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NL-13-027

May 15, 2012

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Stop O-P1-17
Washington, DC 20555-0001

SUBJECT: 2012 Annual Radiological Environmental Operating Report
Indian Point Unit Nos. 1, 2 and 3
Docket Nos. 50-03, 50-247, 50-286
License Nos. DPR-5, DPR-26, DPR-64

Dear Sir or Madam:

Enclosed please find one copy of the Entergy Nuclear Operations, Inc. (Entergy) Indian Point Energy Center (IPEC) Annual Radiological Environmental Operating Report for the period January 1, 2012 to December 31, 2012.

This report is submitted in accordance with facility Technical Specification Appendix A section 6 of the provisional operating license for DPR-5 and section 5.6.2 for DPR-26, and DPR-64, Indian Point Unit Nos. 1, 2 and 3 respectively. There are no commitments are being made by this report.

Should you or your staff have any questions, please contact Mr. Reid Tagliamonte, Radiation Protection Manager at 914-254-5790.

Sincerely,

RW/mb/jd

cc: next page

IE25
FSME20

Enclosure: 1. Annual Radiological Environmental Operating Report

cc: Mr. William Dean, Regional Administrator, NRC Region 1
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ENCLOSURE 1 TO NL-13-027

Annual Radiological Environmental Operating Report

ENTERGY NUCLEAR OPERATIONS, INC.
INDIAN POINT UNIT 1, 2, and 3 NUCLEAR POWER PLANTS
DOCKET Nos. 50-03, 50-247, and 50-286

ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

ENTERGY NUCLEAR

INDIAN POINT NUCLEAR GENERATING STATION
UNITS 1, 2, AND 3

Docket No. 50-003 Indian Point Unit 1 (IP1)
Docket No. 50-247 Indian Point Unit 2 (IP2)
Docket No. 50-286 Indian Point Unit 3 (IP3)

January 1 - December 31, 2012

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EXECUTIVE SUMMARY

INTRODUCTION

This report summarizes the results of the Radiological Environmental Monitoring Program (REMP) conducted in the vicinity of Indian Point Energy Center (IPEC) during the period from January 1 to December 31, 2012. This document has been prepared in accordance with the requirements of IPEC 1, Unit 2 and 3 Technical Specifications.

The REMP has been established to monitor the radiation and radioactivity released to the environment as a result of IPEC's operation. This program, initiated in 1958, includes the collection, analysis, and evaluation of radiological data in order to assess the impact of IPEC on the environment and on the general public.

SAMPLING AND ANALYSIS

The environmental sampling media collected in the vicinity of IPEC and at distant locations included air particulate filters, charcoal cartridges, soil, drinking water, ground water, broadleaf vegetation, river water, precipitation, shoreline sediment, bottom sediment, aquatic vegetation, fish, and invertebrates.

During 2012, there were 1001 samples collected from the atmospheric, aquatic, and terrestrial environments. In addition, 163 exposure measurements were obtained using environmental thermoluminescent dosimeters (TLDs).

A small number of inadvertent issues were encountered in 2012 in the collection of environmental samples in accordance with the IPEC Offsite Dose Calculation Manual (ODCM). Equipment failures and electrical outages resulted in a small number of instances in which lower than normal sampling volumes were collected at the airborne monitoring stations. A full description of all discrepancies encountered with the environmental monitoring program is presented in the Table B-1 of this report.

There were 1513 analyses performed on the environmental media samples. The analysis of the 2012 Indian Point environmental samples was performed by several laboratories. General Engineering Labs (GEL) of Charlestown, SC, performed the ground water analyses. Thermoluminescent dosimeters were analyzed by Environmental Dosimetry Company (formerly Stanford Associates) of Sterling, MA. Teledyne Brown Engineering, Inc. of Knoxville, TN performed all the remaining analyses for 2012. Samples were analyzed as required by the IPEC ODCM.

LAND USE CENSUS

The annual land use census in the vicinity of IPEC was conducted as required by the IPEC ODCM in May through October. No dairy animals within 5 miles of the Station were located during the census. Due to the difficulty of locating individual gardens and determining those having an area greater than 500 square feet, broadleaf sampling was performed. Monthly broad leaf sampling may be used in lieu of a garden census.

RADIOLOGICAL IMPACT TO THE ENVIRONMENT

Most samples collected as part of the IPEC REMP continued to contain detectable amounts of naturally-occurring and man-made radioactive materials. There was no plant related activity detected in any of the terrestrial samples. Offsite ambient radiation measurements using environmental TLDs beyond the site boundary ranged between 55 and 90 milliRoentgens (mR) per year. The range of ambient radiation levels observed with the TLDs is consistent with natural background radiation levels for New York.

Monitoring of the aquatic environment in the area of the discharge indicated the presence of the following station related radionuclides: Tritium and Cs-137. These station related nuclide were only found in the mixing zone of the discharge at levels that were expected from routine plant operation. No other plant related activity was detected in any offsite samples. The predominant radioactivity for all samples was from non-plant related sources, such as fallout from nuclear weapons tests and naturally occurring radionuclides.

RADIOLOGICAL IMPACT TO THE GENERAL PUBLIC

During 2012, radiation doses to the general public as a result of IPEC's operation continued to be well below the federal limits and much less than the dose due to other sources of man-made (e.g., X-rays, medical) and naturally-occurring (e.g., cosmic, radon) radiation.

CONCLUSIONS

The 2012 Radiological Environmental Monitoring Program for IPEC resulted in the collection and analysis of over a thousand environmental samples and measurements. The data obtained were used to determine the impact of IPEC's operation on the environment and on the general public.

An evaluation of direct radiation measurements, environmental sample analyses, and dose calculations demonstrates that all applicable federal criteria were met. Furthermore, radiation levels and resulting doses from station operation were a small fraction of those attributed to natural and man-made background radiation.

In summary, the levels of radionuclides in the environment surrounding Indian Point were within the historical ranges, i.e., previous levels resulting from natural and anthropogenic sources for the detected radionuclides. Further, IPEC operations in 2012 did not result in exposure to the public greater than environmental background levels.

Based on this information, there is no radiological impact on the environment or on the general public due to IPEC's operation.

SECTION 1.0

INTRODUCTION

1.1 Overview

The Radiological Environmental Monitoring Program (REMP) for 2012 performed by Entergy for the Indian Point Energy Center (IPEC) is discussed in this report. Since the operation of a nuclear power plant results in the release of small amounts of radioactivity and low levels of radiation, the Nuclear Regulatory Commission (NRC) requires a program to be established to monitor radiation and radioactivity in the environment (Reference 1). This report, published annually per Indian Point unit specific Technical Specifications (section 5.6.2 for Unit 1/2 and Section 5.6.2 for Unit 3), summarizes the results of measurements of radiation and radioactivity in the environment in the vicinity of the IPEC and at distant locations during the period January 1 to December 31, 2012.

The REMP is used to measure the direct radiation and the airborne and waterborne pathway activity in the vicinity of the Indian Point site. Direct radiation pathways include radiation from buildings and plant structures, airborne and liquid material that might be released from the plant, cosmic radiation, and the naturally occurring radioactive materials in the ground. Analysis of thermoluminescent dosimeters (TLDs), used to measure direct radiation, indicated that there were no increased radiation levels attributable to plant operations.

The airborne pathway includes measurements of air, precipitation, drinking water, and broad leaf vegetation samples. The airborne pathway measurements indicated that there was no adverse radiological impact to the surrounding environment attributed to Indian Point Station operations.

The waterborne pathway consists of Hudson River water, fish and invertebrates, aquatic vegetation, bottom sediment, and shoreline sediment. Measurements of the media comprising the waterborne pathway indicated that there was no adverse radiological impact to the surrounding environment attributed to Indian Point Station operations.

The ground water table is listed after the rain water and drinking water tables for ease of data comparison. However, ground water is not a dose pathway since it is not a drinking water pathway at IPEC.

These results are reviewed by IPEC's staff and have been reported semiannually or annually to the Nuclear Regulatory Commission and others for over 30 years.

In order to more fully understand how a nuclear power plant impacts humans and the environment, background information on radiation and radioactivity, natural and man-made sources of radiation, reactor operations, radioactive effluent controls, and radiological impact on humans is provided. It is believed that this information is helpful in understanding the potential radiological impact on the environment and humans from the operation of IPEC.

1.2 Radiation and Radioactivity

All matter is made of atoms. An atom is the smallest component into which matter can be broken down and still maintain all its chemical properties. Nuclear radiation is energy, in the form of waves or particles that is given off from atoms in an excited state (e.g., unstable, radioactive atoms).

Radioactive materials exist naturally and have always been a part of our environment. The earth's crust, for example, contains radioactive uranium, radium, thorium, and potassium. Some radioactivity is a result of nuclear weapons testing. Examples of radioactive fallout that is normally present in environmental samples are cesium-137 and strontium-90. Some examples of radioactive materials released from a nuclear power plant are cesium-137, iodine-131, strontium-90, and cobalt-60.

Radiation is measured in units of mrem, much like temperature is measured in degrees. A mrem is a measure of the biological effect of the energy deposited in tissue. The natural and man-made radiation dose received in one year by the average American is 300 to 600 mrem (References 2, 3, 4, and 5). The per capita dose has increased substantially since the mid 1980's because of the increased usage of medical procedures involving exposure to radiation (see Reference 3).

Radioactivity is measured in Curies. Levels of radioactivity commonly seen in the environment are typically a small fraction of a Curie, therefore radioactivity in the environment is typically measured in picocuries. One picocurie (pCi) is equal to 0.037 disintegrations per second (2.22 disintegrations per minute).

1.3 Sources of Radiation

As mentioned previously, naturally occurring radioactivity has always been a part of our environment. Table 1.3 shows the sources and doses of radiation from natural and man-made sources.

Table 1.3

Radiation Sources and Corresponding Doses [1]

NATURAL		MAN-MADE	
Source	Radiation Dose (millirem/year)	Source	Radiation Dose (millirem/year)
Internal, inhalation[2]	228	Medical[3]	300
External, space	33	Consumer[4]	13
Internal, ingestion	29	Industrial, security, [5]	0.3
External, terrestrial	21	Occupational	0.5
		Weapons Fallout	< 1
		Nuclear Power Plants	< 1
Approximate Total	311	Approximate Total	314

(1) information from References 3 and 4

(2) from radon and thoron

(3) includes CT (147 millirem), nuclear medicine (77 mrem), interventional fluoroscopy (43 mrem) and conventional radiography and fluoroscopy (33 mrem)

(4) primarily from cigarette smoking (4.6 mrem), commercial air travel (3.4 mrem), building materials (3.5 mrem) and mining and agriculture (0.8 mrem)

(5) Industrial, security, medical, educational and research

Cosmic radiation (external, space) from the sun and outer space penetrates the earth's atmosphere and continuously bombards us with rays and charged particles. Some of this cosmic radiation interacts with gases and particles in the atmosphere, making them radioactive. These radioactive byproducts from cosmic ray bombardment are referred to as cosmogenic radionuclides. Isotopes such as beryllium-7 and carbon-14 are formed in this way. Exposure to cosmic and cosmogenic sources of radioactivity results in about 30 mrem of radiation dose per year.

Additionally, natural radioactivity is in our body and in the food we eat (about 30 mrem/year), the ground we walk on (about 20 mrem/year) and the air we breathe (about 230 mrem/year). The majority of a person's annual dose results from exposure to radon and thoron in the air we breathe. These gases and their radioactive decay products arise from the decay of naturally occurring uranium, thorium and radium in the soil and building products such as brick, stone, and concrete. Radon and thoron levels vary greatly with location, primarily due to changes in the concentration of uranium and thorium in the soil. Residents at some locations in Colorado, New York, Pennsylvania, New Jersey and even Connecticut have a higher annual dose as a result of higher levels of radon/thoron gases in these areas. In total, these various sources of naturally-occurring radiation and radioactivity contribute to a total dose of about 310 mrem per year.

In addition to natural radiation, we are normally exposed to radiation from a number of man-made sources. The single largest doses from man-made sources result from therapeutic and diagnostic applications of x-rays and radiopharmaceuticals. The annual dose to an individual in the U.S. from medical and dental exposure is approximately 300 mrem. Consumer products/uses, such cigarettes, building materials and commercial air travel contribute about 10 mrem/year. Much smaller doses result from weapons fallout (less than 1 mrem/year) and nuclear power plants (less than 1 mrem/year). Typically, the average person in the United States receives approximately 310 mrem per year from man-made sources.

SECTION 2

BACKGROUND

2.0 BACKGROUND

2.1 Site Description

The Indian Point site occupies 239 acres on the east bank of the Hudson River on a point of land at Mile Point 42.6. The site is located in the Village of Buchanan, Westchester County, New York. Three nuclear reactors, Indian Point Unit Nos. 1, 2 and 3, and associated buildings occupy approximately 35 acres. Unit 1 began operation in 1962 and was retired as a generating facility in 1974. Units 2 and 3 began operation 1974 and 1978. All three units are owned and operated by Entergy Nuclear, although only Units 2 and 3 continue to operate.

2.2 Program Background

Environmental monitoring and surveillance have been conducted at Indian Point since 1958, four years prior to the start-up of Unit 1. The pre-operational program was designed and implemented to determine the background radioactivity and to measure the variations in activity levels from natural and other sources in the vicinity, as well as fallout from atmospheric nuclear weapons tests. Accumulation of this background data permits the detection and assessment of environmental activity attributable to plant operations. Thus, as used in this report, background levels consist of those resulting from both natural and anthropogenic sources of environmental radioactivity

Results of the analyses from the indicator and control locations and a comparison to preoperational data are summarized in Section 4 of this report.

2.3 Program Objectives

The current environmental monitoring program is designed to meet three primary objectives:

1. To enable the identification and quantification of changes in the radioactivity of the area.
2. To measure radionuclide concentrations in the environment attributable to operations of the Indian Point site.
3. Compare plant related measurable results to those predicted by the effluent monitoring and modeling and determine if any adjustments need to be made to the effluent calculation methods or the environmental sampling program.

To identify changes in activity, the environmental sampling schedule requires that analyses be conducted for specific environmental media on a regular basis. The radioactivity profile of the environment is established and monitored through routine evaluation of the analytical results obtained.

The REMP designates sampling locations for the collection of environmental media for analysis. These sample locations are divided into indicator and control locations. Indicator locations are established near the site, where the presence of environmental radioactivity of plant origin is most likely to be detected. Control locations are established farther away (and upwind/upstream, where applicable) from the site, where the level would not generally be affected by plant discharges. The use of indicator and control locations enables the identification of potential sources of detected radioactivity, thus meeting one of the program objectives.

Verification of expected radionuclide concentrations resulting from effluent releases attributable to the site is the third program objective. Verifying projected concentrations through the REMP is difficult since the environmental concentrations resulting from plant releases are typically too small to be detected. Plant related radionuclides were detected in 2012 in very low levels; however, residual radioactivity from atmospheric weapons tests and naturally occurring radioactivity were the predominant sources of radioactivity in the samples collected. Analysis of the 2012 REMP sample results confirms that radiological effluents were well below regulatory limits.

SECTION 3

PROGRAM DESCRIPTION

3.0 PROGRAM DESCRIPTION

To achieve the objectives of the REMP and ensure compliance with the ODCM, sampling and analysis of environmental media are performed as outlined in Table A-1 and described in section 3.3.

3.1 Sample Collection

Entergy personnel perform collection of environmental samples for the Indian Point site, with the exception of groundwater and fish/invertebrate samples. The groundwater (monitoring well) samples are collected by a contracted environmental vendor, GZA Geo Environmental, Inc. Collection of fish and invertebrate samples is performed by a contracted environmental vendor - Normandeau Associates, Inc.

3.2 Sample Analysis

The analysis of the 2012 Indian Point environmental samples was performed by several laboratories. General Engineering Labs (GEL) of Charlestown, SC, performed the ground water analyses. Thermoluminescent dosimeters were analyzed by Environmental Dosimetry Company (formerly Stanford Associates) of Sterling, MA. Teledyne Brown Engineering, Inc. of Knoxville, TN performed all the remaining analyses.

3.3 Sample Collection and Analysis Methodology

3.3.1 Direct Radiation

Direct gamma radiation is measured using integrating calcium sulfate thermoluminescent dosimeters (TLDs), which provide cumulative measurements of radiation exposure (i.e., total integrated exposures in milli-roentgen, mR) for a given period. The area surrounding the Indian Point site is divided into 16 compass sectors. Each sector has two TLD sample locations. The inner ring is located near the site boundary at approximately 1 mile (1.6 km). The outer ring is located at approximately 5 miles (8 km) from the site (6.7- 8.0 km), see Figures A-1 and A-2. Additional TLD locations include a control location at Roseton (20.7 miles north) and eight locations of special interest. In total, there are 41 TLD sample sites, designated DR-1 through DR-41, with two TLDs placed at each site. TLDs are collected and processed on a quarterly basis. The results are reported as mR per standard quarter (91 days). The data reported is the average of the two TLDs from each sample site.

3.3.2 Airborne Particulates and Radioiodine

Air samples were taken at eight locations varying in distance from 0.28 to 20.7 miles (0.4 to 33 km) from the plant. These locations represent one control at sampling station 23 (A5) and seven indicator locations. These indicator locations are at sampling stations 4 (A1), 5 (A4), 27, 29, 44, 94 (A2), and 95 (A3). The locations are shown on Figures A-1, A-2, and A-3. The air samples are collected continuously by means of fixed air particulate filters followed by in-line charcoal cartridges. Both filters and cartridges are changed on a weekly basis. The filters are analyzed for gross beta and the cartridge samples for radioiodine. In addition, gamma spectroscopy analysis (GSA) is performed on quarterly composites of the air particulate filters.

3.3.3 Precipitation

Precipitation samples are continuously collected at one indicator location (sampling station 44) and one control location (23); see Figure A-3. They are collected in sample bottles designed to hinder evaporation. They are composited quarterly and analyzed by gamma spectroscopy and for tritium.

3.3.4 Drinking Water

Samples of drinking water are collected monthly from the Camp Field Reservoir (3.4 miles NE, sample station 7, sample designation Wb1) and New Croton Reservoir (6.3 Mi SE, sample station 8); see Figure A-3. Each monthly sample is approximately 4 liters and is analyzed for gross beta and gamma-emitting radionuclides. Monthly samples are composited quarterly and analyzed for tritium.

3.3.5 Groundwater Water

Groundwater samples were obtained semi-annually at Lafarge (106.) Samples are analyzed for tritium, strontium-90, and nickel-63 and by gamma spectroscopy.

3.3.6 Soil

Soil samples are collected from two indicator locations (sampling stations 94 and 95), and one control location (23) on an annual basis; see Figure A-3. They are approximately 2 kg in size and consist of about twenty 2-inch deep cores. The soil samples are analyzed by gamma spectroscopy.

3.3.7 Broad Leaf Vegetation

Broad leaf vegetation samples are collected from three locations during the growing season. The indicator locations are sampling stations 94 (Ic2) and 95 (Ic1), and the control location is at sampling station 23 (Ic3). See Figures A-1 and A-2. The samples are collected monthly, when available, and analyzed by gamma spectroscopy. These samples consist of at least 1 kg of leafy vegetation and are used in the assessment of the food product and milk ingestion pathways.

3.3.8 Hudson River Water

Hudson River water sampling is performed continuously at the intake structure (sampling station 9, Wa1) and at a point exterior to the discharge canal where Hudson River water and water from the discharge canal mix (sampling station 10, Wa2); see Figure A-1. An automatic composite sampler is used to take representative samples. On a weekly basis, accumulated samples are taken from both sample points. These weekly river water samples are composited for monthly gamma spectroscopy analysis and quarterly for tritium analysis.

3.3.9 Hudson River Bottom Sediment

Bottom sediment and benthos are sampled at four locations: three indicator locations (sampling stations 10, 17, and 28) and one control location (84), along the Hudson River, once each spring and summer; see Figure A-3. These samples are obtained using a Peterson grab sampler or similar instrument. The bottom sediment samples are analyzed by gamma spectroscopy.

3.3.10 Hudson River Shoreline Soil

Shoreline soil samples are collected at three indicator and two control locations along the Hudson River. The indicator locations are at sampling stations 53 (Wc1), 28, and 17. The control locations are at sampling stations 50 (Wc2) and 84. Figures A-1, A-2, and A-3 show these locations. The samples are gathered at a level above low tide and below high tide and are approximately 2-kg grab samples. These samples are collected at greater than 90 days apart and are analyzed by gamma spectroscopy and for strontium-90.

3.3.11 Hudson River Aquatic Vegetation

During the spring and summer, aquatic vegetation samples are collected from the Hudson River at two indicator locations (sampling stations 17 and 28) and one control location (84); see Figure A-3. Samples of aquatic vegetation are obtained depending on sample availability. These samples are analyzed by gamma spectroscopy.

3.3.12 Fish and Invertebrates

Fish and invertebrate samples are obtained from the Hudson River at locations upstream and downstream of the plant discharge. The indicator location (downstream sample point) is designated as sampling station 25 (Ib1) and the control location (upstream) is at sampling station 23 (Ib2). See Figures A-1 and A-2. These samples are collected in season or semiannually if they are not seasonal. The fish and invertebrates sampled are analyzed by gamma spectroscopy as well as for strontium-90 and for nickel-63.

3.3.13 Land Use Census

Each year a land use census consisting of milch animal and residence surveys is conducted during the growing season to determine the current utilization of land within 5 miles (8 km) of the site. These surveys are used to determine whether there are changes in existing conditions that warrant changing the sampling program.

For example, the milch animal census is used to identify animals producing milk for human consumption within 5 miles (8 km) of Indian Point. This census consists of visual field surveys of the areas where a high probability of milch animals exists and confirmation through New York State records or with personnel such as feed suppliers who deal with farm animals and dairy associations (See Tables B-21 and B-22).

Visual inspections were made of the 5-mile area around the Indian Point Site during routine sample collections and emergency plan equipment inspections in the area throughout the year. An extensive land survey was conducted of the 5-mile area in an attempt to identify new residential areas, commercial developments and to identify milch animals in pasture.

Although there are presently no animals producing milk for human consumption within 5 miles (8 km) of the site, the census is performed to determine if a milk-sampling program needs to be conducted.

A residence census is also performed to identify the nearest residence(s) to the site in each of the 16 sectors surrounding Indian Point. See Table B-22.

A garden census was not performed, since the ODCM allows sampling of vegetation in two sectors near the site boundary in lieu of a garden census. The sectors are chosen to be in the pre-dominant wind directions with the highest predicted deposition rates.

3.4 Statistical Methodology

There are several statistical calculation methodologies used in evaluating the data from the Indian Point REMP. These methods include determination of Lower Limits of Detection (LLD) and the Minimum Detectable Concentration (MDC), and estimation of the mean and associated propagated error.

3.4.1 LOWER LIMIT OF DETECTION (LLD)

The LLD is the smallest concentration of radioactive material in a sample that will yield a net count above system background, and be detected with 95% probability, with a 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{\frac{2.71}{T_s} + 3.29\, s_b * \sqrt{1 + (\frac{T_b}{T_s})}}{E * V * k * Y * e^{-\lambda t}}$$

where:

LLD =	The lower limit of detection as defined above (as picocurie per unit mass or volume)
Ts =	The sample counting time in minutes
s_b =	The standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute)
T_b =	The background count time in minutes
E =	The counting efficiency (as counts per transformation)
V =	The sample size (in units of mass or volume)
k =	A constant for the number of transformations per minute per unit of activity (normally, 2.22E+6 dpm per uCi)
Y =	The fractional radiochemical yield (when applicable)
λ =	The radioactive decay constant for the particular radionuclide
t =	The elapsed time between midpoint of sample collection and time of counting

Note: The above LLD formula accounts for differing background and sample count times. The Radiological Environmental Monitoring Program, REMP, may use an LLD formula that assumes equal background and sample count times, when appropriate. The constants 2.71 and 3.29 and the general LLD equation were derived from References 6 and 7.

The value of S_b used in the calculation of the LLD for a detection system shall be based on the actual observed variance of the background counting rate or of the counting rate of the blank samples (as appropriate) rather than on an unverified theoretically predicted variance. In calculating the LLD for a radionuclide determined by gamma ray spectrometry, the background shall include the typical contributions of other radionuclides normally present in the samples. Typical values of E, V, Y, and t shall be used in the calculation. The background count rate is calculated from the background counts that are determined by a separate background count or in the case of gamma ray spectroscopy, from adjacent channels of the energy band of the gamma ray peak used for the quantitative analysis for that radionuclide.

It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement process and not as an a posteriori (after the fact) limit for a particular measurement. To document the post priori (after the fact) measurement statistics, the MDC is calculated after the measurement using the same equation as above.

To handle the a posteriori problem, a decision level must be defined. To minimize the number of false positives, a value is not considered positive unless it is greater than the MDC or 3 times the total standard deviation of the post priori measurement, where MDC is the post priori (after the fact) measurement statistic calculated similar to the LLD equation listed above (for $T_b = T_s$, the term $3.29\ \sigma_b \cdot \sqrt{(1+(T_b / T_s))} = 4.66\ \sigma_b$).

3.4.2 Table Statistics

The averages shown in the summary table (Table B-2) are the averages of the positive values in accordance with the NRC's Branch Technical Position (BTP) to Regulatory Guide 4.8 (Reference 8). Samples with "<" values are not included in the averages.

It should be noted that this statistic for the mean using only positive values tends to strongly bias the average high, particularly when only a few of the data are measurably positive. The REMP data show few positive values; thus the corresponding means are biased high. Exceptions to this include direct radiation measured by TLDs and gross beta radioactivity in air, which show positive monitoring results throughout the year.

The historical data tables contain the annual averages of the positive values for each year. The historical averages are calculated using only the positive values presented for 2002 through 2011. The 2012 average values are included in these historic tables for purposes of comparison.

SECTION 4

RESULTS AND DISCUSSION

4.0 RESULTS AND DISCUSSION

The 2012 Radiological Environmental Monitoring Program (REMP) was conducted in accordance with Indian Point's Offsite Dose Calculation Manual ODCM. The ODCM contains requirements for the number and distribution of sampling locations, the types of samples to be collected, and the types of analyses to be performed for measurement of radioactivity.

The REMP at Indian Point includes measurements of radioactivity levels in the following environmental pathways.

Direct Gamma Radiation	Airborne Particulates and Radioiodine
Precipitation	Drinking Water
Groundwater	Soil
Broad Leaf Vegetation	Hudson River Water
Bottom Sediment	Shoreline Soil
Aquatic Vegetation	Fish and Invertebrates

An annual land use and milch animal census is also part of the REMP.

To evaluate the contribution of plant operations to environmental radioactivity levels, other man-made and natural sources of environmental radioactivity, as well as the aggregate of past monitoring data, must be considered. It is not merely the detection of a radionuclide, but the evaluation of the location, magnitude, source, and history of its detection that determines its significance. Therefore, we have reported the data collected in 2012 and assessed the significance of the findings.

A summary of the results of the 2012 REMP is presented in Table B-2. This Table lists the mean and range of all positive results obtained for each of the media sampled at ODCM indicator and control locations. Discussions of these results and their evaluations are provided below.

The radionuclides detected in the environment can be grouped into three categories: (1) naturally occurring radionuclides; (2) radionuclides resulting from weapons testing and other non-plant related, anthropogenic sources; and (3) radionuclides that could be related to plant operations.

The environment contains a broad inventory of naturally occurring radionuclides which can be classified as, cosmic ray induced (e.g., Be-7, H-3) or geologically derived (e.g., Ra-226 and progeny, Th-228 and progeny, and K-40.) These radionuclides constitute the majority of the background radiation source and thus account for a majority of the annual background dose detected. Since the detected concentrations of these radionuclides were consistent at indicator and control locations, and unrelated to plant operations, their presence is noted only in the data tables and will not be discussed further.

The second group of radionuclides detected in 2012 consists of those resulting from past weapons testing in the earth's atmosphere. The more recent contamination events resulting from the Chernobyl and Fukushima accidents only indicated detectable activity shortly after their occurrences (Reference 9). However, weapons testing in the 1950's and 1960's resulted in a significant atmospheric radionuclide inventory, which, in turn, still contributes to the concentrations in the ecological systems. Although reduced in frequency, atmospheric weapons testing continued into the 1980's. The resultant radionuclide inventory of some radionuclides, although diminishing with time (e.g., through radioactive decay and natural dispersion processes), remains detectable.

In 2012, the detected radionuclide that may be attributable to past atmospheric weapons testing consisted of Cs-137 in several media. The levels detected were consistent with the historical levels of radionuclides resulting from weapons tests as measured in previous years.

The final group of radionuclides detected by the 2012 REMP comprises those that may be attributable to current plant operations. During 2012, Cs-137 and tritium (H-3) were the only potentially plant-related radionuclides detected in any environmental samples.

H-3 may be present in the local environment due to either natural occurrence, other man-made sources, or as a result of plant operations. Natural occurrence is very low, on the order of approximately 5 pCi/liter (well below typical detectable levels). The major source of H-3 is typically from above ground nuclear weapons testing (in the range of 50 to 150 pCi/liter). Other sources include weapons production and industrial uses where levels are highly dependent on the release rates and distance from the source term. One such industrial source is nuclear power plant operation.

Cs-137 is ubiquitous in the environment from atmospheric testing debris and a lesser amount from the Chernobyl accident. In 2012, there were two detections of Cs-137 in shoreline soil (2 indicator samples). In bottom sediment there were five positive detections of Cs-137 (all at indicator stations or near the plant). The two discharge canal samples are consistent with historical values.

Shoreline sediment and bottom sediment samples showed detectable levels of Cs-137 somewhat higher at the indicator locations than at the control location at Cold Spring (distant location). The fact that there was no Cs-134 present (recent plant releases would contain Cs-134) and that there was detection also at a distant location indicates that the activity may be due to atmospheric weapons testing, with some contribution from plant releases from the past several years. None of the fish samples indicated any detectable levels of these isotopes.

Strontium-90 (Sr-90) may also be present in the environment from atmospheric testing debris. None of the fish samples, or any other media where Sr-90 was tested, indicated any detectable levels of this isotope.

I-131 is also produced in fission reactors, but can result from non-plant related anthropogenic sources, e.g., medical administrations, such as in previous years. I-131 was not detected in 2012 in aquatic or terrestrial vegetation indicator and control locations.

Co-58 and Co-60 are activation/corrosion products also related to plant operations. They are produced by neutron activation in the reactor core. Co-58 has a much shorter half-life than Co-60. If Co-58 and Co-60 are concurrently detected in environmental samples, then the source of these radionuclides is more likely the result of recent releases. When significant concentrations of Co-60 are detected but no Co-58, there is an increased likelihood that the Co-60 is due to residual Co-60 from past operations. There was no Co-58 or Co-60 detected in the 2012 REMP, although they were observed in historical data.

In the following sections, a summary of the results of the 2012 REMP is presented by sample medium and the significance of any positive findings discussed. It should be noted that naturally occurring radionuclides are omitted from the summary table (Table B-2) and further discussion.

4.1 Direct Radiation

The environmental TLDs used to measure the direct radiation were TLDs supplied and processed by Environmental Dosimetry Company. In 2012, the TLD program produced a consistent picture of ambient background radiation levels in the vicinity of the Indian Point Station. A summary of the annual TLD data is provided in Table B-2 and all the TLD data are presented in Tables B-3, B-4 and B-5. TLD sample site DR-40 is the control site for the direct radiation (DR) series of measurements.

Table B-3 provides the quarterly and annual average reported doses in mR per standard quarter for each of the direct radiation sample points, DR-1 through DR-41. The table also provides the sector for each of the DR sample points. Table B-4 provides the mean, standard deviation, minimum and maximum values in mR per standard quarter for the years 2002 through 2011. The 2012 means are also presented in Table B-4. Table B-5 presents the 2012 TLD data for the inner ring and outer ring of TLDs.

The 2012 mean value for the indicator direct radiation sample points was 13.3 mR per standard quarter – which represents a small decrease from 2011. At those locations where the 2012 mean value was higher than historical means, they are within historical bounds for the respective locations.

The DR sample locations are arranged so that there are two concentric rings of TLDs around the Indian Point site. The inner ring (DR-1 to DR-16) is close to the site boundary. The outer ring (DR-17 to DR-32) has a radius of approximately 5 miles from the three Indian Point units. The results for these two rings of TLDs are provided in Table B-5. The annual average for the inner ring was 13.2 mR per standard quarter and also average for the outer ring was 13.6 mR per standard quarter. The control location average for 2012 was 12.3 mR per standard quarter.

Table C-1 and Figure C-1 present the 10-year historical averages for the inner and outer rings of TLDs. The 2012 averages are consistent with the historical data. The 2012 and previous years' data show that there is no measurable direct radiation in the environment due to the operation of the Indian Point site.

4.2 Airborne Particulates and Radioiodine

An annual summary of the results of the 2012 air particulate filter and charcoal cartridge analyses is presented in Table B-2. As shown, there were no radionuclides detected in the air attributable to plant operations.

The results of the analyses of weekly air particulate filter samples for gross beta activity are presented in Table B-6 and the weekly charcoal cartridge analytical results are presented in Table B-7.

Gross beta activity was found in air particulate samples throughout the year at all indicator and control locations. The average gross beta activity for the eight indicator air sample locations was 0.014 pCi/m^3 and the average for the control location was 0.014 pCi/m^3. The activities detected were consistent for all locations, with no significant differences in gross beta activity in any sample due to location. All the charcoal cartridge results were less than MDC, consistent with historical trends when there were no episodes of fresh fallout from Weapons Testing or accidents

The results of the GSA of the quarterly composites of these samples are in Table B-8. These quarterly composite air samples showed that no reactor-related radionuclides were detected and that only naturally-occurring radionuclides were present at detectable levels.

The mean annual gross beta concentrations and Cs-137 concentrations in air for the past 10 years are presented in Table C-2. From this table and Figure C-2, it can be seen that the average 2012 gross beta concentration was consistent with historical levels. Cs-137 has not been detected since 1987. This is consistent with the trend of decreasing ambient Cs-137 concentrations in recent years.

From the data, it can be seen that no airborne radioactivity attributable to the operation of Indian Point was detected in 2012.

4.3 Precipitation

A summary of the precipitation sample analysis results is presented in Table B-2. Table B-9 contains the results of the precipitation samples for 2012. Only naturally occurring radionuclides were detected in the precipitation samples.

A review of historical data over the last 10 years indicates tritium had been detected in one indicator precipitation sample in 2010 and both indicator and control locations in 2010; however, there have been no instances of positive values in 2012.

4.4 Drinking Water

The annual program summary table (Table B-2) contains a summary of the 2012 drinking water sample analysis results. Results of the tritium and gamma spectroscopy analyses of the monthly drinking water samples are in Table B-10. Other than naturally occurring radionuclides, no radioactivity was detected in drinking water samples. This has historically been the case for the radionuclide results for this media; operation of the Indian Point units had no detectable radiological impact on drinking water.

4.5 Ground Water

A summary of the groundwater samples for 2012 is contained in Table B-2. Data resulting from analysis of the groundwater samples for gamma emitters, tritium analysis, Ni-63 and Sr-90 are given in Table B-11. No plant related nuclides were noted in these samples.

4.6 Soil

A summary of the soil sample analysis results is presented in Table B-2. Table B-12 contains the results of the soil samples for 2012. Other than naturally occurring radionuclides, no activity was detected in any of the soil samples.

4.7 Broad Leaf Vegetation

Table B-2 contains a summary of the broad leaf vegetation sample analysis results. Data from analysis of the 2012 samples are presented in Table B-13.

Table C-3 contains an historical summary and Figure C-3 is an illustration of the broad leaf vegetation analysis results. The detection of low levels of Cs-137 has occurred sporadically at both indicator and control locations at relatively low concentrations for the past ten years. Although Cs-137 was detected in one of the indicator samples in 2012, it is most likely the result of previous atmospheric weapons testing.

4.8 Hudson River Water

A summary of the radionuclides detected in the Hudson River water is contained in Table B-2. Data resulting from analysis of monthly Hudson River water samples for gamma emitters and quarterly composites of H-3 are presented in Tables B-14.

The only plant related activity detected was H-3. The levels are consistent with occasional historical detection of H-3. Table C-4 and Figure C-4 show the recent historical trend of the H-3 levels. Table C-5 and Figure C-5 show a comparison to the amount measured in effluents. Because the REMP Discharge Area River Water sample is located in the mixing zone (per References 8 and 10), the REMP data is less than the calculated levels from the effluent data due to the effect of dilution in the nearby mixing zone.

4.9 Hudson River Bottom Sediment

A summary of the Hudson River bottom sediment analysis results is presented in Table B-2. Table B-15 contains the results of the analysis of bottom sediment samples for 2012. Cs-137 was detected at 5 of 6 indicator station samples. The control station (Cold Spring) samples did not indicate any Cs-137. This detection of positive levels is not unusual. Cs-134 was not detected in any bottom sediment samples. The lack of Cs-134 suggests that the primary source of the Cs-137 in bottom sediment is from historical plant releases over the years and from residual weapons test fallout.

The discharge canal bottom sediments were 397 pCi/kg and 234 pCi/kg on samples taken 3 months apart (average = 251 pCi/kg.). The results are somewhat less than to the 2009, 2010, and 2011 results. The average of all indicator detections is 284 pCi/kg (321 pCi/kg in 2011, 553 pCi/kg in 2010 and 493 pCi/kg in 2009). This is consistent with historical annual average concentration for indicator locations.

This detection of Cs-137 in bottom sediment generally decreased from an average of 1200 pCi/kg in the early 1990s to 500 pCi/kg in the mid-1990s to a recent value of approximately 300 pCi/kg. Cs-134 has not been detected in bottom sediment since 2002.

4.10 Hudson River Shoreline Soil

A summary of the radionuclide concentrations detected in the shoreline soil samples is contained in Table B-2. Table B-16 contains the results of the gamma spectroscopic and strontium-90 analyses of the shoreline soil samples.

In addition to the naturally occurring radionuclides, Cs-137 was identified in the Hudson River shoreline soil samples in 2012. Cs-137 was detected at the Verplanck location in both samples from that location, for a total of two positive values out of eight samples from indicator locations. Cs-137 was not detected at the control location (Manitou Inlet). The average concentration for the indicator locations that had positive indication of Cs-137 was 141 pCi/kg (dry) with a maximum concentration of 167 pCi/kg (dry).

An historical look at Cs-137 detected in shoreline soil at indicator and control locations can be viewed in Table C-6 and Figure C-6. Cs-137 has been and continues to be present in this media, both at indicator and occasionally at the control location, at a consistent level over the past ten years. Cs-134 and Cs-137 are both discharged from the plant in similar quantities. The lack of Cs-134 activity is an indication that the primary source of the Cs-137 in the shoreline soil is legacy contamination from weapons fallout.

No Sr-90 was detected in any collected shoreline soil samples.

4.11 Aquatic Vegetation

A summary of the aquatic sample analysis results is presented in Table B-2. Table B-17 contains the results of the analysis of aquatic vegetation samples for 2012. No plant related radionuclides were detected.

4.12 Fish and Invertebrates

A summary of the fish and invertebrate sample analysis results is presented in Table B-2. Table B-18 contains the results of the analysis of fish and invertebrate samples for 2012. Similar to the past 10 years, no radionuclides other than naturally occurring ones were found in 2012. There were no plant related radionuclides detected.

4.13 Land Use Census

A census was performed in the vicinity of Indian Point in 2012. This census consisted of a milch animal and a residence census. Results of this census are presented in Tables B-21 and B-22.

The results of the 2012 census were generally same as the 2011 census results. The New York Agricultural Statistic Service showed there were no animals producing milk for human consumption found within 5 miles (8 km) of the plant. Field observations also yielded no milching animal locations within five miles.

The second part of this census revealed that the two nearest residences in different sectors are located 0.44 miles (0.71 km) ESE and 0.73 miles (1.13 km) S of the plant. The 2012 land use census indicated there were no new residences that were closer in proximity to IPEC.

The ODCM allows the sampling of broad leaf vegetation in two sectors at the site boundary in lieu of performing a garden census. Analysis results for these two sectors are discussed in Section 4.6 and presented in Table B-14, Table C-6 and Figure C-6.

4.14 Conclusion

The Radiological Environmental Monitoring Program is conducted each year to determine the radiological impact of Indian Point operations on the environment. The preceding discussions of the results of the 2012 REMP reveal that operations at the station did not result in an impact on the environment.

The 2012 REMP results demonstrate the relative contributions of different radionuclide sources, both natural and anthropogenic, to the environmental concentrations. The results indicate that the fallout from previous atmospheric weapons testing continues to contribute to detection of Cs-137 in some environmental samples. There are infrequent detections of plant related radionuclides in the environs; however, the radiological levels are very low and are significantly less than those from natural background and other anthropogenic sources.

SECTION 5

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APPENDIX A

ENVIRONMENTAL SAMPLING AND ANALYSIS REQUIREMENTS

APPENDIX A

Environmental media are sampled at the locations specified in Table A-1 and shown in Figures A-1, A-2, and A-3. The samples are analyzed according to criteria established in the ODCM. These requirements include: methods of sample collection; types of sample analysis; minimum sample size required; lower limit of detection, which must be attained for each medium, sample, or analysis type, and environmental concentrations requiring special reports.

Table A-1 provides the sampling station number, location, sector, and distance from Indian Point, sample designation code, and sample type. This table gives the complete listing of sample locations used in the 2012 REMP.

Three maps are provided to show the locations of REMP sampling. Figure A-1 shows the sampling locations within two miles of Indian Point. Figures A-2 and A-3 show the sampling locations within ten miles of Indian Point.

The ODCM required lower limits of detection (LLD) for Indian Point sample analyses are presented in Table A-2. These required lower limits of detection are not the same as the lower limits of detection or critical levels actually achieved by the laboratory. The laboratory's lower limits of detection and critical levels must be equal to or lower than the required levels presented in Table A-2.

Table A-3 provides the reporting level for radioactivity in various media. Sample results that exceed these levels and are due to plant operations require that a special report be submitted to the NRC.

In addition to the sampling outlined in Table A-1, there is an environmental surveillance requirement that an annual land use and milch animal census be performed. See Tables B-19 and B-20 for the milch animal and land use census.

TABLE A-1
INDIAN POINT REMP SAMPLING STATION LOCATIONS

SAMPLING STATION	SAMPLE DESIGNATION	LOCATION	DISTANCE	SAMPLE TYPES
3	DR8	Service Center Building	Onsite - 0.35 Mi (SSE) at 158°	Direct Gamma
4	A1 A1	Algonquin Gas Line	Onsite - 0.28 Mi (SW) at 234°	Air Particulate Radioiodine
5	A4 A4 DR10	NYU Tower	Onsite - 0.88 Mi (SSW) at 208°	Air Particulate Radioiodine Direct Gamma
7	Wb1	Camp Field Reservoir	3.4 Mi (NE) at 51°	Drinking Water
8	**	Croton Reservoir	6.3 Mi (SE) at 124°	Drinking Water
9	Wa1	Plant Inlet (Hudson River Intake)*	Onsite - 0.16 Mi (W) at 273°	HR Water
10	Wa2 **	Discharge Canal (Mixing Zone)	Onsite - 0.3 Mi (WSW) at 249°	HR Water HR Bottom Sediment
14	DR7	Water Meter House	Onsite - 0.3 Mi (SE) at 133°	Direct Gamma
17	** ** **	Off Verplanck	1.5 Mi (SSW) at 202.5°	HR Aquatic Vegetation HR Shoreline Soil HR Bottom Sediment
20	DR38	Cortlandt Yacht Club (AKA Montrose Marina)	1.5 Mi (S) at 180°	Direct Gamma
23	** A5 A5 DR40 Ic3 ** Ib2	Roseton*	20.7 Mi (N) at 357°	Precipitation Air Particulate, Radioiodine Direct Gamma Broad Leaf Vegetation Soil Fish & Invertebrates
25	Ib1	Downstream	Downstream	Fish & Invertebrates
27	** ** DR41	Croton Point	6.36 Mi (SSE) at 156°	Air Particulate Radioiodine Direct Gamma
28	** DR4 ** **	Lent's Cove	0.45 Mi (ENE) at 069°	HR Shoreline Soil Direct Gamma HR Bottom Sediment HR Aquatic Vegetation
29	** ** DR39	Grassy Point	3.37 Mi (SSW) at 196°	Air Particulate Radioiodine Direct Gamma

* = Control location
** = Locations listed do not have sample designation locations specified in the ODCM
HR = Hudson River R/S = Reuter Stokes

TABLE A-1
INDIAN POINT REMP SAMPLING STATION LOCATIONS

SAMPLING STATION	SAMPLE DESIGNATION	LOCATION	DISTANCE	SAMPLE TYPES
33	DR33	Hamilton Street (Substation)	2.88 Mi (NE) at 053°	Direct Gamma
34	DR9	South East Corner of Site	Onsite - 0.52 Mi (S) at 179°	Direct Gamma
35	DR5	Broadway & Bleakley Avenue	Onsite - 0.37 Mi (E) at 092°	Direct Gamma
38	DR34	Furnace Dock (Substation)	3.43 Mi (SE) at 141°	Direct Gamma
44	** ** **	Peekskill Gas Holder Bldg	1.84 Mi (NE) at 052°	Precipitation Air Particulate Radioiodine
50	Wc2	Manitou Inlet*	4.48 Mi (NNW) at 347°	HR Shoreline Soil
53	Wc1 DR11	White Beach	0.92 Mi (SW) at 226°	HR Shoreline Soil Direct Gamma
56	DR37	Verplanck - Broadway & 6th Street	1.25 Mi (SSW) at 202°	Direct Gamma
57	DR1	Roa Hook	2 Mi (N) at 005°	Direct Gamma
58	DR17	Route 9D - Garrison	5.41 Mi (N) at 358°	Direct Gamma
59	DR2	Old Pemart Avenue	1.8 Mi (NNE) at 032°	Direct Gamma
60	DR18	Gallows Hill Road & Sprout Brook Road	5.02 Mi (NNE) at 029°	Direct Gamma
61	DR36	Lower South Street & Franklin Street	1.3 Mi (NE) at 052°	Direct Gamma
62	DR19	Westbrook Drive (near the Community Center)	5.03 Mi (NE) at 062°	Direct Gamma
64	DR20	Lincoln Road - Cortlandt (School Parking Lot)	4.6 Mi (ENE) at 067°	Direct Gamma
66	DR21	Croton Avenue - Cortlandt	4.87 Mi (E) at 083°	Direct Gamma
67	DR22	Colabaugh Pond Road - Cortlandt	4.5 Mi (ESE) at 114°	Direct Gamma
69	DR23	Mt. Airy & Windsor Road	4.97 Mi (SE) at 127°	Direct Gamma
71	DR25	Warren Ave - Haverstraw	4.83 Mi (S) at 188°	Direct Gamma
72	DR26	Railroad Avenue & 9W - Haverstraw	4.53 Mi (SSW) at 203°	Direct Gamma
73	DR27	Willow Grove Road & Captain Faldermeyer Drive	4.97 Mi (SW) at 226°	Direct Gamma
74	DR12	West Shore Drive - South	1.59 Mi (WSW) at 252°	Direct Gamma
75	DR31	Palisades Parkway	4.65 Mi (NW) at 225°	Direct Gamma
76	DR13	West Shore Drive - North	1.21 Mi (W) at 276°	Direct Gamma
77	DR29	Palisades Parkway	4.15 Mi (W) at 272°	Direct Gamma
78	DR14	Rt. 9W across from R/S #14	1.2 Mi (WNW) at 295°	Direct Gamma

* = Control location
** = Locations listed do not have sample designation locations specified in the ODCM
HR = Hudson River R/S = Reuter Stokes

TABLE A-1
INDIAN POINT REMP SAMPLING STATION LOCATIONS

SAMPLING STATION	SAMPLE DESIGNATION	LOCATION	DISTANCE	SAMPLE TYPES
79	DR30	Anthony Wayne Park	4.57 Mi (WNW) at 296°	Direct Gamma
80	DR15	Route 9W South of Ayers Road	1.02 Mi (NW) at 317°	Direct Gamma
81	DR28	Palisades Pkwy - Lake Welch Exit	4.96 Mi (WSW) at 310°	Direct Gamma
82	DR16	Ayers Road	1.01 Mi (NNW) at 334°	Direct Gamma
83	DR32	Route 9W - Fort Montgomery	4.82 Mi (NNW) at 339°	Direct Gamma
84	** ** **	Cold Spring *	10.88 Mi (N) at 356°	HR Aquatic Vegetation HR Shoreline Soil HR Bottom Sediment
88	DR6	Reuter Stokes Pole #6	0.32 Mi (ESE) at 118°	Direct Gamma
89	DR35	Highland Ave & Sprout Brook Road (near rock cut)	2.89 Mi (NNE) at 025°	Direct Gamma
90	DR3	Charles Point	0.88 Mi (NE) at 047°	Direct Gamma
92	DR24	Warren Road - Cortlandt	3.84 Mi (SSE) at 149°	Direct Gamma
94	A2 A2 Ic2 **	IPEC Training Center	Onsite- 0.39 Mi (S) at 193°	Air Particulate Radioiodine Broad Leaf Vegetation Soil
95	A3 A3 Ic1 **	Meteorological Tower	Onsite - 0.46 Mi (SSW) at 208°	Air Particulate Radioiodine Broad Leaf Vegetation Soil
106	**	Lafarge Monitoring Well	0.63 mi SW	Groundwater

* = Control location
** = Locations listed do not have sample designation locations specified in the ODCM
HR = Hudson River R/S = Reuter Stokes

FIGURE A-1

SAMPLING LOCATIONS
Within Two Miles of Indian Point

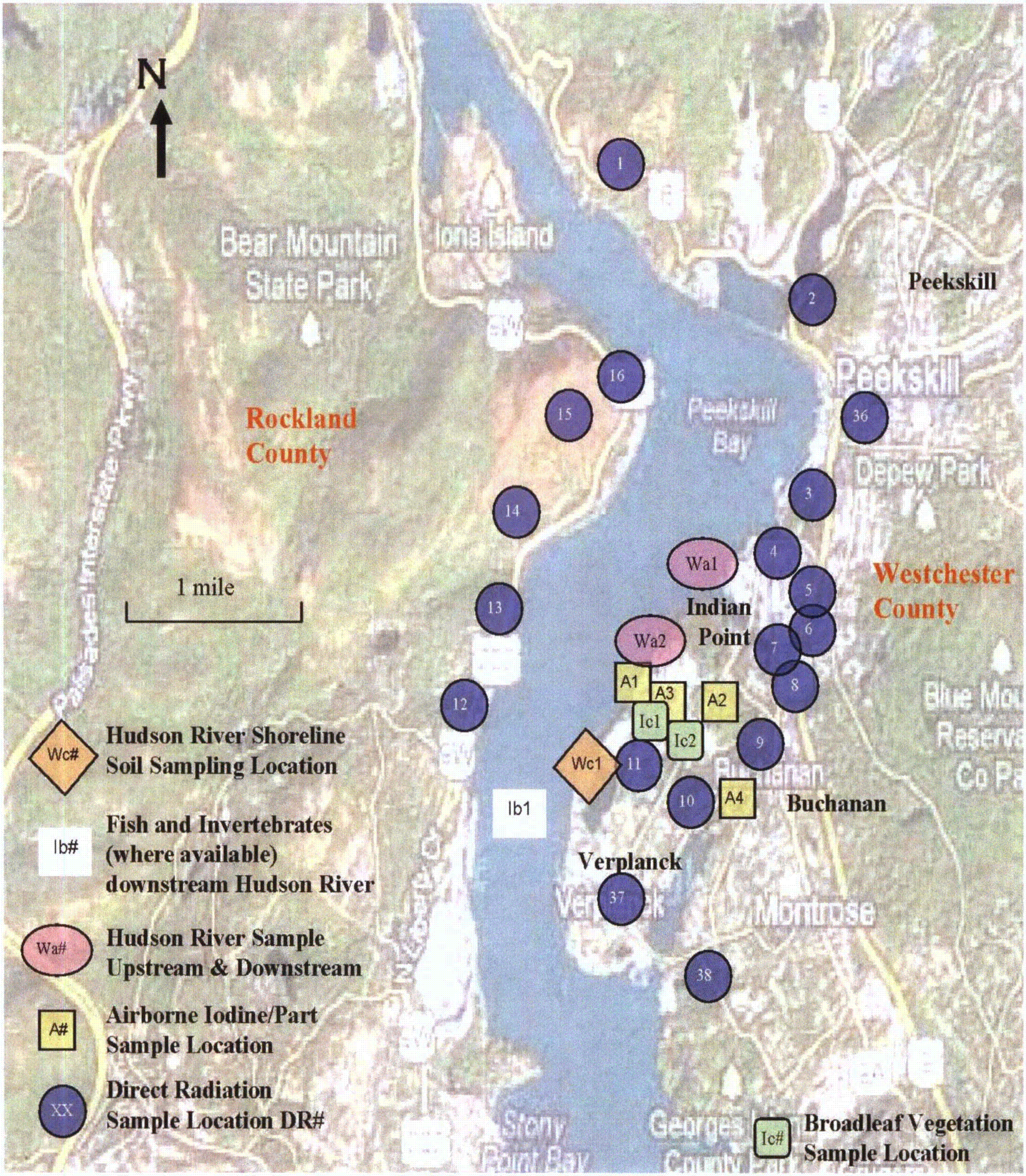


FIGURE A-2

SAMPLING LOCATIONS
Greater than Two Miles from Indian Point

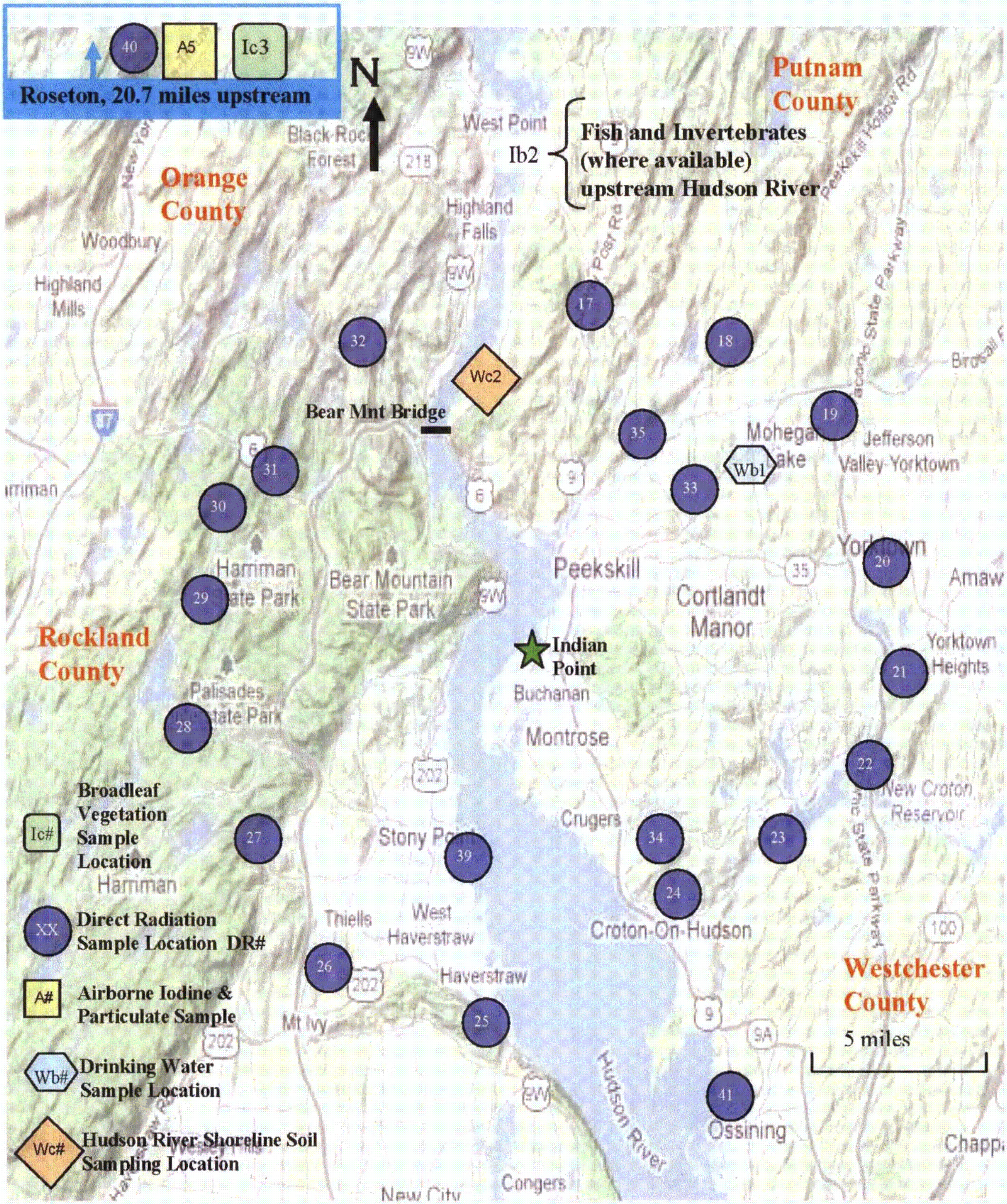


FIGURE A-3

SAMPLING LOCATIONS
Additional Sampling Locations

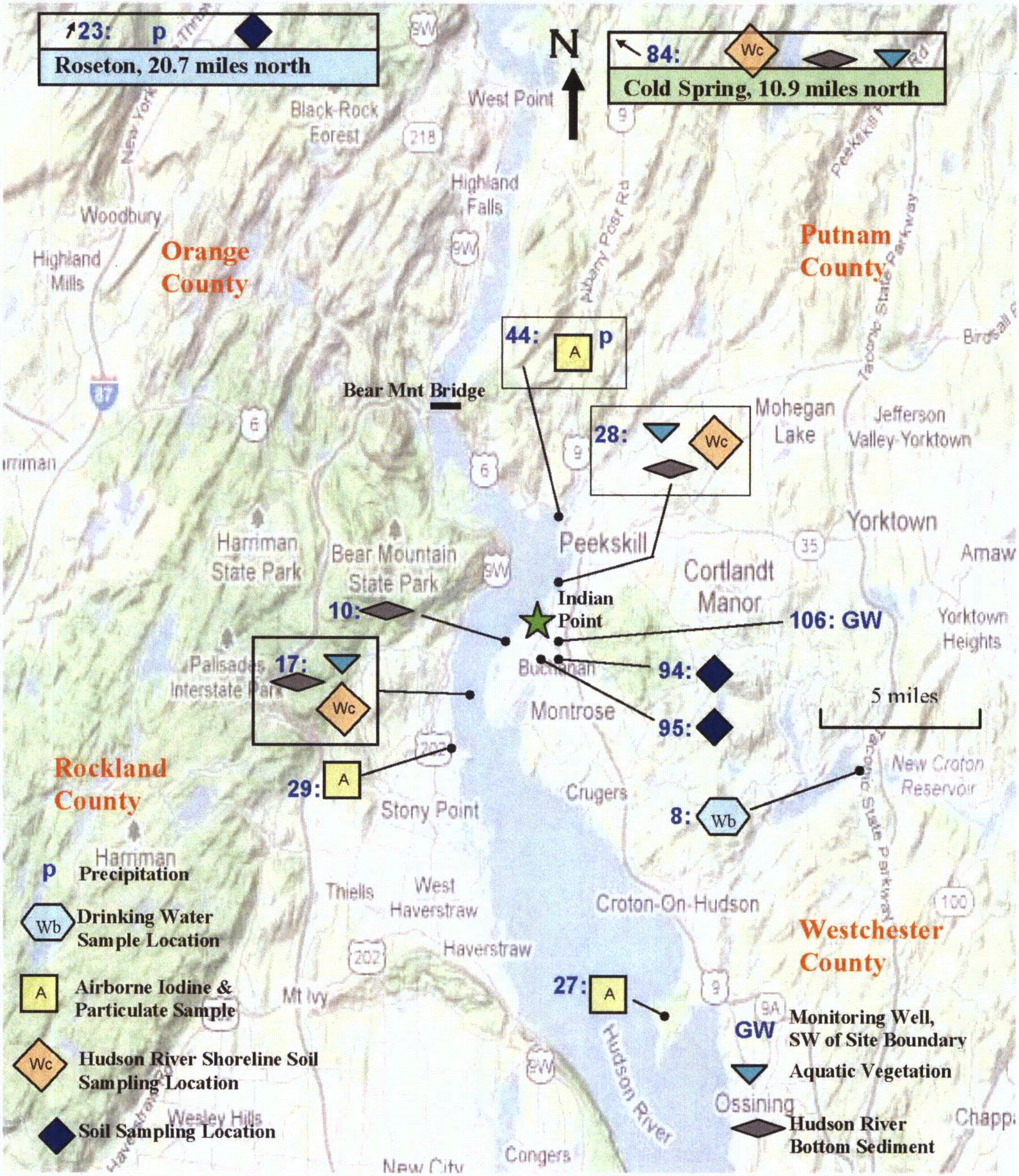


TABLE A-2

LOWER LIMIT OF DETECTION (LLD) REQUIREMENTS FOR ENVIRONMENTAL SAMPLES

RADIONUCLIDE ANALYSIS	WATER (pCi/L)	AIRBORNE PARTIUCLATE OR GASES (pCi/m^3)	FISH (pCi/kg, wet)	MILK (pCi/L)	FOOD PRODUCTS (pCi/kg, wet)	SOIL or SEDIMENT (pCi/kg, dry)
Gross Beta	4	0.01				
H-3	2,000 (d)					
Mn-54	15		130			
Fe-59	30		260			
Co-58	15		130			
Co-60	15		130			
Ni-63 (f)	30		100			
Zn-65	30		260			
Sr-90 (f)	1		5			5000
Zr-95	30					
Nb-95	15					
I-131	1 (d)	0.07		1	60	
Cs-134	15	0.05	130	15	60	150
Cs-137	18	0.06	150	18	80	180
Ba-140	60			60		
La-140	15			15		

TABLE A-2

LOWER LIMIT OF DETECTION (LLD) REQUIREMENTS FOR ENVIRONMENTAL SAMPLES

Table Notation

(a) This list does not mean that only these nuclides are to be considered. Other peaks that are identifiable, together with those of the above nuclides, shall also be analyzed and reported in the Annual Radiological Environmental Operating Report pursuant to the ODCM.

(b) Required detection capabilities for thermoluminescent dosimeters used for environmental measurements are given in Regulatory Guide 4.13.

(c) The LLD is defined as the smallest concentration of radioactive material in a sample that will yield a net count, above system background, that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.

It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement.

Analyses shall be performed in such a manner that the stated LLDs will be achieved under routine conditions. Occasionally background fluctuations, unavoidable small sample sizes, the presence of interfering nuclides, or other uncontrollable circumstances may render these LLDs unachievable.

In such cases, the contributing factors shall be identified and described in the Annual Radiological Environmental Operating Report pursuant to the ODCM.

(d) These LLDs are for drinking water samples. If no drinking water pathway exists, the LLDs may be increased to 3,000 for H-3 and 15 for I-131.

(e) These required lower limits of detection are associated only with the REMP requirements. The Radiological Ground Water Monitoring Program may involve unique reporting level criteria, independent of the REMP, and defined in station procedures.

(f) Sr-90 and Ni-63 are included in this table due to their historical presence in ground water and possible migration to the environment.

TABLE A-3

REPORTING LEVELS FOR RADIOACTIVITY CONCENTRATIONS IN ENVIRONMENTAL SAMPLES

RADIONUCLIDE ANALYSIS	WATER (pCi/L)	AIRBORNE PARTIUCLATE OR GASES (pCi/m^3)	FISH (pCi/kg, wet)	MILK (pCi/L)	FOOD PRODUCTS (pCi/kg, wet)
H-3	20,000 *				
Mn-54	1,000		30,000		
Fe-59	400		10,000		
Co-58	1,000		30,000		
Co-60	300		10,000		
Ni-63 ***	300		1,000		
Zn-65	300		20,000		
Sr-90 ***	8*		40		
Zr-95	400				
Nb-95	400				
I-131	2 *	0.9		3	100
Cs-134	30	10	1,000	60	1,000
Cs-137	50	20	2,000	70	2,000
Ba-140	200			300	
La-140	200			300	

* Values provided are for drinking water pathways. If no drinking water pathway exists, higher values are allowed, as follows:

H-3	30,000 pCi/L (This is a 40 CFR 141 value)
Sr-90	12 pCi/L
I-131	20 pCi/L

** These reporting levels are associated only with the REMP requirements. The Radiological Ground Water Monitoring Program may involve unique reporting level criteria, independent of the REMP, and defined in station procedures.

*** Sr-90 and Ni-63 are included in this table due to their historical presence in ground water and possible migration to the environment.

APPENDIX B

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM RESULTS SUMMARY

APPENDIX B

B.1 2012 Annual Radiological Environmental Monitoring Program Summary

The results of the 2012 radiological environmental sampling program are presented in Tables B-2 through B-18. Table B-2 is a summary table of the sample results for 2012. The format of this summary table conforms to the reporting requirements of the ODCM, NRC Regulatory Guide 4.8 (Reference 4), and NRC Branch Technical Position to Regulatory Guide 4.8 (Reference 17). In addition, the data obtained from the analysis of samples are provided in Tables B-3 through B-18.

REMP samples were analyzed by various counting methods as appropriate. The methods are; gross beta, gamma spectroscopy analysis, liquid scintillation, radiochemical analysis, and TLD processing. Gamma spectroscopy analysis was performed for the following radionuclides; Be-7, K-40, Mn-54, Co-58, Co-60, Fe-59, Zn-65, Zr-95, Nb-95, Ru-103, Ru-106, I-131, Cs-134, Cs-137, Ba/La-140, Ce-141, Ce-144, Ra-226 and Ac/Th-228. Radiochemical analyses were performed for H-3, Ni-63, Sr-90 and I-131 for specific media and locations as required in the ODCM.

B.2 Land Use Census

In accordance with Sections IP2-D3.5.2 and IP3-2.8 of the ODCM, a land use census was conducted to identify the nearest milch animal and the nearest residence. The results of the milch animal and land use census are presented in Tables B-19 and B-20, respectively. In lieu of identifying and sampling the nearest garden of greater than 50 m^2, at least three kinds of broad leaf vegetation were sampled near the site boundary in two sectors and at a designated control location (results are presented in Table B-13).

B.3 Sampling Deviations

During 2012, environmental sampling was performed for 12 unique media types addressed in the ODCM and for direct radiation. A total of 1164 samples of 1167 scheduled were obtained. Of the scheduled samples, 99.7% were collected and analyzed for the program. Sampling deviations are summarized in Table B-1. Discussions of the reasons for the deviations are provided in Table B-1a for the air samples and Table B-1b for other media.

B.4 Analytical Deviations

There was one blue crab sample where there was insufficient sample for Sr-90 analysis. Several LLDs were not met due to the short half lives of the nuclides. Table B-1c provides more details for the analytical deviations.

B.5 Special Reports

No special reports were required under the REMP.

Summary of Sampling Deviations - 2012

MEDIA	TOTAL SCHEDULED SAMPLES	NUMBER OF DEVIATIONS*	SAMPLING EFFICIENCY %	NUMBER OF ANALYSES**	REASC DEVI/
MEDIA					
TLD	164	1	99%	326	See Tal
PARTICULATES IN AIR	416	0	100%	448	N.
CHARCOAL FILTER	416	0	100%	416	N.
PRECIPITATION	8	0	100%	16	N.
DRINKING WATER	24	0	100%	56	N.
GROUNDWATER SAMPLES	2	0	100%	8	N.
SOIL	3	0	100%	3	N.
BROAD LEAF VEGETATION	63	0	100%	108	N.
HUDSON RIVER WATER	24	0	100%	32	N.
SHORELINE SOIL	10	0	100%	20	N.
HUDSON RIVER BOTTOM SEDIMENT	8	0	100%	8	N.
AQUATIC VEGETATION	6	2	67%	4	See Tal
FISH & INVERTEBRATES	23	0	100%	68	N.
TOTALS	1167	3	99.7%	1513	

TOTAL NUMBER OF SAMPLES COLLECTED = 1164

* Samples not collected or unable to be analyzed.

** Several sample types require more than one analysis

Note: all air particulate filters and one charcoal cartridges were analyzed

TABLE B-1b
2012 Other Media Deviations

LOCATION	Week	PROBLEM / ACTIONS TO PREVENT RECURREN
Palasades Pky, Lake Welch exit	15	TLD missing.
Hudson River Intake	23	Failure of the water sampler peristaltic pump caused o 03790
Lents Cove	23	The attempt to collection aquatic vegetation in the spri was no vegetation to be found.
Hudson River Intake	31	Water container full; automatic sampler collecting 2 sa normal). Trouble shooting revealed loose connections.
Hudson River Intake and Discharge	33	Water samples collected on 8/14 instead of 8/13 due t issues.
Hudson River Intake	37	Automatic water sampler sensor not detecting water; a samples per hour (twice normal). Next day follow-up r re-program sampler and replace sampler.
Lents Cove	38	Aquatic vegetation not available at this location.
Roseton	44	Rain water sampler moved inside in preparation for Hu 09:30 to 11/1 10:00).
Hudson River Intake	44	Sample station flooded by Hurricane Sandy, Grab sam

Note: The only samples not obtained were the Week 15 missing TLD and the Week 23 and 38 aqua

TABLE B-1c
2012 Analysis Deviations

LOCATION	Media	PROBLEM / ACTIONS TO PREVENT RECURREN
Croton Reservoir	Drinking Water	I-131 result (<15.12) and La-140 result (<15.89) did nc pCi/liter) for 9/17/12 sample
Roseton	Rain Water	I-131 result (<15.57) did not meet required LLD (15 pC
Hudson River Intake	River Water	I-131 result (<20.22) and La-140 result (<18.64) did nc pCi/liter) for 11/26/12 sample
Hudson River Discharge	River Water	I-131 (<15.63) did not meet required LLD (15 pCi/liter)
Downstream	Blue Crab	Insufficient quantity to perform Sr-90 analysis

The formulas for calculating the activity, uncertainty and MDC are contained in the software For the gamma system, when the new detector number 08 was added to the system in Janu 3.29 was used to calculated the MDCs on detector 08. The activity and uncertainty were not been changed from 3.29 to the required 4.66. When the MDCs were recalculated using 4.66 by 41.6%. This error has been corrected.

TABLE B-2 - RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY
INDIAN POINT ENERGY CENTER - 2012
Dockets 50-03, 50-247 & 50-286

Medium or Pathway Sampled (Units)	Analysis Type	Total Number	LLD*	Indicator Locations	Location with Highest Mean			Control Locations	Non-Routine Reported Measurements
				Mean ** (Range)	**Location Number**	Distance Direction	Mean (Range)	Mean (Range)	
Direct Radiation (mR/Standard Quarter)	Tld-Quarterly	163	NA	13.3 (159/159) (9.0 - 19.9)	DR-28	4.96 Mi. WSW	19.3 (3/3) (18.5 - 19.9)	12.3 (4/4) (11.0 - 13.5)	0
Air Particulate (pCi/m^3)	Gr-B	416	0.01	0.014 (364/364) (0.003 - 0.025)	95	0.46 Mi. SSW	0.014 (52/52) (0.004 - 0.025)	0.014 (52/52) (0.005 - 0.023)	0
Air Iodine (pCi/m^3)	GAMMA	416							
	I-131		0.07	<MDC***			-	<MDC	0
Air Particulate (10^{-3} pCi/m^3)	GAMMA	32							
	Be-7		NA	63.9 (28/28) (42.6 - 84.2)	23	20.7 Mi. N	72.8 (4/4) (58.5 - 111)	72.8 (4/4) (58.5 - 111)	0
	Cs-134		0.05	<MDC			-	<MDC	0
	Cs-137		0.06	<MDC			-	<MDC	0
	Th-228		NA	2.9 (2/28) (2.0 - 3.8)	5	0.88 Mi. SSW	3.8 (1/4)	<MDC	0
Rainwater (pCi/liter)	H-3	8	3000	<MDC			-	<MDC	0
	GAMMA	8							
	Co-60		15	<MDC			-	<MDC	0
	Cs-134		15	<MDC			-	<MDC	0
	Cs-137		18	<MDC			-	<MDC	0

TABLE B-2 - RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY
INDIAN POINT ENERGY CENTER - 2012
Dockets 50-03, 50-247 & 50-286

Medium or Pathway Sampled (Units)	Analysis Type	Total Number	LLD*	Indicator Locations Mean ** (Range)	Location with Highest Mean **Location Number**	Location with Highest Mean Distance Direction	Location with Highest Mean Mean (Range)	Control Locations Mean (Range)	Non-Routine Reported Measurements
Drinking Water (pCi/liter)	H-3	8	2000	<MDC			-	NA	0
	Gr-B	24	4	3.23 (15/24) (2.27 - 4.31)	08	6.3 Mi. SE	3.45 (8/12) (2.45 - 4.31)	NA	0
	GAMMA	24							
	Mn-54		15	<MDC			-	NA	0
	Co-58		15	<MDC			-	NA	0
	Fe-59		30	<MDC			-	NA	0
	Co-60		15	<MDC			-	NA	0
	Zn-65		30	<MDC			-	NA	0
	Nb-95		15	<MDC			-	NA	0
	Zr-95		15	<MDC			-	NA	0
	I-131		15	<MDC			-	NA	0
	Cs-134		15	<MDC			-	NA	0

TABLE B-2 - RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY
INDIAN POINT ENERGY CENTER - 2012
Dockets 50-03, 50-247 & 50-286

Medium or Pathway Sampled (Units)	Analysis Type	Total Number	LLD*	Indicator Locations	Location with Highest Mean			Control Locations	Non-Routine Reported Measurements
				Mean ** (Range)	**Location Number**	Distance Direction	Mean (Range)	Mean (Range)	
Drinking Water (cont'd) (pCi/liter)	Cs-137		18	<MDC			-	NA	0
	Ba-140		15	<MDC			-	NA	0
	La-140		15	<MDC			-	NA	0
Ground Water (pCi/liter)	H-3		2000	<MDC			-	NA	0
	Ni-63		30	<MDC			-	NA	0
	Sr-90		1	<MDC			-	NA	0
	GAMMA Mn-54		15	<MDC			-	NA	0
	Co-58		15	<MDC			-	NA	0
	Fe-59		30	<MDC			-	NA	0
	Co-60		15	<MDC			-	NA	0
	Zn-65		30	<MDC			-	NA	0
	Nb-95		15	<MDC			-	NA	0

TABLE B-2 - RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY
INDIAN POINT ENERGY CENTER - 2012
Dockets 50-03, 50-247 & 50-286

Medium or Pathway Sampled (Units)	Analysis Type	Total Number	LLD*	Indicator Locations	Location with Highest Mean			Control Locations	Non-Routine Reported Measurements
				Mean ** (Range)	**Location Number**	Distance Direction	Mean (Range)	Mean (Range)	
Ground Water (cont'd) (pCi/liter)	Zr-95		15	<MDC			-	NA	0
	Cs-134		15	<MDC			-	NA	0
	Cs-137		18	<MDC			-	NA	0
	Ba-140		60	<MDC			-	NA	0
	La-140		15 A	<MDC			-	NA	0
Soil (pCi/kg dry)	GAMMA	3							
	Be-7		NA	<MDC	23	20.7 Mi. N	900 (1/1)	900 (1/1)	0
	K-40		NA	13620 (2/2) (13500 - 13740)	23	20.7 Mi. N	17400 (1/1)	17400 (1/1)	0
	Co-60		NA	<MDC			-	<MDC	0
	Cs-134		150	<MDC			-	<MDC	0
	Cs-137		180	100 (1/2)	95	0.46 Mi. SSW	100 (1/1)	<MDC	0
	Ra-226		NA	<MDC	23	20.7 Mi. N	1420 (1/1)	1420 (1/1)	0
	Th-228		NA	499 (2/2) (396 - 602)	23	20.7 Mi. N	983 (1/1)	983 (1/1)	0

TABLE B-2 - RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY
INDIAN POINT ENERGY CENTER - 2012
Dockets 50-03, 50-247 & 50-286

Medium or Pathway Sampled (Units)	Analysis Type	Total Number	LLD*	Indicator Locations Mean ** (Range)	Location with Highest Mean: Location Number	Location with Highest Mean: Distance Direction	Location with Highest Mean: Mean (Range)	Control Locations Mean (Range)	Non-Routine Reported Measurements
Broadleaf Vegetation (pCi/kg wet)	I-131	45	60	<MDC			-	<MDC	0
Broadleaf Vegetation (cont'd) (pCi/kg wet)	GAMMA	63							
	BE-7		NA	1462 (41/42) (198 - 4691)	94	0.39 Mi. S	1613 (21/21) (198 - 4691)	1332 (21/21) (278 - 3939)	0
	K-40		NA	5618 (42/42) (1271 - 10520)	95	0.46 Mi. SSW	5896 (21/21) (3390 - 10520)	5156 (21/21) (1169 - 7807)	0
	Co-60		NA	<MDC			-	<MDC	0
	I-131		60	<MDC			-	<MDC	0
	Cs-134		60	<MDC			-	<MDC	0
	Cs-137		80	44.4 (1/42)	94	0.39 Mi. S	44.4 (1/21)	<MDC	0
	Th-228		NA	<MDC	23	20.7 Mi. N	35.8 (1/21)	35.8 (1/21)	0
River Water (pCi/liter)	H-3	8	3000	539 (2/4) (460 - 617)	10	0.3 Mi. WSW	539 (2/4) (460 - 617)	<MDC	0
	GAMMA	24							
	Mn-54		15	<MDC			-	<MDC	0
	Co-58		15	<MDC			-	<MDC	0

TABLE B-2 - RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY
INDIAN POINT ENERGY CENTER - 2012
Dockets 50-03, 50-247 & 50-286

Medium or Pathway Sampled (Units)	Analysis Type	Total Number	LLD*	Indicator Locations	**Location with Highest Mean**			Control Locations	Non-Routine Reported Measurements
				Mean ** (Range)	**Location Number**	Distance Direction	Mean (Range)	Mean (Range)	
River Water (cont'd) (pCi/liter)	Fe-59		30	<MDC			-	<MDC	0
	Co-60		15	<MDC			-	<MDC	0
	Zn-65		30	<MDC			-	<MDC	0
	Nb-95		15	<MDC			-	<MDC	0
	Zr-95		15	<MDC			-	<MDC	0
	I-131		15	<MDC			-	<MDC	0
	Cs-134		15	<MDC			-	<MDC	0
	Cs-137		18	<MDC			-	<MDC	0
	Ba-140		15	<MDC			-	<MDC	0
	La-140		15	<MDC			-	<MDC	0
Bottom Sediment (pCi/kg dry)	GAMMA	8							
	K-40		NA	18443 (6/6) (14850 - 21240)	84	10.88 Mi. N	32010 (2/2) (30690 - 33330)	32010 (2/2) (30690 - 33330)	0

TABLE B-2 - RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY
INDIAN POINT ENERGY CENTER - 2012
Dockets 50-03, 50-247 & 50-286

Medium or Pathway Sampled (Units)	Analysis Type	Total Number	LLD*	Indicator Locations Mean ** (Range)	Location with Highest Mean: Location Number	Distance Direction	Mean (Range)	Control Locations Mean (Range)	Non-Routine Reported Measurements
Bottom Sediment (cont'd) (pCi/kg dry)	Co-60		NA	<MDC			-	<MDC	0
	Cs-134		150	<MDC			-	<MDC	0
	Cs-137		180	284 (5/6) (234 - 397)	10	0.3 Mi. WSW	315 (2/2) (234 - 397)	<MDC	0
	Ra-226		NA	2109 (2/6) (2100 - 2117)	17	1.5 Mi. SSW	2117 (1/2)	1888 (1/2)	0
	Th-228		NA	928 (6/6) (282 - 1213)	17	1.5 Mi. SSW	1162 (2/2) (1111 - 1213)	655 (2/2) (593 - 716)	0
Shoreline Soil (pCi/kg dry)	Sr-90	10	5000	<MDC			-	<MDC	0
	GAMMA	10							
	K-40		NA	12167 (8/8) (2785 - 19790)	84	10.88 Mi. N	32300 (2/2) (31530 - 33070)	32300 (2/2) (31530 - 33070)	0
	Cs-134		150	<MDC			-	<MDC	0
	Cs-137		180	141 (2/8) (115 - 167)	17	1.5 Mi. SSW	141 (2/2) (115 - 167)	<MDC	0
	Ra-226		NA	3605 (4/8) (1172 - 7724)	50	4.48 Mi. NNW	4970 (2/2) (2216 - 7724)	<MDC	0
	Th-228		NA	529 (8/8) (102 - 1230)	28	0.45 Mi. ENE	777 (2/2) (324 - 1230)	549 (2/2) (478 - 620)	0

TABLE B-2 - RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY
INDIAN POINT ENERGY CENTER - 2012
Dockets 50-03, 50-247 & 50-286

Medium or Pathway Sampled (Units)	Analysis Type	Total Number	LLD*	Indicator Locations Mean ** (Range)	Location with Highest Mean: Location Number	Location with Highest Mean: Distance Direction	Location with Highest Mean: Mean (Range)	Control Locations Mean (Range)	Non-Routine Reported Measurements
Aquatic Vegetation (pCi/g wet)	GAMMA	4							
	Be-7		NA	360 (2/2) (338 - 383)	17	1.5 Mi. SSW	360 (2/2) (338 - 383)	206 (1/2)	0
	K-40		NA	2385 (2/2) (2069 - 2701)	17	1.5 Mi. SSW	2385 (2/2) (2069 - 2701)	1798 (2/2) (1332 - 2264)	0
	Co-60		NA	<MDC			-	<MDC	0
	I-131		NA	<MDC			-	<MDC	0
	Cs-134		NA	<MDC			-	<MDC	0
	Cs-137		NA	<MDC			-	<MDC	0
	Ra-226		NA	<MDC	84	10.88 Mi. N	355 (1/2)	355 (1/2)	0
	Th-228		NA	102 (2/2) (95 - 108)	17	1.5 Mi. SSW	102 (2/2) (95 - 108)	53.8 (1/2)	0
Fish (pCi/kg wet)	Ni-63	23	100	<MDC			-	<MDC	0
	Sr-90	21	5	<MDC			-	<MDC	0

TABLE B-2 - RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY
INDIAN POINT ENERGY CENTER - 2012
Dockets 50-03, 50-247 & 50-286

Medium or Pathway Sampled (Units)	Analysis Type	Total Number	LLD*	Indicator Locations Mean ** (Range)	Location with Highest Mean: Location Number	Distance Direction	Mean (Range)	Control Locations Mean (Range)	Non-Routine Reported Measurements
Fish (cont'd)	GAMMA	23							
(pCi/kg wet)	K-40		NA	3320 (11/11) (2541 - 4593)	25	Downstream	3320 (11/11) (2541 - 4593)	3183 (12/12) (2285 - 4239)	0
	Mn-54		130	<MDC			-	<MDC	0
	Co-58		130	<MDC			-	<MDC	0
	Fe-59		260	<MDC			-	<MDC	0
	Co-60		130	<MDC			-	<MDC	0
	Zn-65		260	<MDC			-	<MDC	0
	Cs-134		130	<MDC			-	<MDC	0
	Cs-137		150	<MDC			-	<MDC	0
	Th-228		NA	<MDC	23	20.7 Mi. N	177 (2/12) (168 - 186)	177 (2/12) (168 - 186)	0

* LLD is the Lower Limit of Detection
** The Mean Values are calculated only using the positive values; the fraction of positive values are listed in paraentheses
*** MDC is the Minimum Detectable Concentration. Except as indicated in Table B-1c, all MDCs are less than the required LLD.

INDIAN POINT ENERGY CENTER
TABLE B-3
DIRECT RADIATION, QUARTERLY DATA - 2012

mR/Quarter ± 1 sigma

Sample Nuclide	Station Number	First Quarter 01/01-03/31	Second Quarter 04/01-06/30	Third Quarter 07/01-09/30	Fourth Quarter 10/01-01/01	Annual Average	Annual Total
TLD	DR-01	12.1 ± 0.6	15.3 ± 0.8	14.8 ± 0.7	13.5 ± 0.6	13.9	55.6
	DR-02	12.6 ± 0.7	15.2 ± 0.9	14.0 ± 0.5	14.2 ± 0.7	14.0	55.9
	DR-03	9.7 ± 0.7	11.6 ± 0.9	11.5 ± 0.5	11.4 ± 0.6	11.1	44.2
	DR-04	11.7 ± 0.6	13.7 ± 0.7	13.6 ± 0.5	13.1 ± 0.6	13.0	52.2
	DR-05	11.8 ± 0.7	14.4 ± 1.0	13.7 ± 0.9	13.7 ± 0.6	13.4	53.6
	DR-06	12.4 ± 0.8	14.5 ± 0.8	13.9 ± 0.6	13.9 ± 0.7	13.7	54.8
	DR-07	13.8 ± 0.8	16.2 ± 0.8	15.8 ± 0.7	15.2 ± 0.6	15.3	61.1
	DR-08	9.7 ± 0.8	12.2 ± 0.6	11.8 ± 0.5	11.3 ± 0.5	11.3	45.1
	DR-09	11.0 ± 1.0	13.3 ± 0.8	12.9 ± 0.5	12.8 ± 0.6	12.5	50.0
	DR-10	12.1 ± 0.7	14.8 ± 0.9	14.0 ± 0.7	13.9 ± 0.7	13.7	54.9
	DR-11	9.0 ± 0.6	11.0 ± 0.6	10.9 ± 0.5	10.6 ± 0.7	10.4	41.4
	DR-12	13.6 ± 0.8	15.8 ± 1.0	15.7 ± 0.8	14.5 ± 0.8	14.9	59.5
	DR-13	14.4 ± 0.8	16.6 ± 0.8	16.3 ± 0.6	15.0 ± 0.6	15.6	62.3
	DR-14	11.4 ± 0.5	13.6 ± 0.7	13.3 ± 0.6	12.2 ± 0.8	12.6	50.5
	DR-15	11.2 ± 0.7	13.6 ± 0.8	13.4 ± 0.5	12.1 ± 0.6	12.6	50.3
	DR-16	12.1 ± 0.6	14.9 ± 0.9	15.0 ± 0.6	13.1 ± 0.6	13.8	55.1
	DR-17	12.8 ± 0.6	15.2 ± 0.8	14.4 ± 0.6	13.4 ± 0.7	13.9	55.8
	DR-18	12.4 ± 0.7	15.1 ± 1.0	14.6 ± 0.9	14.1 ± 0.8	14.1	56.3
	DR-19	12.5 ± 0.7	15.1 ± 1.0	14.3 ± 0.7	14.0 ± 0.9	14.0	55.9
	DR-20	11.7 ± 0.6	14.2 ± 0.7	13.8 ± 0.6	13.7 ± 0.6	13.3	53.4
	DR-21	11.4 ± 0.7	14.0 ± 1.1	13.6 ± 0.6	12.9 ± 0.7	13.0	51.9
	DR-22	9.3 ± 0.6	11.5 ± 0.7	11.0 ± 0.7	10.8 ± 0.5	10.6	42.6
	DR-23	11.6 ± 0.6	14.3 ± 0.8	13.9 ± 0.7	13.7 ± 0.9	13.4	53.6
	DR-24	11.9 ± 0.7	15.0 ± 0.9	14.1 ± 0.5	14.8 ± 0.8	14.0	55.8
	DR-25	10.3 ± 0.6	12.0 ± 0.8	12.2 ± 0.5	11.2 ± 0.6	11.4	45.7

INDIAN POINT ENERGY CENTER
TABLE B-3
DIRECT RADIATION, QUARTERLY DATA - 2012

mR/Quarter ± 1 sigma

Sample Nuclide	Station Number	First Quarter 01/01-03/31	Second Quarter 04/01-06/30	Third Quarter 07/01-09/30	Fourth Quarter 10/01-01/01	Annual Average	Annual Total
TLD	DR-26	12.0 ± 0.6	14.0 ± 0.8	13.8 ± 0.6	13.2 ± 0.5	13.2	53.0
	DR-27	11.9 ± 0.6	13.4 ± 0.8	13.6 ± 0.7	12.6 ± 0.8	12.9	51.5
	DR-28	(a)	19.5 ± 0.9	19.9 ± 0.7	18.5 ± 0.7	19.3	77.1
	DR-29	12.1 ± 0.7	14.4 ± 1.3	15.0 ± 0.8	13.7 ± 0.8	13.8	55.2
	DR-30	12.2 ± 0.7	14.4 ± 0.7	14.7 ± 0.8	13.4 ± 0.6	13.7	54.7
	DR-31	14.0 ± 0.6	16.2 ± 0.8	16.1 ± 0.6	15.2 ± 0.6	15.4	61.5
	DR-32	10.6 ± 0.5	13.1 ± 0.6	13.1 ± 0.9	11.9 ± 0.7	12.2	48.7
	DR-33	11.6 ± 0.8	14.5 ± 1.0	13.9 ± 0.6	13.3 ± 0.7	13.3	53.4
	DR-34	10.7 ± 0.8	13.1 ± 0.7	13.4 ± 0.6	13.1 ± 0.7	12.6	50.2
	DR-35	10.3 ± 0.6	13.5 ± 0.9	13.6 ± 0.7	12.8 ± 0.7	12.5	50.2
	DR-36	12.7 ± 0.8	14.7 ± 0.9	15.0 ± 0.6	14.4 ± 0.7	14.2	56.7
	DR-37	11.7 ± 0.7	14.6 ± 1.4	13.4 ± 0.6	13.6 ± 0.8	13.3	53.3
	DR-38	10.2 ± 0.7	12.5 ± 0.8	12.3 ± 0.9	11.7 ± 0.6	11.7	46.7
	DR-39	12.2 ± 0.6	14.4 ± 0.8	14.6 ± 0.6	13.5 ± 0.7	13.7	54.8
	DR-40*	11.0 ± 0.7	13.5 ± 1.0	13.0 ± 0.6	11.8 ± 0.6	12.3	49.3
	DR-41	11.0 ± 0.7	13.2 ± 0.7	13.0 ± 0.7	13.0 ± 0.9	12.5	50.2
AVERAGE (Indicator Locations)		11.7	14.2	13.9	13.3	13.3	53.4

* Control location

(a) TLD missing, the annual total is based on using the 3 quarters average for the first quarter.

INDIAN POINT ENERGY CENTER
TABLE B-4
DIRECT RADIATION, 2002 THROUGH 2012 DATA

mR per Year

Station Number	Mean (2002-2011)	Standard Deviation (2002-2011)	Minimum Value (2002-2011)	Maximum Value (2002-2011)	2012 Mean
DR-01	61.3	2.3	58.3	66.0	55.6
DR-02	57.7	1.9	53.6	60.0	55.9
DR-03	47.3	1.7	44.0	50.0	44.2
DR-04	53.8	3.1	46.8	58.0	52.2
DR-05	54.3	2.3	48.4	56.8	53.6
DR-06	54.6	3.3	46.4	57.6	54.8
DR-07	63.2	3.2	55.6	66.4	61.1
DR-08	49.9	2.6	46.6	54.4	45.1
DR-09	52.7	2.3	47.2	55.2	50.0
DR-10	57.3	1.8	53.6	60.0	54.9
DR-11	43.9	1.7	40.8	46.4	41.4
DR-12	65.6	4.8	60.5	76.0	59.5
DR-13	74.8	5.3	65.6	82.0	62.3
DR-14	53.1	1.9	50.0	56.0	50.5
DR-15	52.2	2.4	46.4	54.8	50.3
DR-16	58.1	2.1	55.2	61.6	55.1
DR-17	58.7	1.9	56.4	61.2	55.8
DR-18	56.4	2.1	52.4	59.1	56.3
DR-19	59.1	2.1	55.2	61.6	55.9
DR-20	52.7	2.2	47.6	55.2	53.4
DR-21	54.8	2.2	50.0	57.6	51.9
DR-22	44.8	1.7	40.4	46.4	42.6
DR-23	55.1	2.3	49.6	58.0	53.6
DR-24	56.7	2.9	49.2	58.8	55.8
DR-25	49.5	2.3	44.8	52.8	45.7
DR-26	55.1	2.3	50.4	58.8	53.0
DR-27	54.2	3.2	46.8	59.2	51.5
DR-28	72.8	7.9	57.2	79.1	77.1
DR-29	59.1	5.6	54.8	73.6	55.2
DR-30	59.1	3.5	52.4	65.2	54.7
DR-31	67.1	2.8	62.0	72.0	61.5
DR-32	51.6	2.3	46.0	54.8	48.7

INDIAN POINT ENERGY CENTER
TABLE B-4
DIRECT RADIATION, 2002 THROUGH 2012 DATA

mR per Year

Station Number	Mean (2002-2011)	Standard Deviation (2002-2011)	Minimum Value (2002-2011)	Maximum Value (2002-2011)	2012 Mean
DR-33	52.0	6.4	34.4	55.2	53.4
DR-34	50.8	3.0	43.2	54.8	50.2
DR-35	53.6	2.5	48.8	56.4	50.2
DR-36	58.7	2.4	52.4	60.8	56.7
DR-37	54.3	2.6	48.8	58.0	53.3
DR-38	50.8	2.4	48.0	56.0	46.7
DR-39	60.3	2.4	55.2	63.2	54.8
DR-40*	61.5	7.8	51.9	75.2	49.3
DR-41	50.7	2.6	44.4	53.6	50.2
AVERAGE (Indicator Locations)	55.9				53.4

* Control location

INDIAN POINT ENERGY CENTER

TABLE B-5

DIRECT RADIATION, INNER AND OUTER RINGS - 2012

(mR per Year)

Inner Ring ID	Outer Ring ID	Sector	Inner Ring Annual Average	Outer Ring Annual Average
DR-01	DR-17	N	55.6	55.8
DR-02	DR-18	NNE	55.9	56.3
DR-03	DR-19	NE	44.2	55.9
DR-04	DR-20	ENE	52.2	53.4
DR-05	DR-21	ENE	53.6	51.9
DR-06	DR-22	ESE	54.8	42.6
DR-07	DR-23	SE	61.1	53.6
DR-08	DR-24	SSE	45.1	55.8
DR-09	DR-25	S	50.0	45.7
DR-10	DR-26	SSW	54.9	53.0
DR-11	DR-27	SW	41.4	51.5
DR-12	DR-28	WSW	59.5	77.1
DR-13	DR-29	WSW	62.3	55.2
DR-14	DR-30	WNW	50.5	54.7
DR-15	DR-31	NW	50.3	61.5
DR-16	DR-32	NNW	55.1	48.7
Average			52.9	54.5

INDIAN POINT ENERGY CENTER
TABLE B-6
GROSS BETA ACTIVITY IN AIRBORNE PARTICULATE SAMPLES - 2012

pCi/m^3 ± 2 Sigma

PERIOD ENDING	Algonquin 4	NYU Tower 5	Roseton 23*	Croton Point 27	Grassy Point 29	Peekskill 44	Training Building 94	Met Tower 95
01/09/12	0.016 ± 0.003	0.016 ± 0.003	0.015 ± 0.003	0.016 ± 0.003	0.018 ± 0.002	0.017 ± 0.003	0.014 ± 0.003	0.017 ± 0.003
01/17/12	0.011 ± 0.002	0.010 ± 0.002	0.011 ± 0.002	0.009 ± 0.002	0.009 ± 0.002	0.008 ± 0.002	0.011 ± 0.002	0.010 ± 0.002
01/23/12	0.012 ± 0.002	0.012 ± 0.003	0.013 ± 0.003	0.015 ± 0.003	0.012 ± 0.002	0.013 ± 0.003	0.013 ± 0.003	0.015 ± 0.003
01/30/12	0.012 ± 0.003	0.011 ± 0.003	0.012 ± 0.003	0.011 ± 0.002	0.013 ± 0.002	0.011 ± 0.003	0.011 ± 0.002	0.011 ± 0.002
02/06/12	0.015 ± 0.002	0.016 ± 0.002	0.017 ± 0.003	0.016 ± 0.002	0.015 ± 0.002	0.016 ± 0.003	0.015 ± 0.002	0.017 ± 0.002
02/13/12	0.012 ± 0.002	0.012 ± 0.002	0.013 ± 0.002	0.012 ± 0.002	0.011 ± 0.002	0.013 ± 0.002	0.013 ± 0.002	0.011 ± 0.002
02/21/12	0.014 ± 0.002	0.013 ± 0.002	0.016 ± 0.002	0.017 ± 0.002	0.013 ± 0.002	0.014 ± 0.002	0.015 ± 0.002	0.016 ± 0.002
02/27/12	0.014 ± 0.003	0.012 ± 0.002	0.010 ± 0.002	0.013 ± 0.002	0.012 ± 0.002	0.014 ± 0.003	0.014 ± 0.002	0.017 ± 0.003
03/05/12	0.011 ± 0.002	0.012 ± 0.003	0.009 ± 0.002	0.012 ± 0.003	0.011 ± 0.002	0.011 ± 0.003	0.013 ± 0.002	0.014 ± 0.002
03/12/12	0.015 ± 0.002	0.014 ± 0.002	0.013 ± 0.002	0.015 ± 0.002	0.011 ± 0.002	0.012 ± 0.002	0.013 ± 0.002	0.013 ± 0.002
03/19/12	0.014 ± 0.002	0.013 ± 0.002	0.014 ± 0.002	0.013 ± 0.002	0.014 ± 0.002	0.012 ± 0.002	0.014 ± 0.002	0.017 ± 0.002
03/26/12	0.016 ± 0.003	0.016 ± 0.003	0.014 ± 0.003	0.014 ± 0.003	0.014 ± 0.002	0.014 ± 0.003	0.016 ± 0.003	0.017 ± 0.003
04/02/12	0.011 ± 0.002	0.016 ± 0.003	0.012 ± 0.002	0.013 ± 0.002	0.010 ± 0.002	0.013 ± 0.003	0.012 ± 0.002	0.014 ± 0.002
04/09/12	0.015 ± 0.003	0.016 ± 0.003	0.015 ± 0.003	0.014 ± 0.002	0.012 ± 0.002	0.015 ± 0.003	0.013 ± 0.002	0.014 ± 0.002
04/16/12	0.013 ± 0.002	0.015 ± 0.002	0.015 ± 0.002	0.016 ± 0.002	0.014 ± 0.002	0.013 ± 0.002	0.016 ± 0.002	0.013 ± 0.002
04/23/12	0.012 ± 0.002	0.013 ± 0.002	0.012 ± 0.002	0.011 ± 0.002	0.013 ± 0.002	0.014 ± 0.003	0.012 ± 0.002	0.013 ± 0.002
04/30/12	0.013 ± 0.002	0.014 ± 0.002	0.013 ± 0.002	0.012 ± 0.002	0.013 ± 0.002	0.011 ± 0.002	0.012 ± 0.002	0.013 ± 0.002
05/07/12	0.008 ± 0.002	0.007 ± 0.002	0.009 ± 0.002	0.007 ± 0.002	0.007 ± 0.002	0.008 ± 0.002	0.007 ± 0.002	0.008 ± 0.002
05/14/12	0.016 ± 0.003	0.015 ± 0.003	0.013 ± 0.002	0.015 ± 0.002	0.014 ± 0.002	0.013 ± 0.003	0.015 ± 0.002	0.013 ± 0.002
05/21/12	0.012 ± 0.002	0.013 ± 0.002	0.010 ± 0.002	0.009 ± 0.002	0.011 ± 0.002	0.009 ± 0.002	0.011 ± 0.002	0.010 ± 0.002
05/29/12	0.008 ± 0.002	0.009 ± 0.002	0.013 ± 0.002	0.009 ± 0.002	0.009 ± 0.002	0.008 ± 0.002	0.010 ± 0.002	0.010 ± 0.002
06/04/12	0.010 ± 0.003	0.009 ± 0.002	0.010 ± 0.002	0.009 ± 0.002	0.010 ± 0.002	0.012 ± 0.003	0.009 ± 0.002	0.012 ± 0.003
06/11/12	0.013 ± 0.002	0.010 ± 0.002	0.011 ± 0.002	0.011 ± 0.002	0.009 ± 0.002	0.013 ± 0.003	0.012 ± 0.002	0.011 ± 0.002
06/18/12	0.010 ± 0.002	0.011 ± 0.002	0.010 ± 0.002	0.009 ± 0.002	0.009 ± 0.002	0.012 ± 0.002	0.009 ± 0.002	0.008 ± 0.002
06/25/12	0.014 ± 0.002	0.016 ± 0.003	0.014 ± 0.002	0.015 ± 0.002	0.014 ± 0.002	0.016 ± 0.003	0.015 ± 0.002	0.018 ± 0.003
07/02/12	0.018 ± 0.003	0.015 ± 0.002	0.015 ± 0.002	0.016 ± 0.003	0.016 ± 0.002	0.016 ± 0.003	0.015 ± 0.002	0.016 ± 0.002

* Control location

INDIAN POINT ENERGY CENTER
TABLE B-6
GROSS BETA ACTIVITY IN AIRBORNE PARTICULATE SAMPLES - 2012

$pCi/m^3 \pm 2$ Sigma

PERIOD ENDING	Algonquin 4	NYU Tower 5	Roseton 23*	Croton Point 27	Grassy Point 29	Peekskill 44	Training Building 94	Met Tower 95
07/09/12	0.015 ± 0.003	0.015 ± 0.003	0.015 ± 0.002	0.015 ± 0.002	0.013 ± 0.002	0.014 ± 0.003	0.016 ± 0.002	0.012 ± 0.002
07/16/12	0.016 ± 0.003	0.014 ± 0.003	0.016 ± 0.003	0.014 ± 0.002	0.014 ± 0.002	0.014 ± 0.003	0.013 ± 0.002	0.014 ± 0.002
07/23/12	0.014 ± 0.002	0.015 ± 0.002	0.016 ± 0.003	0.015 ± 0.002	0.013 ± 0.002	0.017 ± 0.003	0.015 ± 0.002	0.014 ± 0.002
07/30/12	0.013 ± 0.003	0.012 ± 0.003	0.012 ± 0.003	0.012 ± 0.002	0.012 ± 0.002	0.012 ± 0.002	0.013 ± 0.002	0.013 ± 0.002
08/06/12	0.017 ± 0.003	0.014 ± 0.003	0.018 ± 0.003	0.016 ± 0.003	0.018 ± 0.002	0.017 ± 0.002	0.017 ± 0.003	0.019 ± 0.003
08/13/12	0.013 ± 0.002	0.011 ± 0.002	0.014 ± 0.002	0.011 ± 0.002	0.012 ± 0.002	0.014 ± 0.002	0.010 ± 0.002	0.011 ± 0.002
08/20/12	0.014 ± 0.002	0.012 ± 0.002	0.013 ± 0.002	0.014 ± 0.002	0.014 ± 0.002	0.013 ± 0.002	0.014 ± 0.002	0.015 ± 0.002
08/27/12	0.020 ± 0.003	0.019 ± 0.003	0.018 ± 0.003	0.020 ± 0.003	0.017 ± 0.002	0.020 ± 0.003	0.020 ± 0.003	0.021 ± 0.003
09/04/12	0.017 ± 0.002	0.017 ± 0.002	0.019 ± 0.002	0.019 ± 0.002	0.016 ± 0.002	0.017 ± 0.002	0.020 ± 0.002	0.018 ± 0.002
09/10/12	0.014 ± 0.003	0.014 ± 0.003	0.013 ± 0.003	0.012 ± 0.003	0.015 ± 0.002	0.014 ± 0.003	0.014 ± 0.003	0.015 ± 0.003
09/17/12	0.011 ± 0.002	0.013 ± 0.002	0.014 ± 0.002	0.015 ± 0.002	0.011 ± 0.002	0.015 ± 0.002	0.014 ± 0.002	0.011 ± 0.002
09/24/12	0.012 ± 0.003	0.014 ± 0.003	0.013 ± 0.003	0.012 ± 0.002	0.011 ± 0.002	0.012 ± 0.002	0.012 ± 0.002	0.010 ± 0.002
10/01/12	0.015 ± 0.003	0.016 ± 0.003	0.013 ± 0.003	0.014 ± 0.003	0.015 ± 0.002	0.013 ± 0.002	0.015 ± 0.003	0.013 ± 0.003
10/09/12	0.016 ± 0.003	0.014 ± 0.002	0.016 ± 0.002	0.018 ± 0.003	0.015 ± 0.002	0.017 ± 0.002	0.015 ± 0.002	0.015 ± 0.002
10/15/12	0.014 ± 0.003	0.011 ± 0.003	0.014 ± 0.003	0.013 ± 0.003	0.012 ± 0.002	0.012 ± 0.003	0.012 ± 0.003	0.011 ± 0.003
10/22/12	0.014 ± 0.002	0.014 ± 0.002	0.011 ± 0.002	0.010 ± 0.002	0.013 ± 0.002	0.014 ± 0.002	0.012 ± 0.002	0.012 ± 0.002
10/29/12	0.018 ± 0.003	0.018 ± 0.003	0.022 ± 0.003	0.017 ± 0.003	0.017 ± 0.002	0.018 ± 0.003	0.017 ± 0.003	0.019 ± 0.003
11/05/12	0.004 ± 0.002	0.004 ± 0.002	0.005 ± 0.003	0.005 ± 0.002	0.003 ± 0.002	0.004 ± 0.002	0.003 ± 0.002	0.004 ± 0.002
11/13/12	0.017 ± 0.003	0.016 ± 0.002	0.016 ± 0.002	0.017 ± 0.002	0.016 ± 0.002	0.016 ± 0.002	0.016 ± 0.002	0.017 ± 0.002
11/19/12	0.018 ± 0.003	0.017 ± 0.003	0.017 ± 0.003	0.017 ± 0.003	0.017 ± 0.003	0.019 ± 0.003	0.016 ± 0.003	0.017 ± 0.003
11/26/12	0.022 ± 0.003	0.024 ± 0.003	0.023 ± 0.003	0.025 ± 0.003	0.021 ± 0.002	0.022 ± 0.003	0.025 ± 0.003	0.021 ± 0.003
12/03/12	0.023 ± 0.003	0.024 ± 0.003	0.023 ± 0.003	0.022 ± 0.003	0.021 ± 0.002	0.021 ± 0.003	0.022 ± 0.003	0.025 ± 0.003
12/10/12	0.014 ± 0.002	0.016 ± 0.003	0.016 ± 0.002	0.014 ± 0.002	0.015 ± 0.002	0.018 ± 0.002	0.015 ± 0.002	0.015 ± 0.002
12/18/12	0.014 ± 0.002	0.013 ± 0.002	0.015 ± 0.002	0.013 ± 0.002	0.014 ± 0.002	0.016 ± 0.002	0.014 ± 0.002	0.017 ± 0.002
12/26/12	0.011 ± 0.002	0.013 ± 0.002	0.011 ± 0.002	0.011 ± 0.002	0.012 ± 0.002	0.011 ± 0.002	0.011 ± 0.002	0.010 ± 0.002
01/02/13	0.014 ± 0.002	0.015 ± 0.002	0.014 ± 0.002	0.015 ± 0.002	0.015 ± 0.002	0.015 ± 0.002	0.015 ± 0.002	0.015 ± 0.002

* Control location

INDIAN POINT ENERGY CENTER
TABLE B-7
IODINE-131 ACTIVITY IN AIRBORNE CHARCOAL SAMPLES - 2012

$pCi/m^3 \pm 2$ Sigma

PERIOD ENDING	Algonquin 4	NYU Tower 5	Roseton 23*	Croton Point 27	Grassy Point 29	Peekskill 44	Training Building 94	Met Tower 95
01/09/12	< 0.0246	< 0.0242	< 0.0196	< 0.0239	< 0.0152	< 0.0211	< 0.0227	< 0.0186
01/17/12	< 0.0150	< 0.0151	< 0.0182	< 0.0146	< 0.0137	< 0.0189	< 0.0139	< 0.0167
01/23/12	< 0.0180	< 0.0219	< 0.0194	< 0.0216	< 0.0148	< 0.0210	< 0.0202	< 0.0176
01/30/12	< 0.0239	< 0.0244	< 0.0188	< 0.0237	< 0.0142	< 0.0204	< 0.0222	< 0.0170
02/06/12	< 0.0172	< 0.0170	< 0.0203	< 0.0163	< 0.0204	< 0.0223	< 0.0160	< 0.0192
02/13/12	< 0.0275	< 0.0275	< 0.0403	< 0.0271	< 0.0304	< 0.0439	< 0.0255	< 0.0355
02/21/12	< 0.0107	< 0.0107	< 0.0169	< 0.0104	< 0.0128	< 0.0182	< 0.0100	< 0.0158
02/27/12	< 0.0163	< 0.0163	< 0.0164	< 0.0158	< 0.0123	< 0.0182	< 0.0151	< 0.0151
03/05/12	< 0.0261	< 0.0268	< 0.0229	< 0.0260	< 0.0172	< 0.0250	< 0.0244	< 0.0210
03/12/12	< 0.0122	< 0.0119	< 0.0141	< 0.0116	< 0.0107	< 0.0154	< 0.0113	< 0.0130
03/19/12	< 0.0140	< 0.0140	< 0.0234	< 0.0136	< 0.0178	< 0.0254	< 0.0129	< 0.0218
03/26/12	< 0.0105	< 0.0106	< 0.0070	< 0.0102	< 0.0052	< 0.0074	< 0.0097	< 0.0064
04/02/12	< 0.0130	< 0.0129	< 0.0222	< 0.0127	< 0.0166	< 0.0233	< 0.0121	< 0.0207
04/09/12	< 0.0197	< 0.0199	< 0.0204	< 0.0192	< 0.0154	< 0.0216	< 0.0184	< 0.0188
04/16/12	< 0.0160	< 0.0160	< 0.0155	< 0.0154	< 0.0117	< 0.0168	< 0.0148	< 0.0144
04/23/12	< 0.0270	< 0.0273	< 0.0255	< 0.0265	< 0.0190	< 0.0276	< 0.0250	< 0.0230
04/30/12	< 0.0313	< 0.0314	< 0.0243	< 0.0305	< 0.0179	< 0.0264	< 0.0291	< 0.0229
05/07/12	< 0.0236	< 0.0191	< 0.0456	< 0.0186	< 0.0343	< 0.0483	< 0.0174	< 0.0400
05/14/12	< 0.0198	< 0.0197	< 0.0263	< 0.0190	< 0.0201	< 0.0278	< 0.0184	< 0.0249
05/21/12	< 0.0373	< 0.0364	< 0.0302	< 0.0358	< 0.0228	< 0.0329	< 0.0332	< 0.0279
05/29/12	< 0.0217	< 0.0221	< 0.0272	< 0.0211	< 0.0204	< 0.0293	< 0.0203	< 0.0249
06/04/12	< 0.0400	< 0.0404	< 0.0305	< 0.0389	< 0.0224	< 0.0329	< 0.0367	< 0.0287
06/11/12	< 0.0395	< 0.0396	< 0.0285	< 0.0382	< 0.0220	< 0.0310	< 0.0364	< 0.0258
06/18/12	< 0.0372	< 0.0371	< 0.0271	< 0.0359	< 0.0206	< 0.0296	< 0.0342	< 0.0250
06/25/12	< 0.0532	< 0.0534	< 0.0597	< 0.0513	< 0.0450	< 0.0646	< 0.0489	< 0.0561
07/02/12	< 0.0224	< 0.0224	< 0.0143	< 0.0216	< 0.0105	< 0.0156	< 0.0207	< 0.0132

* Control location

INDIAN POINT ENERGY CENTER
TABLE B-7
IODINE-131 ACTIVITY IN AIRBORNE CHARCOAL SAMPLES - 2012

pCi/m^3 ± 2 Sigma

PERIOD ENDING	Algonquin 4	NYU Tower 5	Roseton 23*	Croton Point 27	Grassy Point 29	Peekskill 44	Training Building 94	Met Tower 95
07/09/12	< 0.0149	< 0.0150	< 0.0154	< 0.0143	< 0.0120	< 0.0171	< 0.0137	< 0.0147
07/16/12	< 0.0207	< 0.0210	< 0.0230	< 0.0205	< 0.0167	< 0.0246	< 0.0192	< 0.0207
07/23/12	< 0.0194	< 0.0191	< 0.0286	< 0.0182	< 0.0213	< 0.0284	< 0.0177	< 0.0270
07/30/12	< 0.0178	< 0.0237	< 0.0137	< 0.0172	< 0.0106	< 0.0134	< 0.0165	< 0.0127
08/06/12	< 0.0198	< 0.0201	< 0.0282	< 0.0191	< 0.0216	< 0.0271	< 0.0183	< 0.0266
08/13/12	< 0.0157	< 0.0157	< 0.0202	< 0.0150	< 0.0152	< 0.0190	< 0.0145	< 0.0185
08/20/12	< 0.0141	< 0.0141	< 0.0113	< 0.0136	< 0.0086	< 0.0105	< 0.0130	< 0.0104
08/27/12	< 0.0285	< 0.0283	< 0.0225	< 0.0271	< 0.0170	< 0.0206	< 0.0264	< 0.0208
09/04/12	< 0.0295	< 0.0297	< 0.0279	< 0.0286	< 0.0212	< 0.0259	< 0.0274	< 0.0262
09/10/12	< 0.0172	< 0.0175	< 0.0168	< 0.0168	< 0.0127	< 0.0160	< 0.0160	< 0.0155
09/17/12	< 0.0551	< 0.0547	< 0.0158	< 0.0527	< 0.0120	< 0.0149	< 0.0513	< 0.0148
09/24/12	< 0.0236	< 0.0236	< 0.0177	< 0.0224	< 0.0132	< 0.0159	< 0.0220	< 0.0165
10/01/12	< 0.0218	< 0.0220	< 0.0167	< 0.0216	< 0.0131	< 0.0151	< 0.0202	< 0.0159
10/09/12	< 0.0301	< 0.0305	< 0.0291	< 0.0301	< 0.0222	< 0.0261	< 0.0280	< 0.0278
10/15/12	< 0.0246	< 0.0241	< 0.0197	< 0.0238	< 0.0149	< 0.0176	< 0.0230	< 0.0183
10/22/12	< 0.0254	< 0.0259	< 0.0359	< 0.0255	< 0.0266	< 0.0319	< 0.0238	< 0.0324
10/29/12	< 0.0183	< 0.0180	< 0.0173	< 0.0175	< 0.0133	< 0.0154	< 0.0169	< 0.0167
11/05/12	< 0.0143	< 0.0142	< 0.0404	< 0.0138	< 0.0262	< 0.0215	< 0.0133	< 0.0268
11/13/12	< 0.0510	< 0.0509	< 0.0331	< 0.0504	< 0.0306	< 0.0355	< 0.0483	< 0.0394
11/19/12	< 0.0458	< 0.0457	< 0.0576	< 0.0451	< 0.0360	< 0.0419	< 0.0430	< 0.0424
11/26/12	< 0.0236	< 0.0234	< 0.0282	< 0.0229	< 0.0215	< 0.0249	< 0.0222	< 0.0257
12/03/12	< 0.0236	< 0.0236	< 0.0125	< 0.0233	< 0.0095	< 0.0112	< 0.0224	< 0.0115
12/10/12	< 0.0122	< 0.0122	< 0.0098	< 0.0119	< 0.0074	< 0.0086	< 0.0115	< 0.0090
12/18/12	< 0.0145	< 0.0144	< 0.0133	< 0.0141	< 0.0103	< 0.0120	< 0.0137	< 0.0123
12/26/12	< 0.0232	< 0.0233	< 0.0292	< 0.0227	< 0.0223	< 0.0266	< 0.0220	< 0.0270
01/02/13	< 0.0173	< 0.0172	< 0.0172	< 0.0169	< 0.0128	< 0.0154	< 0.0164	< 0.0156

* Control location

INDIAN POINT ENERGY CENTER
TABLE B-8
GAMMA EMITTERS IN AIRBORNE PARTICULATE SAMPLES - 2012

10^{-3} pCi/m^3 ± 2 Sigma

	Algonquin 4				NYU Tower 5			
DATE	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Be-7	50 ± 13	80 ± 14	64 ± 16	66 ± 19	58 ± 12	71 ± 20	62 ± 16	84 ± 22
K-40	< 18	< 18	< 23	< 14	< 14	< 14	< 29	< 21
Mn-54	< 1	< 1	< 1	< 1	< 1	< 2	< 1	< 1
Co-58	< 2	< 2	< 1	< 2	< 2	< 2	< 1	< 3
Fe-59	< 4	< 3	< 2	< 8	< 5	< 6	< 4	< 9
Co-60	< 1	< 1	< 1	< 1	< 2	< 2	< 1	< 1
Zn-65	< 2	< 2	< 2	< 2	< 3	< 6	< 2	< 4
Nb-95	< 1	< 1	< 2	< 2	< 1	< 3	< 2	< 3
Zr-95	< 3	< 2	< 3	< 4	< 3	< 4	< 5	< 4
Ru-103	< 2	< 2	< 1	< 3	< 2	< 3	< 2	< 4
Ru-106	< 12	< 10	< 7	< 9	< 12	< 16	< 6	< 12
I-131	< 57	< 12	< 31	< 530	< 54	< 20	< 43	< 800
Cs-134	< 1	< 1	< 1	< 1	< 1	< 2	< 1	< 1
Cs-137	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ba-140	< 38	< 15	< 34	< 178	< 44	< 29	< 43	< 209
La-140	< 22	< 8	< 13	< 68	< 16	< 13	< 14	< 120
Ce-141	< 3	< 2	< 3	< 5	< 3	< 3	< 3	< 6
Ce-144	< 5	< 5	< 6	< 5	< 6	< 6	< 5	< 6
Ra-226	< 19	< 20	< 21	< 16	< 20	< 29	< 19	< 22
Ac-228	< 3	< 4	< 4	< 4	< 4	< 7	< 4	< 4
Th-228	< 2	< 2	< 2	< 1	4 ± 2	< 3	< 2	< 2

INDIAN POINT ENERGY CENTER
TABLE B-8
GAMMA EMITTERS IN AIRBORNE PARTICULATE SAMPLES - 2012

10^{-3} pCi/m^3 ± 2 Sigma

	Roseton 23*				Croton Point 27			
DATE	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Be-7	60 ± 22	63 ± 16	58 ± 17	111 ± 29	58 ± 16	65 ± 13	59 ± 22	77 ± 21
K-40	< 25	< 20	< 15	< 30	< 20	< 9	< 15	< 21
Mn-54	< 1	< 2	< 2	< 2	< 1	< 1	< 2	< 1
Co-58	< 2	< 2	< 2	< 3	< 2	< 1	< 2	< 2
Fe-59	< 4	< 6	< 5	< 8	< 5	< 4	< 7	< 8
Co-60	< 1	< 2	< 2	< 1	< 1	< 1	< 1	< 1
Zn-65	< 3	< 5	< 4	< 4	< 3	< 3	< 4	< 2
Nb-95	< 2	< 2	< 3	< 3	< 2	< 2	< 3	< 2
Zr-95	< 4	< 4	< 3	< 6	< 3	< 3	< 4	< 4
Ru-103	< 3	< 2	< 3	< 5	< 3	< 2	< 3	< 3
Ru-106	< 14	< 17	< 14	< 16	< 10	< 12	< 14	< 12
I-131	< 82	< 22	< 52	< 854	< 75	< 13	< 70	< 760
Cs-134	< 1	< 2	< 2	< 2	< 1	< 1	< 2	< 1
Cs-137	< 1	< 1	< 2	< 1	< 1	< 1	< 1	< 1
Ba-140	< 60	< 27	< 48	< 237	< 45	< 19	< 58	< 214
La-140	< 25	< 9	< 12	< 126	< 16	< 8	< 13	< 55
Ce-141	< 3	< 3	< 4	< 8	< 3	< 2	< 4	< 6
Ce-144	< 7	< 6	< 6	< 9	< 5	< 6	< 7	< 6
Ra-226	< 22	< 28	< 26	< 28	< 23	< 23	< 27	< 20
Ac-228	< 4	< 7	< 6	< 6	< 4	< 4	< 7	< 5
Th-228	< 2	< 2	< 2	< 2	< 2	< 2	< 3	< 2

* Control location

INDIAN POINT ENERGY CENTER

TABLE B-8

GAMMA EMITTERS IN AIRBORNE PARTICULATE SAMPLES - 2012

10^{-3} pCi/m^3 ± 2 Sigma

	Grassy Point 29				Peekskill 44			
DATE	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Be-7	51.1 ± 14.5	58.8 ± 11.2	51.4 ± 20.4	78.2 ± 29.6	55.7 ± 13.3	70.7 ± 14.5	65.8 ± 15.6	66.9 ± 18.2
K-40	< 10.8	< 15.5	< 22.9	< 25.7	< 12.6	< 21.1	< 19.6	< 15.7
Mn-54	< 0.9	< 1.0	< 1.2	< 2.0	< 1.6	< 1.1	< 0.8	< 1.1
Co-58	< 1.2	< 1.1	< 1.7	< 2.4	< 2.0	< 1.5	< 1.5	< 1.8
Fe-59	< 2.8	< 2.2	< 4.9	< 9.6	< 4.2	< 4.1	< 3.0	< 6.7
Co-60	< 1.0	< 0.9	< 1.2	< 1.7	< 1.0	< 1.1	< 1.0	< 0.7
Zn-65	< 2.0	< 2.3	< 4.1	< 4.4	< 4.1	< 2.2	< 2.8	< 2.0
Nb-95	< 1.4	< 1.3	< 2.2	< 2.6	< 1.6	< 1.4	< 1.3	< 2.0
Zr-95	< 1.9	< 2.0	< 4.0	< 5.6	< 2.8	< 2.6	< 2.8	< 3.4
Ru-103	< 1.9	< 1.3	< 2.5	< 5.3	< 2.7	< 1.5	< 2.0	< 2.4
Ru-106	< 6.5	< 8.8	< 12.1	< 15.7	< 11.8	< 8.5	< 10.3	< 7.9
I-131	< 49.6	< 9.9	< 53.2	< 976.5	< 72.7	< 12.6	< 32.4	< 600.4
Cs-134	< 0.7	< 0.9	< 1.7	< 1.6	< 1.4	< 1.0	< 1.0	< 0.9
Cs-137	< 0.5	< 1.0	< 1.3	< 1.8	< 1.2	< 1.0	< 0.8	< 0.9
Ba-140	< 37.1	< 14.3	< 48.7	< 283.2	< 59.9	< 16.2	< 34.1	< 143.8
La-140	< 9.1	< 5.2	< 11.7	< 116.1	< 17.5	< 8.1	< 7.5	< 88.8
Ce-141	< 2.4	< 1.9	< 3.7	< 5.6	< 3.9	< 1.7	< 2.4	< 5.1
Ce-144	< 3.8	< 3.8	< 6.3	< 6.0	< 6.4	< 4.4	< 4.7	< 4.8
Ra-226	< 13.0	< 15.4	< 22.5	< 21.9	< 23.4	< 18.4	< 17.8	< 15.5
Ac-228	< 2.9	< 3.7	< 6.0	< 6.5	< 3.6	< 4.1	< 4.0	< 1.8
Th-228	< 1.1	< 1.3	< 1.9	< 2.2	< 2.0	< 1.6	< 1.6	< 1.4

INDIAN POINT ENERGY CENTER
TABLE B-8
GAMMA EMITTERS IN AIRBORNE PARTICULATE SAMPLES - 2012

10^{-3} pCi/m^3 ± 2 Sigma

	Training Building 94				Met Tower 95			
DATE	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Be-7	61.2 ± 13.6	61.9 ± 17.0	42.6 ± 18.4	62.4 ± 14.9	46.8 ± 18.4	65.7 ± 12.9	72.8 ± 18.0	81.2 ± 22.1
K-40	< 17.0	< 22.0	< 36.3	< 20.5	< 28.8	< 18.5	< 22.1	< 11.5
Mn-54	< 1.1	< 1.3	< 1.8	< 1.1	< 1.9	< 1.2	< 1.2	< 1.4
Co-58	< 1.5	< 1.9	< 2.7	< 2.1	< 2.5	< 1.1	< 2.1	< 1.6
Fe-59	< 3.5	< 3.8	< 7.6	< 6.1	< 7.6	< 3.1	< 4.4	< 7.5
Co-60	< 1.4	< 1.4	< 1.9	< 1.1	< 1.6	< 0.7	< 1.5	< 1.2
Zn-65	< 3.1	< 4.3	< 5.8	< 2.9	< 5.3	< 2.0	< 3.7	< 2.8
Nb-95	< 1.7	< 1.8	< 3.2	< 2.3	< 3.0	< 1.5	< 2.2	< 2.0
Zr-95	< 2.8	< 3.4	< 5.4	< 3.9	< 5.0	< 1.8	< 3.2	< 5.1
Ru-103	< 1.7	< 2.0	< 3.5	< 3.7	< 3.8	< 1.0	< 2.8	< 3.9
Ru-106	< 8.7	< 11.0	< 18.9	< 9.4	< 16.0	< 10.4	< 11.6	< 13.2
I-131	< 56.0	< 18.4	< 75.2	< 614.0	< 85.4	< 10.9	< 55.6	< 678.9
Cs-134	< 1.1	< 1.5	< 1.8	< 1.3	< 1.7	< 1.1	< 1.8	< 1.5
Cs-137	< 0.9	< 1.5	< 2.0	< 0.8	< 1.5	< 1.1	< 1.4	< 1.2
Ba-140	< 33.9	< 23.0	< 55.2	< 190.0	< 81.3	< 16.8	< 49.2	< 212.7
La-140	< 18.0	< 7.2	< 27.2	< 72.2	< 25.2	< 5.7	< 22.4	< 98.2
Ce-141	< 2.8	< 2.7	< 3.8	< 5.1	< 4.3	< 1.7	< 3.8	< 5.6
Ce-144	< 4.5	< 7.1	< 5.8	< 4.8	< 6.1	< 4.3	< 6.3	< 6.1
Ra-226	< 16.0	< 23.2	< 26.0	< 15.6	< 24.5	< 18.5	< 22.4	< 18.9
Ac-228	< 3.7	< 5.0	< 6.4	< 4.7	< 7.0	< 2.9	< 5.3	< 5.2
Th-228	2.0 ± 1.1	< 2.4	< 2.7	< 1.7	< 2.5	< 1.5	< 2.3	< 1.7

INDIAN POINT ENERGY CENTER

TABLE B-9

RADIONUCLIDES IN RAINWATER SAMPLES - 2012

pCi/liter ± 2 Sigma

	Roseton 23*				Peekskill 44			
DATE	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
RADIOCHEMICAL								
H-3	< 176	< 180	< 195	< 160	< 174	< 180	< 192	< 160
GAMMA								
Be-7	< 53	< 63	< 85	< 65	< 60	< 58	< 67	< 56
K-40	< 41	< 147	< 168	< 66	< 96	< 68	< 59	< 60
Mn-54	< 5	< 8	< 9	< 6	< 6	< 6	< 7	< 6
Co-58	< 5	< 7	< 9	< 6	< 5	< 6	< 7	< 6
Fe-59	< 11	< 16	< 16	< 14	< 14	< 12	< 15	< 12
Co-60	< 4	< 5	< 10	< 7	< 5	< 6	< 6	< 6
Zn-65	< 11	< 15	< 17	< 13	< 9	< 10	< 15	< 13
Nb-95	< 5	< 9	< 10	< 8	< 5	< 5	< 8	< 6
Zr-95	< 9	< 14	< 18	< 14	< 11	< 11	< 10	< 10
Ru-103	< 6	< 8	< 9	< 8	< 7	< 7	< 8	< 7
Ru-106	< 49	< 67	< 73	< 68	< 53	< 60	< 59	< 57
I-131	< 11	< 12	< 16 (a)	< 12	< 11	< 12	< 14	< 12
Cs-134	< 5	< 7	< 7	< 6	< 5	< 6	< 6	< 5
Cs-137	< 7	< 6	< 10	< 8	< 6	< 5	< 7	< 5
Ba-140	< 28	< 32	< 49	< 35	< 29	< 37	< 37	< 31
La-140	< 9	< 14	< 14	< 13	< 8	< 9	< 14	< 11
Ce-141	< 9	< 12	< 13	< 10	< 11	< 11	< 13	< 12
Ce-144	< 40	< 50	< 54	< 40	< 45	< 47	< 51	< 46
Ra-226	< 114	< 185	< 198	< 146	< 137	< 158	< 186	< 158
Ac-228	< 21	< 29	< 46	< 28	< 18	< 22	< 21	< 24
Th-228	< 9	< 14	< 16	< 11	< 11	< 12	< 12	< 12

* Control location

(a) See Table B-1c

INDIAN POINT ENERGY CENTER
TABLE B-10
RADIONUCLIDES IN DRINKING WATER SAMPLES - 2012

pCi/liter ± 2 Sigma

	Camp Field 7					
DATE	1/9/2012	2/13/2012	3/12/2012	4/9/2012	5/14/2012	6/11/2012
RADIOCHEMICAL						
Gr-B	2.4 ± 1.4	< 2.5	3.2 ± 1.6	3.7 ± 1.8	< 2.2	2.3 ± 1.1
H-3 (a)			< 180			< 169
GAMMA						
Be-7	< 39	< 37	< 46	< 36	< 32	< 38
K-40	< 83	< 60	< 45	< 30	< 38	< 49
Mn-54	< 6	< 4	< 6	< 4	< 4	< 4
Co-58	< 4	< 4	< 5	< 4	< 4	< 4
Fe-59	< 9	< 8	< 13	< 8	< 7	< 6
Co-60	< 4	< 5	< 4	< 4	< 4	< 3
Zn-65	< 8	< 7	< 10	< 9	< 7	< 9
Nb-95	< 4	< 4	< 6	< 4	< 4	< 4
Zr-95	< 8	< 8	< 8	< 7	< 7	< 6
Ru-103	< 5	< 4	< 5	< 4	< 4	< 4
Ru-106	< 48	< 31	< 39	< 35	< 33	< 39
I-131	< 6	< 9	< 7	< 7	< 8	< 8
Cs-134	< 5	< 4	< 4	< 3	< 3	< 4
Cs-137	< 5	< 4	< 6	< 4	< 4	< 4
Ba-140	< 17	< 22	< 24	< 20	< 18	< 17
La-140	< 6	< 7	< 10	< 6	< 7	< 6
Ce-141	< 10	< 8	< 8	< 8	< 7	< 8
Ce-144	< 38	< 30	< 36	< 30	< 30	< 34
Ra-226	< 156	< 109	< 129	< 107	< 93	< 94
Ac-228	< 20	< 18	< 22	< 14	< 17	< 18
Th-228	< 11	< 9	< 8	< 9	< 7	< 7

(a) Quarterly composite

INDIAN POINT ENERGY CENTER
TABLE B-10
RADIONUCLIDES IN DRINKING WATER SAMPLES - 2012

pCi/liter ± 2 Sigma

	Camp Field 7					
DATE	7/9/2012	8/20/2012	9/17/2012	10/15/2012	11/19/2012	12/10/12
RADIOCHEMICAL						
Gr-B	2.7 ± 1.0	< 4.5	3.4 ± 1.2	3.2 ± 2.0	< 3.3	< 3.3
H-3 (a)			< 188			< 180
GAMMA						
Be-7	< 31.9	< 48.9	< 57.6	< 28.8	< 35.5	< 45.7
K-40	< 28.9	< 68.9	< 44.5	< 53.2	< 57.2	< 130.7
Mn-54	< 3.0	< 4.2	< 5.2	< 3.1	< 3.6	< 5.2
Co-58	< 3.0	< 4.1	< 5.3	< 3.2	< 4.0	< 6.3
Fe-59	< 7.3	< 10.1	< 12.4	< 5.6	< 9.8	< 12.7
Co-60	< 3.6	< 3.3	< 5.4	< 3.2	< 3.7	< 6.9
Zn-65	< 8.1	< 9.8	< 9.4	< 6.2	< 8.1	< 12.8
Nb-95	< 4.2	< 5.9	< 6.0	< 4.1	< 4.3	< 5.7
Zr-95	< 5.8	< 8.2	< 10.2	< 6.3	< 6.7	< 8.0
Ru-103	< 3.9	< 5.5	< 5.3	< 3.8	< 4.5	< 5.7
Ru-106	< 32.7	< 38.7	< 51.2	< 31.8	< 31.0	< 50.6
I-131	< 7.0	< 9.0	< 11.5	< 8.0	< 8.0	< 10.1
Cs-134	< 3.8	< 4.6	< 5.6	< 3.2	< 4.1	< 5.4
Cs-137	< 3.9	< 4.0	< 6.2	< 3.2	< 3.7	< 5.9
Ba-140	< 16.7	< 28.1	< 28.8	< 20.1	< 24.7	< 27.1
La-140	< 4.3	< 9.5	< 5.5	< 5.1	< 5.9	< 8.6
Ce-141	< 6.8	< 10.3	< 11.1	< 7.0	< 7.8	< 9.7
Ce-144	< 26.0	< 39.2	< 41.3	< 26.5	< 31.9	< 35.5
Ra-226	< 77.7	< 144.0	< 140.6	< 97.8	< 90.3	< 128.3
Ac-228	< 14.0	< 14.6	< 23.5	< 14.4	< 16.2	< 23.6
Th-228	< 7.7	< 10.7	< 11.7	< 5.7	< 7.1	< 10.5

(a) Quarterly composite

INDIAN POINT ENERGY CENTER
TABLE B-10
RADIONUCLIDES IN DRINKING WATER SAMPLES - 2012

pCi/liter ± 2 Sigma

	Croton 8					
DATE	1/9/2012	2/13/2012	3/12/2012	4/9/2012	5/14/2012	6/11/2012
RADIOCHEMICAL						
Gr-B	< 2.2	3.3 ± 1.5	4.1 ± 1.5	4.3 ± 1.8	2.6 ± 1.5	3.6 ± 1.2
H-3 (a)			< 177			< 168
GAMMA						
Be-7	< 63.6	< 40.3	< 38.8	< 32.3	< 36.4	< 43.2
K-40	< 111.0	< 87.1	< 38.1	< 78.1	< 78.9	< 62.3
Mn-54	< 8.2	< 4.6	< 4.3	< 3.4	< 3.9	< 4.8
Co-58	< 6.1	< 3.9	< 3.5	< 4.1	< 3.9	< 5.1
Fe-59	< 13.5	< 9.3	< 8.6	< 7.7	< 8.6	< 8.2
Co-60	< 8.1	< 4.4	< 4.3	< 3.8	< 4.6	< 4.0
Zn-65	< 16.8	< 8.5	< 8.8	< 7.0	< 7.2	< 9.5
Nb-95	< 7.4	< 5.2	< 4.2	< 4.1	< 4.3	< 4.6
Zr-95	< 11.4	< 7.5	< 7.0	< 6.9	< 8.6	< 8.1
Ru-103	< 7.0	< 5.0	< 4.4	< 4.3	< 4.5	< 5.6
Ru-106	< 60.0	< 36.5	< 40.5	< 38.0	< 41.7	< 45.9
I-131	< 9.4	< 9.7	< 5.9	< 7.0	< 8.6	< 8.1
Cs-134	< 6.6	< 4.0	< 4.2	< 3.6	< 4.5	< 4.1
Cs-137	< 6.4	< 4.3	< 4.1	< 4.0	< 4.6	< 5.4
Ba-140	< 25.6	< 26.0	< 19.8	< 19.8	< 25.2	< 21.5
La-140	< 8.5	< 8.6	< 6.1	< 5.3	< 8.4	< 9.0
Ce-141	< 12.8	< 9.0	< 7.7	< 7.3	< 8.7	< 8.9
Ce-144	< 47.1	< 34.3	< 32.5	< 29.2	< 34.3	< 34.7
Ra-226	< 197.1	< 109.7	< 111.3	< 107.9	< 118.2	< 125.2
Ac-228	< 31.4	< 19.5	< 17.6	< 15.8	< 19.1	< 18.7
Th-228	< 12.0	< 7.9	< 8.8	< 6.1	< 9.3	< 9.8

(a) Quarterly composite

INDIAN POINT ENERGY CENTER
TABLE B-10
RADIONUCLIDES IN DRINKING WATER SAMPLES - 2012

pCi/liter ± 2 Sigma

	Croton 8					
DATE	7/9/2012	8/20/2012	9/17/2012	10/15/2012	11/19/2012	12/10/12
RADIOCHEMICAL						
Gr-B	2.5 ± 1.0	< 4.3	3.8 ± 1.1	3.4 ± 1.9	< 3.3	< 3.2
H-3 (a)			< 186			< 172
GAMMA						
Be-7	< 52.7	< 48.7	< 60.9	< 34.1	< 41.6	< 47.6
K-40	< 61.0	< 103.4	< 144.2	< 64.3	< 88.4	< 47.3
Mn-54	< 4.4	< 5.9	< 7.3	< 3.3	< 4.6	< 4.4
Co-58	< 4.9	< 5.3	< 7.2	< 3.2	< 4.0	< 5.3
Fe-59	< 12.8	< 11.2	< 17.3	< 7.1	< 7.9	< 10.2
Co-60	< 5.6	< 5.4	< 8.5	< 2.9	< 3.8	< 4.4
Zn-65	< 12.0	< 10.1	< 15.3	< 7.2	< 6.6	< 10.1
Nb-95	< 5.8	< 5.4	< 9.0	< 4.1	< 3.9	< 5.3
Zr-95	< 9.9	< 8.9	< 12.7	< 6.0	< 8.0	< 8.4
Ru-103	< 6.5	< 6.2	< 8.0	< 4.0	< 4.8	< 5.8
Ru-106	< 46.9	< 54.4	< 73.0	< 31.9	< 45.0	< 45.8
I-131	< 9.8	< 10.8	< 15.1 (b)	< 8.6	< 9.3	< 9.3
Cs-134	< 5.6	< 5.7	< 7.3	< 3.6	< 3.4	< 5.0
Cs-137	< 5.2	< 6.0	< 9.0	< 3.8	< 4.2	< 5.1
Ba-140	< 26.1	< 29.4	< 40.0	< 20.6	< 25.4	< 27.1
La-140	< 10.4	< 8.7	< 15.9 (b)	< 6.0	< 4.4	< 7.3
Ce-141	< 8.0	< 10.7	< 12.0	< 7.8	< 8.6	< 10.7
Ce-144	< 31.0	< 42.3	< 41.6	< 30.2	< 38.0	< 43.4
Ra-226	< 116.2	< 129.5	< 163.3	< 102.4	< 118.1	< 137.7
Ac-228	< 21.8	< 20.6	< 29.4	< 13.1	< 20.1	< 20.2
Th-228	< 9.6	< 11.4	< 12.5	< 8.3	< 7.5	< 10.8

(a) Quarterly composite
(b) See Table B-1c

INDIAN POINT ENERGY CENTER
TABLE B-11
RADIONUCLIDES IN GROUNDWATER SAMPLES - 2012

pCi/liter ± 2 Sigma

	Lafarge Monitoring Well 106			
DATE	5/29/2012		11/19/2012	
RADIOCHEMICAL				
H-3	< 463		< 219	
Ni-63	< 21.2		< 17.1	
Sr-90	< 1.99		< 1.94	
GAMMA				
Be-7	< 102		< 166	
K-40	< 134		< 76	
Mn-54	< 10		< 11	
Co-58	< 10		< 14	
Fe-59	< 33		< 52	
Co-60	< 11		< 8	
Zn-65	< 22		< 21	
Nb-95	< 12		< 21	
Zr-95	< 22		< 30	
Ru-106	< 81		< 98	
Cs-134	< 12		< 9	
Cs-137	< 11		< 9	
Ba-140	< 40		< 590	(a)
La-140	< 40	(a)	< 590	(a)
Ce-141	< 23		< 51	
Ce-144	< 51		< 50	
Ac-228	< 47		< 45	

(a) LLD not met due to age of sample

INDIAN POINT ENERGY CENTER
TABLE B-12
GAMMA EMITTERS IN SOIL SAMPLES, 2012

pCi/kg dry ± 2 Sigma

	Roseton 23*	Training Building 94	Met Tower 95
DATE	11/13/2012	11/13/2012	11/13/2012
Be-7	900 ± 365	< 455	< 362
K-40	17400 ± 1270	13740 ± 1156	13500 ± 1018
Mn-54	< 51	< 46	< 40
Co-58	< 47	< 46	< 44
Fe-59	< 116	< 114	< 116
Co-60	< 66	< 40	< 48
Zn-65	< 113	< 88	< 108
Nb-95	< 64	< 58	< 52
Zr-95	< 111	< 85	< 70
Ru-103	< 54	< 51	< 42
Ru-106	< 381	< 348	< 323
I-131	< 159	< 154	< 139
Cs-134	< 45	< 36	< 31
Cs-137	< 49	< 57	100 ± 37
Ba-140	< 349	< 313	< 285
La-140	< 99	< 70	< 75
Ce-141	< 86	< 90	< 62
Ce-144	< 277	< 286	< 206
Ra-226	1420 ± 914	< 1046	< 729
Th-228	983 ± 81	602 ± 70	396 ± 52

* Control location

INDIAN POINT ENERGY CENTER
TABLE B-13
GAMMA EMITTERS IN BROADLEAF VEGETATION SAMPLES - 2012

pCi/kg wet ± 2 Sigma

Roseton
23*

DATE	4/30/2012 Burdock	4/30/2012 Common Mullein	4/30/2012 Ragweed	5/21/2012 Burdock	5/21/2012 Common Mullein	5/21/2012 Ragweed	6/18/2012 Burdock
RADIOCHEMICAL							
I-131 (a)							< 23
GAMMA							
Be-7	458 ± 119	564 ± 139	424 ± 108	1642 ± 177	1181 ± 326	987 ± 214	898 ± 133
K-40	3189 ± 311	4260 ± 378	7030 ± 345	6245 ± 380	4106 ± 593	6825 ± 646	4523 ± 342
Mn-54	< 19	< 21	< 16	< 11	< 18	< 22	< 11
Co-58	< 20	< 22	< 17	< 12	< 23	< 25	< 12
Fe-59	< 47	< 50	< 42	< 29	< 62	< 56	< 30
Co-60	< 25	< 30	< 23	< 17	< 23	< 29	< 16
Zn-65	< 52	< 58	< 44	< 30	< 49	< 48	< 30
Nb-95	< 19	< 24	< 16	< 13	< 26	< 25	< 14
Zr-95	< 34	< 42	< 31	< 24	< 37	< 43	< 19
Ru-103	< 21	< 22	< 17	< 12	< 27	< 22	< 12
Ru-106	< 183	< 183	< 147	< 109	< 198	< 208	< 99
I-131	< 38	< 42	< 29	< 28	< 53	< 49	< 25
Cs-134	< 20	< 22	< 16	< 11	< 24	< 21	< 10
Cs-137	< 20	< 23	< 17	< 12	< 23	< 24	< 13
Ba-140	< 102	< 107	< 85	< 58	< 132	< 133	< 60
La-140	< 29	< 35	< 20	< 13	< 36	< 24	< 11
Ce-141	< 35	< 35	< 28	< 23	< 47	< 41	< 22
Ce-144	< 135	< 131	< 108	< 86	< 165	< 153	< 80
Ra-226	< 459	< 417	< 357	< 280	< 637	< 537	< 231
Th-228	< 33	36 ± 24	< 27	< 22	< 41	< 45	< 21

* Control location

(a) Iodine-131 by low level analysis

INDIAN POINT ENERGY CENTER
TABLE B-13
GAMMA EMITTERS IN BROADLEAF VEGETATION SAMPLES - 2012

pCi/kg wet ± 2 Sigma

Roseton
23*

DATE	6/18/2012 Common Mullein	6/18/2012 Ragweed	7/17/2012 Catalpa	7/17/2012 Burdock	7/17/2012 Common Mullein	8/13/2012 Catalpa	8/13/2012 Burdock
RADIOCHEMICAL							
I-131 (a)	< 20	< 32	< 44	< 40	< 55	< 57	< 45
GAMMA							
Be-7	574 ± 307	2132 ± 320	278 ± 96	992 ± 172	2166 ± 328	788 ± 227	769 ± 234
K-40	5743 ± 738	7455 ± 765	1169 ± 173	7807 ± 519	5206 ± 608	3746 ± 444	7450 ± 607
Mn-54	< 27	< 27	< 8	< 16	< 23	< 21	< 20
Co-58	< 26	< 24	< 8	< 16	< 28	< 19	< 24
Fe-59	< 69	< 70	< 20	< 44	< 65	< 49	< 47
Co-60	< 38	< 40	< 9	< 23	< 35	< 23	< 26
Zn-65	< 67	< 65	< 20	< 35	< 68	< 50	< 48
Nb-95	< 30	< 33	< 9	< 17	< 29	< 22	< 23
Zr-95	< 34	< 46	< 13	< 31	< 54	< 32	< 39
Ru-103	< 23	< 24	< 10	< 17	< 29	< 20	< 21
Ru-106	< 271	< 239	< 65	< 119	< 242	< 203	< 193
I-131	< 60	< 50	< 18	< 31	< 57	< 37	< 43
Cs-134	< 23	< 25	< 9	< 14	< 23	< 22	< 20
Cs-137	< 26	< 26	< 9	< 18	< 31	< 23	< 22
Ba-140	< 112	< 165	< 43	< 84	< 133	< 109	< 110
La-140	< 41	< 16	< 10	< 21	< 45	< 29	< 25
Ce-141	< 45	< 49	< 14	< 30	< 50	< 33	< 40
Ce-144	< 173	< 178	< 53	< 109	< 181	< 127	< 148
Ra-226	< 655	< 591	< 194	< 416	< 651	< 460	< 526
Th-228	< 56	< 46	< 19	< 32	< 49	< 42	< 40

* Control location
(a) Iodine-131 by low level analysis

INDIAN POINT ENERGY CENTER
TABLE B-13
GAMMA EMITTERS IN BROADLEAF VEGETATION SAMPLES - 2012

pCi/kg wet ± 2 Sigma

Roseton
23*

DATE	8/13/2012 Common Mullein	9/10/2012 Ragweed	9/10/2012 Catalpa	9/10/2012 Common Mullein	10/9/2012 Ragweed	10/9/2012 Catalpa	10/9/2012 Common Mullein
RADIOCHEMICAL							
I-131 (a)	< 45	< 38	< 34	< 36	< 51	< 54	< 47
GAMMA							
Be-7	517 ± 162	3712 ± 196	1347 ± 146	645 ± 143	3939 ± 528	1785 ± 382	2168 ± 347
K-40	5529 ± 450	5339 ± 317	3326 ± 301	5215 ± 382	4850 ± 744	4066 ± 581	5204 ± 650
Mn-54	< 17	< 11	< 13	< 13	< 38	< 31	< 30
Co-58	< 17	< 11	< 14	< 16	< 42	< 31	< 24
Fe-59	< 41	< 27	< 30	< 36	< 90	< 64	< 56
Co-60	< 21	< 15	< 17	< 19	< 40	< 34	< 35
Zn-65	< 38	< 29	< 29	< 35	< 73	< 69	< 72
Nb-95	< 17	< 13	< 14	< 16	< 40	< 29	< 30
Zr-95	< 29	< 21	< 22	< 26	< 70	< 54	< 44
Ru-103	< 18	< 12	< 11	< 15	< 36	< 30	< 29
Ru-106	< 156	< 109	< 101	< 127	< 301	< 245	< 242
I-131	< 38	< 26	< 28	< 32	< 66	< 62	< 64
Cs-134	< 15	< 11	< 13	< 15	< 36	< 30	< 24
Cs-137	< 17	< 12	< 13	< 14	< 34	< 30	< 30
Ba-140	< 85	< 68	< 68	< 74	< 201	< 176	< 169
La-140	< 29	< 18	< 19	< 21	< 52	< 47	< 43
Ce-141	< 29	< 24	< 24	< 25	< 45	< 49	< 49
Ce-144	< 112	< 89	< 86	< 90	< 187	< 192	< 166
Ra-226	< 389	< 347	< 333	< 335	< 764	< 640	< 596
Th-228	< 28	< 23	< 23	< 26	< 53	< 53	< 59

* Control location
(a) Iodine-131 by low level analysis

INDIAN POINT ENERGY CENTER
TABLE B-13
GAMMA EMITTERS IN BROADLEAF VEGETATION SAMPLES - 2012

pCi/kg wet ± 2 Sigma

Training Center
94

DATE	4/30/2012 Motherswort	4/30/2012 Ragweed	4/30/2012 Common Mullein	5/21/2012 Wild Grape	5/21/2012 Ragweed	5/21/2012 Cottonwood	6/18/2012 Burdock
RADIOCHEMICAL							
I-131 (a)							< 36
GAMMA							
Be-7	198 ± 121	680 ± 191	608 ± 162	826 ± 190	1088 ± 220	552 ± 205	1602 ± 348
K-40	5147 ± 395	8637 ± 531	5291 ± 446	3307 ± 397	7667 ± 561	5068 ± 581	9207 ± 824
Mn-54	< 22	< 27	< 23	< 19	< 19	< 23	< 22
Co-58	< 22	< 28	< 25	< 17	< 23	< 23	< 27
Fe-59	< 54	< 65	< 59	< 46	< 49	< 67	< 78
Co-60	< 27	< 35	< 33	< 25	< 26	< 35	< 47
Zn-65	< 54	< 66	< 62	< 47	< 47	< 64	< 65
Nb-95	< 23	< 29	< 24	< 18	< 24	< 28	< 32
Zr-95	< 41	< 51	< 43	< 34	< 41	< 40	< 60
Ru-103	< 24	< 28	< 24	< 21	< 23	< 21	< 31
Ru-106	< 202	< 237	< 186	< 166	< 199	< 242	< 283
I-131	< 44	< 54	< 44	< 38	< 45	< 51	< 59
Cs-134	< 24	< 29	< 23	< 17	< 21	< 26	< 27
Cs-137	< 24	< 30	< 24	< 19	< 20	< 27	< 30
Ba-140	< 121	< 138	< 114	< 98	< 122	< 156	< 152
La-140	< 30	< 33	< 30	< 26	< 27	< 39	< 50
Ce-141	< 38	< 49	< 39	< 32	< 37	< 32	< 47
Ce-144	< 151	< 201	< 143	< 119	< 133	< 113	< 181
Ra-226	< 468	< 621	< 497	< 416	< 478	< 464	< 693
Th-228	< 36	< 49	< 39	< 30	< 39	< 37	< 40

(a) Iodine-131 by low level analysis

INDIAN POINT ENERGY CENTER

TABLE B-13

GAMMA EMITTERS IN BROADLEAF VEGETATION SAMPLES - 2012

pCi/kg wet ± 2 Sigma

Training Center
94

DATE	6/18/2012 Ragweed	6/18/2012 Catalpa	7/16/2012 Wild Rasberry	7/16/2012 Ragweed	7/16/2012 Catalpa	8/13/2012 Burdock	8/13/2012 Ragweed
RADIOCHEMICAL							
I-131 (a)	< 34	< 29	< 58	< 55	< 51	< 43	< 56
GAMMA							
Be-7	1007 ± 243	568 ± 183	1394 ± 304	1612 ± 207	815 ± 189	1586 ± 231	2378 ± 246
K-40	6408 ± 717	3056 ± 468	4428 ± 550	7673 ± 455	2603 ± 490	7560 ± 525	6199 ± 464
Mn-54	< 25	< 20	< 28	< 15	< 22	< 17	< 18
Co-58	< 31	< 23	< 30	< 17	< 25	< 18	< 18
Fe-59	< 58	< 45	< 54	< 41	< 56	< 40	< 48
Co-60	< 41	< 24	< 33	< 22	< 24	< 26	< 23
Zn-65	< 67	< 53	< 61	< 41	< 56	< 39	< 41
Nb-95	< 26	< 25	< 29	< 15	< 27	< 17	< 21
Zr-95	< 49	< 36	< 51	< 30	< 42	< 31	< 31
Ru-103	< 24	< 23	< 26	< 16	< 25	< 16	< 21
Ru-106	< 171	< 211	< 236	< 137	< 205	< 148	< 164
I-131	< 49	< 52	< 61	< 35	< 42	< 35	< 40
Cs-134	< 23	< 22	< 28	< 16	< 22	< 13	< 17
Cs-137	< 30	< 20	< 26	< 17	< 23	< 16	< 19
Ba-140	< 129	< 119	< 159	< 95	< 140	< 84	< 100
La-140	< 36	< 27	< 39	< 20	< 37	< 26	< 29
Ce-141	< 38	< 40	< 51	< 33	< 30	< 27	< 35
Ce-144	< 157	< 157	< 175	< 119	< 99	< 108	< 123
Ra-226	< 525	< 564	< 530	< 375	< 401	< 361	< 462
Th-228	< 41	< 44	< 52	< 34	< 32	< 32	< 36

(a) Iodine-131 by low level analysis

INDIAN POINT ENERGY CENTER
TABLE B-13
GAMMA EMITTERS IN BROADLEAF VEGETATION SAMPLES - 2012

pCi/kg wet ± 2 Sigma

Training Center
94

DATE	8/13/2012 Bittersweet	9/10/2012 Common Mullein	9/10/2012 Ragweed	9/10/2012 Catalpa	10/9/2012 Common Mullein	10/9/2012 Ragweed	10/9/2012 Catapalpa
RADIOCHEMICAL							
I-131 (a)	< 49	< 26	< 29	< 40	< 52	< 37	< 55
GAMMA							
Be-7	1494 ± 296	2221 ± 184	2175 ± 249	2122 ± 167	2226 ± 404	4024 ± 383	4691 ± 424
K-40	4670 ± 590	4172 ± 316	5079 ± 469	2763 ± 240	5901 ± 739	6038 ± 698	1271 ± 418
Mn-54	< 24	< 13	< 22	< 11	< 32	< 29	< 23
Co-58	< 23	< 13	< 22	< 13	< 31	< 25	< 25
Fe-59	< 62	< 32	< 46	< 24	< 72	< 62	< 46
Co-60	< 28	< 18	< 27	< 13	< 28	< 36	< 31
Zn-65	< 57	< 31	< 49	< 25	< 71	< 59	< 48
Nb-95	< 31	< 15	< 22	< 13	< 29	< 25	< 27
Zr-95	< 46	< 23	< 41	< 22	< 50	< 39	< 37
Ru-103	< 31	< 14	< 24	< 13	< 34	< 30	< 27
Ru-106	< 223	< 121	< 194	< 104	< 250	< 271	< 217
I-131	< 47	< 31	< 47	< 26	< 64	< 60	< 62
Cs-134	< 21	< 12	< 18	< 11	< 29	< 25	< 21
Cs-137	< 24	44 ± 17	< 22	< 13	< 35	< 28	< 26
Ba-140	< 155	< 67	< 115	< 63	< 185	< 154	< 127
La-140	< 34	< 21	< 40	< 20	< 58	< 35	< 31
Ce-141	< 45	< 23	< 38	< 22	< 53	< 48	< 47
Ce-144	< 163	< 88	< 133	< 79	< 208	< 195	< 190
Ra-226	< 619	< 288	< 501	< 285	< 741	< 513	< 667
Th-228	< 44	< 23	< 39	< 26	< 68	< 51	< 55

(a) Iodine-131 by low level analysis

INDIAN POINT ENERGY CENTER

TABLE B-13

GAMMA EMITTERS IN BROADLEAF VEGETATION SAMPLES - 2012

pCi/kg wet ± 2 Sigma

Met Tower

95

DATE	4/30/2012 Motherwort	4/30/2012 Ragweed	4/30/2012 Common Mullein	5/21/2012 Wild Grape	5/21/2012 Ragweed	5/21/2012 Bittersweet	6/18/2012 Burdock
RADIOCHEMICAL							
I-131 (a)							< 30
GAMMA							
Be-7	< 261	354 ± 159	306 ± 125	895 ± 203	1034 ± 215	477 ± 170	936 ± 325
K-40	6298 ± 552	7830 ± 512	4125 ± 354	3540 ± 409	7336 ± 607	3390 ± 466	8266 ± 947
Mn-54	< 31	< 17	< 20	< 22	< 21	< 15	< 44
Co-58	< 33	< 18	< 20	< 21	< 23	< 19	< 33
Fe-59	< 68	< 44	< 46	< 55	< 58	< 47	< 110
Co-60	< 39	< 24	< 24	< 27	< 25	< 21	< 47
Zn-65	< 78	< 45	< 46	< 48	< 50	< 44	< 87
Nb-95	< 34	< 18	< 20	< 25	< 25	< 20	< 33
Zr-95	< 52	< 26	< 38	< 39	< 43	< 33	< 57
Ru-103	< 32	< 19	< 23	< 23	< 24	< 21	< 36
Ru-106	< 303	< 163	< 179	< 195	< 173	< 164	< 308
I-131	< 60	< 33	< 41	< 47	< 54	< 36	< 60
Cs-134	< 27	< 15	< 21	< 21	< 21	< 18	< 30
Cs-137	< 27	< 17	< 22	< 20	< 25	< 19	< 28
Ba-140	< 158	< 86	< 100	< 108	< 134	< 101	< 188
La-140	< 40	< 21	< 25	< 22	< 30	< 21	< 30
Ce-141	< 53	< 30	< 37	< 40	< 43	< 33	< 43
Ce-144	< 209	< 105	< 147	< 143	< 159	< 121	< 157
Ra-226	< 639	< 378	< 469	< 430	< 561	< 438	< 633
Th-228	< 52	< 30	< 35	< 41	< 47	< 37	< 61

(a) Iodine-131 by low level analysis

INDIAN POINT ENERGY CENTER
TABLE B-13
GAMMA EMITTERS IN BROADLEAF VEGETATION SAMPLES - 2012

pCi/kg wet ± 2 Sigma

Met Tower
95

DATE	6/18/2012 Ragweed	6/18/2012 Common Mullein	7/16/2012 Burdock	7/16/2012 Wild Mustard	7/16/2012 Common Mullein	8/13/2012 Ragweed	8/13/2012 Wild Grape
RADIOCHEMICAL							
I-131 (a)	< 34	< 38	< 60	< 52	< 54	< 41	< 37
GAMMA							
Be-7	1513 ± 262	353 ± 206	1602 ± 198	556 ± 185	1131 ± 258	2698 ± 298	775 ± 248
K-40	6510 ± 586	5363 ± 735	8627 ± 486	8788 ± 584	4271 ± 475	6373 ± 523	3550 ± 465
Mn-54	< 23	< 22	< 17	< 22	< 18	< 21	< 25
Co-58	< 22	< 24	< 15	< 23	< 18	< 20	< 24
Fe-59	< 57	< 59	< 42	< 55	< 36	< 56	< 55
Co-60	< 35	< 25	< 22	< 27	< 24	< 27	< 25
Zn-65	< 53	< 65	< 40	< 47	< 41	< 49	< 53
Nb-95	< 27	< 25	< 17	< 24	< 15	< 25	< 29
Zr-95	< 43	< 40	< 27	< 43	< 34	< 42	< 41
Ru-103	< 24	< 27	< 17	< 25	< 21	< 23	< 26
Ru-106	< 197	< 212	< 140	< 205	< 153	< 174	< 190
I-131	< 54	< 56	< 32	< 51	< 38	< 45	< 47
Cs-134	< 23	< 21	< 15	< 21	< 17	< 21	< 23
Cs-137	< 24	< 29	< 18	< 20	< 18	< 22	< 26
Ba-140	< 130	< 113	< 84	< 124	< 104	< 119	< 129
La-140	< 33	< 47	< 23	< 24	< 27	< 27	< 39
Ce-141	< 39	< 40	< 26	< 45	< 29	< 35	< 48
Ce-144	< 151	< 150	< 100	< 164	< 127	< 149	< 179
Ra-226	< 512	< 615	< 320	< 508	< 428	< 448	< 622
Th-228	< 35	< 51	< 25	< 40	< 30	< 37	< 44

(a) Iodine-131 by low level analysis

INDIAN POINT ENERGY CENTER
TABLE B-13
GAMMA EMITTERS IN BROADLEAF VEGETATION SAMPLES - 2012

pCi/kg wet ± 2 Sigma

Met Tower
95

DATE	8/13/2012 Bittersweet	9/10/2012 Ragweed	9/10/2012 Cottonwood	9/10/2012 Burdock	10/9/2012 Ragweed	10/9/2012 Cottonwood	10/9/2012 Common Mullein
RADIOCHEMICAL							
I-131 (a)	< 46	< 37	< 44	< 41	< 53	< 51	< 42
GAMMA							
Be-7	1224 ± 219	1965 ± 269	1482 ± 261	2202 ± 191	3724 ± 470	1471 ± 350	1367 ± 293
K-40	3893 ± 500	4703 ± 467	5284 ± 475	10520 ± 459	5632 ± 683	5022 ± 755	4490 ± 567
Mn-54	< 23	< 26	< 19	< 15	< 32	< 28	< 20
Co-58	< 27	< 24	< 20	< 16	< 29	< 30	< 22
Fe-59	< 54	< 63	< 46	< 37	< 73	< 73	< 54
Co-60	< 27	< 27	< 24	< 20	< 38	< 33	< 33
Zn-65	< 50	< 50	< 39	< 35	< 57	< 77	< 56
Nb-95	< 24	< 26	< 19	< 16	< 28	< 25	< 21
Zr-95	< 38	< 45	< 35	< 27	< 54	< 59	< 36
Ru-103	< 22	< 24	< 21	< 16	< 31	< 30	< 21
Ru-106	< 198	< 210	< 180	< 125	< 260	< 241	< 183
I-131	< 51	< 43	< 44	< 32	< 65	< 59	< 44
Cs-134	< 21	< 21	< 17	< 15	< 29	< 25	< 18
Cs-137	< 27	< 25	< 20	< 16	< 32	< 27	< 22
Ba-140	< 121	< 125	< 112	< 84	< 174	< 162	< 135
La-140	< 29	< 39	< 21	< 19	< 57	< 53	< 24
Ce-141	< 37	< 30	< 37	< 27	< 48	< 45	< 34
Ce-144	< 139	< 108	< 129	< 105	< 202	< 170	< 134
Ra-226	< 536	< 408	< 446	< 368	< 637	< 664	< 497
Th-228	< 41	< 36	< 34	< 26	< 65	< 48	< 44

(a) Iodine-131 by low level analysis

INDIAN POINT ENERGY CENTER
TABLE B-14
RADIONUCLIDES IN RIVER WATER SAMPLES - 2012

pCi/liter ± 2 Sigma

Plant Inlet Hudson River Intake
9*

DATE	1/30/2012	2/27/2012	3/26/2012	5/1/2012	5/29/2012	6/25/2012
RADIOCHEMICAL						
H-3 (a)			< 174			< 180
GAMMA						
K-40	< 165	< 102	< 68	< 81	< 71	< 99
Mn-54	< 6	< 5	< 7	< 7	< 5	< 5
Co-58	< 6	< 5	< 7	< 8	< 5	< 6
Fe-59	< 15	< 9	< 16	< 18	< 12	< 11
Co-60	< 6	< 4	< 7	< 9	< 8	< 4
Zn-65	< 14	< 9	< 13	< 19	< 10	< 9
Nb-95	< 7	< 5	< 7	< 9	< 8	< 5
Zr-95	< 10	< 8	< 12	< 16	< 11	< 11
Ru-103	< 6	< 5	< 7	< 9	< 7	< 6
Ru-106	< 64	< 39	< 64	< 72	< 55	< 52
I-131	< 9	< 7	< 14	< 14	< 9	< 12
Cs-134	< 6	< 5	< 6	< 9	< 6	< 5
Cs-137	< 7	< 5	< 8	< 10	< 7	< 6
Ba-140	< 26	< 21	< 38	< 39	< 29	< 24
La-140	< 6	< 7	< 11	< 15	< 12	< 9
Ce-141	< 11	< 8	< 10	< 12	< 9	< 12
Ce-144	< 48	< 39	< 39	< 48	< 40	< 43
Ra-226	< 165	< 119	< 133	< 163	< 140	< 148
Ac-228	< 31	< 18	< 23	< 35	< 29	< 21
Th-228	< 11	< 10	< 11	< 13	< 10	< 12

* Control location
(a) Quarterly composite

INDIAN POINT ENERGY CENTER
TABLE B-14
RADIONUCLIDES IN RIVER WATER SAMPLES - 2012

pCi/liter ± 2 Sigma

Plant Inlet Hudson River Intake
9*

DATE	7/30/2012	8/27/2012	9/24/2012	10/30/12	11/26/12	1/2/2013
RADIOCHEMICAL						
H-3 (a)			< 193			< 187
GAMMA						
K-40	< 48	< 73	< 51	< 80	< 85	< 33
Mn-54	< 6	< 3	< 6	< 3	< 9	< 4
Co-58	< 5	< 3	< 7	< 4	< 10	< 4
Fe-59	< 10	< 7	< 15	< 8	< 20	< 7
Co-60	< 6	< 4	< 7	< 4	< 10	< 4
Zn-65	< 10	< 6	< 14	< 6	< 20	< 7
Nb-95	< 6	< 3	< 8	< 4	< 10	< 4
Zr-95	< 10	< 6	< 13	< 7	< 18	< 6
Ru-103	< 6	< 4	< 7	< 5	< 8	< 4
Ru-106	< 48	< 33	< 65	< 37	< 63	< 33
I-131	< 10	< 7	< 10	< 7	< 20 (b)	< 7
Cs-134	< 5	< 3	< 6	< 4	< 10	< 3
Cs-137	< 6	< 3	< 7	< 4	< 11	< 4
Ba-140	< 28	< 19	< 30	< 19	< 55	< 18
La-140	< 9	< 7	< 11	< 6	< 19 (b)	< 6
Ce-141	< 9	< 6	< 11	< 8	< 16	< 8
Ce-144	< 37	< 24	< 40	< 31	< 59	< 30
Ra-226	< 125	< 81	< 153	< 103	< 221	< 98
Ac-228	< 22	< 13	< 34	< 15	< 34	< 14
Th-228	< 10	< 7	< 12	< 8	< 17	< 6

* Control location
(a) Quarterly composite
(b) See Table B-1c

INDIAN POINT ENERGY CENTER

TABLE B-14

RADIONUCLIDES IN RIVER WATER SAMPLES - 2012

pCi/liter ± 2 Sigma

Discharge Canal

10

DATE	1/30/2012	2/27/2012	3/26/2012	5/1/2012	5/29/2012	6/25/2012
RADIOCHEMICAL						
H-3 (a)			617 ± 138			< 178
GAMMA						
K-40	< 191	< 55	< 55	< 46	< 143	< 85
Mn-54	< 10	< 5	< 5	< 6	< 7	< 6
Co-58	< 8	< 4	< 5	< 6	< 9	< 8
Fe-59	< 16	< 8	< 9	< 11	< 12	< 15
Co-60	< 8	< 5	< 6	< 6	< 8	< 9
Zn-65	< 13	< 9	< 11	< 12	< 13	< 15
Nb-95	< 6	< 5	< 5	< 6	< 7	< 8
Zr-95	< 12	< 9	< 10	< 10	< 13	< 14
Ru-103	< 7	< 6	< 5	< 7	< 8	< 8
Ru-106	< 84	< 47	< 48	< 54	< 63	< 61
I-131	< 12	< 7	< 11	< 9	< 12	< 12
Cs-134	< 8	< 4	< 5	< 7	< 7	< 7
Cs-137	< 9	< 6	< 5	< 6	< 7	< 6
Ba-140	< 35	< 22	< 28	< 30	< 28	< 39
La-140	< 10	< 6	< 8	< 10	< 11	< 10
Ce-141	< 12	< 9	< 11	< 11	< 13	< 12
Ce-144	< 48	< 37	< 45	< 45	< 51	< 41
Ra-226	< 177	< 148	< 147	< 131	< 185	< 171
Ac-228	< 33	< 23	< 16	< 22	< 27	< 30
Th-228	< 15	< 11	< 13	< 10	< 14	< 13

(a) Quarterly composite

INDIAN POINT ENERGY CENTER

TABLE B-14

RADIONUCLIDES IN RIVER WATER SAMPLES - 2012

pCi/liter ± 2 Sigma

Discharge Canal

10

DATE	7/30/2012	8/27/2012	9/24/2012	10/30/12	11/26/12		1/2/2013
RADIOCHEMICAL							
H-3 (a)			< 193				460 ± 150
GAMMA							
K-40	< 41	< 42	< 121	< 110	< 65		< 46
Mn-54	< 4	< 4	< 5	< 5	< 9		< 2
Co-58	< 4	< 5	< 5	< 6	< 8		< 2
Fe-59	< 9	< 10	< 14	< 11	< 21		< 5
Co-60	< 4	< 5	< 6	< 6	< 8		< 2
Zn-65	< 8	< 10	< 14	< 11	< 22		< 4
Nb-95	< 4	< 6	< 6	< 6	< 7		< 2
Zr-95	< 7	< 8	< 8	< 12	< 13		< 4
Ru-103	< 5	< 5	< 5	< 6	< 9		< 2
Ru-106	< 42	< 42	< 58	< 45	< 73	(b)	< 14
I-131	< 8	< 9	< 11	< 9	< 16		< 3
Cs-134	< 4	< 5	< 5	< 5	< 8		< 2
Cs-137	< 4	< 5	< 5	< 6	< 7		< 2
Ba-140	< 21	< 26	< 31	< 27	< 59		< 10
La-140	< 8	< 9	< 12	< 8	< 9		< 2
Ce-141	< 8	< 7	< 10	< 8	< 15		< 3
Ce-144	< 27	< 27	< 41	< 32	< 53		< 13
Ra-226	< 106	< 85	< 157	< 122	< 181		< 52
Ac-228	< 18	< 19	< 24	< 23	< 27		< 9
Th-228	< 9	< 8	< 10	< 10	< 14		< 5

(a) Quarterly composite

(b) See Table B-1c

INDIAN POINT ENERGY CENTER
TABLE B-15
GAMMA EMITTERS IN BOTTOM SEDIMENT SAMPLES - 2012

pCi/kg dry ± 2 Sigma

	Discharge Canal 10		Off Verplanck 17		Lent's Cove 28		Cold Spring 84*	
DATE	6/12/2012	9/20/2012	6/12/2012	9/20/2012	6/8/2012	9/20/2012	6/8/2012	9/19/2012
Be-7	< 554	< 358	< 762	< 740	< 845	< 558	< 501	< 545
K-40	18320 ± 1480	14850 ± 950	18790 ± 1872	21240 ± 1783	19520 ± 2135	17940 ± 1632	30690 ± 2424	33330 ± 1573
Mn-54	< 63	< 38	< 88	< 79	< 85	< 61	< 60	< 54
Co-58	< 55	< 35	< 73	< 82	< 79	< 65	< 62	< 57
Fe-59	< 142	< 93	< 186	< 181	< 203	< 171	< 182	< 170
Co-60	< 73	< 47	< 108	< 66	< 114	< 84	< 94	< 73
Zn-65	< 141	< 97	< 188	< 185	< 169	< 134	< 160	< 129
Nb-95	< 67	< 48	< 104	< 106	< 74	< 75	< 69	< 67
Zr-95	< 110	< 62	< 152	< 166	< 155	< 137	< 131	< 111
Ru-103	< 66	< 46	< 87	< 102	< 86	< 77	< 63	< 71
Ru-106	< 557	< 328	< 845	< 665	< 638	< 479	< 546	< 476
I-131	< 133	< 186	< 196	< 403	< 207	< 284	< 195	< 302
Cs-134	< 55	< 34	< 82	< 68	< 64	< 62	< 49	< 51
Cs-137	397 ± 74	234 ± 45	269 ± 118	270 ± 83	< 80	250 ± 68	< 70	< 59
Ba-140	< 327	< 330	< 485	< 800	< 519	< 533	< 379	< 592
Ce-141	< 86	< 64	< 168	< 180	< 146	< 104	< 118	< 121
Ce-144	< 345	< 208	< 627	< 553	< 453	< 331	< 389	< 355
Ra-226	< 1141	< 640	< 2043	2117 ± 1292	< 1676	2100 ± 1082	< 1340	1888 ± 886
Th-228	853 ± 90	282 ± 56	1111 ± 133	1213 ± 121	1118 ± 178	994 ± 97	593 ± 143	716 ± 125

* Control location

INDIAN POINT ENERGY CENTER
TABLE B-16
RADIONUCLIDES IN SHORELINE SEDIMENT SAMPLES - 2012

pCi/kg dry ± 2 Sigma

	Off Verplanck 17		Lent's Cove 28		Manitou Inlet 50	
DATE	6/12/2012	9/18/2012	06/08/12	09/18/12	6/8/2012	9/18/2012
RADIOCHEMICAL						
Sr-90	< 36	< 46	< 41	< 45	< 39	< 48
GAMMA						
Be-7	< 308	< 459	< 588	< 625	< 307	< 580
K-40	14060 ± 1062	19790 ± 1330	13070 ± 1593	12960 ± 1296	2785 ± 438	14540 ± 1127
Mn-54	< 37	< 54	< 61	< 51	< 31	< 54
Co-58	< 35	< 54	< 63	< 63	< 30	< 63
Fe-59	< 70	< 129	< 160	< 129	< 62	< 137
Co-60	< 43	< 54	< 91	< 59	< 30	< 68
Zn-65	< 81	< 127	< 161	< 104	< 67	< 140
Nb-95	< 28	< 63	< 69	< 65	< 47	< 95
Zr-95	< 68	< 100	< 131	< 97	< 51	< 117
Ru-103	< 33	< 61	< 81	< 67	< 32	< 76
Ru-106	< 276	< 417	< 572	< 363	< 253	< 460
I-131	< 62	< 313	< 190	< 318	< 103	< 349
Cs-134	< 30	< 44	< 68	< 43	< 31	< 50
Cs-137	115 ± 48	167 ± 50	< 75	< 66	< 32	< 58
Ba-140	< 192	< 557	< 365	< 635	< 212	< 612
La-140	< 47	< 157	< 80	< 130	< 69	< 220
Ce-141	< 54	< 89	< 131	< 109	< 69	< 130
Ce-144	< 221	< 269	< 440	< 327	< 238	< 355
Ra-226	< 652	< 917	3306 ± 1665	< 1222	2216 ± 847	7724 ± 1336
Ac-228	< 121	< 340	< 189	< 161	< 106	< 199
Th-228	437 ± 76	840 ± 81	1230 ± 137	324 ± 77	382 ± 47	784 ± 77

INDIAN POINT ENERGY CENTER
TABLE B-16
RADIONUCLIDES IN SHORELINE SEDIMENT SAMPLES - 2012

pCi/kg dry ± 2 Sigma

	White Beach 53		Cold Spring 84*	
DATE	6/12/2012	9/18/2012	6/8/2012	9/18/2012
RADIOCHEMICAL				
Sr-90	< 41	< 49	< 40	< 47
GAMMA				
Be-7	< 270	< 397	< 463	< 401
K-40	11310 ± 1005	8817 ± 825	31530 ± 1598	33070 ± 1582
Mn-54	< 34	< 37	< 48	< 47
Co-58	< 30	< 41	< 54	< 45
Fe-59	< 83	< 121	< 143	< 137
Co-60	< 46	< 52	< 69	< 64
Zn-65	< 89	< 99	< 131	< 107
Nb-95	< 33	< 52	< 58	< 47
Zr-95	< 57	< 82	< 89	< 94
Ru-103	< 32	< 49	< 50	< 52
Ru-106	< 326	< 322	< 407	< 340
I-131	< 61	< 280	< 136	< 235
Cs-134	< 32	< 34	< 45	< 39
Cs-137	< 37	< 38	< 52	< 41
Ba-140	< 160	< 419	< 324	< 444
La-140	< 49	< 117	< 76	< 140
Ce-141	< 55	< 81	< 88	< 73
Ce-144	< 180	< 224	< 277	< 218
Ra-226	< 800	1172 ± 765	< 885	< 820
Ac-228	< 180	< 181	< 173	< 259
Th-228	138 ± 47	102 ± 49	620 ± 89	478 ± 56

* Control location

INDIAN POINT ENERGY CENTER
TABLE B-17
GAMMA EMITTERS IN AQUATIC VEGETATION SAMPLES - 2012

pCi/kg wet ± 2 Sigma

	Off Verplanck 17		Cold Spring 84*	
DATE	6/12/2012 Myrophyllium	9/20/2012 Myrophyllium	6/8/2012 Myrophyllium	9/19/2012 Myrophyllium
Be-7	383 ± 92	338 ± 123	< 100	206 + 117
K-40	2701 ± 236	2069 ± 218	2264 + 309	1332 + 218
Mn-54	< 11	< 12	< 13	< 9
Co-58	< 11	< 14	< 13	< 11
Fe-59	< 25	< 29	< 31	< 29
Co-60	< 12	< 14	< 13	< 16
Zn-65	< 25	< 27	< 32	< 26
Nb-95	< 12	< 14	< 16	< 12
Zr-95	< 20	< 26	< 22	< 25
Ru-103	< 11	< 14	< 13	< 13
Ru-106	< 91	< 110	< 111	< 99
I-131	< 24	< 48	< 36	< 44
Cs-134	< 10	< 13	< 11	< 10
Cs-137	< 12	< 15	< 17	< 13
Ba-140	< 58	< 103	< 91	< 95
La-140	< 18	< 24	< 17	< 28
Ce-141	< 20	< 28	< 20	< 19
Ce-144	< 76	< 97	< 74	< 65
Ra-226	< 238	< 303	< 274	355 + 196
Ac-228	< 61	< 67	< 46	< 44
Th-228	108 ± 24	95 ± 18	54 + 26	< 19

* Control location

INDIAN POINT ENERGY CENTER
TABLE B-18
RADIONUCLIDES IN FISH / INVERTEBRATES - 2012

pCi/kg wet ± 2 Sigma

	Roseton 23*					
DATE	5/1/2012 American Eel	05/11/12 Sunfish	5/17/2012 White Perch	5/17/2012 Catfish	5/24/2012 Blue Crab	6/15/2012 Striped Bass
RADIOCHEMICAL						
Ni-63	< 39	< 43	< 47	< 36	< 53	< 48
Sr-90	< 3.4	< 3.0	< 3.2	< 3.3	< 3.2	a
GAMMA						
Be-7	< 875	< 945	< 806	< 882	< 654	< 359
K-40	3207 ± 715	3782 ± 793	2285 ± 925	4239 ± 937	2624 ± 679	3327 ± 911
Mn-54	< 45	< 66	< 45	< 56	< 44	< 37
Co-58	< 58	< 88	< 60	< 94	< 67	< 35
Fe-59	< 234	< 225	< 205	< 257	< 189	< 88
Co-60	< 55	< 55	< 52	< 63	< 36	< 36
Zn-65	< 97	< 123	< 85	< 121	< 127	< 61
Nb-95	< 94	< 100	< 96	< 111	< 71	< 46
Zr-95	< 151	< 142	< 151	< 139	< 123	< 72
Ru-103	< 130	< 154	< 110	< 116	< 78	< 49
Ru-106	< 425	< 471	< 380	< 466	< 335	< 318
I-131	< 28030	< 12820	< 7090	< 8920	< 3440	< 420
Cs-134	< 36	< 48	< 48	< 45	< 40	< 34
Cs-137	< 38	< 55	< 45	< 62	< 45	< 33
Ba-140	< 8208	< 6173	< 3497	< 4327	< 2285	< 596
La-140	< 1937	< 2161	< 1092	< 1166	< 942	< 140
Ce-141	< 239	< 285	< 228	< 196	< 141	< 79
Ce-144	< 275	< 287	< 345	< 294	< 215	< 201
Ra-226	< 927	< 1232	< 1064	< 1111	< 857	< 645
Th-228	< 81	< 85	< 87	186 ± 118	< 81	168 ± 83

a Not enough sample for Sr-90 analysis

INDIAN POINT ENERGY CENTER
TABLE B-18
RADIONUCLIDES IN FISH / INVERTEBRATES - 2012

pCi/kg wet ± 2 Sigma

	Roseton 23*					
DATE	7/25/2012 Striped Bass	8/3/2012 American Eel	8/8/2012 Blue Crab	8/8/2012 Catfish	8/8/2012 White Perch	08/15/12 Sunfish
RADIOCHEMICAL						
Ni-63	< 41	< 35	< 74	< 35	< 43	< 44
Sr-90	< 4.4	< 4.6	< 2.1	< 2.0	< 3.9	< 2.5
GAMMA						
Be-7	< 758	< 800	< 507	< 689	< 937	< 575
K-40	4108 ± 1187	2408 ± 914	2339 ± 565	2788 ± 924	2968 ± 1072	4123 ± 860
Mn-54	< 69	< 53	< 46	< 61	< 74	< 51
Co-58	< 81	< 61	< 60	< 69	< 93	< 63
Fe-59	< 238	< 120	< 91	< 122	< 241	< 139
Co-60	< 64	< 50	< 42	< 65	< 83	< 50
Zn-65	< 135	< 115	< 65	< 126	< 156	< 129
Nb-95	< 103	< 79	< 68	< 89	< 109	< 71
Zr-95	< 178	< 129	< 95	< 123	< 195	< 84
Ru-103	< 142	< 104	< 77	< 97	< 140	< 71
Ru-106	< 431	< 557	< 376	< 499	< 850	< 459
I-131	< 3706	< 1510	< 845	< 1260	< 1632	< 580
Cs-134	< 57	< 53	< 37	< 44	< 77	< 46
Cs-137	< 53	< 53	< 46	< 68	< 88	< 58
Ba-140	< 2494	< 1351	< 942	< 1112	< 1609	< 735
La-140	< 869	< 440	< 218	< 284	< 599	< 189
Ce-141	< 223	< 154	< 182	< 200	< 227	< 107
Ce-144	< 369	< 316	< 409	< 494	< 563	< 283
Ra-226	< 1523	< 1257	< 1285	< 1748	< 1863	< 1009
Th-228	< 150	< 77	< 110	< 137	< 134	< 98

INDIAN POINT ENERGY CENTER

TABLE B-18

RADIONUCLIDES IN FISH / INVERTEBRATES - 2012

pCi/kg wet ± 2 Sigma

	Downstream 25					
DATE	4/30/2012 Striped Bass	5/3/2012 American Eel	5/3/2012 Catfish	5/3/2012 White Perch	5/3/2012 Sunfish	6/13/2012 Blue Crab
RADIOCHEMICAL						
Ni-63	< 35	< 42	< 35	< 54	< 45	< 64
Sr-90	< 3.9	< 3.9	< 3.2	< 3.7	< 3.4	a
GAMMA						
Be-7	< 854	< 1125	< 622	< 882	< 910	< 815
K-40	4593 ± 1028	2609 ± 980	2714 ± 780	3679 ± 841	2844 ± 932	4511 ± 1925
Mn-54	< 41	< 49	< 38	< 50	< 43	< 72
Co-58	< 83	< 79	< 59	< 79	< 75	< 90
Fe-59	< 187	< 199	< 232	< 232	< 200	< 198
Co-60	< 30	< 64	< 35	< 50	< 44	< 70
Zn-65	< 122	< 168	< 99	< 106	< 75	< 149
Nb-95	< 54	< 100	< 58	< 99	< 65	< 96
Zr-95	< 148	< 147	< 114	< 145	< 129	< 169
Ru-103	< 121	< 175	< 103	< 149	< 145	< 114
Ru-106	< 451	< 454	< 322	< 474	< 342	< 645
I-131	< 27100	< 26620	< 18500	< 27370	< 18690	< 1082
Cs-134	< 45	< 46	< 32	< 48	< 40	< 73
Cs-137	< 46	< 43	< 38	< 53	< 54	< 71
Ba-140	< 8424	< 9292	< 7632	< 7838	< 6751	< 1371
La-140	< 1278	< 2346	< 1333	< 1649	< 2351	< 366
Ce-141	< 264	< 251	< 207	< 311	< 269	< 168
Ce-144	< 304	< 308	< 231	< 327	< 315	< 436
Ra-226	< 1059	< 1111	< 769	< 1130	< 982	< 1811
Th-228	< 89	< 93	< 67	< 100	< 79	< 166

a Not enough sample for Sr-90 analysis

INDIAN POINT ENERGY CENTER
TABLE B-18
RADIONUCLIDES IN FISH / INVERTEBRATES - 2012

pCi/kg wet ± 2 Sigma

	Downstream 25				
DATE	8/1/2012 American Eel	8/14/2012 White Perch	8/14/2012 Catfish	8/15/2012 Blue Crab	8/16/2012 Sunfish
RADIOCHEMICAL					
Ni-63	< 34	< 44	< 36	< 70	< 38
Sr-90	< 5.0	< 5.0	< 4.9	< 3.6	< 4.6
GAMMA					
Be-7	< 555	< 822	< 434	< 399	< 667
K-40	2541 ± 650	3373 ± 919	3597 ± 739	2740 ± 682	3318 ± 1011
Mn-54	< 38	< 76	< 46	< 46	< 62
Co-58	< 58	< 73	< 57	< 61	< 75
Fe-59	< 133	< 182	< 145	< 107	< 173
Co-60	< 40	< 73	< 52	< 45	< 49
Zn-65	< 96	< 129	< 96	< 70	< 138
Nb-95	< 65	< 83	< 59	< 60	< 80
Zr-95	< 93	< 137	< 108	< 85	< 140
Ru-103	< 73	< 91	< 63	< 59	< 87
Ru-106	< 376	< 590	< 370	< 338	< 537
I-131	< 1520	< 775	< 438	< 423	< 548
Cs-134	< 37	< 68	< 44	< 40	< 62
Cs-137	< 44	< 58	< 45	< 46	< 71
Ba-140	< 1260	< 1077	< 620	< 559	< 816
La-140	< 319	< 233	< 199	< 142	< 308
Ce-141	< 124	< 182	< 87	< 84	< 125
Ce-144	< 260	< 502	< 216	< 238	< 324
Ra-226	< 861	< 1567	< 824	< 920	< 1311
Th-228	< 72	< 119	< 72	< 77	< 105

Table B-19
LAND USE CENSUS - RESIDENCE and MILCH ANIMAL RESULTS
2012

The 2012 land use census indicated there were no new residences that were closer in proximity to IPEC. NEM maintains a complete nearest residence survey with updated distances.

No milch animals were observed during this reporting period within the 5-mile zone. There are no animals producing milk for human consumption within five miles of Indian Point.

TABLE B-20
LAND USE CENSUS
2012

INDIAN POINT ENERGY CENTER

UNRESTRICTED AREA BOUNDARY AND NEAREST RESIDENCES

Sector	Compass Point	Distance to site Boundary from Unit 2 Plant Vent (meters)	Distance to site Boundary from Unit 3 Plant Vent (meters)	Distance to nearest resident, from Unit 1 superheater (meters)	Address of nearest resident, Last Census
1	N	RIVER	RIVER	1788	41 River Road Tomkins Cove
2	NNE	RIVER	RIVER	3111	Chateau Rive Apts. John St. Peekskill
3	NE	550	636	1907	211 Viewpoint Terrace, Peekskill
4	ENE	600	775	1478	1018 Lower South St. Peekskill
5	E	662	785	1371	1103 Lower South St. Peekskill
6	ESE	569	622	715	461 Broadway Buchanan
7	SE	553	564	1168	223 First St. Buchanan
8	SSE	569	551	1240	5 Pheasant's Run Buchanan
9	S	700	566	1133	320 Broadway Verplanck
10	SSW	755	480	1574	240 Eleventh St. Verplanck
11	SW	544	350	3016	8 Spring St. Tomkins Cove
12	WSW	RIVER	RIVER	2170	9 West Shore Dr. Tomkins Cove
13	W	RIVER	RIVER	1919	712 Rt. 9W Tomkins Cove
14	WNW	RIVER	RIVER	1752	770 Rt. 9W Tomkins Cove
15	NW	RIVER	RIVER	1693	807 Rt. 9W Tomkins Cove
16	NNW	RIVER	RIVER	1609	4 River Rd. Tomkins Cove

APPENDIX C

HISTORICAL TRENDS

APPENDIX C

The past ten years of historical data for various radionuclides and media are presented both in tabular form and graphical form to facilitate the comparison of 2012 data with historical values. Although other samples were taken and analyzed, values were only tabulated and plotted where positive indications were present.

Averaging the positive values in these tables can result in a biased high value, especially, when the radionuclide is detected in only one or two quarters for the year.

TABLE C-1

DIRECT RADIATION ANNUAL SUMMARY

2002 - 2012

Average Quarterly Dose (mR/Quarter)			
Year	Inner Ring	Outer Ring	Control Location
2002	15.0	15.0	14.0
2003	14.3	13.9	14.7
2004	13.0	13.0	14.0
2005	14.1	14.1	15.9
2006	13.9	14.3	17.5
2007	14.4	14.6	18.8
2008	14.5	14.2	17.3
2009	14.5	14.2	17.3
2010	14.0	14.3	13.0
2011	13.6	14.4	13.4
2012	**13.2**	**13.6**	**12.3**
Historical Average 2002-2011	14.1	14.2	15.6

FIGURE C-1

DIRECT RADIATION, ANNUAL SUMMARY
2002 - 2012

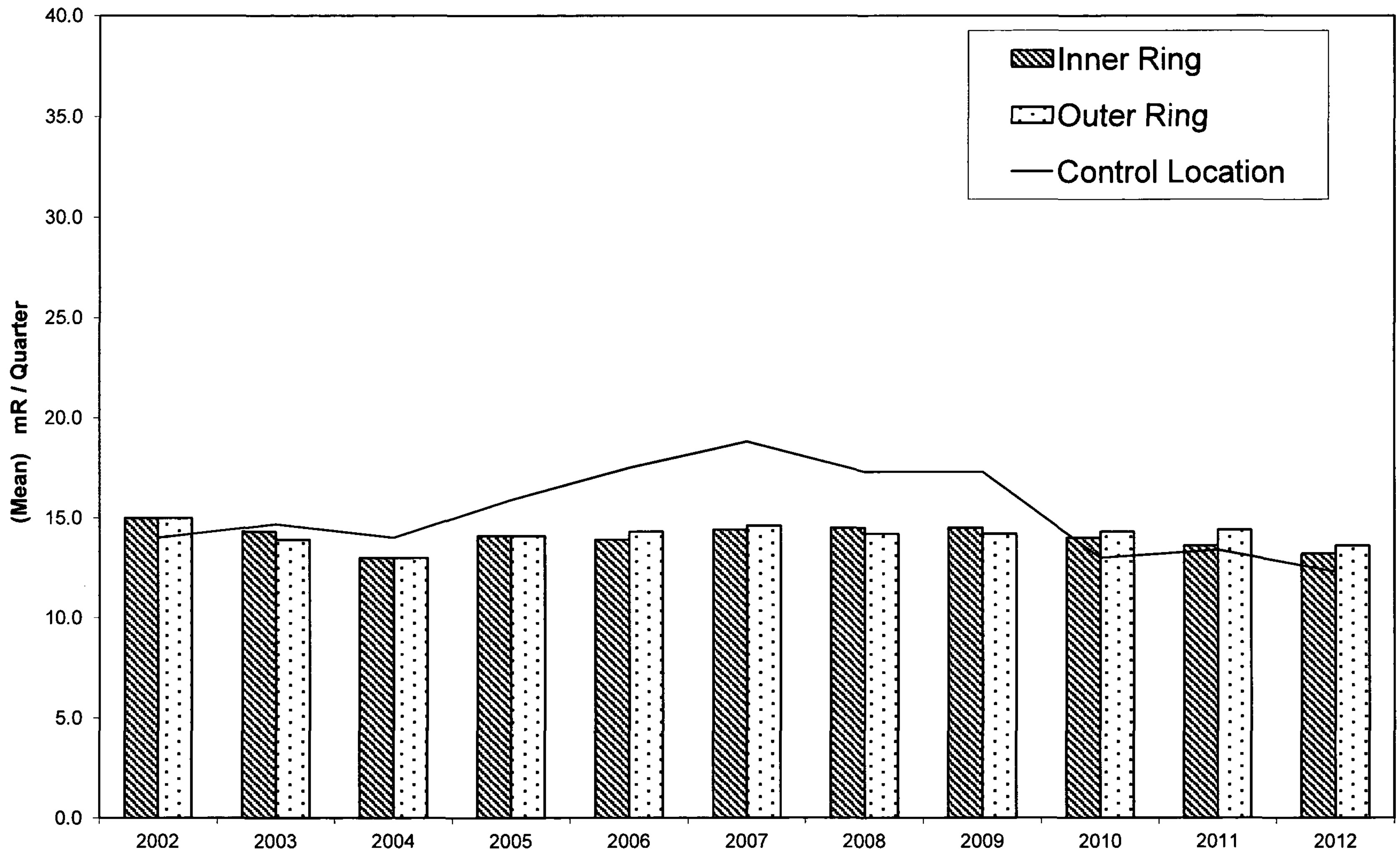


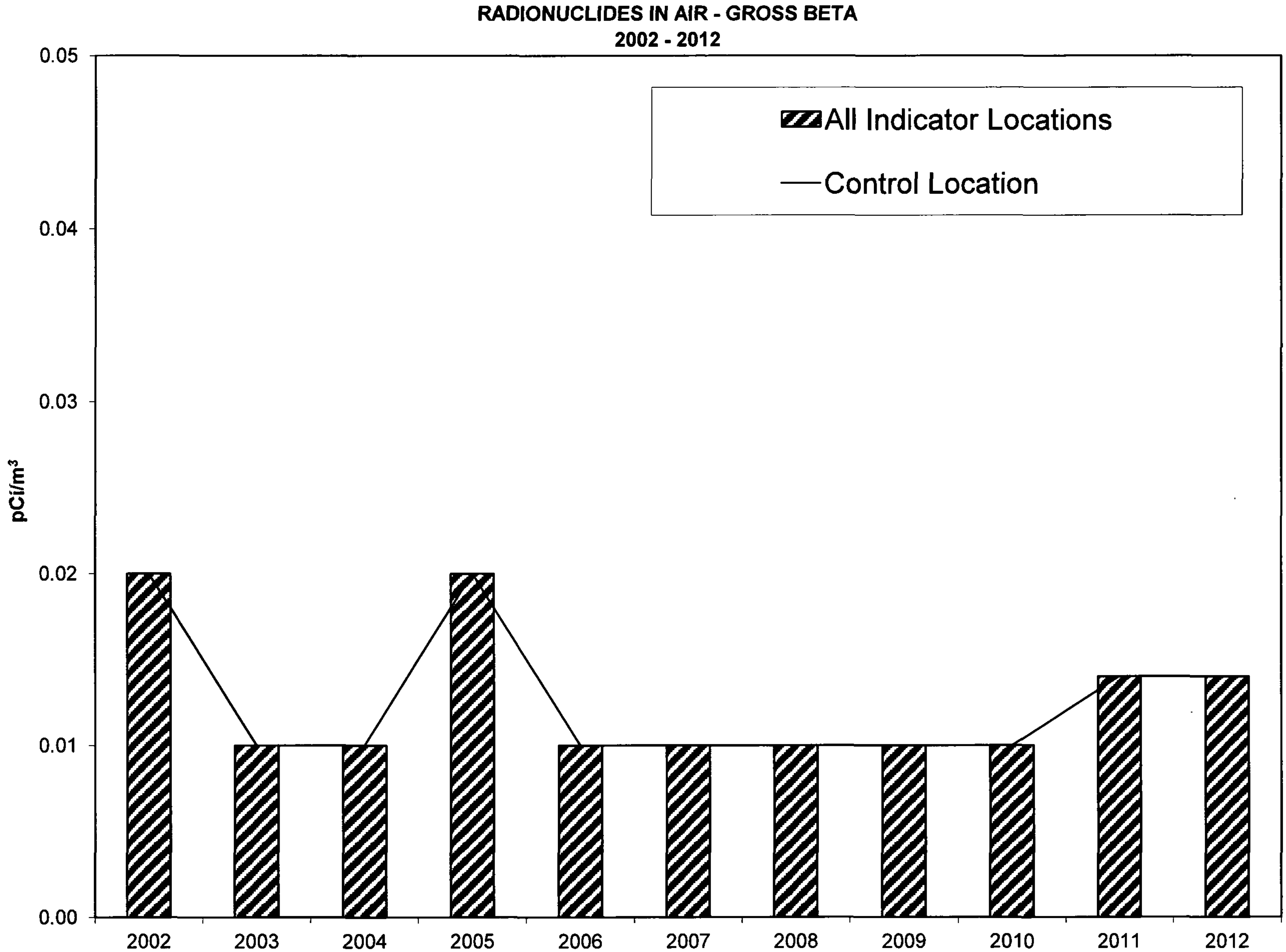
TABLE C-2

RADIONUCLIDES IN AIR
2002 - 2012
(pCi/m^3)

Year	Gross Beta: All Indicator Locations	Gross Beta: Control Location	Cs-137: All Indicator Locations	Cs-137: Control Location
2002	0.02	0.02	< MDC	<MDC
2003	0.01	0.01	< MDC	<MDC
2004	0.01	0.01	< MDC	<MDC
2005	0.02	0.02	< MDC	<MDC
2006	0.01	0.01	< MDC	<MDC
2007	0.01	0.01	< MDC	<MDC
2008	0.01	0.01	< MDC	<MDC
2009	0.01	0.01	< MDC	<MDC
2010	0.01	0.01	< MDC	<MDC
2011	0.014	0.014	< MDC	<MDC
2012	**0.014**	**0.014**	**< MDC**	**<MDC**
Historical Average 2002-2011	0.01	0.01	< MDC	<MDC

The Minimum Detectable Concentration (MDC) is less than the ODCM required LLD.
<MDC indicates no positive values were detected

FIGURE C-2



* Includes ODCM and non-ODCM indicator locations.
Gross Beta ODCM required LLD = 0.01 pCi/m^3

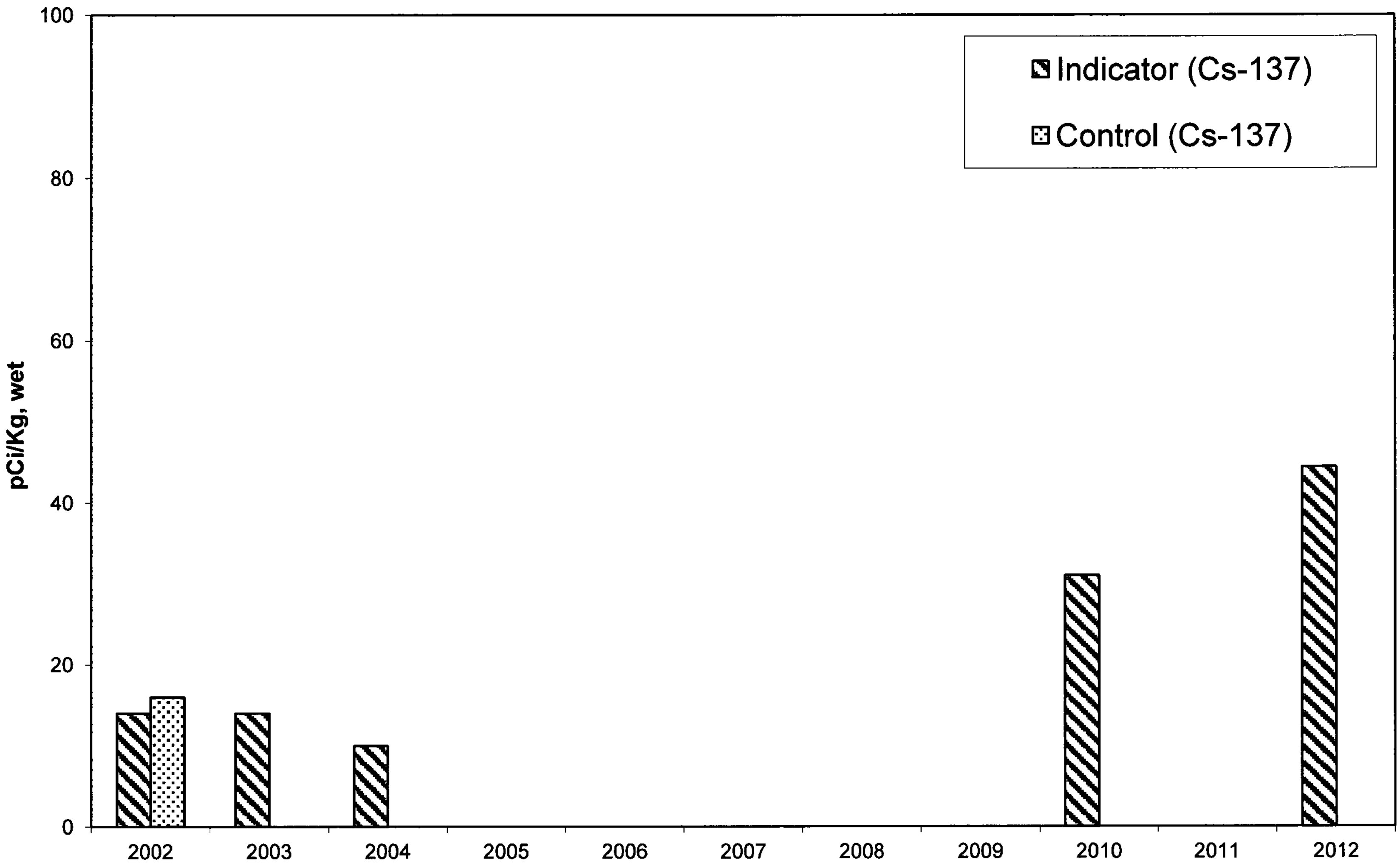
TABLE C-3

BROAD LEAF VEGETATION - Cs-137
2002 - 2012
(pCi/Kg, wet)

	Cs-137	
Year	**Indicator**	**Control**
2002	14	16
2003	14	< MDC
2004	10	< MDC
2005	< MDC	< MDC
2006	< MDC	< MDC
2007	< MDC	< MDC
2008	< MDC	< MDC
2009	< MDC	< MDC
2010	31	< MDC
2011	< MDC	< MDC
2012	**44**	**< MDC**
Historical Average 2002-2011	17	16

The Minimum Detectable Concentration (MDC) is less than the ODCM required LLD.
<MDC indicates no positive values were detected

FIGURE C-3
BROAD LEAF VEGETATION - Cs-137
2002 - 2012



ODCM required LLD = 80 pCi/Kg, wet

TABLE C-4

RADIONUCLIDES IN HUDSON RIVER WATER
2002 - 2012
(pCi/L)

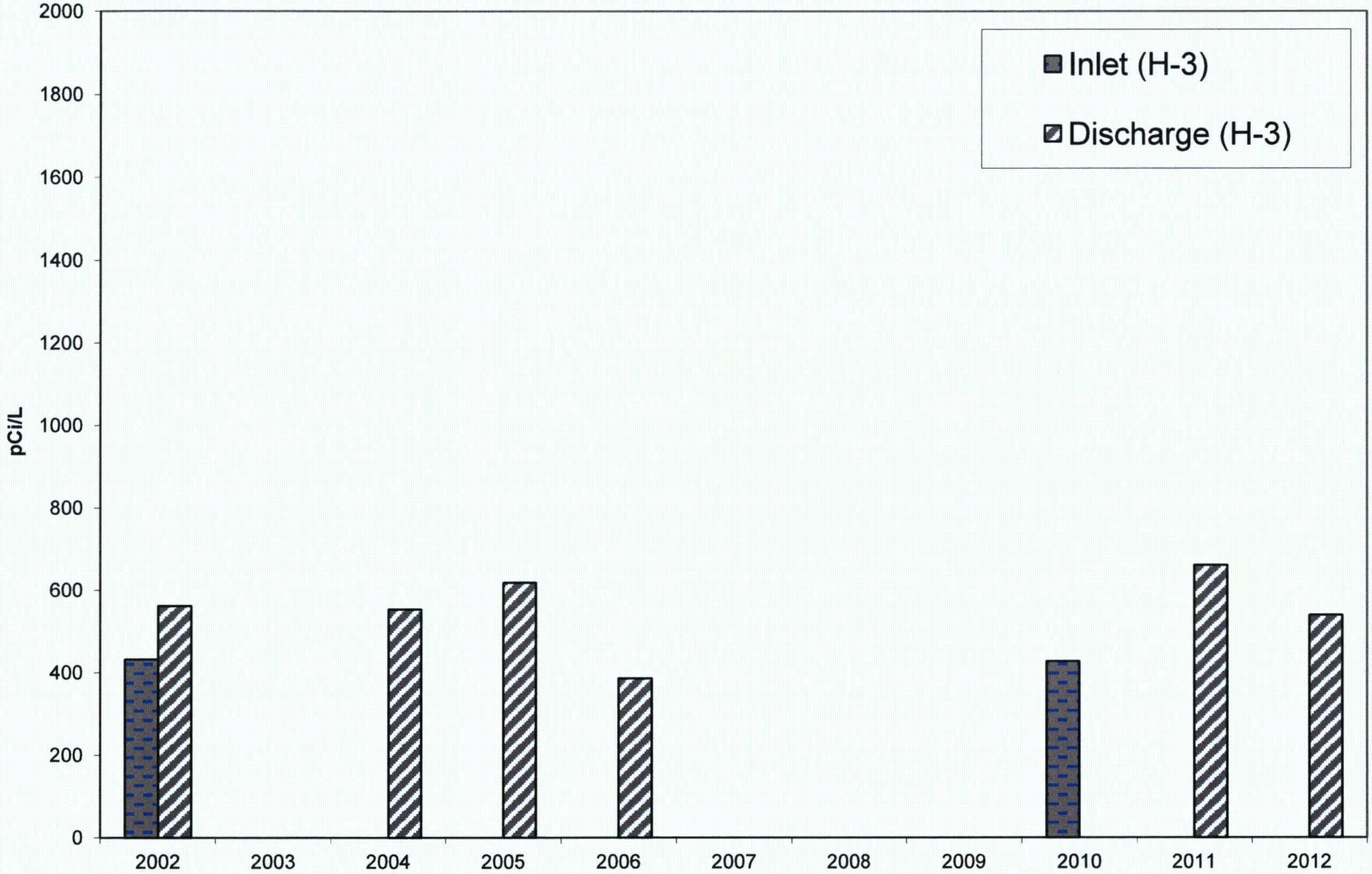
	Tritium (H-3)		Cs-137	
Year	**Inlet**	**Discharge**	**Inlet**	**Discharge**
2002	432	562	< MDC	< MDC
2003	< MDC	< MDC	< MDC	< MDC
2004	< MDC	553	< MDC	< MDC
2005	< MDC	618	< MDC	< MDC
2006	< MDC	386	< MDC	< MDC
2007	< MDC	< MDC	< MDC	< MDC
2008	< MDC	< MDC	< MDC	< MDC
2009	< MDC	< MDC	< MDC	< MDC
2010	428	< MDC	< MDC	< MDC
2011	< MDC	661	< MDC	< MDC
2012	**< MDC**	**539**	**< MDC**	**< MDC**
Historical Average 2002-2011	430	556	< MDC	< MDC

The Minimum Detectable Concentration (MDC) is less than the ODCM required LLD.

<MDC indicates no positive values were detected

FIGURE C-4

RADIONUCLIDES IN HUDSON RIVER WATER
2002 - 2012



Tritium ODCM required LLD = 3000 pCi/L

TABLE C-5

RIVER WATER - Discharge Area - Tritium
REMP vs. EFFLUENT
(pCi/liter)

Year	REMP*	EFFLUENT **
1Q 2010	< 403	959
2Q 2010	< 397	239
3Q 2010	< 409	261
4Q 2010	< 408	796
1Q 2911	661	2192
2Q 2011	< 424	400
3Q 2011	< 412	493
4Q 2011	< 182	389
1Q 2102	617	2186
2Q 2012	< 178	394
3Q 2012	< 193	489
4Q 2012	460	860
Three Year Average 2010 - 2012	639	800

* Sample from mixing zone, expected to be less than average activity in the discharge canal

** Based upon Effluent Report data, average activity in the discharge canal calculated from the total H-3 discharged/total dilution flow

FIGURE C-5

REVER WATER - DISCHARGE AREA - TRITIUM
REMP vs. EFFLUENT
(pCi/liter)

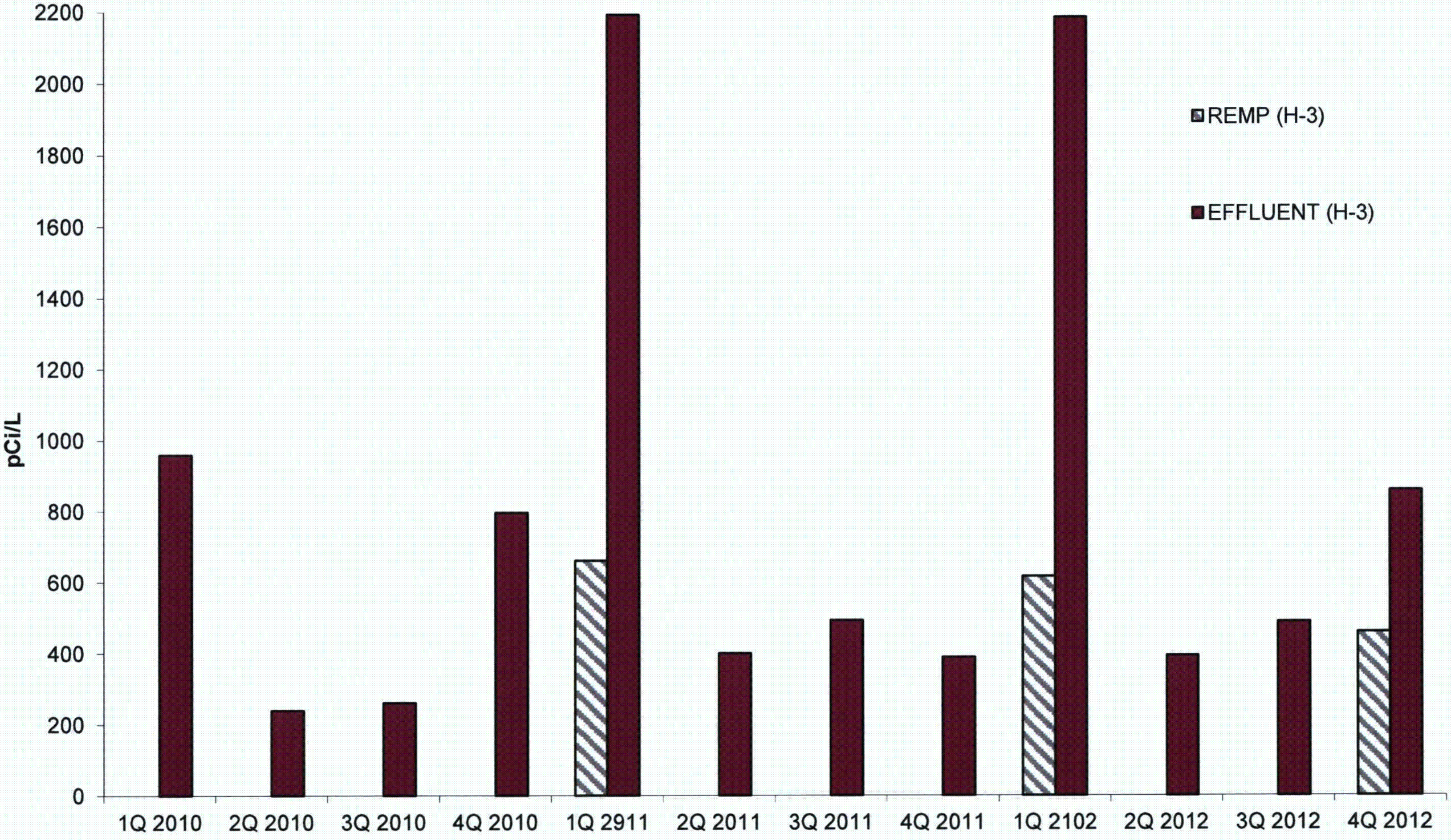


TABLE C-6

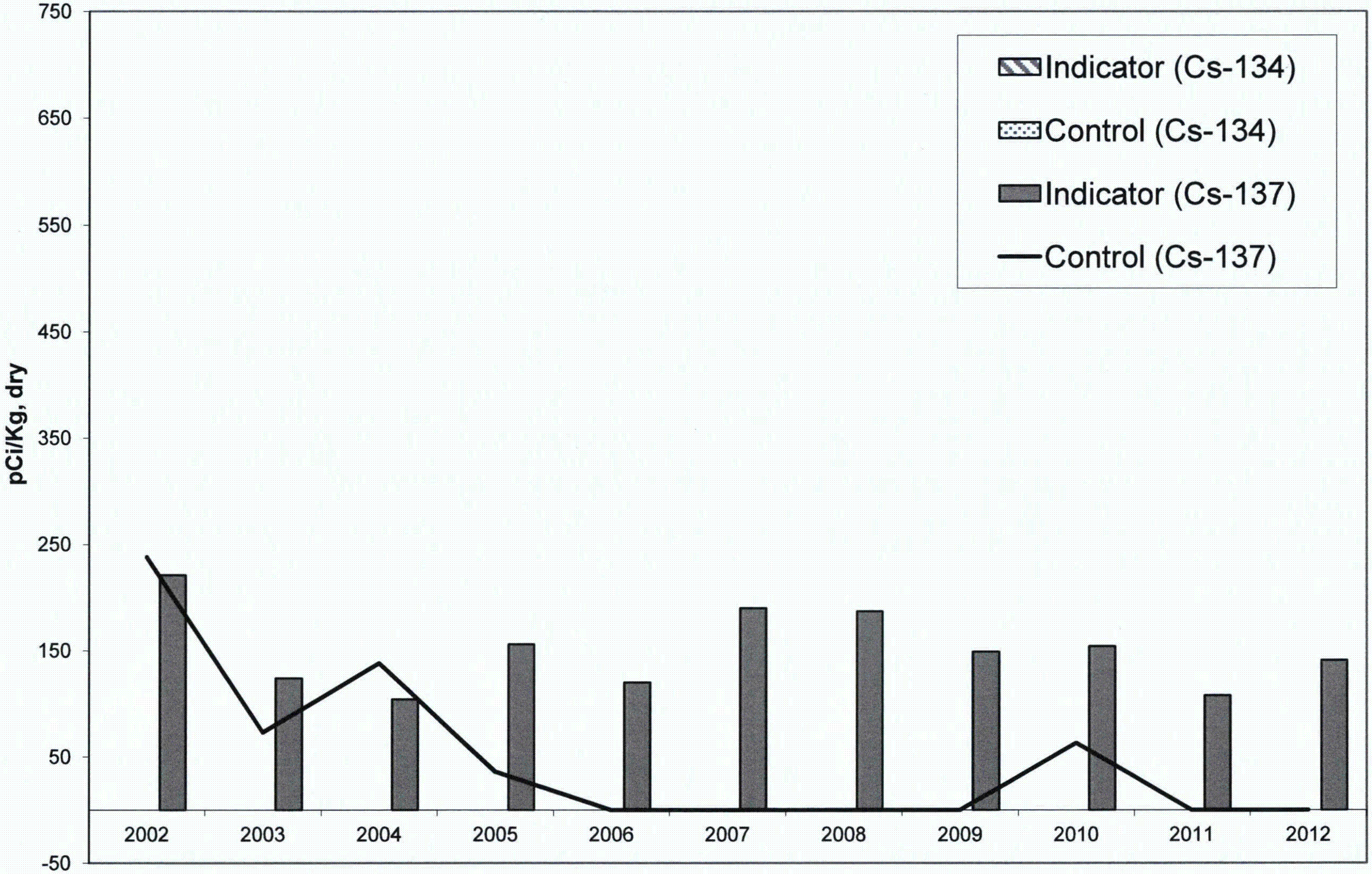
RADIONUCLIDES IN SHORELINE SOIL
2002 - 2012
(pCi/kg, dry)

	Cs-134		Cs-137	
Year	**Indicator**	**Control**	**Indicator**	**Control**
2002	< MDC	< MDC	221	238
2003	< MDC	< MDC	124	73
2004	< MDC	< MDC	104	138
2005	< MDC	< MDC	156	36
2006	< MDC	< MDC	120	< MDC
2007	< MDC	< MDC	190	< MDC
2008	< MDC	< MDC	187	< MDC
2009	< MDC	< MDC	149	< MDC
2010	< MDC	< MDC	154	63
2011	< MDC	< MDC	108	< MDC
2012	**< MDC**	**< MDC**	**141**	**< MDC**
Historical Average 2002-2011	< MDC	< MDC	150	110

The Minimum Detectable Concentration (MDC) is less than the ODCM required LLD.

<MDC indicates no positive values were detected

FIGURE C-6
RADIONUCLIDES IN SHORELINE SOIL
2002 to 2012



Cs-134 ODCM required LLD = 150 pCi/Kg, dry
Cs-137 ODCM required LLD = 175 pCi/Kg, dry

APPENDIX D

INTERLABORATORY COMPARISON PROGRAM

APPENDIX D

INTERLABORATORY COMPARISON PROGRAM

This section presents the results of the interlaboratory comparison program for the Teledyne Brown Engineering Environmental Services and Environmental Dosimetry Company. Since General Engineering Labs only analyzed 2 samples, their interlaboratory data is not presented. However, their results can be provided upon request.

D.1 Program Description – Teledyne Brown Engineering Environmental Services Comparison Programs

The Teledyne Brown Engineering Environmental Services participates in several interlaboratory comparison programs. These programs include sample media for which samples are routinely collected and for which comparison samples are commercially available. Participation in these interlaboratory comparison programs ensure that independent checks on the precision and accuracy of the measurement of radioactive material in the environmental samples are performed as part of the Quality Assurance Program for environmental monitoring. To fulfill the requirement for an Interlaboratory Comparison Program, Teledyne Brown Engineering Environmental Services has engaged the following programs:

- Eckert & Ziegler Analytics Environmental Radioactivity Cross Check Program
- Department of Energy (DOE) Mixed Analyte Performance Evaluation Program (MAPEP)
- Environmental Resource Associates (ERA) Cross Check Program

These programs supply sample media as blind samples (typically spikes), which contain certified levels of radioactivity unknown to the analysis laboratory. These samples are prepared and analyzed by the Teledyne Brown Engineering Environmental Services using standard laboratory procedures. Each program issues a statistical summary report of the results. Teledyne Brown Engineering Environmental Services uses predetermined acceptance criteria methodology for evaluating its laboratory performance.

Teledyne Brown Engineering Environmental Services also analyzes laboratory blanks. The analysis of laboratory blanks provides a means to detect and measure radioactive contamination of analytical samples. The analysis of analytical blanks also provides information on the adequacy of background subtraction. Laboratory blank results are analyzed using control charts.

D.2 Acceptance Criteria

Each sample result is evaluated to determine the accuracy and precision of the laboratory's analysis result. The sample evaluation method is discussed below.

D.2.1 Analytics Sample Results Evaluation

Samples provided by Analytics are evaluated using what is specified as the NRC method. This method is based on the calculation of the ratio of results reported by the participating laboratory (QC result) to the Vendor Laboratory Known value (reference result).

An Environmental Laboratory analytical result is evaluated using the following calculation:

The value for the error resolution is calculated.

$$\text{Error Resolution} = \frac{\text{Reference Result}}{\text{Reference Results Error (1 sigma)}}$$

Using the appropriate row under the Error Resolution column in Table D.3-1, a corresponding Ratio of Agreement interval is given.

The value for the ratio is then calculated.

$$\text{Ratio of agreement} = \frac{\text{QC Result}}{\text{Reference Result}}$$

If the value falls within the agreement interval, the result is acceptable.

TABLE D.3-1

ERROR RESOLUTION	RATIO OF AGREEMENT
< 4	No Comparison
4 to 7	0.5-2.0
8 to 15	0.6-1.66
16 to 50	0.75-1.33
51 to 200	0.8-1.25
>200	0.85-1.18

This acceptance test is generally referred to as the "NRC" method. The acceptance criteria are contained in Procedure EN-CY-102. The NRC method generally results in an acceptance range of approximately ± 25% of the Known value when applied to sample results from the Eckert & Ziegler Analytics Interlaboratory Comparison Program. This method is used as the procedurally required assessment method and requires the generation of a deviation from QA/QC program report when results are unacceptable.

D.2.2 ERA and MAPEP Sample Result Evaluation

Both these programs supply an acceptance range for evaluating the results.

D.3 Program Results Summary

The Interlaboratory Comparison Program numerical results are summarized in the following tables.

ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES

Month/Year	Identification Number	Matrix	Nuclide	Units	Reported Value (a)	Known Value (b)	Ratio (c) TBE/Analytics	Evaluation (d)
March 2012	E10066	Milk	Sr-89	pCi/L	101	94.8	1.07	A
			Sr-90	pCi/L	11.7	13.5	0.87	A
	E10067	Milk	I-131	pCi/L	87.5	92.5	0.95	A
			Ce-141	pCi/L	247	260	0.95	A
			Cr-51	pCi/L	435	436	1.00	A
			Cs-134	pCi/L	133	149	0.89	A
			Cs-137	pCi/L	156	159	0.98	A
			Co-58	pCi/L	127	132	0.96	A
			Mn-54	pCi/L	190	195	0.97	A
			Fe-59	pCi/L	179	168	1.07	A
			Zn-65	pCi/L	327	333	0.98	A
			Co-60	pCi/L	274	279	0.98	A
	E10069	AP	Ce-141	pCi	167	164	1.02	A
			Cr-51	pCi	310	276	1.12	A
			Cs-134	pCi	107	94.5	1.13	A
			Cs-137	pCi	109	101	1.08	A
			Co-58	pCi	87.6	83.5	1.05	A
			Mn-54	pCi	133	123	1.08	A
			Fe-59	pCi	113	106	1.07	A
			Zn-65	pCi	226	210	1.08	A
			Co-60	pCi	185	176	1.05	A
	E10068	Charcoal	I-131	pCi	92.8	94.2	0.99	A
	E10070	Water	Fe-55	pCi/L	1800	1570	1.15	A
June 2012	E10198	Milk	Sr-89	pCi/L	86.1	99.8	0.86	A
			Sr-90	pCi/L	9.2	12.7	0.72	W
	E10199	Milk	I-131	pCi/L	88.9	99.7	0.89	A
			Ce-141	pCi/L	72.8	82.2	0.89	A
			Cr-51	pCi/L	394	402	0.98	A
			Cs-134	pCi/L	159	174	0.91	A
			Cs-137	pCi/L	206	212	0.97	A
			Co-58	pCi/L	89.5	92.3	0.97	A
			Mn-54	pCi/L	129	132	0.98	A
			Fe-59	pCi/L	129	128	1.01	A
			Zn-65	pCi/L	193	199	0.97	A
			Co-60	pCi/L	342	355	0.96	A
	E10201	AP	Ce-141	pCi	73.2	75.1	0.97	A
			Cr-51	pCi	367	366	1.00	A
			Cs-134	pCi	165	159	1.04	A
			Cs-137	pCi	205	193	1.06	A
			Co-58	pCi	84.7	84.2	1.01	A
			Mn-54	pCi	118	121	0.98	A
			Fe-59	pCi	125	117	1.07	A
			Zn-65	pCi	181	182	0.99	A
			Co-60	pCi	338	324	1.04	A
	E10200	Charcoal	I-131	pCi	101	96.6	1.05	A

ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES

Month/Year	Identification Number	Matrix	Nuclide	Units	Reported Value (a)	Known Value (b)	Ratio (c) TBE/Analytics	Evaluation (d)
June 2012	E10202	Water	Fe-55	pCi/L	1890	1580	1.20	A
September 2012	E10296	Milk	Sr-89	pCi/L	106	99.6	1.06	A
			Sr-90	pCi/L	13.6	16.0	0.85	A
	E10297	Milk	I-131	pCi/L	89.8	99.6	0.90	A
			Ce-141	pCi/L	160	164	0.98	A
			Cr-51	pCi/L	230	248	0.93	A
			Cs-134	pCi/L	101	108	0.94	A
			Cs-137	pCi/L	174	174	1.00	A
			Co-58	pCi/L	97.2	100	0.97	A
			Mn-54	pCi/L	188	196	0.96	A
			Fe-59	pCi/L	159	152	1.05	A
			Zn-65	pCi/L	195	192	1.02	A
			Co-60	pCi/L	155	152	1.02	A
	E10299	AP	Ce-141	pCi	145	135	1.07	A
			Cr-51	pCi	219	205	1.07	A
			Cs-134	pCi	94.1	89.4	1.05	A
			Cs-137	pCi	140	144	0.97	A
			Co-58	pCi	88.3	83.0	1.06	A
			Mn-54	pCi	173	162	1.07	A
			Fe-59	pCi	136	125	1.09	A
			Zn-65	pCi	165	159	1.04	A
			Co-60	pCi	133	125	1.06	A
	E10298	Charcoal	I-131	pCi	95.5	97.2	0.98	A
	E10300	Water	Fe-55	pCi/L	1630	1900	0.86	A
December 2012	E10334	Milk	Sr-89	pCi/L	101	96.6	1.05	A
			Sr-90	pCi/L	11.3	13.8	0.82	A
	E10335	Milk	I-131	pCi/L	93.1	90.0	1.03	A
			Ce-141	pCi/L	52.5	51.0	1.03	A
			Cr-51	pCi/L	373	348	1.07	A
			Cs-134	pCi/L	157	165	0.95	A
			Cs-137	pCi/L	113	117	0.97	A
			Co-58	pCi/L	94.1	98.5	0.96	A
			Mn-54	pCi/L	116	116	1.00	A
			Fe-59	pCi/L	124	116	1.07	A
			Zn-65	pCi/L	190	186	1.02	A
			Co-60	pCi/L	172	170	1.01	A
	E10337A	AP	Ce-141	pCi	51.8	49.6	1.04	A
			Cr-51	pCi	372	338	1.10	A
			Cs-134	pCi	165	161	1.02	A
			Cs-137	pCi	113	114	0.99	A
			Co-58	pCi	96.5	95.8	1.01	A
			Mn-54	pCi	118	112	1.05	A
			Fe-59	pCi	105	112	0.94	A
			Zn-65	pCi	166	181	0.92	A
			Co-60	pCi	179	165	1.08	A

ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES

Month/Year	Identification Number	Matrix	Nuclide	Units	Reported Value (a)	Known Value (b)	Ratio (c) TBE/Analytics	Evaluation (d)
December 2012	E10336	Charcoal	I-131	pCi	73.1	72.7	1.01	A
	E10333	Water	Fe-55	pCi/L	1550	1750	0.89	A

(a) Teledyne Brown Engineering reported result.

(b) The Analytics known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation.

(c) Ratio of Teledyne Brown Engineering to Analytics results.

(d) Analytics evaluation based on TBE internal QC limits:
A= Acceptable. Reported result falls within ratio limits of 0.80-1.20.
W=Acceptable with warning. Reported result falls within 0.70-0.80 or 1.20-1.30.
N = Not Acceptable. Reported result falls outside the ratio limits of < 0.70 and > 1.30.

DOE's MIXED ANALYTE PERFORMANCE EVALUATION PROGRAM (MAPEP)
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES

Month/Year	Identification Number	Media	Nuclide	Units	Reported Value (a)	Known Value (b)	Acceptance Range	Evaluation (c)
March 2012	12-MaW26	Water	Cs-134	Bq/L	-0.0045		(1)	A
			Cs-137	Bq/L	37.5	39.9	27.9 - 51.9	A
			Co-57	Bq/L	30.8	32.9	23.0 - 42.8	A
			Co-60	Bq/L	22.4	23.72	16.60 - 30.84	A
			H-3	Bq/L	456	437	306 - 568	A
			Mn-54	Bq/L	31.0	31.8	22.3 - 41.3	A
			K-40	Bq/L	144	142	99 - 185	A
			Sr-90	Bq/L	-0.0084		(1)	A
			Zn-65	Bq/L	-0.369		(1)	A
	12-GrW26	Water	Gr-A	Bq/L	2.06	2.14	0.64 - 3.64	A
			Gr-B	Bq/L	7.48	6.36	3.18 - 9.54	A
	12-MaS26	Soil	Cs-134	Bq/kg	831	828	580 - 1076	A
			Cs-137	Bq/kg	0.145		(1)	A
			Co-57	Bq/kg	1270	1179	825 - 1533	A
			Co-60	Bq/kg	7.61	1.56	(2)	N (3)
			Mn-54	Bq/kg	634	558	391 - 725	A
			K-40	Bq/kg	1690	1491	1044 - 1938	A
			Sr-90	Bq/kg	328	392	274 - 540	A
			Zn-65	Bq/kg	753	642	449 - 835	A
	12-RdF26	AP	Cs-134	Bq/sample	2.31	2.38	1.67 - 3.09	A
			Cs-137	Bq/sample	2.15	1.79	1.25 - 2.33	W
			Co-57	Bq/sample	-0.0701		(1)	A
			Co-60	Bq/sample	2.62	2.182	1.527 - 2.837	W
			Mn-54	Bq/sample	4.13	3.24	2.27 - 4.21	W
			Sr-90	Bq/sample	0.0185		(1)	A
			Zn-65	Bq/sample	4.19	2.99	2.09 - 3.89	N (3)
	12-GrF26	AP	Gr-A	Bq/sample	0.365	1.2	0.4 - 2.0	A
			Gr-B	Bq/sample	2.31	2.4	1.2 - 3.6	A
	12-RdV26	Vegetation	Cs-134	Bq/sample	8.72	8.43	5.90 - 10.96	A
			Cs-137	Bq/sample	0.0424		(1)	A
			Co-57	Bq/sample	15.5	12.0	8.4 - 15.6	W
			Co-60	Bq/sample	6.80	6.05	4.24 - 7.87	A
			Mn-54	Bq/sample	0.0057		(1)	A
			Sr-90	Bq/sample	2.24	2.11	1.48 - 2.74	A
			Zn-65	Bq/sample	10.5	8.90	6.23 - 11.57	A
September 2012	12-MaW27	Water	Cs-134	Bq/L	21.4	23.2	16.2 - 30.2	A
			Cs-137	Bq/L	17.0	16.7	11.7 - 21.7	A
			Co-57	Bq/L	28.7	29.3	20.5 - 38.1	A
			Co-60	Bq/L	0.179		(1)	A
			H-3	Bq/L	387	334	234 - 434	A
			Mn-54	Bq/L	18.1	17.8	12.5 - 23.1	A
			K-40	Bq/L	139	134	94 - 174	A
			Sr-90	Bq/L	19.6	12.2	8.5 - 15.9	N (4)
			Zn-65	Bq/L	27.2	25.9	18.1 - 33.7	A
	12-GrW27	Water	Gr-A	Bq/L	0.966	1.79	0.54 - 3.04	A
			Gr-B	Bq/L	10.0	9.1	4.6 - 13.7	A

DOE's MIXED ANALYTE PERFORMANCE EVALUATION PROGRAM (MAPEP)
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES
(PAGE 2 OF 2)

Month/Year	Identification Number	Media	Nuclide	Units	Reported Value (a)	Known Value (b)	Acceptance Range	Evaluation (c)
September 2012	12-MaS27	Soil	Cs-134	Bq/kg	880	939	657 - 1221	A
			Cs-137	Bq/kg	1220	1150	805 - 1495	A
			Co-57	Bq/kg	1330	1316	921 - 1711	A
			Co-60	Bq/kg	552	531	372 - 690	A
			Mn-54	Bq/kg	1000	920	644 - 1196	A
			K-40	Bq/kg	674	632	442 - 822	A
			Sr-90	Bq/kg	528	508	356 - 660	A
			Zn-65	Bq/kg	665	606	424 - 788	A
	12-RdF27	AP	Cs-134	Bq/sample	2.760	2.74	1.92 - 3.56	A
			Cs-137	Bq/sample	0.0415		(1)	A
			Co-57	Bq/sample	2.00	191.00	1.34 - 2.48	A
			Co-60	Bq/sample	1.78	1.728	1.210 - 2.246	A
			Mn-54	Bq/sample	2.40	2.36	1.65 - 3.07	A
			Sr-90	Bq/sample	0.931	1.03	0.72 - 1.34	A
			Zn-65	Bq/sample	-0.688		(1)	A
	12-GrF27	AP	Gr-A	Bq/sample	0.434	0.97	0.29 - 1.65	A
			Gr-B	Bq/sample	1.927	1.92	0.96 - 2.88	A
	12-RdV27	Vegetation	Cs-134	Bq/sample	6.28	6.51	4.56 - 8.46	A
			Cs-137	Bq/sample	4.62	4.38	3.07 - 5.69	A
			Co-57	Bq/sample	6.51	5.66	3.96 - 7.36	A
			Co-60	Bq/sample	5.32	5.12	3.58 - 6.66	A
			Mn-54	Bq/sample	3.59	3.27	2.29 - 4.25	A
			Sr-90	Bq/sample	0.0012		(1)	A
			Zn-65	Bq/sample	-0.046		(1)	A

(1) False positive test.
(2) Sensitivity evaluation
(3) No cause was found for the failed high soil Co-60 sensitivity test or the high Zn-65 in AP, which TBE considers an anomaly. NCR 12-08
(4) Sr-90 in water high due to incorrect aliquot entered in LIMS. 12-11
(a) Teledyne Brown Engineering reported result.
(b) The MAPEP known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation.
(c) DOE/MAPEP evaluation: A=acceptable, W=acceptable with warning, N=not acceptable.

ERA ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES
(PAGE 1 OF 1)

Month/Year	Identification Number	Media	Nuclide	Units	Reported Value (a)	Known Value (b)	Acceptance Limits	Evaluation (c)
May 2012	RAD-89	Water	Sr-89	pCi/L	63.4	58.5	46.9 - 66.3	A
			Sr-90	pCi/L	33.5	37.4	27.4 - 43.1	A
			Ba-133	pCi/L	89.2	82.3	69.1 - 90.5	A
			Cs-134	pCi/L	66.5	74.2	60.6 - 81.6	A
			Cs-137	pCi/L	152	155	140 - 172	A
			Co-60	pCi/L	73.3	72.9	65.6 - 82.6	A
			Zn-65	pCi/L	109	105	94.5 - 125	A
			Gr-A	pCi/L	82.4	62.9	33.0 - 78.0	N (1)
			Gr-B	pCi/L	43.6	44.2	29.6 - 51.5	A
			I-131	pCi/L	25.9	27.1	22.5 - 31.9	A
			H-3	pCi/L	15433	15800	13800 - 17400	A
	MRAD-16	Filter	Gr-A	pCi/filter	39.5	77.8	26.1 - 121	A
November, 2012	RAD-91	Water	Sr-89	pCi/L	46.5	39.1	29.7 - 46.1	N (2)
			Sr-90	pCi/L	16.6	20.1	14.4 - 23.8	A
			Ba-133	pCi/L	85.2	84.8	71.3 - 93.3	A
			Cs-134	pCi/L	76.9	76.6	62.6 - 84.3	A
			Cs-137	pCi/L	177	183	165 - 203	A
			Co-60	pCi/L	77.4	78.3	70.5 - 88.5	A
			Zn-65	pCi/L	209	204	184 - 240	A
			Gr-A	pCi/L	50.6	58.6	30.6 - 72.9	A
			Gr-B	pCi/L	59.3	39.2	26.0 - 46.7	N (2)
			I-131	pCi/L	22.9	24.8	20.6 - 29.4	A
			H-3	pCi/L	5020	4890	4190 - 5380	A
	MRAD-17	Filter	Gr-A	pCi/filter	59.6	87.5	29.3 - 136	A

(1) Detector G1 is slightly biased high for Th-230 based measurements used only for ERA Gross Alpha samples. NCR 12-05

(2) The Sr-89 found to known ratio was 1.19, which TBE considers acceptable. It appears the aliquot was entered incorrectly for the Gross Beta NCR 12-13

(a) Teledyne Brown Engineering reported result.

(b) The ERA known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation.

(c) ERA evaluation: A=acceptable. Reported result falls within the Warning Limits. NA=not acceptable. Reported result falls outside of the Control Limits. CE=check for Error. Reported result falls within the Control Limits and outside of the Warning Limit.

D.4 Environmental TLD Quality Assurance

Environmental dosimetry services for the reporting period of January – December, 2012 were provided by the Environmental Dosimetry Company (EDC), Sterling, Massachusetts. The TLD systems at the Environmental Dosimetry Company (EDC) are calibrated and operated to ensure consistent and accurate evaluation of TLDs. The quality of the dosimetric results reported to EDC clients is ensured by in house performance testing and independent performance testing by EDC clients.

The purpose of the dosimetry quality assurance program is to provide performance documentation of the routine processing of EDC dosimeters. Performance testing provides a statistical measure of the bias and precision of dosimetry processing against a reliable standard, which in turn points out any trends or performance changes. Dosimetry quality control tests are performed on EDC Panasonic 814 Environmental dosimeters. These tests include: (1) the in house testing program conducted by the EDC QA Officer and (2) independent test perform by EDC clients.

Excluded from this report are instrumentation checks. Although instrumentation checks represent an important aspect of the quality assurance program, they are not included as process checks in this report. Instrumentation checks represent between 5-10% of the TLDs processed.

Table D.4-1 provides a summary of individual dosimeter results evaluated against the EDC internal acceptance criteria for high-energy photons (Cs-137) only. The internal acceptance (tolerance) criteria for the Panasonic Environmental dosimeters are: ± 15% for bias and ± 12.8% for precision. During this period, 100% (72/72) of the individual dosimeters, evaluated against these criteria met the tolerance limits for accuracy and 100% (72/72) met the criterion for precision.

Table D.4-2 provides the Bias + Standard deviation results for each group (N=6) of dosimeters evaluated against the internal tolerance criteria. Overall, 100% (12/12) of the dosimeter sets evaluated against the internal tolerance performance criteria met these criteria.

Table D.4-3 presents the independent blind spike results for irradiated dosimeters provided by client utilities during this annual period. All results passed the performance acceptance criterion.

TABLE D.4-1

PERCENTAGE OF INDIVIDUAL DOSIMETERS THAT PASSED EDC INTERNAL CRITERIA JANUARY – DECEMBER 2012[1], [2]

Dosimeter Type	Number Tested	% Passed Bias Criteria	% Passed Precision Criteria
Panasonic Environmental	72	100	100

[1]This table summarizes results of tests conducted by EDC.

[2]Environmental dosimeter results are free in air.

TABLE D.4-2

MEAN DOSIMETER ANALYSES (N=6)
JANUARY – DECEMBER 2012[(1), (2)]

Process Date	Mean Bias %	Standard Deviation %	Tolerance Limit +/-15%
4/18/2012	7.7	1.7	Pass
4/21/2012	11.6	1.4	Pass
5/1/2012	1.1	1.4	Pass
6/5/2012	-0.5	1.3	Pass
7/19/2012	2.3	1.6	Pass
7/23/2012	-4.0	0.8	Pass
11/1/2012	2.5	2.2	Pass
11/4/2012	1.5	0.9	Pass
11/26/2012	-2.3	2.6	Pass
1/23/2013	-3.2	1.1	Pass
1/28/2013	4.4	1.3	Pass
2/2/2013	-0.1	1.2	Pass

(1) This table summarizes results of tests conducted by EDC for TLDs issued in 2012.
(2) Environmental dosimeter results are free in air.

TABLE D.4-3
SUMMARY OF INDEPENDENT DOSIMETER TESTING
JANUARY – DECEMBER 2012[(1), (2)]

Issuance Period	Client	Mean Bias %	Standard Deviation %	Pass / Fail
1st Qtr.2012	Millstone	-10.4	2.6	Pass
2nd Qtr.2012	Millstone	-4.7	1.6	Pass
2nd Qtr.2012	Seabrook	-0.8	1.5	Pass
3rd Qtr. 2012	Millstone	-13.9	2.6	Pass
4th Qtr.2012	Millstone	4.3	1.5	Pass
4th Qtr.2012	Seabrook	-5.2	1.3	Pass

(1) Performance criteria are +/- 30%.
(2) Blind spike irradiations using Cs-137