/2008 | < 22 | < 4 | < 4 | 1,398 +/- 112 | < 5 |
| 51 | Milk | 10/6/2008 | < 19 | < 4 | < 5 | 1,293 +/- 132 | < 3 |
| 51 | Milk | 0/22/2008 | < 20 | < 3 | < 4 | 811 +/- 87 | < 3 |
| 51 | Milk | 11/3/2008 | < 21 | < 4 | < 4 | 1,186 +/- 120 | < 3 |

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**Milk Gamma Spectral Detail Report 2008**

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Bi-Monthly Results in pCi/L +/- 2 Sigma

| Location | Sample Type | Collection Date | Ba-140 | Cs-134 | Cs-137 | K-40 | La-140 |
|---|---|---|---|---|---|---|---|
| 51 | Milk | 12/1/2008 | < 13 | < 4 | < 5 | 1,336 +/- 136 | < 4 |
| 61 | Milk | 4/21/2008 | < 16 | < 3 | < 2 | 1,497 +/- 120 | < 1 |
| 61 | Milk | 5/5/2008 | < 20 | < 3 | < 4 | 1,720 +/- 119 | < 3 |
| 61 | Milk | 5/20/2008 | < 18 | < 4 | < 5 | 1,710 +/- 122 | < 2 |
| 61 | Milk | 6/2/2008 | < 21 | < 4 | < 5 | 1,963 +/- 127 | < 3 |
| 61 | Milk | 6/16/2008 | < 13 | < 4 | < 5 | 1,802 +/- 139 | < 2 |
| 61 | Milk | 7/7/2008 | < 18 | < 5 | < 5 | 1,757 +/- 146 | < 2 |
| 61 | Milk | 7/21/2008 | < 18 | < 4 | < 5 | 1,806 +/- 132 | < 4 |
| 61 | Milk | 8/4/2008 | < 10 | < 4 | < 3 | 1,844 +/- 123 | < 2 |
| 61 | Milk | 8/18/2008 | < 14 | < 3 | < 4 | 1,800 +/- 122 | < 3 |

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**Milk Gamma Spectral Detail Report 2008**

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Bi-Monthly Results in pCi/L +/- 2 Sigma

| Location | Sample Type | Collection Date | Ba-140 | Cs-134 | Cs-137 | K-40 | La-140 |
|---|---|---|---|---|---|---|---|
| 61 | Milk | 9/8/2008 | < 32 | < 4 | < 4 | 1,924 +/- 123 | < 6 |
| 61 | Milk | 9/15/2008 | < 25 | < 4 | < 4 | 1,900 +/- 137 | < 4 |
| 61 | Milk | 10/6/2008 | < 17 | < 6 | < 5 | 1,849 +/- 199 | < 3 |
| 61 | Milk | 0/22/2008 | < 13 | < 3 | < 4 | 1,811 +/- 108 | < 3 |

# Milk Iodine Detail Report 2008

Radiological Environmental Monitoring Program Detail Data
Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441
Sample Frequency is: Bi-Monthly Results in pCi/L +/- 2 Sigma

| Location | Sample Type | Collection Date | I-131 |
|---|---|---|---|
| 22 | Milk | 1/7/2008 | |
| 22 | Milk | 2/4/2008 | |
| 22 | Milk | 3/3/2008 | |
| 22 | Milk | 4/7/2008 | |
| 22 | Milk | 4/21/2008 | |
| 22 | Milk | 5/5/2008 | |
| 22 | Milk | 5/20/2008 | |
| 22 | Milk | 6/2/2008 | |
| 22 | Milk | 6/16/2008 | |
| 22 | Milk | 7/7/2008 | |
| 22 | Milk | 7/21/2008 | |
| 22 | Milk | 8/4/2008 | |
| 22 | Milk | 8/18/2008 | |
| 22 | Milk | 9/8/2008 | |
| 22 | Milk | 9/15/2008 | |
| 22 | Milk | 10/6/2008 | |
| 22 | Milk | 0/22/2008 | |
| 22 | Milk | 11/3/2008 | |
| 22 | Milk | 12/1/2008 | |
| 41 | Milk | 1/7/2008 | |
| 41 | Milk | 2/4/2008 | |
| 41 | Milk | 3/3/2008 | |
| 41 | Milk | 4/7/2008 | |
| 41 | Milk | 4/21/2008 | < 0.31 |
| 41 | Milk | 5/5/2008 | < 0.25 |
| 41 | Milk | 5/20/2008 | < 0.42 |
| 41 | Milk | 6/2/2008 | < 0.37 |
| 41 | Milk | 6/16/2008 | < 0.33 |
| 41 | Milk | 7/7/2008 | < 0.34 |
| 41 | Milk | 7/21/2008 | < 0.25 |
| 41 | Milk | 8/4/2008 | < 0.34 |
| 41 | Milk | 8/18/2008 | < 0.27 |
| 41 | Milk | 9/8/2008 | < 0.29 |

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# Milk Iodine Detail Report 2008

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Bi-Monthly Results in pCi/L +/- 2 Sigma

| Location | Sample Type | Collection Date | I-131 |
|---|---|---|---|
| 41 | Milk | 9/15/2008 | < 0.49 |
| 41 | Milk | 10/6/2008 | < 0.30 |
| 41 | Milk | 0/22/2008 | < 0.28 |
| 41 | Milk | 11/3/2008 | < 0.40 |
| 41 | Milk | 12/1/2008 | |
| 51 | Milk | 1/7/2008 | < 0.36 |
| 51 | Milk | 2/4/2008 | < 0.16 |
| 51 | Milk | 3/3/2008 | < 0.31 |
| 51 | Milk | 4/7/2008 | < 0.17 |
| 51 | Milk | 4/21/2008 | < 0.37 |
| 51 | Milk | 5/5/2008 | < 0.21 |
| 51 | Milk | 5/20/2008 | < 0.43 |
| 51 | Milk | 6/2/2008 | < 0.44 |
| 51 | Milk | 6/17/2008 | < 0.26 |
| 51 | Milk | 7/7/2008 | < 0.43 |
| 51 | Milk | 7/21/2008 | < 0.26 |
| 51 | Milk | 8/4/2008 | < 0.25 |
| 51 | Milk | 8/18/2008 | < 0.25 |
| 51 | Milk | 9/8/2008 | < 0.28 |
| 51 | Milk | 9/15/2008 | < 0.40 |
| 51 | Milk | 10/6/2008 | < 0.31 |
| 51 | Milk | 0/22/2008 | < 0.31 |
| 51 | Milk | 11/3/2008 | < 0.27 |
| 51 | Milk | 12/1/2008 | < 0.27 |
| 61 | Milk | 1/7/2008 | |
| 61 | Milk | 2/4/2008 | |
| 61 | Milk | 3/3/2008 | |
| 61 | Milk | 4/7/2008 | |
| 61 | Milk | 4/21/2008 | < 0.34 |
| 61 | Milk | 5/5/2008 | < 0.23 |
| 61 | Milk | 5/20/2008 | < 0.35 |
| 61 | Milk | 6/2/2008 | < 0.48 |
| 61 | Milk | 6/16/2008 | < 0.31 |

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# Milk Iodine Detail Report 2008

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Bi-Monthly Results in pCi/L +/- 2 Sigma

| Location | Sample Type | Collection Date | I-131 |
|---|---|---|---|
| 61 | Milk | 7/7/2008 | < 0.19 |
| 61 | Milk | 7/21/2008 | < 0.30 |
| 61 | Milk | 8/4/2008 | < 0.19 |
| 61 | Milk | 8/18/2008 | < 0.27 |
| 61 | Milk | 9/8/2008 | < 0.29 |
| 61 | Milk | 9/15/2008 | < 0.33 |
| 61 | Milk | 10/6/2008 | < 0.26 |
| 61 | Milk | 0/22/2008 | < 0.37 |
| 61 | Milk | 11/3/2008 | |
| 61 | Milk | 12/1/2008 | |

APPENDIX C

**Sediment Gamma Spectral Detail Report 2008**

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Bi-Annually Results in pCi/kg dry +/- 2 Sigma

| Location | Sample Type | Collection Date | Co-58 | Co-60 | Cs-134 | Cs-137 | K-40 |
|---|---|---|---|---|---|---|---|
| 25 | Sediment | 6/25/2008 | < 23.90 | < 14.93 | < 16.29 | 273.00 +/- 42.47 | 15,996.00 +/- 740.40 |
| 25 | Sediment | 9/24/2008 | < 26.94 | < 16.71 | < 21.23 | LLD | 11,841.00 +/- 662.10 |
| 26 | Sediment | 6/25/2008 | < 24.48 | < 33.89 | < 30.43 | LLD | 12,522.00 +/- 908.00 |
| 26 | Sediment | 9/24/2008 | < 26.05 | < 6.49 | < 7.65 | LLD | 13,710.00 +/- 686.30 |
| 27 | Sediment | 6/25/2008 | < 16.72 | < 7.09 | < 10.40 | 212.15 +/- 31.60 | 16,530.00 +/- 758.20 |
| 27 | Sediment | 9/24/2008 | < 31.63 | < 8.73 | < 6.91 | 157.35 +/- 27.05 | 15,632.00 +/- 796.30 |
| 32 | Sediment | 6/25/2008 | < 26.32 | < 21.17 | < 25.66 | 825.41 +/- 44.61 | 26,303.00 +/- 927.60 |
| 32 | Sediment | 9/24/2008 | < 37.07 | < 25.11 | < 25.04 | 697.89 +/- 42.35 | 23,968.00 +/- 686.90 |
| 64 | Sediment | 6/25/2008 | < 11.50 | < 8.66 | < 5.08 | < 13.64 | 9,367.10 +/- 445.70 |

APPENDIX C

**Sediment Gamma Spectral Detail Report 2008**

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Bi-Annually Results in pCi/kg dry +/- 2 Sigma

| Location | Sample Type | Collection Date | Co-58 | Co-60 | Cs-134 | Cs-137 | K-40 |
|---|---|---|---|---|---|---|---|
| 64 | Sediment | 9/19/2008 | < 15.07 | < 20.41 | < 17.74 | < 21.64 | 7,502.50 +/- 705.60 |
| 65 | Sediment | 6/25/2008 | < 13.26 | < 11.45 | < 9.45 | < 12.28 | 10,478.00 +/- 466.30 |
| 65 | Sediment | 9/19/2008 | < 35.13 | < 23.73 | < 18.16 | < 13.92 | 9,946.10 +/- 720.30 |

APPENDIX C

# TLD Gamma Dose Detail Report 2008

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Quarterly Results in mR/91 days +/- 2 Sigma

| Location | Sample Type | Collection Period | | Exposure | | |
|---|---|---|---|---|---|---|
| 1 | TLD | 1/21/2008 | to 4/4/2008 | 14.01 | +/- | 0.84 |
| 1 | TLD | 4/4/2008 | to 7/8/2008 | 9.42 | +/- | 0.74 |
| 1 | TLD | 7/8/2008 | to 0/9/2008 | 11.11 | +/- | 0.87 |
| 1 | TLD | 10/9/2008 | to 1/6/2009 | 10.66 | +/- | 1.13 |
| 3 | TLD | 1/21/2008 | to 4/4/2008 | 14.06 | +/- | 0.77 |
| 3 | TLD | 4/4/2008 | to 7/8/2008 | 10.64 | +/- | 0.55 |
| 3 | TLD | 7/8/2008 | to 0/9/2008 | 11.41 | +/- | 0.90 |
| 3 | TLD | 10/9/2008 | to 1/6/2009 | 11.44 | +/- | 0.54 |
| 4 | TLD | 1/21/2008 | to 4/4/2008 | 14.92 | +/- | 0.73 |
| 4 | TLD | 4/4/2008 | to 7/8/2008 | 11.11 | +/- | 0.41 |
| 4 | TLD | 7/8/2008 | to 0/9/2008 | 12.44 | +/- | 0.63 |
| 4 | TLD | 10/9/2008 | to 1/6/2009 | 12.43 | +/- | 0.74 |
| 5 | TLD | 1/21/2008 | to 4/4/2008 | 13.49 | +/- | 0.61 |
| 5 | TLD | 4/4/2008 | to 7/8/2008 | 11.18 | +/- | 0.49 |
| 5 | TLD | 7/8/2008 | to 0/9/2008 | 10.87 | +/- | 0.74 |
| 5 | TLD | 10/9/2008 | to 1/6/2009 | 12.14 | +/- | 0.45 |
| 6 | TLD | 1/21/2008 | to 4/4/2008 | 15.19 | +/- | 0.92 |
| 6 | TLD | 4/4/2008 | to 7/8/2008 | 12.12 | +/- | 0.43 |
| 6 | TLD | 7/8/2008 | to 0/9/2008 | 12.90 | +/- | 1.16 |
| 6 | TLD | 10/9/2008 | to 1/6/2009 | 13.17 | +/- | 0.45 |
| 7 | TLD | 1/21/2008 | to 4/4/2008 | 15.20 | +/- | 0.95 |
| 7 | TLD | 4/4/2008 | to 7/8/2008 | 12.00 | +/- | 0.43 |
| 7 | TLD | 7/8/2008 | to 0/9/2008 | 12.51 | +/- | 0.67 |
| 7 | TLD | 10/9/2008 | to 1/6/2009 | 13.08 | +/- | 0.75 |
| 8 | TLD | 1/21/2008 | to 4/4/2008 | 13.15 | +/- | 0.63 |
| 8 | TLD | 4/4/2008 | to 7/8/2008 | 11.02 | +/- | 0.39 |
| 8 | TLD | 7/8/2008 | to 0/9/2008 | 11.90 | +/- | 1.07 |
| 8 | TLD | 10/9/2008 | to 1/6/2009 | 11.78 | +/- | 0.53 |
| 9 | TLD | 1/21/2008 | to 4/4/2008 | 13.58 | +/- | 0.66 |

APPENDIX C

# TLD Gamma Dose Detail Report 2008

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Quarterly Results in mR/91 days +/- 2 Sigma

| Location | Sample Type | Collection Period | | Exposure | | |
|---|---|---|---|---|---|---|
| 9 | TLD | 4/4/2008 | to 7/8/2008 | 10.76 | +/- | 0.49 |
| 9 | TLD | 7/8/2008 | to 0/9/2008 | 11.20 | +/- | 0.64 |
| 9 | TLD | 10/9/2008 | to 1/6/2009 | 11.78 | +/- | 1.23 |
| 10 | TLD | 1/21/2008 | to 4/4/2008 | 16.16 | +/- | 0.70 |
| 10 | TLD | 4/4/2008 | to 7/8/2008 | 14.34 | +/- | 0.66 |
| 10 | TLD | 7/8/2008 | to 0/9/2008 | 13.90 | +/- | 0.65 |
| 10 | TLD | 10/9/2008 | to 1/6/2009 | 14.72 | +/- | 0.73 |
| 11 | TLD | 1/21/2008 | to 4/4/2008 | 16.02 | +/- | 0.83 |
| 11 | TLD | 4/4/2008 | to 7/8/2008 | 12.15 | +/- | 0.49 |
| 11 | TLD | 7/8/2008 | to 0/9/2008 | 14.00 | +/- | 0.74 |
| 11 | TLD | 10/9/2008 | to 1/6/2009 | 13.07 | +/- | 0.45 |
| 12 | TLD | 1/21/2008 | to 4/4/2008 | 14.95 | +/- | 0.89 |
| 12 | TLD | 4/4/2008 | to 7/8/2008 | 11.64 | +/- | 0.75 |
| 12 | TLD | 7/8/2008 | to 0/9/2008 | 12.73 | +/- | 0.74 |
| 12 | TLD | 10/9/2008 | to 1/6/2009 | 12.62 | +/- | 0.78 |
| 13 | TLD | 1/21/2008 | to 4/4/2008 | 15.36 | +/- | 0.64 |
| 13 | TLD | 4/4/2008 | to 7/8/2008 | 11.91 | +/- | 0.79 |
| 13 | TLD | 7/8/2008 | to 0/9/2008 | 13.08 | +/- | 0.78 |
| 13 | TLD | 10/9/2008 | to 1/6/2009 | 12.72 | +/- | 0.89 |
| 14 | TLD | 1/21/2008 | to 4/4/2008 | 13.89 | +/- | 0.67 |
| 14 | TLD | 4/4/2008 | to 7/8/2008 | 10.84 | +/- | 0.69 |
| 14 | TLD | 7/8/2008 | to 0/9/2008 | 11.57 | +/- | 0.77 |
| 14 | TLD | 10/9/2008 | to 1/6/2009 | 11.73 | +/- | 0.63 |
| 15 | TLD | 1/21/2008 | to 4/4/2008 | 13.49 | +/- | 0.89 |
| 15 | TLD | 4/4/2008 | to 7/8/2008 | 7.97 | +/- | 0.51 |
| 15 | TLD | 7/8/2008 | to 0/9/2008 | 11.08 | +/- | 0.66 |
| 15 | TLD | 10/9/2008 | to 1/6/2009 | 7.99 | +/- | 0.54 |
| 21 | TLD | 1/21/2008 | to 4/4/2008 | 15.82 | +/- | 0.69 |
| 21 | TLD | 4/4/2008 | to 7/8/2008 | 13.03 | +/- | 0.67 |
| 21 | TLD | 7/8/2008 | to 0/9/2008 | 13.76 | +/- | 0.79 |

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# TLD Gamma Dose Detail Report 2008

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Quarterly Results in mR/91 days +/- 2 Sigma

| Location | Sample Type | Collection Period | | Exposure | | |
|---|---|---|---|---|---|---|
| 21 | TLD | 10/9/2008 | to 1/6/2009 | 13.79 | +/- | 0.53 |
| 23 | TLD | 1/21/2008 | to 4/4/2008 | 17.04 | +/- | 0.81 |
| 23 | TLD | 4/4/2008 | to 7/8/2008 | 13.54 | +/- | 0.76 |
| 23 | TLD | 7/8/2008 | to 0/9/2008 | 14.77 | +/- | 0.85 |
| 23 | TLD | 10/9/2008 | to 1/6/2009 | 14.29 | +/- | 0.49 |
| 24 | TLD | 1/21/2008 | to 4/4/2008 | 14.77 | +/- | 0.68 |
| 24 | TLD | 4/4/2008 | to 7/8/2008 | 12.26 | +/- | 0.66 |
| 24 | TLD | 7/8/2008 | to 0/9/2008 | 12.18 | +/- | 0.70 |
| 24 | TLD | 10/9/2008 | to 1/6/2009 | 13.11 | +/- | 0.69 |
| 29 | TLD | 1/21/2008 | to 4/4/2008 | 18.07 | +/- | 0.77 |
| 29 | TLD | 4/4/2008 | to 7/8/2008 | 15.57 | +/- | 0.46 |
| 29 | TLD | 7/8/2008 | to 0/9/2008 | 16.45 | +/- | 0.67 |
| 29 | TLD | 10/9/2008 | to 1/6/2009 | 16.55 | +/- | 0.46 |
| 30 | TLD | 1/21/2008 | to 4/4/2008 | 16.81 | +/- | 0.87 |
| 30 | TLD | 4/4/2008 | to 7/8/2008 | 14.18 | +/- | 0.37 |
| 30 | TLD | 7/8/2008 | to 0/9/2008 | 14.82 | +/- | 0.79 |
| 30 | TLD | 10/9/2008 | to 1/6/2009 | 15.52 | +/- | 0.42 |
| 31 | TLD | 1/21/2008 | to 4/4/2008 | 16.95 | +/- | 0.75 |
| 31 | TLD | 4/4/2008 | to 7/8/2008 | 15.38 | +/- | 0.54 |
| 31 | TLD | 7/8/2008 | to 0/9/2008 | 15.12 | +/- | 0.89 |
| 31 | TLD | 10/9/2008 | to 1/6/2009 | 16.48 | +/- | 0.47 |
| 33 | TLD | 1/21/2008 | to 4/4/2008 | 17.87 | +/- | 0.99 |
| 33 | TLD | 4/4/2008 | to 7/8/2008 | 15.98 | +/- | 0.42 |
| 33 | TLD | 7/8/2008 | to 0/9/2008 | 16.34 | +/- | 0.82 |
| 33 | TLD | 10/9/2008 | to 1/6/2009 | 17.75 | +/- | 0.67 |
| 35 | TLD | 1/21/2008 | to 4/4/2008 | 13.87 | +/- | 0.53 |
| 35 | TLD | 4/4/2008 | to 7/8/2008 | 11.45 | +/- | 0.41 |
| 35 | TLD | 7/8/2008 | to 0/9/2008 | 11.72 | +/- | 0.70 |
| 35 | TLD | 10/9/2008 | to 1/6/2009 | 12.39 | +/- | 0.48 |

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# TLD Gamma Dose Detail Report 2008

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Quarterly Results in mR/91 days +/- 2 Sigma

| Location | Sample Type | Collection Period | | Exposure | | |
|---|---|---|---|---|---|---|
| 36 | TLD | 1/21/2008 | to 4/4/2008 | 17.25 | +/- | 0.83 |
| 36 | TLD | 4/4/2008 | to 7/8/2008 | 13.18 | +/- | 0.48 |
| 36 | TLD | 7/8/2008 | to 0/9/2008 | 15.56 | +/- | 0.95 |
| 36 | TLD | 10/9/2008 | to 1/6/2009 | 16.13 | +/- | 0.42 |
| 53 | TLD | 1/21/2008 | to 4/4/2008 | 14.17 | +/- | 0.69 |
| 53 | TLD | 4/4/2008 | to 7/8/2008 | 15.95 | +/- | 0.66 |
| 53 | TLD | 7/8/2008 | to 0/9/2008 | 12.84 | +/- | 0.67 |
| 53 | TLD | 10/9/2008 | to 1/6/2009 | 14.15 | +/- | 0.64 |
| 54 | TLD | 1/21/2008 | to 4/4/2008 | 14.06 | +/- | 1.02 |
| 54 | TLD | 4/4/2008 | to 7/8/2008 | 12.45 | +/- | 0.50 |
| 54 | TLD | 7/8/2008 | to 0/9/2008 | 12.34 | +/- | 0.93 |
| 54 | TLD | 10/9/2008 | to 1/6/2009 | 12.93 | +/- | 0.47 |
| 55 | TLD | 1/21/2008 | to 4/4/2008 | 14.54 | +/- | 1.56 |
| 55 | TLD | 4/4/2008 | to 7/8/2008 | 13.78 | +/- | 0.37 |
| 55 | TLD | 7/8/2008 | to 0/9/2008 | 13.75 | +/- | 1.01 |
| 55 | TLD | 10/9/2008 | to 1/6/2009 | 14.34 | +/- | 0.54 |
| 56 | TLD | 1/21/2008 | to 4/4/2008 | 14.29 | +/- | 0.66 |
| 56 | TLD | 4/4/2008 | to 7/8/2008 | 12.74 | +/- | 0.64 |
| 56 | TLD | 7/8/2008 | to 0/9/2008 | 12.62 | +/- | 0.93 |
| 56 | TLD | 10/9/2008 | to 1/6/2009 | 13.59 | +/- | 0.60 |
| 58 | TLD | 1/21/2008 | to 4/4/2008 | 12.60 | +/- | 0.66 |
| 58 | TLD | 4/4/2008 | to 7/8/2008 | 10.79 | +/- | 0.45 |
| 58 | TLD | 7/8/2008 | to 0/9/2008 | 10.71 | +/- | 0.64 |
| 58 | TLD | 10/9/2008 | to 1/6/2009 | 11.95 | +/- | 0.48 |

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# TLD Gamma Dose Detail Report 2008

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Quarterly Results in mR/91 days +/- 2 Sigma

| Location | Sample Type | Collection Period | | Exposure |
|---|---|---|---|---|
| 1 | TLB | 1/21/2008 | to 4/4/2008 | 12.12 +/- 1.10 |
| 1 | TLB | 4/4/2008 | to 7/8/2008 | 8.40 +/- 0.85 |
| 1 | TLB | 7/8/2008 | to 0/9/2008 | 10.54 +/- 0.82 |
| 1 | TLB | 10/9/2008 | to 1/6/2009 | 11.27 +/- 1.05 |
| 3 | TLB | 1/21/2008 | to 4/4/2008 | 13.82 +/- 0.63 |
| 3 | TLB | 4/4/2008 | to 7/8/2008 | 8.04 +/- 0.86 |
| 3 | TLB | 7/8/2008 | to 0/9/2008 | 11.50 +/- 0.58 |
| 3 | TLB | 10/9/2008 | to 1/6/2009 | 10.79 +/- 0.99 |
| 4 | TLB | 1/21/2008 | to 4/4/2008 | 14.10 +/- 0.49 |
| 4 | TLB | 4/4/2008 | to 7/8/2008 | 11.27 +/- 1.39 |
| 4 | TLB | 7/8/2008 | to 0/9/2008 | 12.16 +/- 0.56 |
| 4 | TLB | 10/9/2008 | to 1/6/2009 | 13.76 +/- 0.72 |
| 5 | TLB | 1/21/2008 | to 4/4/2008 | 14.34 +/- 0.57 |
| 5 | TLB | 4/4/2008 | to 7/8/2008 | 9.80 +/- 0.74 |
| 5 | TLB | 7/8/2008 | to 0/9/2008 | 12.20 +/- 0.53 |
| 5 | TLB | 10/9/2008 | to 1/6/2009 | 13.17 +/- 0.84 |
| 6 | TLB | 1/21/2008 | to 4/4/2008 | 13.66 +/- 0.60 |
| 6 | TLB | 4/4/2008 | to 7/8/2008 | 10.55 +/- 0.65 |
| 6 | TLB | 7/8/2008 | to 0/9/2008 | 12.19 +/- 0.63 |
| 6 | TLB | 10/9/2008 | to 1/6/2009 | 13.61 +/- 0.73 |
| 7 | TLB | 1/21/2008 | to 4/4/2008 | 14.94 +/- 0.77 |
| 7 | TLB | 4/4/2008 | to 7/8/2008 | 11.32 +/- 0.70 |
| 7 | TLB | 7/8/2008 | to 0/9/2008 | 12.72 +/- 0.46 |
| 7 | TLB | 10/9/2008 | to 1/6/2009 | 15.39 +/- 0.94 |
| 8 | TLB | 1/21/2008 | to 4/4/2008 | 13.65 +/- 0.64 |
| 8 | TLB | 4/4/2008 | to 7/8/2008 | 10.13 +/- 0.80 |
| 8 | TLB | 7/8/2008 | to 0/9/2008 | 11.84 +/- 0.52 |
| 8 | TLB | 10/9/2008 | to 1/6/2009 | 13.26 +/- 0.75 |
| 9 | TLB | 1/21/2008 | to 4/4/2008 | 13.21 +/- 0.56 |
| 9 | TLB | 4/4/2008 | to 7/8/2008 | 9.31 +/- 0.69 |

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# TLD Gamma Dose Detail Report 2008

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Quarterly Results in mR/91 days +/- 2 Sigma

| Location | Sample Type | Collection Period | | Exposure | | |
|---|---|---|---|---|---|---|
| 9 | TLB | 7/8/2008 | to 0/9/2008 | 11.47 | +/- | 0.63 |
| 9 | TLB | 10/9/2008 | to 1/6/2009 | 12.51 | +/- | 0.78 |
| 10 | TLB | 1/21/2008 | to 4/4/2008 | 15.08 | +/- | 0.53 |
| 10 | TLB | 4/4/2008 | to 7/8/2008 | 12.24 | +/- | 0.75 |
| 10 | TLB | 7/8/2008 | to 0/9/2008 | 14.13 | +/- | 0.42 |
| 10 | TLB | 10/9/2008 | to 1/6/2009 | 15.41 | +/- | 0.79 |
| 11 | TLB | 1/21/2008 | to 4/4/2008 | 13.50 | +/- | 0.75 |
| 11 | TLB | 4/4/2008 | to 7/8/2008 | 11.13 | +/- | 0.71 |
| 11 | TLB | 7/8/2008 | to 0/9/2008 | 12.30 | +/- | 0.59 |
| 11 | TLB | 10/9/2008 | to 1/6/2009 | 14.04 | +/- | 0.83 |
| 12 | TLB | 1/21/2008 | to 4/4/2008 | 14.37 | +/- | 0.64 |
| 12 | TLB | 4/4/2008 | to 7/8/2008 | 10.34 | +/- | 0.68 |
| 12 | TLB | 7/8/2008 | to 0/9/2008 | 12.95 | +/- | 0.44 |
| 12 | TLB | 10/9/2008 | to 1/6/2009 | 13.18 | +/- | 0.72 |
| 13 | TLB | 1/21/2008 | to 4/4/2008 | 14.04 | +/- | 0.52 |
| 13 | TLB | 4/4/2008 | to 7/8/2008 | 9.97 | +/- | 0.89 |
| 13 | TLB | 7/8/2008 | to 0/9/2008 | 12.42 | +/- | 0.44 |
| 13 | TLB | 10/9/2008 | to 1/6/2009 | 12.28 | +/- | 1.09 |
| 14 | TLB | 1/21/2008 | to 4/4/2008 | 12.13 | +/- | 0.55 |
| 14 | TLB | 4/4/2008 | to 7/8/2008 | 9.62 | +/- | 0.73 |
| 14 | TLB | 7/8/2008 | to 0/9/2008 | 10.57 | +/- | 0.59 |
| 14 | TLB | 10/9/2008 | to 1/6/2009 | 12.10 | +/- | 0.93 |
| 15 | TLB | 1/21/2008 | to 4/4/2008 | 12.08 | +/- | 1.46 |
| 15 | TLB | 4/4/2008 | to 7/8/2008 | 8.50 | +/- | 0.83 |
| 15 | TLB | 7/8/2008 | to 0/9/2008 | 10.34 | +/- | 0.74 |
| 15 | TLB | 10/9/2008 | to 1/6/2009 | 10.62 | +/- | 0.88 |
| 21 | TLB | 1/21/2008 | to 4/4/2008 | 15.19 | +/- | 0.69 |
| 21 | TLB | 4/4/2008 | to 7/8/2008 | 11.96 | +/- | 0.78 |
| 21 | TLB | 7/8/2008 | to 0/9/2008 | 13.87 | +/- | 0.55 |
| 21 | TLB | 10/9/2008 | to 1/6/2009 | 14.45 | +/- | 0.92 |

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# TLD Gamma Dose Detail Report 2008

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Quarterly Results in mR/91 days +/- 2 Sigma

| Location | Sample Type | Collection Period | | Exposure | | |
|---|---|---|---|---|---|---|
| 23 | TLB | 1/21/2008 | to 4/4/2008 | 14.33 | +/- | 0.91 |
| 23 | TLB | 4/4/2008 | to 7/8/2008 | 11.38 | +/- | 0.80 |
| 23 | TLB | 7/8/2008 | to 0/9/2008 | 13.32 | +/- | 0.78 |
| 23 | TLB | 10/9/2008 | to 1/6/2009 | 13.92 | +/- | 0.85 |
| 24 | TLB | 1/21/2008 | to 4/4/2008 | 14.80 | +/- | 1.29 |
| 24 | TLB | 4/4/2008 | to 7/8/2008 | 9.65 | +/- | 0.67 |
| 24 | TLB | 7/8/2008 | to 0/9/2008 | 12.64 | +/- | 1.06 |
| 24 | TLB | 10/9/2008 | to 1/6/2009 | 12.21 | +/- | 0.62 |
| 29 | TLB | 1/21/2008 | to 4/4/2008 | 17.55 | +/- | 0.75 |
| 29 | TLB | 4/4/2008 | to 7/8/2008 | 14.55 | +/- | 0.83 |
| 29 | TLB | 7/8/2008 | to 0/9/2008 | 16.08 | +/- | 0.57 |
| 29 | TLB | 10/9/2008 | to 1/6/2009 | 17.42 | +/- | 1.08 |
| 30 | TLB | 1/21/2008 | to 4/4/2008 | 16.25 | +/- | 0.79 |
| 30 | TLB | 4/4/2008 | to 7/8/2008 | 12.25 | +/- | 0.72 |
| 30 | TLB | 7/8/2008 | to 0/9/2008 | 15.28 | +/- | 0.76 |
| 30 | TLB | 10/9/2008 | to 1/6/2009 | 15.49 | +/- | 1.01 |
| 31 | TLB | 1/21/2008 | to 4/4/2008 | 16.62 | +/- | 0.95 |
| 31 | TLB | 4/4/2008 | to 7/8/2008 | 13.88 | +/- | 0.79 |
| 31 | TLB | 7/8/2008 | to 0/9/2008 | 15.63 | +/- | 0.90 |
| 31 | TLB | 10/9/2008 | to 1/6/2009 | 15.42 | +/- | 1.60 |
| 33 | TLB | 1/21/2008 | to 4/4/2008 | 17.83 | +/- | 0.70 |
| 33 | TLB | 4/4/2008 | to 7/8/2008 | 14.35 | +/- | 0.80 |
| 33 | TLB | 7/8/2008 | to 0/9/2008 | 16.89 | +/- | 0.64 |
| 33 | TLB | 10/9/2008 | to 1/6/2009 | 17.93 | +/- | 1.11 |
| 35 | TLB | 1/21/2008 | to 4/4/2008 | 13.64 | +/- | 0.61 |
| 35 | TLB | 4/4/2008 | to 7/8/2008 | 10.43 | +/- | 0.63 |
| 35 | TLB | 7/8/2008 | to 0/9/2008 | 11.75 | +/- | 0.48 |
| 35 | TLB | 10/9/2008 | to 1/6/2009 | 12.77 | +/- | 0.67 |
| 36 | TLB | 1/21/2008 | to 4/4/2008 | 17.29 | +/- | 0.54 |

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# TLD Gamma Dose Detail Report 2008

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Quarterly Results in mR/91 days +/- 2 Sigma

| Location | Sample Type | Collection Period | | Exposure | | |
|---|---|---|---|---|---|---|
| 36 | TLB | 4/4/2008 | to 7/8/2008 | 13.72 | +/- | 0.65 |
| 36 | TLB | 7/8/2008 | to 0/9/2008 | 16.00 | +/- | 0.53 |
| 36 | TLB | 10/9/2008 | to 1/6/2009 | 17.08 | +/- | 0.73 |
| 53 | TLB | 1/21/2008 | to 4/4/2008 | 14.76 | +/- | 0.58 |
| 53 | TLB | 4/4/2008 | to 7/8/2008 | 11.40 | +/- | 0.68 |
| 53 | TLB | 7/8/2008 | to 0/9/2008 | 13.25 | +/- | 0.51 |
| 53 | TLB | 10/9/2008 | to 1/6/2009 | 14.28 | +/- | 0.69 |
| 54 | TLB | 1/21/2008 | to 4/4/2008 | 15.54 | +/- | 0.70 |
| 54 | TLB | 4/4/2008 | to 7/8/2008 | 11.06 | +/- | 0.65 |
| 54 | TLB | 7/8/2008 | to 0/9/2008 | 13.49 | +/- | 0.46 |
| 54 | TLB | 10/9/2008 | to 1/6/2009 | 13.54 | +/- | 0.67 |
| 55 | TLB | 1/21/2008 | to 4/4/2008 | 15.20 | +/- | 0.69 |
| 55 | TLB | 4/4/2008 | to 7/8/2008 | 11.74 | +/- | 0.70 |
| 55 | TLB | 7/8/2008 | to 0/9/2008 | 13.31 | +/- | 0.59 |
| 55 | TLB | 10/9/2008 | to 1/6/2009 | 14.31 | +/- | 0.84 |
| 56 | TLB | 1/21/2008 | to 4/4/2008 | 15.09 | +/- | 0.68 |
| 56 | TLB | 4/4/2008 | to 7/8/2008 | 10.35 | +/- | 1.12 |
| 56 | TLB | 7/8/2008 | to 0/9/2008 | 12.97 | +/- | 0.61 |
| 56 | TLB | 10/9/2008 | to 1/6/2009 | 12.83 | +/- | 1.12 |
| 58 | TLB | 1/21/2008 | to 4/4/2008 | 12.33 | +/- | 0.72 |
| 58 | TLB | 4/4/2008 | to 7/8/2008 | 8.65 | +/- | 0.63 |
| 58 | TLB | 7/8/2008 | to 0/9/2008 | 10.79 | +/- | 0.69 |
| 58 | TLB | 10/9/2008 | to 1/6/2009 | 10.69 | +/- | 0.58 |

APPENDIX C

# TLD Gamma Dose Detail Report 2008

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio  Docket no. : 50-440/50-441

Sample Frequency is: Annual  Results in mR/365 days +/- 2 Sigma

| Location | Sample Type | Collection Period | | Exposure | | |
|---|---|---|---|---|---|---|
| 1 | TLA | 1/21/2008 | to 1/6/2009 | 47.84 | +/- | 1.91 |
| 3 | TLA | 1/21/2008 | to 1/6/2009 | 49.23 | +/- | 2.63 |
| 4 | TLA | 1/21/2008 | to 1/6/2009 | 55.39 | +/- | 2.56 |
| 5 | TLA | 1/21/2008 | to 1/6/2009 | 52.12 | +/- | 2.45 |
| 6 | TLA | 1/21/2008 | to 1/6/2009 | 55.61 | +/- | 2.26 |
| 7 | TLA | 1/21/2008 | to 1/6/2009 | 50.78 | +/- | 2.40 |
| 8 | TLA | 1/21/2008 | to 1/6/2009 | 53.55 | +/- | 1.89 |
| 9 | TLA | 1/21/2008 | to 1/6/2009 | 49.16 | +/- | 1.10 |
| 10 | TLA | 1/21/2008 | to 1/6/2009 | 63.76 | +/- | 2.76 |
| 11 | TLA | 1/21/2008 | to 1/6/2009 | 58.89 | +/- | 1.09 |
| 12 | TLA | 1/21/2008 | to 1/6/2009 | 56.01 | +/- | 1.54 |
| 13 | TLA | 1/21/2008 | to 1/6/2009 | 55.40 | +/- | 1.80 |
| 14 | TLA | 1/21/2008 | to 1/6/2009 | 51.88 | +/- | 2.56 |
| 15 | TLA | 1/21/2008 | to 1/6/2009 | 53.42 | +/- | 2.25 |
| 21 | TLA | 1/21/2008 | to 1/6/2009 | 65.29 | +/- | 4.20 |
| 23 | TLA | 1/21/2008 | to 1/6/2009 | 62.94 | +/- | 1.67 |
| 24 | TLA | 1/21/2008 | to 1/6/2009 | 58.40 | +/- | 4.19 |
| 29 | TLA | 1/21/2008 | to 1/6/2009 | 71.49 | +/- | 2.46 |
| 30 | TLA | 1/21/2008 | to 1/6/2009 | 67.88 | +/- | 4.25 |

APPENDIX C

# TLD Gamma Dose Detail Report 2008

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Annual Results in mR/365 days +/- 2 Sigma

| Location | Sample Type | Collection Period | Exposure |
|---|---|---|---|
| 31 | TLA | 1/21/2008 to 1/6/2009 | 73.46 +/- 1.71 |
| 33 | TLA | 1/21/2008 to 1/6/2009 | 74.83 +/- 2.41 |
| 35 | TLA | 1/21/2008 to 1/6/2009 | 58.13 +/- 1.30 |
| 36 | TLA | 1/21/2008 to 1/6/2009 | 74.50 +/- 1.90 |
| 53 | TLA | 1/21/2008 to 1/6/2009 | 65.55 +/- 2.66 |
| 54 | TLA | 1/21/2008 to 1/6/2009 | 59.19 +/- 1.85 |
| 55 | TLA | 1/21/2008 to 1/6/2009 | 65.17 +/- 1.83 |
| 56 | TLA | 1/21/2008 to 1/6/2009 | 60.85 +/- 1.99 |
| 58 | TLA | 1/21/2008 to 1/6/2009 | 51.55 +/- 2.09 |

APPENDIX C

# TLD Gamma Dose Detail Report 2008

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Annual Results in mR/365 days +/- 2 Sigma

| Location | Sample Type | Collection Period | Exposure |
|---|---|---|---|

APPENDIX C

# Water Gamma Spectral Detail Report 2008

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Monthly Results in pCi/L +/- 2 Sigma

| Location | Sample Type | Collection Period | Ba-140<br>Fe-59<br>Zr-95 | Co-58<br>La-140 | Co-60<br>Mn-54 | Cs-134<br>Nb-95 | Cs-137<br>Zn-65 |
|---|---|---|---|---|---|---|---|
| 28 | Water | /26/2007 to /31/2008 | < 23.02<br>< 5.93<br>< 5.28 | < 3.62<br>< 4.57 | < 2.69<br>< 2.08 | < 3.32<br>< 3.47 | < 3.48<br>< 2.65 |
| 28 | Water | /31/2008 to /29/2008 | < 9.98<br>< 4.52<br>< 1.42 | < 1.14<br>< 2.58 | < 1.38<br>< 2.50 | < 2.44<br>< 3.30 | < 2.92<br>< 2.05 |
| 28 | Water | /29/2008 to /27/2008 | < 11.01<br>< 7.30<br>< 7.14 | < 3.07<br>< 5.80 | < 4.60<br>< 3.44 | < 4.06<br>< 5.34 | < 3.26<br>< 5.36 |
| 28 | Water | /27/2008 to /24/2008 | < 19.34<br>< 6.70<br>< 8.90 | < 4.71<br>< 6.38 | < 2.70<br>< 4.30 | < 4.17<br>< 3.77 | < 4.26<br>< 6.52 |
| 28 | Water | /24/2008 to /29/2008 | < 15.60<br>< 6.14<br>< 4.48 | < 1.39<br>< 3.34 | < 2.04<br>< 3.08 | < 1.34<br>< 2.69 | < 2.65<br>< 2.02 |
| 28 | Water | /29/2008 to /26/2008 | < 17.47<br>< 3.29<br>< 2.52 | < 1.77<br>< 3.96 | < 2.54<br>< 1.76 | < 2.35<br>< 2.42 | < 2.61<br>< 4.79 |
| 28 | Water | /26/2008 to /31/2008 | < 12.56<br>< 5.44<br>< 5.69 | < 1.44<br>< 2.49 | < 1.91<br>< 2.10 | < 2.94<br>< 1.89 | < 3.63<br>< 5.25 |
| 28 | Water | /31/2008 to /28/2008 | < 23.44<br>< 6.56<br>< 7.41 | < 5.37<br>< 2.68 | < 5.05<br>< 5.82 | < 5.23<br>< 3.42 | < 3.94<br>< 4.91 |
| 28 | Water | /28/2008 to /25/2008 | < 19.77<br>< 6.34<br>< 7.22 | < 3.88<br>< 5.08 | < 2.66<br>< 2.61 | < 3.00<br>< 2.49 | < 2.86<br>< 2.59 |
| 28 | Water | /25/2008 to /30/2008 | < 23.85<br>< 3.97<br>< 6.12 | < 2.42<br>< 3.52 | < 2.08<br>< 1.08 | < 2.36<br>< 3.45 | < 3.17<br>< 4.62 |
| 28 | Water | /30/2008 to /26/2008 | < 30.06<br>< 5.83<br>< 7.36 | < 3.95<br>< 3.22 | < 2.99<br>< 3.07 | < 2.92<br>< 3.83 | < 2.38<br>< 4.98 |

APPENDIX C

# Water Gamma Spectral Detail Report 2008

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio  Docket no. : 50-440/50-441

Sample Frequency is: Monthly  Results in pCi/L +/- 2 Sigma

| Location | Sample Type | Collection Period | Ba-140<br>Fe-59<br>Zr-95 | Co-58<br>La-140 | Co-60<br>Mn-54 | Cs-134<br>Nb-95 | Cs-137<br>Zn-65 |
|---|---|---|---|---|---|---|---|
| 28 | Water | /26/2008 to :/30/2008 | < 21.13<br>< 4.36<br>< 5.81 | < 2.41<br>< 3.98 | < 2.72<br>< 2.26 | < 2.26<br>< 3.29 | < 2.79<br>< 4.43 |
| 34 | Water | :/26/2007 to /31/2008 | < 15.95<br>< 5.12<br>< 5.54 | < 3.28<br>< 3.10 | < 2.75<br>< 1.57 | < 2.17<br>< 4.01 | < 1.78<br>< 4.09 |
| 34 | Water | /31/2008 to :/29/2008 | < 12.98<br>< 5.78<br>< 5.56 | < 3.07<br>< 1.88 | < 2.00<br>< 3.46 | < 3.77<br>< 2.27 | < 2.33<br>< 5.71 |
| 34 | Water | :/29/2008 to ;/27/2008 | < 16.89<br>< 7.22<br>< 7.37 | < 2.80<br>< 4.37 | < 2.38<br>< 3.91 | < 2.81<br>< 4.25 | < 2.56<br>< 5.14 |
| 34 | Water | ;/27/2008 to ./24/2008 | < 16.49<br>< 4.63<br>< 4.08 | < 1.75<br>< 3.63 | < 2.05<br>< 2.27 | < 2.27<br>< 2.20 | < 3.31<br>< 4.24 |
| 34 | Water | ./24/2008 to ;/29/2008 | < 15.56<br>< 4.52<br>< 4.21 | < 2.16<br>< 1.34 | < 2.12<br>< 1.88 | < 2.33<br>< 2.93 | < 2.27<br>< 1.98 |
| 34 | Water | ;/29/2008 to ;/26/2008 | < 18.32<br>< 4.38<br>< 3.93 | < 1.69<br>< 8.29 | < 2.10<br>< 1.94 | < 2.49<br>< 3.75 | < 2.35<br>< 3.07 |
| 34 | Water | ;/26/2008 to '/31/2008 | < 13.34<br>< 2.44<br>< 4.81 | < 2.68<br>< 1.77 | < 2.67<br>< 2.99 | < 2.31<br>< 3.31 | < 1.87<br>< 2.97 |
| 34 | Water | '/31/2008 to ;/28/2008 | < 23.25<br>< 3.65<br>< 4.50 | < 2.14<br>< 6.35 | < 1.82<br>< 2.33 | < 2.34<br>< 2.07 | < 2.71<br>< 3.46 |
| 34 | Water | ;/28/2008 to '/25/2008 | < 23.10<br>< 4.55<br>< 6.90 | < 3.78<br>< 7.05 | < 3.65<br>< 3.84 | < 3.59<br>< 3.71 | < 4.42<br>< 3.23 |

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# Water Gamma Spectral Detail Report 2008

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Monthly Results in pCi/L +/- 2 Sigma

| Location | Sample Type | Collection Period | Ba-140<br>Fe-59<br>Zr-95 | Co-58<br>La-140 | Co-60<br>Mn-54 | Cs-134<br>Nb-95 | Cs-137<br>Zn-65 |
|---|---|---|---|---|---|---|---|
| 34 | Water | )/25/2008 to )/30/2008 | < 15.54<br>< 5.00<br>< 5.40 | < 3.08<br>< 4.23 | < 2.48<br>< 3.27 | < 3.14<br>< 1.99 | < 3.19<br>< 6.54 |
| 34 | Water | )/30/2008 to /26/2008 | < 26.63<br>< 5.04<br>< 5.88 | < 2.12<br>< 3.55 | < 2.82<br>< 3.36 | < 3.78<br>< 3.99 | < 3.10<br>< 5.35 |
| 34 | Water | /26/2008 to :/30/2008 | < 16.07<br>< 6.97<br>< 9.79 | < 3.97<br>< 3.76 | < 2.87<br>< 3.85 | < 3.36<br>< 4.19 | < 3.56<br>< 4.94 |
| 36 | Water | :/26/2007 to /31/2008 | < 22.53<br>< 6.20<br>< 3.62 | < 2.53<br>< 3.25 | < 1.51<br>< 2.12 | < 1.36<br>< 3.99 | < 2.02<br>< 2.32 |
| 36 | Water | /31/2008 to :/29/2008 | < 12.77<br>< 6.95<br>< 6.90 | < 3.09<br>< 4.89 | < 2.57<br>< 4.77 | < 4.70<br>< 4.96 | < 3.55<br>< 6.76 |
| 36 | Water | :/29/2008 to ;/27/2008 | < 11.26<br>< 6.14<br>< 5.02 | < 2.15<br>< 2.13 | < 2.14<br>< 2.02 | < 3.61<br>< 2.21 | < 4.35<br>< 4.83 |
| 36 | Water | ;/27/2008 to ./24/2008 | < 24.96<br>< 4.64<br>< 10.31 | < 3.44<br>< 6.02 | < 2.80<br>< 3.92 | < 2.70<br>< 5.61 | < 5.22<br>< 2.70 |
| 36 | Water | ./24/2008 to ;/29/2008 | < 14.53<br>< 4.82<br>< 6.00 | < 1.95<br>< 2.75 | < 2.56<br>< 2.82 | < 2.35<br>< 1.97 | < 3.20<br>< 2.60 |
| 36 | Water | ;/29/2008 to ;/26/2008 | < 26.19<br>< 4.97<br>< 5.88 | < 2.34<br>< 7.30 | < 2.87<br>< 1.53 | < 2.88<br>< 2.94 | < 3.52<br>< 3.01 |
| 36 | Water | ;/26/2008 to '/31/2008 | < 9.15<br>< 3.60<br>< 2.89 | < 2.17<br>< 3.62 | < 2.12<br>< 2.57 | < 2.58<br>< 2.41 | < 2.74<br>< 2.84 |

APPENDIX C

# Water Gamma Spectral Detail Report 2008

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Monthly Results in pCi/L +/- 2 Sigma

| Location | Sample Type | Collection Period | Ba-140<br>Fe-59<br>Zr-95 | Co-58<br>La-140 | Co-60<br>Mn-54 | Cs-134<br>Nb-95 | Cs-137<br>Zn-65 |
|---|---|---|---|---|---|---|---|
| 36 | Water | '/31/2008 to ;/28/2008 | < 25.30<br>< 4.05<br>< 4.43 | < 3.14<br>< 3.64 | < 2.66<br>< 2.78 | < 2.34<br>< 3.31 | < 2.12<br>< 3.33 |
| 36 | Water | ;/28/2008 to )/25/2008 | < 24.39<br>< 4.17<br>< 6.55 | < 3.50<br>< 5.46 | < 2.72<br>< 3.07 | < 2.76<br>< 2.68 | < 3.28<br>< 3.78 |
| 36 | Water | )/25/2008 to )/30/2008 | < 29.87<br>< 8.00<br>< 5.20 | < 2.87<br>< 4.14 | < 2.35<br>< 4.40 | < 3.26<br>< 2.95 | < 5.45<br>< 4.59 |
| 36 | Water | )/30/2008 to /26/2008 | < 15.12<br>< 5.38<br>< 3.62 | < 2.12<br>< 4.56 | < 2.20<br>< 2.20 | < 2.25<br>< 3.19 | < 2.89<br>< 3.91 |
| 36 | Water | /26/2008 to :/30/2008 | < 18.71<br>< 3.07<br>< 6.33 | < 3.23<br>< 3.30 | < 2.45<br>< 2.16 | < 3.35<br>< 4.00 | < 4.07<br>< 4.70 |
| 59 | Water | 4/9/2008 to ./24/2008 | < 21.76<br>< 4.66<br>< 7.12 | < 3.37<br>< 5.40 | < 3.27<br>< 4.17 | < 4.43<br>< 3.50 | < 3.12<br>< 4.94 |
| 59 | Water | ./24/2008 to ;/29/2008 | < 19.66<br>< 2.78<br>< 3.17 | < 2.34<br>< 3.33 | < 1.53<br>< 2.25 | < 2.61<br>< 2.36 | < 3.09<br>< 4.17 |
| 59 | Water | ;/29/2008 to ;/26/2008 | < 20.68<br>< 3.67<br>< 3.19 | < 2.50<br>< 6.94 | < 1.80<br>< 2.44 | < 2.05<br>< 3.01 | < 2.68<br>< 3.80 |
| 59 | Water | ;/26/2008 to '/31/2008 | < 19.58<br>< 4.91<br>< 5.28 | < 3.67<br>< 4.62 | < 3.00<br>< 3.34 | < 2.93<br>< 2.07 | < 3.18<br>< 6.30 |
| 59 | Water | '/31/2008 to ;/28/2008 | < 17.55<br>< 3.13<br>< 4.41 | < 2.37<br>< 8.41 | < 2.74<br>< 1.42 | < 2.93<br>< 3.61 | < 2.91<br>< 5.68 |

APPENDIX C

# Water Gamma Spectral Detail Report 2008

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Monthly Results in pCi/L +/- 2 Sigma

| Location | Sample Type | Collection Period | Ba-140<br>Fe-59<br>Zr-95 | Co-58<br>La-140 | Co-60<br>Mn-54 | Cs-134<br>Nb-95 | Cs-137<br>Zn-65 |
|---|---|---|---|---|---|---|---|
| 59 | Water | ;/28/2008 to )/25/2008 | < 23.85<br>< 5.75<br>< 5.00 | < 2.99<br>< 5.99 | < 2.91<br>< 2.65 | < 3.16<br>< 4.12 | < 3.50<br>< 7.09 |
| 59 | Water | )/25/2008 to )/30/2008 | < 20.96<br>< 10.10<br>< 5.95 | < 4.57<br>< 3.34 | < 2.79<br>< 4.89 | < 3.00<br>< 4.52 | < 4.93<br>< 4.35 |
| 59 | Water | )/30/2008 to /26/2008 | < 22.06<br>< 6.77<br>< 4.32 | < 2.68<br>< 3.13 | < 2.85<br>< 2.60 | < 2.40<br>< 3.39 | < 3.37<br>< 3.27 |
| 60 | Water | 4/9/2008 to -/24/2008 | < 16.28<br>< 4.90<br>< 2.57 | < 1.98<br>< 1.88 | < 1.64<br>< 2.09 | < 3.15<br>< 4.35 | < 3.78<br>< 5.83 |
| 60 | Water | -/24/2008 to ;/29/2008 | < 15.79<br>< 3.62<br>< 3.62 | < 1.72<br>< 4.28 | < 1.69<br>< 1.53 | < 2.41<br>< 3.36 | < 2.90<br>< 2.07 |
| 60 | Water | ;/29/2008 to ;/26/2008 | < 22.47<br>< 6.90<br>< 4.81 | < 2.78<br>< 7.14 | < 2.56<br>< 2.85 | < 2.50<br>< 4.17 | < 2.57<br>< 4.63 |
| 60 | Water | ;/26/2008 to '/31/2008 | < 19.29<br>< 6.20<br>< 8.64 | < 3.69<br>< 3.90 | < 2.64<br>< 3.09 | < 3.58<br>< 3.44 | < 2.39<br>< 7.24 |
| 60 | Water | '/31/2008 to ;/28/2008 | < 20.19<br>< 2.76<br>< 6.20 | < 2.84<br>< 3.95 | < 2.35<br>< 2.81 | < 1.94<br>< 3.53 | < 2.66<br>< 3.47 |
| 60 | Water | ;/28/2008 to )/25/2008 | < 30.35<br>< 5.10<br>< 8.73 | < 3.05<br>< 5.43 | < 3.06<br>< 3.60 | < 3.66<br>< 3.55 | < 3.04<br>< 2.41 |
| 60 | Water | )/25/2008 to )/30/2008 | < 23.54<br>< 5.32<br>< 7.19 | < 2.86<br>< 6.28 | < 2.73<br>< 2.36 | < 3.16<br>< 2.99 | < 2.62<br>< 5.12 |

APPENDIX C

# Water Gamma Spectral Detail Report 2008

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Monthly Results in pCi/L +/- 2 Sigma

| Location | Sample Type | Collection Period | Ba-140<br>Fe-59<br>Zr-95 | Co-58<br>La-140 | Co-60<br>Mn-54 | Cs-134<br>Nb-95 | Cs-137<br>Zn-65 |
|---|---|---|---|---|---|---|---|
| 60 | Water | 1/30/2008 to /26/2008 | < 24.39<br>< 4.13<br>< 6.67 | < 2.85<br>< 2.64 | < 2.64<br>< 1.58 | < 2.04<br>< 2.71 | < 2.38<br>< 3.74 |

APPENDIX C

**Water Gross Beta Detail Report 2008**

Radiological Environmental Monitoring Program Data Summary

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Monthly Results in pCi/L +/- 2 Sigma

| | | Location | | | | |
|---|---|---|---|---|---|---|
| Collection Period | Sample Type | 28 | 34 | 36 | 59 | 60 |
| 12/26/2007 to 1/31/2008 | Water | < 0.91 | LLD | LLD | | |
| 1/31/2008 to 2/29/2008 | Water | LLD | LLD | LLD | | |
| 2/29/2008 to 3/27/2008 | Water | LLD | LLD | < 1.95 | | |
| 3/27/2008 to 4/24/2008 | Water | LLD | LLD | < 0.86 | | |
| 4/9/2008 to 4/24/2008 | Water | | | | LLD | LLD |
| 4/24/2008 to 5/29/2008 | Water | LLD | LLD | LLD | LLD | LLD |
| 5/29/2008 to 6/26/2008 | Water | < 1.88 | LLD | 3.18 +/- 1.08 | < 1.70 | LLD |
| 6/26/2008 to 7/31/2008 | Water | LLD | LLD | LLD | LLD | LLD |
| 7/31/2008 to 8/28/2008 | Water | LLD | LLD | < 0.89 | < 0.87 | LLD |
| 8/28/2008 to 9/25/2008 | Water | LLD | 3.01 +/- 0.99 | LLD | LLD | LLD |
| 9/25/2008 to 10/30/2008 | Water | LLD | LLD | LLD | LLD | LLD |

APPENDIX C

**Water Gross Beta Detail Report 2008**

Radiological Environmental Monitoring Program Data Summary

Perry Nuclear Power Plant, Lake County Ohio · Docket no. : 50-440/50-441

Sample Frequency is: Monthly Results in pCi/L +/- 2 Sigma

| | | Location | | | | |
|---|---|---|---|---|---|---|
| Collection Period | Sample Type | 28 | 34 | 36 | 59 | 60 |
| 10/30/2008 to 11/26/2008 | Water | LLD | LLD | LLD | LLD | LLD |
| 11/26/2008 to 12/30/2008 | Water | LLD | LLD | 3.98 +/- 1.12 | | |

# Water Tritium Detail Report 2008

Radiological Environmental Monitoring Program Detail Data

Perry Nuclear Power Plant, Lake County Ohio Docket no. : 50-440/50-441

Sample Frequency is: Quarterly Results in pCi/L +/- 2 Sigma

| Location | Sample Type | Collection Date | H-3 |
|---|---|---|---|
| 28 | Water | 3/27/2008 | < 166.46 |
| 28 | Water | 5/26/2008 | < 147.77 |
| 28 | Water | 9/25/2008 | < 145.03 |
| 28 | Water | 2/30/2008 | < 144.68 |
| 34 | Water | 3/27/2008 | < 166.46 |
| 34 | Water | 5/26/2008 | < 147.77 |
| 34 | Water | 9/25/2008 | < 145.03 |
| 34 | Water | 2/30/2008 | < 144.68 |
| 36 | Water | 3/27/2008 | < 166.46 |
| 36 | Water | 5/26/2008 | < 147.77 |
| 36 | Water | 9/25/2008 | < 145.03 |
| 36 | Water | 2/30/2008 | < 144.68 |
| 59 | Water | 3/27/2008 | |
| 59 | Water | 5/26/2008 | < 147.77 |
| 59 | Water | 9/25/2008 | < 145.03 |
| 59 | Water | 1/26/2008 | < 145.44 |
| 60 | Water | 3/27/2008 | |
| 60 | Water | 5/26/2008 | < 147.77 |
| 60 | Water | 9/25/2008 | LLD |
| 60 | Water | 1/26/2008 | < 145.44 |

# APPENDIX D

# CORRECTIONS TO PREVIOUS ANNUAL ENVIRONMENTAL AND EFFLUENT RELEASE REPORTS

# APPENDIX D

## 1997 THROUGH 2007 AEERR CORRECTIONS:

- Sampling Locations, Page 22.

  Table 13: REMP Sampling Locations, identify each sample location and media collected. ODCM required locations/media are identified in **bold type**. NRC review of the 2007 AEERR identified air sample location discrepancies between Table 13 and the ODCM (CR 08-40760). All seven (7) air sample locations referenced in Table 13 are identified as ODCM required (**bold type**). Only five (5) of the seven air sample locations are required by the ODCM. Review of past AEERR reports discovered that between the 1996 and 1997 AEERR reports, air sample locations #3 (Meteorological Tower) and #5 (Quincy Substation) referenced in Table 13 were inadvertently identified as ODCM required (**bold type**). Subsequently, locations #3 and #5 were incorrectly identified as ODCM required in all AEERR reports 1997 through 2007. Table 13: REMP Sample Locations should read as follows:

# APPENDIX D

## Table 13: 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. | 0.8 | S | Food Products |
| **20** | **Rainbow Farms** | **1.9** | **E** | **Food Products** |
| **21** | **Hardy Rd.** | **5.1** | **WSW** | **TLD** |
| 22 | Corfias Farm (goat) | 4.9 | S | Milk |
| **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 |
| 61 | Keller Milk Farm (goat) | 7.4 | SE | Milk |
| 63 | Minor Stream Mouth | 0.08 | NNE | Sediment |
| 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) chronologically missing location numbers denote deleted or retired sampling locations.*

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

# APPENDIX D

## 2007 AEERR CORRECTIONS:

- Atmospheric Monitoring, Page 28.

  Air Sample location #1 equipment malfunction (CR 07-24852) was not documented in the 2007 AEERR as required per the ODCM. NRC review of the 2007 AEERR Report documents this omission in Condition Report 08-40765. Air, Paragraph 2, Page 28 should read as follows:

  On occasion, air sample locations can experience power losses associated with storms and/or malfunctioning equipment. For 2007, three (3) locations (#1, #6 and #35) experienced power losses due to malfunctioning equipment and human error (failure to return the sampler to service). On April 11, 2007, sample location #6 was found not running during routine sample collection, resulting in a missed sample. The investigation revealed that although the sampler was operational no elapsed time or volume had been recorded. It was determined that the sampler had not been restarted after change-out the week before. On May 2, 2007 sample location #35 lost power due to an electrical short and subsequent fire, resulting in missed samples for the 4/25/07-5/2/07 and 5/2/07-5/9/07 time frames. The investigation revealed that a mouse nest had been built inside the pole mounted breaker box which shorted and caught fire. Extensive repairs were completed and the sampler returned to service. On August 8, 2007, sample location #1 was found not running during the weekly collection. Troubleshooting identified the sample pump had experienced internal mechanical failure, resulting in a loss of vacuum. Data collected from the keypad confirmed that an adequate sample had been collected for analysis prior to pump failure. A spare unit was installed and the sampler returned to service. These events were reviewed with department personnel for heightened human performance.