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CONSOLIDATED EDISON COMPANY
OF NEW YORK, INC.
INDIAN POINT STATION
BROADWAY & BLEAKLEY AVENUES
BUCHANAN, NY 10511

NewYorkPower Authority

April 21, 2000
IPN-00-030

Docket Nos. 50-03, 50-247, and 50-286
Indian Point Nos. 1, 2, 3
License Nos. DPR-5, DPR-26, DPR-64

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

SUBJECT: **Indian Point's Annual Radiological Environmental Operating Report for 1999**

Dear Sir:

Enclosed please find one copy of the Indian Point Site Annual Radiological Environmental Operating Report for the period January 1, 1999 to December 31, 1999. No commitments are being made by this report.

This report is submitted in accordance with facility licenses DPR-5, DPR-26 and DPR-64 for Indian Points Nos. 1, 2 and 3, respectively.

Should you or your staff have any questions, please contact Mr. Bob Deschamps of the Indian Point Unit 3 staff at (914) 736-8401.

Very truly yours,

Robert J. Barrett
Site Executive Officer
Indian Point 3 Nuclear Power Plant

Very truly yours,

James Baumstark
Vice President Nuclear Engineering
Consolidated Edison Company
Of New York, Inc.

Enclosure

cc: See next page

IE25

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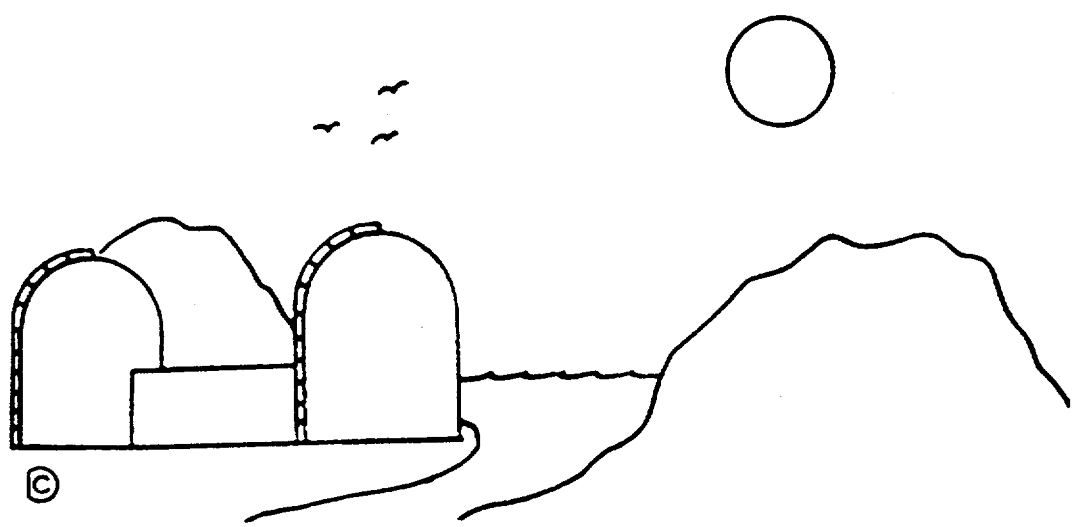
1999

RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

INDIAN POINT NUCLEAR POWER PLANTS

January 1 Through December 31, 1999



NEW YORK POWER AUTHORITY
CONSOLIDATED EDISON COMPANY OF NEW YORK

ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

NEW YORK POWER AUTHORITY
CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.

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, 1999

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SECTION I

EXECUTIVE SUMMARY

1.0 EXECUTIVE SUMMARY

This Annual Radiological Environmental Operating Report contains descriptions and results of the 1999 Radiological Environmental Monitoring Program (REMP) for the Indian Point site. The Indian Point site consists of Units 1, 2 and 3. Units 1 and 2 are owned by the Consolidated Edison Company of New York, Inc., and Unit 3 by the New York Power Authority. 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 structures of the plant, 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 environmental radioactivity attributable to 1999 Indian Point Station operation.

The waterborne pathway consists of Hudson River water, fish and invertebrates, shoreline sediment and aquatic vegetation. Measurements of the media comprising the waterborne pathway indicated that there was no increased environmental radioactivity attributable to 1999 Indian Point Station operation.

This report contains a description of the REMP and the conduct of that program as required by the Radiological Environmental Technical Specifications (RETS). This 1999 REMP report also contains summaries and discussions of the results of the 1999 program, trend analyses, potential impact on the environment, land use census, and interlaboratory comparisons.

During 1999, a total of 1,238 analyses were performed. Table B-1 presents a summary of the collected sample results. The actual sampling frequency in 1999 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 not increasing as a result of Indian Point Station operations in 1999. The levels present in 1999 were within the historic background ranges (i.e., environmental levels resulting from natural and past anthropogenic sources) for the detected radionuclides. Consequently, Indian Point operations in 1999 did not result in any increased radiation levels or 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 (Figure A-1). Unit 1 (Con Edison) has been retired as a generating facility and Units 2 and 3 are owned and operated by Con Edison and the New York Power Authority, respectively.

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 radioactivity, 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. Since effluent releases in 1999 were kept to the lowest level practicable, predictive models for plant releases indicate that the resultant environmental concentrations, resulting from 1999 and prior years' releases, should be virtually undetectable. Residual radioactivity from atmospheric bomb tests and naturally occurring radioactivity were the predominant sources of radioactivity in the samples collected. Their presence makes the detection of the predicted low level concentrations due to plant operations difficult. 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 (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

Con Edison 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.

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 a commercial analytical laboratory, Teledyne Brown Engineering, Inc. of Westwood, New Jersey. The JAFNPP lab at Fulton analyzes all samples except tritium samples, which are processed by Teledyne Brown Engineering, Inc.

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; at approximately 1 mile (1.6 km) and at approximately 5 miles (8 km) from the site (see Figures A-2 and A-3). The inner ring is located near the site boundary; the outer ring is located 4.2-6.4 miles (6.7-10.2 km) from the site.

An additional TLD sample site is located at Roseton (20 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 0.25 to 20 miles (0.4 to 32 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 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-2 and A-3.

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). 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 (GSA), and quarterly for tritium analysis.

3.3.4 Drinking Water

Samples of drinking water are collected monthly from the Camp Field Reservoir (3.5 miles NE, RETS designation Wb1). 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. 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. Normally, there are two indicator locations, RETS Ic1 and Ic2, and one control location, RETS designation Ic3. The samples are collected monthly, when available, and analyzed for gamma-emitting radionuclides and radioiodine. These samples consist of at least

1 kg of leafy vegetation and are used in 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. 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. 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. 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. 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. 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 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 veterinarians and feed suppliers who deal with farm animals and dairy associations. 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.

Technical Specifications 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 (CL), and estimation of the mean and associated propagated error.

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

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 is the standard deviation in the background counting 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). Table A-2 presents the RETS maximum acceptable LLDs for specific media and radionuclides as specified by the NRC. The LLDs actually achieved are usually much lower since the "required LLDs" represent the maximum allowed.

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

$$CL = kp\ S_b\ (1 + t_b/t_s)^{0.5}\ \text{in cpm}$$

where: CL = Critical Level

kp = 1.645 (corresponds to a 95% confidence level)

$S_b = (R_b/t_b)^{0.5}$ (cpm)

S_b = standard deviation of the background count rate, (R_b)

t_b = background count time (min)

t_s = sample count time (min)

For the REMP, net sample results which are less than the CL value are considered not detected, and the CL value is reported as the "less than" value, unless otherwise noted. Values above the CL 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 CL, 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. 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 = mean
X_i = value of each individual observation
N = number of observations

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

where: PE = propagated error of the mean
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 16). 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 CL value, unless other wise noted. If a radionuclide was detected at or above the CL 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 CL values for that sample. If multiple counts were performed on a sample and a radionuclide's values are "<CL" 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 1989 through 1998. The 1999 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:

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.

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.

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 (TLD) results.

Millirem is a measure of radiation dose to humans. It is abbreviated mrem. 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.

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

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.

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.

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

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.

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

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

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

3.6 Program Changes

TLD site 24 was relocated to Warren Road in the town of Cortlandt. This ensures that direct radiation is measured in that sector within 10 kilometers of the plant. Former TLD site 24 has been renumbered 41 and remains in Croton Point Park to provide historical continuity.

SECTION 4

RESULTS AND DISCUSSION

4.0 RESULTS AND DISCUSSION

The 1999 Radiological Environmental Monitoring Program (REMP) was conducted in accordance with Indian Point's Radiological Environmental Technical Specifications (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 Radiological Effluent Technical Specifications.

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)
- sediments (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 1999 and assessed the significance of the findings.

A summary of the results of the 1999 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; i.e., 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), Cs-137, and Cs-134 were detected above background levels in various RETS and non-RETS sample media in the vicinity of Indian Point. Cs-134 was detected in one control location sample of bottom sediment and one indicator location in shoreline soil at levels just above the critical level. The sources and significance of the presence of these radionuclides are described in later sections.

The second group of radionuclides detected in 1999 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 decay), remains detectable.

In 1999, 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. Another reason for attributing the presence of Cs-137 in some media to weapons testing was the general absence of the power-reactor related shorter-lived Cs-134 as described below.

The final group of radionuclides detected through the 1999 REMP comprises those that may be attributable to current plant operations. During 1999, H-3 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 1999 appears to have resulted from a combination of sources. There was no H-3 detected at concentrations above the required RETS LLD.

Cs-137 and Cs-134 are both produced in fission reactors and were introduced into the environment from the accident at Chernobyl, but only Cs-137 remains from weapons test debris. Cs-137, attributable to plant operations (e.g., recent releases), is expected to be accompanied by Cs-134. An absence of such corroborating Cs-134 in samples makes the presence of Cs-137 in these samples difficult to distinguish from the existing background and increases the difficulty of confidently attributing a fraction of the Cs-137 to plant origin.

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 1999 REMP.

In the following sections, a summary of the results of the 1999 REMP are 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 1999, 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 1992 through 1998. The 1999 means are also presented in Table B-4. Table B-5 presents the 1999 TLD data for the inner ring and outer ring of TLDs.

The 1999 mean value for the direct radiation sample points was 14.9 mR per standard quarter. In 1998, the mean value was 15.1 mR and the mean value for the period 1992 through 1998 was 14.5 mR per standard quarter. The 1999 means are within historical bounds for the respective locations. At those locations where the 1999 mean value was higher, the mean value was not significantly different from previous maximum values recorded for those 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 15.0 mR per standard quarter while the average for the outer ring was 14.9 mR per standard quarter. The control location average for 1999 was 16.0 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 1999 averages are consistent with the historical data. The 1999 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 1999 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 0.016 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 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 LLD. 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 1999.

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 detected in the Hudson River water in 1999. Tritium was detected in the discharge canal mixing zone at a maximum concentration of 600 pCi/L in 1999. The detected H-3 concentration was far below (<20%) the RETS required LLD of 3000 pCi/L. Additionally, Ce-141 was identified in one sample at levels very close to the LLD. This is not likely from plant operations because of its absence from other samples.

The relative insignificance of the H-3 concentration of 600 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 24), it was conservatively calculated that the "maximum exposed individual" is an adult who would receive a dose of *0.0015* 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 22).

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 1999 came from waters with 600 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 *0.0015* mrem/year is insignificant.

Data on the radionuclides H-3 and Cs-137 detected in 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 H-3 detected in the discharge canal, as well as the absence of detectable Cs-137, were consistent with the historical data trends.

4.4 Drinking Water

The annual program summary table (Table B-2) contains a summary of the 1999 drinking water sample analysis results. Results of the gamma spectroscopy and gross beta 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 and gross beta at normal background levels, 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 and Cs 134 were the only nuclides identified in the Hudson River shoreline soil samples in 1999. Cs-137 was detected in three out of six samples from indicator locations. Cs-137 was detected in two out of four samples at the control locations. Cs-134 was detected in one of six samples from indicator locations. The average concentration of Cs-137 for the indicator locations was 200 pCi/kg-dry with a maximum concentration of 236 pCi/kg-dry. The concentration of Cs-134 was 46 pCi/kg-dry.

The absence of Co-58, and Co-60, the fact that levels at the control location are higher than the indicator location, and the absence of Cs-134 in all but one sample implies that this Cs-137 is most likely due to fallout and not plant operations.

Cs-137 has been detected in shoreline soils at both indicator and control locations each year for the past ten years. The ten-year average concentrations for indicator and control locations are 206 pCi/kg-dry and 303 pCi/kg-dry, respectively. Cs-134 has been detected at indicator locations for five of the last ten years with an average concentration of 60 pCi/kg-dry. Both indicator and control location concentrations are consistent with the historical data. Table C-5 and Figure C-5 present the ten-year historical average concentrations of Cs-137 and Cs-134 in shoreline soils.

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 1999 samples are presented in Table B-14. Analysis of broad leaf vegetation samples revealed naturally occurring nuclides. Historically, Cs-137 has been detected in both control and indicator broad leaf vegetation. In 1999, Cs-137 was detected in one control location and Ce-141 was detected at one indicator location. See section 4.3 for an explanation.

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 1999 samples. None of the indicator samples revealed radionuclide concentrations greater than CL values. Only naturally occurring nuclides were detected.

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 sediment, soil, and precipitation 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 historic levels. Since these samples were not required by the RETS, individual tables and graphs are not presented for the data.

Soil samples were obtained at two indicator locations and one control location. No Cs-137 was detected in any indicator or control sample. Historically, Cs-137 is detectable in numerous environmental media because of previous atmospheric weapons testing.

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 samples were analyzed for tritium and plant-related nuclides. One sample showed tritium at 160 pCi/l. This is consistent with historical tritium levels detected at the Hudson River Water control location. No other reactor related nuclides were detected. This non-RETS sample location was designated in 1996 and continues to be included in the REMP.

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. The non-RETS sample data corroborate the RETS sample data in determining that the operation of the Indian Point station in 1999 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 1999. 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 1999 census were the same as the 1998 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 calls for 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 1999 REMP reveal that there was no significant radiological impact on the environment due to operations at the station.

The results of the 1999 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 1999 REMP results demonstrate the relative contributions of different radionuclide sources, both natural and anthropogenic, to the environmental concentrations. Overall doses to humans is much more significant from non-plant related sources than that associated with plant operations.

SECTION 5

QUALITY ASSURANCE

5.0 QUALITY ASSURANCE

The Indian Point Radiological Environmental Monitoring Program (REMP) includes a quality assurance 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 1999, 51 samples were submitted to the JAFNPP Environmental Laboratory that processes the Indian Point REMP samples. These submitted sample types included spiked air, water, soil, and vegetation. The spiked samples were obtained from a commercial vendor laboratory and sent to the JAFNPP Environmental Laboratory to be counted as regular environmental samples. The supply vendor certified the activity levels of the spikes at the time of preparation.

  After the Environmental Laboratory analyzed the spike samples, statistical tests were performed using both the spike vendor's and the Laboratory's data. Of the 51 samples, 45 were subject to 69 different analyses when each gamma emitting isotope is considered separately. Of the 69 analyses, 52 (75%) met site statistical criteria and 64 (93%) met the NRC criteria.

  - One identified problem was due to the inadvertent placement of a non-removable identifying sticker over the active area of the air particulate filter (APF) paper. These samples were submitted to the lab and counted with the sticker covering the filter area. This change in sample geometry resulted in 6 samples which could not be properly analyzed. Future samples will be inspected for physical integrity prior to submittal.

  - Three additional air particulate filters (APF) failed for gross beta analysis. Of the 19 viable beta particulate samples, three fell outside of criteria. This type of sample is easily effected by small geometry changes including oils or dust that may cover the active filter area.

As discussed above, physical inspections and handling care will be emphasized in the future.

- A mixed-gamma air particulate filter (APF) did not meet the prescribed statistical criteria for 5 of 8 isotopes. This problem was also identified by JAFNPP Environmental Laboratory and is due to the filter composite stacking. Refer to Appendix D 9.4.2.2 for a more detailed explanation of this issue.

- A mixed-gamma in soil sample passed for 6 of 8 isotopes with the two non-conforming isotopes at extremely low activity. This type of non-conformance is an expected statistical result when analyzing isotopes with low activity since the sample counts are not always distinguishable from background.

- Additionally, an I-131 air charcoal cartridge did not meet the criteria (60% low.) With the exception of this one cartridge, the general agreement for this type of sample is good.

It is notable that the site spike criteria is very rigorous with respect to the NRC Criteria (10% to 15% versus 20%-25%.) Excluding the APF samples that could not be analyzed, and using the NRC criteria, three of the submitted samples and two gamma spec isotopes fell outside of the NRC criteria. This is in comparison to four individual samples and seven gamma spec isotopes that did not meet the site criteria. The three samples that did not meet the NRC criteria were two air particulate filters (APF) and an iodine cartridge.

While the Environmental Laboratory's performance in the Interlaboratory Comparison Program remains good, the sample handling process could be improved. We conclude that results from the JAFNPP Environmental Laboratory are expected to remain reliable.

Annual reviews and audits of the Radiological Environmental Monitoring Program are conducted by New York Power Authority and Consolidated Edison personnel and include:

- Audits of Indian Point and radioanalytical contractor procedures related to the Radiological Environmental Monitoring Program by NYPA Quality Assurance (QA) and Consolidated Edison Nuclear Power Quality Assurance (NPQA) 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 1999 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 12) and internal procedures (Reference 2). Performance of annual audits demonstrated this compliance.

The quality assurance programs of the New York Power Authority's Radiological 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 Environmental Monitoring Program included audits and evaluations of in-house and contractor procedures, work functions, and quality assurance programs. Review of the 1999 quality assurance program indicated that the Radiological Environmental Monitoring Program was performed in accordance with the Radiological Effluent Technical Specifications.

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-2, A-3, and A-4. 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 1999 REMP.

Four maps are provided to show the locations of REMP sampling. Figure A-1 is a site map of the main body of the Indian Point site. Figure A-2 shows the RETS sampling locations within two miles of Indian Point. Figure A-3 shows the RETS sampling locations within ten miles of Indian Point. Figure A-4 shows the non-RETS sample locations within ten miles of Indian Point.

The 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.

Table A-1
Indian Point Station Locations

SAMPLING STATION	LOCATION / DISTANCE	RETS SAMPLE DESIGNATION	SAMPLE TYPES
3	Service Center Building / Onsite - 0.4 Mi (SSE)	DR8	Direct Gamma
4	Algonquin Gas Line / 0.25 Mi (SW)	A1, A1	Air Particulate, Radioiodine
5	NYU Tower / 0.8 Mi (SSW)	A4, A4, DR10	Air Particulate, Radioiodine, Direct Gamma
7	Camp Field Reservoir / 3.5 Mi (NE)	Wb1	Drinking Water
9	Plant Inlet (Hudson River Intake) / Onsite (NW)	Wa1	HR Water
10	Disharge Canal (Mixing Zone) / Onsite - (SW)	Wa2, NR	HR Water, Bottom Sediment
14	Water Meter House / Onsite - 0.3 Mi (SE)	DR7	Direct Gamma
17	Off Verplanck / 1.5 Mi (SSW)	NR, NR, NR	HR Aquatic Vegetation, HR Shoreline Soil, HR Bottom Sediment
20	Cortlandt Yacht Club (AKA Montrose Marina) / 1.6 Mi (S)	DR38	Direct Gamma
22	Lovett / 1.5 Mi (WSW)	NR, NR	Air Particulate, Radioiodine
23	**Control Location (Roseton)** / 20 Mi (N)	NR, A5, A5, DR40, Ic3, NR, Ib2	Precipitation, Air Particulate, Radioiodine, Direct Gamma, Broad Leaf Vegetation, Soil, Fish & Invertebrates
25	Downstream (Hudson River Indicator)	Ib1	Fish & Invertebrate
27	Croton Point / 6.4 Mi (SSE)	NR, NR, DR41	Air Particulate, Radioiodine, Direct Gamma

HR = Hudson River
NR = Non RETS

Table A-1
Indian Point Station Locations

SAMPLING STATION	LOCATION / DISTANCE	RETS SAMPLE DESIGNATION	SAMPLE TYPES
28	Lents Cove / 0.5 Mi (ENE)	NR, DR4, NR, NR	HR Shoreline Soil, Direct Gamma, Bottom Sediment, Aquatic Vegetation
29	Grassy Point / 3.3 Mi (SSW)	NR, NR, DR39	Air Particulate, Radioiodine, Direct Gamma
33	Hamilton St. (Substation) / 3 Mi (NE)	DR33	Direct Gamma
34	SE Corner / Onsite - 0.6 Mi (S)	DR9	Direct Gamma
35	Broadway & Bleakley / Onsite - 0.4 Mi (E)	DR5	Direct Gamma
38	Furnace Dock (Substation) / 3.5 Mi (SE)	DR34	Direct Gamma
44	Peekskill Gas Holder Bldg / 1.7 Mi (NE)	NR, NR, NR	Precipitation, Air Particulate, Radioiodine
50	Manitou Inlet / 4.5 Mi (NNW)	Wc2	HR Shoreline Soil
53	White Beach / 0.9 Mi (SW)	Wc1, DR11	HR Shoreline Soil, Direct Gamma
56	Verplanck - Broadway & Sixth Str. / 1.3 Mi (SSW)	DR37	Direct Gamma
58	Rt. 9D Garrison / 5 Mi (N)	DR17	Direct Gamma
59	Old Pemart Ave (Pole) / 1.8 Mi (NNE)	DR2	Direct Gamma
60	Gallows Hill Rd. (and Sprout Rd.) / 5 Mi (NNE)	DR18	Direct Gamma
61	Lower South Street (& Franklin St.) / 1.3 Mi (NE)	DR36	Direct Gamma
62	Westbrook Drive (& Community Center) / 5 Mi (NE)	DR19	Direct Gamma
64	Lincoln Road - Cortlandt (School Parking Lot) / 4.8 Mi (ENE)	DR20	Direct Gamma

HR = Hudson River
NR = Non RETS

Table A-1
Indian Point Station Locations

SAMPLING STATION	LOCATION / DISTANCE	RETS SAMPLE DESIGNATION	SAMPLE TYPES
66	Croton Ave - Cortlandt / 5 Mi (E)	DR21	Direct Gamma
67	Colabaugh Pond Rd. Cortlandt / 5 Mi (ESE)	DR22	Direct Gamma
69	Mt. Airy & Windsor Road / 5 Mi (SE)	DR23	Direct Gamma
71	Warren Ave - Haverstraw / 4.8 Mi (S)	DR25	Direct Gamma
72	Railroad Avenue & 9W - Haverstraw / 4.6 Mi (SSW)	DR26	Direct Gamma
73	Willow Grove Road & Birch Dr. / 5 Mi (SW)	DR27	Direct Gamma
74	Gays Hill Road South / 1.5 Mi (WSW)	DR12	Direct Gamma
75	Palisades Parkway - Lake Welch / 5 Mi (WSW)	DR28	Direct Gamma
76	Gays Hill Road North / 1 Mi (W)	DR13	Direct Gamma
77	Palisades Parkway / 4 Mi (W)	DR29	Direct Gamma
78	R. 9W across form R/S #14 (Pole #233) 1.2 Mi (WNW)	DR14	Direct Gamma
79	Anthony Wayne Park / 4.5 Mi (WNW)	DR30	Direct Gamma
80	Rt. 9W South of Ayers Road / 1 Mi (NW)	DR15	Direct Gamma
81	Palisades Pkwy South Exit / 4.7 Mi (NW)	DR31	Direct Gamma
82	Ayers Road / 0.9 Mi (NNW)	DR16	Direct Gamma
83	Rt. 9W Fort Montgomery / 4.8 Mi (NNW)	DR32	Direct Gamma
84	Cold Spring / 10.8 Mi (N)	NR, NR, NR	HR Aquatic Vegetation, HR Shoreline Soil, HR Bottom Sediment
88	Sector Six Reuter Stokes Pole / 0.5 Mi (ESE)	DR6	Direct Gamma
89	Highland Ave & Sprout Brook Rd (near rock cut) / 3 Mi (NNE)	DR35	Direct Gamma

HR = Hudson River
NR = Non RETS

Table A-1
Indian Point Station Locations

SAMPLING STATION	LOCATION / DISTANCE	RETS SAMPLE DESIGNATION	SAMPLE TYPES
90	Charles Point / 0.8 Mi (NE)	DR3	Direct Gamma
92	Warren Road, Cortlandt,/ 3.7 Mi	DR24	Direct Gamma
94	NYPA Training Building (Unit 3) / 0.4 Mi (S)	A2, A2, Ic2, NR	Air Particulate, Radioiodine, Broadleaf Vegetation, Soil
95	Met Tower / 0.4 Mi (SSW)	A3, A3, Ic1, NR	Air Particulate, Radioiodine, Broadleaf Vegetation, Soil
96	Roa Hook / 2 Mi (N)	DR1	Direct Gamma
99	Algonquin Outfall / 0.35 Mi (SW)	NR	Special Outfall

HR = Hudson River
NR = Non RETS

Figure A-1
Indian Point Station , Units 1, 2, 3

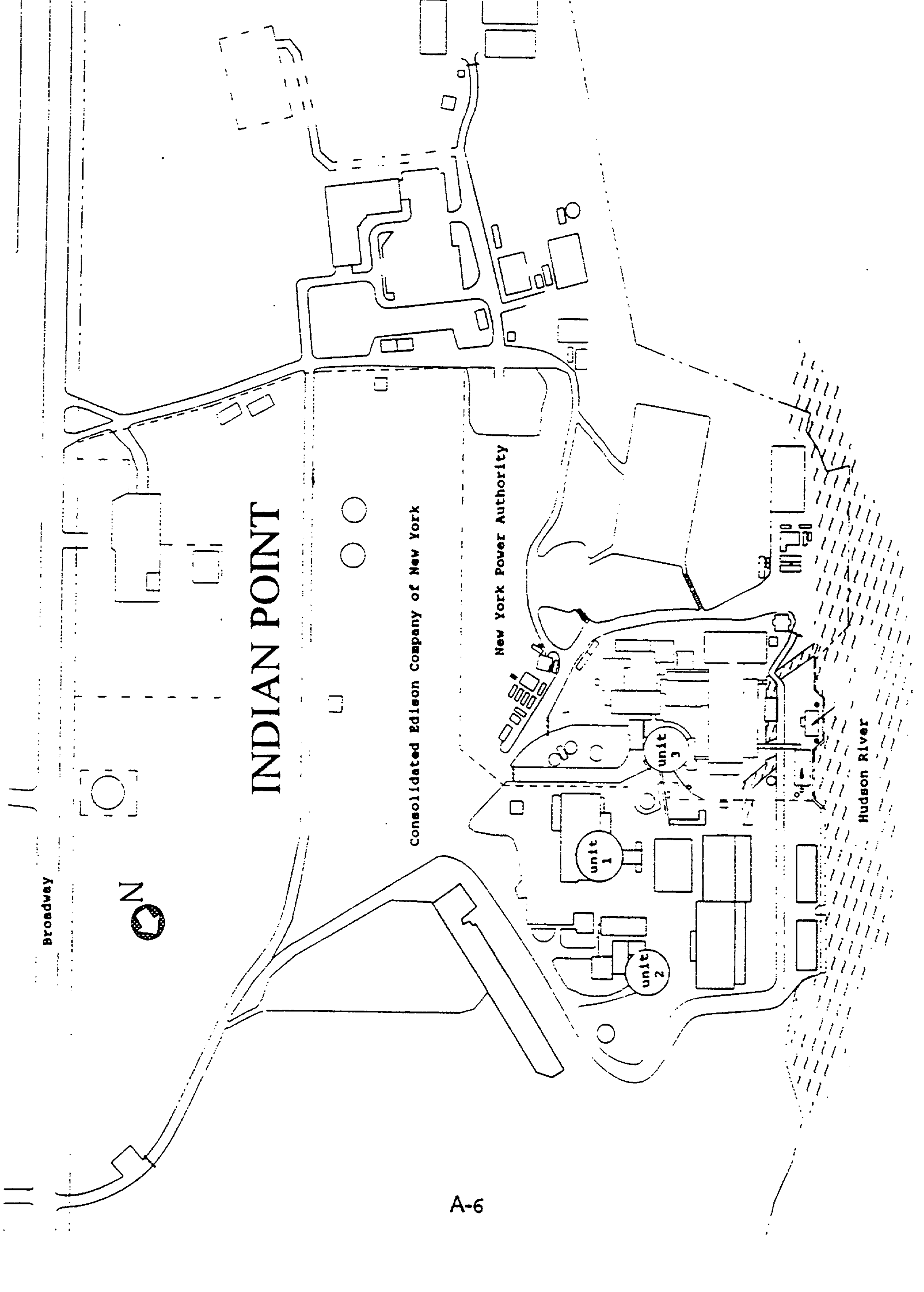
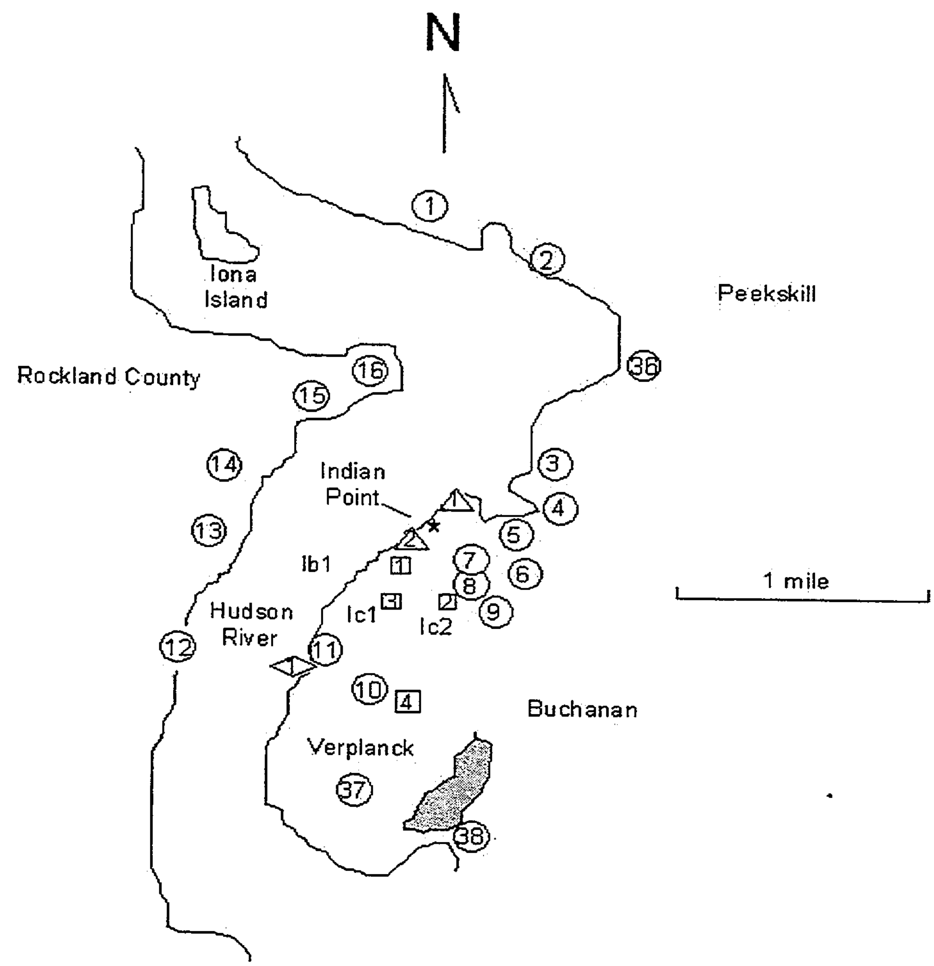


Figure A-2
RETS Sampling Locations
Within 2 miles of the Plant



Key:

△ - Waterborne: Surface (HR) Wa#

○ - Direct Radiation Sample Location DR#

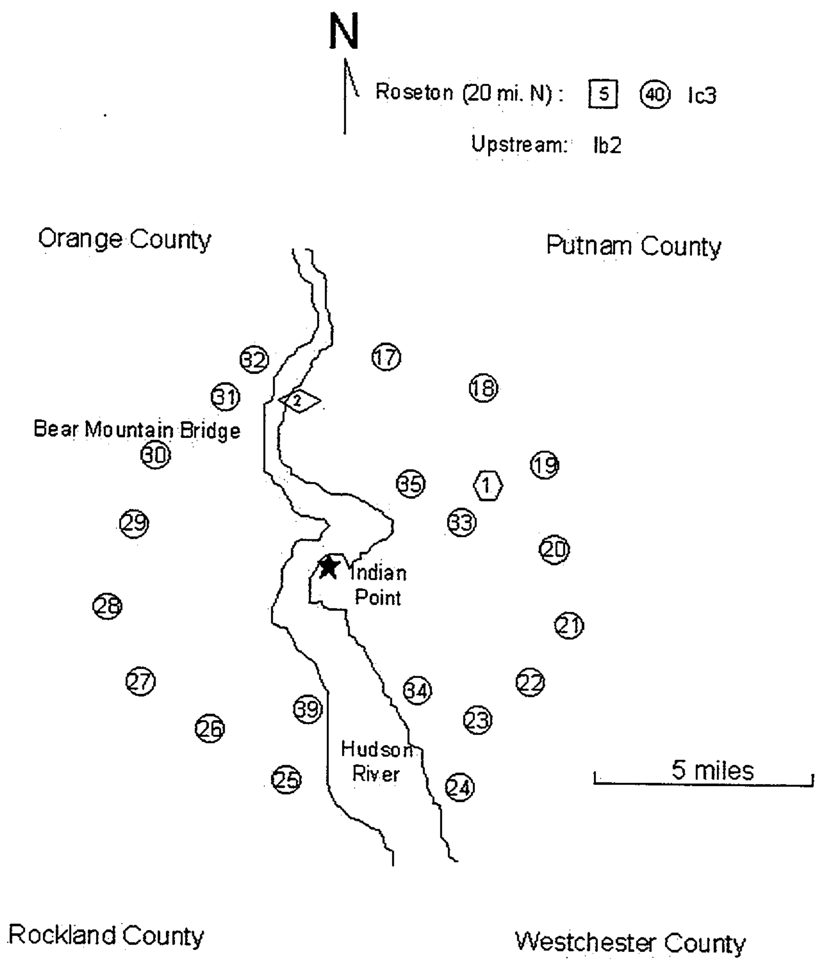
☐ - Airborne Sample Location A#

Ic# - Broadleaf Vegetation

◇ - Shoreline Sediment

Ib1 - Fish and Invertebrates
(where available downstre

Figure A-3
RETS Sampling Locations
Within 10 miles of Indian Point



Key:
- O - Direct Radiation Sample Location DR#
- □ - Airborne Sampling Location A#
- ◇ - Shoreline Sediment

Ic3 - Broadleaf Vegetation
⬡ - Waterborne: Drinking
Ib2 - Fish and Invertebrates (where available upstream)

Figure A-4
Non - RETS Sample Locations

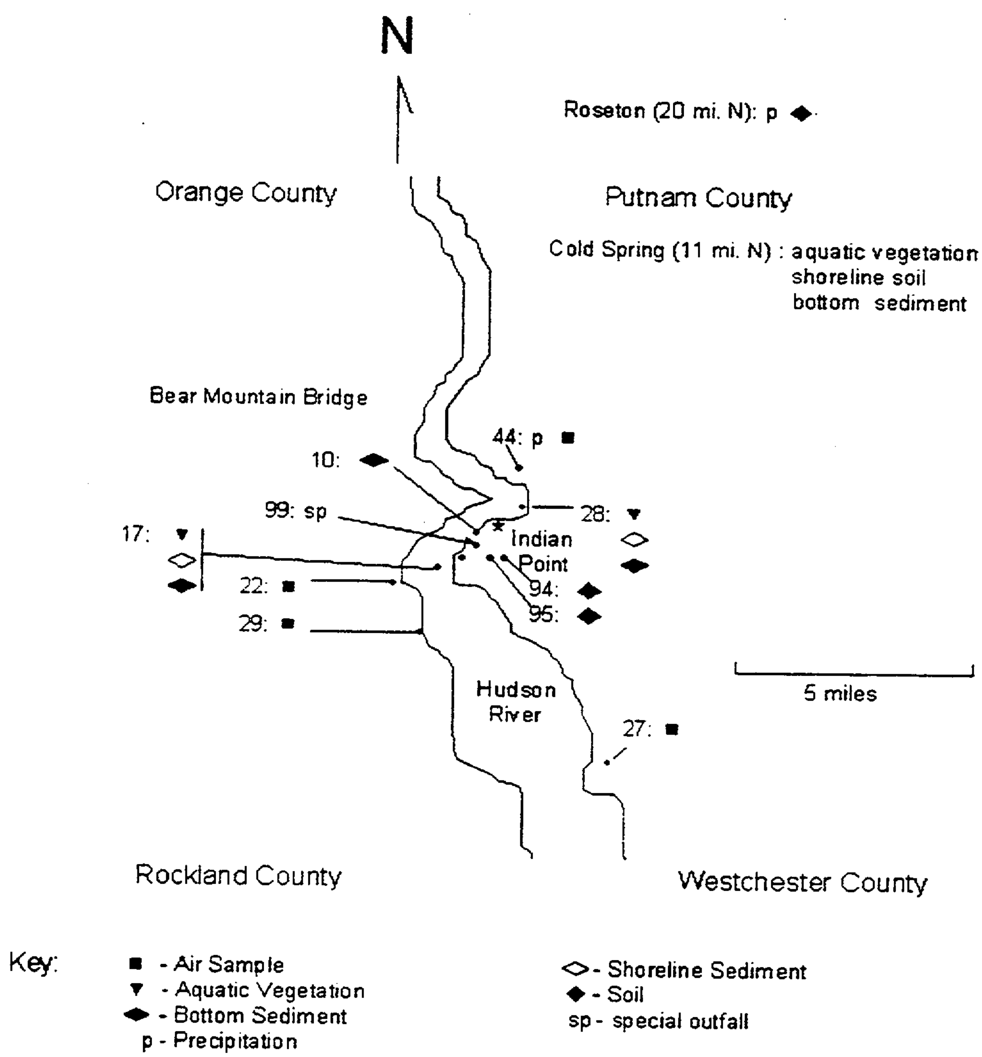


Table A-2
Lower Limit of Detection (LLD) Requirements For Environmental Analysis (a)(b)

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 idenfifiable 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.

(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 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 1999 Annual Radiological Environmental Monitoring Program Summary

The results of the 1999 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 and NRC Regulatory Guide 4.8 (Reference 5). 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, liquid scintillation, and TLD processing. Gamma spectroscopy analysis (GSA) was performed for the following radionuclides; Be-7, K-40, Mn-54, Co-58, Co-60, Fe-59, Zn-65, Zr-95, Ru-103, Ru-106, I-131, Cs-134, Cs-137, Ba-140, Ce-141, Ce-144, Ra-226 and 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 Con Edison RETS and 2.8.A of the NYPA RETS, 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 1999, environmental sampling was performed for six media types required by RETS, five other media types and direct radiation. A total of 1258 samples (1221 RETS and 37 non-RETS) were scheduled. Of the scheduled samples, >98% were collected and analyzed for the program. There were eight samples not reported due to mechanical failures of the samplers or storm access related difficulties. Two TLDs were vandalized, and 3 aquatic vegetation samples were not available. 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 1999, all analytical requirements (e.g., lower limits of detection) were met or exceeded. Thus, no analytical deviations occurred in the 1999 REMP Program.

B.5 Special Reports

All sample results for the 1999 REMP were below the RETS special reporting concentration levels (Table A-3). No special reports to the Nuclear Regulatory Commission were required or submitted.

TABLE B-1
Summary Of Sampling Deviations
1999

MEDIA	TOTAL SCHEDULED SAMPLES	NUMBER OF DEVIATIONS	SAMPLING EFFICIENCY %	REASON FOR DEVIATION
PARTICULATES IN AIR	468	7	99	SEE TABLE B-1a
CHARCOAL FILTER	468	7	99	SEE TABLE B-1a
TLD	160	2	99	SEE TABLE B-1b
HUDSON RIVER WATER	24	0	100	
DRINKING WATER	12	1	92	SEE TABLE B-1b
SHORELINE SOIL	10	0	100	
BROAD LEAF VEGETATION	63	0	100	
FISH & INVERTEBRATES	16	0	100	
SUBTOTALS	1221	17	99	
NON-RETS MEDIA				
AQUATIC VEGETATION	14	3	79	SEE TABLE B-1c
HUDSON RIVER SEDIMENT	8	0	100	
SOIL	3	0	100	
PRECIPITATION	8	0	100	
OUTFALL	4	0	100	
SUBTOTALS	37	3	92	
OVERALL TOTALS	1258	20	98	

TOTAL NUMBER OF ANALYSES REPORTED = 1238

Table B-1a / B-1b/B-1c
1999 sample Deviations

STATION	WEEK	MEDIA	PROBLEM	RESOLUTION / ACTIONS TO PREVENT A RECURRENCE
NYU	6	AIR	VACUUM PUMP FAILED	REPLACED PUMP
LOVETT	34	AIR	LOW SAMPLE VOLUME	AC POWER LOST, RESTORED POWER
U3 TR. BLDG.	37	AIR	LOW SAMPLE VOLUME	REPLACED BLOWN FUSE, RESTORED POWER
LOVETT	38	AIR	LOW SAMPLE VOLUME	AC BREAKER TRIPPED, RESTORED POWER
ALGONQUIN	38	AIR	VACUUM PUMP FAILED	REPLACED SAMPLE PUMP
GRASSY PT. #29	38	AIR	LOSS OF AC POWER	RESTORED POWER AFTER STORM OUTAGE
NYU	44	AIR	LOCAL POWER OUTAGE	POWER RESTORED BY UTILITY
NEW CROTON RESERVOIR	38	DRINKING WATER	NO ACCESS - STORM DAMAGE	ACCESS RESTORED BY PARK SERVICE

Table B-1b

STATION	WEEK	MEDIA	PROBLEM	RESOLUTION/ ACTIONS TO PREVENT A RECURRENCE
DR26	2ND QTR	TLD	TLD MISSING	REPLACED TLD
DR1	3RD QTR	TLD	TLD MISSING	REPLACED TLD

Table B-1c

STATION	WEEK	MEDIA	PROBLEM	RESOLUTION/ ACTIONS TO PREVENT A RECURRENCE
VERPLANK	39	AQUATIC VEG.	SAMPLE UNAVAILABLE	RESAMPLE IN WEEK 40
VERPLANK	40	AQUATIC VEG.	SAMPLE UNAVAILABLE	RESAMPLE IN WEEK 41
VERPLANK	41	AQUATIC VEG.	SAMPLE UNAVAILABLE	NO SAMPLE COLLECTED

TABLE B-2*
ANNUAL SUMMARY - 1999

MEDIUM (UNITS) SEE TABLE	TYPE AND NUMBER OF ANALYSIS	LLD (c)	INDICATOR LOCATIONS: <u>MEAN (a)</u> RANGE	LOCATION (b) OF HIGHEST ANNUAL MEAN: LOCATIONS AND DESIGNATION <u>MEAN (a)</u> RANGE	CONTROL LOCATION: <u>MEAN (a)</u> RANGE	NUMBER OF NONROUTINE REPORTS
DIRECT RADIATION (mR per standard quarter) B-3	158	N/A	*14.9 (158/158) / 9.5 - 20.1*	#76 Gays Hill road North / 1.2 Mi. (270°) DR13 *20.1(4/4) / 18.8-20.9*	*16.0 (4/4)/14.7-18.2*	0
AIR PARTICULATES AND RADIOIODINE (pCi/m^3) B-6, B-7, B-8	GB (467)	0.01	*0.017 (415/416) / 0.009 - 0.037*	#5 NYU Tower / 0.8 Mi (200°) *0.017(51/52) / 0.009-0.037*	*0.016(52/52) / 0.010-0.030*	0
	I-131 (466)	0.07	<LLD	<LLD	<LLD	0
	<u>GSA (36)</u>					
	Cs-134	0.05	<LLD	<LLD	<LLD	0
	Cs-137	0.06	<LLD	<LLD	<LLD	0
SURFACE HUDSON RIVER WATER (pCi/L) B 9, B-10	H-3 (8)	3000	*318 (4/4) / 210-600*	#10 Mixing Zone Discharge Canal (On-site) 318 *(4/4) / 210-600*	#9Hudson River Intake 191 *(1/4) / 191*	0
	<u>GSA (24)</u>					
	Mn-54	15	<LLD	<LLD	<LLD	0
	Co-58	15	<LLD	<LLD	<LLD	0
	Fe-59	30	<LLD	<LLD	<LLD	0
	Co-60	15	<LLD	<LLD	<LLD	0
	Zn-65	30	<LLD	<LLD	<LLD	0
	Zr/Nb-95	15	<LLD	<LLD	<LLD	0
	I-131	15	<LLD	<LLD	<LLD	0
	Cs-134	15	<LLD	<LLD	<LLD	0
	Cs-137	18	<LLD	<LLD	<LLD	0
	Ba/La-140	15	<LLD	<LLD	<LLD	0
DRINKING WATER (pCi/L) B-11, B-12	GB (12)	4	*1.82 (12/12) / 0.63-3.3*	#7 Camp Field Reservior / 3.5 Mi (45°) *1.82 (12/12) / 0.73-3.7*	NONE	0
	H-3 (4)	2000	<LLD	<LLD	NONE	0
	<u>GSA (12)</u>					
	Mn-54	15	<LLD	<LLD	NONE	0
	Co-58	15	<LLD	<LLD	NONE	0
	Fe-59	30	<LLD	<LLD	NONE	0
	Co-60	15	<LLD	<LLD	NONE	0
	Zn-65	30	<LLD	<LLD	NONE	0

TABLE B-2*
ANNUAL SUMMARY - 1999

MEDIUM (UNITS) SEE TABLE	TYPE AND NUMBER OF ANALYSIS	LLD (c)	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	<LLD	<LLD	NONE	0
	I-131	1	<LLD	<LLD	NONE	0
	Cs-134	15	<LLD	<LLD	NONE	0
	Cs-137	18	<LLD	<LLD	NONE	0
	Ba/La-140	15	<LLD	<LLD	NONE	0
SHORELINE SOIL (pCi/kg - dry) B-13	GSA (10)					
	Cs-134	150	46 (1/6)/46-46	#28 Lent's Cove 0.5 Mi. (075°) 46 (1/2) / 46-46	<LLD	0
	Cs-137	180	*200 (3/6) / 97.7 - 236*	#17 Verplanck 1.5 Mi. (202.5°) *231 (2/2) / 236-224.6*	*238 (2/2)/378-97.7*	0
BROADLEAF VEGETATION (pCi/kg - wet) B-14	GSA (63)					
	I-131	60	<LLD	<LLD	<LLD	0
	Co-60	N/A	ND	ND	ND	0
	Cs-134	60	<LLD	<LLD	<LLD	0
	Cs-137	80	<LLD	<LLD	27.2 (1/9)	0
FISH AND INVERTEBRATES (pCi/kg - wet) B-15	GSA (16)					
	Mn-54	130	<LLD	<LLD	<LLD	0
	Co-58	260	<LLD	<LLD	<LLD	0
	Fe-59	130	<LLD	<LLD	<LLD	0
	Co-60	130	<LLD	<LLD	<LLD	0
	Zn-65	260	<LLD	<LLD	<LLD	0
	Cs-134	130	<LLD	<LLD	<LLD	0
	Cs-137	150	<LLD	<LLD	<LLD	0

Table B-2 Notation

1999

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM 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)	=	Required LLD, see Table A-2
GB	=	Gross Beta Analysis.
GSA	=	Gamma Spectral Analysis.

The format of Table B-2, Radiological Environmental Monitoring Program 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 which table contains 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 spectral analysis (GSA), the nuclide Cs-134 and Cs-137 are analyzed for, and there were a total of 10 samples.

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

Table B-2 Notation (Continued)

1998

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY TABLE NOTES

4. The column labeled Indicator Locations gives the results for all the indicator sites. For 1999 shoreline soil samples, Cs-134 was detected in one out of Six. Three out of six samples from indicator locations had Cs-137. The mean of the Cs-137 from the three positive indicator location samples was 200 pCi/kg-dry. The range of the positive samples was 97.7 to 236 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, Verplanck, 1.5 miles from Indian Point at compass direction 202.5 degrees. The mean for this indicator sample site is 231 pCi/kg-dry Cs-137, two samples were taken and both samples were positive. The range of the positive samples at this location was 236 to 224 pCi/kg-dry.

6. Control location column is next. For 1999 only Cs-137 was detected in two out of two samples. The mean was 238 pCi/kg- dry and the range was 378 to 97.7 pCi/kg-dry

7. The right hand column gives the number of non-routine reports that are required because of positive 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

DIRECT RADIATION, TLD DATA FOR 1999

Results in mR per Standard Quarter

Station ID	Sector	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	1999 Average
DR-01	N	16.2	15.8	*	16.1	**16.0**
DR-02	NNE	21.7	23.3	14	20	**19.8**
DR-03	NE	11.5	13.5	12	11.8	**12.2**
DR-04	ENE	13.6	14.2	11.2	12.1	**12.8**
DR-05	ENE	14.3	15.3	13.4	14	**14.3**
DR-06	ENE	14.5	16.3	11.7	13.8	**14.1**
DR-07	SE	14.7	19	15.3	16.8	**16.5**
DR-08	SSE	12.7	13.4	13.4	13.5	**13.3**
DR-09	S	13	16.7	12	13.4	**13.8**
DR-10	SSW	13.9	15.8	12.2	14.5	**14.1**
DR-11	SW	11	11.6	11.5	11.8	**11.5**
DR-12	WSW	17.1	19.8	14.5	16.5	**17.0**
DR-13	WSW	20.1	20.5	18.8	20.9	**20.1**
DR-14	WNW	13.8	15	12.8	13.6	**13.8**
DR-15	NW	13.9	19	12.7	14.2	**15.0**
DR-16	NNW	13.7	18.4	15.5	15.3	**15.7**
DR-17	N	14.5	14.8	13.9	16.5	**14.9**
DR-18	NNE	13.5	15.5	12.2	15.5	**14.2**
DR-19	NE	14.4	16.9	14.2	15.4	**15.2**
DR-20	ENE	13.8	16	14.4	13.5	**14.4**
DR-21	ENE	15.6	14.4	13.7	15.2	**14.7**
DR-22	ESE	11.1	11.8	10.7	12.6	**11.6**
DR-23	SE	13.4	17.1	15	13.4	**14.7**
DR-24	SSE	11.6	15.2	15	14.2	**14.0**
DR-25	S	13.7	*	12.3	12	**12.7**
DR-26	SSW	12.5	13.8	13.2	13.4	**13.2**
DR-27	SW	13.8	14.9	14.1	14.3	**14.3**
DR-28	WSW	14.3	16.7	15.2	14.6	**15.2**
DR-29	W	16.4	21.9	18.3	17.5	**18.5**
DR-30	SNS	15.8	23.8	15.5	16	**17.8**
DR-31	NW	18.5	24.6	18	16.8	**19.5**
DR-32	NNW	12.1	17	13.1	13.7	**14.0**
DR-33	NE	9.5	11.3	8.6	8.4	**9.5**
DR-34	SE	14.3	14.4	13.3	13.1	**13.8**
DR-35	NNE	14.6	18	13.6	15	**15.3**
DR-36	NE	15.1	25.5	15	14.9	**17.6**
DR-37	SSW	13.8	16.2	13.6	14.2	**14.5**
DR-38	S	11.8	14.5	11.3	12.4	**12.5**
DR-39	SSW	16	19.4	16	14.9	**16.6**
DR-40	Control	15.7	18.2	14.7	15.4	**16.0**
DR-41	SSE	15.4	19.4	11	12.1	**14.5**
Average		**14.3**	**17.0**	**13.7**	**14.5**	**14.9**

* Data not available

TABLE B-4

DIRECT RADIATION, AVERAGE TLD DATA FOR 1999
COMPARATIVE RANGES FOR 1992-1998
Results in mR per Standard Quarter

Station ID	Average (1992-1998	Standard Deviation (1992-1998)	Minimum Value (1992 1998)	Maximum Value (1992 1998)	1999 Average
DR-01	14.9	1.3	12.3	17.1	16.0
DR-02	19.2	2.0	13.8	23.3	19.8
DR-03	12.3	1.0	10.3	13.9	12.2
DR-04	13.3	1.2	10.3	15.3	12.8
DR-05	13.9	1.0	11.5	15.6	14.3
DR-06	13.8	1.3	11.2	16.3	14.1
DR-07	15.8	1.7	11.8	19.0	16.5
DR-08	12.8	1.0	10.1	14.2	13.3
DR-09	12.9	1.3	10.6	16.7	13.8
DR-10	13.7	1.4	11.2	16.8	14.1
DR-11	11.5	1.1	9.6	15.6	11.5
DR-12	15.5	1.7	12.7	19.8	17.0
DR-13	18.8	2.1	14.2	24.6	20.1
DR-14	14.0	1.5	11.2	17.4	13.8
DR-15	13.8	1.7	11.2	19.0	15.0
DR-16	14.8	1.6	11.5	18.4	15.7
DR-17	14.2	1.5	11.5	18.0	14.9
DR-18	14.4	1.5	10.9	17.4	14.2
DR-19	15.3	1.4	12.2	18.1	15.2
DR-20	13.9	1.2	11.7	16.8	14.4
DR-21	14.0	1.4	11.2	18.0	14.7
DR-22	12.0	1.3	9.5	15.9	11.6
DR-23	14.3	1.2	11.8	17.1	14.7
DR-24	Relocated to new location in 1999				14.0
DR-25	12.6	1.2	10.0	15.7	12.7
DR-26	13.8	1.1	11.8	16.5	13.2
DR-27	13.9	1.3	11.2	16.8	14.3
DR-28	15.2	1.7	10.8	18.6	15.2
DR-29	17.7	2.1	11.9	21.9	18.5
DR-30	16.9	2.0	13.3	23.8	17.8
DR-31	18.2	2.5	12.2	24.6	19.5
DR-32	13.5	1.3	11.5	17.0	14.0
DR-33	12.7	2.5	8.4	17.8	9.5
DR-34	13.7	1.4	10.9	17.0	13.8
DR-35	14.6	1.5	11.5	18.0	15.3
DR-36	15.5	2.3	12.9	25.5	17.6
DR-37	13.9	1.3	11.9	18.0	14.5
DR-38	12.2	1.4	10.0	15.5	12.5
DR-39	15.7	1.6	12.7	19.4	16.6
DR-40	16.3	1.6	12.7	19.2	16.0
DR-41	13.1	1.2	10.9	15.6	14.5
Average	14.5				14.9

DR 41 was designated as DR 24 in years prior to 1999

* Data not available

TABLE B-5
1999 DIRECT RADIATION TLD DATA
INNER AND OUTER RINGS
Results in mR per Standard Quarter

Inner Ring ID	Outer Ring ID	Inner Ring Annual Average	Outer Ring Annual Average
DR-01	DR-17	16.0	14.9
DR-02	DR-18	19.8	14.2
DR-03	DR-19	12.2	15.2
DR-04	DR-20	12.8	14.4
DR-05	DR-21	14.3	14.7
DR-06	DR-22	14.1	11.6
DR-07	DR-23	16.5	14.7
DR-08	DR-24	13.3	14.0
DR-09	DR-25	13.8	12.7
DR-10	DR-26	14.1	13.2
DR-11	DR-27	11.5	14.3
DR-12	DR-28	17.0	15.2
DR-13	DR-29	20.1	18.5
DR-14	DR-30	13.8	17.8
DR-15	DR-31	15.0	19.5
DR-16	DR-32	15.7	14.0
Average		**15.0**	**14.9**

TABLE B-6

GROSS BETA ACTIVITY IN AIRBORNE PARTICULATE SAMPLES-1999
Results in Units of pCi/m3 ± 1 sigma

STATION #

Week #	End Date	Station #4		Station #5		Station #27		Station #94		Station #95	
1	1/5/99	0.013	± .002	0.012	± .001	0.011	± .002	0.014	± .002	0.015	± .002
2	1/12/99	0.020	± .002	0.018	± .002	0.023	± .002	0.020	± .002	0.020	± .002
3	1/19/99	0.017	± .002	0.018	± .002	0.016	± .001	0.018	± .002	0.018	± .002
4	1/26/99	0.013	± .002	0.011	± .001	0.011	± .001	0.014	± .001	0.012	± .001
5	2/2/99	0.019	± .002	0.019	± .002	0.021	± .002	0.019	± .002	0.018	± .002
6	2/9/99	0.019	± .002	0.018	± .002	0.017	± .002	0.017	± .002	0.018	± .002
7	2/17/99	0.017	± .001	0.017	± .001	0.016	± .001	0.016	± .001	0.016	± .001
8	2/23/99	0.019	± .002	0.017	± .002	0.016	± .002	0.017	± .002	0.014	± .002
9	3/2/99	0.013	± .001	0.015	± .001	0.014	± .001	0.013	± .001	0.016	± .002
10	3/9/99	0.014	± .002	0.012	± .001	0.015	± .001	0.015	± .001	0.012	± .001
11	3/16/99	0.012	± .001	0.009	± .001	0.013	± .001	0.011	± .001	0.011	± .001
12	3/23/99	0.014	± .001	0.012	± .001	0.011	± .001	0.013	± .001	0.014	± .001
13	3/30/99	0.016	± .002	0.015	± .002	0.016	± .001	0.015	± .001	0.015	± .001
14	4/6/99	0.019	± .002	0.015	± .001	0.015	± .001	0.017	± .002	0.016	± .002
15	4/13/99	0.014	± .002	0.012	± .001	0.013	± .001	0.014	± .001	0.012	± .001
16	4/20/99	0.014	± .002	0.013	± .001	0.012	± .001	0.015	± .002	0.015	± .002
17	4/27/99	0.016	± .001	0.014	± .001	0.015	± .001	0.014	± .001	0.015	± .001
18	5/4/99	0.026	± .002	0.018	± .002	0.023	± .002	0.021	± .002	0.020	± .002
19	5/11/99	0.009	± .001	0.012	± .002	0.009	± .001	0.011	± .001	0.012	± .001
20	5/18/99	0.014	± .001	0.012	± .001	0.013	± .001	0.013	± .001	0.015	± .001
21	5/25/99	0.013	± .002	0.015	± .002	0.013	± .001	0.013	± .001	0.012	± .001
22	6/1/99	0.027	± .003	0.025	± .002	0.024	± .002	0.028	± .002	0.027	± .002
23	6/8/99	0.027	± .001	0.027	± .001	0.023	± .001	0.027	± .001	0.025	± .001
24	6/15/99	0.016	± .001	0.014	± .001	0.015	± .001	0.018	± .002	0.014	± .001
25	6/22/99	0.019	± .002	0.020	± .002	0.018	± .002	0.019	± .002	0.016	± .002
26	6/29/99	0.025	± .002	0.024	± .002	0.023	± .002	0.022	± .002	0.020	± .002

TABLE B-6

GROSS BETA ACTIVITY IN AIRBORNE PARTICULATE SAMPLES-1999
Results in Units of pCi/m3 ± 1 sigma

STATION #

WEEK #	END DATE	4		5		27		94		95	
27	7/7/98	0.012	± .001	0.015	± .001	0.013	± .001	0.015	± .002	0.012	± .002
28	7/14/98	0.011	± .001	0.013	± .001	0.012	± .001	0.015	± .001	0.015	± .001
29	7/21/98	0.022	± .002	0.019	± .002	0.018	± .002	0.020	± .002	0.020	± .002
30	7/28/98	0.014	± .002	0.016	± .002	0.017	± .002	0.014	± .002	0.014	± .002
31	8/4/98	0.017	± .002	0.017	± .002	0.019	± .002	0.017	± .002	0.016	± .002
32	8/11/98	0.022	± .002	0.026	± .002	0.020	± .002	0.019	± .002	0.018	± .002
33	8/18/98	0.012	± .002	0.010	± .001	0.014	± .001	0.014	± .002	0.013	± .002
34	8/25/98	0.020	± .002	0.021	± .002	0.020	± .002	0.020	± .002	0.019	± .002
35	9/1/98	0.026	± .002	0.024	± .002	0.019	± .002	0.018	± .002	0.023	± .002
36	9/9/98	0.022	± .001	0.021	± .001	0.022	± .001	0.020	± .001	0.019	± .001
37	9/14/98	0.016	± .002	0.015	± .002	0.017	± .002	0.016	± .002	0.016	± .002
38	9/22/98	0.020	± .002	0.022	± .002	0.020	± .002	0.022	± .002	0.020	± .002
39	9/29/98	0.017	± .002	0.018	± .002	0.019	± .002	0.019	± .002	0.020	± .002
40	10/6/98	0.011	± .001	0.012	± .001	0.012	± .001	0.013	± .001	0.013	± .001
41	10/13/98	0.009	± .001	0.008	± .001	0.005	± .001	0.008	± .001	0.006	± .001
42	10/19/98	0.014	± .002	0.013	± .002	0.013	± .002	0.014	± .002	0.014	± .002
43	10/27/98	0.019	± .002	0.015	± .002	0.016	± .002	0.017	± .002	0.014	± .001
44	11/3/98	0.012	± .002	0.010	± .001	0.009	± .001	0.016	± .003	0.009	± .001
45	11/9/98	0.009	± .001	0.006	± .001	0.007	± .001	0.008	± .001	0.007	± .001
46	11/17/98	0.023	± .002	0.019	± .002	0.023	± .002	0.023	± .002	0.022	± .002
47	11/23/98	0.018	± .002	0.015	± .002	0.016	± .002	0.017	± .002	0.017	± .002
48	12/1/98	0.020	± .002	0.019	± .002	0.017	± .002	0.020	± .002	0.018	± .002
49	12/8/98	0.023	± .002	0.023	± .002	0.022	± .002	0.021	± .002	0.022	± .002
50	12/15/98	0.018	± .002	0.018	± .002	0.017	± .002	0.020	± .002	0.019	± .002
51	12/22/98	0.019	±.002	0.018	±.002	0.020	±.002	0.016	±.002	0.019	±.002
52	12/29/98	0.032	±.002	0.023	±.002	**Note #1**		0.029	±.002	0.028	±.002

Note # 1: No sample collected. See Table B1-a

TABLE B-6

GROSS BETA ACTIVITY IN AIRBORNE PARTICULATE SAMPLES-1999
Results in Units of pCi/m3 ± 1 sigma

STATION #

Week #	End Date	22		23		29		44	
1	1/5/99	0.017	± .002	0.021	± .002	0.017	± .002	0.020	± .002
2	1/12/99	0.017	± .002	0.017	± .002	0.017	± .002	0.019	± .002
3	1/19/99	0.021	± .002	0.019	± .001	0.017	± .001	0.018	± .001
4	1/26/99	0.012	± .002	0.012	± .001	0.012	± .002	0.012	± .002
5	2/2/99	0.020	± .002	0.019	± .002	0.018	± .002	0.017	± .001
6	2/9/99	0.018	± .002	0.015	± .001	0.018	± .002	0.016	± .001
7	2/17/99	0.016	± .001	0.016	± .001	0.017	± .001	0.016	± .001
8	2/23/99	0.018	± .002	0.016	± .002	0.019	± .002	0.016	± .002
9	3/2/99	0.018	± .002	0.018	± .001	0.016	± .001	0.016	± .001
10	3/9/99	0.012	± .001	0.011	± .001	0.011	± .001	0.011	± .001
11	3/16/99	0.013	± .001	0.014	± .001	0.013	± .001	0.011	± .001
12	3/23/99	0.011	± .002	0.012	± .001	0.013	± .001	0.016	± .001
13	3/30/99	0.014	± .002	0.010	± .001	0.012	± .001	0.011	± .001
14	4/6/99	0.017	± .002	0.016	± .001	0.014	± .001	0.018	± .001
15	4/13/99	0.013	± .001	0.011	± .001	0.013	± .001	0.009	± .001
16	4/20/99	0.012	± .001	0.011	± .001	0.014	± .001	0.012	± .001
17	4/27/99	0.011	± .001	0.012	± .001	0.014	± .001	0.012	± .001
18	5/4/99	0.017	± .002	0.015	± .001	0.015	± .002	0.017	± .002
19	5/11/99	0.010	± .001	0.012	± .001	0.010	± .001	0.010	± .001
20	5/18/99	0.011	± .001	0.014	± .001	0.010	± .001	0.013	± .001
21	5/25/99	0.013	± .002	0.010	± .001	0.013	± .001	0.012	± .001
22	6/1/99	0.025	± .002	0.021	± .002	0.023	± .002	0.023	± .002
23	6/8/99	0.021	± .001	0.018	± .001	0.023	± .001	0.022	± .001
24	6/15/99	0.015	± .002	0.014	± .001	0.014	± .001	0.014	± .001
25	6/22/99	0.009	± .001	0.011	± .001	0.012	± .001	0.009	± .001
26	6/29/99	0.019	± .002	0.018	± .002	0.020	± .002	0.017	± .002

Note #1 Sample Point 29 week 18 filter was offset in holder
Note #2 No sample collected. See Table B1-a.

TABLE B-6

GROSS BETA ACTIVITY IN AIRBORNE PARTICULATE SAMPLES-1998
Results in Units of pCi/m3 ± 1 sigma

STATION #

WEEK #	END DATE	22		23		29		44	
27	7/6/99	0.014	± .001	0.015	± .001	0.016	± .001	0.015	± .001
28	7/13/99	0.014	± .001	0.012	± .001	0.014	± .001	0.015	± .001
29	7/20/99	0.023	± .002	0.022	± .002	0.022	± .002	0.022	± .002
30	7/27/99	0.022	± .002	0.016	± .001	0.025	± .002	0.024	± .002
31	8/3/99	0.022	± .002	0.019	± .002	0.024	± .002	0.022	± .002
32	8/10/99	0.014	± .002	0.013	± .001	0.014	± .001	0.024	± .002
33	8/17/99	0.013	±.002	0.013	± .001	0.014	± .001	0.016	±.002
34	8/24/99	0.023	±.005	0.015	± .001	0.015	±.002	0.012	± .001
35	8/31/99	0.019	± .002	0.021	± .002	0.019	± .002	0.020	± .002
36	9/6/99	0.017	±.002	0.016	± .001	0.017	± .001	0.017	± .001
37	9/15/99	0.019	± .002	0.020	± .002	0.020	± .002	0.021	± .002
38	9/21/99	0.026	± .003	0.016	± .001	0.027	±.003	0.019	± .002
39	9/28/99	0.017	± .002	0.018	± .002	0.020	± .003	0.019	± .002
40	10/5/99	0.022	± .002	0.022	± .002	0.023	± .002	0.022	± .002
41	10/12/99	0.015	± .002	0.012	± .001	0.016	± .001	0.016	± .001
42	10/19/99	0.015	± .002	0.010	± .001	0.012	± .002	0.014	± .002
43	10/26/99	0.015	± .002	0.012	± .001	0.014	± .001	0.012	± .001
44	11/2/99	0.030	± .002	0.030	± .002	0.029	± .002	0.027	± .002
45	11/9/99	0.022	± .002	0.021	± .002	0.023	± .002	0.023	± .002
46	11/16/99	0.021	± .002	0.021	± .002	0.022	± .002	0.022	± .002
47	11/23/99	0.018	± .002	0.021	± .002	0.016	± .001	0.017	± .002
48	11/30/99	0.014	± .002	0.011	± .001	0.014	± .001	0.015	± .002
49	12/7/99	0.018	± .002	0.019	± .002	0.018	± .002	0.019	± .002
50	12/14/99	0.021	± .002	0.015	± .001	0.017	± .002	0.016	± .001
51	12/21/99	0.014	± .002	0.014	± .001	0.017	± .002	0.018	± .002
52	12/28/99	0.018	± .002	0.019	± .002	0.020	± .002	0.019	± .002

TABLE B-7

CONCENTRATIONS OF GAMMA EMITTERS IN QUARTERLY COMPOSITES OF AIR PARTICULATE SAMPLES - 1999
Results in Units of 10^{-3} pCi/m^3 ± 1 sigma

#4 ALGONQUIN

Radionuclide	1ST Quarter	2ND Quarter	3RD Quarter	4th Quarter
Be-7*	132.3±10.74	117.1±17.61	44.31±4.73	84.41±7.02
K-40*	45.77±6.62	<4.57	46.78±6.99	<2.61
Mn-54	<0.63	<1.04	<0.55	<0.25
Co-58	<0.84	<0.48	<0.58	<0.6
Fe-59	<2.47	<4.87	<1.03	<1.05
Co-60	<0.23	<0.94	<0.44	<0.26
Zn-65	<1.43	<1.92	<1.2	<0.74
Zr-95	<1.09	<2.02	<0.63	<0.64
Ru-103	<1.49	<1.03	<0.35	<0.56
Ru-106	<6.5	<12.2	<5.74	<2.61
I-131	<14.38	<16.35	<1.12	<2.99
Cs-134	<0.69	<1.34	<0.6	<0.27
Cs-137	<0.47	<0.54	<0.52	<0.22
Ba/La-140	<8.3	<6.61	<0.84	<1.78
Ce-141	<1.57	<2.26	<0.58	<0.84
Ce-144	<2.52	<4.52	<1.86	<1.36
Ra-226*	<8.1	<9.15	<6.65	<4.37
Ac/Th-228*	<1.9	<2.21	<1.55	<0.81

CONCENTRATIONS OF GAMMA EMITTERS IN QUARTERLY COMPOSITES OF AIR PARTICULATE SAMPLES - 1999
Results in Units of 10^{-3} pCi/m^3 ± 1 sigma

#5 NYU

Radionuclide	1ST Quarter	2ND Quarter	3RD Quarter	4th Quarter
Be-7*	89.96±7.92	101.1±11.09	108±15.39	92.04±8.65
K-40*	25.25±5.6	16.8±5.83	<7.1	<4.15
Mn-54	<0.41	<0.7	<0.83	<0.33
Co-58	<0.71	<0.74	<0.64	<0.62
Fe-59	<1.26	<1.85	<2.22	<1.1
Co-60	<0.37	<0.45	<0.82	<0.39
Zn-65	<1.07	<1.8	<2.29	<0.96
Zr-95	<1.15	<1.73	<1.6	<1.28
Ru-103	<1.01	<1.33	<1.39	<0.87
Ru-106	<4.59	<4.94	<4.64	<2.1
I-131	<3.86	<16.44	<10.13	<4.52
Cs-134	<0.49	<0.44	<0.62	<0.32
Cs-137	<0.35	<0.45	<0.7	<0.37
Ba/La-140	<2.35	<6.57	<7.93	<2.32
Ce-141	<1.09	<1.6	<1.94	<0.9
Ce-144	<2.16	<2.65	<2.89	<1.34
Ra-226*	<6.67	<6.19	<9.82	<5.83
Ac/Th-228*	<1.07	<1.05	<3.54	<1.72

*naturally occurring

TABLE B-7

CONCENTRATIONS OF GAMMA EMITTERS IN QUARTERLY COMPOSITES OF AIR PARTICULATE SAMPLES - 1999
Results in Units of 10^{-3} pCi/m^3 ± 1 sigma

#94 TRAINING BUILDING

Radionuclide	1ST Quarter	2ND Quarter	3RD Quarter	4th Quarter
Be-7*	106.7±9.2	152.8±13.32	141.2±18.21	86.04±11.6
K-40*	<2.8	<3.6	31.89±11.57	<6.57
Mn-54	<0.28	<0.35	<0.95	<0.487
Co-58	<0.39	<0.53	<1.04	<0.92
Fe-59	<1.35	<2.28	<2.95	<1.99
Co-60	<0.68	<0.34	<1.22	<1.27
Zn-65	<1.1	<0.80	<2.13	<1.23
Zr-95	<1.19	<1.38	<1.29	<1.59
Ru-103	<0.47	<0.97	<0.8	<0.74
Ru-106	<4.67	<2.28	<13.18	<8.03
I-131	<4.56	<8.85	<11.59	<4.19
Cs-134	<0.41	<0.49	<0.71	<0.311
Cs-137	<0.36	<0.66	<0.8	<0.31
Ba/La-140	<4.35	<5.23	<10.5	<6.5
Ce-141	<0.94	<1.16	<2.03	<0.55
Ce-144	<1.48	<1.64	<3.49	<1.39
Ra-226*	<5.43	<6.03	<12.96	<4.46
Ac/Th-228*	<1.26	<2.04	<2.86	<1.84

CONCENTRATIONS OF GAMMA EMITTERS IN QUARTERLY COMPOSITES OF AIR PARTICULATE SAMPLES - 1999
Results in Units of 10^{-3} pCi/m^3 ± 1 sigma

#95 MET TOWER

Radionuclide	1ST Quarter	2ND Quarter	3RD Quarter	4th Quarter
Be-7*	99.36±9.03	148.3±13.48	127±13.39	91.63±8.01
K-40*	<3.03	<7.43	39.45±8.46	25.95±5.29
Mn-54	<0.44	<0.66	<0.62	<0.37
Co-58	<0.73	<0.77	<1.11	<0.41
Fe-59	<1.56	<1.36	<1.81	<1.94
Co-60	<0.39	<0.6	<0.88	<0.24
Zn-65	<1.2	<0.86	<2.4	<0.97
Zr-95	<0.78	<1.27	<1.3	<0.72
Ru-103	<0.67	<1.05	<1.52	<0.82
Ru-106	<4.08	<4.58	<8.35	<4.33
I-131	<5.31	<13.49	<9.02	<2.78
Cs-134	<0.46	<0.59	<0.85	<0.56
Cs-137	<0.32	<0.47	<0.61	<0.36
Ba/La-140	<4.54	<6.58	<4.59	<2.34
Ce-141	<0.81	<1.6	<1.76	<0.71
Ce-144	<1.52	<2.57	<2.98	<2.31
Ra-226*	<4.56	<8.11	<11.09	<4.05
Ac/Th-228*	<1.44	<1.88	<2.26	<1.37

*naturally occurring

TABLE B-7

CONCENTRATIONS OF GAMMA EMITTERS IN QUARTERLY COMPOSITES OF AIR PARTICULATE SAMPLES - 1999

Results in Units of 10^{-3} pCi/m^3 ± 1 sigma

#22 LOVETT

Radionuclide	1ST Quarter	2ND Quarter	3RD Quarter	4th Quarter
Be-7*	81.32±8.37	132.3±10.74	117.1±17.61	44.31±4.73
K-40*	<4.16	45.77±6.62	31.78±10.78	46.78±6.99
Mn-54	<0.46	<0.63	<1.04	<0.55
Co-58	<0.59	<0.84	<1.15	<0.58
Fe-59	<2.37	<2.47	<4.87	<1.03
Co-60	<0.59	<0.23	<0.94	<0.7
Zn-65	<0.73	<1.43	<1.92	<1.2
Zr-95	<0.97	<1.09	<2.02	<0.63
Ru-103	<0.4	<1.49	<1.03	<0.35
Ru-106	<4.01	<6.5	<12.2	<5.74
I-131	<6.5	<14.38	<16.35	<1.12
Cs-134	<0.45	<0.69	<1.34	<0.6
Cs-137	<0.4	<0.47	<0.54	<0.52
Ba/La-140	<4.13	<8.3	<12.2	<0.84
Ce-141	<0.88	<1.57	<2.26	<0.58
Ce-144	<1.61	<2.52	<4.52	<1.86
Ra-226*	<6.29	<8.1	<9.15	<6.65
Ac/Th-228*	<1.53	<1.9	<2.21	<1.55

CONCENTRATIONS OF GAMMA EMITTERS IN QUARTERLY COMPOSITES OF AIR PARTICULATE SAMPLES - 1999

Results in Units of 10^{-3} pCi/m^3 ± 1 sigma

#23 ROSETON

Radionuclide	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
Be-7*	98.21±9.55	132±10.25	101.1±11.62	62.63±9.44
K-40*	<6.24	36.25±5.57	22.46±5.91	<7.13
Mn-54	<0.47	<0.57	<0.66	<0.427
Co-58	<0.6	<0.57	<0.97	0.611
Fe-59	<2.01	<1.51	<3.73	<1.77
Co-60	<0.29	<0.57	<0.34	<0.91
Zn-65	<1.08	<1.18	<1.47	<1.08
Zr-95	<0.98	<1.54	<1.31	<1
Ru-103	<1.07	<1.42	<1.48	<0.83
Ru-106	<4.76	<3.87	<6.17	<5.75
I-131	<4.72	<12.15	<12.02	<3.47
Cs-134	<0.53	<0.44	<0.64	<0.41
Cs-137	<0.31	<0.45	<0.4	<0.38
Ba/La-140	<2.94	<5.56	<4.19	<7.00
Ce-141	<0.94	<1.38	<1.65	<0.86
Ce-144	<1.59	<2.22	<2.58	<1.3
Ra-226*	<5.5	12.49±5.38	<7.67	<5.75
Ac/Th-228*	<0.91	<1.64	4.62±1.72	<1.81

*naturally occurring

CONCENTRATIONS OF GAMMA EMITTERS IN QUARTERLY COMPOSITES OF AIR PARTICULATE SAMPLES - 1999
Results in Units of 10^{-3} pCi/m^3 ± 1 sigma

#44 PEEKSKILL

Radionuclide	1ST Quarter	2ND Quarter	3RD Quarter	4th Quarter
Be-7*	91.4±9.9	129.9±10.14	115±12.52	99.85±8.57
K-40*	17.45±5.48	41.53±6.23	40.07±9.31	<4.28
Mn-54	<0.46	<0.52	<0.89	<0.44
Co-58	<0.65	<0.68	<0.88	<0.66
Fe-59	<1.52	<1.98	<2.5	<1.22
Co-60	<0.54	<0.47	<0.76	<0.42
Zn-65	<0.94	<1.16	<1.46	<0.86
Zr-95	<0.66	<0.89	<1.63	<0.62
Ru-103	<1.09	<1.34	<1.97	<0.89
Ru-106	<4.02	<5.09	<8.02	<3.26
I-131	<5.73	<14.98	<9.45	<3.39
Cs-134	<0.33	<0.58	<0.77	<0.27
Cs-137	<0.41	<0.42	<0.67	<0.38
Ba/La-140	<5.51	<6.69	<4.66	<3.1
Ce-141	<1.11	<1.32	<1.69	<0.95
Ce-144	<2.41	<2.28	<2.48	<1.35
Ra-226*	<5.91	<7.27	<7.67	<3.83
Ac/Th-228*	<1.17	<1.7	<2.66	<1.16

CONCENTRATIONS OF GAMMA EMITTERS IN QUARTERLY COMPOSITES OF AIR PARTICULATE SAMPLES - 1999
Results in Units of 10^{-3} pCi/m^3 ± 1 sigma

#27 CROTON POINT

Radionuclide	1ST Quarter	2ND Quarter	3RD Quarter	4th Quarter
Be-7*	80.64±9.01	116.5±12.76	116.5±12.76	93.7±8.02
K-40*	<5.66	27.55±6.93	27.55±6.93	29.25±5.37
Mn-54	<0.38	<0.78	<0.78	<0.46
Co-58	<0.44	<1.28	<1.28	<0.47
Fe-59	<1.77	<2.71	<2.71	<1.34
Co-60	<0.38	<0.37	<0.37	<0.46
Zn-65	<0.65	<1.44	<1.44	<1.24
Zr-95	<0.87	<1.74	<1.74	<0.77
Ru-103	<0.74	<0.89	<0.89	<0.81
Ru-106	<4.98	<7.14	<7.14	<4.75
I-131	<3.71	<12.04	<12.04	<5.11
Cs-134	<0.44	<0.59	<0.59	<0.47
Cs-137	<0.38	<0.54	<0.54	<0.36
Ba/La-140	<5.56	<6.14	<6.14	<2.5
Ce-141	<0.73	<1.53	<1.53	<0.88
Ce-144	<1.38	<2.82	<2.82	<2.13
Ra-226*	<5.62	<9.83	<9.83	<6.54
Ac/Th-228*	<1.42	<3.21	<3.21	<1.69

*naturally occurring

TABLE B-7

CONCENTRATIONS OF GAMMA EMITTERS IN QUARTERLY COMPOSITES OF AIR PARTICULATE SAMPLES - 1999
Results in Units of 10^{-3} pCi/m^3 ± 1 sigma

#29 GRASSY POINT

Radionuclide	1ST Quarter	2ND Quarter	3RD Quarter	4th Quarter
Be-7*	112.2±12	143.4±11.15	141.3±17.76	83.17±7.69
K-40*	21.96±7.39	31.47±5.9	<7.72	22.72±4.79
Mn-54	<0.27	<0.53	<1.04	<0.33
Co-58	<0.63	<0.84	<0.71	<0.78
Fe-59	<1.29	<1.58	<2.85	<1.37
Co-60	<1.02	<0.52	<0.89	<0.41
Zn-65	<1.7	<1.17	<2.04	<0.68
Zr-95	<1.1	<1.14	<1.76	<1.1
Ru-103	<1.11	<1.14	<2.39	<0.85
Ru-106	<5.43	<5.13	<10.63	<3.98
I-131	<8.35	<13.37	<7.63	<4.21
Cs-134	<0.49	<0.41	<0.78	<0.3
Cs-137	<0.45	<0.37	<0.44	<0.29
Ba/La-140	<4.6	<3.37	<12.91	<4.2
Ce-141	<1.48	<1.41	<1.53	<0.82
Ce-144	<2.22	<2.14	<2.79	<1.57
Ra-226*	<8.29	<6.61	<8.73	<6.57
Ac/Th-228*	<2.41	1.74±1.05	<3.85	<1.21

*naturally occurring

I-131 ACTIVITY IN CHARCOAL CARTRIDGE SAMPLES -1999*
Results in Units of pCi/m3 ± 1 sigma

Week #	End Date	4	5	27	94	95	22	23	29	44
1	1/5/99	< 0.0150	< 0.0132	< 0.0141	< 0.0206	< 0.0158	< 0.0142	< 0.0139	< 0.0118	< 0.0112
2	1/12/99	< 0.0182	< 0.0131	< 0.0114	< 0.0134	< 0.0163	< 0.0185	< 0.0181	< 0.0101	< 0.0143
3	1/19/99	< 0.0174	< 0.0144	< 0.0142	< 0.0161	< 0.0141	< 0.0115	< 0.0208	< 0.0173	< 0.0152
4	1/26/99	<0.0187	<0.0106	<0.0180	<0.0153	<0.0158	<0.0189	<0.0253	<0.0245	<0.0167
5	2/2/99	<0.0168	<0.0135	<0.0176	<0.0129	<0.0193	<0.0252	<0.0228	<0.0178	<0.0182
6	2/9/99	<0.0152	<0.0126	<0.0140	<0.0147	<0.0132	<0.0215	<0.0145	<0.0146	<0.0142
7	2/17/99	<0.0136	<0.0197	<0.0157	<0.0157	<0.0131	<0.0241	<0.0166	<0.0192	<0.0182
8	2/23/99	<0.0250	<0.0222	<0.0177	<0.0152	<0.0208	<0.0187	<0.0178	<0.0158	<0.0185
9	3/2/99	<0.0082	<0.0141	<0.0141	<0.0169	<0.0150	<0.0216	<0.0157	<0.0179	<0.0113
10	3/9/99	<0.0146	<0.0164	<0.0141	<0.0173	<0.0133	<0.0126	<0.0130	<0.0161	<0.0169
11	3/16/99	<0.0195	<0.0135	<0.0139	<0.0163	<0.0166	<0.0206	<0.0163	<0.0192	<0.0137
12	3/23/99	<0.0162	<0.0129	<0.0170	<0.0155	<0.0121	<0.0150	<0.0179	<0.0194	<0.0113
13	3/30/99	<0.0106	<0.0137	<0.0134	<0.0186	<0.0159	<0.0186	<0.0119	<0.0179	<0.0162
14	4/6/99	<0.0146	<0.0134	<0.0116	<0.0191	<0.0115	<0.0206	<0.0188	<0.0237	<0.0139
15	4/13/99	<0.0144	<0.0199	<0.0142	<0.0195	<0.0140	<0.0196	<0.0248	<0.0171	<0.0155
16	4/20/99	<0.0170	<0.0087	<0.0223	<0.0168	<0.0093	<0.0169	<0.0225	<0.0155	<0.0171
17	4/27/99	<0.0173	<0.0142	<0.0137	<0.0171	<0.0150	<0.0190	<0.0175	<0.0162	<0.0137
18	5/4/99	<0.0161	<0.0138	<0.0134	<0.0133	<0.0249	<0.0156	<0.0193	<0.0254	<0.0204
19	5/11/99	<0.0154	<0.0217	<0.0209	<0.0199	<0.0161	<0.0130	<0.0166	<0.0216	<0.0180
20	5/18/99	<0.0121	<0.0102	<0.0168	<0.0178	<0.0146	<0.0158	<0.0142	<0.0165	<0.0146
21	5/25/99	<0.0241	<0.0169	<0.0170	<0.0124	<0.0139	<0.0160	<0.0219	<0.0168	<0.0192
22	6/1/99	<0.0338	<0.0140	<0.0215	<0.0179	<0.0166	<0.0243	<0.0132	<0.0137	<0.0158
23	6/8/99	<0.0168	<0.0182	<0.0177	<0.0139	<0.0157	<0.0230	<0.0211	<0.0191	<0.0184
24	6/15/99	<0.0137	<0.0157	<0.0157	<0.0117	<0.0176	<0.0195	<0.0127	<0.0169	<0.0187
25	6/22/99	<0.0128	<0.0153	<0.0155	<0.0171	<0.0163	<0.0274	<0.0125	<0.0226	<0.0126
26	6/29/99	<0.0157	<0.0156	<0.0153	<0.0149	<0.0167	<0.0177	<0.0208	<0.0168	<0.0175

* "less than" values expressed as LLD

TABLE B-8

I-131 ACTIVITY IN CHARCOAL CARTRIDGE SAMPLES -1999*
Results in Units of pCi/m3 ± 1 sigma

Week #	End Date	4	5	27	94	95	22	23	29	44
27	7/6/99	<0.0190	<0.0201	<0.0162	<0.0196	<0.0158	<0.0236	<0.0217	<0.0159	<0.0223
28	7/13/99	<0.0216	<0.0178	<0.0096	<0.0207	<0.0211	<0.0214	<0.0273	<0.0264	<0.0192
29	7/20/99	<0.0119	<0.0089	<0.0193	<0.0222	<0.0137	<0.0225	<0.0183	<0.0204	<0.0245
30	7/27/99	<0.0195	<0.0098	<0.0131	<0.0210	<0.0128	<0.0210	<0.0115	<0.0191	<0.0154
31	8/3/99	<0.0132	<0.0155	<0.0195	<0.0143	<0.0167	<0.0139	<0.0115	<0.0202	<0.0115
32	8/10/99	<0.0104	<0.0156	<0.0198	<0.0169	<0.0125	<0.0132	<0.0171	<0.0150	<0.0181
33	8/17/99	<0.0203	<0.0192	<0.0106	<0.0221	<0.0158	<0.0207	<0.0185	<0.0197	<0.0137
34	8/24/99	<0.0139	<0.0169	<0.0138	<0.0143	<0.0239	<0.0474	<0.0143	<0.0217	<0.0091
35	8/31/99	< 0.0139	< 0.0186	< 0.0145	< 0.0145	< 0.0147	< 0.0178	< 0.0123	< 0.0160	< 0.0128
36	9/6/99	<0.0137	<0.0184	<0.0144	<0.0154	<0.0184	<0.0234	<0.0125	<0.0143	<0.0131
37	9/15/99	< 0.0173	< 0.0148	< 0.0174	< 0.0259	< 0.0150	< 0.0253	< 0.0186	< 0.0226	< 0.0164
38	9/21/99	< 0.0192	< 0.0118	< 0.0121	< 0.0378	< 0.019	< 0.0413	< 00193	<0.0307	< 0.0247
39	9/28/99	< 0.0115	< 0.0143	< 0.0184	< 0.0174	< 0.0165	< 0.0262	< 0.0183	< 0.0435	< 0.0191
40	10/5/99	< 0.0146	< 0.0165	< 0.0184	< 0.015	< 0.0168	< 0.0238	< 0.0172	< 0.0155	< 0.0154
41	10/12/99	< 0.0158	< 0.0219	< 0.0263	< 0.0271	< 0.0239	< 0.0227	< 0.0181	< 0.0223	< 0.0254
42	10/19/99	< 0.0116	< 0.0206	< 0.0155	< 0.0144	< 0.0214	< 0.0275	< 0.015	< 0.0214	< 0.0192
43	10/26/99	< 0.0141	< 0.0166	< 0.0129	< 0.0181	< 0.0149	< 0.0144	< 0.0159	< 0.0203	< 0.0119
44	11/2/99	< 0.0154	Note #1	< 0.0186	< 0.0201	< 0.0156	< 0.028	< 0.0235	< 0.0168	< 0.0178
45	11/9/99	< 0.0161	< 0.0419	< 0.0118	< 0.0131	< 0.0168	< 0.0173	< 0.0129	< 0.0213	< 0.0188
46	11/16/99	< 0.0127	< 0.017	< 0.0137	< 0.0127	< 0.0215	< 0.0234	< 0.0237	< 0.0125	< 0.0191
47	11/23/99	< 0.0134	< 0.0213	< 0.015	< 0.0182	< 0.016	< 0.0201	< 0.0189	< 0.0209	< 0.0154
48	11/30/99	< 0.0106	< 0.0135	< 0.016	< 0.018	< 0.0235	< 0.0166	< 0.0166	< 0.0194	< 0.0163
49	12/7/99	< 0.0124	< 0.0167	< 0.0158	< 0.0172	< 0.0123	< 0.0211	< 0.024	< 0.0161	< 0.0182
50	12/14/99	< 0.0148	< 0.0218	< 0.019	< 0.0232	< 0.0154	< 0.0243	< 0.0145	< 0.0254	< 0.0284
51	12/21/99	< 0.0125	< 0.0108	< 0.0125	< 0.0216	< 0.0172	< 0.0164	< 0.0139	< 0.0178	< 0.0175
52	12/28/99	< 0.0104	< 0.0162	< 0.0186	< 0.0105	< 0.0134	< 0.0165	< 0.0172	< 0.0145	< 0.0191

*** "less than" values expressed as LLD**

note #1 : No sample collected. See Table B1-a

TABLE B-9

CONCENTRATIONS OF GAMMA EMITTERS IN HUDSON RIVER WATER SAMPLES-1999
Results in Units of pCi/L ± 1 sigma

#9 HUDSON RIVER INLET

Radionuclide	January	February	March	April	May	June
Be-7*	<11.1	<12.1	<10.64	<11.7	<11.54	<8.83
K-40*	213±14.1	40.4±9.90	<12.85	239.2±14.26	230.5±13.86	48.31±6.41
Mn-54	<1.08	<1.25	<1.26	<1.14	<1.15	<0.81
Co-58	<1.25	<1.60	<1.46	<1.33	<1.35	<1.11
Fe-59	<2.95	<3.74	<2.97	<2.67	<2.62	<1.78
Co-60	<1.19	<1.03	<1.14	<1.26	<1.1	<0.75
Zn-65	<2.31	<3.56	<2.66	<2.57	<2.38	<1.9
Zr-95	<2.58	<2.85	<2.51	<2.58	<2.23	<1.59
Nb-95	<1.75	<2.06	<1.94	<1.53	<1.58	<1.37
Ru-103	<1.69	<2.22	<1.75	<1.67	<1.55	<0.84
Ru-106	<11.0	<15.5	<12.83	<11.18	<12.07	<7.81
I-131	<4.55	<5.76	<5.86	<4.5	<4.43	<7.16
Cs-134	<0.977	<1.51	<0.7	<0.58	<1.11	<0.77
Cs-137	<1.15	<1.24	<1.2	<1.11	<1.14	<0.75
Ba/La-140	<2.76	<4.35	<4.8	<3.19	<3.38	<4.65
Ce-141	<2.36	<2.90	<2.5	<2.36	<2.31	<2.09
Ce-144	<7.09	<8.60	<7.71	<7.37	<7.25	<5.21
Ra-226*	94.5±19.2	78.1±16.6	69.23±12.57	122.2±18.13	99.62±16.72	62.34±8.82
Ac/Th-228*	8.07±2.75	7.79±3.23	<3.99	<3.92	5.95±2.16	8.42±2.64

CONCENTRATIONS OF GAMMA EMITTERS IN HUDSON RIVER WATER SAMPLES-1999
Results in Units of pCi/L ± 1 sigma

#10 HUDSON RIVER DISCHARGE

Radionuclide	January	February	March	April	May	June
Be-7*	<7.36	<8.44	<5.47	<12.59	<13.01	<6.76
K-40*	266±8.45	46.6±9.20	49.29±5.64	244±15.48	180.8±14.38	284.2±7.93
Mn-54	<0.624	<1.04	<0.69	<1.36	<1.34	<0.64
Co-58	<0.725	<1.11	<0.68	<1.35	<1.72	<0.86
Fe-59	<1.73	<2.62	<1.68	<3.09	<3.65	<1.68
Co-60	<0.572	<1.26	<0.73	<1.39	<1.54	<0.61
Zn-65	<1.11	<2.23	<1.64	<3.35	<3.49	<0.8
Zr-95	<1.32	<2.10	<1.27	<2.45	<3.22	<1.42
Nb-95	<0.929	<1.20	<0.85	<1.68	<2.07	<1.01
Ru-103	<1.00	<1.33	<0.82	<1.68	<1.93	<0.65
Ru-106	<6.41	<10.6	<6.48	<12.99	<15.02	<6.31
I-131	<2.89	<3.65	<2.67	<5.71	<6.08	<6.09
Cs-134	<0.570	<1.02	<0.34	<0.75	<1.32	<0.37
Cs-137	<0.582	<0.895	<0.55	<1.21	<1.44	<0.63
Ba/La-140	<1.85	<3.49	<2.99	<4.33	<5.4	<3.15
Ce-141	<1.78	<2.42	<1.56	<3.28	<3.06	<1.99
Ce-144	<5.51	<7.48	<5	<9.94	<9.57	<5.24
Ra-226*	101±11.9	58.0±13.8	46.91±7.3	85.92±16.23	51.58±17.63	88±10.23
Ac/Th-228*	11.4±1.75	<3.76	<2.28	5.06±3.23	<5.17	13.3±1.58

*naturally occurring

TABLE B-9

CONCENTRATIONS OF GAMMA EMITTERS IN HUDSON RIVER WATER SAMPLES-1999
Results in Units of pCi/L ± 1 sigma

#9 HUDSON RIVER INLET

Radionuclide	July	August	September	October	November	December
Be-7*	<6.81	<6.84	<6.53	<17.7	<9.1	<9.83
K-40*	95.6±6.68	131±7.67	279.8±8.49	245.1±22.41	217.4±10.74	180.4±10.18
Mn-54	<0.68	<0.74	<0.69	<1.98	<0.99	<0.89
Co-58	<0.79	<0.9	<0.81	<1.71	<1.08	<1.07
Fe-59	<1.79	<1.85	<1.63	<4.19	<2.31	<2.44
Co-60	<0.75	<0.75	<0.63	<1.84	<0.86	<0.94
Zn-65	<1.53	<1.56	<1.41	<3.41	<2.12	<1.91
Zr-95	<1.39	<1.34	<1.28	<3.4	<1.8	<1.88
Nb-95	<0.92	<0.96	<0.88	<2.45	<1.2	<1.36
Ru-103	<0.99	<0.98	<0.59	<2.55	<1.26	<1.43
Ru-106	<7.5	<7.85	<7.02	<19	<9.37	<9.07
I-131	<2.78	<3.12	<3.39	<7.39	<3.36	<5.27
Cs-134	<0.65	<0.68	<0.66	<1.69	<0.83	<0.85
Cs-137	<0.61	<0.66	<0.63	<1.91	<0.87	<0.82
Ba/La-140	<2.16	<2.49	<2.21	<6.69	<2.78	<3.68
Ce-141	<1.57	<1.5	<1.58	<4.4	<2.23	<2.48
Ce-144	<4.24	<4.46	<4.89	<14.64	<6.88	<6.83
Ra-226*	66.74±9.29	62.89±9.1	82.73±10.27	98.07±30.21	52.06±11.03	61.3±11.55
Ac/Th-228*	<2.26	<2.43	13.56±1.64	12.04±4.58	3.85±1.59	<2.78

CONCENTRATIONS OF GAMMA EMITTERS IN HUDSON RIVER WATER SAMPLES-1999
Results in Units of pCi/L ± 1 sigma

#10 HUDSON RIVER DISCHARGE

Radionuclide	July	August	September	October	November	December
Be-7*	<7.99	<9.58	<7.37	<9.9	<11.38	<10.29
K-40*	59.61±8.22	248.6±11.59	238.6±10.67	247.5±12.67	251.1±14.41	306.2±12.65
Mn-54	<0.89	<0.92	<0.72	<1.09	<1.13	<1.01
Co-58	<0.9	<1.15	<0.87	<1.31	<1.16	<1.28
Fe-59	<2.3	<2.44	<2.12	<2.71	<3.18	<2.47
Co-60	<0.82	<0.97	<0.86	<0.94	<1.2	<0.98
Zn-65	<2.1	<2.3	<1.73	<1.45	<2.51	<1.29
Zr-95	<1.59	<1.83	<1.66	<2.07	<2.08	<2.15
Nb-95	<1.22	<1.32	<1.18	<1.41	<1.53	<1.43
Ru-103	<0.79	<0.85	<1.11	<1.39	<1.56	<1.53
Ru-106	<9.46	<9.65	<8	<11.63	<11.95	<10.58
I-131	<3.48	<4.27	<3.19	<4.46	<4.69	<7
Cs-134	<0.84	<0.91	<0.7	<1.03	<1.08	<0.61
Cs-137	<0.8	<0.84	<0.7	<1.03	<1.11	<0.98
Ba/La-140	<2.92	<3.5	<2.81	<3.01	<3.25	<3.39
Ce-141	<1.88	<2.25	2.29±0.86	<2.48	<2.74	<2.75
Ce-144	<5.93	<6.6	<5.67	<7.91	<8.95	<8
Ra-226*	51.58±8.97	42.18±8.71	92.24±11.17	99.07±17.55	72.15±15.36	76.17±13.78
Ac/Th-228*	5.15±1.8	5.31±1.94	4.11±1.38	15.13±2.58	7.87±2.2	14.5±2.31

*naturally occurring

TABLE B-10

CONCENTRATION OF TRITIUM IN HUDSON RIVER WATER SAMPLES-1999
(QUARTERLY COMPOSITES)
Results in Units of pCi/L ± 1 sigma

#9 HUDSON RIVER INLET

Radionuclide	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
TRITIUM	<170	<160	<270	190.5 ± 98

#10 HUDSON RIVER DISCHARGE

Radionuclide	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
TRITIUM	210±110	260±100	600 ± 180	201±88

Note: "less than" values are expressed as LLD

TABLE B-11

GROSS BETA ACTIVITY AND CONCENTRATIONS OF GAMMA EMITTERS IN DRINKING WATER SAMPLES - 1999
Results in Units of pCi/L ± 1 sigma
CAMP FIELD RESERVOIR

Radionuclide	January	February	March	April	May	June
Gross Beta	1.82	3.29	1.59	0.629	1.08±0.37	2.78±0.47
Be-7*	<16.3	<23.3	<15.12	<17.06	<11.02	<13.13
K-40*	<17.8	148±30.4	316.6±23.31	<21.77	41.66±12.57	226±20.95
Mn-54	<1.98	<3.10	<1.81	<2.12	<1.47	<1.82
Co-58	<2.20	<2.50	<1.73	<2.25	<1.78	<1.87
Fe-59	<5.26	<6.72	<3.08	<4.06	<3.47	<3.13
Co-60	<2.94	<3.31	<1.92	<2.41	<2.04	<1.53
Zn-65	<4.82	<5.60	<3.93	<5.15	<4.77	<3.85
Zr-95	<3.63	<5.24	<3.27	<2.84	<2.42	<2.72
Nb-95	<2.42	<2.24	<1.9	<2.53	<1.51	<1.73
Ru-103	<2.42	<3.09	<1.97	<2.05	<1.56	<1.7
Ru-106	<23.0	<27.2	<15.85	<21.46	<16.17	<19.51
I-131	<0.294	<0.274	<0.2	<0.22	<0.19	<0.23
Cs-134	<2.13	<2.66	<0.97	<2.23	<1.72	<1.61
Cs-137	<1.79	<3.23	<1.99	<2.24	<1.59	<1.52
Ba/La-140	<3.00	<2.67	<1.98	<3.98	<2.38	<2.06
Ce-141	<2.65	<4.51	<3.09	<3.3	<2.66	<3.24
Ce-144	<11.4	<16.3	<13.94	<14.54	<12.64	<14.32
Ra-226*	77.4±36.4	81.7±45.4	63.64±27.87	72.34±29.15	65.17±19.25	99.85±25.03
Ac/Th-228*	<7.05	<8.37	13.45±4.08	<6.37	<4.98	7.53±2.87

GROSS BETA ACTIVITY AND CONCENTRATIONS OF GAMMA EMITTERS IN DRINKING WATER SAMPLES - 1999
Results in Units of pCi/L ± 1 sigma
CAMP FIELD RESERVOIR

Radionuclide	July	August	September	October	November	December
Gross Beta	0.914±0.44	2.47±0.43	2.87±0.48	2.88±0.47	1.031 ± 0.39	2.30±0.25
Be-7*	<17.44	<16.07	<14.69	<13.29	<24.36	<26.65
K-40*	23.92±12.14	<23.28	262.8±22.83	220.5±17.08	173.7±37.36	264.9±39.25
Mn-54	<1.22	<2.39	<1.89	<1.84	<3.17	<1.99
Co-58	<1.81	<1.64	<1.8	<1.74	<3.85	<3.29
Fe-59	<3.59	<3.32	<3.5	<3.29	<9.11	<7.8
Co-60	<2.41	<2.64	<1.68	<1.55	<4.61	<3.53
Zn-65	<6.98	<4.93	<4.28	<2.07	<9.38	<6.48
Zr-95	<3.64	<3.83	<2.95	<2.64	<4.58	<5.2
Nb-95	<1.98	<2.18	<1.72	<1	<4.41	<3.56
Ru-103	<1.5	<2.64	<1.71	<1.61	<3.22	<3.31
Ru-106	<20.08	<18.59	<17.58	<16.64	<26.98	<29.25
I-131	<0.31	<0.190	<0.177	<0.326	<0.236	0.377
Cs-134	<1.8	<2.18	<1.06	<1.46	<2.89	<3.57
Cs-137	<2.31	<1.96	<1.79	<1.83	<3.63	<2.25
Ba/La-140	<3.17	<2.94	<2.01	<1.98	<5.6	<5.78
Ce-141	<3.22	<3.11	<2.79	<2.69	<4.62	<5.96
Ce-144	<13.82	<14.44	<12.92	<11.99	<20.55	<19.93
Ra-226*	111.3±32.02	83.97±35.95	75.03±17.8	96.11±22.52	<67.2	<69.75
Ac/Th-228*	<7.05	<7.66	10.44±4.08	12.59±2.93	<13.82	<10.68

*naturally occurring

TABLE B-12

CONCENTRATION OF TRITIUM IN DRINKING WATER SAMPLES-1999
(QUARTERLY COMPOSITES)
Results in Units of pCi/L ± 1 sigma

CAMP FIELD RESERVOIR

Radionuclide	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
TRITIUM	<170	<170	<240	<180

Note: "less than" values are expressed as LLD

TABLE B-14

CONCENTRATIONS OF GAMMA EMITTERS IN BROADLEAF VEGETATION - 1999
Results in Units of pCi/Kg (wet) ± 1 sigma

#23 Roseton**

April-99

Radionuclide	THISTLE	RAGWEED	SORREL
Be-7*	541.5±51.22	1892±86.83	1645±53.88
K-40*	9369±253.5	11250±299.6	4340±121.8
Mn-54	<8.57	<9.25	<5.28
Co-58	<9.23	<11.33	<5.09
Fe-59	<23.59	<26.81	<11.92
Co-60	<9.42	<10.87	<5.64
Zn-65	<25.65	<29.17	<12.92
Zr-95	<14.9	<18.73	<8.48
Ru-103	<8.87	<10	<4.5
Ru-106	<84.26	<101.6	<48.2
I-131	<14.3	<17.73	<9.66
Cs-134	<8.01	<8.79	<5
Cs-137	<9.03	<9.27	<5.04
Ba/La-140	<14.28	<18 1	<8.26
Ce-141	<9.4	<12 53	<6.29
Ce-144	<35.43	<46 02	<23.98
Ra-226*	455.7±72.34	501±100.6	212.5±45.17
Ac/Th-228*	44.27±16.11	45 27±19.87	32.43±11.99

May-99

Radionuclide	Sorrel	Clover	Grape Leaves
Be-7*	984.2±68.3	167.4±25.28	110.2±31.01
K-40*	6264±235.2	3676±112.7	3261±145.1
Mn-54	<10.46	<4.6	<7.43
Co-58	<10.88	<5.02	<7.45
Fe-59	<22.22	<10.44	<14.36
Co-60	<12	<5.86	<7.44
Zn-65	<26.55	<11.14	<17.38
Zr-95	<17.79	<8.08	<10.62
Ru-103	<8.3	<4.24	<6.08
Ru-106	<102.4	<50.56	<72.85
I-131	<9.92	<5.04	<7.15
Cs-134	<8.92	<4.96	<6.34
Cs-137	<10.17	<4.32	<7.04
Ba/La-140	<13.41	<6.73	<7.12
Ce-141	<10.86	<4.8	<6.65
Ce-144	<47.2	<22.28	<29
Ra-226*	542.7±109.8	257.4±51.79	261.2±61.23
Ac/Th-228*	110.6±26.58	<16.63	<26.83

June-99

Radionuclide	CLOVER	SORREL	REEDS
Be-7*	302.3±43	476 1±105.5	<85.57
K-40*	6994±217.9	<222.1	13330±274.8
Mn-54	<7.6	<14.27	<12.46
Co-58	<8.9	<16 59	<12.15
Fe-59	<18.59	<36 66	<22.96
Co-60	<8.24	<18 07	<12.24
Zn-65	<24.19	<37 92	<28.09
Zr-95	<10.98	<27.96	<18.87
Ru-103	<8.11	<14 45	<10.48
Ru-106	<82.47	<166.2	<120.5
I-131	<7.75	<14 49	<13.45
Cs-134	<7.46	<14.1	<11.52
Cs-137	<8.08	<17.46	<11.32
Ba/La-140	<8.32	<30.32	<14.19
Ce-141	<7.92	<11.95	<15.23
Ce-144	<31.76	<48.75	<64.29
Ra-226*	386.4±74.87	893.7±187.8	934.7±123.7
Ac/Th-228*	<29.65	<65.11	173.6±26.64

July-99

Radionuclide	REEDS	CATALPA	GRAPE LEAVES
Be-7*	249.3±68.58	507.7±53.77	750.3±61.29
K-40*	8450±330.5	4056±180.8	5163±189.9
Mn-54	<14.2	<8.45	<8.36
Co-58	<14.01	<7.96	<9.34
Fe-59	<29.73	<19.28	<18.85
Co-60	<18.11	<11.08	<9.55
Zn-65	<41.18	<23.13	<19.54
Zr-95	<23.71	<14.42	<14.36
Ru-103	<12.73	<8.14	<9.13
Ru-106	<143.7	<94.92	<96.33
I-131	<16.34	<11	<12.78
Cs-134	<13.41	<9.1	<9.44
Cs-137	<13.92	<9.21	<9.39
Ba/La-140	<22.52	<15.7	<11.51
Ce-141	<14.2	<12.03	<10.88
Ce-144	<58.46	<47.82	<37.02
Ra-226*	503.2±124.7	425.5±94.29	946.8±115.3
Ac/Th-228*	<51.16	<28.73	<38.32

* Indicates naturally occurring
** Indicates control location

TABLE B-14

CONCENTRATIONS OF GAMMA EMITTERS IN BROADLEAF VEGETATION - 1999
Results in Units of pCi/Kg (wet) ± 1 sigma

#23 Roseton**

August-99

Radionuclide	Reeds	Grape Leaves	Ragweed
Be-7*	305.8±49.38	563.7±44.55	1397±62.74
K-40*	7593±244.7	4546±162.3	8740±206.2
Mn-54	<11.03	<7.01	<7.65
Co-58	<10.54	<6.89	<7.25
Fe-59	<22.33	<16.81	<15.18
Co-60	<11.29	<8.07	<7.02
Zn-65	<26.01	<16.79	<16.96
Zr-95	<18.21	<12.45	<13.15
Ru-103	<10.36	<6.55	<6.53
Ru-106	<113.4	<70.63	<75.47
I-131	<12.05	<7.91	<9.27
Cs-134	<11.55	<7.07	<6.73
Cs-137	<9.35	<6.6	<7.67
Ba/La-140	<12.71	<10.3	<9.94
Ce-141	<11.6	<8.77	<8.3
Ce-144	<43.41	<35.8	<29.2
Ra-226*	633.1±103.2	248.9±119.5	616.1±83.7
Ac/Th-228*	<36.52	46.56±19.7	<28.69

September-99

Radionuclide	Sorrel	Ragweed	Grape Leaves
Be-7*	2949±110.1	1571±81.16	717.3±60.21
K-40*	6956±219.2	8306±256.3	4598±159.5
Mn-54	<9.66	<9.04	<8.16
Co-58	<10.56	<9.39	<8.04
Fe-59	<21.92	<22.73	<18.39
Co-60	<10.24	<9.72	<8.31
Zn-65	<23.71	<24.28	<19.04
Zr-95	<18.46	<15.63	<14.54
Ru-103	<11.25	<9.5	<9.71
Ru-106	<98.6	<96.74	<75.22
I-131	<28.4	<21.28	<17.97
Cs-134	<9.28	<9.27	<6.95
Cs-137	<8.94	<8.7	<6.84
Ba/La-140	<21.77	<17.9	<17.11
Ce-141	<13.56	<14.17	<11.13
Ce-144	<45	<49.46	<36.05
Ra-226*	988±118.9	365.6±95.95	772±101.7
Ac/Th-228*	99.32±21.42	<37.15	77.31±23.65

October-99

Radionuclide	SORREL	GRAPE LEAVES	RAGWEED
Be-7*	1745±67.09	760.5±68.5	1774±51.25
K-40*	9104±173.4	4623±193.7	8157±149.7
Mn-54	<8.27	<10.3	<6.11
Co-58	<8.83	<9.7	<5.75
Fe-59	<19.32	<18.74	<13.24
Co-60	<7.15	<11.27	<5.94
Zn-65	<10.96	<22.68	<13.84
Zr-95	<14.29	<15.93	<10.08
Ru-103	<8.58	<9.89	<5.23
Ru-106	<81.45	<110.6	<62.25
I-131	<26.12	<12.2	<7.95
Cs-134	<7.67	<10.34	<5.83
Cs-137	27.2±4.88	<11.26	<5.69
Ba/La-140	<17.48	<15.38	<6.48
Ce-141	<12.26	<11.86	<7.29
Ce-144	<42.26	<48.98	<30.7
Ra-226*	823.9±98.85	951.9±129.8	491.5±72.86
Ac/Th-228*	174.6±20.15	<33.68	68.86±13.89

* Indicates naturally occurring
** Indicates control location

TABLE B-14

CONCENTRATIONS OF GAMMA EMITTERS IN BROADLEAF VEGETATION - 1999
Results in Units of pCi/Kg (wet) ± 1 sigma

#94 Unit 3 Training Building

April-99

Radionuclide	MOTHERWORT	RAGWEED	SORREL
Be-7*	134.8±30.62	507.8±37.1	2241±98.95
K-40*	4812±162.1	6366±176.1	7283±269.1
Mn-54	<6.55	<6.6	<12.18
Co-58	<7.2	<5.29	<10.74
Fe-59	<14.41	<13.25	<23.37
Co-60	<7.71	<7.33	<12.53
Zn-65	<19.63	<17.08	<28.43
Zr-95	<10.51	<10.4	<20.71
Ru-103	<5.64	<5.22	<9.96
Ru-106	<60	<60.38	<95.88
I-131	<6.34	<5.36	<11.44
Cs-134	<5.78	<4.8	<10.33
Cs-137	<6.66	<6.55	<11.45
Ba/La-140	<7.2	<6.25	<13.09
Ce-141	<6.51	<6.59	<13.51
Ce-144	<29.53	<27.74	<54.31
Ra-226*	158.9±52.11	184.5±53.4	555.1±111.3
Ac/Th-228*	<26.33	<22.31	131.4±31.49

May-99

Radionuclide	RAGWEED	SORREL	GRAPE LEAVES
Be-7*	197.8±25.29	204.6±37.45	285.2±39.04
K-40*	7128±151.4	5236±181.1	6208±159.9
Mn-54	<5.24	<7.27	<8.41
Co-58	<5.12	<7.76	<8.14
Fe-59	<11.22	<15.94	<16.05
Co-60	<5.78	<7.83	<9.04
Zn-65	<13.96	<19.35	<16.52
Zr-95	<8.79	<11.55	<13.22
Ru-103	<4.46	<7.25	<6.98
Ru-106	<49.7	<72.98	<83.77
I-131	<5	<6.86	<8.24
Cs-134	<5.04	<7.4	<4.76
Cs-137	<4.87	<6.49	<7.56
Ba/La-140	<4.06	<10.19	<9.01
Ce-141	<5.31	<6.59	<10.68
Ce-144	<22.82	<31.47	<46.67
Ra-226*	246.4±51.47	355.3±67.4	635.2±94.84
Ac/Th-228*	<20.48	<26.84	67.55±19.39

June-99

Radionuclide	GRAPE LEAVES	SORREL	BITTERSWEET
Be-7*	677.8±38.64	920.9±63.6	550.9±37.41
K-40*	5167±101.6	6493±232	5534±109.5
Mn-54	<5.35	<9.47	<5.52
Co-58	<6.06	<9.22	<6.24
Fe-59	<12.37	<21.83	<13.69
Co-60	<5.09	<9.82	<6.3
Zn-65	<7.19	<25.47	<7.58
Zr-95	<9.42	<15.4	<9.8
Ru-103	<6.95	<9.92	<6.57
Ru-106	<6.06	<8.57	<6.45
I-131	<51.48	<103.3	<56.4
Cs-134	<25.12	<9.14	<23.86
Cs-137	<5.01	<10.36	<3.4
Ba/La-140	<4.65	<8.39	<5.09
Ce-141	<13.74	<10.57	<14.66
Ce-144	<9.4	<9.08	<10.29
Ra-226*	<30.36	<37.48	<31.01
Ac/Th-228*	506.1±56.59	482±91.13	564±72.48

July-99

Radionuclide	SORREL	GRAPE LEAVES	RAGWEED
Be-7*	657.9±55.09	656.2±59.93	1013±52.22
K-40*	8264±228.2	6654±225.6	11130±215.3
Mn-54	<8.71	<9.45	<6.27
Co-58	<9.88	<10.21	<6.59
Fe-59	<19.45	<23.74	<17.38
Co-60	<9.19	<11.67	<8.02
Zn-65	<21.16	<26.35	<19.13
Zr-95	<15.93	<16.45	<12.11
Ru-103	<8.43	<9.54	<7.4
Ru-106	<102.2	<100.2	<68.37
I-131	<9.6	<15.62	<10.53
Cs-134	<9.18	<9.18	<6.56
Cs-137	<8.83	<10.15	<6.22
Ba/La-140	<11.31	<19.17	<9.57
Ce-141	<9.9	<13.32	<8
Ce-144	<34.32	<48.89	<27.45
Ra-226*	427.4±78.82	390.9±90.47	262.7±57.11
Ac/Th-228*	<31.53	81.93±22.02	<24.72

* Indicates naturally occurring
** Indicates control location

TABLE B-14

CONCENTRATIONS OF GAMMA EMITTERS IN BROADLEAF VEGETATION - 1999
Results in Units of pCi/Kg (wet) ± 1 sigma

#94 Unit 3 Training Building

August-99

Radionuclide	Bittersweet	Grape Leaves	Ragweed
Be-7*	366.1±36.45	619.4±44.24	1030±59.34
K-40*	4567±137	5670±143.6	8379±243.7
Mn-54	<5.86	<7.25	<9.37
Co-58	<5.74	<7.17	<9.63
Fe-59	<12.39	<14.26	<22.73
Co-60	<5.87	<7.34	<11.11
Zn-65	<13.19	<9.7	<25.06
Zr-95	<9.68	<11.48	<16.88
Ru-103	<5.34	<6.34	<7.87
Ru-106	<59.19	<76.51	<93.21
I-131	<6.38	<8.83	<9.27
Cs-134	<5.35	<4.39	<9.29
Cs-137	<5.47	<7.18	<7.61
Ba/La-140	<6.85	<7.7	<10.88
Ce-141	<6.35	<9.71	<10.75
Ce-144	<22.74	<40.65	<46.21
Ra-226*	525±74.43	636±100.1	400.7±77.27
Ac/Th-228*	32.64±11.22	134.1±19.26	64.82±22.29

September-99

Radionuclide	Grape Leaves	Bittersweet	Ragweed
Be-7*	1379±77.78	799.8±43.84	3060±65.63
K-40*	4543±192.3	5421±125.5	7976±140.5
Mn-54	<9.23	<5.92	<5.59
Co-58	<8.95	<6.45	<6.09
Fe-59	<22.17	<13.93	<13.15
Co-60	<9.84	<6.17	<6.14
Zn-65	<25.13	<15.34	<7.73
Zr-95	<15.35	<10.75	<10.13
Ru-103	<9.9	<6.52	<5.8
Ru-106	<99.16	<54.83	<55.89
I-131	<17.92	<16.94	<13
Cs-134	<8.43	<3.58	<5.23
Cs-137	<8.47	<5.63	<5.29
Ba/La-140	<19	<12.47	<8.66
Ce-141	<12.78	<9.01	<7.97
Ce-144	<46.52	<31.11	<30.22
Ra-226*	349.1±82.92	647.6±81.36	404.8±68.86
Ac/Th-228*	<35.47	84.79±12.73	69.97±11.02

October-99

Radionuclide	RAGWEED	GRAPE LEAVES	BITTERSWEET
Be-7*	4088±76.06	1581±58.29	1161±83.09
K-40*	9200±152.2	4433±127.9	4981±218.4
Mn-54	<5.64	<7.56	<11.24
Co-58	<6.61	<6.94	<11.93
Fe-59	<13.92	<13.79	<24.67
Co-60	<6.03	<6.89	<11.84
Zn-65	<8.56	<9.89	<28.26
Zr-95	<10.57	<11.08	<18.48
Ru-103	<6.27	<6.38	<12.38
Ru-106	<58.14	<73.07	<120.2
I-131	<15.93	<8.01	<29.7
Cs-134	<3.23	<7.04	<11.08
Cs-137	<5.37	<6.78	<10.15
Ba/La-140	<11.42	<8.2	<24.49
Ce-141	<8.72	8.17±4.4	<16.19
Ce-144	<29.7	<37.88	<58.04
Ra-226*	465.7±88.57	496.1±90.27	670.4±135.1
Ac/Th-228*	76.44±12.16	100.7±16.17	88.35±28.81

* Indicates naturally occurring
** Indicates control location

TABLE B-14

CONCENTRATIONS OF GAMMA EMITTERS IN BROADLEAF VEGETATION - 1999
Results in Units of pCi/Kg (wet) ± 1 sigma

#95 Met Tower

April-99

Radionuclide	MOTHERWORT	RAGWEED	SORREL
Be-7*	98.68±21.6	316.5±30.27	675.8±36.38
K-40*	4646±124	6106±159.5	6576±132.9
Mn-54	<5.03	<5.88	<5.46
Co-58	<4.73	<5.45	<5.67
Fe-59	<11.6	<13.67	<11.86
Co-60	<6.46	<5.65	<5.94
Zn-65	<13.27	<14.26	<13.37
Zr-95	<8.12	.<7.8	<10.2
Ru-103	<4.27	<4.59	<5.45
Ru-106	<50.49	<51.74	<58.67
I-131	<4.1	<4.57	<5.58
Cs-134	<5.03	<5.13	<5.61
Cs-137	<4.8	<4.56	<5.1
Ba/La-140	<5.25	<7.01	<6.19
Ce-141	<5.01	<5.21	<7.44
Ce-144	<22.13	<23.89	<32.01
Ra-226*	296.1±49.12	187.7±41.08	450.1±71.26
Ac/Th-228*	<18.46	21.14±11.21	59.26±12.09

May-99

Radionuclide	RAGWEED	GRAPE LEAVES	BITTERSWEET
Be-7*	153.3±32.54	102.1±42.45	<64.55
K-40*	7224±235.9	4662±215.9	5486±206.9
Mn-54	<8.95	<11.56	<8.45
Co-58	<9.46	<10.83	<8.27
Fe-59	<22.6	<23.87	<17.28
Co-60	<9.85	<13.92	<10.28
Zn-65	<26.87	<28.87	<21.8
Zr-95	<17.34	<20.41	<12.95
Ru-103	<8.02	<9.69	<7.33
Ru-106	<95.26	<117.2	<72.53
I-131	<9.32	<10.26	<6.85
Cs-134	<9.41	<10.45	<7.92
Cs-137	<8.71	<11.2	<8.67
Ba/La-140	<10.4	<13.75	<10.83
Ce-141	<9.03	<11	<9.5
Ce-144	<39.13	<51.46	<39.83
Ra-226*	220±78.39	250±87.03	165.1±75.01
Ac/Th-228*	<34.56	<44	<27.77

June-99

Radionuclide	RAGWEED	BITTERSWEET	GRAPE LEAVES
Be-7*	643.6±49.8	296.4±45.93	251.1±31.31
K-40*	10840±208.7	4918±161.4	5701±133.2
Mn-54	<6.99	<7.87	<6.85
Co-58	<7.08	<8.12	<6.64
Fe-59	<21.89	<19.66	<13.45
Co-60	<7.71	<7.77	<6.89
Zn-65	<19.4	<18.34	<15.75
Zr-95	<13.67	<13.46	<9.95
Ru-103	<8.1	<8.62	<5.91
Ru-106	<72.69	<74.52	<65.87
I-131	<26.09	<24.77	<7.71
Cs-134	<6.91	<6.66	<6.12
Cs-137	<6.77	<7.93	<6.58
Ba/La-140	<20.76	<22.9	<7.03
Ce-141	<11.28	<10.07	<8.48
Ce-144	<35.15	<30.92	<36.48
Ra-226*	392.2±72.21	418.8±68.87	493.5±77.62
Ac/Th-228*	66.97±25.88	56.08±16.24	92.53±19.07

July-99

Radionuclide	SORREL	GRAPE LEAVES	BITTERSWEET
Be-7*	543.4±53.56	484.3±48.38	565.1±57.79
K-40*	6482±218.5	6415±168.2	6196±232.7
Mn-54	<8.41	<8.51	<11.41
Co-58	<9.62	<9.05	<11.2
Fe-59	<18.32	<15.72	<24.44
Co-60	<10.52	<9.2	<11.83
Zn-65	<28.12	<12.17	<27.69
Zr-95	<13.24	<14.85	<18.25
Ru-103	<8.21	<8.56	<9.73
Ru-106	<85.6	<89.97	<105.3
I-131	<9.23	<10.69	<11.67
Cs-134	<6.23	<9.04	<10.01
Cs-137	<8.78	<8.9	<9.02
Ba/La-140	<13.86	<11.47	<15.76
Ce-141	<11.22	<11.85	<12.64
Ce-144	<46.92	<50.79	<52.18
Ra-226*	286.4±92.72	643.1±100.6	467.4±105.7
Ac/Th-228*	<34.76	127±19.63	68.5±25.19

* Indicates naturally occurring
** Indicates control location

TABLE B-14

CONCENTRATIONS OF GAMMA EMITTERS IN BROADLEAF VEGETATION - 1999
Results in Units of pCi/Kg (wet) ± 1 sigma

#95 Met Tower

August-99

Radionuclide	Bittersweet	Grape Leaves	Ragweed
Be-7*	526.7±40.04	532.1±46.06	1179±60.11
K-40*	4814±151	5325±180.4	7253±216.7
Mn-54	<6.6	<7.27	<7.81
Co-58	<5.85	<6.82	<7.15
Fe-59	<13.3	<16.67	<16.97
Co-60	<6.85	<8.71	<7.89
Zn-65	<15.5	<19.81	<19.56
Zr-95	<10.97	<12.91	<11.26
Ru-103	<5.02	<6.63	<7.2
Ru-106	<57.59	<77.99	<73.07
I-131	<6.17	<7.1	<6.84
Cs-134	<4.07	<7.51	<4.28
Cs-137	<5.59	<7.19	<7.78
Ba/La-140	<6.09	<9.37	<9.89
Ce-141	<7.3	<9.22	<7.42
Ce-144	<25.22	<40.58	<31.05
Ra-226*	346.6±65.42	215.4±69.97	286.8±69.69
Ac/Th-228*	52.56±15.08	<27.36	<27.13

September-99

Radionuclide	Grape Leaves	Bittersweet	Ragweed
Be-7*	1048±70.47	502.6±37.88	1801±64.17
K-40*	5134±199.2	4842±114.9	6495±158.6
Mn-54	<8.07	<5.53	<6.18
Co-58	<7.92	<6.36	<6.68
Fe-59	<20.43	<13.48	<15.06
Co-60	<9.16	<5.31	<6.18
Zn-65	<21.74	<7.67	<15.7
Zr-95	<15.67	<9.78	<10.75
Ru-103	<8.96	<6	<6.47
Ru-106	<92.5	<57.97	<61.36
I-131	<19.71	<13.46	<14.29
Cs-134	<8.7	<5.37	<5.55
Cs-137	<8.49	<5.58	<5.17
Ba/La-140	<18.27	<10.56	<9.01
Ce-141	<12.82	<7.82	5.12±3.16
Ce-144	<46.45	<29.04	<27
Ra-226*	383.7±91.97	576.9±79.76	483.7±68.82
Ac/Th-228*	62.03±22.75	75.2±12.11	<20.2

October-99

Radionuclide	BITTERSWEET	RAGWEED
Be-7*	1182±94.95	4113±88.23
K-40*	7217±305.3	7445±174.3
Mn-54	<13.91	<6.52
Co-58	<13.3	<6.34
Fe-59	<30.02	<13.99
Co-60	<13.62	<6.95
Zn-65	<35.41	<15.98
Zr-95	<22.25	<10.93
Ru-103	<14.01	<6.05
Ru-106	<147	<60.57
I-131	<14.02	<7.01
Cs-134	<13.09	<5.53
Cs-137	<13.98	<5.9
Ba/La-140	<17.84	<7.95
Ce-141	<16.79	<7.07
Ce-144	<76.03	<28.94
Ra-226*	776.7±179.9	580.9±77.33
Ac/Th-228*	<54.05	34.89±11.57

* Indicates naturally occurring
** Indicates control location

CONCENTRATIONS OF GAMMA EMITTERS IN FISH AND INVERTEBRATE SAMPLES-1999
Results in Units of pCi/Kg (wet) ± 1 sigma

#35 HUDSON RIVER INDICATOR

Radionuclide	Eels 6/99	Eels 6/99	Blue Crab 6/99	White Perch 6/99	White Perch 9/99	Crabs 9/99	Sunfish 9/99	Catfish 9/99	Eels 9/99	Catfish 9/99
Be-7*	<202	<271	<330	<254	<273	<235	<213	<270	<199	<238
K-40*	4970±290	4000±246	5890±236	4720±230	3680 ± 209	2790 ± 183	5560 ± 187	9750 ± 183	5680 ± 120	5370 ± 151
Mn-54	<16.8	<14.0	<17.2	<15.7	<12.2	<12.8	<12.4	<14.2	<8.22	<102
Co-58	<23.8	<26.7	<30.8	<25.9	<25.8	<26.7	<19.0	<27.5	<19.9	<20.5
Fe-59	<53.9	<99.1	<109	<92.2	<115	<115	<76.9	<84.2	<67.0	<81.7
Co-60	<14.9	<14.6	<14.7	<11.9	<11.4	<13.7	<11.1	<10.8	<7.18	<9.48
Zn-65	<41.6	<38.9	<40.6	<36.3	<35.5	<33.4	<29.7	<18.7	<13.1	<25.3
Zr-95	<37.8	<52.8	<63.2	<45.8	<52.1	<51.7	<39.7	<47.3	<34.4	<40.3
Ru-103	<29.7	<56.2	<66.7	<51.7	<55.0	<53.5	<39.7	<50.5	<41.2	<48.7
Ru-106	<162	<156	<160	<146	<120	<109	<122	<146	<92.5	<100
I-131	<564	<26600	<47100	<23900	<62700	<51800	<11000	<25600	<51800	<50000
Cs-134	<16.3	<13.8	<15.8	<12.4	<9.44	<8.97	<9.97	<13.3	<8.15	<9.90
Cs-137	<13.1	<11.9	<13.5	<11.1	<9.46	<9.27	<9.65	<11.4	<7.20	<7.88
Ba/La-140	<165	<1790	<2840	<1590	<4570	<3860	<998	<1400	<1560	<2500
Ce-141	<49.9	<104	<109	<97.1	<73.0	<72.6	<72.5	<97.6	<81.0	<91.8
Ce-144	<101	<83.6	<76.3	<81.2	<44.8	<44.4	<64.6	<77.4	<48.8	<55.9
Ra-226*	666±220	486±125	907±130	412±145	481 ± 94.0	295 ± 74.6	868 ± 112	1720 ± 147	931 ± 104	497 ± 87.9
Ac/Th-228*	<52.6	<54.5	<54.7	<42.1	<38.9	<37.7	54.7 ± 19.2	286 ± 29.7	155 ± 19.4	62.7 ± 20.2

CONCENTRATIONS OF GAMMA EMITTERS IN FISH AND INVERTEBRATE SAMPLES-1999
Results in Units of pCi/Kg (wet) ± 1 sigma
#23 Roseton Control

	BLUE CRAB	WHITE PERCH	CATFISH	WHITE PERCH	EELS
Radionuclide	Jun-99	Jun-99	Jun-99	Sep-99	Sep-99
Be-7*	<156	<156	<272	<379	<317
K-40*	2190±179	2780±159	7070±426	8250 ± 402	5490 ± 248
Mn-54	<11.5	<10.9	<22.6	<26.8	<19.1
Co-58	<18.2	<16.5	<26.9	<41.2	<33.5
Fe-59	<46.0	<52.7	<89.9	<112	<90.2
Co-60	<14.8	<11.4	<28.4	<29.3	<14.3
Zn-65	<28.3	<26.5	<53.4	<72.1	<47.6
Zr-95	<25.7	<29.7	<48.0	<71.8	<56.5
Ru-103	<24.4	<28.5	<40.3	<60.8	<52.6
Ru-106	<139	<99.5	<279	<314	<190
I-131	<245	<3150	<1200	<1970	<11900
Cs-134	<13.2	<10.9	<23.6	<17.4	<15.8
Cs-137	<10.1	<8.04	<21.6	<25.6	<14.7
Ba/La-140	<95.3	<385	<229	<298	<1050
Ce-141	<27.6	<43.8	<68.2	<96.9	<97.6
Ce-144	<67.3	<51.7	<150	<163	<98.8
Ra-226*	543±120	401±93.4	<442	1150 ± 305	888 ± 178
Ac/Th-228*	90.6±30.3	<36.9	<85.2	155 ± 68.8	129 ± 44.6

* Indicates naturally occurring

TABLE B-16
ANNUAL SUMMARY, NON-RETS SAMPLE RESULTS
1999

SAMPLE MEDIUM (UNITS)	NUCLIDE DETECTED	LLD	INDICATOR LOCATIONS AVG. OF POSITIVE SAMPLES	INDICATOR LOCATIONS HIGHEST POSITIVE SAMPLE	INDICATOR LOCATIONS LOWEST POSTITIVE SAMPLE	INDICATOR LOCATIONS NO. OF POSITIVE SAMPLES	INDICATOR LOCATIONS TOTAL NO. OF SAMPLES	CONTROL LOCATIONS AVG. OF POSITIVE SAMPLES	CONTROL LOCATIONS HIGHEST POSTIVIE SAMPLE	CONTROL LOCATIONS LOWEST POSTITIVE SAMPLE	CONTROL LOCATIONS NO. OF POSITIVE SAMPLES	CONTROL LOCATIONS TOTAL NO. OF SAMPLES	HISTORICAL AVG VALUE* INDICATOR	HISTORICAL AVG VALUE* CONTROL
AQUATIC VEGETATION (pCi/kg - WET)														
	Co-60	NONE	ND	ND	ND	ND	2	ND	ND	ND	ND	3	NA	NA
(C)	I-131	100	ND	ND	ND	ND	2	ND	ND	ND	ND	3	NA	NA
	Cs-134	100	ND	ND	ND	ND	2	ND	ND	ND	ND	3	NA	NA
	Cs-137	100	9.7	18.3	4.11	2	2	13.6	16.5	8.8	2	2	74	91
BOTTOM SEDIMENT (pCi/kg - DRY)														
	Co-60	NONE	ND	ND	ND	ND	6	ND	ND	ND	ND	2	147	ND
	Cs-134	150	ND	ND	ND	ND	6	54	54	54	1	2	75	29(A)
	Cs-137	180	377	779	74	6	6	ND	ND	ND	ND	2	988	392
SOIL (pCi/kg - DRY)	Cs-137	180	ND	ND	ND	ND	3	ND	ND	ND	ND	1	313	(B)
PRECIPITATION (pCi/L)	H-3	2000	ND	ND	ND	0	4	ND	ND	ND	0	4	298	447
ALGONQUIN OUTFALL (pCi/L)	H-3	2000	160	160	160	1	4	N/A	N/A	N/A	N/A	N/A	174	N/A

* - AVERAGE OF POSITIVE VALUES FOR 1987-1997
(A) - WAS DETECTED AT CONTROL LOCATION, 1988 AND 1992
(B) - NO DIFFERENCE MADE BETWEEN INIDCATOR AND CONTROL LOCATIONS OR HISTORICAL DATA
(C) - IODINE NOT DUE TO STATION OPERATIONS, SEE BODY OF REPORT FOR FURTHER DETAILS
ND - NOT DETECTED
NA - DATA NOT AVAILABLE

TABLE B-17

THERE ARE NO ANIMALS PRODUCING MILK FOR HUMAN CONSUMPTION WITHIN FIVE MILES OF INDIAN POINT AS NOTED IN THE 1999 LAND USE CENSUS.

TABLE B-18

LAND USE CENSUS

1999

Sector	Mile	Locastion 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	Gays Hill Road, Tomkins Cove
13 - W	1.21	Gays Hill Road, 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 1999 data with historical values. Since no RETS indicator samples were at or above the LLD due to plant operations, there is no comparison with pre-operational studies. Although other samples were taken and analyzed, values were only tabulated and plotted where positive indications were present.

TABLE C-1
TEN YEAR HISTORICAL DATA
DIRECT RADIATION ANNUAL SUMMARY
1989-1999

	Average Quarterly Dose (mR/Quarter)		
Year	Inner Ring	Outer Ring	Control Location
1989	14	13	14
1990	13	13	14
1991	12	13	14
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**
Historical Average 1989-1998	14	14	15

FIGURE C-1
Direct Radiation
(1989-1999)

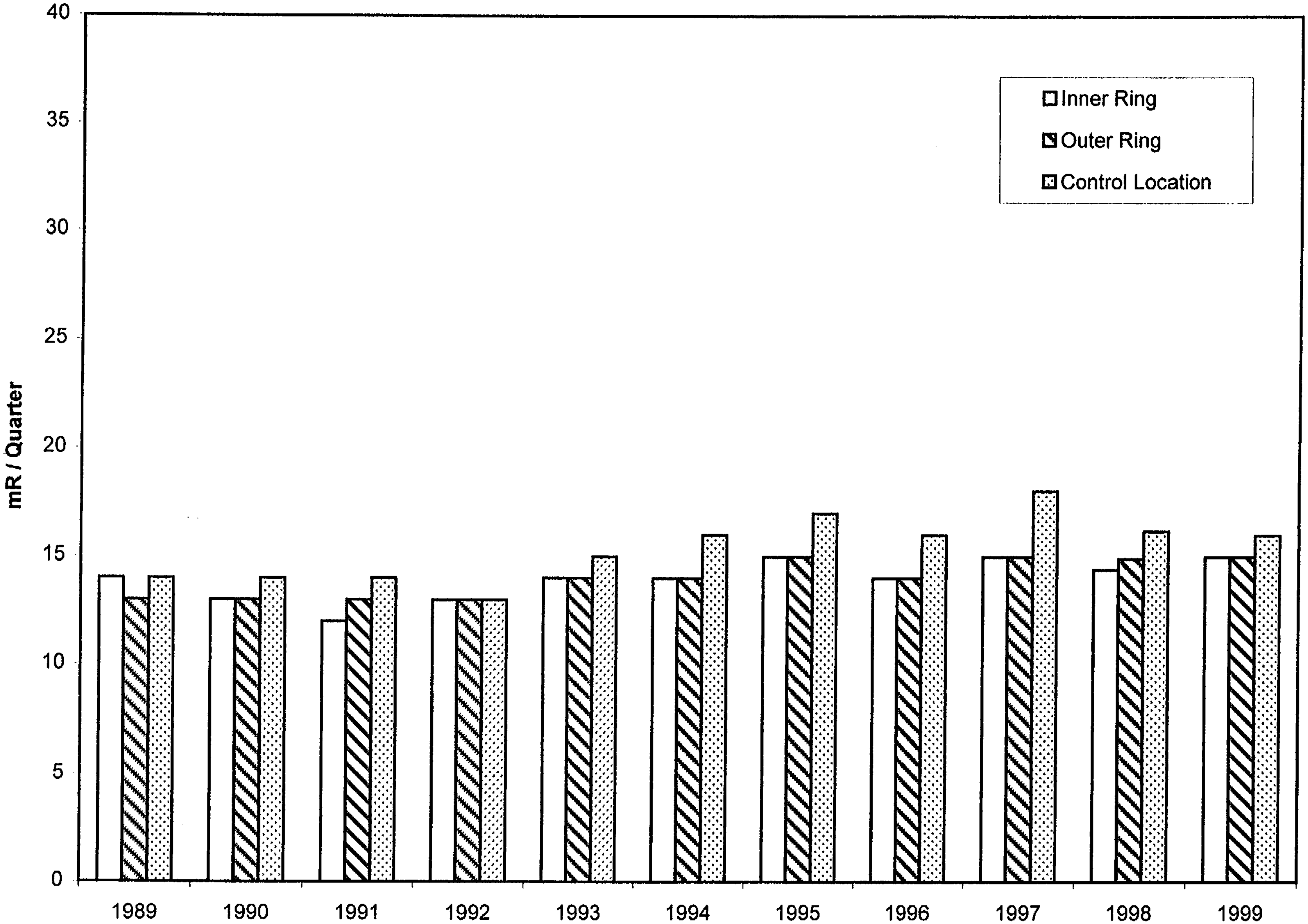


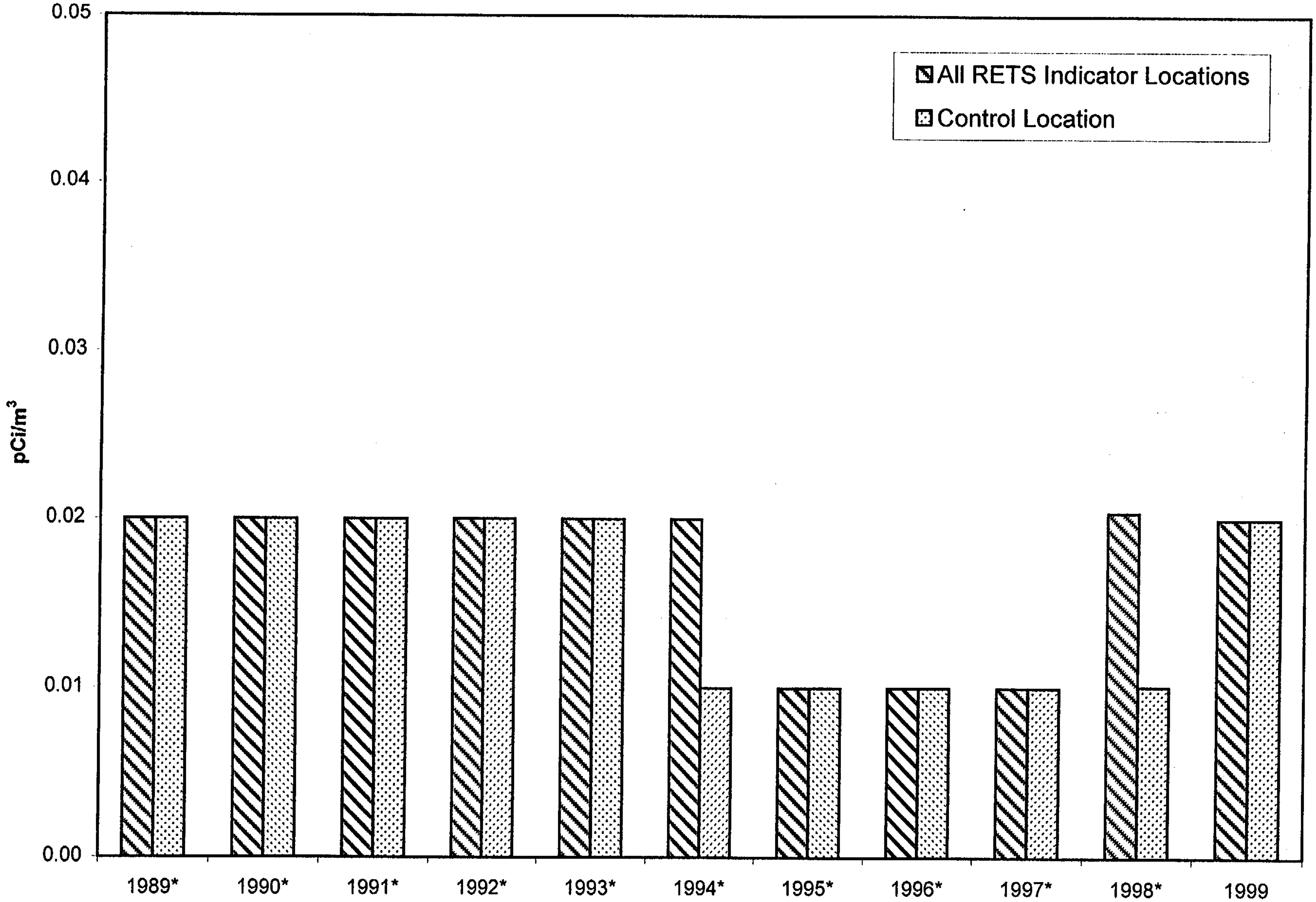
TABLE C-2
TEN YEAR HISTORICAL DATA
RADIONUCLIDES IN AIR
1989-1999
(pCi/m³)

Year	Gross Beta		Cs-137	
	All RETS Indicator Locations	Control Location	All RETS Indicator Locations	Control Location
1989*	0.02	0.02	<LLD	<LLD
1990*	0.02	0.02	<LLD	<LLD
1991*	0.02	0.02	<LLD	<LLD
1992*	0.02	0.02	<LLD	<LLD
1993*	0.02	0.02	<LLD	<LLD
1994*	0.02	0.01	<LLD	<LLD
1995*	0.01	0.01	<LLD	<LLD
1996*	0.01	0.01	<LLD	<LLD
1997*	0.01	0.01	<LLD	<LLD
1998*	0.02	0.01	<LLD	<LLD
1999	**0.02**	**0.02**	<LLD	<LLD
Historical Average 1989-1998	0.02	0.02	<LLD	<LLD

* Includes RETS and non-RETS indicator locations

<LLD indicates no positive values detected above the sample lower limit of detection

FIGURE C-2
RADIONUCLIDES IN AIR - GROSS BETA
(1989-1999)



*Includes RETS and Non-RETS Indicator Location

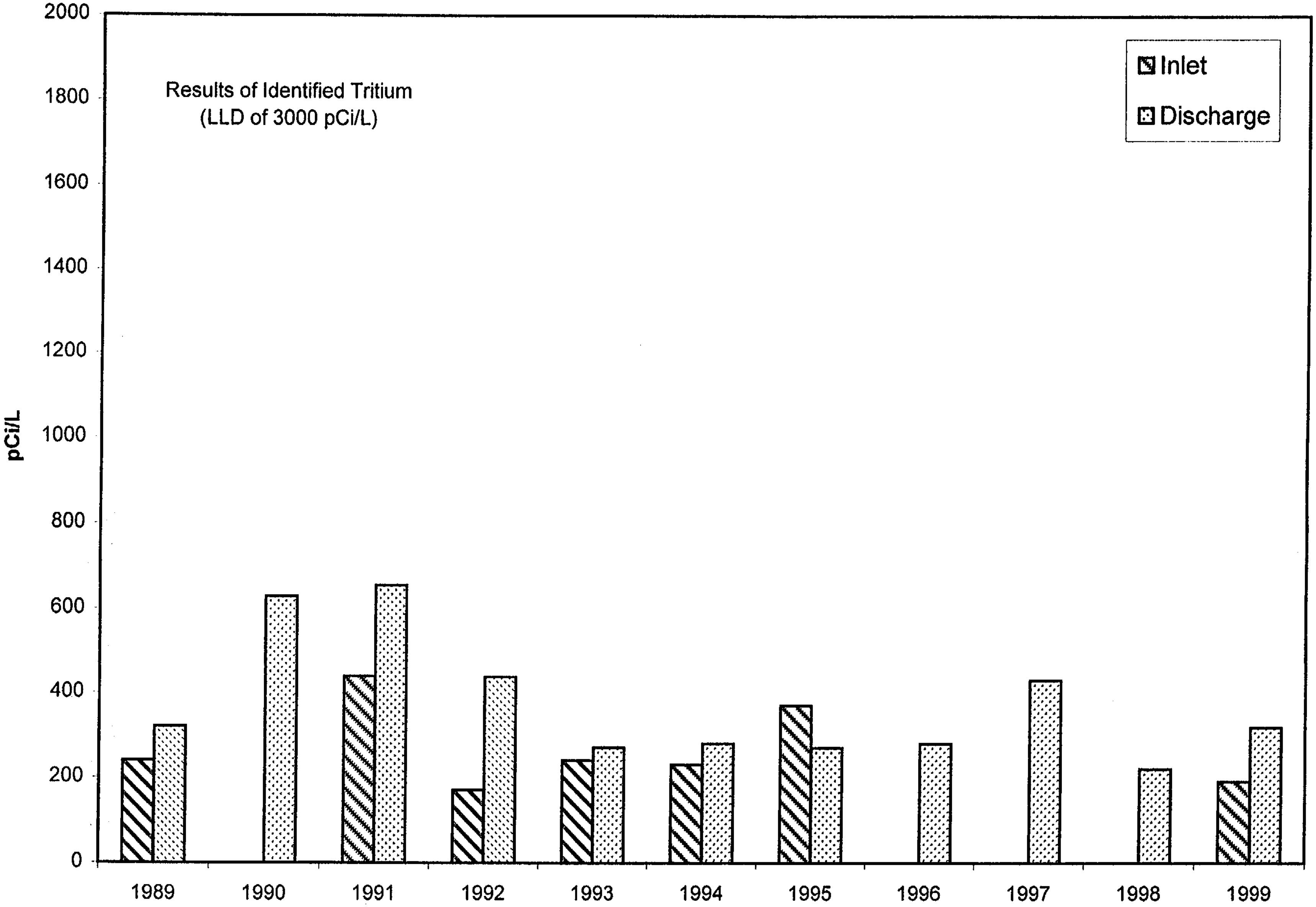
Required LLD = 0.01 pCi/m^3

TABLE C-3
TEN YEAR HISTORICAL DATA
RADIONUCLIDES IN HUDSON RIVER WATER
1989-1999
(pCi/l)

	Tritium		Cs-137	
Year	**Inlet**	**Discharge**	**Inlet**	**Discharge**
1989	240	320	<LLD	<LLD
1990	<LLD	630	<LLD	<LLD
1991	439	656	<LLD	<LLD
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
Historical Average 1989-1998	282	379	<LLD	<LLD

<LLD indicates no positive values detected above the sample lower limit of detection

FIGURE C-3
HUDSON RIVER WATER - TRITIUM
(1989-1999)



Required LLD = 3000 pCi/l

TABLE C-4
TEN YEAR HISTORICAL DATA
RADIONUCLIDES IN DRINKING WATER
1989-1999
(pCi/l)

Year	Tritium	Cs-137
1989	263	<LLD
1990	<LLD	<LLD
1991	<LLD	<LLD
1992	<LLD	<LLD
1993	<LLD	<LLD
1994	<LLD	<LLD
1995	<LLD	<LLD
1996	<LLD	<LLD
1997	<LLD	<LLD
1998	<LLD	<LLD
1999	<LLD	<LLD
Historical Average 1989-1998	263	<LLD

<LLD indicates no positive values detected above the sample lower limit of detection

FIGURE C-4
TRITIUM IN DRINKING WATER
(1989-1999)

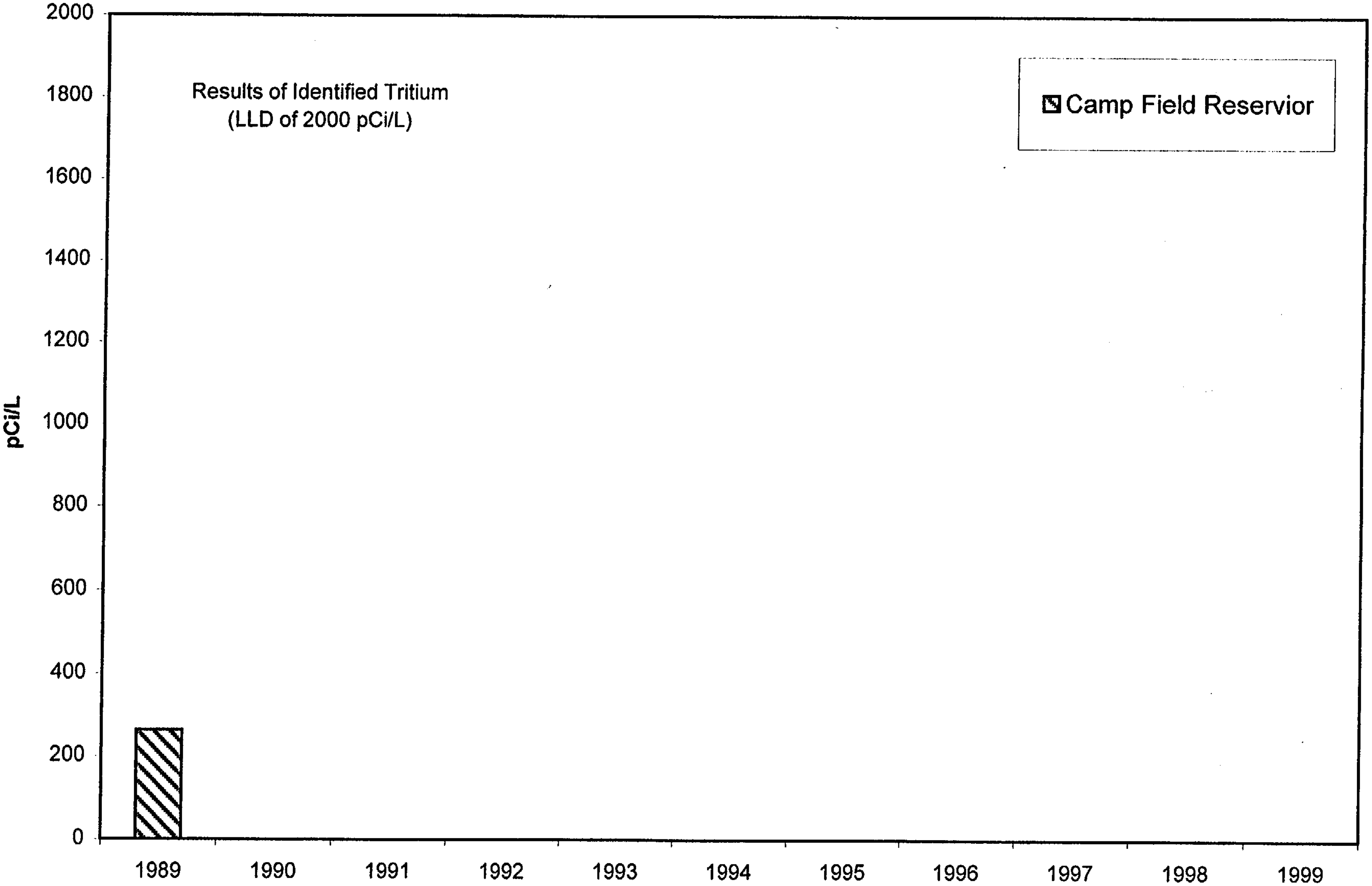
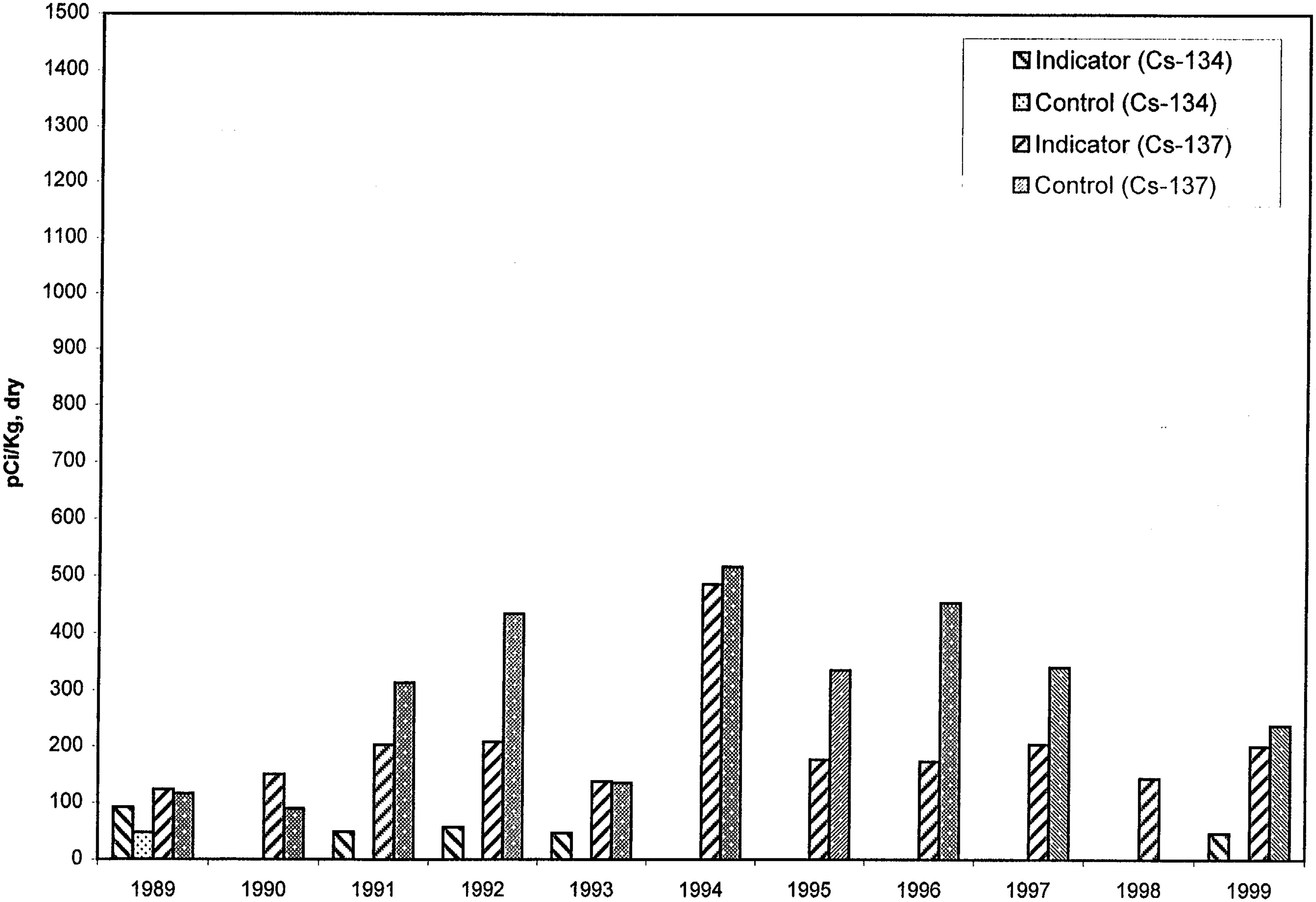


TABLE C-5
TEN YEAR HISTORICAL DATA
RADIONUCLIDES IN SHORELINE SOILS
1989-1999
(pCi/kg - dry)

	Cs-134		Cs-137	
Year	Indicator	Control	Indicator	Control
1989	91	47	123	116
1990	<LLD	<LLD	150	89
1991	48	<LLD	202	313
1992	56	<LLD	207	433
1993	46	<LLD	137	135
1994	<LLD	<LLD	485	516
1995	<LLD	<LLD	176	335
1996	<LLD	<LLD	173	453
1997	<LLD	<LLD	203	340
1998	<LLD	<LLD	143	<LLD
1999	**46**	**<LLD**	**200**	**238**
Historical Average 1989-1998	60	47	200	303

<LLD indicates no positive values detected above the sample lower limit of detection

FIGURE C-5
RADIONUCLIDES IN SHORELINE SOILS
1989-1999



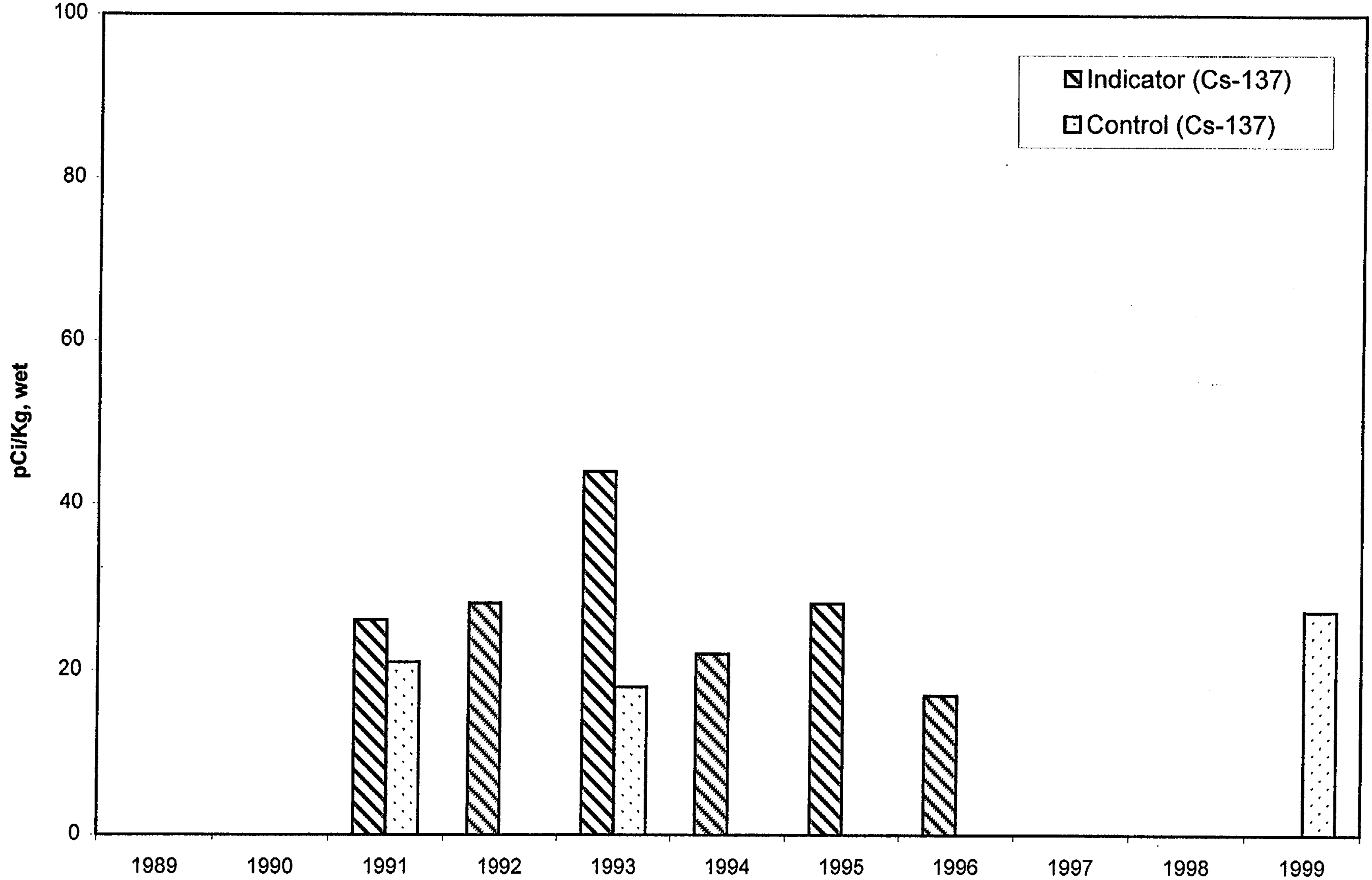
Cs 134 - Required LLD = 150 pCi/kg
Cs 137 - Required LLD = 175 pCi/kg

TABLE C-6
TEN YEAR HISTORICAL DATA
RADIONUCLIDES IN BROAD LEAF VEGETATION
1989-1999
(pCi/kg -dry)

	Cs-137	
Year	**Indicator**	**Control**
1989	<LLD	<LLD
1990	<LLD	<LLD
1991	26	21
1992	28	<LLD
1993	44	18
1994	22	<LLD
1995	28	<LLD
1996	17	<LLD
1997	<LLD	<LLD
1998	<LLD	<LLD
1999	**<LLD**	**27**
Historical Average 1989-1998	28	20

<LLD indicates no positive values detected above the sample lower limit of detection

FIGURE C-6
RADIONUCLIDES BROAD LEAF VEGETATION
(1989-1999)
pCi/kg - wet)



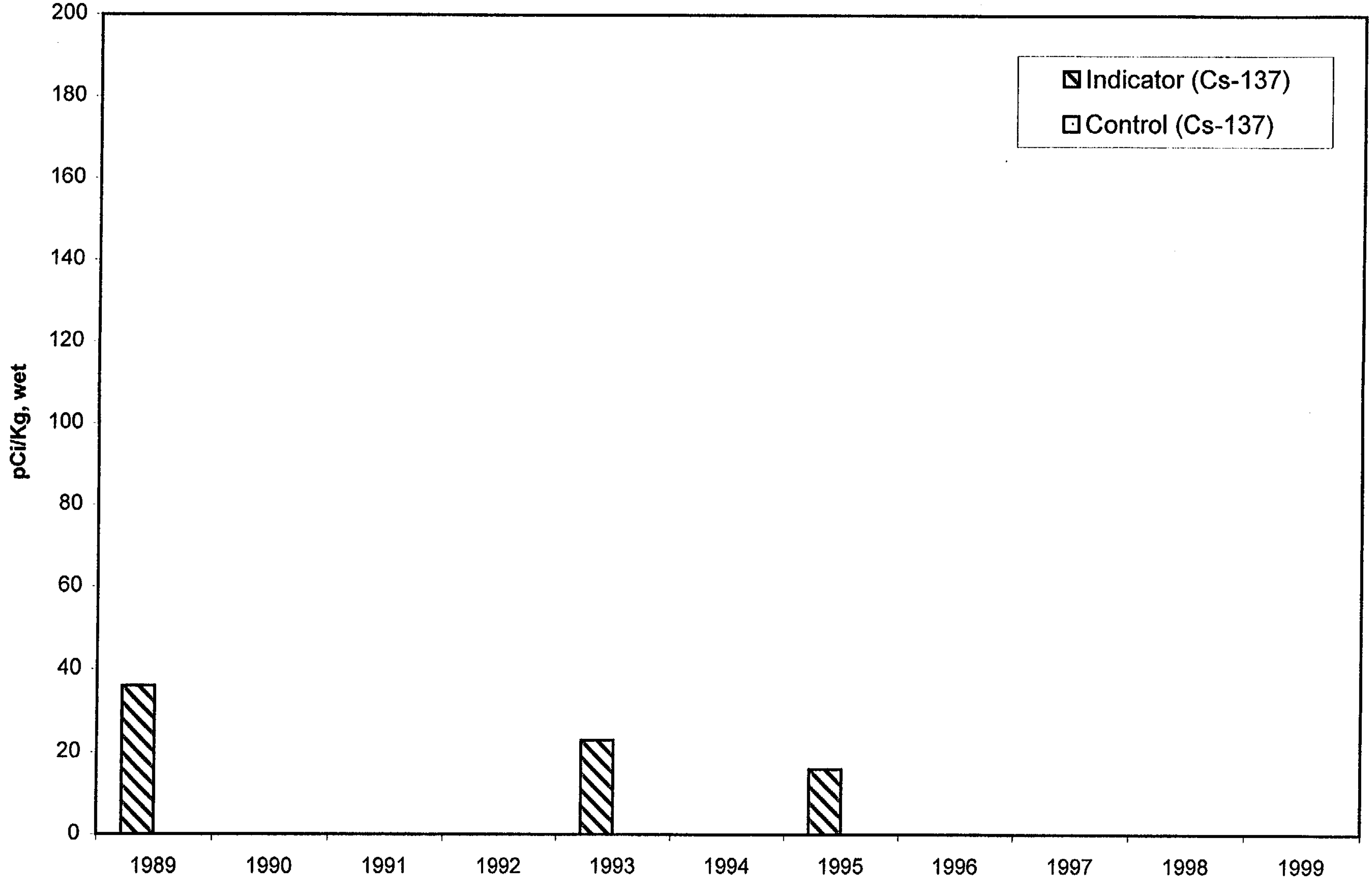
Required LLD = 80 pCi/kg

TABLE C-7
TEN YEAR HISTORICAL DATA
RADIONUCLIDES IN FISH AND INVERTEBRATES
1989-1999
(pCi/kg - wet)

	Cs-137	
Year	**Indicator**	**Control**
1989	36	<LLD
1990	<LLD	<LLD
1991	<LLD	<LLD
1992	<LLD	<LLD
1993	23	<LLD
1994	<LLD	<LLD
1995	16	<LLD
1996	<LLD	<LLD
1997	<LLD	<LLD
1998	<LLD	<LLD
1999	**<LLD**	**<LLD**
Historical Average 1989-1998	25	**<LLD**

<LLD indicates no positive values detected above the sample lower limit of detection

FIGURE C-7
RADIONUCLIDES IN FISH AND INVERTEBRATES
(1989-1999)



Required LLD = 150 pCi/Kg

APPENDIX D

INTERLABORATORY COMPARISON PROGRAM

INTERLABORATORY COMPARISON PROGRAM

D.1 PROGRAM DESCRIPTION

The Radiological Effluent Technical Specification (RETS) requires 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 cross-check 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 cross-check samples. The two laboratories are Analytics, Incorporated in Atlanta, Georgia and the U.S. Department of Energy's Environmental Measurement Laboratory (EML) in New York City.

Analytics supplies requested sample media as blind sample spikes, which contain known levels of radioactivity. 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 Analytics' 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 known amounts 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.

Teledyne Brown Engineering Laboratory performs the routine tritium analysis for the JAF Environmental Laboratory. To provide a quality assurance check on the Teledyne Lab, tritium samples from Analytics and EML are provided by the JAF laboratory to Teledyne for analysis.

D.2 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 cross-check 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.

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

Using the appropriate row under the Error Resolution column in Table D.3.1 below, a corresponding Ratio of Agreement interval is given.

The value for the ratio is then calculated.

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

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

TABLE D.3.1

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

Again, this acceptance test is generally referred to as the "NRC" method. The acceptance criteria is contained in 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 (QAP)

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 D5th 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 Cross-Check Program numerical results are provided on Table D-1.

D.4.1 ANALYTICS QA SAMPLES RESULTS

Seventeen QA blind spike samples were analyzed as part of Analytics' 1999 Interlaboratory Comparison Program. The following sample media were evaluated as part of the Cross-Check 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 67 individual analysis on the seventeen QA samples. Of the 67 analysis performed, 64 were in agreement using the NRC acceptance criteria for a 95.5% agreement ratio. These percentage values were calculated using the re-analysis results for Analytics Sample E-1671-05.

Sample non-agreements are discussed in Section D.4.2 below.

D.4.2 ANALYTICS SAMPLE NONCONFORMITIES

D.4.2.1 Analytics Sample E-1907-05
Nonconformity No. 99-02, Cr-51 in Water

A mixed gamma water sample was received from Analytics and prepared for counting in accordance with laboratory procedures. The sample contained a total of eight radioisotopes for analysis. Eight of the eight isotopes present were quantified with seven of the isotopes quantified with acceptable results. The results for Cr-51 were determined to be outside the acceptable range.

The Lab reported Cr-51 results of 138±22 pCi/l, 144±28 pCi/l and 137±21 pCi/l for a mean of 139.7±13.8 pCi/l. The Analytics or reference value was 184±3 pCi/l. The peak search results were examined with no recurring abnormalities identified. Cr-51 decays by electron capture with 27.7 day half-life and a gamma ray energy and yield of 320 KeV and 9.8% respectively. No other gamma energies are produced. This low gamma yield will result in low net counts for samples containing environmental levels of Cr-51. The average net count rate for the three analyses was approximately 1 count per minute.

The Cr-51 results for other Quality Assurance samples analyzed as part of the 1999 program were all acceptable and are summarized below:

		1999 Cr-51 Results		
Sample ID	Medium	JAF	Reference Lab	Ratio
E-1670-05	WATER	380±13.5	398±6.7	0.95
E-1909-05	MILK	125±17	149±2	0.84
E-1908-05	FILTER	80±10	86±1	0.93
E-1768-05	MILK	216±19	215±4	1.00

A review of historical QA data for 1998 was performed to determine if this is a recurring systematic error or bias. In 1998 six QA samples were analyzed which contained Cr-51. The mean ratio for these samples relative to the Known (reference) Value is 0.955. There was one Cr-51 disagreement in the 1998 Crosscheck Program. The current and historical data demonstrate that there is no systematic error or significant bias for the analysis of Cr-51 in environmental samples.

The 1999 QA sample contained a relatively low concentration of Cr-51 relative to the other QA samples analyzed. The lower concentration and resulting low count rate may have contributed to the inaccuracy in the measured results. This nonconformity does not represent a systematic error or programmatic deficiency in the laboratory analysis program. No corrective actions were implemented as a result of this nonconformity.

D.4.2.2 Analytics Sample E-1671-05
Nonconformity No. 99-01, Air Particulate Filter Gamma Emitters

A QA sample consisting of a single air particulate filter (APF) was received from Analytics, Inc. This sample was part of the scheduled Intercomparison Crosscheck Program. The filter is used to verify the four filters APF geometry, which is routinely used to analyze the monthly air particulate filter composite samples. In preparation for analysis, the filter is placed flat into a petri dish which is the normal air particulate filter counting geometry. Three additional blank filters were added to make a composite sample which is representative of the routine APF composite configuration. The evaluation of the results reported by the laboratory determined that seven of the eight radionuclides included in the sample were not in agreement with the reference value. The ensuing investigation showed that the configuration of the filters had shifted within the petri dish during the counting process. The three blank composite filters were flat on the counting face of the petri dish but the active filter was stuck to the top of the petri dish cover. The location of the filter resulted in the active filter being away from the detector face. The slight change in geometry for the active filter caused the calculated activity to be proportionally low for all the radionuclides in the sample. When samples are counted on the detector end cap, small changes in the sample to detector distance can have measurable impact on the accuracy of the quantitative results.

As an immediate corrective action, the sample was taken apart and the filter composite was reassembled. The active filter was placed in the number two of four position in the composite stack. The composite was recounted in the new configuration. The sample results for the re-analysis were in agreement with the exception of Cr-51 and Fe-59, which had decayed off to a concentration that was below the detection limit. The short term corrective action is complete and was reported on the Interlaboratory Intercomparison Program Results Table under sample ID E-1671-05.

The long term corrective action is to configure future composite filters using sufficient filters to fill the petri dish. This action will ensure that the active filter will not shift within the petri dish and become miss-aligned with the detector face.

The nonconformity resulting from this QA sample does not represent a systematic error or programmatic deficiency in the laboratory analysis program.

D.4.2.3 Analytics Sample E-1908-05
Nonconformity No. 99-03, Air Particulate Filter Gamma Emitters

The QA analysis of sample E-1908, which contained eight radionuclides, resulted in seven agreements and one disagreement. The Fe-59 results had a calculated ratio of 1.32, which places the results outside the acceptable limit. The nonconformity for the Fe-59 was the result of geometry differences between the QA filter and the calibration standard. The sample ratio of 1.32 demonstrates that the Fe-59 sample results are biased high. The Fe-59 was the single outlier of the radionuclide inventory in the sample. The results for the other seven radionuclides in the sample were in agreement with the reference values. An evaluation of collective ratio values for all the radionuclides showed that all the results, with the exception of Cs-134, were on the positive side of the ratio calculation with a mean ratio of 1.15. Cs-134 results have a known negative bias of approximately 8% which would explain why the Cs-134 result did not demonstrate a positive bias shown by the other results. An investigation into the cause for the positive bias revealed that the placement of the active filter in the 16 filter composite stack in the No. 4 of 16 location placed the filter a slight distance closer to the detector than would be representative of a homogeneous 16 filter stack. The placement of the active filter in the No. 4 location introduced a positive bias into the sample results. Counting geometries which are surface loaded and are counted on the detector end cap are very sensitive to slight changes in distance relative to the detector face. The sample was reanalyzed using the four filter stack geometry. This reanalysis resulted in a mean ratio of 1.02, which is very good accuracy. When the sample was analyzed using the four filter geometry the ratio for Fe-59 was 1.19 which is within the acceptable band.

Both sixteen filter and four filter geometries are used at the lab for routine analysis of air particulate filter composites. Using a single filter QA sample to demonstrate performance of multi-filter geometries produces inherent biases in the process that can not be removed. The out of bounds results for Fe-59 measurement in this sample does not represent a systematic or process bias in the laboratory procedure. Routine sample analysis is performed using calibration standards that are constructed such that they duplicate the sample configuration exactly. The laboratory maintains specific calibration standards for the single filter, four filter and the sixteen filter composite geometry (configuration). The bias experienced in this sample is the result of differences in calibration and the QA sample counting geometries not procedure or program deficiencies. A corrective action in response to this nonconformity will require that future QA air particulate filter samples will be constructed and analyzed in a manner that will minimize the effects of analyzing a single filter to demonstrate the precision and accuracy of multi-filter geometries.

D.4.2.4 Analytics Sample E-1911-05
Nonconformity No. 99-04, Vegetation Gamma Emitters

The Analytics vegetation QA sample E-1911-05 contained six gamma emitting radionuclides. The analytical results for the sample produced measurements that were in agreement with the reference value for five of the six radionuclides present. The Zn-65 result was low relative to the reference value of 181±3 and had a calculated ratio of 0.73. The resulting ratio value of 0.73 is outside the acceptance band. A review of the data set showed that one of three analysis results was an outlier. The three measured values were in pCi/kg 144±29, 96±29 and 155±31 with a mean of 132±17. The measured value of 96 pCi/kg is considered an outlier for the data set. A review of the spectral data showed that the peak was properly shaped and positioned in the spectrum and was correctly identified. The analysis of this sample was a two hour count and resulted in a total of 38 net counts or a count rate of 0.3 counts per minute. This low count rate resulted in Zn-65 peak that was close to background. The background count rate in this area of the spectrum was approximately 0.4 counts per minute. The physical properties of the sample also introduced a small negative bias into the sample results. The bias was the result of the relative differences in density between the sample and the calibration standard of 4.3 to 1.0. The higher density of the sample biased the sample results low. When the outlier value in the Zn-65 sample result set is removed (96±29 pCi/kg) the calculated mean for the remaining two results are 149.5 which calculates a ratio of 0.82, within the acceptable range.

In summary, the reason for the Zn-65 nonconformity was low concentration of Zn-65 in the sample resulting in a low count rate relative to the background. The computer analysis of the peak shape resulted in a conservative estimate of the total number of counts in the Zn-65 photo peak. The differences in densities between sample and calibration standard also added a small negative bias to the calculated sample result.

To determine if this nonconformity represents an inherent or systematic error in the routine analysis process, a review was made of other spiked samples analyzed as part of the 1999 Interlaboratory Intercomparison Program. In addition to the vegetation sample, Zn-65 was present in seven other spiked samples analyzed in 1999 representing four different sample media. Each of these seven samples were in agreement with the reference sample and as a group had an agreement ratio of 1.00 for Zn-65. The ratio of 1.00 is an excellent indicator that the routine measurement of Zn-65 in environmental media is accurate and produces collective results around unity. These collective results demonstrate that there is no systematic error for analysis of Zn-65. A corrective action in response to this nonconformity will result in a vegetation sample matrix which has a density which is more representative of the calibration standard that is used for vegetation analysis.

D.4.3 ENVIRONMENTAL MEASUREMENTS LABORATORY (EML)

In 1999, the JAF Environmental Laboratory participated in both the EML Quality Assessment Programs, QAP-50 and QAP-51. 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 19 radionuclides were evaluated for the ten samples included in QAP-50 and QAP-51. Using the EML acceptance criteria, 18 of 19 radionuclide analyses (94.7%) were evaluated to be acceptable or acceptable with warning. One of 19 sample results was not acceptable (5.3%).

A summary of the JAF Environmental Laboratory results is as follows:

Matrix	Total Analyses	Acceptable*	Not Acceptable
Air	11	11	0
Water	8	7	1

* Acceptable and Acceptable with Warning

Total Evaluation	19	18	1
Percentage		94.7%	5.3%

D.4.3.1 EML Nonconformities

There were no JAFEL nonconformities in the 1999 program. All sample results were in agreement. One nonconformity for tritium in water was the result of a contractor analysis. See Section D.4.4.

D.4.4 TELEDYNE BROWN ENGINEERING QA SAMPLES

Teledyne Brown Engineering Northeast (TBE) performs the analysis of tritium in water samples for the JAFEL. During 1999, TBE participated in an interlaboratory cross-check program with EML and Analytics, Inc. The JAFEL provides QA samples directly to TBE as a part of the interlaboratory cross-check program. These samples are obtained as part of the Analytics/JAFEL Program and the EML/JAFEL Program. Three tritium samples were provided to TBE for the 1999 program and the results are listed on TABLE D-1. The sample ID's are; E-1669-05, QAP-50 Water/Tritium, and QAP-51 Water/Tritium. One tritium analysis performed by Teledyne resulted in a nonconformity.

D.4.4.1 Teledyne Nonconformity

Nonconformity No. 99-05, Tritium in Water

The QAP-51, Tritium result provided by TBE was evaluated as not acceptable. The sample ratio was 1.93 which is an indication of a sample preparation or counting instrument problem. Teledyne reported that acceptable results were obtained for their internal EML/QAP-51 Tritium sample analysis. Teledyne also obtained acceptable results for their internal analysis of the QAP-50 tritium blind spike which was performed in June of 1998. Calibration checks for the fourth quarter 1999 were reviewed by Teledyne and found to be acceptable. A review of the in-house spike results for the fourth quarter 1999 showed that all sample results were in the acceptable range. An investigation by TBE concluded that the tritium analysis process was in control during this period. The unacceptable results for JAFEL sample was determined to have been caused by the use of a small sample volume of 1.0 ml and a relatively short sample count time of 100 minutes. The sample was subsequently recounted using a sample volume of 100 ml and a count time of 200 minutes. The recount result was 78 Bq/l which is within the acceptable range with a calculated ratio of 0.98. In the case of the initial sample analysis, Teledyne did not follow the standard laboratory procedure steps for tritium analysis.

The failure to distill samples prior to tritium analysis was sited by Teledyne as the reason for missing a JAFEL tritium sample in 1998 as part of the QAP-49 sample set. This current sample nonconformity implies that Teledyne has not effectively implemented corrective actions promulgated in 1998 in response to the nonconformity. The JAFEL is currently evaluating alternate laboratories and processes for future tritium analysis.

D.5 REFERENCES

D.5.1 Semi-Annual Report of the Department of Energy, Office of Environmental Management, Quality Assessment Program, EML 604, June 1999.

D.5.2 Semi-Annual Report of the Department of Energy, Office of Environmental Management, Quality Assessment Program, EML 605, December 1999.

TABLE D-1

INTERLABORATORY INTERCOMPARISON PROGRAM

Gross Beta Analysis of Air Particulate Filters
(pCi/filter)

DATE	JAF ENV ID NUMBER	MEDIUM	ANALYSIS	JAF RESULT (1)	REFERENCE LABORATORY* (1)	RATIO (2)
06/24/99	E-1767-05	AIR	Gross Beta	41.7±1.6 42.7±1.6 45.1±1.6 Mean = 43.2±0.9	50±1	0.88, A
12/09/99	E-2012-05	AIR	Gross Beta	66.0±2.0 66.1±2.0 63.8±1.9 Mean = 65.3±1.1	69±1	0.94, A

(1) Results reported as activity ± 1 sigma.

(2) Ratio = Reported/Analytics (See Section 9.3).

(*) Samples provided by Analytics, Inc.

(A) Evaluation Results, Acceptable.

TABLE D-1 (Continued)

INTERLABORATORY INTERCOMPARISON PROGRAM

Tritium Analysis of Water (pCi/liter)

DATE	JAF ENV ID NUMBER	MEDIUM	ANALYSIS	JAF RESULT (1)	REFERENCE LABORATORY* (1)	RATIO (2)
03/18/99	E-1669-05	WATER	H-3	2500±200	2698±45	0.93, A

(1) Results reported as activity ± 1 sigma. Sample Analyzed by Teledyne Brown Eng.

(2) Ratio = Reported/Analytics (See Section 9.3).

(*) Samples provided by Analytics, Inc.

(A) Evaluation Results, Acceptable.

TABLE D-1 (Continued)

INTERLABORATORY INTERCOMPARISON PROGRAM

Iodine Analysis of Water, Air and Milk

DATE	JAF ENV ID NUMBER	MEDIUM	ANALYSIS	JAF RESULT (1)	REFERENCE LABORATORY* (1)	RATIO (2)
03/18/99	E-1670-05	WATER pCi/liter	I-131**	89.3±2.0 101.0±6.0 78.7±2.2 Mean = 89.7±2.2	91.0±1.7	0.99, A
06/24/99	E-1770-05	AIR pCi/cc	I-131	81.4±17.6 55.2±15.3 58.5±15.7 Mean = 65.0±9.4	77±1.3	0.84, A
06/24/99	E-1768-05	MILK pCi/liter	I-131**	74.9±3.0 62.3±3.3 51.5±5.6 Mean = 62.9±2.4	72±1.3	0.88, A
09/23/99	E-1909-05	MILK pCi/liter	I-131**	84.1±7.6 71.4±10.8 70.5±10.9 Mean = 75.3±5.7	91±1.7	0.82, A
09/23/99	E-1910-05	AIR pCi/cc	I-131	73.4±7.7 71.5±7.4 60.4±7.7 Mean = 68.4±4.4	62±1	1.10, A
09/23/99	E-1907-05	WATER pCi/liter	I-131**	64.8±6.7 60.4±6.4 72.3±7.0 Mean = 65.8±3.9	77±1.2	0.86, A

(1) Results reported as activity ± 1 sigma.
(2) Ratio = Reported/Analytics (See Section 9.3).
(*) Samples provided by Analytics, Inc.
(**) Result determined by Resin Extraction/Gamma Spectral Analysis.
(A) Evaluation Results, Acceptable.

TABLE D-1 (Continued)

INTERLABORATORY INTERCOMPARISON PROGRAM

Gamma Analysis Water (pCi/liter)

DATE	JAF ENV ID NUMBER	MEDIUM	ANALYSIS	JAF RESULT (1)	REFERENCE LABORATORY* (1)	RATIO (2)
03/18/99	E-1670-05	WATER	Ce-141	167±5 178±5 173±5 Mean = 173±2.9	177±3	0.98, A
			Cr-51	405±26 369±21 366±23 Mean = 380±13.5	398±6.7	0.95, A
			Cs-134	107±4 103±2 102±2 Mean = 104±1.3	114±2	0.91, A
			Cs-137	221±5 229±5 220±4 Mean = 223±2.7	240±4	0.93, A
			Mn-54	159±5 153±4 150±4 Mean = 154±2.5	152±2.7	1.01, A
			Fe-59	71.5±6.3 82.6±5.8 79.3±6.2 Mean = 77.8±3.5	79±1.3	0.99, A
			Zn-65	175±8 205±8 190±7 Mean = 190±4.4	195±3.3	0.97, A
			Co-60	186±4 179±3 174±3 Mean = 180±1.9	181±3	0.99, A

(1) Results reported as activity ± 1 sigma.

(2) Ratio = Reported/Analytics (See Section 9.3).

(*) Sample provided by Analytics, Inc.

(A) Evaluation Results, Acceptable.

TABLE D-1 (Continued)

INTERLABORATORY INTERCOMPARISON PROGRAM

Gamma Analysis Water (pCi/liter)

DATE	JAF ENV ID NUMBER	MEDIUM	ANALYSIS	JAF RESULT (1)	REFERENCE LABORATORY* (1)	RATIO (2)
09/23/99	E-1907-05	WATER	Ce-141	229±8 233±8 238±7 Mean = 233±4.4	244±4	0.95, A
			Cr-51	138±22 144±28 137±21 Mean=139.7±13.8	184±3	0.76 , D
			Cs-134	102±3 96.7±3.3 99.5±2.7 Mean = 99.4±1.7	119±2	0.83, A
			Cs-137	238±7 248±7 265±5.4 Mean = 250±3.8	268±4.3	0.93, A
			Mn-54	208±7 217±7 228±5 Mean = 217.7±3.7	210±3.7	1.04, A
			Fe-59	97.4±8.6 105±8 95.3±6.3 Mean = 99.2±5.1	94±1.7	1.05, A
			Zn-65	214±11 202±11 205±8 Mean = 207±5.8	202±3.3	1.02, A
			Co-60	159±5 155±5 160±4 Mean = 158±2.7	159±2.7	0.99, A

(1) Results reported as activity ± 1 sigma.

(2) Ratio = Reported/Analytics (See Section 9.3).

(*) Sample provided by Analytics, Inc.

(A) Evaluation Results, Acceptable.

(D) Evaluation Results, Disagreement.

TABLE D-1 (Continued)
INTERLABORATORY INTERCOMPARISON PROGRAM
Gamma Analysis of Air Particulate Filters (pCi/filter)

DATE	JAF ENV ID NUMBER	MEDIUM	ANALYSIS	JAF RESULT (1)	REFERENCE LABORATORY* (1)	RATIO (2)
03/18/99	E-1671-05	FILTER	Ce-141	78.5±5.6 78.7±7.1 85.8±4.7 Mean = 81.0±3.4 Mean = 102±30.1 †	108±1.7	0.75, D 0.94, A †
			Cs-134	46.1±3.5 46.6±4.8 37.9±3.5 Mean = 43.5±2.3 Mean = 62.2±3.4 †	69±1	0.64, D 0.90, A †
			Cs-137	110±7 82.3±7.9 109±5.4 Mean = 100±4 Mean = 155±6.4 †	146±2.3	0.68, D 1.06, A †
			Mn-54	76.1±6.2 70.8±8.0 75.0±5.0 Mean = 74.0±3.8 Mean = 94.0±6.5 †	93±1.7	0.80, D 1.01, A †
			Fe-59	28.5±8.0 37.5±11.6 29.5±8.0 Mean = 31.8±5.4 Mean = <171 †	48±0.7	0.67, D N/A †
			Zn-65	96.7±12.3 94.7±15.2 98.3±9.7 Mean = 96.6±7.3 Mean = 123±12.7 †	119±2	0.82, A 1.03, A †
			Co-60	72.9±5.1 83.3±7.0 81.8±4.4 Mean = 79.3±3.2 Mean = 115±5.3 †	110±2	0.72, D 1.05, A †
			Cr-51	96.0±26.8 151±40.2 183±25 Mean = 143.3±18.1 Mean = <1430 †	242±4	0.59, D N/A †

(1) Results reported as activity ± 1 sigma.
(2) Ratio = Reported/Analytics (See Section 9.3).
(*) Sample provided by Analytics, Inc.
(D) Evaluation Results, Disagreement.
(A) Evaluation Results, Acceptable.
(†) Recount Analysis, See Section 9.4.2.2.

TABLE D-1 (Continued)
INTERLABORATORY INTERCOMPARISON PROGRAM
Gamma Analysis of Air Particulate Filters (pCi/filter)

DATE	JAF ENV ID NUMBER	MEDIUM	ANALYSIS	JAF RESULT (1)	REFERENCE LABORATORY* (1)	RATIO (2)
09/23/99	E-1908-05	FILTER	Ce-141	126±5 129±5 128±5 Mean = 127.7±2.9 Mean = 116±3 †	114±2	1.12, A 1.02, A †
			Cr-51	105±21 79.2±19.3 92.9±19 Mean = 92.4±11.4 Mean = 80.1±9.9 †	86±1.3	1.07, A 0.93, A †
			Cs-134	48.3±2.6 45.7±2.6 48.8±3.4 Mean = 47.6±1.7 Mean = 41.6±1.5 †	56±1	0.86, A 0.74, D †
			Cs-137	149±6 146±5 150±6 Mean = 148.3±3.3 Mean = 131±3 †	125±2	1.18, A 1.05, A †
			Mn-54	116±5 129±6 117±5 Mean = 120.7±3.1 Mean = 108±3 †	98±1.7	1.23, A 1.10, A †
			Fe-59	57.4±7.4 62.9±7.3 54.6±7.3 Mean = 58.3±4.2 Mean = 52.5±3.8 †	44±0.7	1.32, D 1.19, A †
			Zn-65	111±9 109±9 129±9 Mean = 116.3±5.2 Mean = 105±5 †	94±1.7	1.23, A 1.12, A †
			Co-60	77.7±3.6 81.4±3.6 78.9±3.6 Mean = 79.3±2.1 Mean = 71.9±2.0 †	74±1.3	1.07, A 0.97, A †

(1) Results reported as activity ± 1 sigma.
(2) Ratio = Reported/Analytics (See Section 9.3).
(*) Sample provided by Analytics, Inc.
(A) Evaluation Results, Acceptable.
(D) Evaluation Results, Disagreement.
(†) Recount Analysis, See Section 9.4.2.3.

TABLE D-1 (Continued)

INTERLABORATORY INTERCOMPARISON PROGRAM

Gamma Analysis of Milk (pCi/liter)

DATE	JAF ENV ID NUMBER	MEDIUM	ANALYSIS	JAF RESULT (1)	REFERENCE LABORATORY* (1)	RATIO (2)
06/24/99	E-1768-05	MILK	Ce-141	158±7 158±8 178±7 Mean = 165±4	168±2.7	0.98, A
			Cr-51	200±27 228±37 219±35 Mean = 216±19	215±3.7	1.00, A
			Cs-134	105±4 97.9±5.9 96.9±5.0 Mean = 99.9±2.9	115±2.0	0.87, A
			Cs-137	178±7 178±8 170±7 Mean = 175±4	188±3.0	0.93, A
			Mn-54	86.6±5.4 71±6 86.3±5.4 Mean = 81.3±3.2	85±1.3	0.96, A
			Fe-59	40±9 49.3±9.5 50.2±9.7 Mean = 46.5±5.4	48±0.7	0.97, A
			Zn-65	119±11 103±11 110±12 Mean = 111±7	122±2.0	0.91, A
			Co-60	212±6 228±7 217±6 Mean = 219±4	214±3.7	1.02, A

(1) Results reported as activity ± 1 sigma.

(2) Ratio = Reported/Analytics (See Section 9.3).

(*) Sample provided by Analytics, Inc.

(A) Evaluation Results, Acceptable.

TABLE D-1 (Continued)

INTERLABORATORY INTERCOMPARISON PROGRAM

Gamma Analysis of Milk (pCi/liter)

DATE	JAF ENV ID NUMBER	MEDIUM	ANALYSIS	JAF RESULT (1)	REFERENCE LABORATORY* (1)	RATIO (2)
09/23/99	E-1909-05	MILK	Ce-141	189±6 185±8 198±8 Mean = 190.7±4.3	197±3.3	0.97, A
			Cr-51	144±25 118±31 112±30 Mean = 124.7±16.6	149±2.3	0.84, A
			Cs-134	81.9±2.5 83.2±4.0 78.8±3.0 Mean = 81.3±1.9	96±1.7	0.84, A
			Cs-137	202±5 190±6 201±6 Mean = 197.7±3.3	217±3.7	0.91, A
			Mn-54	171±6.1 158±6 172±6 Mean = 167±3.3	170±3	0.98, A
			Fe-59	77.4±6.1 76.0±8.7 63.1±8 Mean = 72.2±4.4	76±1.3	0.95, A
			Zn-65	168±8 154±10 150±10 Mean = 157.3±5.4	164±2.7	0.96, A
			Co-60	131±3 129±4 131±4 Mean = 130.3±2.1	129±2	1.01, A

(1) Results reported as activity ± 1 sigma.

(2) Ratio = Reported/Analytics (See Section 9.3).

(*) Sample provided by Analytics, Inc.

(A) Evaluation Results, Acceptable.

TABLE D-1 (Continued)

INTERLABORATORY INTERCOMPARISON PROGRAM

Gamma Analysis of Soil (pCi/g)

DATE	JAF ENV ID NUMBER	MEDIUM	ANALYSIS	JAF RESULT (1)	REFERENCE LABORATORY* (1)	RATIO (2)
06/24/99	E-1769-05	SOIL	Ce-141	0.291±0.056 0.215±0.042 0.272±0.044 Mean=0.259±0.028	0.269±0.004	0.96, A
			Cs-134	0.155±0.015 0.150±0.011 0.158±0.014 Mean=0.154±0.008	0.184±0.003	0.84, A
			Cs-137	0.379±0.027 0.368±0.020 0.409±0.027 Mean=0.385±0.014	0.429±0.007	0.90, A
			Mn-54	0.134±0.019 0.133±0.015 0.154±0.020 Mean=0.140±0.010	0.136±0.002	1.03, A
			Co-60	0.354±0.022 0.361±0.016 0.352±0.021 Mean = 0.356±0.11	0.343±0.006	1.04, A
			Zn-65	0.183±0.045 0.246±0.031 0.177±0.038 Mean=0.202±0.022	0.196±0.003	1.03, A

(1) Results reported as activity ± 1 sigma.

(2) Ratio = Reported/Analytics (See Section 9.3).

(*) Sample provided by Analytics, Inc.

(A) Evaluation Results, Acceptable.

TABLE D-1 (Continued)

INTERLABORATORY INTERCOMPARISON PROGRAM

Gamma Analysis of Vegetation

DATE	JAF ENV ID NUMBER	MEDIUM	ANALYSIS	JAF RESULT (1)	REFERENCE LABORATORY* (1)	RATIO (2)
09/23/99	E-1911-05	VEGETATION	Ce-141	200±15 185±16 196±16 Mean = 193.7±9.0	219±3.7	0.89, A
			Cs-134	89.5±8.1 96.5±8.7 83.1±8.0 Mean = 89.7±4.8	107±1.7	0.84, A
			Cs-137	232±16 265±16 229±16 Mean = 242±9.2	241±4	1.00, A
			Mn-54	198±16 187±16 162±15 Mean = 182.3±9.0	188±3	0.97, A
			Zn-65	144±29 95.5±28.8 155±31.4 Mean = 131.5±17.2	181±3	0.73, D
			Co-60	127±12 143±12 136±12.1 Mean = 135.3±6.9	143±2.3	0.94, A

(1) Results reported as activity ± 1 sigma.

(2) Ratio = Reported/Analytics (See Section 9.3).

(*) Sample provided by Analytics, Inc.

(A) Evaluation Results, Acceptable.

(D) Evaluation Results, Disagreement.

TABLE D-1 (Continued)

INTERLABORATORY INTERCOMPARISON PROGRAM

Gamma Analysis of Water

DATE	JAF ENV ID NUMBER	MEDIUM	ANALYSIS	JAF RESULT (1)	REFERENCE LABORATORY* (1)	RATIO (2)
03/01/99	QAP-50	WATER Bq/liter	Cs-137	38.1±1.8 36.5±1.2 35.9±1.7 Mean = 36.8±0.9	39.4±2.4	0.93, A
			Co-60	53.7±1.8 52.2±1.2 51.8±1.8 Mean = 52.6±0.9	51.1±3.0	1.03, A
09/01/99	QAP-51	WATER Bq/liter	Cs-137	77.3±1.7 75.0±1.8 79.6±1.7 † Mean = 77.3±1.0	76.0±3.4	1.02, A
			Co-60	55.5±1.2 54.7±1.3 55.5±1.2 † Mean = 55.2±0.4	52.4±2.2	1.05, A

(1) Results reported as activity ± 1 sigma.

(2) Ratio = Reported/EML.

(*) Sample provided by Environmental Measurements Lab, Dept. of Energy.

(A) Evaluation Results, Acceptable.

(†) Revised from initially reported and published values. Initial sample results reported with incorrect volumes for 2 of 3 analysis. Sample volumes were corrected and ratio values recalculated.

TABLE D-1 (Continued)

INTERLABORATORY INTERCOMPARISON PROGRAM

Gamma Analysis Air Particulate Filters (Bq/filter)

DATE	JAF ENV ID NUMBER	MEDIUM	ANALYSIS	JAF RESULT (1)	REFERENCE LABORATORY* (1)	RATIO (2)
03/01/99	QAP-50	FILTER	Co-57	2.88±0.08 3.08±0.11 2.96±0.09 Mean = 2.97±0.05	3.01±0.14	0.99, A
			Co-60	5.00±0.16 5.07±0.23 4.77±0.15 Mean = 4.95±0.11	4.96±0.28	1.00, A
			Sb-125	3.02±0.23 4.37±0.38 3.34±0.24 Mean = 3.58±0.17	3.59±0.31	1.00, A
			Cs-137	5.70±0.19 6.11±0.28 6.07±0.15 Mean = 5.96±0.12	6.05±0.3	0.99, A
09/01/99	QAP-51	FILTER	Mn-54	9.18±0.28 8.81±0.28 8.92±0.28 Mean = 8.97±0.13	7.91±0.45	1.13, A
			Co-60	6.96±0.21 6.62±0.20 6.66±0.20 Mean = 6.75±0.12	6.35±0.41	1.06, A
			Co-57	8.36±0.14 8.07±0.14 8.07±0.14 Mean = 8.17±0.08	7.73±0.033	1.06, A
			Cs-137	6.92±0.23 6.51±0.22 6.73±0.23 Mean = 6.72±0.13	6.43±0.42	1.05, A
			Ru-106	4.96±1.04 6.81±1.04 6.18±1.05 Mean = 5.98±0.60	5.5±1.76	1.09, A

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

TABLE D-1 (Continued)

INTERLABORATORY INTERCOMPARISON PROGRAM

Gross Beta Analysis of Water (Bq/liter)

DATE	JAF ENV ID NUMBER	MEDIUM	ANALYSIS	JAF RESULT (1)	REFERENCE LABORATORY* (1)	RATIO (2)
03/01/99	QAP-50	WATER	GROSS BETA	1143.7±24.1 1080±24 1175.1±25.5 Mean=1132.9±14.2	1100±40	1.03, A
09/01/99	QAP-51	WATER	GROSS BETA	851.7±21.1 850.3±21.1 840.6±20.7 Mean=847.5±12.1	740.0±40.0	1.15, A

(1) Results reported as activity ± 1 sigma.

(2) Ratio = Reported/EML.

(*) Sample provided by Environmental Measurements Lab, Dept. of Energy.

(A) Evaluation Results, Acceptable.

TABLE D-1 (Continued)

INTERLABORATORY INTERCOMPARISON PROGRAM

Tritium Analysis of Water (Bq/liter)

DATE	JAF ENV ID NUMBER	MEDIUM	ANALYSIS†	JAF RESULT (1)	REFERENCE LABORATORY* (1)	RATIO (2)
03/01/99	QAP-50	WATER	H-3	140.6±29.6	121.1±6.8	1.16, A
09/01/99	QAP-51	WATER	H-3	155.4±40.7	80.7±3.7	1.93, N

(1) Results reported as activity ± 1 sigma.

(2) Ratio = Reported/EML.

(*) Sample provided by Environmental Measurements Lab, Dept. of Energy.

(†) Analysis performed by Teledyne Brown Engineering

(A) Evaluation Results, Acceptable.

(N) Evaluation Results, Not Acceptable.

TABLE D-1 (Continued)

INTERLABORATORY INTERCOMPARISON PROGRAM

Gross Beta Analysis of Air (Bq/filter)

DATE	JAF ENV ID NUMBER	MEDIUM	ANALYSIS	JAF RESULT (1)	REFERENCE LABORATORY* (1)	RATIO (2)
03/01/99	QAP-50	AIR	GROSS BETA	1.49±0.06 1.42±0.06 1.58±0.06 Mean = 1.50±0.03	1.56±0.16	0.96, A
09/01/99	QAP-51	AIR	GROSS BETA	2.75±0.08 2.92±0.08 2.78±0.08 Mean = 2.82±0.05	2.66±0.26	1.06, A

(1) Results reported as activity ± 1 sigma.

(2) Ratio = Reported/EML.

(*) Sample provided by Environmental Measurements Lab, Dept. of Energy.

(A) Evaluation Results, Acceptable.