Entergy

Entergy Nuclear Northeast
Indian Point Energy Center
295 Broadway, Suite 1
P.O. Box 249
Buchanan, NY 10511-0249
Tel 914 734 5340
Fax 914 734 5718

Fred Dacimo
Vice President, Operations

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

SUBJECT: Indian Point Nuclear Power Plant Units No. 1, 2, and 3
Docket Nos. 50-03, 50-247 and 50-286
License Nos. DPR-5, DPR-26 and DPR-64
Annual Radiological Environmental Operating Report

Dear Sir:

This letter provides Entergy Nuclear Operations, Inc.'s (ENO's) Annual Environmental Operating Report for the period January 1, 2002 through December 31, 2002. This report is submitted in accordance with facility's operating license, DPR-5, DPR-26, and DPR-64, for Indian Point Units 1, 2, and 3, respectively.

ENO is making no new commitments in this letter.

Should you have any questions regarding this matter, please contact Mr. John McCann, Manager, Nuclear Licensing at (914) 734-5074.

Very truly yours,

Fred R. Dacimo
Vice President, Operations
Indian Point Energy Center

Enclosure

IE25

cc: Mr. Hubert J. Miller
Regional Administrator - Region I
U.S. Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

Mr. Patrick D. Milano, Senior Project Manager
Project Directorate I-1
Division of Licensing Project Management
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Mail Stop O-8-C2
Washington, D.C. 20555-0001

Mr. R. Laufer, Project Manager
Project Directorate I
Division of Reactor Projects I/II
U.S. Nuclear Regulatory Commission
Mail Stop 8G9
Washington, D.C. 20555

Mr. John L. Minns, Project Manager
Division of Reactor Program Management
U.S. Nuclear Regulatory Commission
Mail Stop 10-D4
Washington, D.C. 20555

Senior Resident Inspector
Indian Point Unit 2
U.S. Nuclear Regulatory Commission
P.O. Box 38
Buchanan, NY 10511

Senior Resident Inspector
Indian Point Unit 3
U.S. Nuclear Regulatory Commission
P.O. Box 337
Buchanan, NY 10511

Mr. John P. Spath, Director
Radioactive Waste Policy
and Nuclear Coordination
New York State Energy Research and
Development Authority
2 Empire State Plaza, Suite 1901
Albany, NY 12233-1253

NL-03-075

ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

ENTERGY NUCLEAR NORTHEAST

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, 2002

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

LIST OF FIGURES

LIST OF TABLES

LIST OF TABLES (Continued)

SECTION I

EXECUTIVE SUMMARY

1.0 EXECUTIVE SUMMARY

This Annual Radiological Environmental Operating Report (AREOR) contains descriptions and results of the 2002 Radiological Environmental Monitoring Program (REMP) for the Indian Point site. The Indian Point site consists of Units 1, 2 and 3. Units 1, 2 and 3 are owned by Entergy Nuclear Northeast. Unit 1 was retired as a generating facility in 1974, and as such, its reactor is no longer operated.

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 material that might be released from the plant, cosmic radiation, fallout, and the naturally occurring radioactive materials in soil, air and water. 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 increased radioactivity attributable to 2002 Indian Point Station operation.

The waterborne pathway consists of Hudson River water, fish and invertebrates, aquatic vegetation, bottom sediment, and shoreline soil. Measurements of the media comprising the waterborne pathway indicated that there were no significantly increased levels of radioactivity attributable to 2002 Indian Point Station operation.

This report contains a description of the REMP and the conduct of that program as required by the IP2 Radiological Environmental Technical Specifications and IP3 Radiological Effluent Controls, herein referred to as RETS. This 2002 AREOR also contains summaries and discussions of the results of the 2002 program, trend analyses, potential impact on the environment, land use census, and interlaboratory comparisons.

During 2002, a total of 1323 analyses were performed. Table B-1 presents a summary of the collected sample results. The actual sampling frequency in 2002 was higher than required, due to the inclusion of additional (non-RETS) sample locations and media.

In summary, the levels of radionuclides in the environment surrounding Indian Point are significantly less than NRC limits as a result of Indian Point Station operations in 2002. The levels present in 2002 were within the historical ranges, i.e., previous levels resulting from natural and anthropogenic sources for the detected radionuclides. Consequently, Indian Point operations in 2002 did not result in approaching any environmental regulatory limits posed by the NRC, or result in any exposure to the public greater than environmental background levels.

SECTION 2

INTRODUCTION

2.0 INTRODUCTION

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 has been retired as a generating facility. Units 1, 2, and 3 are owned and operated by Entergy Nuclear Northeast.

2.2 Program Background

Environmental monitoring and surveillance have been conducted at Indian Point since 1958, which was 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 nuclear weapons tests. Thus, as used in this report, background levels consist of those resulting from both natural and anthropogenic sources of environmental radioactivity. Accumulation of this background data permits the detection and assessment of environmental activity attributable to plant operations.

2.3 Program Objectives

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

1. To enable the identification and quantification of changes in the radioactivity of the area, and

2. To measure radionuclide concentrations in the environment attributable to operations of the Indian Point site.

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 another program objective. Verifying projected concentrations through the REMP is difficult since the environmental concentrations resulting from plant releases are consistently too small to be detected. Plant related radionuclides were detected in 2002, however, residual radioactivity from atmospheric bomb tests and naturally occurring radioactivity were the predominant sources of radioactivity in the samples collected. Nonetheless, analysis of the data verified that plant effluents were far below regulatory limits at environmental levels.

SECTION 3

PROGRAM DESCRIPTION

3.0 PROGRAM DESCRIPTION

To achieve the objectives of the REMP and ensure compliance with the Radiological Environmental Technical Specifications and Radiological Effluent Controls (RETS), sampling and analysis of environmental media are performed as outlined in Table A-1 and described in section 3.3. The Indian Point REMP consists of samples that are required by RETS and additional samples, Non-RETS, that are not required by RETS.

3.1 Sample Collection

Entergy Nuclear Northeast (IP2) Nuclear Environmental Monitoring personnel perform collection of environmental samples for the entire Indian Point site.

Assistance in the collection of fish and invertebrate samples was provided by a contracted environmental vendor, Normandeau Associates, Inc.

3.2 Sample Analysis

The analysis of Indian Point environmental samples is performed by two laboratories: James A. Fitzpatrick Nuclear Power Plant (JAFNPP) Environmental Laboratory in Fulton, New York; and Framatome ANP, Environmental Laboratory, Massachusetts. The JAFNPP lab at Fulton analyzes all samples; however, tritium samples were processed by Framatome ANP, Environmental Laboratory, Massachusetts and verified by JAFNPP in 2002.

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 milliroentgen, 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.

An additional TLD sample site is located at Roseton (20.7 miles north) as a control, and there are eight other TLD sample locations of special interest. In total, there are 41 TLD sample sites, designated DR-1 through DR-41, with two TLDs at each site. TLDs are collected and processed on a quarterly basis. The results are reported as mR per standard quarter (91 days). The mR reported is the average of the two TLDs from each sample site.

3.3.2 Airborne Particulates and Radioiodine

Air samples were taken at nine locations varying in distance from 0.28 to 20.7 miles (0.4 to 33 km) from the plant. These locations represent one control and eight indicator locations. The air samples are collected continuously by means of fixed air particulate filters followed by in-line charcoal cartridges. Both are changed on a weekly basis. The filter and cartridge samples are analyzed for gross beta and radioiodine, respectively. In addition, gamma spectroscopy analysis (GSA) is performed on quarterly composites of the air particulate filters. The five required RETS air sample locations are designated by the codes A-1 through A-5, see Figures A-1 and A-2.

3.3.3 Hudson River Water

Hudson River water sampling is performed continuously at the intake structure (RETS designation Wa1) and at a point exterior to the discharge canal where Hudson River water and water from the discharge canal mix (RETS designation Wa2), see Figure A-1. An automatic sampling apparatus 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.

3.3.4 Drinking Water

Samples of drinking water are collected monthly from the Camp Field Reservoir (3.4 miles NE, RETS designation Wb1), see Figure A-2. Each monthly sample is approximately 4 liters and is analyzed for gamma-emitting radionuclides, gross beta, and I-131. They are also composited quarterly and analyzed for tritium.

3.3.5 Hudson River Shoreline Soil

Shoreline soil samples are collected at three indicator and two control locations along the Hudson River. The designation for the RETS indicator location is Wc1 and the RETS control location is designated Wc2, see Figures A-1 and A-2. The remaining two indicator and one control locations are non-RETS. 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.

3.3.6 Broad Leaf Vegetation

Broad leaf vegetation samples are collected from three locations during the growing season. The designation for the two RETS indicator locations are Ic1 and Ic2, and the RETS control location is designated 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.

3.3.7 Fish and Invertebrates

Fish and invertebrate samples are obtained from the Hudson River at locations upstream and downstream of the plant discharge. The RETS designation for the upstream sample point is Ib2 and the downstream designation is Ib1, 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.

3.3.8 Hudson River Aquatic Vegetation (Non-RETS)

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

3.3.9 Hudson River Bottom Sediment (Non-RETS)

Bottom sediment and benthos are sampled at four locations, three indicator and one control, 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 Precipitation (Non-RETS)

Precipitation samples are continuously collected at one indicator and one control location, see Figure A-3. They are collected in sample bottles designed to hinder evaporation. They are composited quarterly and analyzed for tritium. They are also analyzed by gamma spectroscopy.

3.3.11 Soil (Non-RETS)

Soil samples are collected from one control and two indicator locations, 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.

3.3.12 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.

The milch animal census is used to identify animals producing milk for human consumption within 5 miles (8 km) of Indian Point. The census consists of visual field surveys of the areas where a high probability of milch animals exists and confirmation through personnel such as feed suppliers who deal with farm animals and dairy associations (See Table B-17). 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-18.

RETS allow sampling of vegetation in two sectors near the site boundary in lieu of a garden census.

3.4 Statistical Methodology

There are a number of statistical calculation methodologies used in evaluating the data from the Indian Point REMP. These methods include determination of Lower Limits of Detection (LLD) and Critical Levels (L_c), and estimation of the mean and associated propagated error.

3.4.1 Lower Limit of Detection (LLD) and Critical Level (L_c)

The LLD is a predetermined concentration or activity level used to establish a detection limit for the analytical procedures.

The Nuclear Regulatory Commission (NRC) specifies the maximum acceptable LLDs for each radionuclide in specific media. The LLDs are determined by taking into account overall measurement methods. The equation used to calculate the LLD is:

$$LLD = 4.66\ K\ S_b,$$

where: S_b = standard deviation of the background count rate,
and

K consists of variables, which account for such parameters as:
- Instrument characteristics (e.g., efficiency)
- Sample size
- Counting time
- Media density (self-absorption)
- Radioactive decay
- Chemical yield

In the RETS program, LLDs are used to ensure that minimum acceptable detection capabilities for the counting system are met with specified statistical confidence levels (95% detection probability with 5% probability of a false negative). 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. Table A-2 presents the RETS required LLDs for specific media and radionuclides as specified by the NRC. The LLDs actually achieved are usually much lower since the RETS required LLDs represent the maximum allowed.

The critical level (L_c) is defined as that net sample counting rate which has a 5% probability of being exceeded when the actual sample activity is zero (e.g., when counting background only). It is determined using the following equation.

$$L_c = k_a\ S_b\ (1 + T_b/T_s)^{0\ 5} \text{ in cpm}$$

where: k_a = 1.645 (corresponds to a 95% confidence level)
S_b = standard deviation of the background count rate = $(R_b/T_b)^{0\ 5}$
R_b = background count rate (cpm)
T_b = background count time (min)
T_s = sample count time (min)

For the REMP, net sample results which are less than the L_c value are considered not detected, and the L_c value is reported as the "less than" value, unless otherwise noted. Values above the L_c are considered positively detected radioactivity in the environmental media of interest (with a 5% chance of false positive).

3.4.2 Determination of Mean and Propagated Error

In accordance with program policy, recounts of positive samples are performed. When the initial count reveals the presence of radioactivity, which may be attributed to plant operations, at a value greater than the L_c, two recounts are performed to verify the positive results. The recounts are not performed on; air samples with positive results from gross beta analysis, since the results are always positive due to natural background radioactive material in the air, or tritium in water samples, since an outside contractor provides these activities. When a radionuclide is positively identified in two or more counts, the analytical result for the radionuclide is reported as the mean of the positive detections and the associated propagated error for that mean. In cases where more than one sample result is available, the mean of the sample results and the estimated error for the mean are reported in the Annual Report.

The mean (X) and propagated error (PE) are calculated using the following equations:

$$X = \frac{\sum_{i=1}^{N} X_i}{N}$$

where: X_i = value of each individual observation
N = number of observations

$$PE = \frac{\sqrt{\sum_{i=1}^{N} (ERR_i)^2}}{N}$$

where: ERR_i = 1 sigma error of the individual analysis
N = number of observations

3.4.3 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 14). 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.

In the data tables B-6 through B-15, values shown are based on the L_c value, unless otherwise noted. If a radionuclide was detected at or above the L_c value in two or more counts, the mean and error are calculated as per Section 3.4.2, and reported in the data table. Values listed as "<" in the data tables are the L_c values for that sample, unless otherwise noted. If multiple counts were performed on a sample and a radionuclide's values are "$< L_c$ " each time, the largest critical level is reported in the data table.

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 1992 through 2001. The 2002 average values are included in these historic tables for purposes of comparison.

3.5 Program Units

The Radiological Environmental Monitoring Program uses standard radiological units to express program results. The units and their description are as follows:

Becquerel is a measure of radioactive material, abbreviated Bq, from the International System of Units (SI). A Becquerel is one atom disintegration per second. A Becquerel will normally be used with a volume or mass to express the radioactive concentration of some sample material.

Cubic meter is a metric volume slightly larger than a cubic yard. It is abbreviated m^3 and is used in this report as the unit for the volume of air.

Curie is the basic unit used to describe the intensity of radioactivity. The curie is equal to 37 billion disintegrations per second.

Kilogram is a metric unit of mass; it is equivalent to 2.2 pounds. Kilogram is abbreviated kg and can be expressed as kg-wet or kg-dry. The wet or dry designation denotes whether the sample is dried or not before it is counted.

Liter is a metric unit of volume slightly larger than a quart. It is abbreviated L and is used as the volume for liquids.

Microsievert (uSv) is the SI unit for measure of radiation dose to humans. It is equal to 0.1 mrem.

Millirem is a measure of radiation dose to humans, abbreviated mrem; it is 1/1000 of a rem. Millirem expressed for some period of time is the dose rate. The millirem is different from the milliroentgen in that the millirem is used for reporting radiation dose to humans and the milliroentgen is a measure of radiation in the environment or in air. Normal background radiation dose is approximately 300 mrem per year.

Milliroentgen is a measure of radiation exposure, abbreviated mR; it is 1/1000 of a roentgen. Milliroentgen expressed for some period of time is the exposure rate.

Milliroentgen (mR) per standard quarter is used for direct radiation or Thermoluminescent Dosimeter (TLD) results.

Picocurie is a measure of radioactive material, abbreviated pCi. A picocurie is 2.22 atom disintegrations per minute. A picocurie will normally be used with a volume or mass to express the radioactive concentration of some sample material.

Picocuries per cubic meter (pCi/m^3) is used to express concentration for all air samples.

Picocuries per kilogram (pCi/kg) is the expression used to express concentration for REMP vegetation, soil, shoreline soil, and bottom sediment samples.

Picocuries per liter (pCi/L) is used to express concentration for liquid samples such as, precipitation, drinking water, and river water samples.

Standard quarter is a measure of time (91 days). It is used as the unit of time for expression of mR for the direct radiation measurements from TLDs.

SECTION 4

RESULTS AND DISCUSSION

4.0 RESULTS AND DISCUSSION

The 2002 Radiological Environmental Monitoring Program (REMP) was conducted in accordance with Indian Point's Radiological Environmental Technical Specifications and Radiological Effluent Controls, herein referred to as RETS. The RETS contain 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. Additional sampling conducted for the REMP is designated "non-RETS" because these samples are not required by the RETS.

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

- Hudson River-water
  - shoreline soil
  - fish and invertebrates
  - aquatic vegetation (non-RETS)
  - bottom sediment (non-RETS)
- Airborne Particulates and Radioiodine
- Precipitation (non-RETS)
- Drinking Water
- Terrestrial Broad Leaf Vegetation
- Soil (non-RETS)
- Direct Gamma Radiation

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 2002 and assessed the significance of the findings.

A summary of the results of the 2002 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 RETS 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, 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 (with the exception of H-3 as discussed below), their presence is noted only in the data tables and will not be discussed further.

In addition to the naturally occurring radionuclides discussed above, H-3 (which may result from human activity as well as from natural occurrence), I-131, Cs-134, and Cs-137 were detected above background levels in various RETS and non-RETS sample media in the vicinity of Indian Point. The sources and significance of the presence of these radionuclides are described in later sections.

The second group of radionuclides detected in 2002 consists of those resulting from past weapons testing in the earth's atmosphere. Such testing in the 1950's and 1960's resulted in a significant atmospheric radionuclide inventory, which, in turn, contributed to the concentrations in the lower atmosphere and ecological systems. Although reduced in frequency, atmospheric weapons testing continued into the 1980's. The resultant radionuclide inventory, although diminishing with time (e.g., through radioactive decay), remains detectable.

In 2002, the detected radionuclide(s) attributable to past atmospheric weapons testing consisted of Cs-137 in some 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 through the 2002 REMP comprises those that may be attributable to current plant operations. During 2002, H-3, Cs-134, and Cs-137 were the only potentially plant-related radionuclides detected in some of the RETS and non-RETS 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. The H-3 detected in 2002 resulted from a combination of sources. There was no H-3 detected at concentrations above the RETS required LLD. "Less than" values for H-3 are reported from the laboratory as less than the sample LLD, which are less than the RETS required LLD.

Cs-137 and Cs-134 are both produced in and released from fission reactors and were introduced into the environment from the accident at Chernobyl. Only Cs-137 is found in weapons test debris.

I-131 is also produced in fission reactors, but can result from non-plant related anthropogenic sources, e.g., medical administrations, such as in the 1998, 2000, 2001, and 2002 AREOR.

Co-58 and Co-60 are activation/corrosion products also related to plant operations. They are produced by neutron activation in the reactor core. As Co-58 has a much shorter half-life, its absence "dates" the presence of Co-60 as residual from releases of both nuclides in the past. If Co-58 and Co-60 are concurrently detected in environmental samples, then the source of these nuclides is considered to be from 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 2002 REMP, though they (Co-58 and Co-60) can be observed in historical tables.

In the following sections, a summary of the results of the 2002 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 the JAFNPP Environmental Laboratory. The laboratory uses a Panasonic TLD system. In 2002, 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 1997 through 2001. The 2002 means are also presented in Table B-4. Table B-5 presents the 2002 TLD data for the inner ring and outer ring of TLDs.

The 2002 mean value for the direct radiation sample points was 14.4 mR per standard quarter. In 2001, the mean value was 14.7 mR and the mean value for the period 1997 through 2001 was 14.8 mR per standard quarter. At those locations where the 2002 mean value was higher, 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 14.7 mR per standard quarter while the average for the outer ring was 14.6 mR per standard quarter. The control location average for 2002 was 14.2 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 2002 averages are consistent with the historical data. The 2002 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 2002 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 results of the gamma spectroscopy analyses of the quarterly composites of these samples are 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 0.015 pCi/m^3 and the average for the control location was 0.015 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. Gamma spectroscopy analyses of the quarterly composite air samples showed that no reactor-related nuclides 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 2002 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.

The charcoal cartridge analytical results are presented in Table B-8. "Less than" values are presented as sample critical level (L_C). There was no I-131 detected (LLD = 0.07 pCi/m^3) in the charcoal cartridge samples, which is consistent with historical trends.

From the data, it can be seen that no airborne radioactivity attributable to the operation of Indian Point was detected in 2002.

4.3 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 H-3 analysis of quarterly composites, are presented in Tables B-9 and B-10, respectively.

In addition to naturally occurring radionuclides, tritium, whose presence may or may not be attributable to plant operations, was the only radionuclide detected in the Hudson River water in 2002. Tritium was detected in the discharge canal mixing zone at a maximum concentration of 783 pCi/L in 2002. The detected H-3 concentration was far below the RETS required LLD of 3000 pCi/L.

The relative insignificance of the H-3 concentration of 783 pCi/L can be seen by calculating the potential dose from the H-3. Using the guidelines set forth in the Offsite Dose Calculation Manual (Reference 22), it was conservatively calculated that the "maximum exposed individual" is an adult who would receive a dose of 0.0019 mrem/year. The insignificance of this dose becomes readily apparent when it is compared to the annual average dose of 300 mrem from background (Reference 21).

Dose calculation assumptions, which continue to provide conservative estimates of dose, still yield an insignificant dose result. The major assumptions are: all fish and invertebrates eaten in 2002 came from waters with 783 pCi/L H-3; the maximum exposed individual is an adult who consumed 21 kg of fish and 5 kg of invertebrates; and generic bioaccumulation factors for fish are representative. The potential dosimetric impact of 0.0019 mrem/year is insignificant.

Data on the radionuclides H-3 and Cs-137 detected in the Hudson River water over the past ten years, are summarized in Table C-3. From this table and Figure C-3, it can be seen that the average of the positive results for H-3 detected in the discharge canal was higher than the 10 year historical average; however, a review of the past twelve years indicates that the 783 pCi/l value is consistent with historical trends. The absense of detectable Cs-137 was consistent with the historical data trends.

4.4 Drinking Water

The annual program summary table (Table B-2) contains a summary of the 2002 drinking water sample analysis results. Results of the gamma spectroscopy analyses of the monthly drinking water samples are in Table B-11; results of tritium analysis of quarterly composites are in Table B-12. Other than naturally occurring radionuclides, no radionuclides were detected in drinking water samples.

A summary and illustration of historic trends of drinking water are provided in Table C-4 and Figure C-4, respectively. An examination of the data indicates that operation of the Indian Point units had no detectable radiological impact on drinking water.

4.5 Hudson River Shoreline Soil

A summary of the radionuclide concentrations detected in the shoreline soil samples is contained in Table B-2. Table B-13 contains all the results of the gamma spectroscopic analyses of the shoreline soil samples.

In addition to the naturally occurring nuclides, Cs-137 was identified in the Hudson River shoreline soil samples in 2002. Cs-137 was detected in three out of six samples from indicator locations. Cs-137 was detected at the control location in one out of four samples. The average concentration for the indicator locations was 221 pCi/kg-dry with a maximum concentration of 241pCi/kg-dry. The control location had a positive sample indicating 238 pCi/kg-dry.

Cs-137 has been detected in shoreline soil at indicator and control locations within the past ten years.

4.6 Broad Leaf Vegetation

Table B-2 contains a summary of the broad leaf vegetation sample analysis results. All the data from analysis of the 2002 samples are presented in Table B-14. Analyses of broad leaf vegetation samples revealed naturally occurring nuclides, and Cs-137 detected in one of forty-two samples from indicator locations at a concentration of 14.1 pCi/kg-wet and Cs-137 detected in one of twenty-one samples at a concentration of 15.3 pCi/kg. Historically, Cs-137 has been detected in both control and indicator broad leaf vegetation.

Table C-6 contains a summary and Figure C-6 an illustration, of the broad leaf vegetation analysis results for the past 10 years. The detection of low levels of Cs-137 is consistent with the sporadic detection at both indicator and control locations of relatively low concentrations for the past ten years.

4.7 Fish and Invertebrates

A summary of the fish and invertebrate sample analysis results is presented in Table B-2. Table B-15 contains the results of the analysis of all fish and invertebrate samples for 2002. None of the indicator samples revealed radionuclide concentrations greater than L_c values. Only naturally occurring nuclides were detected. A summary of historical fish and invertebrate analytical data is presented in Table C-7 and illustrated in Figure C-7. Data are consistent with historical trends.

4.8 Additional Media Sampling

Although not required by the RETS, analyses were performed on aquatic vegetation, Hudson River bottom sediment, soil, precipitation samples, and various other special water samples. A summary of the analytical results obtained is presented in Table B-16. As shown by these data, the radionuclides detected were consistent with their respective historical levels. Since these samples were not required by the RETS, individual tables and graphs are not presented for the data.

I-131 was detected in aquatic vegetation samples in one out of four indicator samples and one out of nine control samples with an average concentration of 7.1 and 17.6 pCi/kg-wet, respectively. The I-131 detected was not due to station operations based on a review of plant discharge records during the sample months, but most likely due to medical administrations especially since the I-131 was detected in both control and indicator locations. Cs-137 was detected in four out of four indicator samples and three out of nine control samples at an average concentration of 24.2 pCi/kg-wet and 6.35 pCi/kg-wet, respectively.

Soil samples were obtained at two indicator locations and one control location. Cs-137 was not detected in indicator and control samples.

Precipitation samples were analyzed for H-3 (tritium) and plant-related nuclides at two locations. No tritium or other plant related nuclides were detected at either location. Historically, tritium has been detected in precipitation at both indicator and control locations.

The Algonquin Outfall, Gypsum Plant Stream, Verplanck-5th Street Well, and Trap Rock Quarry samples were analyzed for tritium and plant-related nuclides. The samples did not show any tritium or other plant-related nuclides. The non-RETS sample location of Algonquin Outfall was designated in 1996 and the other special water samples were designated late in 2002.

The results from the non-RETS sampling show that the main detected anthropogenic activity is Cs-137, which is found at both indicator and control locations. I-131 was detected in both indicator and control locations for aquatic vegetation and was likely attributed to sources other than plant operations, such as medical administrations. The non-RETS sample data corroborate the RETS sample data in determining that the operation of the Indian Point station in 2002 had no detectable adverse radiological impact on the environment.

4.9 Land Use Census

A census was performed in the vicinity of Indian Point in 2002. This census consisted of a milch animal and a residence census. Results of this census are presented in Tables B-17 and B-18.

The results of the 2002 census were the same as the 2001 census results. There were no animals producing milk for human consumption found within 5 miles (8 km) of the plant. The second part of this census revealed that the nearest residences are located 0.4 miles (0.64 km) ESE and 0.5 miles (0.75 km) E of the plant.

The Indian Point REMP does not include a garden census. RETS allows the sampling of broad leaf vegetation in two sectors at the site boundary in lieu of performing a garden census. Analysis results are discussed in section 4.6 and presented in Table B-14, Table C-6 and Figure C-6.

4.10 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 2002 REMP reveal that operations at the station did not result in an adverse impact on the environment.

The results of the 2002 REMP also revealed that the impact on the environment of fallout from previous atmospheric weapons testing and Chernobyl continues to represent the greatest long-term radiological environmental impact from anthropogenic sources. The 2002 REMP results demonstrate the relative contributions of different radionuclide sources, both natural and anthropogenic, to the environmental concentrations. Overall, doses to humans are much more significant from non-plant related sources than those associated with plant operations.

SECTION 5

QUALITY ASSURANCE

5.0 QUALITY ASSURANCE

The Indian Point Radiological Environmental Monitoring Program (REMP) includes a quality assurance (QA) program. The QA program ensures that the REMP fulfills its intended function and that results of the REMP are reliable. The QA program of the REMP consists of operational (i.e., day-to-day) activities as well as routine inspections and audits.

The operational quality assurance activities are:

- Submission for analysis of duplicate (split) samples to the radioanalytical laboratory to verify reproducibility (precision) of results, and

- Submission for analysis of environmental samples, spiked with known levels of radioactivity, to the radioanalytical laboratory to verify accuracy of results.

During 2002, 34 samples involving 76 individual analyses were requested of the JAFNPP Environmental Laboratory that processes the Indian Point REMP samples. Spiked air, water, soil, and vegetation samples were submitted for analysis. The spiked samples were obtained from a commercial vendor laboratory and sent to the JAFNPP Environmental Laboratory to be analyzed as regular environmental samples. The supply vendor certified the activity levels of the spikes at the time of preparation. Of the 76 analyses, three air particulate filters were discounted; one was damaged in transit and two had incorrect lab requests that yielded incomparable results.

After the Environmental Laboratory analyzed the spiked samples, statistical tests were performed using both the spike vendor's and the Laboratory's data. In summary, 71 of the 73 individual analyses met the Indian Point acceptance criteria, which yields an overall laboratory performance rating of 97%.

A summary of the identified nonconforming samples:

- Two gross beta air particulate filters did not meet the criteria. This discrepancy has been documented in condition report #CR-IP2-2003-2402 and an investigation will be conducted and documented in response to this condition report. With the exception of these two filters, the remaining 23 samples of this type were within the acceptance range.

The Environmental Laboratory's performance in other comparable areas, notably the Interlaboratory Comparison Program, remains good. We conclude that results from the JAFNPP Environmental Laboratory are expected to remain reliable.

Reviews and audits of the Radiological Environmental Monitoring Program are conducted by Entergy Nuclear Northeast personnel and include:

- Audits of Indian Point and radioanalytical contractor procedures related to the Radiological Environmental Monitoring Program by Entergy Nuclear Northeast Quality Assurance (QA) personnel.

- Assessment of the radioanalytical contractor's performance in the Analytics Environmental Cross Check Program and the Environmental Measurements Laboratory Quality Assurance Program (see Appendix D).

- Audits of Indian Point sample collection and radioanalytical laboratory processes by QA personnel and program personnel.

Conduct of the quality assurance program in 2002 ensured that sampling and analysis of environmental media at Indian Point were conducted in accordance with quality assurance requirements specified in Regulatory Guide 4.15 (Reference 10) and internal procedures (Reference 2). Performance of routine audits demonstrates this compliance.

The quality assurance programs of Entergy Nuclear Northeast's Environmental Laboratory demonstrate that all requirements specified in 10 CFR Part 50 Appendix B and applicable sections of Regulatory Guide 4.15 are achieved. In addition, the JAFNPP Laboratory's performance in the Analytics Environmental Cross Check Program and the Environmental Measurements Laboratory Quality Assurance Program was satisfactory (see Appendix D).

In summary, the quality assurance program conducted in conjunction with the Indian Point Radiological Environmental Monitoring Program included audits and evaluations of in-house and contractor procedures, work functions, and quality assurance programs. Review of the 2002 quality assurance program indicated that the Radiological Environmental Monitoring Program was performed in accordance with the RETS.

SECTION 6

REFERENCES

6.0 REFERENCES

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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 Radiological Effluent Technical Specifications (RETS). These RETS 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, distance from Indian Point, RETS designation and sample type. Non-RETS samples are also listed but have no RETS designation code. This table gives the complete listing of sample locations used in the 2002 REMP.

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

The RETS required lower limits of detection 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 the RETS environmental surveillance requirement that an annual land use and milch animal census be performed. See Tables B-17 and B-18 for the milch animal and land use census.

TABLE A-1

INDIAN POINT REMP SAMPLING STATION LOCATIONS

SAMPLING STATION	RETS/RECS 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	NR	New 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 NR	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	NR NR NR	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
22	NR NR	Lovett Power Plant	1.6 Mi (WSW) at 244°	Air Particulate, Radioiodine
23	NR A5 A5 DR40 Ic3 NR 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 & Invertebrate
27	NR NR DR41	Croton Point	6.36 Mi (SSE) at 156°	Air Particulate, Radioiodine, Direct Gamma
28	NR DR4 NR NR	Lent's Cove	0.45 Mi (ENE) at 069°	HR Shoreline Soil, Direct Gamma, HR Bottom Sediment, HR Aquatic Vegetation

* = Control location
HR = Hudson River
NR = non RETS
R/S = Reuter Stokes

TABLE A-1

INDIAN POINT REMP SAMPLING STATION LOCATIONS

SAMPLING STATION	RETS/RECS SAMPLE DESIGNATION	LOCATION	DISTANCE	SAMPLE TYPES
29	NR NR DR39	Grassy Point	3.37 Mi (SSW) at 196°	Air Particulate, Radioiodine, Direct Gamma
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	NR NR NR	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 & Sixth 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

* = Control location
HR = Hudson River
NR = non RETS
R/S = Reuter Stokes

TABLE A-1

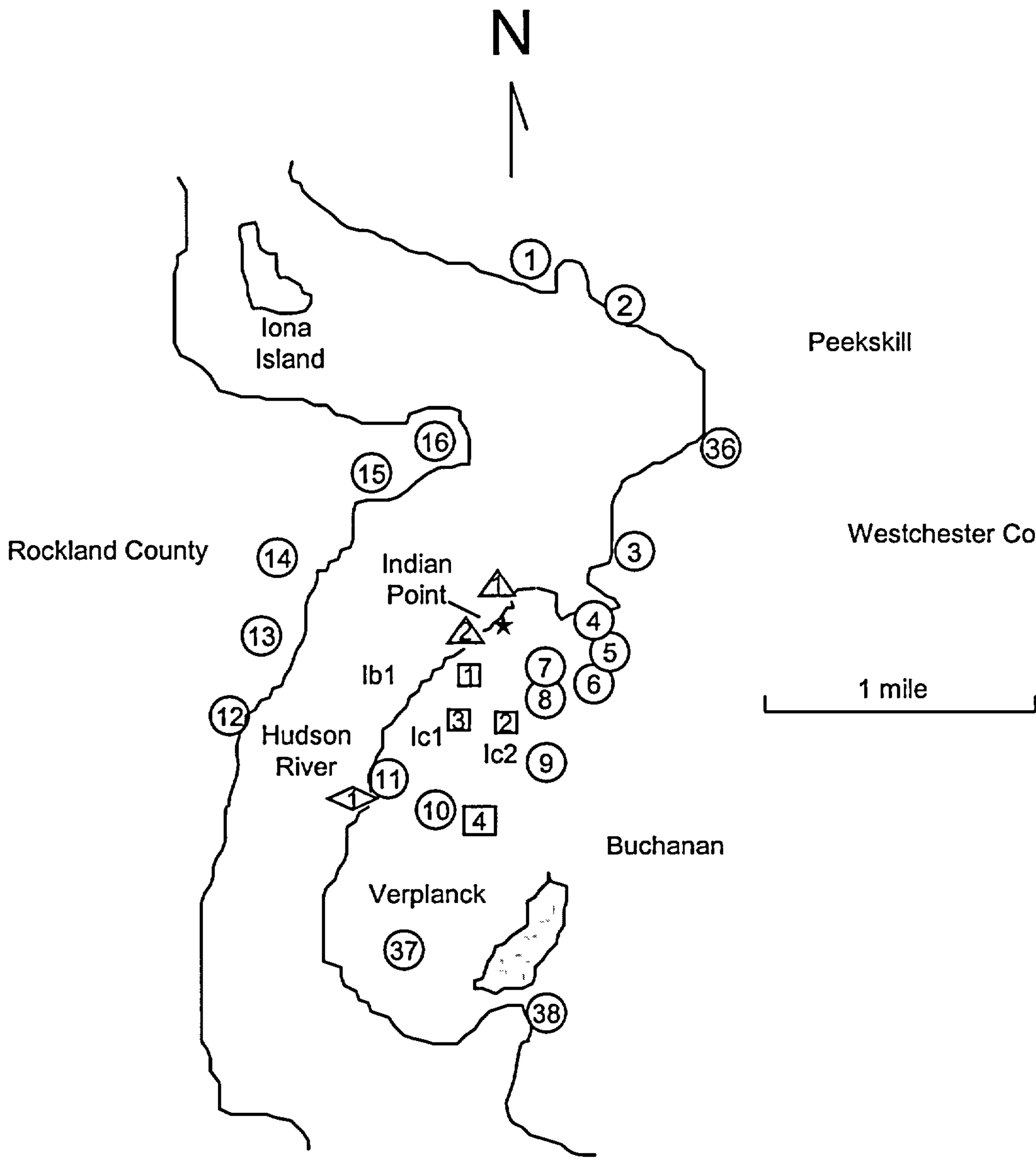
INDIAN POINT REMP SAMPLING STATION LOCATIONS

SAMPLING STATION	RETS/RECS SAMPLE DESIGNATION	LOCATION	DISTANCE	SAMPLE TYPES
75	DR28	Palisades Parkway	4.65 Mi (NW) at 310°	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
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	DR31	Palisades Pkwy - Lake Welch Exit	4.96 Mi (WSW) at 255°	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	NR NR NR	Cold Spring *	10.88 Mi (N) at 356°	HR Aquatic Vegetation, HR Shoreline Soil, HR Bottom Sediment
88	DR6	R/S 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 NR	IPEC Training Center	Onsite- 0.39 Mi (S) at 193°	Air Particulate, Radioiodine, Broadleaf Vegetation, Soil

* = Control location
HR = Hudson River
NR = non RETS
R/S = Reuter Stokes

FIGURE A-1

RETS SAMPLING LOCATIONS
Within Two Miles of Indian Point



Key:

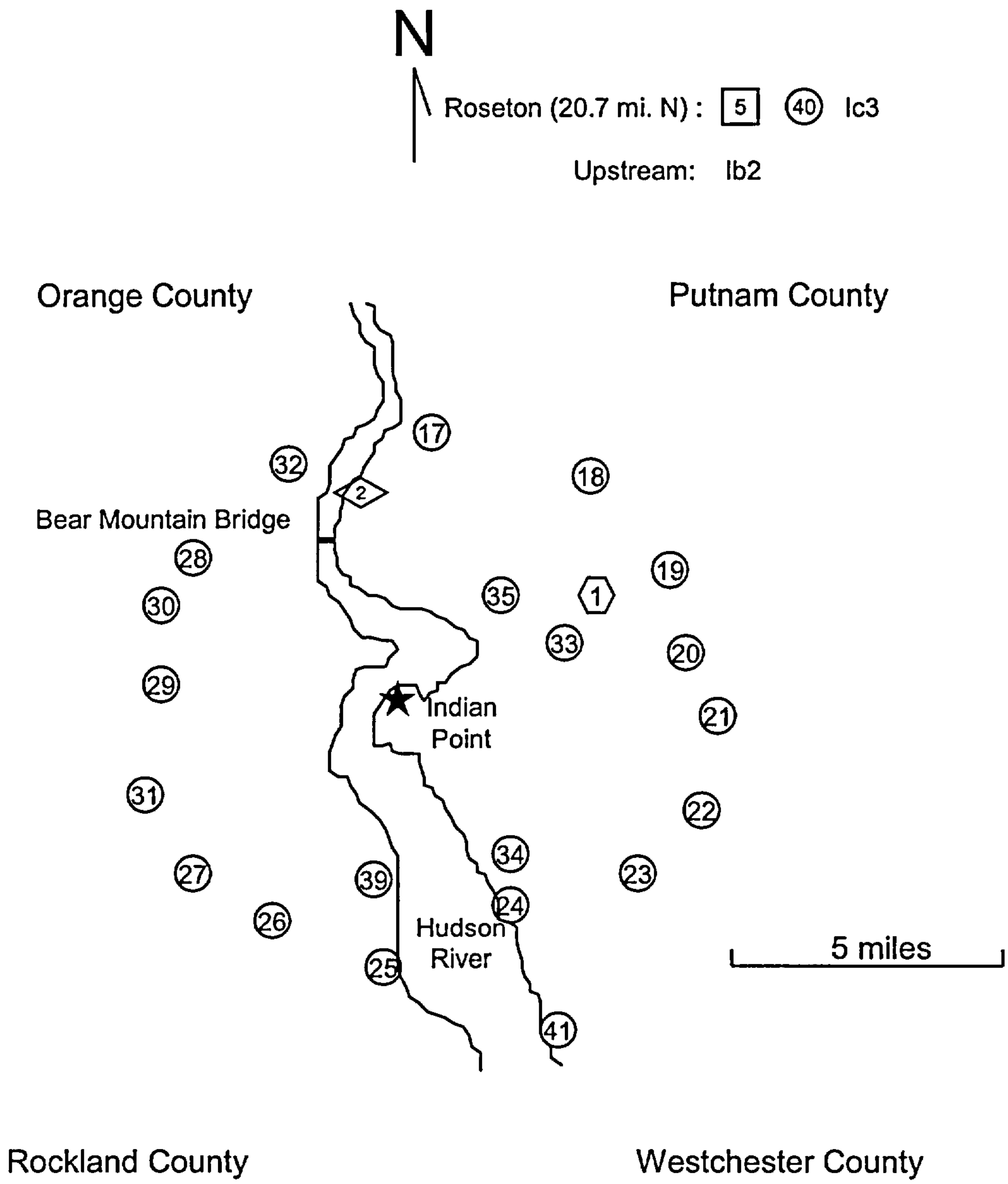
- △ - Waterborne: Surface (HR) Wa#
- ○ - Direct Radiation Sample Location DR#
- □ - Air Particulate & Radioiodine A#
- ◇ - HR Shoreline Sediment Wc#

Ic# - Broadleaf Vegetation

Ib1 - Fish and Invertebrates (where available downstream)

FIGURE A-2

RETS SAMPLING LOCATIONS
Within 10 Miles of Indian Point



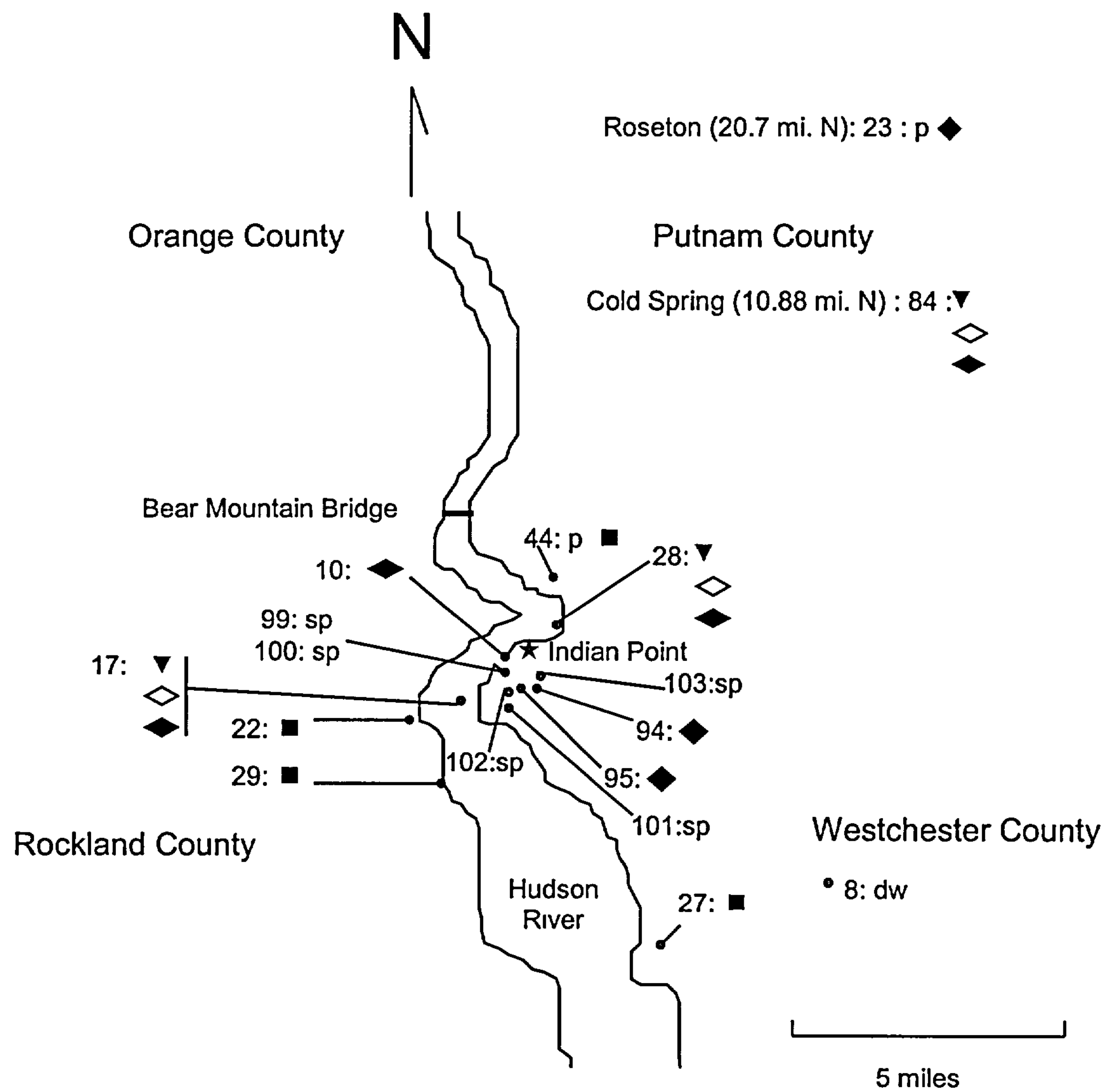
Key:

- ○ - Direct Radiation Sample Location DR#
- □ - Air Particulate & Radioiodine A#
- ◇ - HR Shoreline Sediment Wc#
- ⬡ - Waterborne: Drinking Wb#

Ic3 - Broadleaf Vegetation
Ib2 - Fish and Invertebrates (where available upstream)

FIGURE A-3

NON-RETS SAMPLING LOCATIONS



Key:

- ■ - Air Particulate & Radioiodine
- ▼ - Aquatic Vegetation
- ◆ - HR Bottom Sediment
- p - Precipitation
- ◇ - HR Shoreline Sediment
- ◆ - Soil
- sp - Special Water
- dw – Drinking Water

TABLE A-2

LOWER LIMIT OF DETECTION (LLD) REQUIREMENTS FOR ENVIRONMENTAL SAMPLE ANALYSIS [(a) (b)]

ANALYSIS	WATER (pCi/L)	AIRBORNE PARTICULATES OR GASES (pCi/m^3)	FISH (pCi/kg, wet)	MILK (pCi/L)	FOOD PRODUCTS (pCi/kg, wet)	SEDIMENT (pCi/kg, wet)
Gross β	4	0.01				
H-3	2000 [(c)]					
Mn-54	15		130			
Fe-59	30		260			
Co-58	15		130			
Co-60	15		130			
Zn-65	30		260			
Zr-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-La-140	15			15		

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

(b) Required detection capabilities for thermoluminescent dosimeters used for environmental measurements are given in Regulatory Guide 4.13 (Reference 28)

(c) LLD for drinking water samples If no drinking water pathway exists, a value of 3000 pCi/L may be used

(d) LLD for drinking water samples If no drinking water pathway exists, a value of 15 pCi/L may be used.

TABLE A-3

REPORTING LEVELS FOR RADIOACTIVITY CONCENTRATIONS IN ENVIRONMENTAL SAMPLES

ANALYSIS	WATER (pCi/L)	AIRBORNE PARTICULATES OR GASES (pCi/m^3)	FISH (pCi/kg, wet)	MILK (pCi/L)	FOOD PRODUCTS (pCi/kg, wet)
H-3	20000 [(a)]				
Mn-54	1000		30000		
Fe-59	400		10000		
Co-58	1000		30000		
Co-60	300		10000		
Zn-65	300		20000		
Zr-Nb-95	400				
I-131	2 [(b)]	0.9		3	100
Cs-134	30	10	1000	60	1000
Cs-137	50	20	2000	70	2000
Ba-La-140	200			300	

[(a)] For drinking water samples. This is the 40 CFR Part 141 value. If no drinking water pathway exists, a value of 30,000 pCi/L may be used

[(b)] If no drinking water pathway exists, a value of 20 pCi/L may be used.

APPENDIX B

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM RESULTS SUMMARY

APPENDIX B

B.1 2002 Annual Radiological Environmental Monitoring Program Summary

The results of the 2002 radiological environmental sampling program are presented in Tables B-2 through B-16. Table B-2 is a summary of the RETS samples and Table B-16 is a summary of the non-RETS samples. The format of these summary tables conforms to the reporting requirements of the RETS, NRC Regulatory Guide 4.8 (Reference 4), and NRC Branch Technical Position to Regulatory Guide 4.8 (Reference 14). In addition, the data obtained from the analysis of all the individual RETS samples are provided in Tables B-3 through B-15.

REMP samples were analyzed by various counting methods as appropriate. The methods are; gross beta, gamma spectroscopy analysis, liquid scintillation, 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 (I-131) and tritium analyses were performed for specific media and locations as required in the RETS.

B.2 Land Use Census

In accordance with Sections 4.11.B of the IP2 RETS and Part I Section 2.8 of the IP3 RECS, 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 censuses are presented in Tables B-17 and B-18, respectively. In lieu of identifying and sampling the nearest garden of greater than $50m^2$, 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-14).

B.3 Sampling Deviations

During 2002, environmental sampling was performed for six media types required by RETS, five other media types and direct radiation. A total of 1338 samples (1245 RETS and 93 non-RETS) were scheduled. Of the scheduled samples, 99% 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 air samples, B-1b for TLDs, and B-1c for other environmental media.

B.4 Analytical Deviations

During 2002, one fish sample could not meet the LLD for Cs-134/137 and one fish sample could not meet the LLD for Fe-59 due to sample receipt/shipment delays.

B.5 Special Reports

No special reports were required under the REMP.

TABLE B-1

SUMMARY OF SAMPLING DEVIATIONS 2002

MEDIA	TOTAL # SCHEDULED SAMPLES	NUMBER OF DEVIATIONS	SAMPLING EFFICIENCY %	REASON FOR DEVIATION
RETS MEDIA				
PARTICULATES IN AIR	468	3	99	SEE TABLE B-1a
CHARCOAL FILTER	468	3	99	SEE TABLE B-1a
TLD	164	3	98	SEE TABLE B-1b
HUDSON RIVER WATER	32	0	100	
DRINKING WATER	32	0	100	
SHORELINE SOIL	10	0	100	
BROAD LEAF VEGETATION	63	0	100	
FISH & INVERTEBRATES	8	3	63	SEE TABLE B-1c
SUBTOTALS	1245	12	99	
NON-RETS MEDIA				
AQUATIC VEGETATION	15	2	87	SEE TABLE B-1c
HUDSON RIVER BOTTOM SEDIMENT	8	0	100	
SOIL	3	0	100	
PRECIPITATION	8	0	100	
SPECIAL WATER SAMPLES	59	1	98	
SUBTOTALS	93	3	97	
OVERALL TOTALS	1338	15	99	

TOTAL NUMBER OF ANALYSES REPORTED = 1323

TABLE B-1a / B-1b/B-1c

TABLE B-1a
2002 Air Sampling Deviations

STATION	WEEK	PROBLEM / ACTIONS TO PREVENT RECURRENCE
#22 Lovett Power Plant	13 & 14 (Air Particulate & Charcoal)	Electrical power was lost to the electrical feed panel at the Lovett Power Station during a steam leak / A temporary feed unit was installed by Lovett Station on 4/9/02 for this air sampler until the power could be returned to the electrical feed panel.
#29 Grassy Point	19 (Air Particulate & Charcoal)	Sample holder was dropped into a puddle of water and the filters were destroyed. / Technician was coached on attention to detail.

TABLE B-1b
2002 TLD Deviations

STATION	QUARTER	PROBLEM / ACTIONS TO PREVENT RECURRENCE
#74 (DR-12) Westshore Drive - South	1st QTR (TLD)	Utility pole was replaced which housed the TLD. / Replaced TLD and continued to trend missing TLDs for patterns.
#76 (DR-13) Westshore Drive - North	2nd QTR (TLD)	Damaged TLD. / Replaced TLD and continue to track and trend damaged TLDs
#64 (DR-20) Lincoln Road -Cortlandt	2nd QTR (TLD)	TLD was missing / Replaced and relocated TLD. Continued to trend missing TLDs for patterns.

TABLE B-1c
2002 Other Media Deviations

STATION	SAMPLE SCHEDULE	PROBLEM / ACTIONS TO PREVENT RECURRENCE
#28 Lent's Cove	Spring (Fish)	One species of fish caught at the Cold Spring control location. / Performed a review of the NAI fishing practices and resolving the issue with a contract with NAI for IPEC fish sampling.
#17 - Off Verplanck	Spring (Aquatic Vegetation)	Aquatic vegetation was not available in this area this spring
#84 - Cold Spring	Spring (Aquatic Vegetation)	Aquatic vegetation was not available in this area this spring
#103 - IP3 Trailer Well	April (Special Water)	Non-potable water was not available from the IP3 Trailer Well.
#23 - Roseton	Summer (Fish)	LLD for Cs-134/137 not met due to sample being >39 days old upon delivery to lab. / Performed a review of the NAI fishing practices and resolving the issue with a contract with NAI for IPEC fish sampling.
#25 - Downstream	Summer (Fish)	LLD for Fe-59 not met due to sample being >60 days old upon delivery to lab. / Performed a review of the NAI fishing practices and resolving the issue with a contract with NAI for IPEC fish sampling

TABLE B-2*
RETS ANNUAL SUMMARY - 2002

MEDIUM (UNITS) SEE TABLE	TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED (e)	LLD (c,d)	INDICATOR LOCATIONS: MEAN (a) RANGE	LOCATION (b) OF HIGHEST ANNUAL MEAN: LOCATIONS AND DESIGNATION MEAN (a) RANGE	CONTROL LOCATION: MEAN (a) RANGE	NUMBER OF NONROUTINE REPORTS
DIRECT RADIATION (mR / standard quarter) B-3	TLD Reads 161	N/A	*14.3 (157/157) / 7.2 - 20 5*	#76 West Shore Drive North 1.21 Mi. (276°) DR13 19 *(4/4) / 17.9-20.5*	*14.2 (4/4) / 12.6 - 15 5*	0
AIR PARTICULATES AND RADIOIODINE (pCi/m^3) B-6, B-7, B-8	GB (465)	0 01	*0 015 (413/413) / 0 005-0.025*	#44 Peekskill Gas Holder Bldg 1.84 Mi. (52°) *0.016 (52/52) / 0 008-0.023*	*0.015 (52/52) / 0.006-0.022*	0
	I-131 (465)	0.07	$< L_c$	$< L_c$	$< L_c$	0
	GSA (36)					
	Cs-134	0.05	$< L_c$	$< L_c$	$< L_c$	0
	Cs-137	0 06	$< L_c$	$< L_c$	$< L_c$	0
SURFACE HUDSON RIVER WATER (pCi/L) B-9, B-10	H-3 (8)	3000	*562 (2/4) / 340-783*	#10 Discharge Canal Mixing Zone(On-site) *562 (2/4) / 340-783*	*432 (1/4) / 432-432*	0
	GSA (24)					
	Mn-54	15	$< L_c$	$< L_c$	$< L_c$	0
	Co-58	15	$< L_c$	$< L_c$	$< L_c$	0
	Fe-59	30	$< L_c$	$< L_c$	$< L_c$	0
	Co-60	15	$< L_c$	$< L_c$	$< L_c$	0
	Zn-65	30	$< L_c$	$< L_c$	$< L_c$	0
	Zr/Nb-95	15	$< L_c$	$< L_c$	$< L_c$	0
	I-131	15	$< L_c$	$< L_c$	$< L_c$	0
	Cs-134	15	$< L_c$	$< L_c$	$< L_c$	0
	Cs-137	18	$< L_c$	$< L_c$	$< L_c$	0
	Ba/La-140	15	$< L_c$	$< L_c$	$< L_c$	0
DRINKING WATER (pCi/L) B-11, B-12	GB (24)	4	*2.19 (24/24) / 1.07-3.34*	#8 New Croton Reservoir 6.3 Mi (124°) *2 20 (12/12) / 1.07-3.34*	N/A	0
	H-3 (8)	2000	< LLD	< LLD	N/A	0
	GSA (24)					
	Mn-54	15	$< L_c$	$< L_c$	N/A	0
	Co-58	15	$< L_c$	$< L_c$	N/A	0
	Fe-59	30	$< L_c$	$< L_c$	N/A	0
	Co-60	15	$< L_c$	$< L_c$	N/A	0
	Zn-65	30	$< L_c$	$< L_c$	N/A	0

TABLE B-2*
RETS ANNUAL SUMMARY - 2002

MEDIUM (UNITS) * SEE TABLE	TYPE AND TOTAL NUMBER OF ANALYSIS PERFORMED (e)	LLD (c,d)	INDICATOR LOCATIONS: MEAN (a) RANGE	LOCATION (b) OF HIGHEST ANNUAL MEAN: LOCATIONS AND DESIGNATION MEAN (a) RANGE	CONTROL LOCATION: MEAN (a) RANGE	NUMBER OF NONROUTINE REPORTS
DRINKING WATER (CON'T)	Zr/Nb-95	15	$< L_c$	$< L_c$	N/A	0
	I-131	1	$< L_c$	$< L_c$	N/A	0
	Cs-134	15	$< L_c$	$< L_c$	N/A	0
	Cs-137	18	$< L_c$	$< L_c$	N/A	0
	Ba/La-140	15	$< L_c$	$< L_c$	N/A	0
SHORELINE SOIL (pCi/kg - dry) B-13	GSA (10)					
	Cs-134	150	$< L_c$	$< L_c$	$< L_c$	0
	Cs-137	180	*221 (3/6) / 206-241*	#17 Off Verplanck 1.5 Mi. (202.5°) 229 *(2/2) / 217-241*	*238 (1/4) / 238-238*	0
BROADLEAF VEGETATION (pCi/kg - wet) B-14	GSA (63)					
	I-131	60	$< L_c$	$< L_c$	$< L_c$	0
	Co-60	N/A	$< L_c$	$< L_c$	$< L_c$	0
	Cs-134	60	$< L_c$	$< L_c$	$< L_c$	0
	Cs-137	80	*14.1(1/42) / 14.1-14.1*	#94 IPEC Training Center 0.39 Mi. (193°) *14 1 (1/21) / 14.1-14.1*	*15 3 (1/21) / 15.3-15.3*	0
FISH AND INVERTEBRATES (pCi/kg - wet) B-15	GSA (5)					
	Mn-54	130	$< L_c$	$< L_c$	$< L_c$	0
	Co-58	130	$< L_c$	$< L_c$	$< L_c$	0
	Fe-59	260	$< L_c$	$< L_c$	$< L_c$	0
	Co-60	130	$< L_c$	$< L_c$	$< L_c$	0
	Zn-65	260	$< L_c$	$< L_c$	$< L_c$	0
	Cs-134	130	$< L_c$	$< L_c$	$< L_c$	0
	Cs-137	150	$< L_c$	$< L_c$	$< L_c$	0

Table B-2 Notation

2002
RETS ANNUAL SUMMARY
TABLE NOTES

*	=	Data for the Annual Summary Tables are based on RETS required samples, with the exception of Air Samples which include RETS and Non-RETS locations.
N/A	=	Not applicable.
(a)	=	(Detectable activity measurements) / (Total measurements.)
(b)	=	Location is distance in miles and direction in compass degrees.
(c)	=	RETS Required LLD, see Table A-2
(d)	=	RETS Required LLD > Critical Level (L_c).
(e)	=	"Less then" results for tritium are reported as <sample LLD, which is less than RETS requires LLD.
GB	=	Gross Beta Analysis.
GSA	=	Gamma Spectroscopy Analysis.

The format of Table B-2, RETS Annual Summary, is dictated by regulations. To help understand this table, one section of Table B-2 is presented in narrative. The following explanation for the Shoreline Soil section of Table B-2 should help the reader understand all of the summaries in Table B-2.

1. The left-hand column reports the sample media, media reporting units, and the table containing the detailed sample results. For Shoreline Soil, the reporting units are pCi/kg-dry and the detailed sample results are in Table B-13.

2. The second column tells how the samples are analyzed and how many samples were analyzed. In this case, the samples are analyzed by gamma spectroscopy analysis (GSA) for the nuclides Cs-134 and Cs-137 and there were a total of 10 samples.

Table B-2 Notation (Continued)

2002
RETS ANNUAL SUMMARY
TABLE NOTES

3. The third column lists the RETS required lower limit of detection for the type of analysis performed. These values are also listed in Table A-2.

4. The column labeled Indicator Locations gives the results for all the indicator sites. Three out of six samples from indicator locations had Cs-137. The mean of the Cs-137 from the three indicator location sample results that were > L_c was 221 pCi/kg-dry. The range of the samples results > L_c was 206 to 241 pCi/kg-dry.

5. The location of the highest indicator is the next column. The indicator site with the highest mean is reported here. For shoreline soil samples, the highest indicator mean for Cs-137 is from sample location 17, Off Verplanck, 1.5 miles from Indian Point at compass direction 202.5 degrees. The mean for this indicator sample site is 229 pCi/kg-dry Cs-137, two samples were taken and both sample results were >L_c. The range of the samples results that were > L_c was 217 to 241 pCi/kg-dry.

6. The control location column is next. For 2002, Cs-137 was detected in one of the four samples at 238 pCi/kg-dry.

7. The right hand column gives the number of non-routine reports that are required because of sample results at or above the reporting level. The reporting levels are given in Table A-3.

8. All the sample media reported in Table B-2 follow this general format.

TABLE B-3

2002 DIRECT RADIATION, QUARTERLY DATA
(mR per STANDARD QUARTER)

Station ID	Sector	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	2002 Avg
DR-01	N	15.4	15.9	17.2	17.3	16.5
DR-02	NNE	13.2	15.4	15.3	15.2	14.8
DR-03	NE	11.0	12.2	13.1	11.5	12.0
DR-04	ENE	13.2	16.3	14.1	13.7	14.3
DR-05	ENE	13.2	13.7	14.5	13.3	13.7
DR-06	ESE	12.8	14.1	12.7	13.5	13.3
DR-07	SE	16.0	17.5	17.8	15.1	16.6
DR-08	SSE	12.8	15.1	12.5	13.9	13.6
DR-09	S	13.1	13.0	13.5	14.0	13.4
DR-10	SSW	13.5	16.8	14.8	14.7	15.0
DR-11	SW	10.8	12.6	11.7	11.3	11.6
DR-12	WSW	*	19.2	18.2	19.6	19.0
DR-13	WSW	17.9	*	18.7	20.5	19.0
DR-14	WNW	13.7	15.9	14.9	11.5	14.0
DR-15	NW	13.2	14.2	14.4	12.1	13.5
DR-16	NNW	15.5	15.2	17.7	13.2	15.4
DR-17	N	15.8	16.6	15.4	13.1	15.2
DR-18	NNE	15.0	14.6	13.3	12.4	13.8
DR-19	NE	15.5	18.0	15.6	12.3	15.4
DR-20	ENE	13.7	*	13.1	13.5	13.4
DR-21	E	14.2	16.0	13.5	12.5	14.1
DR-22	ESE	11.8	12.5	11.1	10.6	11.5
DR-23	SE	14.1	15.3	14.1	13.2	14.2
DR-24	SSE	13.0	15.6	14.8	12.3	13.9
DR-25	S	13.3	14.9	12.2	12.5	13.2
DR-26	SSW	13.9	14.8	13.6	13.0	13.8
DR-27	SW	14.2	15.6	14.0	15.2	14.8
DR-28	NW	15.0	14.8	14.1	13.3	14.3
DR-29	W	17.6	19.3	18.6	18.1	18.4
DR-30	SNS	17.5	17.1	16.6	14.0	16.3
DR-31	WSW	18.5	20.1	18.6	14.6	18.0
DR-32	NNW	13.5	14.7	13.9	10.7	13.2
DR-33	NE	9.5	9.1	8.5	7.2	8.6
DR-34	SE	14.2	14.9	13.2	12.4	13.7
DR-35	NNE	14.0	15.9	14.7	11.9	14.1
DR-36	NE	15.1	17.4	14.9	13.5	15.2
DR-37	SSW	14.5	15.6	13.2	12.4	13.9
DR-38	S	12.6	13.7	12.3	11.1	12.4
DR-39	SSW	16.6	16.8	16.1	13.2	15.7
DR-40**	N	14.6	15.5	14.1	12.6	14.2
DR-41	SSE	12.6	13.5	12.5	12.2	12.7
AVERAGE		14.1	15.4	14.5	13.4	14.4

* Data not available

** Control Location

TABLE B-4

DIRECT RADIATION, 1997 THROUGH 2002 DATA

(mR per Standard Quarter)

Station ID	Mean (1997-2001)	Standard Deviation (1997-2001)	Minimum Value (1997-2001)	Maximum Value (1997-2001)	2002 Average
DR-01	16.1	0.6	15.4	17.0	16.5
DR-02	17.9	2.3	14.9	19.8	14.8
DR-03	12.3	0.3	11.9	12.6	12.0
DR-04	13.5	0.8	12.8	14.7	14.3
DR-05	13.3	1.9	10.0	14.5	13.7
DR-06	13.9	0.5	13.1	14.4	13.3
DR-07	16.4	0.6	15.7	17.2	16.6
DR-08	13.2	0.6	12.4	14.1	13.6
DR-09	13.4	0.7	12.6	14.5	13.4
DR-10	14.0	0.5	13.3	14.6	15.0
DR-11	11.7	0.3	11.3	12.1	11.6
DR-12	16.4	0.4	15.9	17.0	19.0
DR-13	19.6	0.9	18.2	20.3	19.0
DR-14	14.1	0.9	12.8	15.1	14.0
DR-15	14.5	0.4	14.0	15.0	13.5
DR-16	15.3	0.5	14.7	15.9	15.4
DR-17	15.2	1.0	14.0	16.7	15.2
DR-18	14.7	0.4	14.2	15.2	13.8
DR-19	15.5	0.3	15.2	15.9	15.4
DR-20	14.5	0.3	14.1	14.8	13.4
DR-21	14.2	0.8	13.1	15.2	14.1
DR-22	12.4	0.6	11.6	13.0	11.5
DR-23	14.5	0.2	14.2	14.7	14.2
DR-24	14.4	0.5	14.0	14.9	13.9
DR-25	12.6	0.4	12.2	13.3	13.2
DR-26	14.2	0.6	13.2	14.7	13.8
DR-27	14.2	0.7	13.6	15.4	14.8
DR-28	15.5	1.0	14.6	17.3	14.3
DR-29	18.2	0.9	16.8	19.3	18.4
DR-30	17.3	0.4	16.9	17.8	16.3
DR-31	19.3	0.6	18.6	20.1	18.0
DR-32	13.9	0.3	13.5	14.3	13.2
DR-33	10.0	1.5	8.5	12.0	8.6
DR-34	14.1	0.7	13.4	15.2	13.7
DR-35	15.1	0.3	14.7	15.3	14.1
DR-36	16.4	0.7	16.0	17.6	15.2
DR-37	14.4	0.5	13.9	15.0	13.9
DR-38	13.4	0.8	12.5	14.6	12.4
DR-39	16.5	0.2	16.1	16.7	15.7
DR-40	16.3	0.8	15.5	17.6	14.2
DR-41*	14.0	0.6	13.4	14.7	12.7
Average	14.8	0.7	14.0	15.6	14.4

TABLE B-5

2002 DIRECT RADIATION
INNER AND OUTER RINGS
(mR per Standard Quarter)

Inner Ring ID	Outer Ring ID	Sector	Inner Ring Annual Average	Outer Ring Annual Average
DR-01	DR-17	N	16.5	15.2
DR-02	DR-18	NNE	14.8	13.8
DR-03	DR-19	NE	12.0	15.4
DR-04	DR-20	ENE	14.3	13.4
DR-05	DR-21	E	13.7	14.1
DR-06	DR-22	ESE	13.3	11.5
DR-07	DR-23	SE	16.6	14.2
DR-08	DR-24	SSE	13.6	13.9
DR-09	DR-25	S	13.4	13.2
DR-10	DR-26	SSW	15.0	13.8
DR-11	DR-27	SW	11.6	14.8
DR-12	DR-31	WSW	19.0	14.3
DR-13	DR-29	W	19.0	18.4
DR-14	DR-30	WNW	14.0	16.3
DR-15	DR-28	NW	13.5	18.0
DR-16	DR-32	NNW	15.4	13.2
Average			14.7	14.6

TABLE B-6

GROSS BETA ACTIVITY IN AIRBORNE PARTICULATE SAMPLES-2002

($pCi/m^3 \pm$ 1 sigma)

STATION #

Week #	End Date	4	5	27	94	95
1	1/7/2002	0.019 ± 0.001	0.017 ± 0.001	0.019 ± 0.001	0.016 ± 0.001	0.020 ± 0.002
2	1/15/2002	0.016 ± 0.001	0.013 ± 0.001	0.015 ± 0.002	0.014 ± 0.002	0.017 ± 0.002
3	1/22/2002	0.017 ± 0.001	0.018 ± 0.002	0.019 ± 0.002	0.018 ± 0.002	0.020 ± 0.002
4	1/29/2002	0.016 ± 0.001	0.017 ± 0.002	0.021 ± 0.002	0.020 ± 0.002	0.021 ± 0.002
5	2/5/2002	0.016 ± 0.001	0.015 ± 0.001	0.014 ± 0.001	0.015 ± 0.002	0.012 ± 0.001
6	2/12/2002	0.023 ± 0.002	0.024 ± 0.002	0.024 ± 0.002	0.024 ± 0.002	0.022 ± 0.002
7	2/19/2002	0.013 ± 0.001	0.011 ± 0.001	0.012 ± 0.001	0.013 ± 0.001	0.011 ± 0.001
8	2/26/2002	0.013 ± 0.001	0.012 ± 0.001	0.012 ± 0.001	0.015 ± 0.002	0.015 ± 0.002
9	3/5/2002	0.014 ± 0.001	0.013 ± 0.001	0.015 ± 0.002	0.017 ± 0.002	0.016 ± 0.002
10	3/12/2002	0.020 ± 0.001	0.023 ± 0.002	0.020 ± 0.002	0.022 ± 0.002	0.022 ± 0.002
11	3/19/2002	0.015 ± 0.001	0.017 ± 0.002	0.013 ± 0.001	0.018 ± 0.002	0.020 ± 0.002
12	3/26/2002	0.015 ± 0.001	0.015 ± 0.002	0.013 ± 0.002	0.017 ± 0.002	0.014 ± 0.002
13	4/2/2002	0.011 ± 0.001	0.012 ± 0.001	0.011 ± 0.001	0.010 ± 0.001	0.014 ± 0.002
14	4/9/2002	0.016 ± 0.001	0.014 ± 0.002	0.017 ± 0.002	0.016 ± 0.002	0.015 ± 0.002
15	4/16/2002	0.014 ± 0.001	0.011 ± 0.001	0.016 ± 0.002	0.015 ± 0.002	0.013 ± 0.002
16	4/23/2002	0.016 ± 0.001	0.020 ± 0.002	0.018 ± 0.002	0.014 ± 0.002	0.018 ± 0.002
17	4/30/2002	0.012 ± 0.001	0.012 ± 0.001	0.014 ± 0.001	0.013 ± 0.001	0.012 ± 0.001
18	5/7/2002	0.016 ± 0.001	0.013 ± 0.001	0.011 ± 0.001	0.012 ± 0.001	0.012 ± 0.001
19	5/14/2002	0.010 ± 0.001	0.010 ± 0.001	0.011 ± 0.001	0.012 ± 0.002	0.013 ± 0.002
20	5/21/2002	0.011 ± 0.001	0.011 ± 0.001	0.010 ± 0.001	0.013 ± 0.002	0.012 ± 0.001
21	5/28/2002	0.011 ± 0.001	0.012 ± 0.001	0.013 ± 0.001	0.012 ± 0.001	0.012 ± 0.001
22	6/4/2002	0.016 ± 0.001	0.014 ± 0.002	0.014 ± 0.002	0.015 ± 0.002	0.015 ± 0.002
23	6/11/2002	0.011 ± 0.001	0.013 ± 0.001	0.006 ± 0.001	0.012 ± 0.001	0.009 ± 0.001
24	6/18/2002	0.010 ± 0.001	0.010 ± 0.001	0.009 ± 0.001	0.012 ± 0.001	0.012 ± 0.001
25	6/25/2002	0.015 ± 0.001	0.018 ± 0.002	0.018 ± 0.002	0.018 ± 0.002	0.019 ± 0.002
26	7/1/2002	0.017 ± 0.001	0.018 ± 0.002	0.015 ± 0.002	0.019 ± 0.002	0.018 ± 0.002

* Sample deviation.

** Control location.

TABLE B-6

GROSS BETA ACTIVITY IN AIRBORNE PARTICULATE SAMPLES-2002

(pCi/m^3 ± 1 sigma)

STATION #

Week #	End Date	4	5	27	94	95
27	7/9/2002	0.024 ± 0.002	0.020 ± 0.002	0.022 ± 0.002	0.022 ± 0.002	0.025 ± 0.002
28	7/16/2002	0.013 ± 0.001	0.016 ± 0.002	0.015 ± 0.002	0.014 ± 0.002	0.017 ± 0.002
29	7/22/2002	0.025 ± 0.002	0.017 ± 0.002	0.020 ± 0.002	0.018 ± 0.002	0.020 ± 0.002
30	7/30/2002	0.013 ± 0.001	0.013 ± 0.001	0.013 ± 0.001	0.020 ± 0.002	0.021 ± 0.002
31	8/6/2002	0.018 ± 0.002	0.017 ± 0.002	0.020 ± 0.002	0.015 ± 0.002	0.012 ± 0.001
32	8/13/2002	0.013 ± 0.001	0.013 ± 0.002	0.015 ± 0.002	0.024 ± 0.002	0.022 ± 0.002
33	8/20/2002	0.024 ± 0.002	0.020 ± 0.002	0.021 ± 0.002	0.013 ± 0.001	0.011 ± 0.001
34	8/27/2002	0.018 ± 0.001	0.016 ± 0.002	0.017 ± 0.002	0.015 ± 0.002	0.015 ± 0.002
35	9/3/2002	0.008 ± 0.001	0.005 ± 0.001	0.008 ± 0.001	0.017 ± 0.002	0.016 ± 0.002
36	9/9/2002	0.016 ± 0.002	0.015 ± 0.002	0.013 ± 0.002	0.022 ± 0.002	0.022 ± 0.002
37	9/17/2002	0.020 ± 0.001	0.016 ± 0.001	0.016 ± 0.002	0.018 ± 0.002	0.020 ± 0.002
38	9/24/2002	0.018 ± 0.001	0.016 ± 0.002	0.016 ± 0.002	0.017 ± 0.002	0.014 ± 0.002
39	9/30/2002	0.016 ± 0.001	0.019 ± 0.002	0.018 ± 0.002	0.010 ± 0.001	0.014 ± 0.002
40	10/8/2002	0.018 ± 0.002	0.019 ± 0.002	0.017 ± 0.002	0.016 ± 0.002	0.015 ± 0.002
41	10/15/2002	0.009 ± 0.001	0.011 ± 0.002	0.010 ± 0.001	0.015 ± 0.002	0.013 ± 0.002
42	10/21/2002	0.012 ± 0.001	0.012 ± 0.002	0.012 ± 0.001	0.014 ± 0.002	0.018 ± 0.002
43	10/29/2002	0.010 ± 0.001	0.012 ± 0.002	0.011 ± 0.001	0.013 ± 0.001	0.012 ± 0.001
44	11/5/2002	0.016 ± 0.001	0.014 ± 0.002	0.019 ± 0.002	0.012 ± 0.001	0.012 ± 0.001
45	11/11/2002	0.020 ± 0.002	0.018 ± 0.002	0.019 ± 0.002	0.012 ± 0.002	0.013 ± 0.002
46	11/19/2002	0.012 ± 0.001	0.011 ± 0.001	0.013 ± 0.001	0.013 ± 0.002	0.012 ± 0.001
47	11/26/2002	0.017 ± 0.001	0.018 ± 0.002	0.019 ± 0.002	0.012 ± 0.001	0.012 ± 0.001
48	12/3/2002	0.016 ± 0.001	0.016 ± 0.002	0.013 ± 0.002	0.015 ± 0.002	0.015 ± 0.002
49	12/10/2002	0.016 ± 0.001	0.007 ± 0.002	0.012 ± 0.001	0.012 ± 0.001	0.009 ± 0.001
50	12/17/2002	0.013 ± 0.001	0.010 ± 0.001	0.012 ± 0.001	0.012 ± 0.001	0.012 ± 0.001
51	12/23/2002	0.013 ± 0.001	0.012 ± 0.002	0.010 ± 0.002	0.018 ± 0.002	0.019 ± 0.002
52	12/30/2002	0.013 ± 0.001	0.014 ± 0.002	0.012 ± 0.001	0.019 ± 0.002	0.018 ± 0.002

* Sample deviation.
** Control location.

TABLE B-6

GROSS BETA ACTIVITY IN AIRBORNE PARTICULATE SAMPLES-2002

(pCi/m^3 ± 1 sigma)

STATION #

Week #	End Date	22	23**	29	44
1	1/8/2002	0.019 ± 0.001	0.018 ± 0.002	0.019 ± 0.001	0.019 ± 0.002
2	1/14/2002	0.014 ± 0.001	0.016 ± 0.002	0.015 ± 0.001	0.016 ± 0.002
3	1/22/2002	0.014 ± 0.001	0.020 ± 0.001	0.014 ± 0.001	0.015 ± 0.001
4	1/28/2002	0.016 ± 0.002	0.016 ± 0.002	0.016 ± 0.001	0.017 ± 0.002
5	2/5/2002	0.016 ± 0.001	0.018 ± 0.002	0.017 ± 0.001	0.017 ± 0.002
6	2/11/2002	0.024 ± 0.002	0.020 ± 0.002	0.022 ± 0.001	0.023 ± 0.002
7	2/19/2002	0.012 ± 0.001	0.014 ± 0.001	0.015 ± 0.001	0.013 ± 0.001
8	2/25/2002	0.014 ± 0.001	0.012 ± 0.002	0.012 ± 0.001	0.014 ± 0.002
9	3/4/2002	0.012 ± 0.001	0.012 ± 0.001	0.012 ± 0.001	0.015 ± 0.002
10	3/11/2002	0.022 ± 0.002	0.021 ± 0.002	0.021 ± 0.001	0.020 ± 0.002
11	3/18/2002	0.019 ± 0.001	0.017 ± 0.002	0.018 ± 0.001	0.021 ± 0.002
12	3/25/2002	0.006 ± 0.001	0.012 ± 0.001	0.013 ± 0.001	0.012 ± 0.002
13	4/1/2002	*	0.012 ± 0.001	0.012 ± 0.001	0.014 ± 0.002
14	4/8/2002	*	0.020 ± 0.002	0.014 ± 0.001	0.018 ± 0.002
15	4/15/2002	0.015 ± 0.002	0.014 ± 0.002	0.014 ± 0.001	0.017 ± 0.002
16	4/22/2002	0.020 ± 0.002	0.017 ± 0.002	0.017 ± 0.001	0.022 ± 0.002
17	4/29/2002	0.009 ± 0.001	0.011 ± 0.001	0.011 ± 0.001	0.012 ± 0.001
18	5/6/2002	0.011 ± 0.001	0.012 ± 0.001	0.013 ± 0.001	0.013 ± 0.001
19	5/13/2002	0.015 ± 0.001	0.013 ± 0.002	*	0.016 ± 0.002
20	5/20/2002	0.011 ± 0.001	0.012 ± 0.001	0.008 ± 0.001	0.013 ± 0.002
21	5/28/2002	0.011 ± 0.001	0.012 ± 0.001	0.011 ± 0.001	0.013 ± 0.001
22	6/3/2002	0.015 ± 0.002	0.014 ± 0.002	0.016 ± 0.002	0.016 ± 0.002
23	6/10/2002	0.011 ± 0.001	0.010 ± 0.001	0.012 ± 0.001	0.015 ± 0.002
24	6/17/2002	0.013 ± 0.002	0.007 ± 0.001	0.009 ± 0.001	0.009 ± 0.001
25	6/25/2002	0.016 ± 0.001	0.018 ± 0.002	0.016 ± 0.001	0.017 ± 0.002
26	7/2/2002	0.016 ± 0.002	0.015 ± 0.002	0.014 ± 0.001	0.015 ± 0.002

* Sample deviation.
** Control location.

TABLE B-6

GROSS BETA ACTIVITY IN AIRBORNE PARTICULATE SAMPLES-2002

(pCi/m^3 ± 1 sigma)

STATION #

Week #	End Date	22	23**	29	44
27	7/8/2002	0.018 ± 0.001	0.022 ± 0.002	0.021 ± 0.002	0.023 ± 0.002
28	7/15/2002	0.014 ± 0.001	0.015 ± 0.002	0.014 ± 0.001	0.018 ± 0.002
29	7/23/2002	0.019 ± 0.001	0.021 ± 0.002	0.020 ± 0.001	0.022 ± 0.002
30	7/29/2002	0.012 ± 0.001	0.007 ± 0.002	0.010 ± 0.001	0.009 ± 0.002
31	8/5/2002	0.023 ± 0.002	0.018 ± 0.002	0.019 ± 0.001	0.019 ± 0.002
32	8/12/2002	0.015 ± 0.001	0.011 ± 0.001	0.014 ± 0.001	0.014 ± 0.002
33	8/19/2002	0.022 ± 0.002	0.017 ± 0.002	0.022 ± 0.002	0.020 ± 0.002
34	8/26/2002	0.013 ± 0.001	0.013 ± 0.001	0.013 ± 0.001	0.014 ± 0.002
35	9/3/2002	0.008 ± 0.001	0.006 ± 0.001	0.009 ± 0.001	0.008 ± 0.001
36	9/9/2002	0.021 ± 0.002	0.014 ± 0.002	0.016 ± 0.002	0.016 ± 0.002
37	9/16/2002	0.019 ± 0.002	0.018 ± 0.002	0.016 ± 0.001	0.017 ± 0.002
38	9/25/2002	0.020 ± 0.002	0.018 ± 0.002	0.017 ± 0.001	0.017 ± 0.002
39	10/1/2002	0.015 ± 0.001	0.018 ± 0.002	0.013 ± 0.001	0.015 ± 0.002
40	10/7/2002	0.017 ± 0.001	0.018 ± 0.002	0.021 ± 0.002	0.020 ± 0.002
41	10/14/2002	0.010 ± 0.001	0.012 ± 0.001	0.009 ± 0.001	0.010 ± 0.001
42	10/22/2002	0.010 ± 0.001	0.009 ± 0.001	0.010 ± 0.001	0.013 ± 0.001
43	10/29/2002	0.011 ± 0.001	0.011 ± 0.001	0.012 ± 0.001	0.013 ± 0.002
44	11/4/2002	0.012 ± 0.001	0.014 ± 0.002	0.015 ± 0.001	0.015 ± 0.002
45	11/12/2002	0.017 ± 0.001	0.022 ± 0.002	0.021 ± 0.001	0.022 ± 0.002
46	11/18/2002	0.015 ± 0.001	0.014 ± 0.002	0.014 ± 0.001	0.013 ± 0.002
47	11/25/2002	0.017 ± 0.001	0.016 ± 0.002	0.015 ± 0.001	0.017 ± 0.002
48	12/2/2003	0.014 ± 0.001	0.016 ± 0.002	0.014 ± 0.001	0.015 ± 0.002
49	12/9/2002	0.015 ± 0.001	0.016 ± 0.002	0.015 ± 0.001	0.016 ± 0.002
50	12/16/2002	0.014 ± 0.001	0.012 ± 0.001	0.013 ± 0.001	0.011 ± 0.001
51	12/23/2002	0.011 ± 0.001	0.011 ± 0.001	0.013 ± 0.001	0.014 ± 0.002
52	12/30/2002	0.013 ± 0.001	0.010 ± 0.001	0.014 ± 0.001	0.013 ± 0.001

* Sample deviation.
** Control location.

TABLE B-7
CONCENTRATIONS OF GAMMA EMITTERS IN QUARTERLY COMPOSITES OF AIR PARTICULATE SAMPLES** - 2002
(RESULTS IN UNITS OF 10^{-3} pCi/m^3 ± 1 SIGMA)

#4 ALGONQUIN GAS LINE

RADIONUCLIDES	FIRST QUARTER	SECOND QUARTER	THIRD QUARTER	FOURTH QUARTER
Be-7*	106.5±12.18	115.5±12.56	100.9±10.45	74.18±8.29
K-40*	<9.07***	<3.81	33.35±6.83	<37.0***
Mn-54	<0.36	<0 25	<0.42	<0 40
Co-58	<0.73	<0.51	<0.52	<0 69
Fe-59	<2.73***	<2.53	<2.33	<2.76
Co-60	<0.57***	<0.5	<0.51	<0 59
Zn-65	<1.29	<1.35	<1.04	<1.45
Zr-95	<2 20	<1.52	<1.18	<1.05
Nb-95	<0.70	<0.78	<1.14	<1.06
Ru-103	<0 73	<1.16	<0.58	<0.58
Ru-106	<3 84	<6.94	<4.86	<5.28
I-131	<6 26	<7.37	<6.79	<7.95
Cs-134	<0.46	<0 54	<0 61	<0.55
Cs-137	<0 44	<0.32	<0.54	<0.36
Ba/La-140	<9 07	<8 15	<2.73	<3 87
Ce-141	<0.98	<0.87	<1.32	<0.74
Ce-144	<1.87	<2.15	<2.7	<1.48
Ra-226*	<6.88	<5 48	<8 2	<5 92
Ac/Th-228*	<1.33	<1.95	<1.18	<1.22
OTHERS	$<L_c$	$<L_c$	$<L_c$	$<L_c$

#5 NYU TOWER

RADIONUCLIDES	FIRST QUARTER	SECOND QUARTER	THIRD QUARTER	FOURTH QUARTER
Be-7*	84 72±12 29	111.4±12.7	95.9±11.69	61.65±7.98
K-40*	<6.42	<5 53***	35 24±7.9	23.42±6 4
Mn-54	<0.41	<0.68	<0.64	<0 41
Co-58	<0.42	<0 78	<0.91	<0 66
Fe-59	<2.89	<3.16	<2.89	<16.7***
Co-60	<0 85	<0 44	<0.63	<0.30
Zn-65	<1.30	<0.97	<1.12	<0.76
Zr-95	<1.52	<0 95	<1.86	<1.39
Nb-95	<1 25	<1.2	<1.07	<0.93
Ru-103	<1.14	<1.14	<1.13	<0.87
Ru-106	<5.03	<3.06	<6.46	<4.82
I-131	<9.27	<6 02	<7.87	<7.73
Cs-134	<0.74	<0.73	<0.91	<0.65
Cs-137	<0.54	<0.4	<0.73	<0 24
Ba/La-140	<4.79	<10.16	<7.59	<4.3***
Ce-141	<1.20	<1.33	<1.46	<1.11
Ce-144	<2.75	<2	<3.36	<1.55
Ra-226*	<6.52	<6.48	14.98±6 91	<5.61
Ac/Th-228*	<2.59	<1.41***	<1.46	<1 26
OTHERS	$<L_c$	$<L_c$	$<L_c$	$<L_c$

* Indicates naturally occurring.
** "Less than" values expressed as Critical Level (L_c), unless otherwise noted.
*** Reported as sample LLD.

TABLE B-7
CONCENTRATIONS OF GAMMA EMITTERS IN QUARTERLY COMPOSITES OF AIR PARTICULATE SAMPLES** - 2002

(RESULTS IN UNITS OF 10^{-3} pCi/m^3 ± 1 SIGMA)

#27 CROTON POINT

RADIONUCLIDES	FIRST QUARTER	SECOND QUARTER	THIRD QUARTER	FOURTH QUARTER
Be-7*	106.7±12.11	104.6±13.33	103.5±11.95	60.67±7.51
K-40*	<5.16	<5.39***	<6.58	<3.0***
Mn-54	<0 61	<0.64	<0 63	<0.31
Co-58	<0.71	<0.44	<0.63	<0.54
Fe-59	<2.48	<2 5	<2.33	<1.38
Co-60	<0.67	<0 5	<0.72	<0.47
Zn-65	<0.83	<1.24	<1.28	<0.83
Zr-95	<1.91	<0.98***	<1.59	<0.61
Nb-95	<1.22	<1.16	<1.5	<0.64
Ru-103	<0.78	<1.1	<1.06	<0.77
Ru-106	<5.65	<3.15***	<3.19	<3.98
I-131	<6.17	<11.16	<7.16	<7.27
Cs-134	<0.74	<0 51	<0.67	<0.45
Cs-137	<0.59	<0.39	<0.55	<0.21
Ba/La-140	<5.45***	<5.73	<6.71	<4.63
Ce-141	<1.11	<1.56	<1.4	<0.96
Ce-144	<2.17	<2.39	<3.32	<1.81
Ra-226*	<6.06	<7.17	<9.65	<5.40
Ac/Th-228*	<1.60	<1.67	<1.44	<1.59
OTHERS	$<L_c$	$<L_c$	$<L_c$	$<L_c$

#94 IP TRAINING CENTER

RADIONUCLIDES	FIRST QUARTER	SECOND QUARTER	THIRD QUARTER	FOURTH QUARTER
Be-7*	99 02±11.51	126±13.86	99.96±12.85	75 47±8.64
K-40*	<4.78	<7.06	<7.06	19 32±5.09
Mn-54	<0.59	<0 36	<0.68	<0.49
Co-58	<0.85	<0 91	<1.11	<0.66
Fe-59	<2.30	<2.71***	<3.55	<2.26
Co-60	<0 67	<0 86	<0.38	<0.39
Zn-65	<1.68	<5 36***	<1.82	<0.98
Zr-95	<1.74	<1.62	<1.85	<1.38
Nb-95	<1.47	<0 81	<1.28	<0.91
Ru-103	<1.04	<1.14	<0.85	<0.85
Ru-106	<4.58	<6 21	<6.41	<4 86
I-131	<5.57	<12.28	<9 6	<7.79
Cs-134	<0.26	<0.77	<1.13	<0.48
Cs-137	<0 65	<0 26	<0.39	<0.43
Ba/La-140	<6 63	<5.73	<3.96***	<5.73
Ce-141	<1.33	<1.63	<1.71	<1.09
Ce-144	<1.96	<2 25	<3.36	<1.49
Ra-226*	<7.04	<5.86	<11.26	<5.20
Ac/Th-228*	<2.12	<1.92	<1.9	<1.23
OTHERS	$<L_c$	$<L_c$	$<L_c$	$<L_c$

* Indicates naturally occurring.
** "Less than" values expressed as Critical Level (L_c), unless otherwise noted
*** Reported as sample LLD.

TABLE B-7
CONCENTRATIONS OF GAMMA EMITTERS IN QUARTERLY COMPOSITES OF AIR PARTICULATE SAMPLES** - 2002

(RESULTS IN UNITS OF 10^{-3} pCi/m^3 ± 1 SIGMA)

#95 METEOROLOGICAL TOWER

RADIONUCLIDES	FIRST QUARTER	SECOND QUARTER	THIRD QUARTER	FOURTH QUARTER
Be-7*	114.8±14.19	105.7±12.89	109 8±13.05	61.7±8.53
K-40*	40 63±10.44	<8 59	28 88±6.8	<3 09
Mn-54	<0.58	<0 55	<0.61	<0 50
Co-58	<1.09	<0 94	<0.86	<1.00
Fe-59	<4.04	<2.89***	<2.99	<2.94
Co-60	<0.56***	<0 46	<0.53	<0 50
Zn-65	<1.58	<1.43	<1.64	<0.73
Zr-95	<1.92	<0 99	<1.8	<1.21
Nb-95	<1.25	<0 72	<1.24	<0.74
Ru-103	<0.77	<0.75	<0.83	<1.26
Ru-106	<4.55	<3 19	<7.82	<5.92
I-131	<6 07	<12.58	<7.87	<6 48
Cs-134	<0.90	<0.5	<0.7	<0.71
Cs-137	<0.54	<0 42	<0.58	<0 52
Ba/La-140	<5.76	<6.13	<3.52	<7.30
Ce-141	<1.79	<1.27	<1.81	<1.13
Ce-144	<2.93	<2 95	<2.58	<2.19
Ra-226*	<9.36	<4.51	<11.16	<6.67
Ac/Th-228*	<2.97	<1.79	<1.85	<1.49
OTHERS	$<L_c$	$<L_c$	$<L_c$	$<L_c$

#22 LOVETT POWER PLANT

RADIONUCLIDES	FIRST QUARTER	SECOND QUARTER	THIRD QUARTER	FOURTH QUARTER
Be-7*	73.64±10.32	86.13±11.69	86 08±10 31	58 3±6.98
K-40*	33 35±8.03	34 63±7.76	<4.44	<3.07
Mn-54	<0.42	<0.64	<0.43	<0.31
Co-58	<0.79	<0.88	<0 81	<0 51
Fe-59	<3.73	<3.79	<1.39	<1.19
Co-60	<0 57	<0.87	<0.3	<0 33
Zn-65	<1.34	<1.99	<1.51	<0.83
Zr-95	<0.89	<0.91	<1.09	<0.98
Nb-95	<1.31	<1.26	<1.1	<0.91
Ru-103	<1.12	<1.33	<0.85	<0.75
Ru-106	<5 58	<5.57	<6.76	<4.20
I-131	<8.61	<10 3	<8.6	<6 27
Cs-134	<0.78	<0.75	<0.77	<0.39
Cs-137	<0.55	<0 47	<0 46	<0.32
Ba/La-140	<3.95***	<6 39	<3.24***	<4 02
Ce-141	<1.66	<1.49	<1.44	<0.97
Ce-144	<2.63	<2.67	<2.91	<1.30
Ra-226*	<7.58	<8.46	<7.81	<4 07
Ac/Th-228*	<2.18	<1.64	<1.69	<0 96
OTHERS	$<L_c$	$<L_c$	$<L_c$	$<L_c$

* Indicates naturally occurring.
** "Less than" values expressed as Critical Level (L_c), unless otherwise noted.
*** Reported as sample LLD.

TABLE B-7
CONCENTRATIONS OF GAMMA EMITTERS IN QUARTERLY COMPOSITES OF AIR PARTICULATE SAMPLES - 2002**
(RESULTS IN UNITS OF 10^{-3} pCi/m^3 ± 1 SIGMA)

#23 ROSETON

RADIONUCLIDES	FIRST QUARTER	SECOND QUARTER	THIRD QUARTER	FOURTH QUARTER
Be-7*	97.21±11.21	127.2±13.78	119 2±16 85	71.1±7.8
K-40*	<6.27	<8.17	<7.64	<3.48
Mn-54	<0.45	<0.61	<0.55***	<0.45
Co-58	<0.92	<1.11	<1.04	<0.47
Fe-59	<2.34***	<3 9	<3.86***	<2.34
Co-60	<0.44	<0.44	<0.76	<0.37
Zn-65	<1.75	<1.67	<2.92	<1.15
Zr-95	<1.41	<1.01***	<1.29	<1.32
Nb-95	<0.69	<1.57	<1.08	<0.96
Ru-103	<0.87	<1.15	<1.19	<0.71
Ru-106	<6.95	<8.05	<3.9	<3.53
I-131	<7.24	<9.98	<7.12	<7.16
Cs-134	<0.49	<0.47	<1.02	<0.35
Cs-137	<0.39	<0.49	<0.73	<0.36
Ba/La-140	<5.3***	<7.17***	<8.24***	<5.58
Ce-141	<1.01	<1.46	<1.32	<1.05
Ce-144	<1.63	<2.09	<3.19	<1.49
Ra-226*	<6.53	<7.11	<7.5	<5.83
Ac/Th-228*	<0.98	<1.40***	<1.91	<1.26
OTHERS	$<L_c$	$<L_c$	$<L_c$	$<L_c$

#29 GRASSY POINT

RADIONUCLIDES	FIRST QUARTER	SECOND QUARTER	THIRD QUARTER	FOURTH QUARTER
Be-7*	96.5±11.22	137.2±13.73	109.6±10.85	75.73±7.28
K-40*	<5 36	<3.84	<6.5	24.05±4.39
Mn-54	<0.35	<0.65	<0.41	<0.32
Co-58	<0.62	<0.64	<0.59	<0.48
Fe-59	<2 45	<2 97	<1.66	<1.35
Co-60	<0.53	<0.44***	<0 43***	<0.22***
Zn-65	<0.95	<1.26	<1.31	<0.50
Zr-95	<1.27	<1.46	<0.71	<1.14
Nb-95	<0.93	<1.14	<1.01	<0.81
Ru-103	<0.81	<0 59	<0.37	<0.78
Ru-106	<4.32	<5.5	<2.4	<3.71
I-131	<5.93	<8.91	<6.11	<4.06
Cs-134	<0.50	<0.59	<0.43	<0 33
Cs-137	<0.31	<0.45	<0.22	<0 23
Ba/La-140	<4.44	<5 84***	<4.32***	<2.83***
Ce-141	<1.00	<0 82	<1.04	<0.84
Ce-144	<2.16	<1.69	<1.98	<1.20
Ra-226*	<8 63	<5.94	<4.82	<3 67
Ac/Th-228*	<1.69	<1.39	<1.35	<0 63
OTHERS	$<L_c$	$<L_c$	$<L_c$	$<L_c$

* Indicates naturally occurring.
** "Less than" values expressed as Critical Level (L_c), unless otherwise noted
*** Reported as sample LLD.

TABLE B-7
CONCENTRATIONS OF GAMMA EMITTERS IN QUARTERLY COMPOSITES OF AIR PARTICULATE SAMPLES - 2002**
(RESULTS IN UNITS OF 10^{-3} pCi/m^3 ± 1 SIGMA)

#44 PEEKSKILL GAS HOLDER BUILDING

RADIONUCLIDES	FIRST QUARTER	SECOND QUARTER	THIRD QUARTER	FOURTH QUARTER
Be-7*	83 71±12.71	112.8±13 51	104.9±13.37	55.64±8.27
K-40*	<6 47	<8 43	<5.7***	44.27±8.18
Mn-54	<0.48	<0.61	<0.75	<0.27
Co-58	<0.57	<0.9	<0.89	<0.80
Fe-59	<3 45	<4.97	<2.48	<2.76
Co-60	<0.75	<0 53***	<0.52	<0.38
Zn-65	<1.36	<1.01***	<1.07***	<0.97
Zr-95	<1.43	<0.92	<1.11	<0.80
Nb-95	<1.22	<1.8	<1.6	<0.90
Ru-103	<1.28	<1.24	<1.46	<0.84
Ru-106	<7.07	<2 72	<8.23	<4.28
I-131	<8.40	<10.35	<9.97	<7.82
Cs-134	<0.91	<0.76	<0.75	<0 49
Cs-137	<0.54	<0.43	<0 5	<0 46
Ba/La-140	<6.13	<5.91	<4.86	<5.63
Ce-141	<1.74	<1.25	<1.11	<1.31
Ce-144	<3.23	<2.2	<2.61	<1.27
Ra-226*	<9.05	<5.72	<9.12	<5.97
Ac/Th-228*	<3.02	<1.87	<2.49	<1.39
OTHERS	<L_c	<L_c	<L_c	<L_c

* Indicates naturally occurring.
** "Less than" values expressed as Critical Level (L_c), unless otherwise noted.
*** Reported as sample LLD.

TABLE B-8

I-131 ACTIVITY IN CHARCOAL CARTRIDGE SAMPLES - 2002*

(pCi/m^3 ± 1 sigma)

Week #	End Date	4	5	27	94	95	22	23***	29	44
1	1/8/2002	<0.010	<0.005	<0.010	<0.012	<0.008	<0.012	<0.017	<0.006	<0 006
2	1/14/2002	<0.004**	<0.009	<0.012	<0.010	<0.013	<0.010	<0.015	<0.006	<0.012
3	1/22/2002	<0.005	<0.010	<0 012	<0.011	<0.009	<0.005	<0.005	<0.007	<0.009
4	1/28/2002	<0.009	<0.007	<0.011	<0.013	<0 011	<0.005	<0.007**	<0.012	<0.015
5	2/5/2002	<0.005	<0.013	<0.009	<0.008	<0.009	<0.010	<0.007	<0.007	<0 014
6	2/11/2002	<0.006	<0.009	<0.008	<0.008	<0.009	<0.009	<0.012	<0.011	<0.009
7	2/19/2002	<0.005	<0.006	<0.014	<0.012	<0.016	<0.009	<0.007	<0.006	<0 011
8	2/25/2002	<0.008	<0.005	<0.010	<0.014	<0.008**	<0.009	<0.009	<0.008	<0.011
9	3/4/2002	<0.009	<0.015	<0.010	<0.008	<0.009	<0.007**	<0.010	<0.007	<0.010
10	3/11/2002	<0.006**	<0.010	<0.012	<0.009	<0 019	<0.009	<0.010	<0.008	<0.012
11	3/18/2002	<0.005	<0.009	<0.007	<0.016	<0.016	<0.006	<0.013	<0.015	<0.016
12	3/25/2002	<0.008	<0.004	<0 007	<0.010	<0.014	<0.012	<0 010	<0.007	<0 008
13	4/1/2002	<0.005	<0 006**	<0.007	<0 006**	<0.005	****	<0.012	<0.013	<0.011
14	4/8/2002	<0.010	<0.010	<0.010	<0.011	<0.010	****	<0.016	<0.010	<0.012
15	4/15/2002	<0.006	<0.008**	<0.010	<0.007	<0.005	<0.005	<0.014	<0.008	<0 012
16	4/22/2002	<0.011	<0.012	<0.011	<0.011	<0.014	<0.011	<0.005	<0.012	<0.012
17	4/29/2002	<0.010	<0.012	<0.006	<0.009	<0.014	<0.012	<0.008	<0.008	<0 011
18	5/6/2002	<0 006	<0.009	<0 008	<0.012	<0.012	<0.009	<0 017	<0 010	<0 016
19	5/13/2002	<0.006	<0.008	<0.011	<0.013	<0.011	<0 010	<0.008	****	<0 012
20	5/20/2002	<0 006	<0.009	<0.006	<0.015	<0.009	<0.009	<0.011	<0.010	<0.008
21	5/28/2002	<0.006	<0.010	<0.008	<0.006	<0.013	<0.008	<0.012	<0.004	<0.011
22	6/3/2002	<0 013	<0.005	<0 014	<0.015	<0.013	<0 010	<0 016	<0 009	<0 019
23	6/10/2002	<0.006	<0 008	<0.012	<0.013	<0.007	<0.009	<0.009	<0.009	<0.012
24	6/17/2002	<0.008	<0.012	<0.011	<0.009	<0.010	<0.020	<0.008	<0.005	<0.015
25	6/25/2002	<0.008	<0.005	<0.009	<0.011	<0.011	<0.005	<0 008	<0 009	<0 011
26	7/2/2002	<0.007	<0.012	<0.010	<0.015	<0.015	<0.012	<0.014	<0.011	<0.015

* "Less than" values expressed as sample Critical Level (L_c) unless otherwise noted.

** Reported as sample LLD.

*** Control location.

**** Sample deviation.

TABLE B-8

I-131 ACTIVITY IN CHARCOAL CARTRIDGE SAMPLES - 2002*

(pCi/m^3 ± 1 sigma)

Week #	End Date	4	5	27	94	95	22	23***	29	44
27	7/9/2002	<0.011	<0.015	<0.016	<0.015	<0.011	<0.012	<0.014	<0.006	<0.011
28	7/16/2002	<0.007	<0.006**	<0 007	<0.006	<0.016	<0.007	<0.005	<0.012	<0.010
29	7/22/2002	<0.008**	<0.015	<0.016	<0.010	<0.017	<0.008	<0.010	<0.005	<0.014
30	7/30/2002	<0.008	<0.008	<0.010	<0.010	<0.005	<0.009	<0.007	<0.017	<0 021
31	8/6/2002	<0.013	<0.009	<0.005	<0.010	<0.011	<0.013	<0.011	<0.012	<0 011
32	8/13/2002	<0.008	<0.009**	<0.011	<0.008	<0.008	<0.010	<0.009	<0.012	<0.016
33	8/20/2002	<0.007**	<0.011	<0.009	<0.009	<0.011	<0.007	<0.012	<0.004	<0.017
34	8/27/2002	<0.007	<0.011	<0.011	<0.007	<0.005	<0.012	<0.012	<0.004	<0 014
35	9/3/2002	<0.013	<0.011	<0.020	<0.020	<0.015	<0.008	<0.012	<0.006**	<0.010
36	9/9/2002	<0.009	<0.011	<0.013	<0.013	<0.016	<0.009	<0 013	<0.013	<0.016
37	9/17/2002	<0.009	<0.006**	<0.014	<0.011	<0.008**	<0.010	<0.014	<0.012	<0 017
38	9/24/2002	<0.007	<0.010	<0.008	<0.006	<0.012	<0.009	<0.012	<0.010	<0.012
39	9/30/2002	<0.008	<0.008	<0.014	<0.019	<0.008	<0.011	<0.009	<0.006	<0.009
40	10/8/2002	<0.008	<0.014	<0.010	<0.009	<0 011	<0.009	<0 012	<0.008	<0 011
41	10/15/2002	<0.008	<0.005	<0.009	<0.009	<0.010	<0.007	<0.005	<0.005	<0.007
42	10/21/2002	<0.006	<0.012	<0.007	<0.011	<0 008	<0.011	<0.009	<0.009	<0 010
43	10/29/2002	<0.005	<0.009	<0.007	<0 010	<0 009	<0.005	<0.009	<0.008	<0 007
44	11/5/2002	<0 006	<0.009	<0.003	<0.009	<0.007	<0.010	<0.008	<0.007	<0.012
45	11/11/2002	<0.006	<0.009	<0.008	<0.009	<0.007	<0.008	<0.009	<0.010	<0.007
46	11/19/2002	<0.011	<0.007	<0.010	<0.007	<0 010	<0.007	<0.008	<0.009	<0 008
47	11/26/2002	<0.005	<0.009	<0.007	<0.005	<0.007	<0.007	<0.008	<0.006	<0.010
48	12/3/2002	<0 007	<0.007	<0.007	<0.008	<0 009	<0.006	<0.011	<0.006	<0.009
49	12/10/2002	<0.006	<0.011	<0.007	<0.007	<0.010	<0.007	<0.007	<0.008	<0.010
50	12/17/2002	<0.007	<0.010	<0.007	<0.009	<0.008	<0 014	<0 009	<0.006	<0.008
51	12/23/2002	<0.007	<0.006	<0.008	<0.011	<0.008	<0 006	<0 008	<0.005	<0.009
52	12/30/2002	<0.007	<0.010	<0.008	<0.016	<0.017	<0.011	<0.011	<0.010	<0.007

* "Less than" values expressed as sample Critical Level (L_c) unless otherwise noted.
** Reported as sample LLD.
*** Control location.
**** Sample deviation.

TABLE B-9

CONCENTRATIONS OF GAMMA EMMITERS IN HUDSON RIVER WATER SAMPLES** - 2002

(pCi/L ± 1 SIGMA)

#9 PLANT INLET (HUDSON RIVER INTAKE)

Radionuclide	January	February	March	April	May	June
Be-7*	<7.75	<7.49	<11.81	<7.22	<10.32	<7.97
K-40*	209+10.3	197.2+10 6	255 2+14.9	253.8±8 44	261.7±15.3	158 4±9.46
Mn-54	<0 5	<0 79	<1.15	<0.73	<1.03	<0.8
Co-58	<0.95	<0.91	<1.25	<0 83	<1.33	<0 95
Fe-59	<2.97	<2 71	<3.74	<2.2	<3.29	<2.94
Co-60	<0.77	<0 79	<1.12	<0.7	<1.2	<0 86
Zn-65	<1.65	<1.69	<2.51	<0 9	<2.4	<1.73
Zr-95	<1.71	<1.62	<2.29	<1.42	<2.15	<1.57
Nb-95	<1.24	<1.01	<1.45	<1.02	<1.4	<1.17
Ru-103	<1.28	<1.19	<1.54	<0.6	<1.56	<1.21
Ru-106	<7.95	<7.65	<11.09	<7.33	<11.45	<8.17
I-131	<4.27	<3 52	<4.31	<3 09	<4 98	<5
Cs-134	<0 77	<0 78	<1.02	<0 44	<1.18	<0.77
Cs-137	<0 75	<0.8	<1.03	<0 66	<1.09	<0.72
Ba/La-140	<2.74	<2.38	<2.06	<1.97	<4.04	<2.66
Ce-141	<1.24	<1.13	<2.22	<1.76	<2.38	<1 21
Ce-144	<5 56	<5 61	<6 8	<5.62	<7.18	<5.48
Ra-226*	89 6+13 3	106 9+12 8	113.9+16.9	82.85±13.25	88.32±17.08	125 4±14 23
Ac/Th-228*	<2 59	5 26+2 3	13 0+3 2	12 84±2.15	10 14±2 93	3 59±1.95

#10 DISCHARGE CANAL (MIXING ZONE)

Radionuclide	January	February	March	April	May	June
Be-7*	<10 59	<10.46	<7.83	<11.22	<8 52	<10.67
K-40*	391+14.11	385.5+14 33	190 6+10.23	269.9±15 61	172 8±10.21	316.9±13 09
Mn-54	<1.02	<0.91	<0.78	<1.1	<0.79	<0.96
Co-58	<1.23	<1.1	<0.92	<1.24	<0 9	<1.08
Fe-59	<3.19	<3.3	<2.43	<3.77	<2 63	<3.28
Co-60	<1.06	<1.1	<0.83	<1.17	<0 82	<0.98
Zn-65	<1.36	<1.26	<1.99	<2.4	<1.97	<2.38
Zr-95	<2 08	<1.95	<1.66	<2.13	<1.67	<1.98
Nb-95	<1.47	<1.23	<1.09	<1.5	<1.05	<1.38
Ru-103	<1.54	<1.45	<1.15	<0 99	<1.29	<1.51
Ru-106	<9 14	<9.89	<8 67	<11 51	<8 26	<9.2
I-131	<5 11	<4.19	<3 31	<4 64	<3.95	<5.84
Cs-134	<0 64	<0.87	<0 74	<1.05	<0.74	<0.61
Cs-137	<0 9	<0.91	<0.85	<1.06	<0.83	<0.84
Ba/La-140	<3 49	<3.06	<2.42	<3 7	<3 02	<3.98
Ce-141	<1.79	<1.69	<1.9	<1.63	<1.99	<2.73
Ce-144	<7.78	<7.61	<5.89	<7.19	<5 85	<7.8
Ra-226*	124 6+16 36	103.4+17.32	53 88+13.56	110.7±17.46	63 76±14.96	89 54±16.1
Ac/Th-228*	4.87+2.66	8 06+2 74	<2.59	5.86±3.11	3.68±2 21	12.16±2 67

* Indicates naturally occurring

** "Less than" values expressed as Critical Level (L_C)

TABLE B-9

CONCENTRATIONS OF GAMMA EMMITERS IN HUDSON RIVER WATER SAMPLES** - 2002

(pCi/L ± 1 SIGMA)

#9 PLANT INLET (HUDSON RIVER INTAKE)

Radionuclide	July	August	September	October	November	December
Be-7*	<10.21	<8.77	<10 61	<16.26	<9.76	<12.28
K-40*	220.3±14.22	223 8±10 78	244 3±14 64	407.2+22 69	173 4+13 2	187.2+14 59
Mn-54	<1.1	<0.74	<1.06	<1.51	<1.03	<1.1
Co-58	<1.2	<0.92	<1.19	<1.69	<1.12	<1.37
Fe-59	<3 35	<2.57	<3.47	<4.75	<3.77	<3.98
Co-60	<1.13	<0 83	<1.18	<1 59	<1.02	<1.1
Zn-65	<2.12	<1.62	<2.45	<3 82	<2.43	<2.51
Zr-95	<2 39	<1.82	<2.23	<3 36	<2.25	<2.49
Nb-95	<1.5	<1.14	<1.46	<2.09	<1.54	<1.52
Ru-103	<1.45	<1.24	<1.42	<2.54	<0.87	<1.94
Ru-106	<10 27	<8 55	<11.67	<15.1	<9.02	<12.17
I-131	<5 47	<5 04	<4.51	<7.31	<4.75	<6.4
Cs-134	<0 56	<0.78	<1.01	<1.01	<0 6	<1.11
Cs-137	<1.05	<0 71	<1.04	<1.48	<0.96	<1.14
Ba/La-140	<3.93	<3 09	<2.75	<5 8	<3.6	<4 25
Ce-141	<2.26	<1.94	<2.2	<4 09	<2.12	<1.8
Ce-144	<6.85	<5 69	<6 78	<12.49	<6.97	<8.18
Ra-226*	71.13±16 51	114.5±15.02	77.2±16 61	148 2+27.84	117.5+17.8	<25.1
Ac/Th-228*	11.02±3 23	4 96±2 03	12.18±3.19	8.03+4 2	5 37+3 03	<3 97

#10 DISCHARGE CANAL (MIXING ZONE)

Radionuclide	July	August	September	October	November	December
Be-7*	<8 03	<10 83	<7.93	<11.36	<8.15	<12.34
K-40*	222.5±10.91	385 5±14.44	261.5±11.58	288.5+14.11	194.2+10 55	166 4+14 82
Mn-54	<0 83	<0.98	<0.81	<1.05	<0 8	<1.29
Co-58	<0 87	<1.11	<0 84	<1.25	<0.9	<1.59
Fe-59	<2.6	<3.31	<2.76	<3 71	<2 52	<4 45
Co-60	<0.79	<1.12	<0 76	<1.03	<0 81	<1.42
Zn-65	<2.01	<2.33	<1.93	<1.36	<2.01	<3.08
Zr-95	<1.63	<1.91	<1.58	<2.22	<1.76	<2.78
Nb-95	<1.17	<1.43	<1.02	<1.52	<1.02	<1.82
Ru-103	<0.7	<1.54	<1.15	<1.55	<1.19	<1.75
Ru-106	<8 42	<9 88	<8.56	<11.18	<7.96	<13.7
I-131	<3 94	<5 89	<2.99	<5 35	<3.32	<7.35
Cs-134	<0 76	<0.61	<0.81	<0 67	<0 46	<1.15
Cs-137	<0.78	<0.87	<0 85	<0.92	<0.85	<1.27
Ba/La-140	<2.93	<3.77	<2.28	<3 37	<2.48	<5.09
Ce-141	<1.92	<2.69	<1.91	<2.93	<1.87	<2.87
Ce-144	<5 82	<7.47	<5.95	<8 69	<5.83	<8.31
Ra-226*	62.89±14.65	99 24±17.68	50.25±13 59	77.33+19 49	70 94+16 42	113.8+21.79
Ac/Th-228*	10 41±2.43	9.35±2.65	6 29±2.16	9.09+2 67	8.36+2.4	<4 46

* Indicates naturally occurring

** "Less than" values expressed as Critical Level (L_c).

TABLE B-10

CONCENTRATION OF TRITIUM IN HUDSON RIVER WATER SAMPLES*- 2002 (QUARTERLY COMPOSITES)

(pCi/L ± 1 sigma)

#9 PLANT INLET (HUDSON RIVER INTAKE)
(Control Location)

Radionuclide	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
TRITIUM	<290	<270	<290	432±76

#10 DISCHARGE CANAL (MIXING ZONE)

Radionuclide	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
TRITIUM	<290	<270	340±94	783±79

* "Less than" values expressed as Lower Limit of Detection (LLD).

TABLE B-11

GROSS BETA ACTIVITY AND CONCENTRATIONS OF GAMMA EMITTERS IN DRINKING WATER SAMPLES** - 2002

(pCi/L ± 1 sigma)

#7 CAMP FIELD RESERVOIR

Radionuclide	January	February	March	April	May	June
Gross Beta	2.63±0.52	2.66±0.59	2.24±0.54	2.74±0.58	2.02±0.49	1.66±0.49
Be-7*	<29.55	<19.31	<17.35	<15.5	<19.72	<21.89
K-40*	405.1±53.31	142.2±26.47	159.3±28.64	162.1±25.3	237.1±37.35	359.6±36.03
Mn-54	<4.06	<2.52	<2.72	<1.84	<2.78	<2.71
Co-58	<3.96	<2.33	<2.32	<1.97	<2.66	<2.34
Fe-59	<8.95	<5.4	<6.22	<5.58	<7.6	<5.92
Co-60	<3.85	<3.28	<2.32	<2.32	<2.94	<2.57
Zn-65	<9.33	<5.68	<6.14	<4.87	<7.06	<6.73
Zr-95	<5.45	<4.74	<4.34	<3.88	<4.48	<4.3
Nb-95	<3.94	<3.07	<2.75	<2.19	<2.73	<2.6
Ru-103	<3.54	<2.8	<2.39	<2.35	<2.95	<2.96
Ru-106	<33.52	<25.98	<25.55	<21.8	<27.81	<25.77
I-131	<0.27	<0.22	<0.32	<0.26	<0.23	<0.21
Cs-134	<2.47	<2.51	<2.35	<2.25	<2.63	<2.51
Cs-137	<3.3	<2.06	<1.81	<2.15	<2.5	<2.74
Ba/La-140	<5.14	<3.92	<3.63	<3.66	<4.2	<3.21
Ce-141	<6.52	<4.25	<4.65	<3 54	<4.29	<4.56
Ce-144	<27.04	<15.65	<16.37	<14.94	<17.22	<18.73
Ra-226*	<96.23	163.5±46.87	87.01±43.75	<45.29	<63.98	112±44.05
Ac/Th-228*	<11.03	<8.21	<7.94	<8.57	<11.94	<8.62

#7 CAMP FIELD RESERVOIR

Radionuclide	July	August	September	October	November	December
Gross Beta	2.58±0.52	2.10±0.44	2.46±0.49	1.66±0.48	2.29±0.56	1.08±0.55
Be-7*	<21.74	<21	<20.97	<23.01	<18.44	<25.29
K-40*	167.7±30.77	<29.65	203.6±31.49	173.8±34.58	205.7±36.57	185.9±28.36
Mn-54	<2.47	<2.39	<2.73	<2.99	<2.36	<2.61
Co-58	<2.97	<2.45	<2.54	<2.81	<2.68	<2.32
Fe-59	<6.96	<6.44	<6.32	<7.06	<6.14	<7.41
Co-60	<2.63	<2.53	<2.32	<3.56	<3.39	<2.4
Zn-65	<5.66	<5.68	<6	<6.17	<6.83	<7.12
Zr-95	<4	<4.13	<4.49	<4.24	<4.2	<4.95
Nb-95	<2.6	<1.92	<2.45	<2.84	<3.75	<3 82
Ru-103	<2.89	<2.67	<2.56	<2.73	<2.55	<3.19
Ru-106	<27.62	<25.86	<23.56	<23.96	<25.46	<28.51
I-131	<0.2	<0.23	<0.23	<0.21	<0.28	<0.22
Cs-134	<2.9	<2.24	<2.52	<2.48	<2.96	<2.91
Cs-137	<2.93	<2.74	<2.42	<2.72	<2.5	<2.58
Ba/La-140	<3.58	<2.29	<3	<2.97	<3.8	<4.45
Ce-141	<3.93	<3.73	<3.95	<4.15	<3.85	<4.5
Ce-144	<16.98	<16.48	<15.48	<18.72	<16.98	<16.98
Ra-226*	102.1±41.69	<48.25	<49.43	81.51±45.57	<55.19	<54.88
Ac/Th-228*	<9.57	<7.23	<7.88	<10.41	<9.57	<6.48

* Indicates naturally occurring.

** "Less than" values expressed as Critical Level (L_c).

TABLE B-11

GROSS BETA ACTIVITY AND CONCENTRATIONS OF GAMMA EMITTERS IN DRINKING WATER SAMPLES** - 2002

(pCi/L ± 1 sigma)

#8 NEW CROTON RESERVOIR

Radionuclide	January	February	March	April	May	June
Gross Beta	2.52+0.49	1.73±0.53	2.32±0.53	1.07±0.53	2.66±0.52	2.41±0.52
Be-7*	<29.96	<25.42	<18.12	<17.12	<18.12	<16.84
K-40*	159.4±42.33	322.8±45.02	210±26.06	112±24.02	187.6±26.24	191.9±31.89
Mn-54	<3.26	<3.06	<2.00	<2.46	<2.14	<2.23
Co-58	<3.23	<2.98	<2.03	<2.12	<1.97	<2.33
Fe-59	<8.81	<8.10	<5.54	<5.31	<5.41	<7.64
Co-60	<3.27	<3.07	<1.83	<1.94	<2.32	<3.14
Zn-65	<4.80	<6.83	<5.64	<4.42	<6.47	<5.04
Zr-95	<5.51	<6.73	<4.01	<3.69	<4.97	<3.45
Nb-95	<3.04	<3.04	<2.37	<1.81	<2	<2.36
Ru-103	<2.54	<3.24	<2.31	<2.2	<2.63	<2.28
Ru-106	<36.23	<29.89	<19.70	<21.7	<25.56	<22.68
I-131	<0.24	<0.21	<0.30	<0.24	<0.20	<0.19
Cs-134	<3.35	<2.07	<1.36	<2.54	<2.22	<2.22
Cs-137	<3.31	<2.55	<2.19	<1.82	<2.29	<2.14
Ba/La-140	<2.89	<4.85	<2.93	<2.71	<2.58	<2.91
Ce-141	<5.32	<5.31	<4.08	<3.82	<3.41	<3.97
Ce-144	<23.18	<25.28	<16.25	<16.96	<16.23	<17.17
Ra-226*	121.2±53.66	<78.07	<46.45	<45.36	<45.77	145.4±44.49
Ac/Th-228*	<9.50	<11.43	<7.89	<7.34	<6.86	<6.94

#8 NEW CROTON RESERVOIR

Radionuclide	July	August	September	October	November	December
Gross Beta	2.89±0.52	2.22±0.45	3.34±0.5	1.51±0.48	2.08±0.54	1.67±0.66
Be-7*	<18.51	<22.15	<17.12	<14.59	<16.5	<18.77
K-40*	152.4±24.73	159.7±29.89	263.1±27.32	148.1±26.16	140.7±27.26	158.1±23.69
Mn-54	<2.42	<2.32	<2.18	<2.14	<2.33	<2.26
Co-58	<2.12	<2.41	<1.93	<2.11	<2.09	<2.12
Fe-59	<5.55	<5.23	<4.84	<5.29	<5.41	<5.03
Co-60	<1.94	<2.75	<1.96	<1.7	<2.47	<1.61
Zn-65	<4.55	<5.31	<4.86	<5.17	<5.67	<4.65
Zr-95	<2.35	<4.43	<3.11	<2.77	<3.97	<4
Nb-95	<1.94	<2.22	<1.99	<2.11	<2.26	<2.41
Ru-103	<2.29	<2.69	<2.10	<2.39	<1.97	<2.37
Ru-106	<25.60	<28.30	<19.50	<23.16	<23.96	<22.78
I-131	<0.21	<0.23	<0.31	<0.23	<0.23	<0.21
Cs-134	<2.36	<2.49	<1.27	<2.06	<1.84	<1.86
Cs-137	<2.41	<2.85	<2.00	<2.42	<1.9	<1.73
Ba/La-140	<2.57	<3.61	<2.05	<3.13	<3.1	<3.38
Ce-141	<3.68	<3.92	<3.60	<3.66	<3.54	<3.22
Ce-144	<16.80	<18.81	<17.48	<14.91	<15.68	<14.23
Ra-226*	75.69±29.97	<59.13	105.9±38.21	<43.32	<46.95	169.3±42.03
Ac/Th-228*	<6.70	<6.10	<6.61	<7.48	<8.4	<7.01

* Indicates naturally occurring.

** "Less than" values expressed as Critical Level (L_c).

TABLE B-12

CONCENTRATION OF TRITIUM IN DRINKING WATER SAMPLES*- 2002
(QUARTERLY COMPOSITES)

(pCi/L ± 1 sigma)

#7 CAMP FIELD RESERVOIR

Radionuclide	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
TRITIUM	<270	<280	<280	<270

#8 NEW CROTON RESERVOIR

Radionuclide	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
TRITIUM	<290	<280	<280	<270

* "Less than" values expressed as Lower Limit of Detection (LLD).

TABLE B-13

CONCENTRATION OF GAMMA EMITTERS IN SHORELINE SOIL SAMPLES**-2002
(pCi/Kg ,dry ± 1 sigma)

#17 OFF VERPLANCK

Collection Date	K-40	Co-60	Cs-134	Cs-137	Ra-226*	Ac/Th-228*	Others
6/8/2002***	17703±290	<19.7	<17.3	217±10.78	1174±170	687.07±38 25	<L_c
9/12/2002***	16316±307	<21.72	<18 46	241.4±11.9	1185±168.7	622.5±40 59	<L_c

#28 LENT'S COVE

Collection Date	K-40	Co-60	Cs-134	Cs-137	Ra-226*	Ac/Th-228*	Others
6/8/2002***	17880±433	<27.24	<32.92	205 6±16 05	2252±262	494.5±53 85	<L_c
9/16/2002***	34440±763	<22.77	<29.66	<23 96	1196±348	545.5±88 52	<L_c

#50 MANITOU INLET
(control location)

Collection Date	K-40	Co-60	Cs-134	Cs-137	Ra-226*	Ac/Th-228*	Others
6/8/2002***	14863±344	<32.22	<20.62	<30 82	4710±317	1749±72.2	<L_c
9/12/2002***	12460±540	<38.21	<36.1	237.8±26.6	2726±437	869.7±106	<L_c

#53 WHITE BEACH

Collection Date	K-40	Co-60	Cs-134	Cs-137	Ra-226*	Ac/Th-228*	Others
6/8/2002***	6984±316 6	<12.36	<11.44	<9.89	484.4±176.7	81.64±31.13	<L_c
9/12/2002***	8566.5±297	<21.41	<14.41	<16.55	473.5±153	144.2±53.8	<L_c

#84 COLD SPRING
(control location)

Collection Date	K-40	Co-60	Cs-134	Cs-137	Ra-226*	Ac/Th-228*	Others
6/8/2002***	34450±698.7	<22.53	<16.63	<19.77	968 6±397.8	481.6±69	<L_c
9/12/2002***	34440±763 3	<20.78	<25.43	<19.34	1292±322.9	559 2±73.98	<L_c

* Indicates naturally occurring
** "Less than" values expressed as Critical Level (L_c)
*** Indicates the average of the positive sample results reported for samples with recounts performed.

TABLE B-14

CONCENTRATIONS OF GAMMA EMITTERS IN BROAD LEAF VEGETATION*** - 2002

(pCi/Kg, wet ± 1 sigma)

#23 Roseton**

April

Radionuclide	Ragweed	Peppermint	Common Mullein
Be-7*	593 6±29.49	390±20 26	497 4±40 29
K-40*	6372±107.1	4887±73 31	4147±120
Mn-54	<3 26	<2 7	<4 87
Co-58	<3 53	<2.82	<4 35
Fe-59	<11 33	<7.26	<14 36
Co-60	<4 33	<2 81	<5 21
Zn-65	<9 33	<3 95	<12 11
Zr-95	<5 87	<4 76	<9 5
Nb-95	<3 99	<2.94	<5 28
Ru-103	<3 38	<2 82	<4 72
Ru-106	<30 18	<25 99	<44 31
I-131	<5 53	<4 41	<8 89
Cs-134	<3 48	<1 86	<5 3
Cs-137	<2 93	<2 49	<4 55
Ba/La-140	<5 42	<3 19	<5 46
Ce-141	<5 16	<4 11	<4 23
Ce-144	<18 97	<15 52	<26 18
Ra-226*	200 5±47.75	130 5±40 84	491±65 6
Ac/Th-228*	25.24±10 19	44 03±7.98	<16 16

May

Radionuclide	Common Mullein	Ragweed	Burdock
Be-7*	1310±61 48	404 6±39 24	1329±56 3
K-40*	6111±171 3	7480±165 8	8570±186 1
Mn-54	<6 02	<5 97	<6 2
Co-58	<6.26	<5 32	<6 17
Fe-59	<17 65	<16 81	<17.06
Co-60	<6 31	<5 75	<6 41
Zn-65	<18 14	<14 61	<14 86
Zr-95	<10 38	<9 2	<9 89
Nb-95	<5 9	<5 24	<6 66
Ru-103	<6 35	<5 23	<5 86
Ru-106	<72 03	<54 72	<52 6
I-131	<7.21	<6 16	<6 98
Cs-134	<7	<5 73	<6 42
Cs-137	<6 88	<5 26	<5 39
Ba/La-140	<8 84	<5 13	<6 01
Ce-141	<8 29	<7.12	<4.67
Ce-144	<36 22	<29 61	<29 83
Ra-226*	352±102	138 4±78 57	365 3±80 05
Ac/Th-228*	39 72±16 13	<22 27	38 6±19 16

June

Radionuclide	Common Mullein	Ragweed	Clover
Be-7*	1643±95 25	277 9±58 12	139 5±38.31
K-40*	7804±236 1	9543±226 4	4605±124 4
Mn-54	<10 05	<7 96	<6 66
Co-58	<10 39	<8 44	<6 27
Fe-59	<28 58	<20 75	<13 42
Co-60	<12 32	<9 93	<5 91
Zn-65	<28 45	<25 17	<8 03
Zr-95	<19	<14 28	<10 8
Nb-95	<10 23	<8 74	<6 53
Ru-103	<10 58	<8.4	<6 07
Ru-106	<97.82	<86.57	<67.74
I-131	<12.64	<9 95	<7 61
Cs-134	<10.95	<5 56	<4 43
Cs-137	<9 58	<8 15	<6
Ba/La-140	<14.08	<11.64	<7.68
Ce-141	<14.22	<14.26	<8 75
Ce-144	<59 21	<53 67	<37 43
Ra-226*	638 6±159	<243 5	677±95 92
Ac/Th-228*	51 73±29 41	<33 52	117±18 73

July

Radionuclide	Ragweed	Reeds	Common Mullien
Be-7*	1027±53 75	1168±78 95	<67.79
K-40*	10309 7±149	13630±305.3	7801±225 3
Mn-54	<10.7	<9 39	<8 62
Co-58	<10 58	<9 95	<7 87
Fe-59	<25 82	<29 97	<24 1
Co-60	<10.26	<10 96	<9 01
Zn-65	<24.37	<27 12	<21 67
Zr-95	<16.86	<17 39	<16 41
Nb-95	<11.48	<9 35	<8 12
Ru-103	<8 99	<9 78	<9 29
Ru-106	<102 3	<106	<92 47
I-131	<18 03	<10 2	<10 23
Cs-134	<11.88	<10 86	<10 99
Cs-137	<8 49	<10 22	<8 73
Ba/La-140	<13 59	<11.19	<10 57
Ce-141	<12.56	<11.7	<11 78
Ce-144	<51.22	<48 09	<49 51
Ra-226*	870 5±158 9	474 1±137 6	444.7±116 8
Ac/Th-228*	375 9±42 55	77.47±30 29	<32 59

* Indicates naturally occurring
** Indicates control location.
*** "Less than" values expressed as Critical Level (L_c)

TABLE B-14

CONCENTRATIONS OF GAMMA EMITTERS IN BROAD LEAF VEGETATION*** - 2002

(pCi/Kg, wet ± 1 sigma)

#23 Roseton (continued)**

August

Radionuclide	Ragweed	Clover	Loose Strife
Be-7*	963 9±78 71	861.6±80.09	804 1±60 51
K-40*	11270±313 3	11250±304 6	7391±199 2
Mn-54	<10 72	<10 85	<7 21
Co-58	<11 48	<11 52	<6 51
Fe-59	<33 13	<33 85	<18 38
Co-60	<12 4	<11.26	<7 95
Zn-65	<27.45	<30 29	<17.71
Zr-95	<18 89	<18 74	<11 84
Nb-95	<10 54	<10 36	<7.18
Ru-103	<9 25	<11 37	<6 93
Ru-106	<96 12	<117.5	<70 93
I-131	<12 11	<11 68	<8 7
Cs-134	<10 97	<6 91	<4 98
Cs-137	<8 81	<12 34	<7 25
Ba/La-140	<15 21	<13 18	<8 83
Ce-141	<12	<14 24	<10.3
Ce-144	<48 8	<55 06	<44 69
Ra-226*	640 1±143 1	705 6±155 5	574 3±112.7
Ac/Th-228*	<41 31	<41 47	<26 96

September

Radionuclide	Ragweed	Golden Rod	Catalpa
Be-7*	1105±68 02	1417±83 4	483 8±45 13
K-40*	8371±219.1	10470±260	5490±132 8
Mn-54	<8 15	<9 55	<6 06
Co-58	<8 87	<10.31	<5 63
Fe-59	<23 98	<27.84	<15 87
Co-60	<8.31	<11 27	<6 47
Zn-65	<20 97	<28 51	<13 26
Zr-95	<15 68	<17.17	<10 04
Nb-95	<8.64	<10 25	<6 08
Ru-103	<7.62	<10 04	<5 7
Ru-106	<80 04	<98 78	<65 53
I-131	<10 38	<12 6	<8 37
Cs-134	<7 9	<7 17	<4 39
Cs-137	<7 4	<9 01	<6 15
Ba/La-140	<10 64	<14 94	<7 96
Ce-141	<9 9	<13 86	<9 05
Ce-144	<40 1	<55 22	<39 11
Ra-226*	898 9±123 5	689 3±145 1	628 6±106 1
Ac/Th-228*	<29 38	82 95±27 66	84 71±16 4

October

Radionuclide	Alum Root	Common Mullien	Golden Rod
Be-7*	614 5±48 43	1270±109	2348 67±52 56
K-40*	6954±176 9	7699±302 7	8910±131.31
Mn-54	<5 76	<12.89	<6 92
Co-58	<6 46	<11 6	<7 32
Fe-59	<18.03	<38.67	<20 6
Co-60	<7.44	<14 18	<7 04
Zn-65	<17.91	<34 98	<18 16
Zr-95	<11.22	<22 71	<12 9
Nb-95	<5 97	<14 15	<7 98
Ru-103	<5 42	<11.57	<7 34
Ru-106	<69 39	<128 9	<73 89
I-131	<6 84	<18 95	<14 95
Cs-134	<6 01	<12 91	<4 9
Cs-137	<6 75	<11.13	<6 78
Ba/La-140	<7.89	<16 96	<11 78
Ce-141	<8 18	<15 28	<12 07
Ce-144	<33 71	<60 88	<44 06
Ra-226*	154 9±88 18	861 8±164 5	610 73±73 15
Ac/Th-228*	26 43±15 62	93.94±41 58	84 46±19.71

* Indicates naturally occurring.
** Indicates control location.
*** "Less than" values expressed as Critical Level (L_c)

TABLE B-14

CONCENTRATIONS OF GAMMA EMITTERS IN BROAD LEAF VEGETATION*** - 2002
(pCi/Kg, wet ± 1 sigma)

#94 IPEC Training Center

April

Radionuclide	Alum Root	Ragweed	Common Mullein
Be-7*	626 8±47 21	942 2±38 31	923 3±55 07
K-40*	7145±167 8	7628±135 2	5609±171.1
Mn-54	<6 11	<3 84	<6 13
Co-58	<5 73	<3 88	<7.05
Fe-59	<18 58	<13 31	<22.68
Co-60	<6 41	<4 43	<5 95
Zn-65	<14 44	<11 65	<15.68
Zr-95	<9 64	<7.3	<10 48
Nb-95	<6 51	<4 37	<7.27
Ru-103	<5 62	<3 87	<6 61
Ru-106	<61 86	<38 98	<56.42
I-131	<9 75	<5 88	<9 94
Cs-134	<6 17	<2 58	<6 08
Cs-137	<5 92	<4 09	<5 94
Ba/La-140	<7.72	<5 03	<11 3
Ce-141	<8 66	<5 15	<8 04
Ce-144	<31 53	<19 97	<30.34
Ra-226*	318 4±75 59	276 1±62 64	372 9±95 07
Ac/Th-228*	<22 72	28 03±10 55	52 68±17.99

May

Radionuclide	Common Mullein	Ragweed	Burdock
Be-7*	923 8±55 04	527±30 75	1369±66
K-40*	6523±181 3	6461±124 5	8825±199 7
Mn-54	<6 91	<3 92	<7.42
Co-58	<6 46	<3 57	<6.99
Fe-59	<19 26	<12 22	<21.12
Co-60	<8 55	<4 11	<8.37
Zn-65	<18 05	<10.47	<20 47
Zr-95	<10 29	<6.5	<12.91
Nb-95	<6 69	<4.3	<7.47
Ru-103	<6 33	<3 59	<6 9
Ru-106	<73 37	<35.56	<67 4
I-131	<8 5	<4 27	<8.31
Cs-134	<8 95	<4 05	<4 88
Cs-137	<6 91	<3 59	<6.75
Ba/La-140	<9 03	<3 85	<9.18
Ce-141	<9 65	<4 53	<9.91
Ce-144	<41 81	<19 32	<42 21
Ra-226*	371 2±95 32	375 9±54 04	449 4±101 9
Ac/Th-228*	<25 56	17.9±9 36	55 51±24 26

June

Radionuclide	Ragweed	Reeds	Common Mullein
Be-7*	1643±95 25	829 6±42 08	311.9±33 41
K-40*	7804±236 1	7969±158 5	4954±130 6
Mn-54	<10 05	<4 57	<4 64
Co-58	<10 39	<4 79	<4 61
Fe-59	<28 58	<15 62	<14 17
Co-60	<12 32	<4 93	<6 08
Zn-65	<28 45	<14 52	<10 46
Zr-95	<19	<8 87	<8 24
Nb-95	<10 23	<4 74	<4 45
Ru-103	<10 58	<4 58	<4 44
Ru-106	<97.82	<47.82	<54 13
I-131	<12 64	<5 02	<5 41
Cs-134	<10 95	<4 83	<3 37
Cs-137	<9 58	<4 85	<5 19
Ba/La-140	<14 08	<6 65	<6 36
Ce-141	<14 22	<6 04	<6 67
Ce-144	<59 21	<25 23	<26 38
Ra-226*	638 6±159	263 4±76 26	188 6±67 69
Ac/Th-228*	51 73±29 41	20.46±13 07	<17 13

July

Radionuclide	Ragweed	Reeds	Grape Leaves
Be-7*	509 7±53 28	<86 6	236 6±49 54
K-40*	10910±235	8808±236 9	5844±148 1
Mn-54	<8 73	<9 82	<6 55
Co-58	<8 36	<9 91	<7.31
Fe-59	<23 26	<30 42	<19 54
Co-60	<8 58	<12	<7.18
Zn-65	<21.12	<27.75	<9 31
Zr-95	<14.66	<18 11	<13 12
Nb-95	<8 48	<11 66	<7.96
Ru-103	<7 42	<10 28	<7 25
Ru-106	<74.57	<96 29	<75 62
I-131	<12.42	<15 3	<12 36
Cs-134	<8 54	<10 36	<4 91
Cs-137	<7 82	<9 14	<7 26
Ba/La-140	<11.73	<14 67	<10 43
Ce-141	<6 01	<13 52	<11 54
Ce-144	<38.01	<52 33	<44 65
Ra-226*	696 7±99 37	670 6±139 9	552±109 9
Ac/Th-228*	<28.98	110 6±29 29	118 8±20 84

* Indicates naturally occurring.
** Indicates control location.
*** "Less than" values expressed as Critical Level (L_c).

TABLE B-14

CONCENTRATIONS OF GAMMA EMITTERS IN BROAD LEAF VEGETATION*** - 2002

(pCi/Kg, wet ± 1 sigma)

#94 IPEC Training Center (continued)

August

Radionuclide	Ragweed	Burdock	Common Mullen
Be-7*	850 5±59 24	489 8±53.31	431 8±19 32
K-40*	9705±228.1	8379±195 8	6221.6±73.7
Mn-54	<8 73	<7.06	<3 59
Co-58	<6 99	<7.1	<3 65
Fe-59	<24 2	<22 25	<10 21
Co-60	<9 58	<8 41	<3 87
Zn-65	<18 48	<18 53	<8 72
Zr-95	<13	<12 8	<5 97
Nb-95	<7 6	<7 5	<3 68
Ru-103	<6 97	<6.39	<3 49
Ru-106	<85 82	<67.47	<39 74
I-131	<8 41	<7.86	<4 65
Cs-134	<8 77	<7.61	<2 46
Cs-137	<7 63	<6.26	14.07±11.92
Ba/La-140	<10 26	<8.92	<4 02
Ce-141	<10 51	<9 24	<5 37
Ce-144	<42 8	<40 23	<22 97
Ra-226*	435 6±122 3	467.7±110 5	311.7±37 6
Ac/Th-228*	<29 11	<27 41	48.78±8 57

September

Radionuclide	Ragweed	Burdock	Common Mullen
Be-7*	1832±84 02	781.1±48 8	828 2±47.12
K-40*	9945±242 6	7117±171 3	7074±144 9
Mn-54	<9 04	<6 36	<6 03
Co-58	<8 27	<6 67	<5 55
Fe-59	<21 72	<18 28	<16 19
Co-60	<9 6	<7 89	<6 16
Zn-65	<20 99	<17 33	<8 59
Zr-95	<14 56	<11 07	<10.7
Nb-95	<9.28	<6 5	<6 18
Ru-103	<7.93	<6 28	<5 88
Ru-106	<82 61	<61 74	<65 59
I-131	<11 12	<7 8	<7 85
Cs-134	<9	<6 83	<4 41
Cs-137	<7.78	<5 64	<6
Ba/La-140	<12 15	<8 64	<6 87
Ce-141	<10 69	<9 1	<9 44
Ce-144	<44 63	<36 46	<38 92
Ra-226*	928 5±125 8	387 5±86 27	556 2±94 9
Ac/Th-228*	73 28±23 54	36 91±19 04	137 7±18 56

October

Radionuclide	Common Mullein	Bittersweet	Burdock
Be-7*	1566±97 07	288 2±46 44	1370±67.01
K-40*	8415±274 7	3924±145 6	7058±180 6
Mn-54	<10 44	<7.28	<6 88
Co-58	<10 25	<7.22	<7 28
Fe-59	<30 45	<20 83	<19 08
Co-60	<13 58	<6 49	<8 03
Zn-65	<26 36	<18 75	<19 21
Zr-95	<19 25	<13 22	<11 36
Nb-95	<11 2	<7.61	<7 08
Ru-103	<9 7	<6 5	<7 47
Ru-106	<105 6	<71 82	<71.52
I-131	<15 8	<8 91	<9 64
Cs-134	<11 08	<4 64	<7.37
Cs-137	<10 21	<7.07	<6 68
Ba/La-140	<14	<12 65	<11.28
Ce-141	<12 46	<9 33	<10 03
Ce-144	<50 55	<35 52	<39 76
Ra-226*	304 2±132 9	172 3±100 7	521 9±109 1
Ac/Th-228*	69 31±31.53	107.4±21 27	48 32±21 01

* Indicates naturally occurring.
** Indicates control location.
*** "Less than" values expressed as Critical Level (L_c).

TABLE B-14

CONCENTRATIONS OF GAMMA EMITTERS IN BROAD LEAF VEGETATION*** - 2002

(pCi/Kg, wet ± 1 sigma)

#95 Meteorological Tower

April

Radionuclide	Thistle	Ragweed	Common Mullein
Be-7*	818.3±48 5	354 6±31 76	613 7±44 43
K-40*	6728±156 9	8884±155 5	5235±140 4
Mn-54	<4.74	<5 17	<5 26
Co-58	<4.83	<4 13	<5 08
Fe-59	<16 9	<17.44	<15 86
Co-60	<4.89	<5 28	<6 51
Zn-65	<15 12	<11 8	<13 18
Zr-95	<9.59	<8 32	<9 88
Nb-95	<5.75	<4 68	<5 95
Ru-103	<5.21	<4 31	<5 59
Ru-106	<58 39	<45 06	<51 41
I-131	<8.36	<7.49	<9 46
Cs-134	<6	<4 61	<5 17
Cs-137	<5 48	<4 11	<5 65
Ba/La-140	<9.19	<6 87	<8 72
Ce-141	<7.56	<6 49	<7.19
Ce-144	<29 41	<24 43	<27.18
Ra-226*	193 7±78 86	257.3±61 63	566 8±69 92
Ac/Th-228*	47 82±16 47	27 27±12 9	<19 04

May

Radionuclide	Reeds	Ragweed	Bittersweet
Be-7*	<61.52	575 3±42 8	202 9±36 99
K-40*	8030±194	7355±177.5	4996±148.9
Mn-54	<7 22	<5 22	<6 14
Co-58	<7.31	<5 41	<5 91
Fe-59	<22.13	<18 49	<17.42
Co-60	<8 83	<6 99	<6 42
Zn-65	<20.33	<16	<15 13
Zr-95	<13 04	<8 88	<11 04
Nb-95	<7 59	<5 36	<5 88
Ru-103	<7 28	<4 78	<5 93
Ru-106	<69.19	<49 11	<65 51
I-131	<7.94	<5 27	<5 94
Cs-134	<5 14	<5 47	<6 36
Cs-137	<6 72	<5 19	<5 96
Ba/La-140	<11 03	<7.94	<7.37
Ce-141	<9 53	<6 13	<7 53
Ce-144	<41 36	<24 91	<31.9
Ra-226*	460 5±106 1	266 4±75 08	235 1±84 68
Ac/Th-228*	67 63±20 06	52 8±18 3	56.35±19 76

June

Radionuclide	Ragweed	Grape Leaves	Bittersweet
Be-7*	1135±46 03	681.2±51 63	315 8±45 32
K-40*	9599±156 9	5091±164 8	4848±155 4
Mn-54	<5 61	<6 23	<7.12
Co-58	<5 1	<6 34	<6 53
Fe-59	<14 33	<16 22	<18 17
Co-60	<5.79	<7 11	<7 71
Zn-65	<8.35	<17.79	<15 95
Zr-95	<10 05	<13 05	<11 34
Nb-95	<5.41	<5 88	<7.31
Ru-103	<4 9	<6 22	<6 43
Ru-106	<57.96	<72 61	<68 36
I-131	<6.53	<6 88	<7 03
Cs-134	<3 87	<7.49	<6 57
Cs-137	<5.35	<7.03	<6 25
Ba/La-140	<5 92	<8 98	<9 23
Ce-141	<7 94	<9	<8 43
Ce-144	<34 01	<35 35	<34 22
Ra-226*	386 9±90.25	227.9±97 28	666±97.84
Ac/Th-228*	80 15±16.34	53 4±21 17	35 3±17.77

July

Radionuclide	Ragweed	Grape Leaves	Bittersweet
Be-7*	357.4±60 13	325 4±50 03	236 8±46 81
K-40*	9357±262 6	4913±161.5	4861±157 4
Mn-54	<8 85	<6 77	<6 87
Co-58	<9 56	<7.18	<6 28
Fe-59	<26 43	<20 77	<20 99
Co-60	<10.19	<7.04	<7 29
Zn-65	<22.45	<18 25	<17 63
Zr-95	<16 42	<11 8	<12 35
Nb-95	<9 25	<7 44	<7.42
Ru-103	<8 55	<7 29	<7.12
Ru-106	<74 8	<76 84	<73 8
I-131	<13.76	<10 78	<10 79
Cs-134	<8 87	<7.21	<7 84
Cs-137	<8 38	<6 69	<5 87
Ba/La-140	<12 52	<9 49	<10 41
Ce-141	<9 99	<9 35	<9 26
Ce-144	<40 57	<37.13	<39 04
Ra-226*	260 4±109 7	394 4±87.46	371 3±90 39
Ac/Th-228*	<35 4	<24 43	<25 42

* Indicates naturally occurring.
** Indicates control location.
*** "Less than" values expressed as Critical Level (L_c).

TABLE B-14

CONCENTRATIONS OF GAMMA EMITTERS IN BROAD LEAF VEGETATION*** - 2002

(pCi/Kg, wet ± 1 sigma)

#95 Meteorological Tower (continued)

August

Radionuclide	Ragweed	Grape Leaves	Common Mullen
Be-7*	728 9±66 26	416 4±46 01	630 6±65.67
K-40*	9850±242 5	5829±140 6	7735±232 3
Mn-54	<9 67	<6 61	<8.44
Co-58	<9 65	<6 29	<8.95
Fe-59	<25 19	<17.37	<27.33
Co-60	<10 72	<6 8	<10 92
Zn-65	<25 91	<8 96	<24 61
Zr-95	<16 32	<10 99	<16 23
Nb-95	<9 94	<6 31	<8.43
Ru-103	<9 03	<6 04	<8.57
Ru-106	<91.14	<68 12	<101 9
I-131	<10 17	<7 46	<9.78
Cs-134	<9 81	<4 76	<10 69
Cs-137	<8 2	<6 46	<8.54
Ba/La-140	<10 94	<8 78	<9.24
Ce-141	<12 61	<9 43	<11 03
Ce-144	<50 82	<40 62	<47 09
Ra-226*	896 3±144 9	800 4±116 1	320 8±141.8
Ac/Th-228*	<33 21	91±18 42	<30 24

September

Radionuclide	Ragweed	Grape Leaves	Common Mullen
Be-7*	1088±80 34	580 1±65 62	1137±85 35
K-40*	7172±237.1	6335±205 6	8435±262 8
Mn-54	<9 51	<7.63	<12 25
Co-58	<9 37	<8 07	<9.72
Fe-59	<24 05	<23 16	<33 81
Co-60	<10 03	<8 61	<10 81
Zn-65	<23 46	<22 54	<27 46
Zr-95	<16 71	<15 74	<17 93
Nb-95	<10 36	<8 81	<11 1
Ru-103	<7.73	<8 03	<10 28
Ru-106	<91 65	<89 28	<118 3
I-131	<11 52	<9 45	<13 44
Cs-134	<10 26	<8 95	<12.73
Cs-137	<8 06	<8 65	<11 94
Ba/La-140	<11 48	<9 83	<15 91
Ce-141	<9 97	<10 93	<15 36
Ce-144	<42 2	<43 77	<60 3
Ra-226*	390 8±115 5	387 7±115 5	466 4±156
Ac/Th-228*	53±30 51	88 39±27 83	53 43±30.24

October

Radionuclide	Bittersweet	Grape Leaves	Comon Mullen
Be-7*	676 4±58 49	1030±48 71	1495±73 79
K-40*	5835±168 2	4277±107.7	7262±205 6
Mn-54	<7.49	<4 99	<7.24
Co-58	<7 09	<5 31	<7.74
Fe-59	<20 97	<14 27	<29 04
Co-60	<7.7	<5 53	<9.53
Zn-65	<19 09	<6 8	<18 86
Zr-95	<13 84	<9 26	<14 11
Nb-95	<8 16	<5 75	<9 5
Ru-103	<7 34	<5 41	<7.71
Ru-106	<65 2	<55 44	<85 39
I-131	<9 58	<7 88	<11.17
Cs-134	<7 19	<3 71	<7.81
Cs-137	<6 94	<5 32	<6.31
Ba/La-140	<9 39	<7 33	<12 75
Ce-141	<10.5	<8 03	<6.36
Ce-144	<41 64	<33 84	<40 96
Ra-226*	473 7±116.1	418 6±89 53	713 2±120 1
Ac/Th-228*	129 1±24 04	84 39±15 47	<27 32

* Indicates naturally occurring
** Indicates control location.
*** "Less than" values expressed as Critical Level (L_c)

TABLE B-15

CONCENTRATIONS OF GAMMA EMITTERS IN FISH AND INVERTEBRATE SAMPLES - 2002

(pCi/Kg, wet ± 1 sigma)

#23 ROSETON
(control)

Radionuclide	White Perch 6/12/02	Eel 8/19/02
Be-7*	<83 17	<243.9
K-40*	4541±220 1	6855±276 9
Mn-54	<11.8	<16 93
Co-58	<10 12	<23 06
Fe-59	<32 96	<92 51
Co-60	<12 69	<17.68
Zn-65	<23 87	<43 72
Zr-95	<20 01	<47.87
Nb-95	<11.19	<41 94
Ru-103	<11 93	<40 67
Ru-106	<103 4	<194 5
I-131	<17.7	<1062
Cs-134	<8 49	<16 46
Cs-137	<9 35	<16 97
Ba/La-140	<15 14	<270 3
Ce-141	<14 07	<58 56
Ce-144	<54 32	<100 9
Ra-226*	822.7±156 1	1425±277.8
Ac/Th-228*	<36.74	115.9±48 3

#25 DOWNSTREAM (HUDSON RIVER)
(indicator)

Radionuclide	White Perch 6/13/02	Blue Crab 8/21/02	White Perch 9/16/02
Be-7*	<91 04	<228 6	<125 7
K-40*	4188±204 8	4811±290 4	4892±239 9
Mn-54	<9 01	<16 22	<12 49
Co-58	<11 8	<24 39	<10 75
Fe-59	<29 13	<97 37	<44 85
Co-60	<11.74	<13 93	<11 28
Zn-65	<29	<42 39	<29 63
Zr-95	<18 95	<42 17	<27 61
Nb-95	<11 01	<37 07	<17 61
Ru-103	<11.77	<30 68	<15 27
Ru-106	<103.3	<202 5	<135 9
I-131	<16 95	<952 3	<82 41
Cs-134	<10 07	<17 72	<12 88
Cs-137	<10 73	<17 05	<11.74
Ba/La-140	<20 63	<202	<40 7
Ce-141	<15 21	<50 69	<21 97
Ce-144	<55 55	<91 72	<62 54
Ra-226*	689.9±161 2	463 2±242	864.1±182.1
Ac/Th-228*	<40 24	<61 7	<42 28

* Indicates naturally occurring

TABLE B-16

ANNUAL SUMMARY, NON-RETS SAMPLE RESULTS 2002

SAMPLE MEDIUM (UNITS)	NUCLIDE DETECTED	LLD	INDICATOR LOCATIONS AVG. OF POSITIVE SAMPLES	HIGHEST POSITIVE SAMPLE	LOWEST POSTITIVE SAMPLE	NO. OF POSITIVE SAMPLES	TOTAL NO. OF SAMPLES	CONTROL LOCATIONS AVG. OF POSITIVE SAMPLES	HIGHEST POSITIVE SAMPLE	LOWEST POSITIVE SAMPLE	NO. OF POSITIVE SAMPLES	TOTAL NO. OF SAMPLES	HISTORICAL AVG VALUE* INDICATOR	CONTROL
AQUATIC VEGETATION (pCi/kg - WET)	Co-60	NONE	< L_c	< L_c	< L_c	0	4	< L_c	< L_c	< L_c	0	9	19 8	< L_c
	I-131	100	7 1	7 1	7.1	1	4	17 6	17 6	17 6	1	9	114	33 1
	Cs-134	100	< L_c	< L_c	< L_c	0	4	< L_c	< L_c	< L_c	0	9	< L_c	< L_c
	Cs-137	100	24 2	33	9 53	4	4	6 35	7 34	5 65	3	9	29 2	70 3
BOTTOM SEDIMENT (pCi/kg - DRY)	Co-60	NONE	< L_c	< L_c	< L_c	0	6	< L_c	< L_c	< L_c	0	2	131 2	< L_c
	Cs-134	150	48 3	53 9	42 8	2	6	< L_c	< L_c	< L_c	0	2	50 2	39 7**
	Cs-137	180	493	791	200	6	6	59 3	59 3	59 3	1	2	726	131
SOIL (pCi/kg - DRY)	Co-60	NONE	< L_c	< L_c	< L_c	0	2	< L_c	< L_c	< L_c	0	1	< L_c	< L_c
	Cs-134	150	< L_c	< L_c	< L_c	0	2	< L_c	< L_c	< L_c	0	1	< L_c	< L_c
	Cs-137	180	< L_c	< L_c	< L_c	0	2	< L_c	< L_c	< L_c	0	1	141	75.7
PRECIPITATION (pCi/L)	H-3	2000	< LLD	< LLD	< LLD	0	4	< LLD	< LLD	< LLD	0	4	254	341
	Co-60	15	< L_c	< L_c	< L_c	0	4	< L_c	< L_c	< L_c	0	4	< L_c	< L_c
	Cs-134	15	< L_c	< L_c	< L_c	0	4	< L_c	< L_c	< L_c	0	4	< L_c	< L_c
	Cs-137	18	< L_c	< L_c	< L_c	0	4	< L_c	< L_c	< L_c	0	4	< L_c	< L_c
SPECIAL WATER (pCi/L)	H-3	2000	< LLD	< LLD	< LLD	0	25	NA	NA	NA	NA	NA	167	NA
	Co-60	15	< L_c	< L_c	< L_c	0	33	NA	NA	NA	NA	NA	< L_c	< L_c
	Cs-134	15	< L_c	< L_c	< L_c	0	33	NA	NA	NA	NA	NA	< L_c	< L_c
	Cs-137	18	< L_c	< L_c	< L_c	0	33	NA	NA	NA	NA	NA	< L_c	< L_c

* Average of positive values for 1991 - 2001
** Detected at control location, 1992, 1999, AND 2001.

NA - Data not available
Lc - Critical Level, which is less than the required Lower Limit of Detection (LLD), unless otherwise noted

TABLE B-17
MILCH ANIMAL CENSUS
2002

THERE ARE NO ANIMALS PRODUCING MILK FOR HUMAN CONSUMPTION WITHIN FIVE MILES OF INDIAN POINT.

TABLE B-18

LAND USE CENSUS

2002

Sector	Mile	Location of Nearest Residence
1 - N	1.14	Ayers Road, Jones Point
2 - NNE	1.95	St. Mary's School, Peekskill
3 - NE	1.21	South Street, Peekskill
4 - ENE	1	South Street, Peekskill
5 - E	0.47	Bleakley Avenue, Buchanan
6 - ESE	0.39	Broadway, Buchanan
7 - SE	0.73	Westchester Avenue, Buchanan
8 - SSE	0.73	Westchester Avenue, Buchanan
9 - S	0.71	Broadway, Verplanck
10 - SSW	0.97	St. Partricks Rectory, Verplanck
11 - SW	1.8	Elm Avenue, Tomkins Cove
12 - WSW	1.36	West Shore Drive South, Tomkins Cove
13 - W	1.21	West Shore Drive North, Tomkins Cove
14 - WNW	1.09	Route 9W, Tomkins Cove
15 - NW	1.04	Route 9W, Tomkins Cove
16 - NNW	0.98	Jones Point

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 in graphical form to facilitate the comparison of 2002 data with historical values. Although other samples were taken and analyzed, values were only tabulated and plotted where positive indications were present.

Averaging only 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. This bias can be seen in Table C-3 and Figure C-3. A comparison between Hudson River average tritium values for 2002 and 1992 would indicate a 28% increase in 2002 for average tritium detected; however, when the maximum tritium values are compared there is only a 4% difference in values.

TABLE C-1

DIRECT RADIATION ANNUAL SUMMARY
1992 to 2002

Average Quarterly Dose (mR/Quarter)			
Year	Inner Ring	Outer Ring	Control Location
1992	13	13	13
1993	14	14	15
1994	14	14	16
1995	15	15	17
1996	14	14	16
1997	15	15	18
1998	14	15	16
1999	15	15	16
2000	14	15	16
2001	15	15	17
2002	**15**	**15**	**14**
Historical Average 1992-2001	14	15	16

FIGURE C-1
DIRECT RADIATION
1992 to 2002

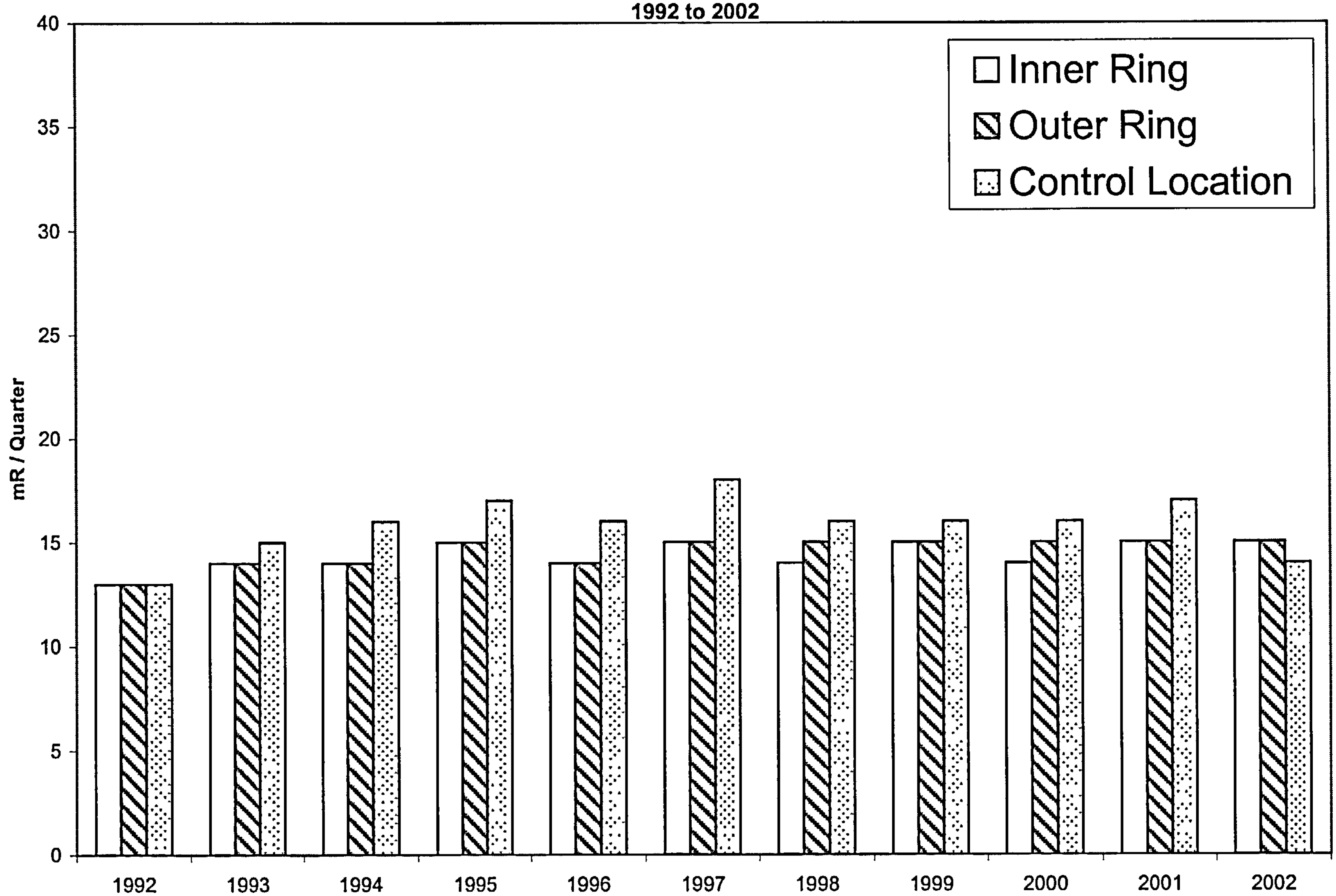


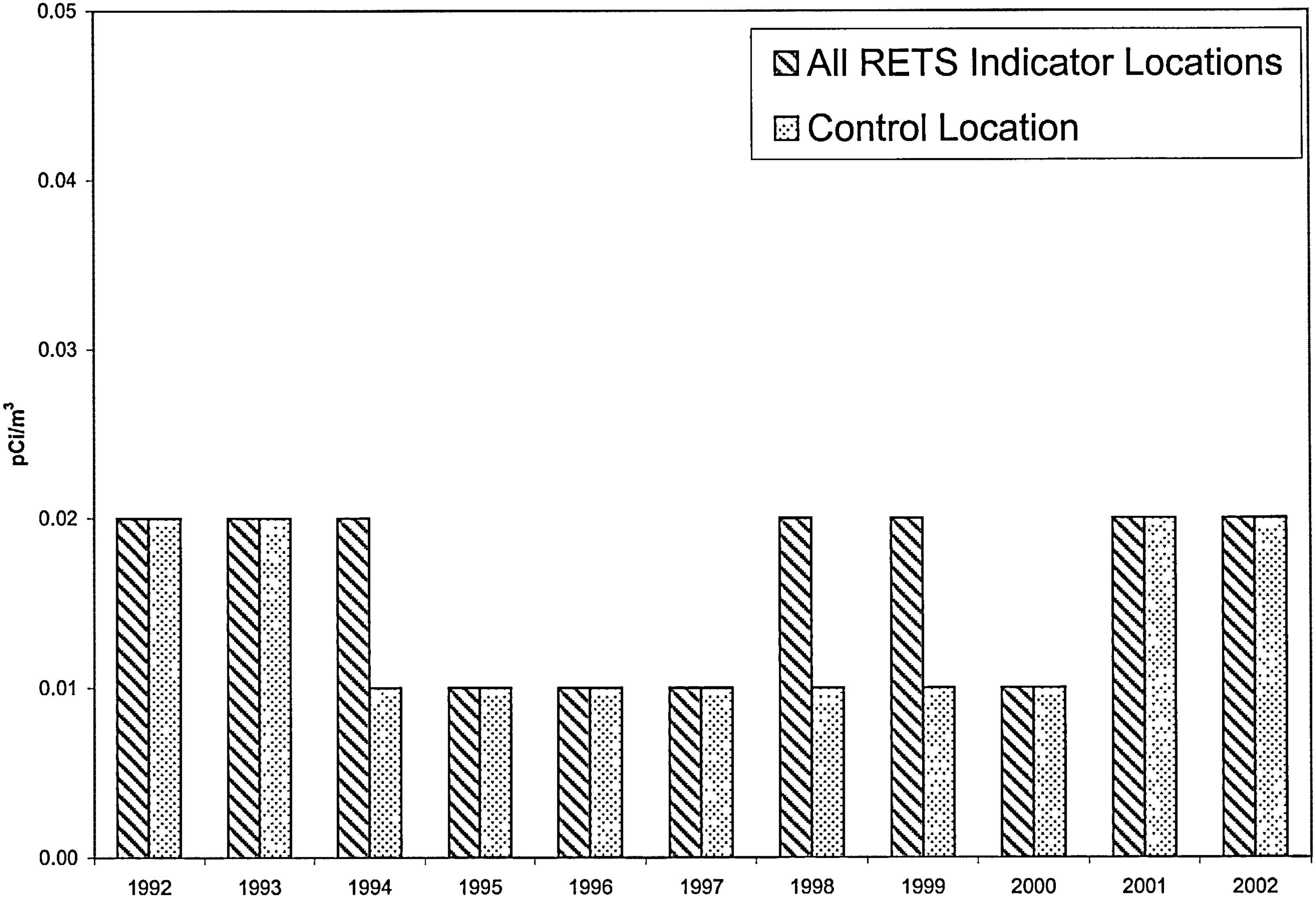
TABLE C-2

RADIONUCLIDES IN AIR
1992 to 2002
(pCi/m^3)

Year	Gross Beta		Cs-137	
	All RETS Indicator Locations	Control Location	All RETS Indicator Locations	Control Location
1992	0.02	0.02	$< L_c$	$< L_c$
1993	0.02	0.02	$< L_c$	$< L_c$
1994	0.02	0.01	$< L_c$	$< L_c$
1995	0.01	0.01	$< L_c$	$< L_c$
1996	0.01	0.01	$< L_c$	$< L_c$
1997	0.01	0.01	$< L_c$	$< L_c$
1998	0.02	0.01	$< L_c$	$< L_c$
1999	0.02	0.01	$< L_c$	$< L_c$
2000	0.01	0.01	$< L_c$	$< L_c$
2001	0.02	0.02	$< L_c$	$< L_c$
2002	**0.02**	**0.02**	$< L_c$	$< L_c$
Historical Average 1992-2001	0.02	0.01	$< L_c$	$< L_c$

Critical Level (L_c) is less than the RETS required LLD.
$<L_c$ indicates no positive values above sample critical level.

FIGURE C-2
RADIONUCLIDES IN AIR - GROSS BETA
1992 to 2002



* Includes RETS and non-RETS indicator locations.

Gross Beta RETS required LLD = 0.01 pCi/m^3

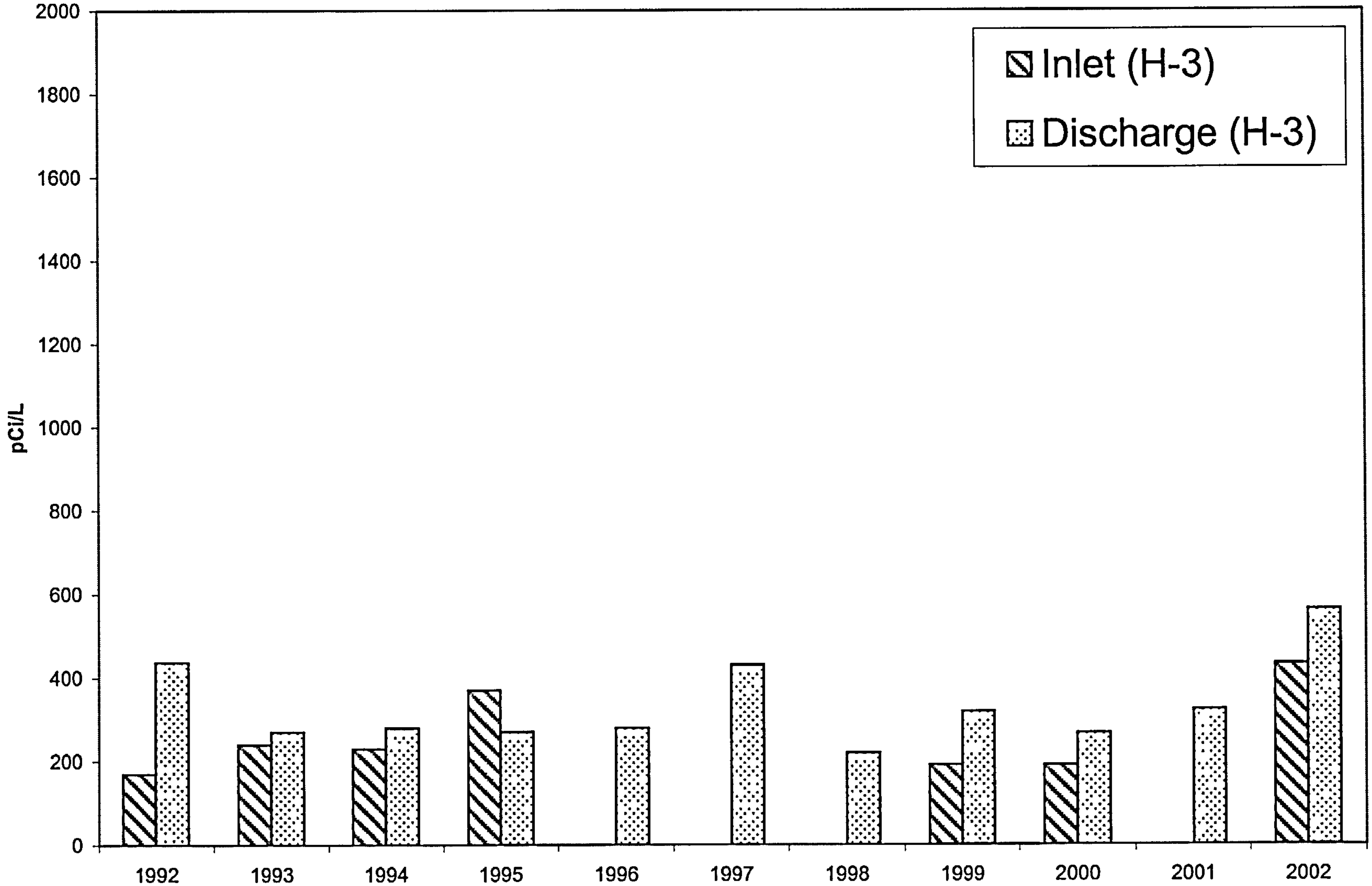
TABLE C-3

RADIONUCLIDES IN HUDSON RIVER WATER
1992 to 2002
(pCi/L)

	Tritium (H-3)		Cs-137	
Year	Inlet	Discharge	Inlet	Discharge
1992	170	437	< LLD	< LLD
1993	240	270	< LLD	< LLD
1994	230	280	< LLD	< LLD
1995	370	270	< LLD	< LLD
1996	< LLD	280	< LLD	< LLD
1997	< LLD	430	< LLD	< LLD
1998	< LLD	220	< LLD	< LLD
1999	191	318	< LLD	< LLD
2000	190	267	< LLD	< LLD
2001	< LLD	323	< LLD	< LLD
2002	**432**	**562**	< LLD	< LLD
Historical Average 1990-2001	232	310	< LLD	< LLD

<LLD is less than the RETS required LLD, unless otherwise noted.

FIGURE C-3
HUDSON RIVER WATER - TRITIUM
1992 to 2002



Tritium RETS required LLD = 3000 pCi/L

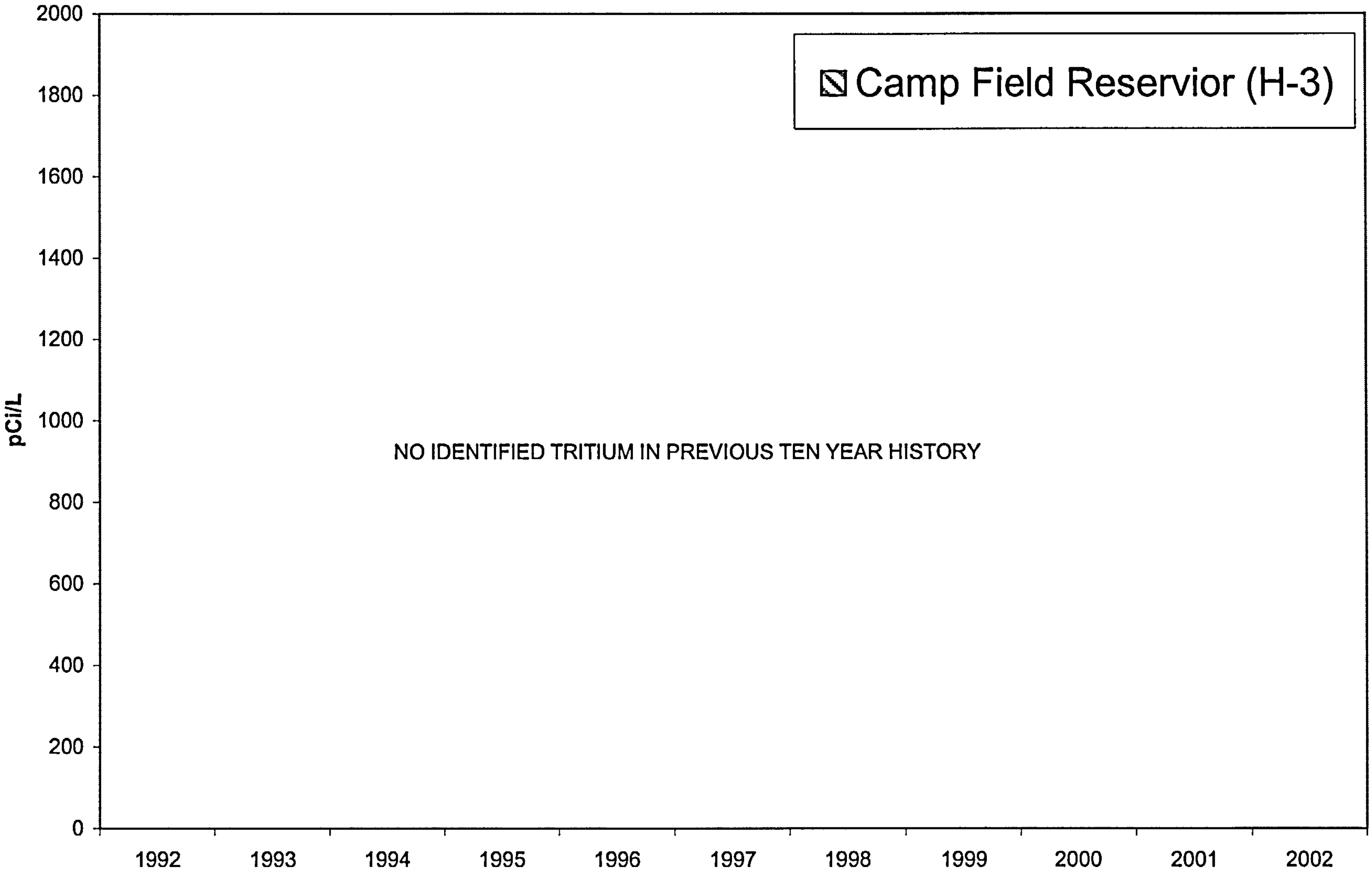
TABLE C-4

RADIONUCLIDES IN DRINKING WATER
1992 to 2002
(pCi/L)

Year	Tritium (H-3)	Cs-137
1992	< LLD	< L_c
1993	< LLD	< L_c
1994	< LLD	< L_c
1995	< LLD	< L_c
1996	< LLD	< L_c
1997	< LLD	< L_c
1998	< LLD	< L_c
1999	< LLD	< L_c
2000	< LLD	< L_c
2001	< LLD	< L_c
2002	< LLD	**< L_c**
Historical Average 1992-2001	< LLD	< L_c

<LLD is less than the RETS required LLD, unless otherwise noted.

FIGURE C-4
DRINKING WATER - TRITIUM
1992 to 2002



Tritium RETS required LLD = 2000 pCi/L

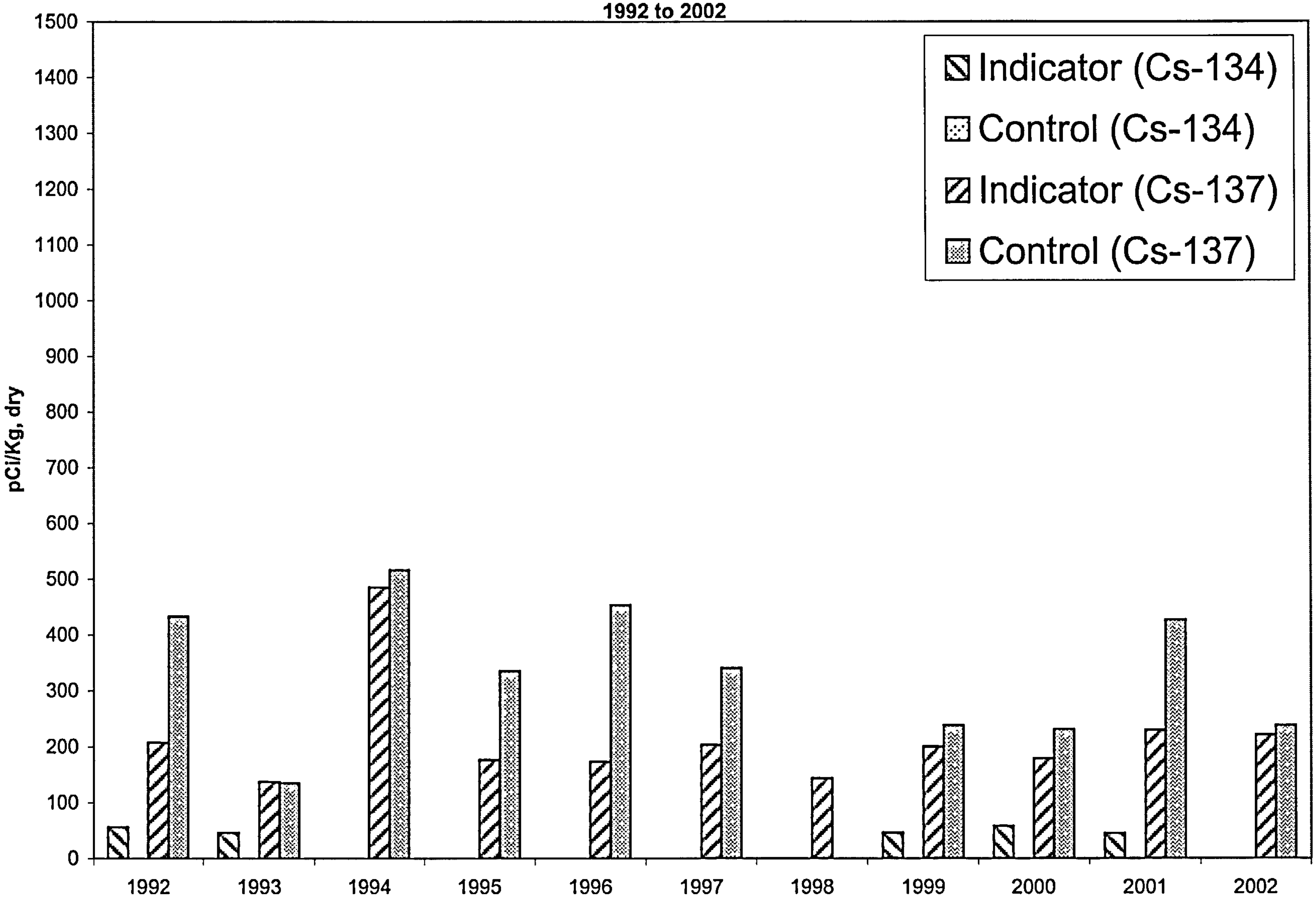
TABLE C-5

RADIONUCLIDES IN SHORELINE SOIL
1992 - 2002
(pCi/Kg, dry)

	Cs-134		Cs-137	
Year	Indicator	Control	Indicator	Control
1992	56	< L_c	207	433
1993	46	< L_c	137	135
1994	< L_c	< L_c	485	516
1995	< L_c	< L_c	176	335
1996	< L_c	< L_c	173	453
1997	< L_c	< L_c	203	340
1998	< L_c	< L_c	143	< L_c
1999	46	< L_c	200	238
2000	58	< L_c	179	231
2001	45	< L_c	230	427
2002	**< L_c**	**< L_c**	**221**	**238**
Historical Average 1992-2001	50	< L_c	214	345

Critical Level (L_c) is less than the RETS required LLD.
<L_c indicates no positive values above sample critical level.

FIGURE C-5
RADIONUCLIDES IN SHORELINE SOIL
1992 to 2002



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

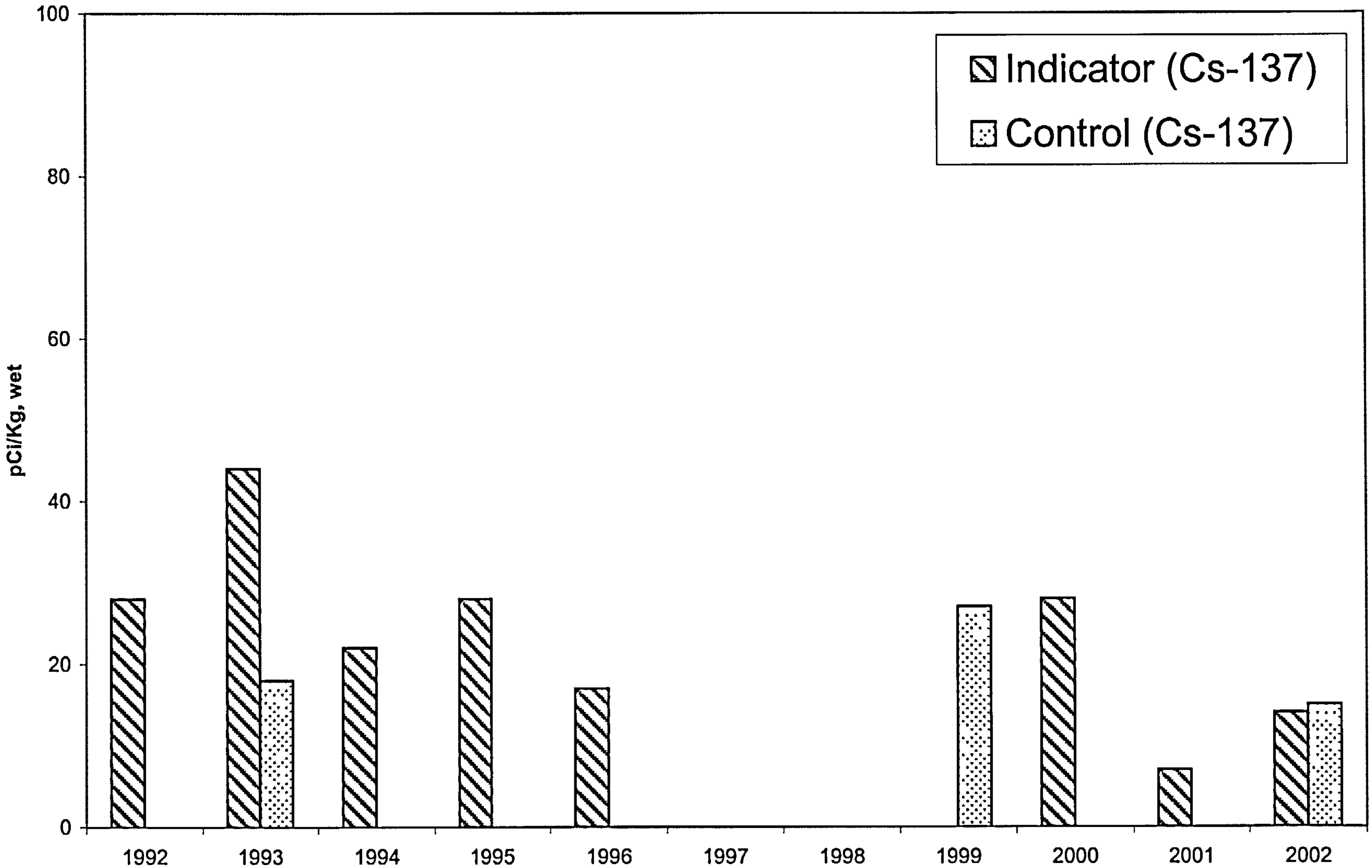
TABLE C-6

RADIONUCLIDES IN BROAD LEAF VEGETATION
1992 to 2002
(pCi/Kg, wet)

	Cs-137	
Year	**Indicator**	**Control**
1992	28	< L_c
1993	44	18
1994	22	< L_c
1995	28	< L_c
1996	17	< L_c
1997	< L_c	< L_c
1998	< L_c	< L_c
1999	< L_c	27
2000	28	< L_c
2001	7	< L_c
2002	**14**	**15**
Historical Average 1992-2001	25	23

Critical Level (L_c) is less than the RETS required LLD.
<L_c indicates no positive values above sample critical level.

FIGURE C-6
BROAD LEAF VEGETATION - Cs-137
1992 to 2002



RETS required LLD = 80 pCi/Kg, wet

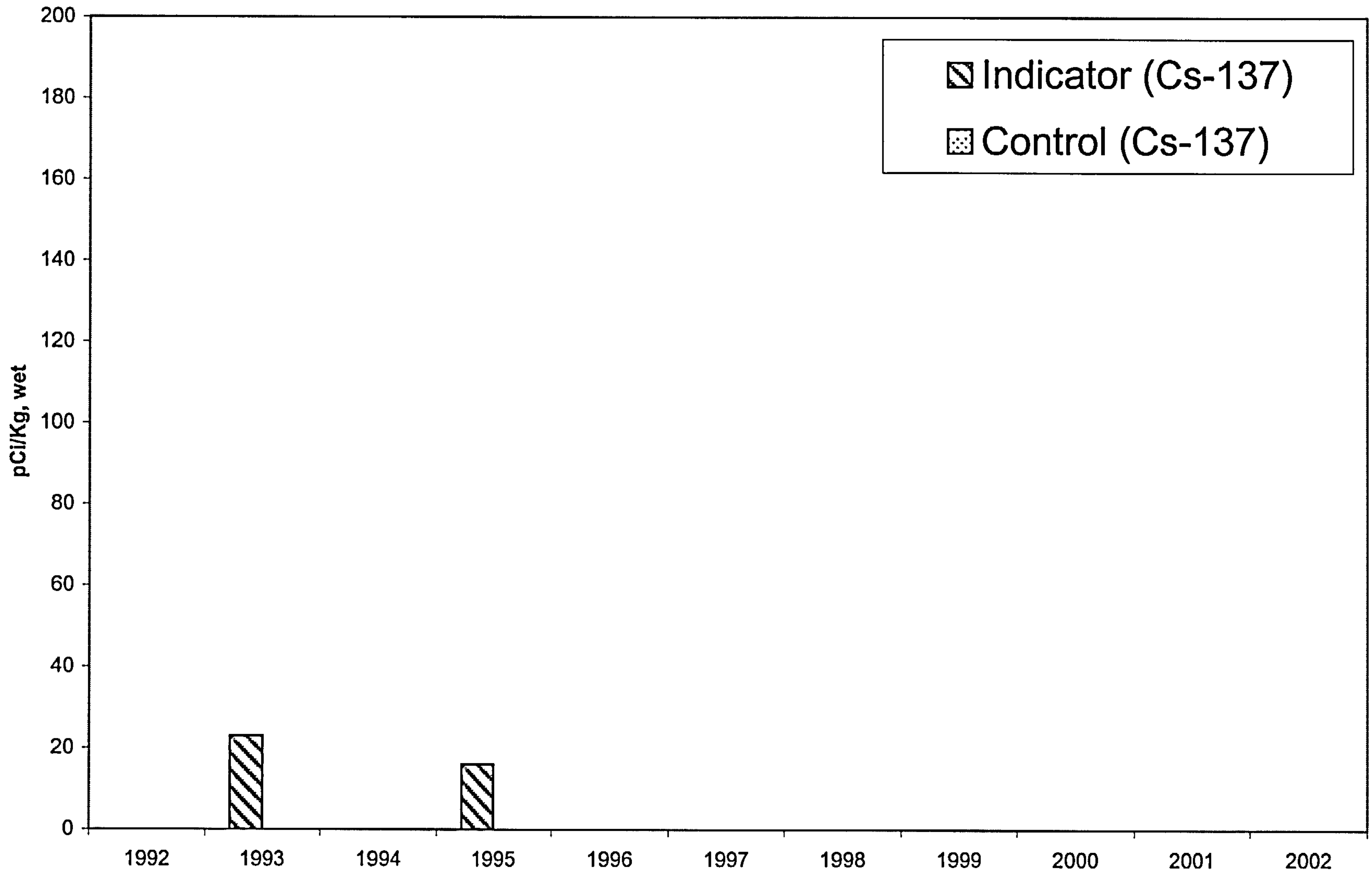
TABLE C-7

RADIONUCLIDES IN FISH AND INVERTEBRATES
1992 to 2002
(pCi/Kg, wet)

	Cs-137	
Year	**Indicator**	**Control**
1992	< L_c	< L_c
1993	23	< L_c
1994	< L_c	< L_c
1995	16	< L_c
1996	< L_c	< L_c
1997	< L_c	< L_c
1998	< L_c	< L_c
1999	< L_c	< L_c
2000	< L_c	< L_c
2001	< L_c	< L_c
2002	**< L_c**	**< L_c**
Historical Average 1992-2001	20	< L_c

Critical Level (L_c) is less than the RETS required LLD.
<L_c indicates no positive values above sample critical level.

FIGURE C-7
FISH AND INVERTEBRATES - Cs-137
1992 to 2002



Cs-137 RETS required LLD = 150 pCi/Kg, wet

APPENDIX D

INTERLABORATORY COMPARISON PROGRAM

APPENDIX D

D.1 PROGRAM DESCRIPTION

Radiological Effluent Technical Specification (RETS) and Radiological Effluent Controls (RECS) require that each licensee participate in an Interlaboratory Comparison Program. The Interlaboratory Comparison Program shall include sample media for which samples are routinely collected and for which comparison samples are commercially available. Participation in an Interlaboratory Comparison Program ensures 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 Technical Specification requirement for an Interlaboratory Comparison Program, the JAF Environmental Laboratory has engaged the services of two independent laboratories to provide quality assurance comparison samples. The two laboratories are Analytics, Incorporated in Atlanta, Georgia and the U.S. Department of Energy's Environmental Measurements Laboratory (EML) in New York City.

Analytics supplies requested sample media as blind sample spikes, which contain certified levels of radioactivity unknown to the analysis laboratory. These samples are prepared and analyzed using standard laboratory procedures. The results are submitted to Analytics, which issues a statistical summary report. The JAFNPP Environmental Laboratory uses predetermined acceptance criteria methodology for evaluating the laboratory's performance for Analytic's sample results.

In addition to the Analytics Program, the JAF Environmental Laboratory participated in the Environmental Measurements Laboratory (EML) Quality Assessment Program (QAP). EML supplies sample media as blind sample spikes to approximately 127 laboratories worldwide. These samples, containing a spiked amount of low level activity, are analyzed using standard laboratory procedures. The results are submitted to the Environmental Measurements Laboratory for statistical evaluation. Reports are provided to each participating laboratory, which provide an evaluation of the laboratory's performance.

During 2002, tritium analyses for the JAF Environmental Laboratory were performed by Framatome, ANP.

D.2 PROGRAM SCHEDULE

TABLE D-1
2002 QA Program Schedule

Sample Media	Laboratory Analysis	Sample Provider: Analytics	Sample Provider: EML	Yearly Total
Water	Gross Beta	0	2	2
Water	Tritium	1	2	3
Water	I-131	2	0	2
Water	Mixed Gamma	2	2	4
Air	Gross Beta	2	2	4
Air	I-131	2	0	2
Air	Mixed Gamma	2	2	4
Milk	I-131	2	0	2
Milk	Mixed Gamma	2	0	2
Soil	Mixed Gamma	1	0	1
Vegetation	Mixed Gamma	1	0	1
TOTAL SAMPLE INVENTORY		17	10	27

D.3 ACCEPTANCE CRITERIA

Each sample result is evaluated to determine the accuracy and precision of the laboratory's analysis result. The evaluation method for the QA sample results is dependent on the supplier of the sample. The sample evaluation methods are discussed below.

D.3.1 ANALYTICS SAMPLE RESULTS

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.

$$\text{The error resolution} = \frac{\text{Reference Result}}{\text{Reference Results Error}}$$

Using the appropriate row under the Error Resolution column in Table D-2 below, 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-2
Ratio of Agreement

ERROR RESOLUTION	RATIO OF AGREEMENT
≤ 3	0.4 to 2.5
3.1 to 7.5	0.5 to 2.0
7.6 to 15.5	0.6 to 1.66
15.6 to 50.5	0.75 to 1.33
50.6 to 200	0.8 to 1.25
>200	0.85 to 1.18

Again, this acceptance test is generally referred to as the "NRC" method. The acceptance criteria is contained in JAFNPP procedure DVP-04.01 and was taken from the Criteria of Comparing Analytical Results (USNRC) and Bevington, P.R., Data Reduction and Error Analysis for the Physical Sciences, McGraw-Hill, New York, (1969). The NRC method generally results in an acceptance range of approximately ±25% of the Known Value when applied to sample results from the Analytics Inc. Interlaboratory Comparison Program. This method is used as the procedurally required assessment method and requires the generation of a nonconformity report when results are unacceptable.

D.3.2 ENVIRONMENTAL MEASUREMENTS LABORATORY (EML)

The laboratory's analytical performance is evaluated by EML based on the historical analytical capabilities for individual analyte/matrix pairs. The statistical criteria for Acceptable Performance, "A", has been chosen by EML to be between the 15th and 85th percentile of the cumulative normalized distribution, which can be viewed as the middle 70% of all historic measurements. The Acceptable With Warning criteria, "W", is between the 5th and 15th percentile and between the 85th and 95th percentile. In other words, the middle 70% of all reported values are acceptable, while the other 5th-15th (10%) and 85th-95th percentiles (10%) are in the warning area. The Not Acceptable criteria, "N", is established at less than the 5th percentile and greater than the 95th percentile, that is, the outer 10% of the historical data. Using five years worth of historical analytical data, the EML, determined performance results using the percentile criteria summarized below:

Result	Cumulative Normalized Distribution
Acceptable ("A")	15% - 85%
Acceptable with Warning ("W")	5% - 15% or 85% - 95%
Not Acceptable ("N")	<5% or >95%

D.4 PROGRAM RESULTS SUMMARY

The Interlaboratory Comparison Program numerical results are provided on Table D-7.

D.4.1 ANALYTICS QA SAMPLES RESULTS

Seventeen QA blind spike samples were analyzed as part of Analytics' 2002 Interlaboratory Comparison Program. The following sample media were evaluated as part of the comparison program.

- Air Charcoal Cartridge, I-131
- Air Particulate Filter, Mixed Gamma Emitters/Gross Beta
- Water, I-131/Mixed Gamma Emitters/Tritium
- Soil, Mixed Gamma Emitters
- Milk, I-131 Mixed Gamma Emitters
- Vegetation, Mixed Gamma Emitters

The JAF Environmental Laboratory performed 79 individual analysis on the seventeen QA samples. Of the 79 analysis performed, 77 were in agreement using the NRC acceptance criteria for a 97.5% agreement ratio.

Sample non-conformities are discussed in Section D.4.2.

D.4.2 ANALYTICS SAMPLE NONCONFORMITIES

D.4.2.1 Analytics Sample E-3286-05, Cr-51 in Milk Nonconformity No. 02-09

A spiked mixed gamma in milk sample supplied by Analytics, Inc., was analyzed in accordance with standard laboratory procedures. The sample contained a total of nine radionuclides for analysis. Nine of the nine radionuclides present were quantified. Eight of the nine radionuclides were quantified within the acceptable range. The results for Cr-51 were determined to be outside the QA Acceptance Criteria. The milk sample was analyzed on three different detectors with the mean Cr-51 results reported as 176.7 pCi/l. The known results for the sample was 227 pCi/l as determined by the supplier.

An evaluation of the Cr-51 result was performed. The spectrum and peak search results were examined with no abnormalities identified. Cr-51 decays by electron capture with a 27.7 day half-life and a gamma ray energy of 320 KeV with a yield of 9.8%. No secondary gamma energies are produced in the Cr-51 decay scheme. This low gamma energy yield and short half-life will result in very low net counts for samples containing environmental levels of Cr-51. The average net count rate of the three analyses ranged from a high of 1.9 counts per minute to a low of 0.68 counts per minute. One of the three reported results was 244 pCi/l and resulted in an agreement when compared to the known of 227 with a ratio of 1.07. This result had an associated counting error of 13.1%. The remaining two counts had ratios of 0.55 and 0.71 with high associated counting errors of 29.3% and 21.2% respectively.

The combination of the following; low sample activity, very small net count rate, short half-life, low gamma energy, and small gamma yield, resulted in an inaccurate sample result. The wide range of the associated counting errors demonstrates the low confidence level in the reported results. The poor analytical results for this sample is not routine and does not indicate a programmatic deficiency in the analysis of Cr-51 in milk samples or other environmental media. Confidence in the accurate analysis of Cr-51 can be demonstrated by other Cr-51 analytical results, both in the sample results for the 2002 QA program and historical Cr-51 QA results. The Cr-51 results for the other Quality Assurance samples analyzed as part of the

2002 Interlaboratory Comparison Program were all acceptable and are summarized below:

TABLE D-3
2002 Cr-51 Results

Sample ID	Medium	JAF	Lab	Ratio
E-3051-05	WATER pCi/liter	234±20	198±10	1.18
E-3284-05	WATER pCi/liter	324±23	304±15	1.07
E-3052-05	FILTER pCi/filter	187±13	203±10	0.92
E-3285-05	FILTER pCi/filter	157±13	141±7	1.11
E-3215-05	MILK pCi/liter	239±19	235±12	1.02
E-3218-05	VEGETATION pCi/kg	408±23	403±20	1.01
E-3216-05	SOIL pCi/kg	370±75	318±16	1.16
Mean Ratio				1.07

A review of historical QA data for 2001 was also performed to determine if this is a recurring systematic error or bias. In 2001, eleven QA samples were analyzed which contained Cr-51. The mean ratio for these samples relative to the known (reference) value is 98.5. There were two Cr-51 nonconformities in the 2001 Interlaboratory Comparison Program and were determined not to be systematic or programmatic errors. The historic Cr-51 nonconformities were a low percentage of the overall gamma spectroscopy QA program and have been determined to be the result of the low sample activity and low gamma yields for Cr-51 in the spiked samples. Analytical methods and system calibrations are not the cause of this nonconformity, based on the accurate results achieved for the analysis of the other eight radionuclides present in the sample. No corrective actions were implemented as a result of this nonconformity.

D.4.2.2 Analytics Sample E-3285-05 Nonconformity No. 02-08, Air Particulate Gamma Emitters

The gamma spectral analysis of sample E-3285-05 resulted in the quantification of nine radionuclides. Results for eight of the identified radionuclides were in agreement with the reference value and one measurement was in disagreement. The Fe-59 results had a calculated ration of 1.29, which places the results outside the acceptable limit. The sample ratio of 1.29 demonstrates that the Fe-59 sample result is biased high. An evaluation of the Fe-59 result was performed. Fe-59 concentrations were detected in three of the three analysis reported for this sample. The spectrum and peak search results were examined with no abnormalities identified. Fe-59 decays with a 44.5 day half-life with two gamma ray energies of 1099 KeV and 1291 KeV with yields of 57% and 43% respectively. Fe-59 concentrations were identified at both the 1099 KeV and 1291 KeV peaks in all three analysis with the following results.

TABLE D-4
Nonconformity No. 02-08 Fe-59 Results

Concentration pCi/filter			
Detector Number	**Peak 1 1099 KeV**	**Peak 2 1291 KeV**	**Mean Concentration**
1	69.9	79.3	73.5
2	68.5	61.4	65.4
8	74.7	73.0	73.9
Mean pCi/filter	71.0	71.2	70.9
Ratio	1.29	1.30	1.29

There were no significant differences for the activity that was measured at either of the two Fe-59 peaks. The number of total counts measured in both of these peaks maybe biased high due to coincidence counting as the result of other radionuclides that are present in the sample. The relatively low gamma yield and low activity of 55 pCi/Kg may have also contributed to the inaccuracy of this sample result.

Fe-59 was measured in seven other samples analyzed as part of the 2002 Interlaboratory Comparison Program. All of these samples were in agreement with the reference laboratory with a mean agreement ration of 1.09. This mean ratio of greater than 1.09 would indicated that these samples were biased high and the bias was the possible result of coincidence counting from other radionuclides in the sample. The amount of biased experienced in most Interlaboratory Comparison Program samples due to coincidence counting has been limited to less than 20 percent and has resulted in sample results which were statistically acceptable when compared to the reference value. Changes to the radionuclide library were made in 2001 to direct the gamma spectroscopy software to calculate the mean concentration value based on both the 1099 KeV and 1291 KeV peaks. In most gamma spectrums, this has reduced the effect of the coincidence count on the Fe-59 analytical results as the 1291 KeV peak may be less affected by the coincidence counting in multiple radionuclide samples. No corrective actions were implemented as a result of this nonconformity.

D.4.3 ENVIRONMENTAL MEASUREMENTS LABORATORY (EML)

In 2002, JAF Environmental Laboratory participated in both the EML Quality Assessment Programs, QAP-56 and QAP-57. Sample sets consisted of the following sample media:

- Water – Gross Beta/Mixed Gamma Emitters
- Water – Tritium
- Air Particulate Filter – Mixed Gamma Emitters/Gross Beta

A total of 10 samples containing 18 individual radionuclides were evaluated for the samples included in QAP-56 and QAP-57. Using the EML acceptance criteria, 17 of 18 radionuclides analyses (94.4%) were evaluated to be acceptable. Results for the EML Cross Check Program can be viewed on-line at www.eml.doe.gov. A summary of the JAF Environmental Laboratory results is as follows:

TABLE D-5
JAF Environmental Lab Summary

Matrix	Analyses	Total Acceptable	Not Acceptable
Air	10	10	0
Water	8	7	1
Total	18	17	1
Percentage		94.4%	5.6%

D.4.3.1 EML Sample QAP-56, Cs-134 in Water Nonconformity No. 02-02

The QAP-56 gamma in water sample contained three radionuclides for evaluation; Cs-137, Cs-134 and Co-60. Two of the three radionuclides present, Co-60 and Cs-137, were quantified with agreement ratios of 1.02 and 0.99, respectively. The JAF laboratory reported a Cs-134 result of 2.6 ± 0.5 Bq/L (70.3 pCi/l). The EML known activity was reported as 3.357 Bq/L (90.74 pCi/L). The agreement ratio for the Cs-134 analysis was 0.77, which placed the result outside the acceptable range. The cause of the nonconformity is attributed to several factors. The concentration of Cs-134 in the sample was very small at 3.36 Bq/L and resulted in a one sigma counting error of approximately 20%. By comparison the one sigma counting errors for the Co-60 result was 1.0% and the one sigma counting error for the Cs-137 result was 1.3%. The high associated counting error was the result of the low count rate measured for the Cs-134 peak and resulted in poor counting statistics. The measurement of the Cs-134 concentration in this sample was further complicated by the presence of an interference peak at 609 KeV. The combination of the low concentration and interference from 609 KeV peak were both contributing factors in the non-conforming result. A review of the EML summary statistics for this sample showed a relatively high failure or nonconformity rate for other laboratories participating in this sample comparison. Their statistics are as follows:

TABLE D-6

EML Summary QAP-56

Cs-134 in Water

Isotope	No. Labs Reporting	% in Agreement	% with Warning	% not in Agreement
Cs-134	116	60.3	23.3	16.40
Cs-137	146	87.0	11.0	2.10

As the table shows for the 116 laboratories reporting results, only 60.3% were in agreement with the known value. 16.4% of the participating laboratories were not in agreement and 23.3% of laboratories reporting results were in the warning range for the reported results. An additional 30 laboratories reported no results for the Cs-134 concentration. By comparison, the statistics for the Cs-137 concentration showed a failure rate of only 2.1% and acceptable results for 87% of the results reported for the study.

The Cs-134 results reported for the 2002 QAP-57 study, conducted in the second half of the year, were acceptable with an agreement ratio of 1.0. Cs-134 was measured in nine other comparison samples analyzed as part of the 2002 Interlaboratory Comparison Program. The mean ratio for all the reported results was 0.96 and there were no nonconformities. These results demonstrate that there is no programmatic or systematic error inherent to the analyses of Cs-134 in environmental sample medium. No corrective action was implemented as a result of this nonconformity.

TABLE D-7
INTERLABORATORY COMPARISON PROGRAM
Gross Beta Analysis of Air Particulate Filters
(pCi/filter)

DATE	JAF ENV ID NUMBER	MEDIUM	ANALYSIS	JAF RESULT (1)	REFERENCE LABORATORY* (2)	RATIO (3)
06/13/02	E-3214-05	AIR pCi/filter	GROSS BETA	27.5±1.3 24.8±1.3 25.9±1.3 Mean = 26.1±0.8	25±1	1.04, A
12/05/02	E-3467-05	AIR pCi/filter	GROSS BETA	114.7±1.2 114.3±1.2 113.1±1.2 Mean = 114.0±0.7	127±6	0.90, A

(1) Results reported as activity ± 1 sigma.
(2) Results reported as activity ± 3 sigma.
(3) Ratio = Reported/Analytics (See Section D.3).
(*) Sample provided by Analytics, Inc.
(A) Evaluation Results, Acceptable.

TABLE D-7(Continued)
INTERLABORATORY COMPARISON PROGRAM
Tritium Analysis of Water
(pCi/liter)

DATE	JAF ENV ID NUMBER	MEDIUM	ANALYSIS	JAF RESULT (1)	REFERENCE LABORATORY* (2)	RATIO (3)
03/14/02	E-3050-05	WATER pCi/liter	H-3	10080±140 9880±140 10130±140 Mean = 10030±81	10026±501	1.0, A

(1) Results reported as activity ± 1 sigma. Sample Analyzed by Framatome, ANP.
(2) Results reported as activity ± 3 sigma.
(3) Ratio = Reported/Analytics (See Section D.3).
(*) Samples provided by Analytics, Inc.
(A) Evaluation Results, Acceptable.

TABLE D-7 (Continued)
INTERLABORATORY COMPARISON PROGRAM

Iodine Analysis of Water, Air and Milk

DATE	JAF ENV ID NUMBER	MEDIUM	ANALYSIS	JAF RESULT (1)	REFERENCE LABORATORY* (2)	RATIO (3)
03/14/02	E-3051-05	WATER pCi/liter	I-131**	58.5±1.6 57.6±1.8 60.9±1.2 Mean = 59.0±0.9	61±3	0.97, A
06/13/02	E-3217-05	AIR pCi/cc	I-131	80.2±7.4 104.0±8.1 112.0±8.5 Mean = 98.7±4.6	93±5	1.06, A
06/13/02	E-3215-05	MILK pCi/liter	I-131**	75.8±1.0 80.4±1.2 76.8±1.3 Mean = 77.7±0.7	87±4	0.90, A
09/12/02	E-3287-05	AIR pCi/cc	I-131	84.4±7.1 78.8±8.8 83.2±7.0 Mean = 82.4±4.4	81±4	1.01, A
09/12/02	E-3284-05	WATER pCi/liter	I-131**	76.8±1.2 72.6±1.2 75.3±1.1 Mean = 74.9±0.7	79±4	0.95, A
09/12/02	E-3286-05	MILK pCi/liter	I-131**	69.8±1.5 73.8±1.3 72.1±1.5 Mean = 71.9±0.8	80±4	0.90, A

(1) Results reported as activity ± 1 sigma.
(2) Results reported as activity ± 3 sigma.
(3) Ratio = Reported/Analytics (See Section D.3).
(*) Samples provided by Analytics, Inc.
(**) Result determined by Resin Extraction/Gamma Spectral Analysis.
(A) Evaluation Results, Acceptable.

TABLE D-7 (Continued)
INTERLABORATORY COMPARISON PROGRAM
Gamma Analysis Water
(pCi/liter)

DATE	JAF ENV ID NUMBER	MEDIUM	ANALYSIS	JAF RESULT (1)	REFERENCE LABORATORY* (2)	RATIO (3)
03/14/02	E-3051-05	WATER pCi/liter	Ce-141	248.0±9.5 251.0±8.3 249.0±8.3 Mean = 249.0±5.0	242±12	1.03, A
			Cr-51	222.0±35.5 249.0±35.6 232.0±33.4 Mean = 234.3±20.1	198±10	1.18, A
			Cs-134	80.8±5.1 82.6±4.3 79.1±4.3 Mean = 80.8±2.6	91±5	0.89, A
			Cs-137	184.0±6.6 183.0±6.4 191.0±6.4 Mean = 186.0±3.7	197±10	0.94, A
			Mn-54	183.0±6.8 172.0±6.4 185.0±6.4 Mean = 180.0±3.8	166±8	1.08, A
			Fe-59	91.4±7.0 110.0±6.7 89.8±6.1 Mean = 97.1±3.8	86±4	1.13, A
			Zn-65	160.0±11.1 182.0±9.9 167.0±10.6 Mean = 169.7±6.1	164±8	1.04, A
			Co-60	109.0±4.3 124.0±4.3 110.0±4.0 Mean = 114.3±2.4	117±6	0.97, A

(1) Results reported as activity ± 1 sigma.
(2) Results reported as activity ± 3 sigma.
(3) Ratio = Reported/Analytics (See Section D.3).
(*) Sample provided by Analytics, Inc.
(A) Evaluation Results, Acceptable.

TABLE D-7 (Continued)
INTERLABORATORY COMPARISON PROGRAM
Gamma Analysis Water (pCi/liter)

DATE	JAF ENV ID NUMBER	MEDIUM	ANALYSIS	JAF RESULT (1)	REFERENCE LABORATORY* (2)	RATIO (3)
09/19/02	E-3284-05	WATER pCi/liter	Ce-141	230.0±9.3 221.0±7.6 224.0±9.7 Mean = 225.0±5.1	214±11	1.05, A
			Cr-51	321.0±38.1 264.0±34.9 389.0±46.1 Mean = 324.7±23.1	304±15	1.07, A
			Cs-134	172.0±6.9 171.0±6.4 167.0±7.9 Mean = 170.0±4.1	176±9	0.97, A
			Cs-137	150.0±6.4 171.0±6.2 174.0±7.9 Mean = 165.0±4.0	169±8	0.98, A
			Mn-54	208.0±7.1 217.0±7.2 232.0±9.1 Mean = 219.0±4.5	204±10	1.07, A
			Fe-59	120.0±7.0 133.0±7.1 127.0±8.8 Mean = 126.7±4.5	119±6	1.07, A
			Zn-65	271.0±13.1 272.0±12.8 242.0±15.9 Mean = 261.7±8.1	251±13	1.04, A
			Co-60	191.0±5.3 185.0±5.3 191.0±6.6 Mean = 189.0±3.3	199±10	0.95, A
			Co-58	130.0±6.2 139.0±6.1 130.0±8.0 Mean = 133.0±3.9	130±7	1.02, A

(1) Results reported as activity ± 1 sigma.
(2) Results reported as activity ± 3 sigma.
(3) Ratio = Reported/Analytics (See Section D.3).
(*) Sample provided by Analytics, Inc.
(A) Evaluation Results, Acceptable.

TABLE D-7 (Continued)
INTERLABORATORY COMPARISON PROGRAM
Gamma Analysis of Air Particulate Filters (pCi/filter)

DATE	JAF ENV ID NUMBER	MEDIUM	ANALYSIS	JAF RESULT (1)	REFERENCE LABORATORY* (2)	RATIO (3)
03/14/02	E-3052-05	FILTER pCi/filter	Ce-141	236.0±5.8 226.0±5.6 236.0±6.5 Mean = 232.0±3.5	248±12	0.94, A
			Cr-51	186.0±22.2 217.0±22.3 158.0±24.2 Mean = 187.0±13.2	203±10	0.92, A
			Cs-134	75.7±4.7 93.5±4.9 80.5±5.7 Mean = 83.2±2.9	93±5	0.89, A
			Cs-137	205.0±6.4 204.0±6.4 193.0±7.3 Mean = 200.7±3.9	202±10	1.00, A
			Mn-54	175.0±6.3 178.0±6.5 178.0±7.6 Mean = 177.0±4.0	170±9	1.04, A
			Fe-59	93.9±6.5 98.9±6.9 101.0±7.9 Mean = 97.9±4.1	88±4	1.11, A
			Zn-65	178.0±11.1 169.0±11.2 167.0±12.9 Mean = 171.3±6.8	168±8	1.02, A
			Co-60	113.0±4.3 120.0±4.6 121.0±5.3 Mean = 118.0±2.7	120±6	0.98, A

(1) Results reported as activity ± 1 sigma.
(2) Results reported as activity ± 3 sigma.
(3) Ratio = Reported/Analytics (See Section D.3).
(*) Sample provided by Analytics, Inc.
(A) Evaluation Results, Acceptable.

TABLE D-7 (Continued)
INTERLABORATORY COMPARISON PROGRAM
Gamma Analysis of Air Particulate Filters (pCi/filter)

DATE	JAF ENV ID NUMBER	MEDIUM	ANALYSIS	JAF RESULT (1)	REFERENCE LABORATORY* (2)	RATIO (3)
09/20/02	E-3285-05	FILTER pCi/filter	Ce-141	109.0±4.2 104.0±4.3 109.0±4.1 Mean = 107.3±2.4	99±5	1.08, A
			Cr-51	159.0±21.4 175.0±22.5 137.0±21.3 Mean = 157.0±12.6	141±7	1.11, A
			Cs-134	82.8±5.0 82.60±5.2 87.50±4.9 Mean = 84.3±2.9	82±4	1.02, A
			Cs-137	92.2±4.7 91.2±5.0 91.2±4.6 Mean = 91.5±2.8	79±4	1.16, A
			Mn-54	114.0±5.6 116.0±5.8 112.0±5.4 Mean = 114.0±3.2	95±5	1.20, A
			Fe-59	73.5±6.0 65.4±6.5 73.9±5.9 Mean = 70.9±3.5	55±3	1.29, D NC-02-08
			Zn-65	140.0±10.2 143.0±10.8 153.0±10.4 Mean = 145.3±6.0	117±6	1.24, A
			Co-60	91.2±4.1 98.0±4.3 99.4±4.2 Mean = 96.2±2.4	92±5	1.04, A
			Co-58	76.0±4.7 72.0±4.9 65.7±4.4 Mean = 71.2±2.7	60±3	1.18, A

(1) Results reported as activity ± 1 sigma.
(2) Results reported as activity ± 3 sigma.
(3) Ratio = Reported/Analytics (See Section D.3).
(*) Sample provided by Analytics, Inc.
(A) Evaluation Results, Acceptable.
(D) Evaluation Results, Disagreement.
(NC) Nonconformity Report Number.

TABLE D-7 (Continued)
INTERLABORATORY COMPARISON PROGRAM
Gamma Analysis Milk (pCi/liter)

DATE	JAF ENV ID NUMBER	MEDIUM	ANALYSIS	JAF RESULT (1)	REFERENCE LABORATORY* (2)	RATIO (3)
06/13/02	E-3215-05	MILK pCi/liter	Ce-141	92.2±7.2 93.5±5.9 82.7±6.7 Mean = 89.5±3.8	90±5	1.00, A
			Cr-51	230.0±33.5 206.0±30.6 282.0±32.8 Mean = 239.3±18.7	235±12	1.02, A
			Cs-134	111.0±5.4 112.0±5.3 115.0±5.1 Mean = 112.7±3.0	120±6	0.94, A
			Cs-137	93.9±5.1 88.0±4.8 87.5±5.1 Mean = 89.8±2.9	91±5	0.99, A
			Mn-54	98.8±5.3 93.1±5.1 103.0±5.3 Mean = 98.3±3.0	95±5	1.03, A
			Fe-59	83.3±6.4 88.8±6.4 84.4±6.7 Mean = 85.5±3.8	81±4	1.06, A
			Zn-65	187.0±11.7 157.0±10.4 192.0±11.7 Mean = 178.7±6.5	180±9	0.99, A
			Co-60	115.0±4.4 124.0±4.4 124.0±4.4 Mean = 121.0±2.5	125±6	0.97, A
			Co-58	92.4±5.6 99.4±5.3 93.8±5.1 Mean = 95.2±3.1	100±5	0.95, A

(1) Results reported as activity ± 1 sigma.
(2) Results reported as activity ± 3 sigma.
(3) Ratio = Reported/Analytics (See Section D.3).
(*) Sample provided by Analytics, Inc.
(A) Evaluation Results, Acceptable.

TABLE D-7 (Continued)
INTERLABORATORY COMPARISON PROGRAM
Gamma Analysis Milk (pCi/liter)

DATE	JAF ENV ID NUMBER	MEDIUM	ANALYSIS	JAF RESULT (1)	REFERENCE LABORATORY* (2)	RATIO (3)
09/12/02	E-3286-05	MILK pCi/liter	Ce-141	159.0±6.7 153.0±8.6 162.0±7.0 Mean = 158.0±4.3	160±8	0.99, A
			Cr-51	244.0±32.0 125.0±36.6 161.0±34.1 Mean = 176.7±19.8	227±11	0.78, D NC-02-09
			Cs-134	120.0±5.7 118.0±7.0 115.0±5.6 Mean = 117.7±3.5	132±7	0.89, A
			Cs-137	111.0±5.5 129.0±6.9 124.0±5.6 Mean = 121.3±3.5	127±6	0.95, A
			Mn-54	159.0±6.2 146.0±7.6 151.0±6.0 Mean = 152.0±3.8	152±8	1.00, A
			Fe-59	93.7±6.5 102.0±8.4 91.8±6.4 Mean = 95.8±4.1	89±4	1.08, A
			Zn-65	192.0±11.4 179.0±14.9 192.0±11.2 Mean = 187.7±7.3	187±9	1.01, A
			Co-60	143.0±4.8 145.0±6.0 147.0±4.7 Mean = 145.0±3.0	149±7	0.97, A
			Co-58	98.1±5.2 99.4±7.0 104.0±5.4 Mean = 100.5±3.4	97±5	1.04, A

(1) Results reported as activity ± 1 sigma.
(2) Results reported as activity ± 3 sigma.
(3) Ratio = Reported/Analytics (See Section D.3).
(*) Sample provided by Analytics, Inc.
(A) Evaluation Results, Acceptable.
(D) Evaluation Results, Disagreement.
(NC) Nonconformity Report Number.

TABLE D-7(Continued)
INTERLABORATORY COMPARISON PROGRAM
Gamma Analysis Soil (pCi/gram)

DATE	JAF ENV ID NUMBER	MEDIUM	ANALYSIS	JAF RESULT (1)	REFERENCE LABORATORY* (2)	RATIO (3)
06/13/02	E-3216-05	SOIL pCi/gram	Ce-141	0.114±0.026 0.186±0.024 0.0141±0.022 Mean = 0.147±0.014	0.122±0.006	1.20, A
			Cr-51	0.427±0.142 0.349±0.125 0.334±0.122 Mean = 0.370±0.075	0.318±0.016	1.16, A
			Cs-134	0.158±0.020 0.126±0.020 0.192±0.020 Mean = 0.159±0.012	0.163±0.008	0.98, A
			Cs-137	0.240±0.019 0.214±0.022 0.204±0.020 Mean = 0.219±0.012	0.208±0.010	1.05, A
			Mn-54	0.133±0.015 0.157±0.017 0.132±0.018 Mean = 0.141±0.010	0.129±0.006	1.09, A
			Fe-59	0.107±0.027 0.099±0.029 0.145±0.030 Mean = 0.117±0.016	0.109±0.005	1.07, A
			Zn-65	0.227±0.027 0.292±0.034 0.279±0.034 Mean = 0.266±0.019	0.243±0.012	1.09, A
			Co-60	0.156±0.012 0.165±0.014 0.142±0.013 Mean = 0.154±0.008	0.168±0.008	0.92, A
			Co-58	0.115±0.016 0.114±0.017 0.125±0.017 Mean = 0.118±0.010	0.135±0.007	0.87, A

(1) Results reported as activity ± 1 sigma.
(2) Results reported as activity ± 3 sigma.
(3) Ratio = Reported/Analytics (See Section D.3).
(*) Sample provided by Analytics, Inc.
(A) Evaluation Results, Acceptable.

TABLE D-7(Continued)
INTERLABORATORY COMPARISON PROGRAM
Gamma Analysis Vegetation (pCi/gram)

DATE	JAF ENV ID NUMBER	MEDIUM	ANALYSIS	JAF RESULT (1)	REFERENCE LABORATORY* (2)	RATIO (3)
06/13/02	E-3218-05	VEGETATION pCi/gram	Ce-141	0.175±0.006 0.161±0.007 0.176±0.008 Mean = 0.171±0.004	0.154±0.008	1.11, A
			Cr-51	0.414±0.038 0.424±0.040 0.385±0.042 Mean = 0.408±0.023	0.403±0.020	1.01, A
			Cs-134	0.227±0.007 0.218±0.007 0.229±0.008 Mean = 0.225±0.004	0.206±0.010	1.09, A
			Cs-137	0.162±0.006 0.154±0.007 0.178±0.007 Mean = 0.165±0.004	0.156±0.008	1.06, A
			Mn-54	0.186±0.007 0.184±0.007 0.193±0.001 Mean = 0.188±0.004	0.163±0.009	1.15, A
			Fe-59	0.154±0.009 0.141±0.009 0.156±0.010 Mean = 0.150±0.006	0.138±0.007	1.09, A
			Zn-65	0.327±0.016 0.343±0.016 0.324±0.017 Mean = 0.331±0.009	0.308±0.015	1.07, A
			Co-60	0.233±0.006 0.229±0.006 0.230±0.006 Mean = 0.231±0.004	0.213±0.011	1.08, A
			Co-58	0.187±0.007 0.183±0.007 0.184±0.008 Mean = 0.185±0.004	0.171±0.009	1.08, A

(1) Results reported as activity ± 1 sigma.
(2) Results reported as activity ± 3 sigma.
(3) Ratio = Reported/Analytics (See Section D.3).
(*) Sample provided by Analytics, Inc.
(A) Evaluation Results, Acceptable.

TABLE D-7(Continued)
INTERLABORATORY COMPARISON PROGRAM
Gamma Analysis Water (Bq/liter)

DATE	JAF ENV ID NUMBER	MEDIUM	ANALYSIS	JAF RESULT (1)	REFERENCE LABORATORY* (1)	RATIO (2)
03/01/02	QAP-56	WATER Bq/liter	Cs-134	2.5±1.0 2.4±0.8 3.0±0.6 2.7±1.1 2.3±1.4 Mean = 2.6±0.5	3.4±0.2	0.77, D NC-02-02
			Cs-137	57.1±1.8 52.9±1.7 57.0±1.7 53.7±1.7 55.5±1.9 Mean = 55.7±0.8	56.1±2.9	0.99, A
			Co-60	352.0±3.0 355.9±3.1 353.0±3.0 352.6±3.8 354.5±3.6 Mean = 353.8±1.5	347.3±12.4	1.02, A

(1) Results reported as activity ± 1 sigma.
(2) Ratio = Reported/Environmental Measurements Lab (EML)(See Section D.3).
(*) Sample provided by Environmental Measurements Lab., Dept. of Energy.
(A) Evaluation Results, Acceptable.
(D) Evaluation Results, Disagreement.
(NC) Nonconformity Report Number.

TABLE D-7(Continued)
INTERLABORATORY COMPARISON PROGRAM
Gamma Analysis Water (Bq/liter)

DATE	JAF ENV ID NUMBER	MEDIUM	ANALYSIS	JAF RESULT (1)	REFERENCE LABORATORY* (1)	RATIO (2)
09/01/02	QAP-57	WATER Bq/liter	Cs-134	62.9±2.2 61.1±2.3 59.9±2.2 57.7±2.7 60.7±1.7 62.2±2.1 Mean = 60.7±0.9	60.2±1.9	1.01, A
			Cs-137	81.0±2.5 77.7±2.5 78.1±2.4 73.3±2.9 77.8±1.8 78.8±2.5 Mean = 77.7±1.0	81.4±4.3	0.95, A
			Co-60	265.7±3.4 271.6±3.6 275.7±3.5 258.6±4.2 268.3±2.5 270.5±3.4 Mean = 268.4±1.4	268.7±9.7	1.00, A

(1) Results reported as activity ± 1 sigma.
(2) Ratio = Reported/EML(See Section D.3).
(*) Sample provided by Environmental Measurements Lab., Dept. of Energy.
(A) Evaluation Results, Acceptable.

TABLE D-7(Continued)
INTERLABORATORY COMPARISON PROGRAM
Gamma Analysis Air Particulate Filters (Bq/filter)

DATE	JAF ENV ID NUMBER	MEDIUM	ANALYSIS	JAF RESULT (1)	REFERENCE LABORATORY* (1)	RATIO (2)
03/01/02	QAP-56	FILTER Bq/filter	Co-60	28.4±0.4 29.5±0.4 30.0±0.4 29.6±0.5 29.2±0.4 Mean = 29.3±0.2	30.5±0.7	0.96, A
			Mn-54	40.3±0.6 39.6±0.6 40.0±0.6 40.7±0.7 40.0±0.6 Mean = 40.0±0.3	38.5±0.9	1.04, A
			Cs-137	28.2±0.5 28.0±0.5 27.5±0.5 27.8±0.5 27.8±0.4 Mean = 27.9±0.2	28.2±0.7	0.99, A
09/01/02	QAP-57	FILTER Bq/filter	Mn-54	58.1±1.0 57.7±1.1 58.5±1.0 58.1±1.3 58.5±0.9 57.0±1.0 Mean = 58.0±0.4	52.2±1.2	1.11, A
			Co-60	24.0±0.5 23.5±0.6 22.6±0.5 23.0±0.7 22.4±0.5 22.9±0.5 Mean = 23.1±0.2	23.0±0.1	1.00, A
			Cs-137	33.6±0.7 34.3±0.8 33.8±0.7 34.6±0.9 32.9±0.7 34.2±0.7 Mean = 33.9±0.3	32.5±0.8	1.04, A

(1) Results reported as activity ± 1 sigma.
(2) Ratio = Reported/EML (See Section D.3).
(*) Sample provided by Environmental Measurements Lab., Dept. of Energy.
(A) Evaluation Results, Acceptable.

TABLE D-7 Continued)
INTERLABORATORY COMPARISON PROGRAM
Gross Beta Analysis of Water (Bq/liter)

DATE	JAF ENV ID NUMBER	MEDIUM	ANALYSIS	JAF RESULT (1)	REFERENCE LABORATORY* (1)	RATIO (2)
03/01/02	QAP-56	WATER Bq/liter	GROSS BETA	1099±17 1125±17 1110±17 Mean = 1111±10	1030±130	1.08, A
09/01/02	QAP-57	WATER Bq/liter	GROSS BETA	782±20 787±20 823±20 Mean = 797.0±11.32	900±90	0.89, A

(1) Results reported as activity ± 1 sigma.
(2) Ratio = Reported/EML (See Section D.3).
(*) Sample provided by Environmental Measurements Lab., Dept. of Energy.
(A) Evaluation Results, Acceptable.

TABLE D-7(Continued)
INTERLABORATORY COMPARISON PROGRAM
Tritium Analysis of Water (Bq/liter)

DATE	JAF ENV ID NUMBER	MEDIUM	ANALYSIS	JAF RESULT (1)	REFERENCE LABORATORY* (1)	RATIO (2)
03/01/02	QAP-56	WATER Bq/liter	H-3	325±5 310±6 313±7 Mean = 316±3	283.7±3.4	1.11, A
09/01/02	QAP-57	WATER Bq/liter	H-3	249±10 241±10 239±10 Mean = 243±6	227.3±5.6	0.88, A

(1) Results reported as activity ± 1 sigma.
(2) Ratio = Reported/EML (See Section D.3).
(*) Sample provided by Environmental Measurements Lab., Dept. of Energy.
(A) Evaluation Results, Acceptable.

TABLE D-7(Continued)
INTERLABORATORY COMPARISON PROGRAM
Gross Beta Analysis of Air (Bq/filter)

DATE	JAF ENV ID NUMBER	MEDIUM	ANALYSIS	JAF RESULT (1)	REFERENCE LABORATORY* (1)	RATIO (2)
03/01/02	QAP-56	AIR Bq/filter	GROSS BETA	1.21±0.003 1.18±0.03 1.21±0.03 Mean = 1.20±0.02	1.30±0.13	0.92, A
09/01/02	QAP-57	AIR Bq/filter	GROSS BETA	0.84±0.03 0.80±0.03 0.85±0.03 Mean = 0.83±0.02	0.87±0.09	0.95, A

(1) Results reported as activity ± 1 sigma.
(2) Ratio = Reported/EML (See Section D.3).
(*) Sample provided by Environmental Measurements Lab., Dept. of Energy.
(A) Evaluation Results, Acceptable.