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INDIAN POINT STATION
BROADWAY & BLEAKLEY AVENUES
BUCHANAN, NY 10511

April 30, 2001
IPN-01-040
NL 01-055

Docket Nos. 50-003, 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
Mail Station P1-137
Washington, DC 20555-0001

SUBJECT: **Indian Point's Annual Radiological Environmental Operating Report for 2000**

Dear Sir:

Enclosed please find one copy of the Indian Point Site Annual Radiological Environmental Operating Report for the period January 1, 2000 to December 31, 2000. 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,

A. Alan Blind
A. Alan Blind
Vice President Nuclear Power
Consolidated Edison Company
Of New York, Inc.

Enclosure

cc: See next page

JE25

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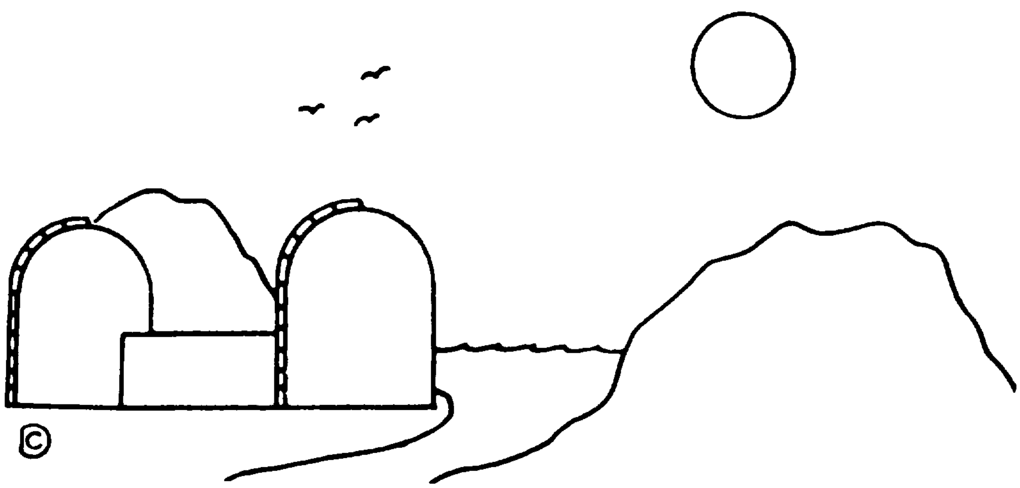
2000
RADIOLOGICAL ENVIRONMENTAL
OPERATING REPORT

INDIAN POINT
NUCLEAR POWER PLANTS
January 1 through December 31, 2000



ENTERGY NUCLEAR NORTHEAST
CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.

ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

ENTERGY NUCLEAR NORTHEAST
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, 2000

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SECTION I

EXECUTIVE SUMMARY

1.0 EXECUTIVE SUMMARY

This Annual Radiological Environmental Operating Report contains descriptions and results of the 2000 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 Entergy Nuclear Northeast. Unit 1 was retired as a generating facility in 1974, and as such, its reactor is no longer operated.

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

The airborne pathway includes measurements of air, precipitation, drinking water, and broad leaf vegetation samples. The airborne pathway measurements indicated that there was no increased radioactivity attributable to 2000 Indian Point Station operation.

The waterborne pathway consists of Hudson River water, fish and invertebrates, and shoreline sediment. Measurements of the media comprising the waterborne pathway indicated that there were no significantly increased levels of radioactivity attributable to 2000 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 and Radiological Effluent Controls, herein referred to as RETS. This 2000 REMP report also contains summaries and discussions of the results of the 2000 program, trend analyses, potential impact on the environment, land use census, interlaboratory comparisons, and information in response to the Indian Point Unit 2 steam generator event (see Appendix E).

During 2000, a total of 1221 analyses were performed. Table B-1 presents a summary of the collected sample results. The actual sampling frequency in 2000 was higher than required, due to the inclusion of additional (non-RETS) sample locations and media.

In summary, the levels of radionuclides in the environment surrounding Indian Point are significantly less than NRC limits as a result of Indian Point Station operations in 2000. The levels present in 2000 were within the historical ranges, i.e., previous levels resulting from natural and anthropogenic sources for the detected radionuclides. Consequently, Indian Point operations in 2000 did not result in approaching any environmental regulatory limits posed by the NRC, or result in any exposure to the public greater than environmental background levels.

SECTION 2

INTRODUCTION

2.0 INTRODUCTION

2.1 Site Description

The Indian Point site occupies 239 acres on the east bank of the Hudson River on a point of land at Mile Point 42.6. The site is located in the Village of Buchanan, Westchester County, New York. Three nuclear reactors, Indian Point Unit Nos. 1, 2 and 3, and associated buildings occupy approximately 35 acres. Unit 1 (Con Edison) has been retired as a generating facility and Units 2 and 3 are owned and operated by Con Edison and Entergy Nuclear Northeast, 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 activity, the environmental sampling schedule requires that analyses be conducted for specific environmental media on a regular basis. The radioactivity profile of the environment is established and monitored through routine evaluation of the analytical results obtained.

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

Verification of expected radionuclide concentrations resulting from effluent releases attributable to the site is another program objective. Verifying projected concentrations through the REMP is difficult since the environmental concentrations resulting from plant releases are consistently too small to be detected. Plant related radionuclides were detected in 2000, however, residual radioactivity from atmospheric bomb tests and naturally occurring radioactivity were the predominant sources of radioactivity in the samples collected. Nonetheless, analysis of the data verified that plant effluents were far below regulatory limits at environmental levels.

SECTION 3

PROGRAM DESCRIPTION

3.0 PROGRAM DESCRIPTION

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

3.1 Sample Collection

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, Inc.

3.2 Sample Analysis

The analysis of Indian Point environmental samples is performed by three laboratories: James A. Fitzpatrick Nuclear Power Plant (JAFNPP) Environmental Laboratory in Fulton, New York; and two commercial analytical laboratories, Teledyne Brown Engineering, Inc., New Jersey and Environmental Inc. Midwest Laboratories, Illinois. The JAFNPP lab at Fulton analyzes all samples except tritium samples, which are processed by Teledyne Brown Engineering, Inc and Environmental Inc. Midwest Laboratories. Tritium values reported are the higher of the two laboratories; reported values.

3.3 Sample Collection and Analysis Methodology

3.3.1 Direct Radiation

Direct gamma radiation is measured using integrating calcium sulfate thermoluminescent dosimeters (TLDs), which provide cumulative measurements of radiation exposure (i.e., total integrated exposures in milliroentgen, mR) for a given period. The area surrounding the Indian Point site is divided into 16 compass sectors. Each sector has two TLD sample locations. The inner ring is located near the site boundary at approximately 1 mile (1.6 km). The outer ring is located at approximately 5 miles (8 km) from the site (6.7- 8.0 km), see Figures A-1 and A-2.

An additional TLD sample site is located at Roseton (20 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-1 and A-2.

3.3.3 Hudson River Water

Hudson River water sampling is performed continuously at the intake structure (RETS designation Wa1) and at a point exterior to the discharge canal where Hudson River water and water from the discharge canal mix (RETS designation Wa2). 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, two recounts are performed to verify the positive results. The recounts are not performed on; air samples with positive results from gross beta analysis, since the results are always positive due to natural background radioactive material in the air, or tritium in water samples, since an outside contractor provides these activities. When a radionuclide is positively identified in two or more counts, the analytical result for the radionuclide is reported as the mean of the positive detections and the associated propagated error for that mean. In cases where more than one sample result is available, the mean of the sample results and the estimated error for the mean are reported in the Annual Report.

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

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

where:

X = 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 otherwise 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 1990 through 1999. The 2000 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

Indian Point Unit 3 provided two programmatic changes to the REMP. First, IP3 submitted a change to their station's technical specifications in accordance with NRC Generic Letter 89-01. The licensee relocated the procedural controls of the REMP, contained in technical specifications, to the Off Site Dose Calculation Manual (ODCM). Within this Annual Radiological Environmental Operating Report, Radiological Environmental Technical Specifications (RETS) also refers to the Radiological Effluent Controls contained within the IP3 ODCM.

Secondly, Indian Point Unit 3 submitted another license amendment (No. 203) transferring its operating license (DPR-64) from the New York Power Authority to Entergy Nuclear Operations, Inc. effective November 21, 2000.

SECTION 4

RESULTS AND DISCUSSION

4.0 RESULTS AND DISCUSSION

The 2000 Radiological Environmental Monitoring Program (REMP) was conducted in accordance with Indian Point's Radiological Environmental Technical Specifications and Radiological Effluent Controls (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. Response to the Indian Point Unit 2 steam generator event is found in Appendix E.

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 2000 and assessed the significance of the findings.

A summary of the results of the 2000 REMP is presented in Table B-2. This table lists the mean and range of all positive results obtained for each of the media sampled at RETS indicator and control locations. Discussions of these results and their evaluations are provided below.

The radionuclides detected in the environment can be grouped into three categories:

(1) naturally occurring radionuclides; (2) radionuclides resulting from weapons testing and other non-plant related, anthropogenic sources; and (3) radionuclides that could be related to plant operations.

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

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

The second group of radionuclides detected in 2000 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 2000, the detected radionuclide(s) attributable to past atmospheric weapons testing consisted of Cs-137 in some media. The levels detected were consistent with the historical levels of radionuclides resulting from weapons tests as measured in previous years.

The final group of radionuclides detected through the 2000 REMP comprises those that may be attributable to current plant operations. During 2000, H-3, I-131, Cs-134, and Cs-137 were the only potentially plant-related radionuclides detected in some of the RETS and non-RETS samples.

H-3 may be present in the local environment due to either natural occurrence, other man-made sources, or as a result of plant operations. The H-3 detected in 2000 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 and released from fission reactors and were introduced into the environment from the accident at Chernobyl. Only Cs-137 is found in weapons test debris.

I-131 is also produced in fission reactors, but can result from non-plant related anthropogenic sources, e.g., medical administrations, such as in the 1998 and this years' REMP.

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 2000 REMP, though they (Co-58 and Co-60) can be observed in historical tables.

In the following sections, a summary of the results of the 2000 REMP is presented by sample medium, and the significance of any positive findings discussed. It should be noted that naturally occurring radionuclides are omitted from the summary table (Table B-2) and further discussion.

4.1 Direct Radiation

The environmental TLDs used to measure the direct radiation were TLDs supplied and processed by the JAFNPP Environmental Laboratory. The laboratory uses a Panasonic TLD system. In 2000, 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.

During the first quarter of 2000, the TLD samples were collected mid February in response to the IP2 steam generator event. New TLDs were deployed and later collected at the end of the calendar quarter. TLD results for the first quarter are the sum of the first and second sample sets, in mR per standard quarter. Response to the Indian Point Unit 2 steam generator event is found in Appendix E.

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 1995 through 1999. The 2000 means are also presented in Table B-4. Table B-5 presents the 2000 TLD data for the inner ring and outer ring of TLDs.

The 2000 mean value for the direct radiation sample points was 14.5 mR per standard quarter. In 1999, the mean value was 14.9 mR and the mean value for the period 1995 through 1999 was 14.7 mR per standard quarter. At those locations where the 2000 mean value was higher, they are within historical bounds for the respective locations.

The DR sample locations are arranged so that there are two concentric rings of TLDs around the Indian Point site. The inner ring (DR-1 to DR-16) is close to the site boundary. The outer ring (DR-17 to DR-32) has a radius of approximately 5 miles from the three Indian Point units. The results for these two rings of TLDs are provided in Table B-5. The annual average for the inner ring was 14.3 mR per standard quarter while the average for the outer ring was 14.9 mR per standard quarter. The control location average for 2000 was 15.5 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 2000 averages are consistent with the historical data. The 2000 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 2000 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 0.0144 pCi/m^3 and the average for the control location was 0.014 pCi/m^3. The activities detected were consistent for all locations, with no significant differences in gross beta activity in any sample due to location. 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 2000 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 2000.

4.3 Hudson River Water

A summary of the radionuclides detected in the Hudson River water is contained in Table B-2. Data resulting from analysis of monthly Hudson River water samples for gamma emitters, and H-3 analysis of quarterly composites, are presented in Tables B-9 and B-10, respectively.

In addition to naturally occurring radionuclides, tritium, whose presence may or may not be attributable to plant operations, was the only radionuclide detected in the Hudson River water in 2000. Tritium was detected in the discharge canal mixing zone at a maximum concentration of 332 pCi/L in 2000. The detected H-3 concentration was far below the RETS required LLD of 3000 pCi/L.

The relative insignificance of the H-3 concentration of 332 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 0.0008 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 2000 came from waters with 332 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 0.0008 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 2000 drinking water sample analysis results. Results of the gamma spectroscopy analyses of the monthly drinking water samples are in Table B-11; results of tritium analysis of quarterly composites are in Table B-12. Other than naturally occurring radionuclides, no radionuclides were detected in drinking water samples.

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

4.5 Hudson River Shoreline Soil

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

In addition to the naturally occurring nuclides, Cs-134 and Cs-137 were identified in the Hudson River shoreline soil samples in 2000. Cs-137 was detected in four out of six samples from indicator locations. Cs-137 was detected at the control location in one out of four samples. The average concentration for the indicator locations was 178 pCi/kg-dry with a maximum concentration of 258 pCi/kg-dry.

Cs-134 was detected with the Cs-137 in two of the six indicator samples with a minimum and maximum concentration of 34 pCi/kg-dry and 83 pCi/kg-dry. Cs-137 with the accompanying presence of Cs-134 would tend to date the radioactivity as resulting from recent plant operations. Cs-137 and Cs-134 have been detected in shoreline soils at indicator and control locations within the past ten years.

4.6 Broad Leaf Vegetation

Table B-2 contains a summary of the broad leaf vegetation sample analysis results. All the data from analysis of the 2000 samples are presented in Table B-14. Analyses of broad leaf vegetation samples revealed naturally occurring nuclides, and Cs-137 was detected in two of thirty samples from indicator locations at concentrations of 18.3 pCi/kg-wet and 37.7 pCi/kg-wet. Historically, Cs-137 has been detected in both control and indicator broad leaf vegetation.

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

4.7 Fish and Invertebrates

A summary of the fish and invertebrate sample analysis results is presented in Table B-2. Table B-15 contains the results of the analysis of all 2000 samples. None of the indicator samples revealed radionuclide concentrations greater than CL values. Only naturally occurring nuclides were detected. No Cs-134, Cs-137, Co-58, or Co-60 was detected.

A summary of historical fish and invertebrate analytical data is presented in Table C-7 and illustrated in Figure C-7. Data are consistent with historical trends.

4.8 Additional Media Sampling

Although not required by the RETS, analyses were performed on aquatic vegetation, Hudson River 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 historical levels. Since these samples were not required by the RETS, individual tables and graphs are not presented for the data.

I-131 was detected in an aquatic vegetation sample at a concentration of 15.5 pCi/kg-wet. The I-131 detected was not due to Station operations, but rather to medical administrations. The sample location is 10.8 miles north and is considered a control location for these media. Cs-137 was detected in two samples, one indicator and one control, at concentrations of 12.5 pCi/kg-wet and 12 pCi/kg-wet, respectively. Data are consistent with historical trends.

Soil samples were obtained at two indicator locations and one control location. Cs-137 was detected in one indicator sample; 78.9 pCi/kg-dry. 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. The samples did not show any tritium or other plant-related nuclides. 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. I-131 was detected in aquatic vegetation and was attributed to medical administrations; not station operations. The non-RETS sample data corroborate the RETS sample data in determining that the operation of the Indian Point station in 2000 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 2000. 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 2000 census were the same as the 1999 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 2000 REMP reveal that operations at the station did not result in an adverse impact on the environment.

The results of the 2000 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 2000 REMP results demonstrate the relative contributions of different radionuclide sources, both natural and anthropogenic, to the environmental concentrations. Overall, doses to humans are much more significant from non-plant related sources than those associated with plant operations.

SECTION 5

QUALITY ASSURANCE

5.0 QUALITY ASSURANCE

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

The operational quality assurance activities are:

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

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

During 2000, 58 samples involving 98 individual analyses were requested of the JAFNPP Environmental Laboratory that processes the Indian Point REMP samples. Spiked air, water, soil, and vegetation samples were submitted for analysis. The spiked samples were obtained from a commercial vendor laboratory and sent to the JAFNPP Environmental Laboratory to be analyzed as regular environmental samples. The supply vendor certified the activity levels of the spikes at the time of preparation.

After the Environmental Laboratory analyzed the spike samples, statistical tests were performed using both the spike vendor's and the Laboratory's data. In summary, 94 of the 98 individual analyses met the Indian Point acceptance criteria, which yields an overall performance rating of 96%. This is well within the prescribed standard for laboratory performance.

A summary of the identified nonconforming samples:

- Both a mixed gamma in vegetation and mixed gamma in air did not meet the prescribed statistical criteria for 1 of 8 isotopes. Both samples had a negative bias for the isotope Cs-134. These lower than actual reported values for Cs-134 have been identified as a recurring problem and are accredited to coincidence summing. This type of nonconformity and the corrective action to prevent future recurrence is discussed in detail in section D.4.2 of the "QA/QC Program."

- Two gross beta air particulate filters did not meet the criteria (21% and 15% low.) With the exception of these two filters, the remaining 24 samples of this type were within the acceptance range.

The Environmental Laboratory's performance in other comparable areas, notably the

Interlaboratory Comparison Program, remains good. We conclude that results from the JAFNPP Environmental Laboratory are expected to remain reliable.

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

- Audits of Indian Point and radioanalytical contractor procedures related to the Radiological Environmental Monitoring Program by Entergy Nuclear Northeast Quality Assurance (QA) 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 2000 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 routine audits demonstrates this compliance.

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

In summary, the quality assurance program conducted in conjunction with the Indian Point Radiological Environmental Monitoring Program included audits and evaluations of in-house and contractor procedures, work functions, and quality assurance programs. Review of the 2000 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

1. Radiological Environmental Technical Specifications, for Indian Point Nuclear Generating Stations 1, 2, and 3.

2. Consolidated Edison Company of N.Y., Nuclear Environmental Monitoring Procedures, Radiological Support Procedures, Indian Point Station.

3. Environmental Analytical Procedures, Teledyne Isotopes, Inc., Westwood, NJ - Knoxville, TN.

4. U.S Nuclear Regulatory Commission. Regulatory Guide 4.8, Environmental Technical Specifications for Nuclear Power Plants, December 1975.

5. Eisenbud, M., Environmental Radioactivity, Academic Press, New York, 1987.

6. Glasstone, S., and W. H. Jordan, Nuclear Power and Its Environmental Effects, American Nuclear Society, La Grange Park, IL, 1980.

7. Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR 50, Appendix I, U.S. NRC Regulatory Guide 1.109, Revision 1, 1977.

8. Cohen N., and Eisenbud M., Radiological Studies of the Hudson River, Progress Report Institute of Environmental Medicine, New York University Medical Center, December 1983.

9. Consolidated Edison Company of New York, Quality Control Program for Environmental Monitoring Rev. 2 (RS - 8.500)

10. Quality Assurance Manual Environmental Analysis Department Teledyne Isotopes, Westwood, NJ - Knoxville, TN.

11. U.S. Nuclear Regulatory Commission. Regulatory Guide 4.15, Revision 1, Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment February 1979.

12. J. W. Poston, Cesium-137 and Other Man-Made Radionuclides in the Hudson River: A Review of the Available Literature, Applied Physical Technology, Inc., report to NYPA, September 1977.

13. U.S. Environmental Protection Agency Report EPC-520/1 80-012, Upgrading Environmental Radiation Data, August 1980.

14. Andrews, Howard L. and Lapp, Ralph E. Nuclear Radiation Physics, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1972.

15. U.S. Nuclear Regulatory Commission, Branch Technical Position to Regulatory Guide 4.8, An Acceptable Radiological Environmental Monitoring Program, November 1979.

16. Eichholz, Geoffrey G., Environmental Aspects of Nuclear Power, Lewis Publishers, Inc., Chelsea, Michigan, 1985.

17. Kelly, J. J. (Ed.), Effluent and Environmental Radiation Surveillance, ASTM STP #698, Philadelphia, PA, 1978.

18. Entergy Nuclear Northeast, James A. FitzPatrick Nuclear Power Plant, Radiological and Environmental Services Department Environmental Surveillance Procedures.

19. Knoll, Glenn F., Radiation Detection and Measurement, first edition, John Wiley and Sons, New York, 1979.

20. Dixon, Wilfred J., Introduction to Statistical Analysis, third edition, McGraw-Hill Inc., 1969.

21. National Council on Radiation Protection. NCRP Report No.94, Exposure of the Population in the United States and Canada from Natural Background Radiation December 1987.

22. National Council on Radiation Protection. NCRP Report No. 62, Tritium in the Environment, March 1979.

23. Entergy Nuclear Northeast, Offsite Dose Calculation Manual – Part 1, Radiological Effluent Controls – Part 2 Offsite Dose Calculation Manual, Revision 14, November 2000.

24. Consolidated Edison Company of New York, Offsite Dose Calculation Manual Rev. 6, October, 1999.

25. Kuhn, W.,et al., The Influence of Soil Parameters on Cs-137 Uptake by Plants from Long-Term Fallout on Forest Clearings and Grasslands, Health Physics Journal, 46(5), p. 1083, May 1984.

26. Garner, J.,et al., High Radiocesium Levels in Granite Outcrop Vegetation and Reductions Through Time, Health Physics Journal, 60(4), p. 533, April 1991.

27. McGee, E., et al., The Variability in Fallout Content of Soils and Plants and the Design of Optimum Field Sampling Strategies, Health Physics Journal, 68(3), March 1995.

28. Consolidated Edison Company of New York, Safety Evaluation for Amendment #45 to Unit 1 Provisional Operating License, January 1996.

APPENDIX A

ENVIRONMENTAL SAMPLING AND ANALYSIS REQUIREMENTS

APPENDIX A

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

Table A-1 provides the sampling station number, location, sector, distance from Indian Point, RETS designation and sample type. Non-RETS samples are also listed but have no RETS designation code. This table gives the complete listing of sample locations used in the 2000 REMP.

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

The 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 REMP SAMPLING STATION LOCATIONS

SAMPLING STATION	LOCATION / DISTANCE	RETS/RECS 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	Discharge Canal (Mixing Zone) / Onsite - (SW)	Wa2, NR	HR Water, Bottom Sediment
14	Water Meter House / Onsite (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 & Invertebrates
27	Croton Point / 6.4 Mi (SSE)	NR, NR, DR41	Air Particulate, Radioiodine, Direct Gamma
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

HR = Hudson River
NR = non RETS

TABLE A-1

INDIAN POINT REMP SAMPLING STATION LOCATIONS

SAMPLING STATION	LOCATION / DISTANCE	RETS/RECS SAMPLE DESIGNATION	SAMPLE TYPES
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
57	Roa Hook / 2 Mi (N)	DR1	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	Pine Road - Cortlandt (School Parking Lot) / 4.8 Mi (ENE)	DR20	Direct Gamma
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 Exit 19, Tree on Medium North of Sign for Exit 19 / 5 Mi (NW)	DR28	Direct Gamma

HR = Hudson River
NR = non RETS

TABLE A-1

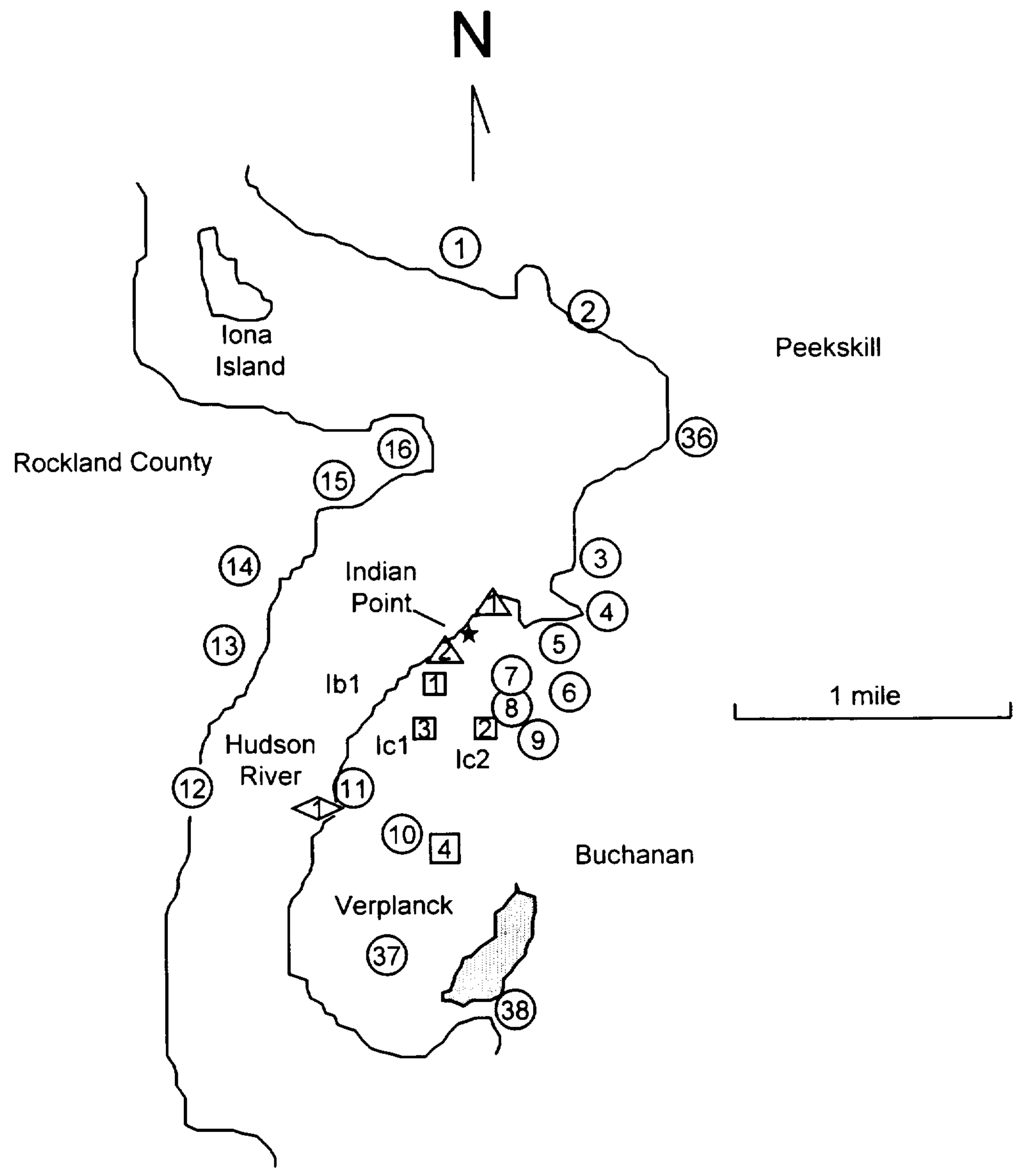
INDIAN POINT REMP SAMPLING STATION LOCATIONS

SAMPLING STATION	LOCATION / DISTANCE	RETS/RECS SAMPLE DESIGNATION	SAMPLE TYPES
76	On R/S Pole 13, West Shore (North) / 1 Mi (W)	DR13	Direct Gamma
77	Palisades Parkway / 4 Mi (W)	DR29	Direct Gamma
78	Rt. 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 16-Lake Welch / 4.7 Mi (WSW)	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
90	Charles Point / 0.8 Mi (NE)	DR3	Direct Gamma
92	Warren Road Cortlandt/ 3.7 Mi (SSE)	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
99	Algonquin Outfall / 0.35 Mi (SW)	NR	Special Outfall

HR = Hudson River
NR = non RETS

FIGURE A-1

RETS SAMPLING LOCATIONS
Within Two Miles of Indian Point

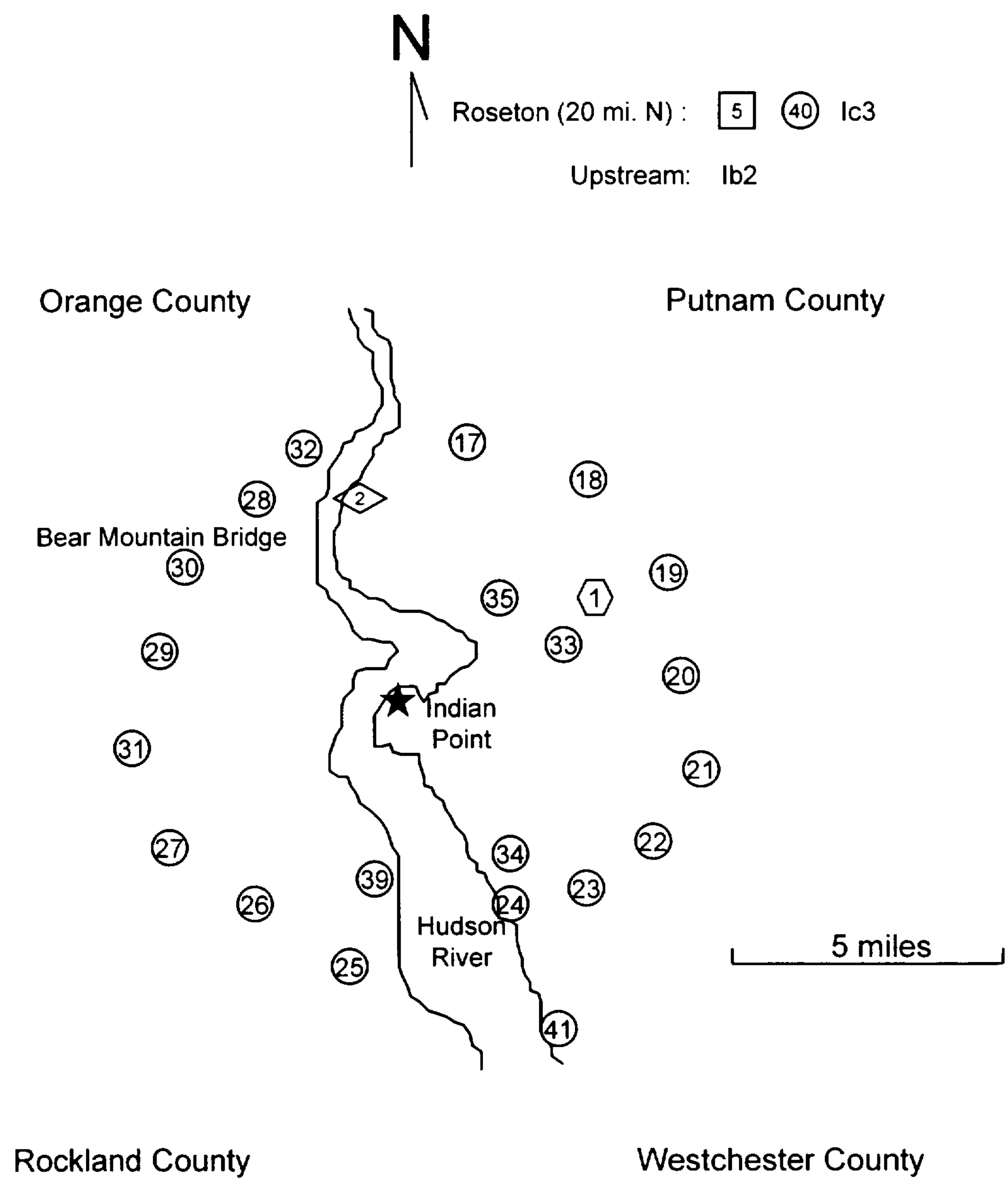


Key:

- △ - Waterborne: Surface (HR) Wa#
- ○ - Direct Radiation Sample Location DR#
- □ - Airborne Sample Location A#
- Ic# - Broadleaf Vegetation
- ◇ - Shoreline Sediment
- Ib1 - Fish and Invertebrates (where available downstream)

FIGURE A-2

RETS SAMPLING LOCATIONS
Within 10 Miles of Indian Point

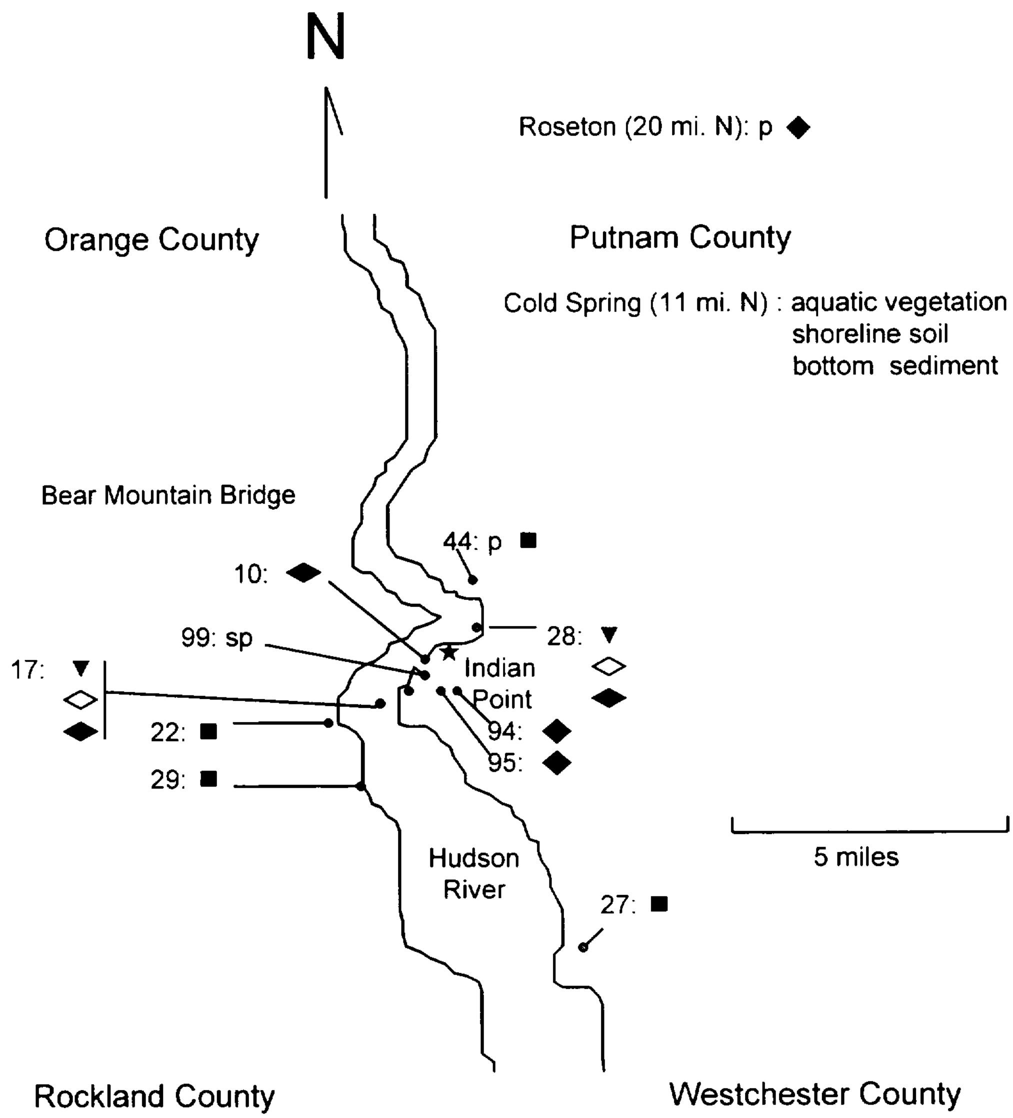


Key:
- ○ - Direct Radiation Sample Location DR#
- □ - Airborne Sampling Location A#
- ◇ - Shoreline Sediment

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

FIGURE A-3

NON-RETS SAMPLING LOCATIONS



Key:

- ■ - Air Sample
- ▼ - Aquatic Vegetation
- - Bottom Sediment
- p - Precipitation
- ◇ - Shoreline Sediment
- ◆ - Soil
- sp - special outfall

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, dry)
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 2000 Annual Radiological Environmental Monitoring Program Summary

The results of the 2000 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, Nb-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 Part I Section 2.8 of the Entergy IP3 RECS, a land use census was conducted to identify the nearest milch animal and the nearest residence. The results of the milch animal and land use censuses are presented in Tables B-17 and B-18, respectively. In lieu of identifying and sampling the nearest garden of greater than $50m^2$, at least three kinds of broad leaf vegetation were sampled near the site boundary in two sectors and at a designated control location (results are presented in Table B-14).

B.3 Sampling Deviations

During 2000, environmental sampling was performed for six media types required by RETS, five other media types and direct radiation. A total of 1244 samples (1211 RETS and 33 non-RETS) were scheduled. Of the scheduled samples, 98% were collected and analyzed for the program. Sampling deviations are summarized in Table B-1; discussions of the reasons for the deviations are provided in Table B-1a for air samples, B-1b for TLDs, and B-1c for other environmental media.

B.4 Analytical Deviations

In response to the Indian Point Unit 2 steam generator event (see Appendix E), TLD samples were analyzed mid-1st quarter. The two data sets from the 1st quarter were summed to determine the exposure for the standard month (91 days). These were considered one data set, but are not considered analytical deviations.

During 2000, three samples of fish and invertebrates could not meet their respective LLD (lower limit of detection) for Fe-59 due to delays in sample preparation and shipment.

B.5 Special Reports

No special reports were required under the REMP. Response to the Indian Point Unit 2 steam generator event is found in Appendix E.

TABLE B-1
SUMMARY OF SAMPLING DEVIATIONS
2000

MEDIA	TOTAL SCHEDULED SAMPLES	NUMBER OF DEVIATIONS	SAMPLING EFFICIENCY %	REASON FOR DEVIATION
PARTICULATES IN AIR	468	3	99	SEE TABLE B-1a
CHARCOAL FILTER	468	3	99	SEE TABLE B-1a
TLD	164	2	99	SEE TABLE B-1b
HUDSON RIVER WATER	32	5	84	SEE TABLE B-1b
DRINKING WATER	16	0	100	
SHORELINE SOIL	10	0	100	
BROAD LEAF VEGETATION	45	0	100	
FISH & INVERTEBRATES	8	4	50	SEE TABLE B-1c
SUBTOTALS	1211	17	99	
NON-RETS MEDIA				
AQUATIC VEGETATION	6	4	33	SEE TABLE B-1c
HUDSON RIVER SEDIMENT	8	1	88	SEE TABLE B-1c
SOIL	3	0	100	
PRECIPITATION	12	0	100	
OUTFALL	4	1	75	SEE TABLE B-1c
SUBTOTALS	33	6	82	
OVERALL TOTALS	1244	23	98	

TOTAL NUMBER OF ANALYSES REPORTED = 1221

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

2000 SAMPLE AND ANALYTICAL DEVIATIONS

TABLE B-1a

STATION	WEEK	PROBLEM / ACTIONS TO PREVENT RECURRENCE
#22 Lovett	18 (Air Particulate & Charcoal)	Defective circuit breaker in plant /notified Lovett station watch/breaker repaired
#4 Algonquin	31 (Air Particulate & Charcoal)	Loss of AC power/temporary power installed/new dedicated circuit initiated
#5 NYU Tower	35 (Air Particulate & Charcoal)	Low flow / replaced pump/continue to trend pump performance as per maintenance program

TABLE B-1b

STATION	QUARTER	PROBLEM / ACTIONS TO PREVENT RECURRENCE
#35 (DR-05)	4th QTR (TLD)	TLD missing/Replaced TLD/continue to trend missing TLDs for patterns, none noted.
#78 (DR-14)	4th QTR (TLD)	TLD missing/Replaced TLD/continue to trend missing TLDs for patterns, none noted.

TABLE B-1c

STATION	SAMPLE SCHEDULE	PROBLEM / ACTIONS TO PREVENT RECURRENCE
#9 Plant Inlet	HR Monthly / Quarterly H3 Composite (March & 1st Qtr)	Breaker out of service due to building modification affecting monthly and 1st QTR sample / grab sample taken / evaluate backup power supply to intake and discharge samplers
#9 Plant Inlet	HR Monthly / Quarterly H3 Composite (April & 2nd Qtr)	Breaker out of service due to building modification affecting monthly and 2nd QTR sample / grab sample taken / evaluate backup power supply to intake and discharge samplers
#9 Plant Inlet	HR Monthly / Quarterly H3 Composite (May & 2nd Qtr)	Breaker out of service due to building modification affecting monthly and 2nd QTR (same 2nd QTR deviation from previous) sample / grab sample taken / evaluate backup power supply to intake and discharge samplers
#23 Roseton	Seasonal/Semiannual (Fish/Invertebrate)	Fe-59 LLD not met due to delayed sample shipment/reviewed timeliness of sample shipments regarding analysis LLDs with NEM group
#23 Roseton	Seasonal/Semiannual (Fish/Invertebrate)	Fe-59 LLD not met due to delayed sample shipment/reviewed timeliness of sample shipments regarding analysis LLDs with NEM group
#25 Downstream (Vicinity of Plant)	Seasonal/Semiannual (Fish/Invertebrate)	Fe-59 LLD not met due to delayed sample shipment/reviewed timeliness of sample shipments regarding analysis LLDs with NEM group
#23 Roseton	Seasonal/Semiannual (Fish/Invertebrate)	One set of samples obtained/evaluate vendor contract
#17 Off Verplank	Spring and Summer (Aquatic Veg.)	No spring sample available/sample in summer
#17 Off Verplank	Spring and Summer (Aquatic Veg.)	No summer sample available/ continue spring & summer sampling schedule
#28 Lents Cove	Spring and Summer (Aquatic Veg.)	No spring sample available/sample in summer
#84 Cold Spring	Spring and Summer (Aquatic Veg.)	Spring sample lost in shipment/evaluate sample labeling and packaging methods
#17 Off Verplank	Spring and Summer (Bottom Sediment)	Spring sample lost in shipment/evaluate sample labeling and packaging methods
#99 Algonquin Outfall	Quarterly Grab	2nd quarter sample lost in shipment/ another sample taken when notified (3rd quarter)/evaluate sample labeling and packaging methods

TABLE B-2*
ANNUAL SUMMARY - 2000

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
DIRECT RADIATION (mR per standard quarter) B-3	164	N/A	*14.5 (158/160) / 8.1 - 20.0*	#81 Palisades Pkwy South Exit/ 4.7 Mi. (314°) DR13 19.6*(4/4) / 19.3-19.9*	*15.5 (4/4)/13.6-16.4*	0
AIR PARTICULATES AND RADIOIODINE (pCi/m³) B-6, B-7, B-8	GB (465)	0.01	*0.0144 (465/465) / 0.003-0.031*	#94 NYPA Trng Bldg (Unit 3)/ 0.4 Mi. (180°) *0.0152 (52/52) / 0.003-0.031*	*0.014 (52/52)/(0.004-0.029)*	0
	I-131 (465)	0.07	<LLD	<LLD	<LLD	0
	GSA (36)					
	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	*267 (4/4) / 194-332*	#10 Mixing Zone Discharge Canal (On-site) *267 (4/4) / 194-332*	*190 (2/4) 189-190*	0
	GSA (24)					
	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	*2.11 (12/12) / 1.34-2.76*	#7 Camp Field Reservoir / 3.5 Mi (45°) *2.11 (12/12) / 1.34-2.76*	NONE	0
	H-3 (4)	2000	<LLD	<LLD	NONE	0
	GSA (12)					
	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

ND - not detected

TABLE B-2*
ANNUAL SUMMARY - 2000

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	*58 (2/6)/34-83*	#28 Lent's Cove 0.5 Mi. (45°) 83 *(1/2) / 83-83*	<LLD	0
	Cs-137	180	*178 (4/6) / 107.6 - 257.6*	#17 Verplanck 1.5 Mi. (202.5°) 235 *(2/2) / 212-258*	*231 (1/2) / 231-231*	0
BROADLEAF VEGETATION (pCi/kg - wet) B-14	GSA (45)					
	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	*28 (2/30)/18.3-37.7*	#95 Met Tower 0.4 (202.5°) *37.7(1/15)/ 37.7-37.7*	<LLD	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

ND - not detected

Table B-2 Notation

2000

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)

2000

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY TABLE NOTES

4. The column labeled Indicator Locations gives the results for all the indicator sites. Four out of six samples from indicator locations had Cs-137 and two out of six samples from indicator locations had Cs-134. The mean of the Cs-137 from the four positive indicator location samples was 178 pCi/kg-dry. The range of the positive samples was 107.6 to 257.6 pCi/kg-dry. The mean of the Cs-134 from the two positive indicator location samples was 56 pCi/kg-dry. The range of the positive samples was 34–83 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 235 pCi/kg-dry Cs-137, two samples were taken and both samples were positive.

   The highest indicator mean for Cs-134 is from sample location 28, Lents Cove, 0.5 miles from Indian Point at compass direction 45 degrees. The mean for this indicator sample site is 83 pCi/kg-dry Cs-134, two samples were taken and one was positive. The range of the positive samples at this location was <LLD to 83 pCi/kg-dry.

6. The control location column is next. For 2000 no Cs-134 was detected at the control location. Cs-137 was detected in one of the two samples at 231 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 2000
mR PER STANDARD QUARTER

Station ID	Sector	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter	2000 Avg
DR-01	N	14.6	16.9	14.1	16.1	15.4
DR-02	NNE	20.0	15.7	15.0	14.0	16.2
DR-03	NE	10.5	12.6	11.7	12.7	11.9
DR-04	ENE	12.8	13.4	11.1	14.3	12.9
DR-05	ENE	12.8	14.5	14.5	*	13.9
DR-06	ESE	12.5	14.5	14.4	15.0	14.1
DR-07	SE	14.0	14.3	18.2	17.2	15.9
DR-08	SSE	11.6	11.1	12.6	14.3	12.4
DR-09	S	12.0	12.6	12.9	13.9	12.9
DR-10	SSW	12.8	15.0	14.3	14.5	14.2
DR-11	SW	11.1	11.7	10.9	11.5	11.3
DR-12	WSW	15.5	16.9	17.4	15.7	16.4
DR-13	WSW	18.9	18.7	19.4	19.2	19.1
DR-14	WNW	14.0	13.8	13.4	*	13.7
DR-15	NW	14.7	13.6	14.0	13.6	14.0
DR-16	NNW	15.2	15.3	14.6	15.6	15.2
DR-17	N	15.3	15.1	16.0	14.7	15.3
DR-18	NNE	14.9	15.0	15.4	13.5	14.7
DR-19	NE	14.9	14.7	15.9	15.6	15.3
DR-20	ENE	13.2	15.1	15.2	13.7	14.3
DR-21	E	13.5	14.8	14.0	13.9	14.1
DR-22	ESE	11.4	12.8	12.2	12.1	12.1
DR-23	SE	14.0	13.2	15.1	14.6	14.2
DR-24	SSE	14.0	14.7	15.6	15.5	15.0
DR-25	S	12.5	11.8	12.5	12.2	12.3
DR-26	SSW	13.8	14.4	14.9	14.1	14.3
DR-27	SW	12.9	13.9	13.1	14.6	13.6
DR-28	NW	13.8	15.2	16.0	15.0	15.0
DR-29	W	17.3	17.8	19.0	18.7	18.2
DR-30	SNS	18.9	16.5	16.0	16.2	16.9
DR-31	WSW	19.7	19.4	19.9	19.3	19.6
DR-32	NNW	13.4	14.0	13.0	13.7	13.5
DR-33	NE	8.7	8.5	8.6	8.1	8.5
DR-34	SE	13.2	15.0	13.4	14.6	14.1
DR-35	NNE	14.9	15.0	13.5	15.3	14.7
DR-36	NE	15.8	15.7	16.9	15.7	16.0
DR-37	SSW	15.6	14.6	14.6	13.9	14.7
DR-38	S	13.8	13.9	13.7	13.4	13.7
DR-39	SSW	16.4	16.5	16.2	17.0	16.5
DR-40	CONTROL	16.4	15.8	13.6	16.1	15.5
DR-41	SSE	14.3	14.8	12.1	13.7	13.7
AVERAGE		14.3	14.6	14.5	14.7	14.5

* Data not available

TABLE B-4

DIRECT RADIATION, AVERAGE TLD DATA FOR 2000
COMPARATIVE RANGES FOR 1995-1999
Results in mR per Standard Quarter

Station ID	Mean (1995-1999)	Standard Deviation (1995-1999)	Minimum Value (1995-1999)	Maximum Value (1995-1999)	2000 Average
DR-01	15.3	1.0	13.6	16.1	15.4
DR-02	19.2	0.8	17.8	19.8	16.2
DR-03	12.3	0.6	11.6	13.2	11.9
DR-04	13.4	0.7	12.8	14.2	12.9
DR-05	14.1	0.6	13.3	14.8	13.9
DR-06	13.9	0.4	13.3	14.4	14.1
DR-07	16.1	0.7	15.0	16.7	15.9
DR-08	13.0	0.5	12.1	13.3	12.4
DR-09	13.0	0.6	12.5	13.8	12.9
DR-10	13.9	0.7	12.9	14.6	14.2
DR-11	11.5	0.4	10.9	12.1	11.3
DR-12	15.9	0.9	14.7	17.0	16.4
DR-13	19.6	1.1	17.7	20.3	19.1
DR-14	14.3	0.8	13.3	15.1	13.7
DR-15	14.2	0.9	12.6	15.0	14.0
DR-16	15.1	1.0	13.6	15.9	15.2
DR-17	14.5	0.9	13.0	15.3	15.3
DR-18	14.7	0.5	14.2	15.2	14.7
DR-19	15.5	0.5	14.7	15.9	15.3
DR-20	14.1	0.8	12.9	14.8	14.3
DR-21	14.4	0.7	13.3	15.2	14.1
DR-22	12.2	0.6	11.6	13.0	12.1
DR-23	14.6	0.5	14.0	15.4	14.2
DR-24*	14.0	*	14.0	14.0	15.0
DR-25	12.7	0.5	11.8	13.3	12.3
DR-26	14.0	0.6	13.2	14.7	14.3
DR-27	14.2	1.0	12.7	15.4	13.6
DR-28	15.7	1.0	14.8	17.3	15.0
DR-29	18.4	0.9	16.9	19.3	18.2
DR-30	17.2	0.7	16.0	17.8	16.9
DR-31	19.2	0.8	18.0	20.1	19.6
DR-32	13.8	0.6	12.7	14.2	13.5
DR-33	12.0	2.1	9.5	15.2	8.5
DR-34	13.8	0.7	12.9	14.6	14.1
DR-35	15.0	0.6	13.9	15.4	14.7
DR-36	16.2	1.0	14.9	17.6	16.0
DR-37	14.2	0.7	13.1	15.0	14.7
DR-38	12.6	0.7	11.5	13.2	13.7
DR-39	16.1	1.1	14.3	17.0	16.5
DR-40	16.5	0.8	15.7	17.6	15.5
DR-41**	13.5	0.7	12.8	14.5	13.7
Average	14.7	0.8	13.6	15.5	14.5

* - DR-24 location was implemented in 1999. One data point does not permit an appropriate estimate of the standard deviation.

** In 1999, a new TLD location (DR-24) was implemented. The old DR-24 location was renamed DR-41.

TABLE B-5

2000 DIRECT RADIATION TLD DATA

INNER AND OUTER RINGS

Results in mR per Standard Quarter

Inner Ring ID	Outer Ring ID	Sector	Inner Ring Annual Average	Outer Ring Annual Average
DR-01	DR-17	N	15.4	15.3
DR-02	DR-18	NNE	16.2	14.7
DR-03	DR-19	NE	11.9	15.3
DR-04	DR-20	ENE	12.9	14.3
DR-05	DR-21	E	13.9	14.1
DR-06	DR-22	ESE	14.1	12.1
DR-07	DR-23	SE	15.9	14.2
DR-08	DR-24	SSE	12.4	15.0
DR-09	DR-25	S	12.9	12.2
DR-10	DR-26	SSW	14.1	14.3
DR-11	DR-27	SW	11.3	13.6
DR-12	DR-31	WSW	16.4	19.6
DR-13	DR-29	W	19.1	18.2
DR-14	DR-30	WNW	13.7	16.9
DR-15	DR-28	NW	14.0	15.2
DR-16	DR-32	NNW	15.2	13.5
Average			14.3	14.9

TABLE B-6

GROSS BETA ACTIVITY IN AIRBORNE PARTICULATE SAMPLES-2000
Results in Units of pCi/m3 ± 1 sigma

STATION #

Week #	End Date	4	5	27	94	95
1	1/11/00	0.019 ± .001	0.022 ± .002	0.019 ± .002	0.021 ± .002	0.019 ± .002
2	1/18/00	0.015 ± .001	0.014 ± .001	0.016 ± .001	0.015 ± .001	0.016 ± .001
3	1/25/00	0.021 ± .001	0.024 ± .002	0.023 ± .002	0.023 ± .002	0.021 ± .002
4	2/1/00	0.024 ± .001	0.026 ± .002	0.024 ± .002	0.026 ± .002	0.023 ± .002
5	2/8/00	0.016 ± .001	0.005 ± .001	0.016 ± .001	0.017 ±.002	0.014 ± .001
6	2/15/00	0.021 ± .001	0.023 ± .002	0.022 ± .002	0.022 ± .002	0.023 ± .002
7	2/23/00	0.021 ±.002	0.021 ± .002	0.024 ± .002	0.020 ± .002	0.019 ± .002
8	2/29/00	0.015 ± .001	0.014 ± .002	0.015 ± .002	0.014 ± .002	0.015 ± .002
9	3/7/00	0.012 ± .001	0.015 ± .001	0.013 ± .001	0.013 ± .001	0.013 ± .001
10	3/14/00	0.012 ± .001	0.012 ± .001	0.013 ± .001	0.012 ± .001	0.014 ± .001
11	3/20/00	0.014 ± .001	0.014 ± .002	0.015 ± .002	0.016 ± .002	0.015 ± .002
12	3/28/00	0.012 ± .001	0.012 ± .001	0.013 ± .001	0.012 ± .001	0.011 ± .001
13	4/4/00	0.012 ± .001	0.014 ± .001	0.014 ± .001	0.011 ± .001	0.011 ± .001
14	4/11/00	0.012 ± .001	0.013 ± .001	0.012 ± .001	0.011 ± .001	0.011 ± .001
15	4/18/00	0.013 ± .001	0.008 ± .002	0.015 ± .001	0.012 ± .001	0.013 ± .001
16	4/25/00	0.007 ± .001	0.008 ± .001	0.006 ± .001	0.008 ± .001	0.007 ± .001
17	5/2/00	0.013 ± .001	0.013 ± .001	0.013 ± .001	0.014 ± .001	0.011 ± .001
18	5/8/00	0.018 ± .001	0.012 ± .002	0.018 ± .002	0.019 ± .002	0.016 ± .002
19	5/15/00	0.013 ± .001	0.013 ± .002	0.013 ± .001	0.013 ± .002	0.011 ± .001
20	5/23/00	0.012 ± .001	0.013 ± .001	0.014 ± .001	0.015 ± .001	0.014 ± .001
21	5/30/00	0.007 ± .001	0.005 ± .001	0.006 ± .001	0.005 ± .001	0.008 ± .001
22	6/6/00	0.010 ± .001	0.011 ± .001	0.010 ± .001	0.011 ± .001	0.008 ± .001
23	6/13/00	0.014 ± .001	0.014 ± .001	0.018 ± .002	0.015 ± .002	0.014 ± .001
24	6/20/00	0.009 ± .001	0.007 ± .001	0.009 ± .001	0.008 ± .001	0.009 ± .001
25	6/27/00	0.014 ± .001	0.015 ± .002	0.016 ± .002	0.018 ± .002	0.015 ± .001
26	7/5/00	0.015 ± .001	0.014 ± .001	0.015 ± .001	0.017 ± .001	0.014 ± .001

TABLE B-6

GROSS BETA ACTIVITY IN AIRBORNE PARTICULATE SAMPLES-2000
Results in Units of pCi/m3 ± 1 sigma

STATION #

WEEK #	End Date	4	5	27	94	95
27	7/12/00	0.015 ± .001	0.014 ± .002	0.015 ± .002	0.014 ± .002	0.015 ± .002
28	7/18/00	0.015 ± .001	0.013 ± .002	0.010 ± .001	0.014 ± .002	0.010 ± .001
29	7/25/00	0.010 ± .001	0.011 ± .001	0.011 ± .001	0.012 ± .001	0.010 ± .001
30	8/1/00	0.004 ± .001	0.005 ± .001	0.004 ± .001	0.006 ± .001	0.004 ± .001
31	8/8/00	*	0.015 ± .002	0.016 ± .002	0.018 ± .002	0.014 ± .001
32	8/15/00	0.007 ± .001	0.010 ± .001	0.008 ± .001	0.011 ± .001	0.012 ± .001
33	8/22/00	0.008 ± .001	0.011 ± .001	0.007 ± .001	0.008 ± .001	0.007 ± .001
34	8/29/00	0.019 ± .001	0.009 ± .002	0.018 ± .002	0.019 ± .002	0.019 ± .002
35	9/6/00	0.014 ± .001	*	0.013 ± .001	0.014 ± .001	0.009 ± .001
36	9/12/00	0.018 ± .002	0.022 ± .002	0.021 ± .002	0.021 ± .002	0.017 ± .002
37	9/19/00	0.019 ± .001	0.019 ± .001	0.013 ± .001	0.021 ± .002	0.015 ± .002
38	9/26/00	0.014 ± .001	0.011 ± .001	0.012 ± .001	0.014 ± .002	0.012 ± .001
39	10/3/00	0.020 ± .001	0.017 ± .001	0.014 ± .002	0.017 ± .002	0.015 ± .002
40	10/10/00	0.016 ± .001	0.016 ± .001	0.017 ± .002	0.015 ± .002	0.014 ± .002
41	10/17/00	0.027 ± .002	0.028 ± .002	0.028 ± .002	0.031 ± .002	0.029 ± .002
42	10/23/00	0.019 ± .002	0.018 ± .002	0.018 ± .002	0.028 ± .002	0.018 ± .002
43	10/31/00	0.020 ± .001	0.018 ± .001	0.019 ± .002	0.021 ± .002	0.019 ± .002
44	11/7/00	0.009 ± .001	0.008 ± .001	0.009 ± .001	0.010 ± .001	0.010 ± .001
45	11/14/00	0.005 ± .001	0.005 ± .001	0.004 ± .001	0.003 ± .001	0.005 ± .001
46	11/14/00	0.005 ± .001	0.006 ± .001	0.003 ± .001	0.008 ± .001	0.006 ± .001
47	11/21/00	0.021 ± .001	0.021 ± .001	0.026 ± .002	0.018 ± .002	0.021 ± .002
48	11/27/00	0.009 ± .001	0.009 ± .001	0.008 ± .001	0.010 ± .001	0.009 ± .001
49	12/5/00	0.013 ± .001	0.014 ± .001	0.014 ± .001	0.014 ± .001	0.014 ± .001
50	12/12/00	0.015 ± .001	0.015 ± .001	0.017 ± .002	0.013 ± .001	0.014 ± .001
51	12/18/00	0.010 ± .001	0.013 ± .001	0.013 ± .002	0.012 ± .002	0.012 ± .002
52	12/27/00	0.021 ± .001	0.023 ± .001	0.028 ± .002	0.028 ± .002	0.023 ± .002

* sample deviation

TABLE B-6

GROSS BETA ACTIVITY IN AIRBORNE PARTICULATE SAMPLES-2000
Results in Units of pCi/m3 ± 1 sigma

STATION #

Week #	End Date	22	23	29	44
1	1/10/00	0.021 ± .002	0.020 ± .002	0.020 ± .002	0.020 ± .002
2	1/18/00	0.019 ± .002	0.013 ± .001	0.016 ± .001	0.017 ± .001
3	1/24/00	0.027 ± .002	0.026 ± .002	0.022 ± .002	0.024 ± .002
4	1/31/00	0.029 ± .002	0.029 ± .002	0.026 ± .002	0.027 ± .002
5	2/7/00	0.021 ± .002	0.018 ± .001	0.020 ± .001	0.019 ± .002
6	2/14/00	0.024 ± .002	0.024 ± .002	0.023 ± .001	0.025 ± .002
7	2/22/00	0.023 ± .002	0.020 ± .002	0.022 ± .002	0.022 ± .002
8	2/28/00	0.018 ± .002	0.017 ± .002	0.020 ± .001	0.017 ± .002
9	3/6/00	0.014 ± .002	0.008 ± .001	0.012 ± .001	0.011 ± .001
10	3/13/00	0.012 ± .001	0.014 ± .001	0.012 ± .001	0.013 ± .001
11	3/20/00	0.013 ± .002	0.014 ± .001	0.015 ± .001	0.016 ± .002
12	3/27/00	0.016 ± .002	0.011 ± .001	0.013 ± .001	0.014 ± .001
13	4/3/00	0.012 ± .001	0.012 ± .001	0.011 ± .001	0.011 ± .001
14	4/10/00	0.014 ± .002	0.010 ± .001	0.012 ± .001	0.010 ± .001
15	4/17/00	0.011 ± .001	0.012 ± .001	0.013 ± .001	0.014 ± .001
16	4/24/00	0.009 ± .001	0.007 ± .001	0.007 ± .001	0.007 ± .001
17	5/1/00	0.013 ± .002	0.014 ± .001	0.013 ± .001	0.012 ± .001
18	5/9/00	*	0.019 ± .001	0.017 ± .001	0.018 ± .001
19	5/16/00	0.009 ± .002	0.012 ± .001	0.011 ± .001	0.012 ± .001
20	5/22/00	0.012 ± .002	0.013 ± .001	0.014 ± .001	0.015 ± .002
21	5/30/00	0.010 ± .001	0.006 ± .001	0.005 ± .001	0.007 ± .001
22	6/5/00	0.012 ± .002	0.011 ± .001	0.010 ± .001	0.010 ± .001
23	6/12/00	0.015 ± .002	0.013 ± .001	0.015 ± .001	0.017 ± .002
24	6/19/00	0.009 ± .001	0.007 ± .001	0.008 ± .001	0.008 ± .001
25	6/26/00	0.014 ± .002	0.013 ± .001	0.014 ± .001	0.012 ± .001
26	7/3/00	0.014 ± .002	0.011 ± .001	0.012 ± .001	0.015 ± .002

* sample deviation

TABLE B-6

GROSS BETA ACTIVITY IN AIRBORNE PARTICULATE SAMPLES-2000
Results in Units of pCi/m3 ± 1 sigma

STATION #

WEEK #	End Date	22	23	29	44
27	7/11/00	0.014 ± .002	0.012 ± .001	0.012 ± .001	0.014 ± .001
28	7/17/00	0.013 ± .002	0.011 ± .001	0.011 ± .001	0.012 ± .002
29	7/24/00	0.011 ± .001	0.012 ± .001	0.010 ± .001	0.011 ± .001
30	7/31/00	0.008 ± .001	0.005 ± .001	0.005 ± .001	0.003 ± .001
31	8/7/00	0.012 ± .002	0.013 ± .001	0.009 ± .001	0.014 ± .001
32	8/14/00	0.015 ± .002	0.012 ± .001	0.013 ± .001	0.014 ± .002
33	8/21/00	0.013 ± .002	0.007 ± .001	0.008 ± .001	0.006 ± .001
34	8/28/00	0.017 ± .002	0.016 ± .001	0.014 ± .001	0.016 ± .002
35	9/5/00	0.015 ± .002	0.011 ± .001	0.011 ± .001	0.013 ± .001
36	9/11/00	0.017 ± .002	0.016 ± .002	0.016 ± .001	0.017 ± .002
37	9/18/00	0.016 ± .002	0.016 ± .001	0.017 ± .001	0.017 ± .002
38	9/25/00	0.015 ± .002	0.015 ± .001	0.014 ± .001	0.016 ± .002
39	10/2/00	0.013 ± .002	0.013 ± .001	0.012 ± .001	0.012 ± .001
40	10/9/00	0.025 ± .002	0.017 ± .002	0.016 ± .001	0.016 ± .002
41	10/16/00	0.030 ± .002	0.028 ± .002	0.026 ± .002	0.030 ± .002
42	10/23/00	0.010 ± .001	0.015 ± .002	0.013 ± .001	0.016 ± .002
43	10/31/00	0.022 ± .002	0.021 ± .002	0.022 ± .002	0.023 ± .002
44	11/6/00	0.011 ± .001	0.009 ± .001	0.009 ± .001	0.012 ± .001
45	11/13/00	0.005 ± .001	0.004 ± .001	0.005 ± .001	0.004 ± .001
46	11/13/00	0.005 ± .001	0.005 ± .001	0.006 ± .001	0.006 ± .001
47	11/20/00	0.018 ± .001	0.020 ± .002	0.018 ± .001	0.019 ± .002
48	11/27/00	0.015 ± .001	0.013 ± .001	0.013 ± .001	0.011 ± .001
49	12/4/00	0.014 ± .001	0.013 ± .001	0.010 ± .001	0.013 ± .001
50	12/11/00	0.015 ± .001	0.016 ± .001	0.014 ± .001	0.016 ± .002
51	12/18/00	0.015 ± .001	0.011 ± .002	0.013 ± .001	0.015 ± .001
52	12/27/00	0.021 ± .001	0.024 ± .001	0.024 ± .001	0.027 ± .002

TABLE B-7

CONCENTRATIONS OF GAMMA EMITTERS IN QUARTERLY COMPOSITES
OF AIR PARTICULATE SAMPLES - 2000

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

#4 ALGONQUIN

RADIONUCLIDES	FIRST QUARTER	SECOND QUARTER	THIRD QUARTER	FOURTH QUARTER
Be-7*	103.5±7.65	77.67±0.01	82.74±0.01	53.54±6.2
K-40*	<3.5	<2.76	27.85±0.01	19.13±4.08
Mn-54	<0.28	<0.35	<0.38	<0.28
Co-58	<0.53	<0.44	<0.43	<0.4
Fe-59	<0.99	<1.26	<2.05	<0.65
Co-60	<0.29	<0.25	<0.43	<0.28
Zn-65	<0.72	<0.45	<1.12	<0.81
Zr-95	<0.62	<0.78	<0.85	<1.07
Nb-95	<0.77	<0.83	<0.9	<0.7
Ru-103	<0.46	<0.73	<0.72	<0.67
Ru-106	<2.99	<3.41	<3.94	<2.59
I-131	<3.26	<3.64	<2.82	<1.86
Cs-134	<0.32	<0.23	<0.43	<0.3
Cs-137	<0.2	<0.32	<0.37	<0.26
Ba/La-140	<2.67	<2.53	<2.91	<2.03
Ce-141	<0.51	<0.74	<0.72	<0.68
Ce-144	<1.3	<1.36	<1.62	<1.41
Ra-226*	<4.37	<4.75	<6.16	<4.39
Ac/Th-228*	<0.85	<0.61	<0.81	<0.88
OTHERS	<CL	<CL	<CL	<CL

#5 NYU

RADIONUCLIDES	FIRST QUARTER	SECOND QUARTER	THIRD QUARTER	FOURTH QUARTER
Be-7*	100.7±8.93	91.64±0.01	83.21±0.01	54.62±6.16
K-40*	<2.81	<4.96	35.21±0.01	<2.47
Mn-54	<0.6	<0.32	<0.53	<0.26
Co-58	<0.67	<0.85	<0.77	<0.29
Fe-59	<1.19	<1.51	<1.72	<1.12
Co-60	<0.31**	<0.46	<0.47	<0.215**
Zn-65	<1.39	<1.14	<0.88	<0.69
Zr-95	<0.99	<1.38	<0.83	<0.7
Nb-95	<0.81	<0.66	<0.78	<0.73
Ru-103	<0.54	<0.98	<0.75	<0.54
Ru-106	<3.3	<4.27	<4.86	<3.11
I-131	<4.2	<4.78	<4.52	<3.59
Cs-134	<0.41	<0.53	<0.5	<0.28
Cs-137	<0.41	<0.36	<0.38	<0.22
Ba/La-140	<2.49	<5.78	<3.04	<3.04
Ce-141	<0.94	<0.91	<1.09	<0.71
Ce-144	<2	<2.17	<2.21	<1.2
Ra-226*	<5.17	<6.3	<7.18	<3.29
Ac/Th-228*	<2.1	<1.44	<1.61	<0.82
OTHERS	<CL	<CL	<CL	<CL

* Indicates naturally occurring

** reported as LLD

TABLE B-7

CONCENTRATIONS OF GAMMA EMITTERS IN QUARTERLY COMPOSITES
OF AIR PARTICULATE SAMPLES - 2000
RESULTS IN UNITS OF 10^{-3} pCi/m^3 ± 1 SIGMA

#27 CROTON POINT

RADIONUCLIDES	FIRST QUARTER	SECOND QUARTER	THIRD QUARTER	FOURTH QUARTER
Be-7*	97.37±8.12	109.9±0.01	85.77±0.01	45.08±6.58
K-40*	33.35±5.42	<4.39	30.24±0.01	17.53±4.62
Mn-54	<0.53	<0.22	<0.26	<0.31
Co-58	<0.58	<0.54	<0.46	<0.36
Fe-59	<1.54	<0.88	<1.79	<1.23
Co-60	<0.33	<0.41	<0.26	<0.46
Zn-65	<1.09	<0.54	<1.13	<0.98
Zr-95	<1.04	<0.72	<1.04	<1
Nb-95	<0.8	<1.11	<0.93	<0.74
Ru-103	<0.88	<0.65	<0.9	<0.71
Ru-106	<4.16	<3.43	<3.85	<2.77
I-131	<5.51	<5.32	<5.39	<4.9
Cs-134	<0.48	<0.45	<0.21	<0.39
Cs-137	<0.35	<0.32	<0.41	<0.36
Ba/La-140	<3.54	<2.57	<2.02	<4.71
Ce-141	<1.14	<0.74	<0.81	<0.69
Ce-144	<2.37	<1.57	<1.43	<1.32
Ra-226*	<6.51	<7.35	<5.1	<4.15
Ac/Th-228*	<1.72	<1.81	<1.43	<1.24
OTHERS	<CL	<CL	<CL	<CL

#94 UNIT 3 TRAINING BUILDING

RADIONUCLIDES	FIRST QUARTER	SECOND QUARTER	THIRD QUARTER	FOURTH QUARTER
Be-7*	107.7±8.99	132.6±0.01	90.1±0.01	63.7±7.35
K-40*	<2.73	<4.61	<5.54	<2.52
Mn-54	<0.45	<0.49	<0.26	<0.3
Co-58	<0.48	<0.7	<0.89	<0.56
Fe-59	<1.72	<1.94	<2.72	<2.02
Co-60	<0.55	<0.85	<0.36	<0.25
Zn-65	<0.97	<0.98	<0.83**	<0.83
Zr-95	<1.07	<1.86	<0.83	<1.08
Nb-95	<0.68	<0.58	<0.83	<0.73
Ru-103	<0.72	<0.42	<0.69	<0.55
Ru-106	<4.95	<2.77	<3.31	<3.65
I-131	<4.09	<4.94	<4.44	<4.08
Cs-134	<0.42	<0.51	<0.43	<0.41
Cs-137	<0.34	<0.26	<0.44	<0.34
Ba/La-140	<2.55	<6.23	<3.46	<2.52
Ce-141	<0.89	<0.99	<1.16	<0.86
Ce-144	<1.47	<2.37	<1.68	<1.12
Ra-226*	<6.58	<7.47	<6.39	<5.1
Ac/Th-228*	<1.48	<2.27	<1.36	<1.2
OTHERS	<CL	<CL	<CL	<CL

* Indicates naturally occurring
** reported as LLD

TABLE B-7

CONCENTRATIONS OF GAMMA EMITTERS IN QUARTERLY COMPOSITES
OF AIR PARTICULATE SAMPLES - 2000
RESULTS IN UNITS OF 10^{-3} pCi/m^3 ± 1 SIGMA

#95 MET TOWER

RADIONUCLIDES	FIRST QUARTER	SECOND QUARTER	THIRD QUARTER	FOURTH QUARTER
Be-7*	93.09±8.29	96.02±0.01	72.94±0.01	78.35±8.2
K-40*	<4.73	35.94±0.01	38.46±0.01	29.21±6.06
Mn-54	<0.35	<0.54	<0.47	<0.29
Co-58	<0.35	<0.68	<0.54	<0.47
Fe-59	<1.15	<1.66	<1.38	<1.91
Co-60	<0.36	<0.52	<0.35	<0.59
Zn-65	<0.72	<1.66	<1.34	<1.18
Zr-95	<0.96	<1.48	<1.32	<0.7
Nb-95	<0.79	<1.27	<0.94	<0.71
Ru-103	<0.65	<0.88	<0.81	<0.84
Ru-106	<4.24	<5.68	<5.08	<3.7
I-131	<3.55	<7.18	<5.02	<2.44
Cs-134	<0.29	<0.51	<0.58	<0.45
Cs-137	<0.42	<0.49	<0.43	<0.44
Ba/La-140	<4.2	<4.01	<2.68	<3.76
Ce-141	<0.87	<1.23	<1.17	<0.82
Ce-144	<1.8	<2.1	<1.79	<1.6
Ra-226*	<4.59	<9.48	<7.66	<4.68
Ac/Th-228*	<1.59	<1.88	<1.74	<0.94
OTHERS	<CL	<CL	<CL	<CL

#22 LOVETT

RADIONUCLIDES	FIRST QUARTER	SECOND QUARTER	THIRD QUARTER	FOURTH QUARTER
Be-7*	98.02±9.24	90.27±0.01	100±0.01	59.67±6.29
K-40*	<2.99	<7.32	<2.97	20.06±5.2
Mn-54	<0.37	<0.72	<0.52	<0.34
Co-58	<0.6	<0.87	<0.52	<0.38
Fe-59	<1.19	<2.29	<2.05	<1.07
Co-60	<0.42	<0.46	<0.73	<0.232**
Zn-65	<1.05	<1.38	<0.73	<0.38
Zr-95	<1.19	<1.69	<1.06	<0.95
Nb-95	<1.24	<1.42	<0.87	<0.46
Ru-103	<0.62	<0.74	<1	<0.5
Ru-106	<4.36	<5.57	<4.34	<3.36
I-131	<6.02	<5.88	<5.79	<4.58
Cs-134	<0.45	<0.54	<0.36	<0.41
Cs-137	<0.38	<0.48	<0.4	<0.35
Ba/La-140	<2.43	<6.28	<4.85	<2.13
Ce-141	<1.11	<1.39	<1.07	<0.82
Ce-144	<1.89	<2.86	<1.7	<1.1
Ra-226*	<5	<7.42	<6.17	<4.84
Ac/Th-228*	<1.75	<1	<1.61	<0.82
OTHERS	<CL	<CL	<CL	<CL

* Indicates naturally occurring

** reported as LLD

TABLE B-7

CONCENTRATIONS OF GAMMA EMITTERS IN QUARTERLY COMPOSITES
OF AIR PARTICULATE SAMPLES - 2000
RESULTS IN UNITS OF 10^{-3} pCi/m^3 ± 1 SIGMA

#23 ROSETON

RADIONUCLIDES	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
Be-7*	88.94±10.11	87.17±0.01	76.84±0.01	57.6±7.95
K-40*	<4.80**	<4.17	<2.49	<4.17**
Mn-54	<0.36	<0.47	<0.47	<0.48
Co-58	<0.72	<0.52	<0.5	<0.84
Fe-59	<2.11	<1.49	<1.22	<1.16
Co-60	<0.88	<0.39	<0.25	<0.38
Zn-65	<1.31	<1.16	<0.75	<0.71
Zr-95	<1.05	<0.69	<1.25	<0.96
Nb-95	<1.04	<0.82	<0.73	<0.93
Ru-103	<1.06	<0.73	<0.61	<1
Ru-106	<4.96	<3.27	<2.38	<5.71
I-131	<5.13	<3.97	<3.44	<6.71
Cs-134	<0.67	<0.44	<0.28	<0.71
Cs-137	<0.57	<0.34	<0.26	<0.45
Ba/La-140	<5.49	<3.81	<2.87	<3.6
Ce-141	<0.96	<0.82	<0.76	<0.93
Ce-144	<2.33	<1.34	<1.52	<1.83
Ra-226*	<7.2	<4.93	<4.79	<6.3
Ac/Th-228*	<2.04	<1.73	<1.1	<2.17
OTHERS	<CL	<CL	<CL	<CL

#29 GRASSY POINT

RADIONUCLIDES	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
Be-7*	105.4±7.56	76.66±0.01	74.25±0.01	56.42±5.75
K-40*	30.79±4.77	<4.81	<3.97	<2.47
Mn-54	<0.42	<0.36	<0.45	<0.3
Co-58	<0.4	<0.6	<0.59	<0.35
Fe-59	<0.64	<1.47	<1.26	<1.16
Co-60	<0.31	<0.51	<0.322	<0.3
Zn-65	<0.95	<0.63	<0.55	<0.71
Zr-95	<1.07	<0.62	<0.95	<0.76
Nb-95	<0.85	<0.89	<0.71	<0.73
Ru-103	<0.54	<0.85	<0.57	<0.48
Ru-106	<3.56	<2.05	<4.12	<2.88
I-131	<4.94	<5.43	<4.21	<3.42
Cs-134	<0.41	<0.29	<0.36	<0.19
Cs-137	<0.35	<0.33	<0.35	<0.19
Ba/La-140	<2.66	<3.59	<2.65	<2.03
Ce-141	<0.96	<1.02	<0.93	<0.65
Ce-144	<1.73	<1.66	<1.54	<1.1
Ra-226*	<5.47	<5.92	<5.08	<3.36
Ac/Th-228*	<1.09	<1.45	<0.98	<1.08
OTHERS	<CL	<CL	<CL	<CL

* Indicates naturally occurring
** reported as LLD

TABLE B-7

CONCENTRATIONS OF GAMMA EMITTERS IN QUARTERLY COMPOSITES
OF AIR PARTICULATE SAMPLES - 2000

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

#44 PEEKSKILL

RADIONUCLIDES	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
Be-7*	97.48±9.03	109.6±0.01	80.66±0.01	60.52±7.38
K-40*	<2.69	30.74±0.01	20.39±0.01	<5.82
Mn-54	<0.47	<0.52	<0.42	<0.52
Co-58	<0.53	<0.66	<0.63	<0.75
Fe-59	<1.72	<1.41	<2.27	<1.92
Co-60	<0.54	<0.53	<0.54	<0.63
Zn-65	<0.48	<0.9	<1.4	<1.04
Zr-95	<0.96	<1.08	<1.17	<0.69
Nb-95	<1.04	<1.09	<1.01	<0.71
Ru-103	<0.57	<1.10	<0.75	<0.88
Ru-106	<4.61	<1.11	<4.75	<4.48
I-131	<4.4	<1.12	<6.41	<4.92
Cs-134	<0.41	<1.13	<0.42	<0.47
Cs-137	<0.3	<1.14	<0.41	<0.37
Ba/La-140	<4.61	<1.15	<5.35	<4.8
Ce-141	<0.92	<1.16	<1.21	<0.97
Ce-144	<1.78	<1.17	<2.43	<1.43
Ra-226*	<5.54	<1.18	<7.55	<6.21
Ac/Th-228*	<1.73	<1.19	<1.64	<1.14
OTHERS	<CL	<1.20	<CL	<CL

* Indicates naturally occurring

TABLE B-8

I-131 ACTIVITY IN CHARCOAL CARTRIDGE SAMPLES - 2000**
Results in Units of pCi/m3 ± 1 sigma

Week #	End Date	4	5	27	94	95	22	23	29	44
1	1/11/00	<0.011	<0.013	<0.017	<0.018	<0.015	<0.026	<0.019	<0.017	<0.013
2	1/18/01	<0.011	<0.017	<0.016	<0.012	<0.022	<0.020	<0.016	<0.013	<0.014
3	1/25/00	<0.017	<0.013	<0.021	<0.023	<0.013	<0.031	<0.014	<0.023	<0.026
4	2/1/00	<0.009	<0.014	<0.011	<0.013	<0.018	<0.019	<0.027	<0.012	<0.026
5	2/8/00	<0.017	<0.025	<0.024	<0.018	<0.014	<0.016	<0.011	<0.011	<0.015
6	2/15/00	<0.019	<0.021	<0.022	<0.024	<0.026	<0.029	<0.015	<0.017	<0.017
7	2/23/00	<0.019	<0.014	<0.024	<0.012	<0.017	<0.035	<0.018	<0.014	<0.020
8	2/29/00	<0.017	<0.019	<0.025	<0.027	<0.023	<0.033	<0.025	<0.019	<0.022
9	3/7/00	<0.010	<0.011	<0.016	<0.017	<0.016	<0.012	<0.019	<0.010	<0.020
10	3/14/00	<0.012	<0.020	<0.014	<0.015	<0.013	<0.016	<0.018	<0.008	<0.015
11	3/20/00	<0.014	<0.019	<0.016	<0.018	<0.018	<0.021	<0.012	<0.015	<0.020
12	3/28/00	<0.013	<0.015	<0.018	<0.017	<0.013	<0.015	<0.017	<0.012	<0.009
13	4/4/00	<0.012	<0.016	<0.020	<0.014	<0.013	<0.021	<0.016	<0.015	<0.018
14	4/11/00	<0.012	<0.012	<0.017	<0.012	<0.017	<0.015	<0.013	<0.012	<0.016
15	4/18/00	<0.009	<0.023	<0.016	<0.020	<0.012	<0.020	<0.011	<0.014	<0.018
16	4/25/00	<0.009	<0.012	<0.013	<0.015	<0.016	<0.018	<0.014	<0.012	<0.018
17	5/2/00	<0.014	<0.014	<0.015	<0.014	<0.016	<0.016	<0.019	<0.012	<0.014
18	5/8/00	<0.011	<0.020	<0.017	<0.020	<0.017	*	<0.014	<0.013	<0.017
19	5/15/00	<0.015	<0.022	<0.018	<0.013	<0.014	<0.017	<0.020	<0.011	<0.013
20	5/23/00	<0.014	<0.015	<0.014	<0.013	<0.016	<0.022	<0.023	<0.014	<0.009
21	5/30/00	<0.011	<0.013	<0.012	<0.016	<0.013	<0.018	<0.009	<0.010	<0.014
22	6/6/00	<0.012	<0.016	<0.015	<0.015	<0.016	<0.021	<0.009	<0.018	<0.018
23	6/13/00	<0.016	<0.017	<0.018	<0.019	<0.011	<0.012	<0.014	<0.008	<0.020
24	6/20/00	<0.008	<0.018	<0.013	<0.014	<0.015	<0.017	<0.017	<0.010	<0.012
25	6/27/00	<0.013	<0.024	<0.030	<0.018	<0.015	<0.033	<0.022	<0.013	<0.021
26	7/5/00	<0.009	<0.008	<0.014	<0.016	<0.014	<0.014	<0.012	<0.017	<0.022

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

TABLE B-8

I-131 ACTIVITY IN CHARCOAL CARTRIDGE SAMPLES - 2000**
Results in Units of pCi/m3 ± 1 sigma

Week #	End Date	4	5	27	94	95	22	23	29	44
27	7/12/00	<0.010	<0.017	<0.013	<0.020	<0.014	<0.019	<0.018	<0.016	<0.015
28	7/18/00	<0.009	<0.017	<0.028	<0.019	<0.015	<0.026	<0.016	<0.015	<0.017
29	7/25/00	<0.012	<0.008	<0.014	<0.018	<0.010	<0.015	<0.013	<0.014	<0.019
30	8/1/00	<0.018	<0.016	<0.010	<0.014	<0.014	<0.023	<0.018	<0.020	<0.019
31	8/8/00	*	<0.016	<0.014	<0.013	<0.010	<0.016	<0.019	<0.011	<0.016
32	8/15/00	<0.015	<0.016	<0.014	<0.012	<0.017	<0.022	<0.015	<0.010	<0.017
33	8/22/00	<0.010	<0.018	<0.014	<0.015	<0.023	<0.020	<0.019	<0.014	<0.021
34	8/29/00	<0.012	<0.023	<0.019	<0.014	<0.018	<0.015	<0.020	<0.015	<0.016
35	9/6/00	<0.017	*	<0.015	<0.016	<0.020	<0.020	<0.022	<0.013	<0.014
36	9/12/00	<0.014	<0.022	<0.023	<0.020	<0.026	<0.018	<0.029	<0.019	<0.024
37	9/19/00	<0.011	<0.010	<0.025	<0.016	<0.016	<0.016	<0.019	<0.015	<0.020
38	9/26/00	<0.013	<0.008	<0.010	<0.015	<0.017	<0.018	<0.012	<0.010	<0.016
39	10/3/00	<0.009	<0.011	<0.022	<0.018	<0.019	<0.018	<0.011	<0.017	<0.016
40	10/10/00	<0.013	<0.012	<0.016	<0.017	<0.018	<0.028	<0.013	<0.012	<0.012
41	10/17/00	<0.010	<0.012	<0.018	<0.016	<0.018	<0.020	<0.014	<0.014	<0.019
42	10/23/00	<0.010	<0.013	<0.017	<0.015	<0.018	<0.007	<0.013	<0.011	<0.012
43	10/31/00	<0.009	<0.013	<0.016	<0.016	<0.017	<0.018	<0.021	<0.014	<0.019
44	11/7/00	<0.011	<0.008	<0.017	<0.012	<0.014	<0.016	<0.015	<0.010	<0.014
45	11/14/00	<0.007	<0.010	<0.013	<0.018	<0.021	<0.010	<0.016	<0.011	<0.020
46	11/14/00	<0.007	<0.010	<0.013	<0.018	<0.021	<0.010	<0.016	<0.011	<0.020
47	11/21/00	<0.015	<0.016	<0.019	<0.018	<0.024	<0.012	<0.017	<0.012	<0.020
48	11/27/00	<0.012	<0.012	<0.012	<0.022	<0.017	<0.012	<0.012	<0.011	<0.018
49	12/5/00	<0.010	<0.009	<0.020	<0.019	<0.015	<0.016	<0.020	<0.013	<0.019
50	12/12/00	<0.008	<0.011	<0.015	<0.017	<0.017	<0.011	<0.011	<0.011	<0.018
51	12/18/00	<0.013	<0.014	<0.017	<0.026	<0.021	<0.016	<0.029	<0.010	<0.011
52	12/27/00	<0.013	<0.015	<0.019	<0.015	<0.012	<0.017	<0.015	<0.014	<0.015

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

TABLE B-9
CONCENTRATIONS OF GAMMA EMMITERS IN HUDSON RIVER WATER SAMPLES - 2000
RESULTS IN UNITS OF pCi/L ± 1 SIGMA

#9 HUDSON RIVER INLET

Radionuclide	January	February	March	April	May	June
Be-7*	<9.64	<10.6	<6.89	<6.57	<7.11	<10.66
K-40*	204±10.3	76.06±11.77	63.89±5.73	83.04±6.63	59.83±5.94	261.2±13.52
Mn-54	<0.86	<1.22	<0.67	<0.64	<0.69	<0.95
Co-58	<0.962	<1.38	<0.81	<0.73	<0.81	<1.13
Fe-59	<2.31	<3.14	<1.71	<1.74	<1.92	<2.55
Co-60	<0.955	<1.25	<0.79	<0.78	<0.77	<1.09
Zn-65	<1.95	<2.7	<1.45	<1.42	<1.49	<2.45
Zr-95	<1.82	<2.37	<1.37	<1.3	<1.53	<2.26
Nb-95	<1.24	<1.64	<0.95	<0.81	<1.03	<1.39
Ru-103	<0.806	<1.64	<0.59	<0.97	<1.02	<1.44
Ru-106	<8.78	<11.36	<7.97	<7.38	<7.98	<11.36
I-131	<4.20	<5.07	<2.69	<2.57	<3.18	<4.67
Cs-134	<0.820	<1.25	<0.65	<0.67	<0.66	<1.02
Cs-137	<0.779	<1.09	<0.65	<0.69	<0.67	<1.06
Ba/La-140	<2.81	<3.69	<2	<2.08	<2.49	<3.67
Ce-141	<2.25	<2.58	<1.57	<1.58	<1.68	<2.41
Ce-144	<6.82	<8.03	<5.25	<5.06	<5.04	<7.53
Ra-226*	50.0±10.9	73.48±17.89	79.06±10.97	56.41±9.01	72.07±10.03	91.74±14.33
Ac/Th-228*	4.35±1.72	<3.47	<2.45	<2.49	<2.55	5.76±1.99

#10 HUDSON RIVER DISCHARGE

Radionuclide	January	February	March	April	May	June
Be-7*	<7.93	<14.28	<7.2	<7.15	<9.02	<6.81
K-40*	193±9.58	199±17.11	62.87±6.39	72.39±6.63	191.4±10.04	259.3±8.54
Mn-54	<0.707	<1.26	<0.66	<0.67	<0.86	<0.74
Co-58	<0.929	<1.59	<0.77	<0.81	<1.01	<0.76
Fe-59	<2.23	<3.62	<1.76	<1.64	<2.31	<1.55
Co-60	<0.795	<1.27	<0.76	<0.82	<0.91	<0.64
Zn-65	<1.81	<3.52	<1.62	<1.48	<1.95	<0.88
Zr-95	<1.75	<2.83	<1.48	<1.48	<1.65	<1.37
Nb-95	<1.22	<1.83	<0.96	<0.98	<1.33	<0.94
Ru-103	<0.655	<2.26	<1.05	<1.01	<1.39	<0.95
Ru-106	<8.15	<14.71	<7.8	<7.8	<8.89	<7.24
I-131	<4.73	<6.42	<2.88	<2.88	<4.03	<3.26
Cs-134	<0.675	<1.45	<0.4	<0.68	<0.89	<0.7
Cs-137	<0.743	<1.38	<0.65	<0.7	<0.75	<0.68
Ba/La-140	<3.69	<4.8	<2.33	<2.45	<2.71	<1.9
Ce-141	<2.03	<3.75	<1.68	<1.61	<2.29	<1.85
Ce-144	<5.88	<11.47	<5.04	<5.1	<6.89	<5.86
Ra-226*	106±10.1	74.38±18.07	61.61±9.22	67.62±8.52	57.17±10.96	92.05±11.36
Ac/Th-228*	6.57±1.67	<4.86	<2.46	<2.43	8.89±1.88	11.34±1.64

*Indicates naturally occurring

TABLE B-9

CONCENTRATIONS OF GAMMA EMMITERS IN HUDSON RIVER WATER SAMPLES - 2000

RESULTS IN UNITS OF pCi/L ± 1 SIGMA

#9 HUDSON RIVER INLET

Radionuclide	July	August	September	October	November	December
Be-7*	<7.63	<7.59	<9.11	<7.82	<10.42	<12.45
K-40*	80.67±6.62	87.89±6.58	171.2±10.21	118.4±8.02	270±13.68	97.27±11.8
Mn-54	<0.69	<0.7	<0.82	<0.72	<1.03	<1.11
Co-58	<0.8	<0.86	<0.92	<0.83	<1.2	<1.14
Fe-59	<2.01	<2.03	<2.26	<2.13	<2.71	<2.79
Co-60	<0.71	<0.68	<0.86	<0.66	<1.17	<1.1
Zn-65	<1.63	<1.39	<1.81	<1.58	<2.34	<2.71
Zr-95	<1.55	<1.49	<1.77	<1.42	<2.05	<2.2
Nb-95	<1.07	<1.06	<1.16	<1.04	<1.36	<1.56
Ru-103	<0.64	<1.14	<1.3	<1.14	<1.33	<1.63
Ru-106	<8.2	<7.37	<8.87	<7.05	<11.63	<9.47
I-131	<5.21	<4.91	<4.87	<5.54	<4.24	<4.67
Cs-134	<0.67	<0.66	<0.53	<0.4	<1.07	<1.09
Cs-137	<0.73	<0.61	<0.86	<0.63	<1.04	<1.18
Ba/La-140	<3.54	<3.49	<3.28	<3.57	<2.8	<3.73
Ce-141	<1.86	<1.89	<2.31	<2.38	<2.18	<2.6
Ce-144	<5.13	<5.15	<6.09	<5.04	<7.19	<7.93
Ra-226*	67.12±9.75	71.01±8.53	81.43±15.56	65.93±10.61	79.77±19.01	45.56±16.13
Ac/Th-228*	<2.48	<2.34	5.18±2.25	<2.33	6.38±3.11	<4.04

#10 HUDSON RIVER DISCHARGE

Radionuclide	July	August	September	October	November	December
Be-7*	<10.09	<10.23	<7.17	<8.04	<6.97	<13.62
K-40*	204.5±10.53	238.5±13.98	277.2±9.17	297.8±9.18	327.5±9.61	170±16.67
Mn-54	<0.87	<1.02	<0.74	<0.75	<0.71	<1.29
Co-58	<0.99	<1.36	<0.83	<0.94	<0.85	<1.41
Fe-59	<2.44	<2.6	<1.74	<1.92	<1.65	<3.86
Co-60	<0.96	<1	<0.64	<0.69	<0.63	<1.4
Zn-65	<2.13	<2.57	<0.95	<0.95	<0.93	<2.64
Zr-95	<1.84	<2.38	<1.42	<1.41	<1.32	<3
Nb-95	<1.4	<1.63	<0.99	<1.11	<0.86	<1.91
Ru-103	<1.46	<1.75	<1.01	<1.09	<0.98	<1.84
Ru-106	<8.53	<10.56	<7.36	<7.73	<7.42	<14.27
I-131	<7.24	<6.01	<4.16	<6.64	<3.13	<6.31
Cs-134	<0.82	<1.04	<0.41	<0.43	<0.42	<1.41
Cs-137	<0.76	<1.05	<0.67	<0.7	<0.67	<1.49
Ba/La-140	<4.46	<4.24	<2.3	<3.12	<1.85	<3.74
Ce-141	<2.54	<2.74	<1.95	<2.32	<1.85	<3.55
Ce-144	<7.07	<8.13	<6.06	<6.02	<6.19	<9.44
Ra-226*	37.3±12.24	98.05±14.98	79.84±14.2	75.9±13.14	90.83±14.29	59.33±22.82
Ac/Th-228*	<3.1	<3.83	14.9±1.78	13.8±2	13.09±1.98	<5.04

*Indicates naturally occurring

TABLE B-10

CONCENTRATION OF TRITIUM IN HUDSON RIVER WATER SAMPLES-2000
(QUARTERLY COMPOSITES)
Results in Units of pCi/L ± 1 sigma

#9 HUDSON RIVER INLET
(Control Location)

Radionuclide	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
TRITIUM	190	<176	189	<112

#10 HUDSON RIVER DISCHARGE

Radionuclide	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
TRITIUM	282	194	332	258

Note: "less than" values are expressed as LLD

TABLE B-11

GROSS BETA ACTIVITY AND CONCENTRATIONS OF GAMMA EMITTERS IN DRINKING WATER SAMPLES - 2000
Results in Units of pCi/L ± 1 sigma
CAMP FIELD RESERVOIR

Radionuclide	January	February	March	April	May	June
Gross Beta	1.90±0.26	2.20±0.47	2.04±0.43	2.4±0.5	2.50±0.46	2.06±0.46
Be-7*	<14.59	<17.58	<22.19	<13.99	<21.94	<15.54
K-40*	178±26.2	195.5±23.69	280.9±40	<20.86	219±35.84	61.19±17.07
Mn-54	<1.69	<1.52	<2.82	<1.89	<2.59	<1.76
Co-58	<1.85	<1.91	<3.42	<1.56	<2.56	<2.02
Fe-59	<3.66	<4.6	<5.54	<3.58	<7.05	<3.9
Co-60	<1.79	<2.31	<3.82	<1.48	<3.49	<1.76
Zn-65	<4.92	<4.69	<4.96	<3.97	<6.77	<4.65
Zr-95	<4.14	<3.52	<5.2	<3.49	<5.31	<3.51
Nb-95	<2.29	<1.85	<3.07	<1.85	<2.95	<2.03
Ru-103	<2.47	<2.06	<3.28	<1.89	<3.09	<2.04
Ru-106	<24.07	<22.29	<28.54	<19.08	<31.67	<20.86
I-131	<0.32	<0.19	<0.228	<0.21	<0.29	<0.187
Cs-134	<1.78	<1.87	<2.47	<1.77	<2.47	<1.13
Cs-137	<1.95	<2.2	<3.57	<1.92	<3.21	<1.81
Ba/La-140	<3.97	<2.66	<3.12	<2.82	<2.97	<2.71
Ce-141	<3.73	<3.34	<4.71	<2.93	<4.42	<2.89
Ce-144	<14.29	<14.29	<19.57	<14.22	<21.52	<13.74
Ra-226*	152±38.3	124.4±35.85	<68.11	<41.96	<73.16	<42.42
Ac/Th-228*	<8.09	<7.47	<8.13	<5.57	<8.12	<6.9

GROSS BETA ACTIVITY AND CONCENTRATIONS OF GAMMA EMITTERS IN DRINKING WATER SAMPLES - 2000
Results in Units of pCi/L ± 1 sigma
CAMP FIELD RESERVOIR

Radionuclide	July	August	September	October	November	December
Gross Beta	1.81±0.42	1.34±0.42	2.49±0.55	1.97±0.65	1.86±0.51	2.76±0.48
Be-7*	<15.53	<24.56	<18.15	<16.53	<17.58	<15.73
K-40*	169.5±22.81	142.1±28.43	238.5±33.04	155.9±24.82	163.9±28.17	99.64±20.43
Mn-54	<2.29	<2.72	<2.88	<2.02	<1.83	<1.63
Co-58	<2.28	<3.08	<2.8	<2.16	<2.32	<1.54
Fe-59	<4.4	<4.53	<5.34	<3.99	<4.36	<3.35
Co-60	<2.08	<2.7	<1.94	<1.78	<1.74	<1.9
Zn-65	<5.06	<5.56	<5.64	<4.3	<6.18	<4.16
Zr-95	<3.15	<4.19	<4.31	<3.32	<3.56	<3.31
Nb-95	<2.07	<2.63	<2.53	<2.49	<1.64	<1.58
Ru-103	<2.28	<2.62	<2.73	<2.43	<2.41	<1.99
Ru-106	<19.57	<27.81	<24.25	<18.31	<18.12	<17.8
I-131	<0.208	<0.224	<0.244	<0.161	<0.198	<0.198
Cs-134	<2.22	<2.55	<2.78	<1.87	<2.07	<0.98
Cs-137	<2.13	<2.38	<2.64	<1.94	<2.11	<1.48
Ba/La-140	<2.24	<4.07	<2.72	<2.59	<2.82	<2.11
Ce-141	<3.17	<4.98	<4.43	<3.4	<3.54	<2.61
Ce-144	<13.26	<20.43	<21.72	<15.14	<13.31	<12.17
Ra-226*	114.6±30.24	<61.77	<57.24	99.78±35.52	<43.86	<34.41
Ac/Th-228*	<6.88	<8.44	<7.65	<6.01	<7.86	<7.06

* Indicates naturally occurring

TABLE B-12

CONCENTRATION OF TRITIUM IN DRINKING WATER SAMPLES-2000
(QUARTERLY COMPOSITES)
Results in Units of pCi/L ± 1 sigma

CAMP FIELD RESERVOIR

Radionuclide	1ST Quarter	2ND Quarter	3RD Quarter	4TH Quarter
TRITIUM	<170	<160	<178	<180

Note: "less than" values are expressed as LLD

TABLE B-13

CONCENTRATION OF GAMMA EMITTERS IN SHORELINE SOIL SAMPLES-2000

Results in Units of pCi/Kg (dry) ± 1 sigma

#17 VERPLANK

Collection Date	Co-60	Cs-134	Cs-137	Ra-226*	Ac/Th-228*	Others
6/19/00	<22.06	<17.55	211.87±9.99	1048±143.35	550.53±34.32	ND
9/18/00	<17.75	34.07±15.04	257.6±11.38	1225.67±164.31	609.13±37.41	ND

#28 LENTS COVE

Collection Date	Co-60	Cs-134	Cs-137	Ra-226*	Ac/Th-228*	Others
6/19/00	<35.35	<35.87	107.6±15.15	5535.33±361.22	360.33±97.0	ND
9/18/00	<37.35	82.82±22.11	137.2±19.55	5282.67±412.35	137.67±95.0	ND

#50 MANITOU INLET**

Collection Date	Co-60	Cs-134	Cs-137	Ra-226*	Ac/Th-228*	Others
6/20/00	<37.76	<21.77	30.73±19.9	3778±380.29	264.33±83.9	ND
9/18/00	<42.72	<43.9	<42.49	3294±753.8	1690±178.4	ND

#53 WHITE BEACH

Collection Date	Co-60	Cs-134	Cs-137	Ra-226*	Ac/Th-228*	Others
6/19/00	<17.76	<15.61	<11.19	773.4±245.6	<59.62	ND
9/18/00	<11.09	<14.52	<11.86	1063±183.2	126.9±37.39	ND

#84 COLD SPRING**

Collection Date	Co-60	Cs-134	Cs-137	Ra-226*	Ac/Th-228*	Others
6/20/00	<20.82	<10.44	<10.44	1721±294.7	770.6±64.46	ND
9/18/00	<23.59	<22.46	<17.51	641.8±317	539.5±75.81	ND

* Indicates naturally occurring

** Indicates control location

ND - not detected

TABLE B-14

CONCENTRATIONS OF GAMMA EMITTERS IN BROADLEAF VEGETATION - 2000
Results in Units of pCi/Kg (wet) ± 1 sigma

#23 Roseton**

Jun-00

Radionuclide	Ragweed	Clover	Reeds
Be-7*	595.2±42.16	272.9±41.45	261.2±42.79
K-40*	5523±159.5	4563±176.3	8816±189.1
Mn-54	<6.36	<7.28	<8.31
Co-58	<6.06	<7.45	<8.61
Fe-59	<14.51	<16.81	<16.42
Co-60	<7.67	<9.62	<8.4
Zn-65	<16.46	<19.74	<18.86
Zr-95	<10.76	<13.81	<14.96
Nb-95	<6.13	<7.78	<8.53
Ru-103	<6.3	<7.24	<7.71
Ru-106	<69.73	<83.95	<84.9
I-131	<7.31	<9.3	<10.92
Cs-134	<6.45	<7.98	<8.45
Cs-137	<6.7	<7.65	<8.41
Ba/La-140	<8.46	<8.29	<9.64
Ce-141	<7.37	<8.73	<11.82
Ce-144	<30.31	<35.02	<46.87
Ra-226*	313.5±72.61	402.5±96.62	585.2±95.75
Ac/Th-228*	<21.84	<27.92	116.3±23.21

Jul-00

Radionuclide	Grape Leaves	Reeds	Ragweed
Be-7*	401±40.63	242±34.6	440.4±53.25
K-40*	7475±163	7147±182.8	9835±257
Mn-54	<7.49	<6.84	<8.26
Co-58	<6.91	<6.5	<8.49
Fe-59	<15.45	<15.51	<21.15
Co-60	<7.47	<7.81	<9.24
Zn-65	<10.46	<18.45	<22.05
Zr-95	<12.34	<12.21	<15.31
Nb-95	<7.71	<7.34	<8.13
Ru-103	<7.41	<6.6	<7.95
Ru-106	<76.26	<80.48	<86.26
I-131	<13.32	<9.54	<12.62
Cs-134	<4.48	<6.5	<8.05
Cs-137	<6.79	<6.67	<8.25
Ba/La-140	<9.92	<9.91	<12.34
Ce-141	<10.98	<7.91	<9.84
Ce-144	<42.26	<31.34	<37.74
Ra-226*	623.8±86.33	471.2±73.64	299±64.81
Ac/Th-228*	97.83±17.81	<26.04	<31.98

Aug-00

Radionuclide	Ragweed	Grapeleaves	Reeds
Be-7*	962.8±45.21	380.5±52.84	193.2±46.97
K-40*	10480±173.5	5101±201.8	7356±251.3
Mn-54	<5.92	<8.42	<10.19
Co-58	<5.66	<7.9	<9.41
Fe-59	<13.49	<17.62	<21.08
Co-60	<6.14	<10.88	<10.7
Zn-65	<9.44	<23.18	<27.24
Zr-95	<10.13	<15.7	<18.88
Nb-95	<6.16	<7.98	<10.95
Ru-103	<5.88	<8.75	<9.7
Ru-106	<62.96	<85.94	<104
I-131	<7.88	<8.89	<12.1
Cs-134	<6.12	<7.22	<11.07
Cs-137	<6.04	<7.91	<9.27
Ba/La-140	<7.02	<13.59	<15.02
Ce-141	<8.63	<10.37	<13.21
Ce-144	<36.34	<39.22	<51.98
Ra-226*	481.2±84.62	387.5±93.87	467.6±125.7
Ac/Th-228*	80.01±14.55	<26.6	71.62±21.76

Sep-00

Radionuclide	Ragweed	Clover	Reeds
Be-7*	1199±56.87	776±51.81	1402±117.6
K-40*	8080±156.4	9530±173.8	6875±293
Mn-54	<6.9	<6.82	<12.97
Co-58	<6.42	<7.17	<13.25
Fe-59	<13.69	<15.2	<34.79
Co-60	<6.1	<7.08	<13.59
Zn-65	<8.95	<9.47	<34.85
Zr-95	<10.81	<11.78	<27.58
Nb-95	<6.97	<7.07	<17.42
Ru-103	<6.39	<6.31	<14.44
Ru-106	<67.26	<69.99	<128.1
I-131	<12.09	<10.92	<22.12
Cs-134	<3.59	<3.88	<13.36
Cs-137	<6.26	<6.36	<15.12
Ba/La-140	<9.75	<9.46	<23.71
Ce-141	<9.91	<10.35	<18.6
Ce-144	<37.31	<37.35	<69.94
Ra-226*	548.5±92.64	591±97.19	492.8±244.5
Ac/Th-228*	70.06±18.31	117±20.46	<53.94

Oct-00

Radionuclide	Goldenrod	Ragweed	Sorrel
Be-7*	2086±109.3	1694±74.48	970.1±58.97
K-40*	10550±343.6	6067±192.2	8262±180
Mn-54	<13.09	<7.53	<8.18
Co-58	<11.99	<7.31	<8.2
Fe-59	<28.67	<15.16	<16.57
Co-60	<14.64	<7.78	<8.46
Zn-65	<36.75	<22.65	<11.79
Zr-95	<20.49	<13	<13.25
Nb-95	<12.12	<8.81	<7.6
Ru-103	<11.86	<7.23	<7.29
Ru-106	<125.8	<74.71	<86.12
I-131	<13.87	<7.93	<9.54
Cs-134	<12.16	<6.94	<4.62
Cs-137	<12.17	<8.03	<7.45
Ba/La-140	<15.54	<8.74	<7.44
Ce-141	<13.9	<9.27	<11.12
Ce-144	<60.95	<36.37	<44.15
Ra-226*	472.1±176.1	381.5±114.5	694.6±114.5
Ac/Th-228*	<50.8	<27.59	130.8±22.73

* Indicates naturally occurring

** Indicates control location

TABLE B-14

CONCENTRATIONS OF GAMMA EMITTERS IN BROADLEAF VEGETATION - 2000
Results in Units of pCi/Kg (wet) ± 1 sigma

#94 Unit 3 Training Building

Jun-00

Radionuclide	Ragweed	Bittersweet	Grape Leaves
Be-7*	579.7±53.11	600±55.76	343.2±52.55
K-40*	7592±211.3	4949±177.9	4438±183.5
Mn-54	<8.48	<7.75	<9.6
Co-58	<8.37	<8.33	<10
Fe-59	<17.54	<18.83	<20.96
Co-60	<8.86	<7.65	<11.09
Zn-65	<22.57	<18.05	<23.8
Zr-95	<13.76	<12.74	<16.78
Nb-95	<8.07	<7.29	<8.88
Ru-103	<8.44	<7.32	<9.49
Ru-106	<73.28	<76.79	<102.1
I-131	<8.83	<9.33	<11.06
Cs-134	<5.04	<7.58	<10.4
Cs-137	<7.83	<7.02	<9.73
Ba/La-140	<9.98	<9.6	<13.72
Ce-141	<10.2	<9.31	<12.58
Ce-144	<44.12	<34.04	<51.86
Ra-226*	319.3±71.88	770.9±94.15	273.6±88.59
Ac/Th-228*	64.5±19.27	<26.75	<35.07

July-00

Radionuclide	Ragweed	Bittersweet	Grape Leaves
Be-7*	453.8±51.83	463.2±34.4	205.6±52.5
K-40*	11030±247.8	4810±110	4377±183.4
Mn-54	<7.88	<5.26	<7.35
Co-58	<8.53	<5.1	<8.45
Fe-59	<19.05	<9.93	<17.63
Co-60	<8.94	<4.46	<10.38
Zn-65	<20.92	<13.3	<19.59
Zr-95	<13.13	<8.96	<14.08
Nb-95	<8.46	<5.57	<8.37
Ru-103	<7.2	<4.97	<8.03
Ru-106	<81.62	<51.68	<78.83
I-131	<13.1	<9.36	<12.68
Cs-134	<7.69	<3.06	<7.82
Cs-137	<7.86	<4.78	<8.09
Ba/La-140	<13	<7.78	<15.83
Ce-141	<9.68	<7.72	<10.43
Ce-144	<31.68	<29.9	<40.87
Ra-226*	680.7±83.89	449.9±70.93	482.1±108.7
Ac/Th-228*	<34.43	83.3±11.3	<30.08

Aug-00

Radionuclide	Grape Leaves	Clover	Bittersweet
Be-7*	640 ± 25.9	662 ± 28.2	472.3±62.3
K-40*	4380 ± 79.4	6890 ± 102	5660±246.3
Mn-54	<5.14	<8.57	<11.69
Co-58	<6.16	<8.62	<11.02
Fe-59	<12.4	<21.69	<21.24
Co-60	<5.31	<9.75	<12.5
Zn-65	<7.96	<22.64	<26.56
Zr-95	<10.99	<16	<18.84
Nb-95	<6.99	<10.32	<10.86
Ru-103	<6.64	<8.85	<9.63
Ru-106	<59.77	<84.45	<97.96
I-131	<22.38	<13.83	<10.8
Cs-134	<5.43	<7.35	<9.16
Cs-137	18.3 ± 2.20	<7.81	<9.6
Ba/La-140	<11.25	<15.53	<11.15
Ce-141	<10.41	<10.67	<11.54
Ce-144	<32	<40.04	<48.34
Ra-226*	426 ± 49.6	404 ± 43.5	503.5±111.8
Ac/Th-228*	85.4 ± 12.5	77.2 ± 9.89	<38.19

Sep-00

Radionuclide	Reeds	Ragweed	Bittersweet
Be-7*	1014±68.79	1519±58.12	829±85.58
K-40*	5829±196.6	7907±160.9	6683±253.1
Mn-54	<6.8	<6.88	<11.16
Co-58	<7.09	<6.55	<12.35
Fe-59	<16.01	<13.78	<27.52
Co-60	<7.43	<7.1	<12.75
Zn-65	<23.4	<9.23	<24.81
Zr-95	<13.89	<10.82	<19.53
Nb-95	<7.77	<6.42	<13.35
Ru-103	<7.49	<5.98	<11.8
Ru-106	<81.49	<68.29	<121.4
I-131	<8.81	<7.43	<17.08
Cs-134	<7.67	<3.7	<11.09
Cs-137	<8.05	<6.39	<12.11
Ba/La-140	<12	<6.92	<18.88
Ce-141	<9.52	<8.92	<13.99
Ce-144	<40.04	<41.01	<57.26
Ra-226*	333.9±112.1	382±99.19	1085±174.1
Ac/Th-228*	<31.32	80.12±19.11	95.23±31.59

Oct-00

Radionuclide	Goldenrod	Ragweed	Sorrel
Be-7*	2807±86.17	3154±126.8	1207±125.9
K-40*	8448±215.1	8515±306.3	9309±393.3
Mn-54	<7.17	<13.57	<17.65
Co-58	<7.6	<12.73	<17.07
Fe-59	<15.91	<27.29	<40.34
Co-60	<8.48	<14.29	<17.19
Zn-65	<19.18	<30.78	<24.39
Zr-95	<13.37	<18.87	<31.09
Nb-95	<8.26	<11.99	<18.65
Ru-103	<7.2	<11.11	<16.65
Ru-106	<75.87	<124.5	<198.7
I-131	<8.01	<12.93	<19.47
Cs-134	<6.53	<11.39	<18.58
Cs-137	<7.43	<13.18	<19.81
Ba/La-140	<8.78	<13.23	<22.22
Ce-141	<9.09	<13.52	<21.48
Ce-144	<35.92	<57.24	<82.37
Ra-226*	672.8±115.5	553.2±189.1	586.9±237.1
Ac/Th-228*	42.74±20.05	<48.19	<63.59

* Indicates naturally occurring

TABLE B-14

CONCENTRATIONS OF GAMMA EMITTERS IN BROADLEAF VEGETATION - 2000
Results in Units of pCi/Kg (wet) ± 1 sigma

#95 Met Tower

Jun-00

Radionuclide	Clover	Ragweed	Grape Leaves
Be-7*	262±31.93	593.2±48.66	298.5±40.58
K-40*	5293±154.9	7237±208.2	4865±174
Mn-54	<6.01	<8.22	<8
Co-58	<5.38	<7.95	<7.67
Fe-59	<13.66	<18.31	<17.01
Co-60	<7.04	<9	<10.32
Zn-65	<15.31	<20.4	<20.5
Zr-95	<10.6	<14.57	<13.71
Nb-95	<6.39	<7.27	<7.74
Ru-103	<5.55	<8.07	<7.58
Ru-106	<70.32	<94.14	<83.29
I-131	<5.37	<7.79	<8.55
Cs-134	<5.85	<8.31	<8.03
Cs-137	<6.93	<8.57	<7.75
Ba/La-140	<9.1	<12.19	<8.64
Ce-141	<6.63	<9.2	<9.32
Ce-144	<28.5	<39.21	<35.71
Ra-226*	352.8±66.58	354.6±86.45	672.3±86.79
Ac/Th-228*	<23.17	<31.36	50.03±19.34

Jul-00

Radionuclide	Ragweed	Bittersweet	Grape Leaves
Be-7*	545.1±47.68	261±33.63	211.1±29.98
K-40*	10280±232.4	5680±160.6	4680±144.4
Mn-54	<8.19	<6.87	<6.69
Co-58	<7.75	<6.19	<5.37
Fe-59	<18.56	<14.86	<12.31
Co-60	<9.82	<7.12	<6.36
Zn-65	<21.75	<15.24	<15.65
Zr-95	<13.49	<11.18	<8.47
Nb-95	<7.47	<6	<5.56
Ru-103	<6.99	<6.1	<5.07
Ru-106	<79.54	<59.57	<60.01
I-131	<6.86	<6.47	<6.43
Cs-134	<8.15	<6.41	<5.54
Cs-137	<8.24	<5.86	<5.55
Ba/La-140	<9.75	<6.97	<5.7
Ce-141	<8.24	<8.01	<6.72
Ce-144	<36.32	<32.2	<23.99
Ra-226*	357.7±82.17	204.7±57.19	549±65.27
Ac/Th-228*	<28.82	57.1±17.79	41.35±11.43

Aug-00

Radionuclide	Grape Leaves	Bittersweet	Ragweed
Be-7*	349±25.4	467.5±56.64	1195±45.1
K-40*	5450±97.6	5442±230.5	8750±16.2
Mn-54	<6.414	<8.77	<9.31
Co-58	<7.278	<10.1	<8.85
Fe-59	<21.26	<21.22	<21.37
Co-60	<7.18	<9.66	<10.75
Zn-65	<17.11	<26.61	<24.31
Zr-95	<14.23	<17.07	<16.64
Nb-95	<9.762	<9.14	<10.27
Ru-103	<8.277	<8.35	<9.34
Ru-106	<69.77	<80.77	<83.82
I-131	<26.55	<10.33	<13.95
Cs-134	<6.721	<9.29	<7.98
Cs-137	37.7±3.08	<7.34	<8.88
Ba/La-140	<16	<12.32	<14.51
Ce-141	<10.37	<11.11	<11.3
Ce-144	<34.47	<46.51	<45.93
Ra-226*	488±46.1	403.8±127.9	483±51.4
Ac/Th-228*	<25.17	<38.45	<31.41

Sep-00

Radionuclide	Bittersweet	Sorrel	Ragweed
Be-7*	849±63.77	931.2±46.96	1726±70.0
K-40*	6375±197.8	6381±134.5	7666±171.8
Mn-54	<8.19	<6.07	<11.49
Co-58	<7.7	<5.7	<10.52
Fe-59	<17.51	<11.23	<26.92
Co-60	<9.02	<6.04	<12
Zn-65	<19.52	<7.86	<28.19
Zr-95	<12.74	<9.95	<19.74
Nb-95	<7.74	<5.42	<10.69
Ru-103	<7.18	<5.37	<9.9
Ru-106	<77.76	<56.6	<115.2
I-131	<8.29	<6.91	<17.92
Cs-134	<7.58	<3.45	<11.83
Cs-137	<7.8	<5.84	<9.69
Ba/La-140	<10.37	<6.97	<18.84
Ce-141	<9.15	<8.27	<13.78
Ce-144	<38.18	<34.17	<52.74
Ra-226*	429±89.69	512.6±98.41	457±99.8
Ac/Th-228*	<32.3	103.1±17.28	62.7±28.6

Oct-00

Radionuclide	Goldenrod	Ragweed	Sorrel
Be-7*	1023±53.56	2234±91.08	1002±65.36
K-40*	5192±152.3	8048±236.5	8323±228.1
Mn-54	<5.48	<8.62	<7.86
Co-58	<6.15	<7.91	<8.1
Fe-59	<14.42	<19.94	<19.24
Co-60	<7.26	<10.25	<9.35
Zn-65	<16.16	<21.87	<20.55
Zr-95	<10.44	<14.69	<14.27
Nb-95	<6.1	<8.83	<6.71
Ru-103	<5.29	<7.63	<7.99
Ru-106	<58.8	<78.85	<97.6
I-131	<5.46	<9.13	<9.11
Cs-134	<5.74	<8.32	<8.96
Cs-137	<5.8	<9.16	<8.65
Ba/La-140	<6.6	<12.93	<10.56
Ce-141	<6.83	<10.74	<10.29
Ce-144	<28.79	<46.42	<39.49
Ra-226*	320.1±73.09	531.4±128.9	283.7±102.1
Ac/Th-228*	<24.23	43.27±25.36	<31.95

* Indicates naturally occurring

TABLE B-15

CONCENTRATIONS OF GAMMA EMITTERS IN FISH AND INVERTEBRATE SAMPLES-2000
Results in Units of pCi/Kg (wet) ± 1 sigma

#23 ROSETON CONTROL

Radionuclide	White Perch 7/26/00	White Catfish 7/26/00	American Eel 7/26/00
Be-7*	<303.4	<1.32E+03	<418
K-40*	5980±237.5	27300±798	9590±297
Mn-54	<14.54	<64.5	<23.4
Co-58	<26.25	<120	<39.4
Fe-59	<86.93	<355	<132
Co-60	<12.74	<55.0	<16.6
Zn-65	<34.76	<92.0	<27.6
Zr-95	<55.94	<226	<75.1
Nb-95	<62.23	<276	<97.3
Ru-103	<50.44	<226	<76.3
Ru-106	<158.5	<685	<220
I-131	<16660	<80500	<29700
Cs-134	<8.76	<37.1	<11.8
Cs-137	<14.23	<59.1	<17.8
Ba/La-140	<1265	<5020	<1860
Ce-141	<94.22	<292	<158
Ce-144	<73.34	<400	<138
Ra-226*	556.9±151.1	6390±870	1890±296
Ac/Th-228*	<50.9	1250±178	340±58.2

CONCENTRATIONS OF GAMMA EMITTERS IN FISH AND INVERTEBRATE SAMPLES-2000
Results in Units of pCi/Kg (wet) ± 1 sigma

#25 HUDSON RIVER INDICATOR

Radionuclide	Striped Bass 5/4/00	White Catfish 5/19/00	White Perch 6/8/00	White Perch 8/3/00	Americal Eel 8/3/00	White Catfish 8/3/00	Blue Crab 8/17/00
Be-7*	<169	<163.7	<203.7	<586.6	<404.7	<403.4	<292.5
K-40*	4129±234.3	5850±218.2	5807±283.8	10320±448.5	5540±291.7	8767±289	5405±271
Mn-54	<12.62	<14.84	<13.61	<32.72	<22.36	<23	<19.76
Co-58	<20.11	<17.23	<18.57	<58.73	<39.03	<41.95	<28.51
Fe-59	<63.46	<41.89	<59.56	<185.3	<115.4	<110.5	<86.23
Co-60	<12.22	<11.25	<13.38	<30.28	<19.88	<17.96	<18.85
Zn-65	<31.46	<29	<39.04	<82.94	<58.31	<53.69	<43.19
Zr-95	<35.46	<29.87	<34.41	<107	<69.68	<68.8	<52.8
Nb-95	<31.86	<25.99	<29.42	<135	<90.34	<75.46	<55.07
Ru-103	<25.02	<24.39	<24.54	<105	<70.42	<67.3	<45.3
Ru-106	<145.5	<146.2	<181.1	<345.6	<212.3	<219.8	<176.3
I-131	<1343	<435	<323.9	<20460	<12530	<14330	<3247
Cs-134	<10.93	<7.83	<16.13	<32.66	<19.06	<12.39	<17.5
Cs-137	<9.96	<13.16	<14.43	<27.61	<18.45	<19.22	<16.48
Ba/La-140	<215.6	<135.9	<122.9	<1832	<1559	<1138	<446.8
Ce-141	<42.38	<41.15	<37.5	<179.5	<120.3	<132.3	<68.62
Ce-144	<64.59	<80.67	<83.01	<172	<121.8	<136.8	<91.63
Ra-226*	413.1±110.1	820.1±174.3	620.3±149.9	4901±478.5	854.4±283.7	1600±275.9	1255±213.5
Ac/Th-228*	<38.27	134.8±26.37	<59.9	298.6±83.13	104.8±53.48	310±62.18	<69.21

* Indicates naturally occurring

TABLE B-16

ANNUAL SUMMARY, NON-RETS SAMPLE RESULTS 2000

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 POSITIVE SAMPLE	CONTROL LOCATIONS LOWEST POSITIVE 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	0	9	ND	ND	ND	0	3	NA	NA
	I-131	100	ND	ND	ND	0	9	15.5	15.5	15.5	1	3	289	NA
	Cs-134	100	ND	ND	ND	0	9	ND	ND	ND	0	3	NA	NA
	Cs-137	100	12.5	12.5	12.5	1	9	12	12	12	1	3	77	102
BOTTOM SEDIMENT (pCi/kg - DRY)														
	Co-60	NONE	ND	ND	ND	0	6	ND	ND	ND	0	2	120	ND
	Cs-134	150	ND	ND	ND	0	6	ND	ND	ND	0	2	71	42(A)
	Cs-137	180	428	676	269	6	6	79	79	79	1	2	851	227
SOIL (pCi/kg - DRY)	Cs-137	180	ND	ND	ND	0	2	78.9	78.9	78.9	1	1	183	(B)
PRECIPITATION (pCi/L)	H-3	2000	ND	ND	ND	0	4	ND	ND	ND	0	4	285	135
ALGONQUIN OUTFALL (pCi/L)	H-3	2000	ND	ND	ND	0	4	NA	N/A	N/A	N/A	N/A	167	N/A

* - AVERAGE OF POSITIVE VALUES FOR 1990-1999

(A) - WAS DETECTED AT CONTROL LOCATION, 1992 AND 1999

(B) - NO DIFFERENCE MADE BETWEEN INIDCATOR AND CONTROL LOCATIONS FOR HISTORICAL DATA

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 2000 LAND USE CENSUS.

TABLE B-18

LAND USE CENSUS

2000

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 2000 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
1990 - 2000

	Average Quarterly Dose (mR/Quarter)		
Year	**Inner Ring**	**Outer Ring**	**Control Location**
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
2000	**14**	**15**	**16**
Historical Average 1990-1999	14	14	16

FIGURE C-1
DIRECT RADIATION
1990 - 2000

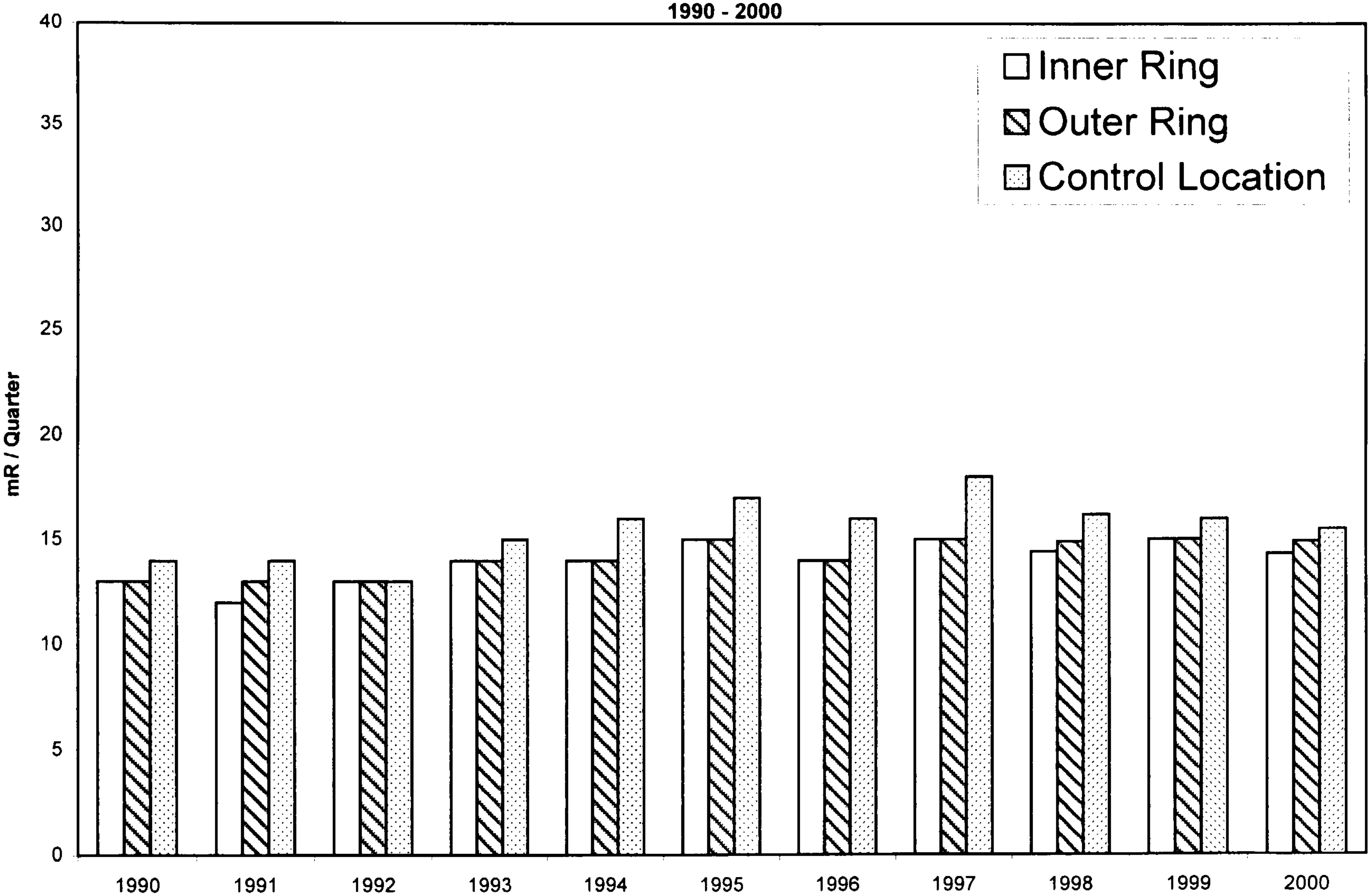
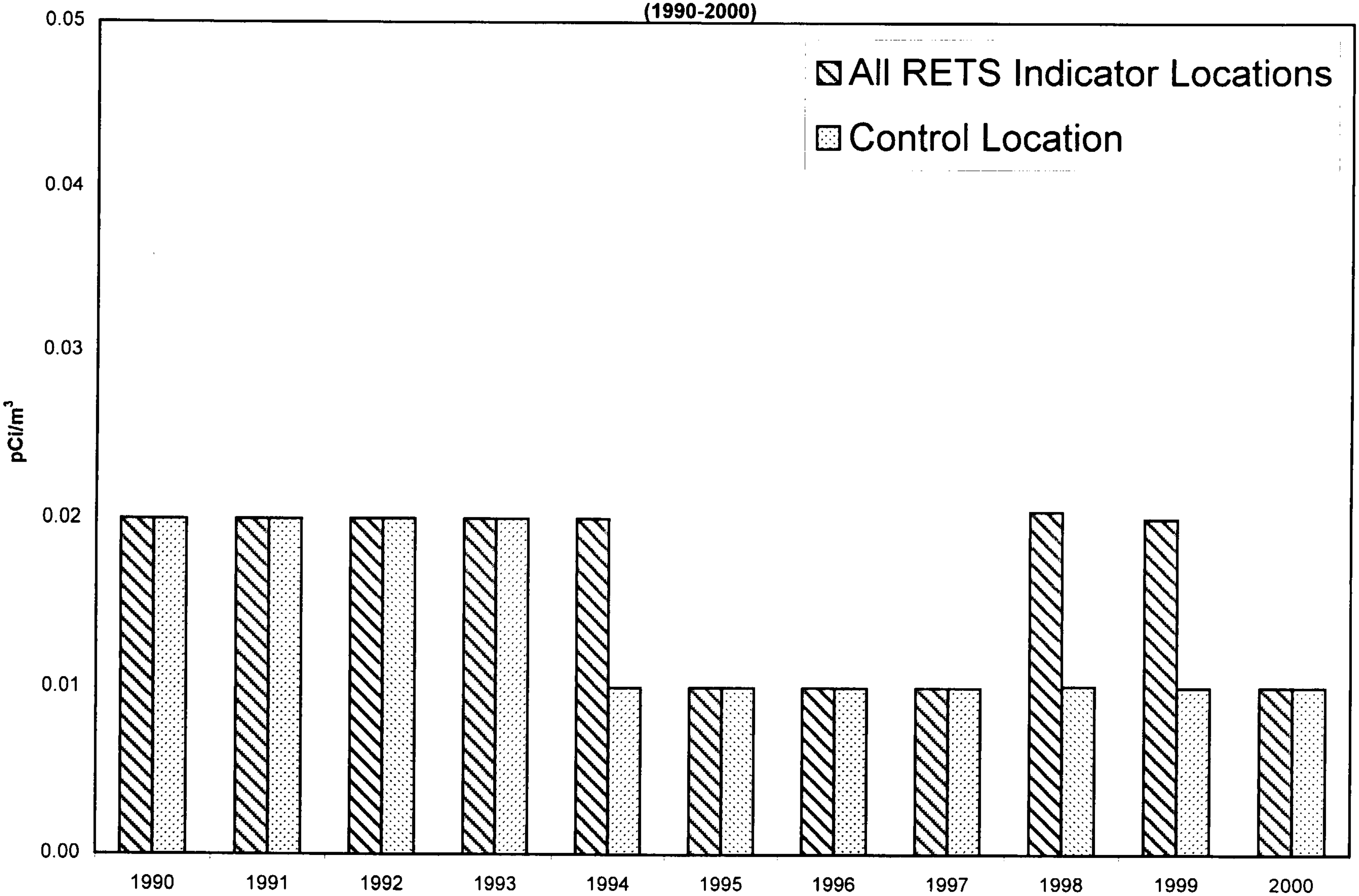


TABLE C-2
TEN YEAR HISTORICAL DATA
RADIONUCLIDES IN AIR
1990 - 2000
(pCi/m^3)

Year	Gross Beta		Cs-137	
	All RETS Indicator Locations	Control Location	All RETS Indicator Locations	Control Location
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	0.01	<LLD	<LLD
2000	**0.01**	**0.01**	**<LLD**	**<LLD**
Historical Average 1990-1999	0.02	0.01	<LLD	<LLD

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

FIGURE C-2
RADIONUCLIDES IN AIR - GROSS BETA
(1990-2000)



* Includes RETS and non-RETS indicator locations.

Required LLD = 0.01 pCi/m^3

TABLE C-3
TEN YEAR HISTORICAL DATA
RADIONUCLIDES IN HUDSON RIVER WATER
1990 - 2000
(pCi/L)

	Tritium		Cs-137	
Year	**Inlet**	**Discharge**	**Inlet**	**Discharge**
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
2000	**190**	**267**	**<LLD**	**<LLD**
Historical Average 1990-1999	273	379	<LLD	<LLD

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

FIGURE C-3
RADIONUCLIDES IN HUDSON RIVER WATER
(1990-2000)

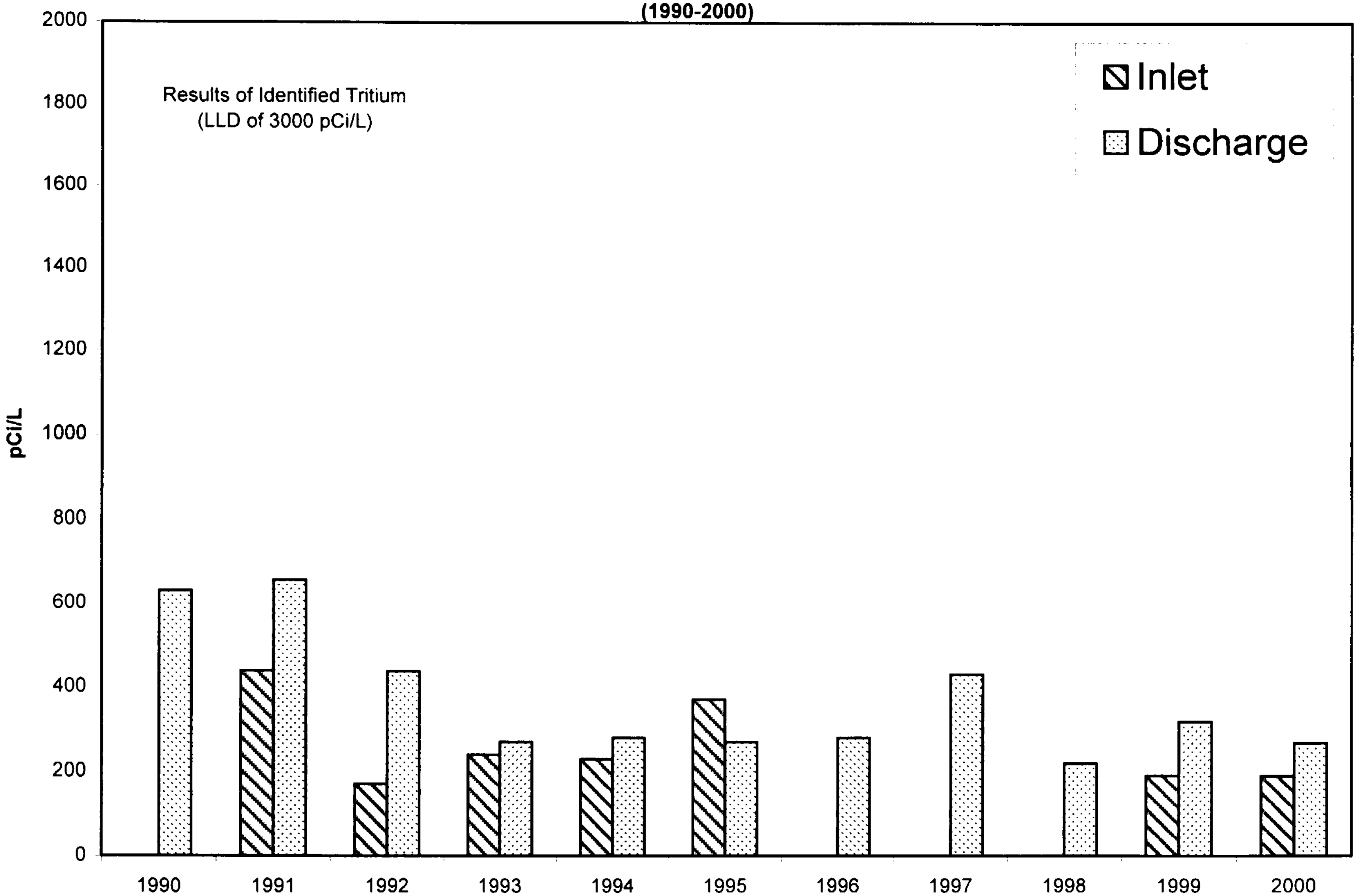
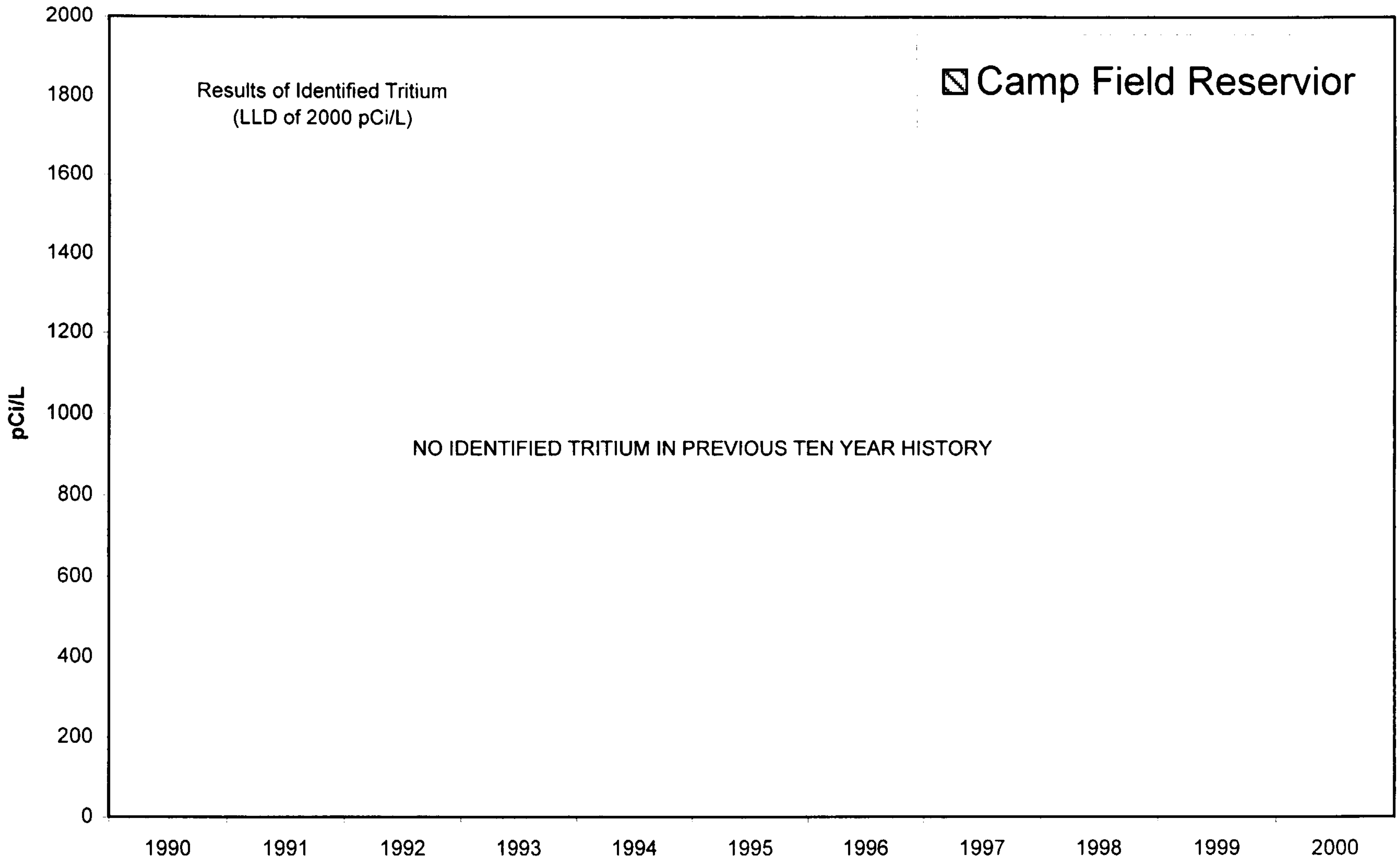


TABLE C-4
TEN YEAR HISTORICAL DATA
RADIONUCLIDES IN DRINKING WATER
1990 - 2000
(pCi/L)

Year	Tritium	Cs-137
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
2000	**<LLD**	**<LLD**
Historical Average 1990-1999	<LLD	<LLD

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

FIGURE C-4
RADIONUCLIDES IN DRINKING WATER
(1990-2000)



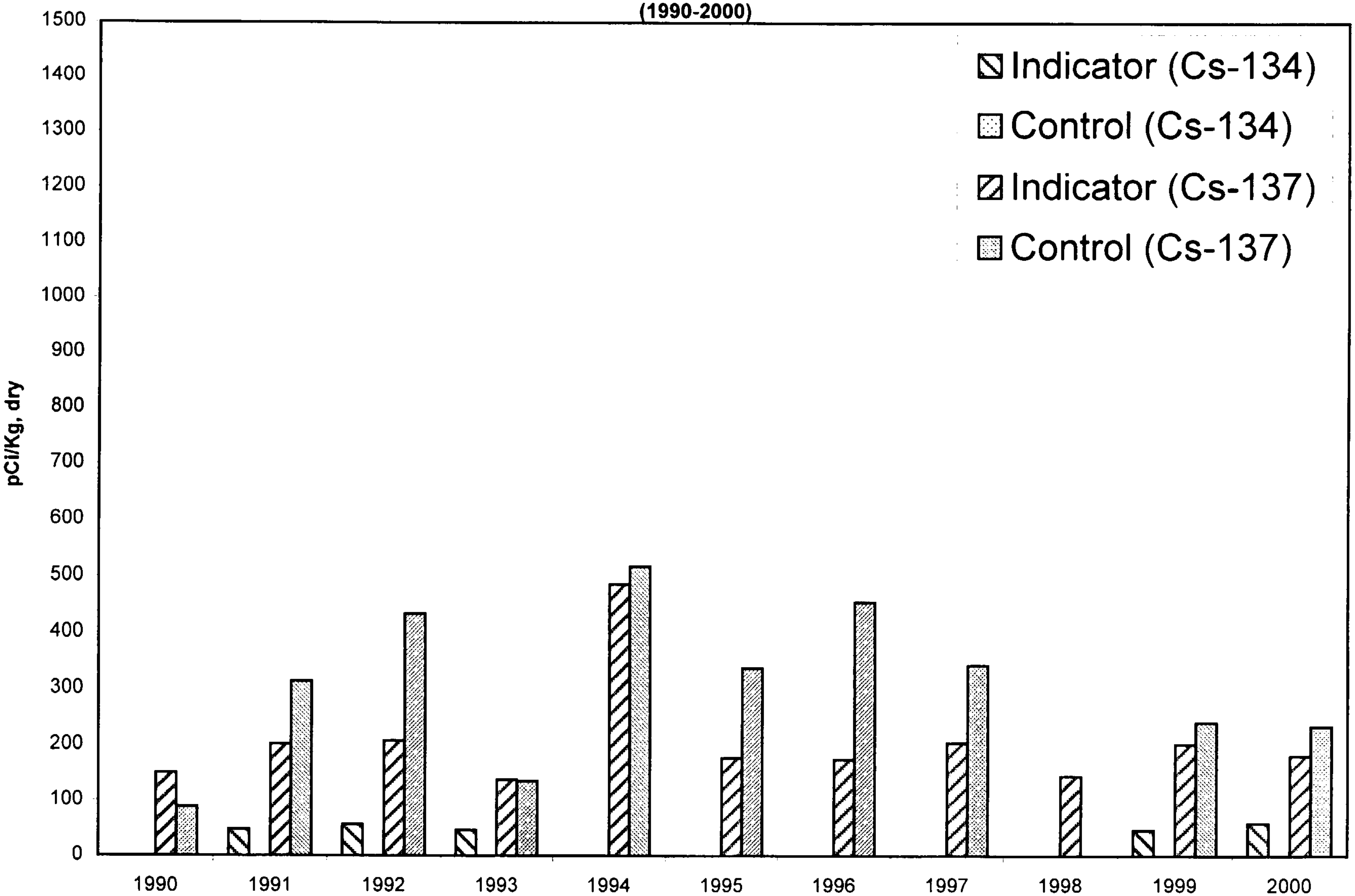
Required LLD = 2000 pCi/L

TABLE C-5
TEN YEAR HISTORICAL DATA
RADIONUCLIDES IN SHORELINE SOILS
1990 - 2000
(pCi/Kg, dry)

	Cs-134		Cs-137	
Year	**Indicator**	**Control**	**Indicator**	**Control**
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
2000	**58**	**<LLD**	**179**	**231**
Historical Average 1990-1999	49	<LLD	208	317

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

FIGURE C-5
RADIONUCLIDES IN SHORELINE SOILS
(1990-2000)



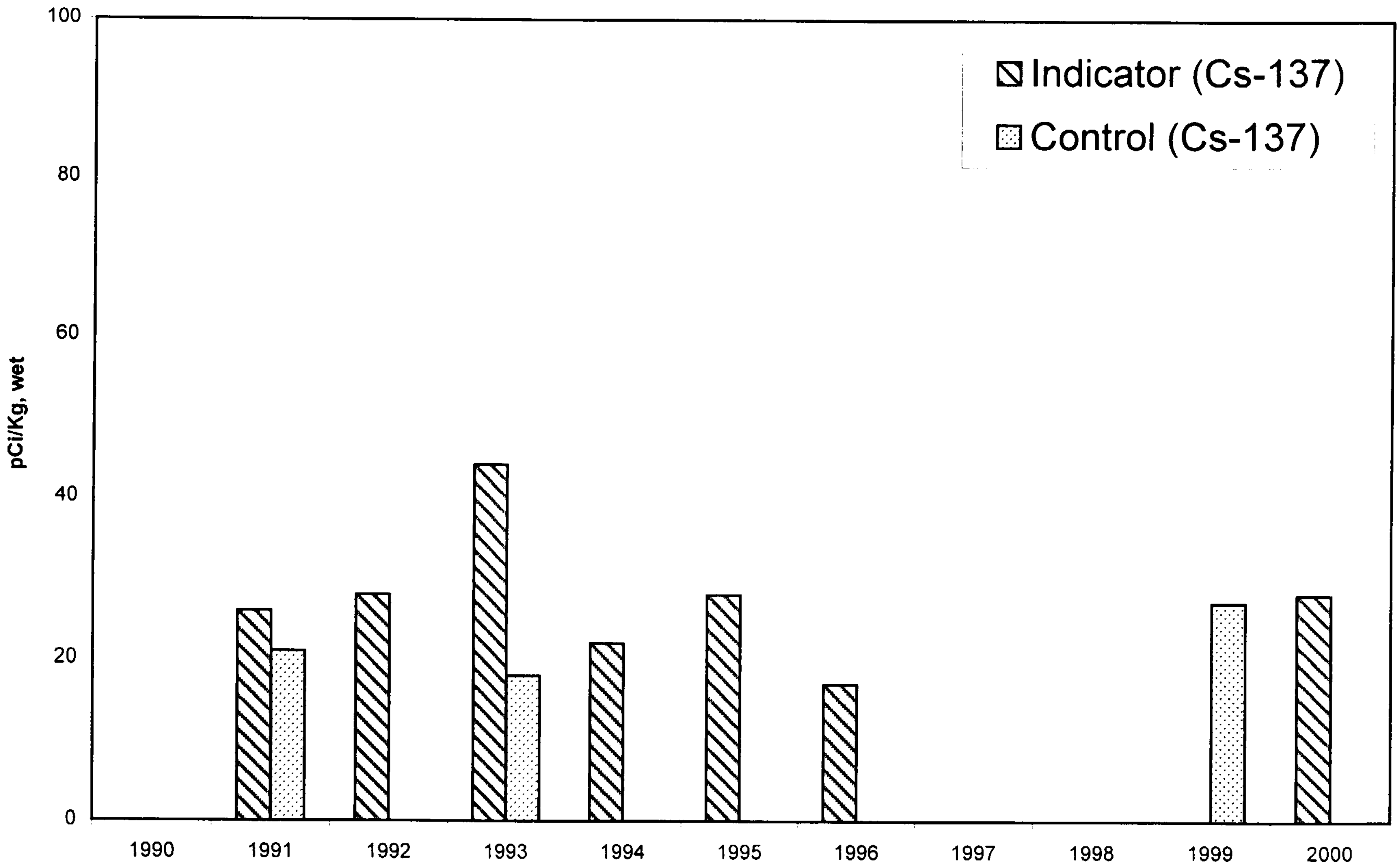
Cs-134 required LLD = 150 pCi/Kg
Cs-137 required LLD = 175 pCi/Kg

TABLE C-6
TEN YEAR HISTORICAL DATA
RADIONUCLIDES IN BROAD LEAF VEGETATION
1990 - 2000
(pCi/Kg, wet)

	Cs-137	
Year	**Indicator**	**Control**
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
2000	**28**	**<LLD**
Historical Average 1990-1999	28	22

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

FIGURE C-6
RADIONUCLIDES IN BROAD LEAF VEGETATION
(1990 - 2000)



Required LLD = 80 pCi/Kg

TABLE C-7

TEN YEAR HISTORICAL DATA

RADIONUCLIDES IN FISH AND INVERTEBRATES

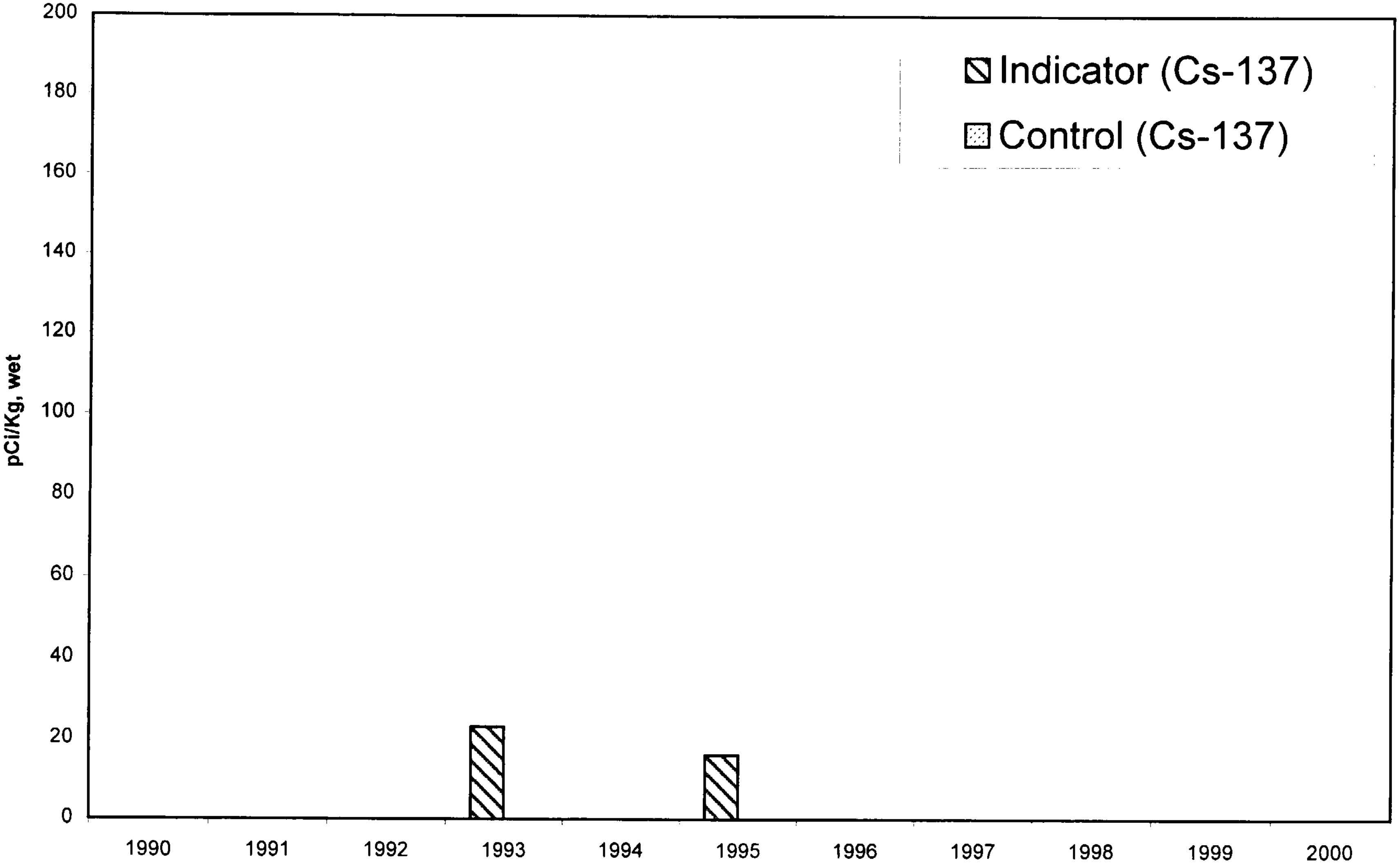
1990 - 2000

(pCi/Kg, wet)

	Cs-137	
Year	**Indicator**	**Control**
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
2000	**<LLD**	**<LLD**
Historical Average 1990-1999	20	<LLD

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

FIGURE C-7
RADIONUCLIDES IN FISH AND INVERTEBRATES
(1990 - 2000)



Required LLD = 150 pCi/Kg

APPENDIX D

INTERLABORATORY COMPARISON PROGRAM

APPENDIX D

D.1 PROGRAM DESCRIPTION

Radiological Effluent Technical Specification (RETS) and Radiological Effluent Controls (RECS) require that each licensee participate in an Interlaboratory Comparison Program. The Interlaboratory Comparison Program shall include sample media for which samples are routinely collected and for which 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 Measurements 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 Analytic's sample results.

In addition to the Analytics Program, the JAF Environmental Laboratory participated in the Environmental Measurements Laboratory (EML) Quality Assessment Program (QAP). EML supplies sample media as blind sample spikes to approximately 127 laboratories worldwide. These samples containing 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.

Environmental Inc. Midwest Laboratories and Teledyne Brown Engineering performed the tritium analysis for the Indian Point samples. To provide a quality assurance check, tritium samples from Analytics and EML are provided by the JAF laboratory.

D.2 PROGRAM SCHEDULE

SAMPLE MEDIA	LABORATORY ANALYSIS	SAMPLE PROVIDER ANALYTICS	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	no comparison
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 95th percentile. In other words, the middle 70% of all reported values are acceptable, while the other 5th-15th (10%) and 85th-95th percentiles (10%) are in the warning area. The Not Acceptable criteria, "N", is established at less than the 5th percentile and greater than the 95th percentile, that is, the outer 10% of the historical data. Using five years worth of historical analytical data, the EML, determined performance results using the percentile criteria summarized below:

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

D.4 PROGRAM RESULTS SUMMARY

The Interlaboratory Cross-Check Program numerical results are provided in Table D-1.

D.4.1 ANALYTICS QA SAMPLES RESULTS

Seventeen QA blind spike samples were analyzed as part of Analytics' 2000 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 81 individual analysis on the seventeen QA samples. Of the 81 analysis performed, 79 were in agreement using the NRC acceptance criteria for a 97.5% agreement ratio.

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

D.4.2 ANALYTICS SAMPLE NONCONFORMITIES

D.4.2.1 Analytics Sample E-2094-05 Nonconformity No. 2000-04, Cs-134 in Air Filter

A single air filter from Analytics was analyzed for gamma emitters. Eight of the nine isotopes present were in agreement with the reference value. Cs-134 activity was not in agreement. The cause of the nonconformity was determined to be coincidence summing of the Cs-134 peak at 604 KeV, which is the primary peak for quantifying this isotope. This coincidence summing causes the counts observed for Cs-134 to be lower than expected with a resulting under reporting of activity. ACTS No. 00-53189 was generated to provide a corrective action to address the coincidence counting bias on a program level. In response to this requirement, coincidence counting correction factors were determined using the QA sample results data base. The correction factors were implemented using gamma analysis software.

D.4.2.2 Analytics Sample E-2354-05
Nonconformity No. 2000-09, Cs-134 in Air Filter

A single air filter from Analytics was analyzed for gamma emitters. Eight of the nine isotopes were in agreement with the reference value. Cs-134 was not in agreement. The cause of the nonconformity was the coincident summing of the Cs-134 peak at 604 KeV. The corrective action was discussed in D.4.2.1. A re-analysis of the original gamma spectrums using the coincidence summing correction factors produced results that were in agreement with the known value.

D.4.3 ENVIRONMENTAL MEASUREMENTS LABORATORY (EML)

In 2000, JAF Environmental Laboratory participated in both the EML Quality Assessment Programs, QAP-52 and QAP-53. 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 samples included in QAP-52 and QAP-53. Using the EML acceptance criteria, 18 of 19 radionuclide analyses (94.7%) were found to be acceptable or acceptable with warning. One of 19 sample result was not acceptable (5.3%). Results for the EML cross Check Program can be viewed on-line at www.eml.doe.gov.

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

Matrix	Total Analyses	Acceptable	Not Acceptable
Air	11	10	1
Water	8	8	0
Total Evaluation	19	18	1
Percentage		94.7%	5.3%

D.4.3.1 EML Nonconformity
Nonconformity 2000-05, QAP-52, Ru-106 in Air Filter

A single air filter from EML was analyzed for gamma emitters. Using the standard single filter geometry, all results were in agreement with the exception of Ru-106. The apparent cause of the nonconformity was the low Ru-106 activity contained in the sample. Ru-106 was detected in only one of the three sample analyses. The second and third analysis reported Ru-106 results as less than detectable concentrations (LLD). The Ru-106 activity was reported using the single positive result. Because of the low activity level present in the sample the resulting count rate for Ru-106 for this sample was less than 0.7 counts per minute. The one sigma associated counting error was 30% for the 2-hour count time. By comparison, the associated one sigma counting error for Co-60 was less than 2.5% for the sample count time. There was no corrective action associated with this nonconformity. Future QA samples results will be evaluated when less that 3 positive results are obtained for a specific radionuclide. Based on the evaluation it will be determined if the results can be reported with the appropriate level of confidence.

D.5 REFERENCES

D.5.1 Semi-Annual Report of the Department of Energy, Office of Environmental Management, Quality Assessment Program, EML 608, March 2000.

D.5.2 Semi-Annual Report of the Department of Energy, Office of Environmental Management, Quality Assessment Program, EML 611, September 2000.

D.5.3 Radioactivity and Radiochemistry, The Counting Room: Special Edition, 1994 Caretaker Publications, Atlanta, Gerogia

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)
06/22/00	E-2235-05	AIR	Gross Beta	48.2±1.7 50.4±1.7 51.3±1.7 Mean =50±1	57±1	0.88, A
12/07/00	E-2493-05	AIR	Gross Beta	71.2±2.0 67.4±1.2 69.0±2.0 Mean =69.2±1.2	72±1	0.96, A

(1) Results reported as activity ± 1 sigma.
(2) Ratio = Reported/Analytics (See Section D.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)
03/23/00	E-2092-05	WATER	H-3	4170±194	4170±70	1.0, A

(1) Results reported as activity ± 1 sigma. Sample Analyzed by Environmental Inc. Midwest Laboratory
(2) Ratio = Reported/Analytics (See Section D.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)
03/23/00	E-2093-05	WATER pCi/liter	I-131**	74.3±0.97 76.2±1.07 75.0±1.19 Mean =75.2±0.6	74±1.3	1.02, A
06/22/00	E-2238-05	AIR pCi/cc	I-131	61.1±6.0 68.8±6.1 63.4±5.8 Mean =64.4±3.4	72.0±1.3	0.89, A
06/22/00	E-2236-05	MILK pCi/liter	I-131**	76.2±1.2 72.3±1.6 72.2±1.4 Mean =73.6±0.8	81.0±1.3	0.91, A
09/21/00	E-2355-05	MILK pCi/liter	I-131**	53.0±1.0 50.0±1.3 57.1±1.5 Mean =53.4±0.7	58.0±1.0	0.92, A
09/21/00	E-2356-05	AIR pCi/cc	I-131	89.7±6.4 84.8±5.2 81.3±5.2 Mean =85.3±3.3	83.0±1.3	1.02, A
09/21/00	E-2353-05	WATER pCi/liter	I-131**	71.8±1.1 74.0±1.6 74.4±1.4 Mean =73.4±0.6	75.0±1.3	0.97, A

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

TABLE D-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)
03/23/00	E-2093-05	WATER	Ce-141	471±8.6 471±8.6 463±11.6 Mean = 459±6	427±7	1.07, A
			Cr-51	215±20.9 270±24.3 217±39.0 Mean =234±17	238±4	0.98, A
			Cs-134	124±3.0 128±3.8 128±4.9 Mean = 127±2	139±2	0.91, A
			Cs-137	127±4.1 134±4.3 116±6.6 Mean = 126±3	128±2	0.98, A
			Mn-54	166±4.7 171±4.7 170±7.9 Mean = 169±3	159±3	1.06, A
			Fe-59	96.7±6.0 101±6.2 106±10.9 Mean = 101±5	92±2	1.10, A
			Zn-65	211±8.4 221±8.5 198±14.1 Mean = 210±6	196±3	1.07, A
			Co-60	123±3.2 114±3.1 115±5.2 Mean = 117±2	116±2	1.01, A
			Co-58	45.0±2.9 47.8±3.0 48.7±5.0 Mean = 47±2	44±0.7	1.07,A

(1) Results reported as activity ± 1 sigma.
(2) Ratio = Reported/Analytics (See Section D.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)
09/21/00	E-2353-05	WATER	Ce-141	222±11.6 214±7.5 196±7.3 Mean = 211±5	191±3.3	1.1, A
			Cr-51	197±46.0 258±33.1 255±36.7 Mean = 227±23	230±4.0	0.99, A
			Cs-134	116±6.9 116±3.8 111±8.9 Mean = 114±4	128±2.0	0.89, A
			Cs-137	223±9.2 226±5.3 203±6.8 Mean = 217±4	218±4.0	1.0, A
			Mn-54	82.3±6.7 112±4.2 87.4±5.3 Mean = 94±3	89±1.3	1.06, A
			Fe-59	48.7±11.4 65.5±6.8 46.6±8.1 Mean = 54±5	54±1.0	1.00, A
			Zn-65	122±13.3 140±8.3 120±10.0 Mean = 127±6	134±2.3	0.95, A
			Co-60	243.0±7.7 257±4.5 259±6.0 Mean = 253±4	246±4.0	1.03, A
			Co-58	48.4±6.1 56.9±3.4 65.9±4.8 Mean = 57±3	60±1.0	0.95, A

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

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)
03/23/00	E-2094-05	FILTER	Ce-141	269±4.4 265±4.4 258±4.3 Mean = 264±2	293±5.0	0.9, A
			Cs-134	68.8±1.9 70.4±1.9 68.7±2.5 Mean = 69±1	95±1.7	0.73, N NC 2000-4
			Cs-137	77.9±2.7 82.2±2.8 76.9±2.7 Mean = 79±2	88±1.3	0.9, A
			Mn-54	110±3.5 105±3.4 108±3.6 Mean = 108±2	109±1.3	0.99, A
			Fe-59	56.9±5.1 62.6±4.9 63.4±5.2 Mean = 61±3	63±1.0	0.97, A
			Zn-65	134±6.4 138±6.6 125±6.5 Mean = 132±4	132±2.3	1.00, A
			Co-60	71.6±2.4 69.0±2.4 67.6±2.4 Mean = 69±1	80±1.3	0.87, A
			Cr-51	154±14.4 148±14.8 138±13.3 Mean = 147±8	163±2.7	0.9, A
			Co-58	26.4±2.1 25.6±2.2 28.7±2.3 Mean = 26.9±1	30±0.7	0.9, A

(1) Results reported as activity ± 1 sigma.
(2) Ratio = Reported/Analytics (See Section D.3).
(*) Sample provided by Analytics, Inc.
(N) Evaluation Results, Not Acceptable.
(A) Evaluation Results, Acceptable.
(NC) Nonconformity

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)
09/21/00	E-2354-05	FILTER	Ce-141	106±4.0 101±4.5 102±3.9 Mean = 103±2	102±1.7	1.01, A
			Cr-51	125±20.0 139±23.9 108±20.7 Mean = 124±13	123±2.0	1.01, A
			Cs-134	51.2±3.5 46.0±4.1 53.8±6.4 Mean = 50±3	68±1.0	0.74, N NC 2000-9
			Cs-137	119±4.8 108±5.8 121±5.0 Mean = 116±3	117±2.0	0.99, A
			Mn-54	65.4±4.0 54.7±5.0 48.6±3.8 Mean = 56±3	48±0.7	1.17, A
			Fe-59	41.3±6.7 34.1±8.5 30.8±6.9 Mean = 35±4	29±0.3	1.21, A
			Zn-65	79.3±7.7 81.3±9.6 81.2±8.4 Mean = 81±5	72±1.3	1.13, A
			Co-60	134±4.4 139±5.8 123±4.6 Mean = 132±3	132±2.7	1.0, A
			Co-58	34.1±3.1 30.9±4.0 27.8±3.4 Mean = 31±2	32±0.7	0.97, A

(1) Results reported as activity ± 1 sigma.
(2) Ratio = Reported/Analytics (See Section D.3).
(*) Sample provided by Analytics, Inc.
(A) Evaluation Results, Acceptable.
(n) Evaluation Results, Not Acceptable. (NC) Nonconformity

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)
06/22/00	E-2236-05	MILK	Ce-141	65.7±5.3 68.6±5.2 61.5±5.2 Mean =65±3	69±1	0.94, A
			Cr-51	194±28.5 188±27.6 218±24.4 Mean =200±16	211±3.7	0.95, A
			Cs-134	80.4±3.2 81.7±3.0 81.8±3.2 Mean =81±2	91±1.7	0.89, A
			Cs-137	193±6.1 206±5.8 196±4.8 Mean =198±3	190±3.3	1.04, A
			Mn-54	126±5.3 120±4.8 122±4.1 Mean =123±3	118±2	1.04, A
			Fe-59	40.9±6.5 49.0±6.4 55.1±5.9 Mean =48±4	50±1.0	0.97, A
			Zn-65	144±9.5 148±8.8 141±7.3 Mean =144±5	148±2.3	0.97, A
			Co-60	150±4.6 142±4.1 148±3.5 Mean =147±2	142±2.3	1.04, A
			Co-58	98±5.1 108±4.8 105±4.0 Mean =104±3	104±1.7	1.0, A

(1) Results reported as activity ± 1 sigma.
(2) Ratio = Reported/Analytics (See Section D.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)
09/21/00	E-2355-05	MILK	Ce-141	160±7.0 163±8.3 181±10.7 Mean =168±5	164±2.7	1.02, A
			Cr-51	208±30.3 138±36.6 209±46.2 Mean =185±22	198±3.3	0.93, A
			Cs-134	96.4±3.5 95.0±4.4 90.8±6.4 Mean =94±3	110±2	0.85, A
			Cs-137	194±5.1 178±6.5 196±8.0 Mean =189±47	188±3	1.01, A
			Mn-54	88.9±3.9 84.5±5.0 73.4±6.2 Mean =82±3	77±1.3	1.06, A
			Fe-59	46.3±6.1 25.8±7.6 77.4±11.8 Mean =50±5	47±0.7	1.06, A
			Zn-65	117±7.6 102±10.5 124±13.4 Mean =114±6	115±2	0.99, A
			Co-60	221±4.3 212±5.6 215±7.1 Mean =216±3	212±3.7	1.02, A
			Co-58	52.7±3.1 52.7±4.6 46.6±5.5 Mean =51±3	51±1	1.00, A

(1) Results reported as activity ± 1 sigma.
(2) Ratio = Reported/Analytics (See Section D.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)
06/22/00	E-2237-05	SOIL	Ce-141	0.178±0.02 0.160±0.02 0.196±0.02 Mean=0.178±0.01	0.175±0.003	1.02, A
			Cs-134	0.220±0.01 0.241±0.02 0.218±0.01 Mean=0.217±0.01	0.232±0.004	0.94, A
			Cs-137	0.644±0.03 0.544±0.03 0.583±0.03 Mean=0.590±0.02	0.610±0.010	0.97, A
			Mn-54	0.278±0.02 0.306±0.02 0.299±0.02 Mean=0.294±0.01	0.300±0.005	0.98, A
			Co-60	0.275±0.02 0.336±0.02 0.369±0.02 Mean=0.360±0.01	0.359±0.006	1.00, A
			Zn-65	0.333±0.04 0.275±0.04 0.418±0.04 Mean=0.342±0.02	0.375±0.006	0.91, A
			Co-58	0.266±0.02 0.267±0.02 0.283±0.02 Mean=0.272±0.01	0.263±0.004	1.03, A
			Fe-59	0.124±0.03 0.155±0.03 0.127±0.03 Mean=0.135±0.02	0.128±0.002	1.05, A
			Cr-51	0.480±0.11 0.472±0.11 0.517±0.12 Mean=0.49±0.07	0.536±0.009	0.91, A

(1) Results reported as activity ± 1 sigma.
(2) Ratio = Reported/Analytics (See Section D.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)
06/22/00	E-2239A-05	VEGETATION	Ce-141	0.085±0.006 0.088±0.006 0.082±0.007 Mean=0.085±0.004	0.089±0.001	0.96, A
			Cs-134	0.098±0.003 0.101±0.005 0.104±0.004 Mean=0.101±0.002	0.118±0.002	0.86, A
			Cs-137	0.259±0.006 0.257±0.007 0.259±0.007 Mean=0.258±0.004	0.245±0.004	1.05, A
			Mn-54	0.160±0.005 0.158±0.006 0.146±0.006 Mean=0.155±0.003	0.152±0.003	1.02, A
			Zn-65	0.214±0.010 0.160±0.011 0.179±0.014 Mean=0.185±0.007	0.190±0.003	0.97, A
			Co-60	0.189±0.004 0.198±0.005 0.187±0.006 Mean=0.191±0.003	0.183±0.003	1.04, A
			Co-58	0.136±0.005 0.132±0.006 0.118±0.006 Mean=0.129±0.003	0.134±0.002	0.96, A
			Fe-59	0.060±0.008 0.055±0.010 0.069±0.012 Mean=0.061±0.006	0.065±0.001	0.94, A
			Cr-51	0.281±0.031 0.218±0.380 0.282±0.037 Mean=0.260±0.020	0.272±0.005	0.96, A

(1) Results reported as activity ± 1 sigma.
(2) Ratio = Reported/Analytics (See Section D.3).
(*) Sample provided by Analytics, Inc.
(A) Evaluation Results, Acceptable.
(N) Evaluation Results, Not Acceptable.

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)
03/01/00	QAP-52	WATER Bq/liter	Cs-137	104±2.2 110±1.7 111±1.9 Mean= 108±1.12	103.0±4.0	1.05, A
			Co-60	55.5±1.4 54.0±1.0 53.3±1.1 Mean= 54.3±0.7	48.9±1.8	1.11, A
09/01/00	QAP-53	WATER Bq/liter	Cs-137	64.8±2.2 67.3±1.4 61.1±1.7 Mean= 64.4±1.0	67.0±3.5	0.96, A
			Co-60	70.3±2.0 76.6±1.3 71.8±1.6 Mean= 72.9±0.9	73.7±2.9	0.99, 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

Gamma Analysis Air Particulate Filters (Bq/filter)

DATE	JAF ENV ID NUMBER	MEDIUM	ANALYSIS	JAF RESULT (1)	REFERENCE LABORATORY* (1)	RATIO (2)
03/01/00	QAP-52	FILTER	Co-57	4.92±0.07 4.81±0.08 4.96±0.08 Mean=4.90±0.04	5.31±0.22	0.92, A
			Co-60	4.88±0.12 5.11±0.14 4.92±0.12 Mean=4.97±0.07	5.32±0.26	0.93, A
			Mn-54	26.97±0.33 26.71±0.39 28.19±0.33 Mean=27.3±0.2	27.2±0.8	1.0, A
			Cs-137	5.59±0.15 5.66±0.17 5.92±0.15 Mean=5.72±0.09	6.1±0.3	0.94, A
			Ru-106	2.81±0.83 Mean=2.81±0.8	2.01±1.94	1.40, N NC 2000-5
09/01/00	QAP-53	FILTER	Mn-54	44.03±0.24 46.62±0.62 46.99±0.62 Mean=44.7±0.4	43.2±1.3	1.04, A
			Co-60	8.40±0.09 8.33±0.22 8.07±0.22 Mean=8.3±0.1	8.43±0.48	0.98, A
			Co-57	14.2±0.20 14.8±0.18 14.5±0.19 Mean=14.1±0.1	14.5±0.46	0.97, A
			Cs-137	7.14±0.30 7.29±0.26 7.55±0.26 Mean=7.1±0.2	7.41±0.36	0.96, A

(1) Results reported as activity ± 1 sigma.
(2) Ratio = Reported/EML.
(A) Evaluation Results, Acceptable.
(N) Evaluation Results, Not Acceptable. (NC) Nonconformity

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)
03/01/00	QAP-52	WATER	GROSS BETA LBC A**	811±16 824±16 805±16 Mean=814±9.1	690±70	1.18,A
09/01/00	QAP-53	WATER	GROSS BETA LBC A**	960±13 993±13 1005±13 Mean=986±7	950±90	1.04,A
			LBC C**	980±15 1077±15 988±15 Mean=1015±8	950±90	1.07,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.
(**) There are two Beta, low background counting instruments in the JAF Environmental Laboratory, LBC-A, LBC-C.

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)
03/01/00	QAP-52	WATER	H-3	95±6	79.4±2.5	1.20, A
09/01/00	QAP-53	WATER	H-3	113±6	91.3±0.3	1.24, A

(1) Results reported as activity ± 1 sigma.
(2) Ratio = Reported/EML.
(*) Sample provided by Environmental Measurements Lab, Dept. of Energy.
(†) Analysis performed by Environmental Inc. Midwest Laboratory.
(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)
03/01/00	QAP-52	AIR	GROSS BETA LBC A**	2.71±0.04 2.71±0.04 2.77±0.04 Mean=2.73±0.02	2.42±0.2	1.13, A
09/01/00	QAP-53	AIR	GROSS BETA LBC A**	1.49±0.06 1.49±0.06 1.43±0.06 Mean=1.46±0.03	1.52±0.15	0.96, A
			LBC C**	1.55±0.07 1.61±0.07 1.43±0.06 Mean=1.53±0.04	1.52±0.15	1.01, 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.
(**) There are two Beta, low background counting instruments in the JAF Environmental Laboratory, LBC-A and LBC-C

APPENDIX E

INDIAN POINT UNIT 2 STEAM GENERATOR EVENT SUMMARY

APPENDIX E

Indian Point Unit 2 (IP2) has four steam generators (SG), which are designated as the number 21, 22, 23 and 24 SGs. Each steam generator has 3260 U-shaped tubes. Reactor coolant (the "primary" side) passes through the tubes, heating the normally non-radioactive water in the steam generator (the "secondary" side) to produce steam, which is used to operate the main turbine. After the steam passes through the main turbine, it is condensed and the water is pumped back to the steam generator to repeat the cycle.

On February 15, 2000, one of the tubes in the No. 24 steam generator failed, allowing reactor coolant into the "secondary" side of the steam generator. Until the affected steam generator was isolated, the contaminated water mixed with the steam and water in the secondary plant. Actions taken by IP2 to mitigate a steam generator tube failure included: shutting down the reactor, isolating the affected steam generator, and cooling down and depressurizing the reactor coolant system (RCS), declaration of an Alert, and staffing of the emergency response organization (ERO). There was no radioactivity measured off-site in excess of normal background levels and it was determined that the event did not impact the health and safety of the public.

Radiological Releases

The #24 SG tube leak initially resulted in a radioactive gaseous (principally noble gases) release to the turbine and condenser. The radioactive gas set off the high radiation alarm on the steam jet air ejector (SJAE) monitor (R-45) within one minute following the tube failure and automatically diverted the SJAE flow from the atmosphere to the reactor containment. As a result, any initial radioactive gaseous release from the SJAE to atmosphere was limited to the time it took for the valve to automatically divert flow to containment (i.e., about 45 seconds). The No. 24 SG was then isolated to limit any subsequent releases.

Given the potential for radioactive gaseous release from the secondary steam plant, the action was initiated following the event to account for all known and possible release pathways. The calculation assumed that the #24 auxiliary steam diversion valve (ASDV) leaked at the Class IV valve leak rate for the ten hour duration that the #24 SG pressure was elevated. This assumption was conservative and bounding for any actual leakage through this path.

Based on sampling and analysis, the radioactive gases released from the condenser were identified as radioactive noble gases (argon, krypton, and xenon). Releases from the ASDV were assumed to contain the same noble gases as well as some limited radioiodine that may have carried over in the steam. A calculation determined that a total of about 1.7 curies (Ci) of radioactive gases were released, resulting in a dose at the site boundary of about 0.01 mrem to the whole body and 0.04 mrem to the thyroid. Most of this activity, approximately 1.5 curies, was attributed to the planned containment venting operation on February 17, 2000, that was necessary in order to open the containment for examination of the steam generators. This venting activity was performed in accordance with station procedures, and constituted a planned, controlled, and monitored radiological effluent release.

Radioactive liquids generated from this occurrence were drained into the liquid radioactive waste processing system to be treated, (i.e. filtered, demineralized, and sampled prior to release) in accordance with the IP2 Radiological Effluent Technical Specifications. On February 21, and 22, a small amount of liquid activity that had been introduced into the SG blowdown system piping during the event was unexpectedly released to the discharge canal during a planned discharge of the contents of a groundwater collection tank. The release was diluted in the discharge canal prior to release into the Hudson River. The total radioactive liquid released was estimated to be .0138 curies, resulting in an estimated whole body exposure to the public of 0.001 mrem.

Environmental Radiation Measurements

Evidence of significant noble gas releases may be detectable but are dependent on several factors including, the amount of radioactivity involved, the radiation and decay characteristics of the isotopes, the duration of the release, and meteorological conditions. Meteorological data during the first four hours of the event indicated that winds were light and variable (2-4 mph). A non-specific wind direction prompted a review of all direct radiation measurement locations in the vicinity of Indian Point Station. To support the Radiological Environmental Monitoring Program, there are several fixed radiation monitoring stations established in the environment surrounding the Indian Point plants. There are 32 thermoluminescent dosimeters (TLDs) surrounding the plant close to the site boundary and another 32 TLDs surrounding the plant at approximately 5 miles. There are 18 additional TLDs at various other locations.

After the event, the environmental TLDs were changed and read with the following results:

	Range	Average
Inner ring TLDs	0.0051 - 0.010 mrem/hr	0.0064 mrem/hr
Outer ring TLDs	0.0051 - 0.0083 mrem/hr	0.0065 mrem/hr

Background comparison from 1998 Radiological Environmental Operating Report:

		Range	Average
1998	Inner ring TLDs	0.0056 -.011 mrem/hr	0.0066 mrem/hr
1998	Outer ring TLDs	0.0060 -.010 mrem/hr	0.0068 mrem/hr

Based on the above comparison, the environmental TLDs read after the event did not show any radiation exposure distinguishable from naturally occurring background.

Three soil samples were taken during the event between 0.25 and 2 miles North of Indian Point and 3 soil samples 1 mile South of the plant. The NRC and the State of New York also took 8 soil samples at various locations around the plant. No radioactivity, greater than historical levels of naturally occurring and anthropogenic sources, was detected in any of the soil samples. IP2 obtained air samples from the nine continuously operating environmental air-sampling stations that circle the plant between 0.4 - 6.4 miles. Analysis of these particulate and iodine air samples did not show any measurable radioactivity.

The NRC conducted independent onsite and offsite surveys, collected independent offsite soil samples, and reviewed IP2 data from offsite TLDs, offsite radiation monitors, and air and soil measurements. The NRC reviewed the IP2's radiological response to the event and determined that the IP2's radiological response and environmental monitoring of the event were adequate and met regulatory expectations and requirements. Based on the environmental monitoring data reviewed (including the results of radiation surveys conducted by IP2 and Westchester County survey teams during the occurrence on February 15-16), the NRC concluded that any radiological release which occurred was not distinguishable from naturally occurring background radiation, and confirmed that the IP2's radiological release and dose assessment was reasonable.

<u>Indian Point Steam Generator Tube Failure Calculated Releases</u>

<u>NRC Assessment</u>

The NRC reviewed the IP2's chemistry sample analyses, radiation monitoring data, and meteorological information, pertinent to radiological release and public dose assessment associated with the steam generator tube failure event. Additionally, the NRC performed independent radiological surveys on- and offsite, and collected soil samples offsite to confirm the absence of any trace or residual activity. The NRC reviewed the assumptions that were used by the IP2, and performed an independent computation to verify and validate the reasonableness of the IP2's dose assessment. This effort confirmed that the IP2's assumptions were conservative and that the dose assessment was an upper bound of the release due to this event.

Public Dose Assessment

In 40 CFR Part 190, the Environmental Protection Agency (EPA) established public dose limits resulting from the uranium fuel cycle as: 25 mrem per year to the whole body, 75 mrem per year to the thyroid, and 25 mrem to any other organ. In the Indian Point Unit 2 Radiological Effluent Technical Specifications, more stringent criteria are specified for gaseous and liquid effluents: 3 mrem to the whole body, and 10 mrem to any organ from radioactive liquid effluents in a year; and 10 mrem to the whole body, and 15 mrem to any organ from radioactive gaseous effluents in a year.

The exposure calculations resulting from the event were compared to the EPA and operating license limits as tabulated below.

	Whole Body (WB)	Thyroid	% of Tech Specs
Gaseous	0.0104 mrem	0.0425 mrem	0.104% WB; 0.28% Organ
Liquids	0.00092 mrem	0.0015 mrem	0.031% WB; 0.015% Organ
Total	0.0113 mrem	0.0440 mrem	
% of EPA	0.045 %	0.059 %	

Based on the above comparison, the conservatively calculated public exposures due to the event were a very small fraction of regulatory limits, and would be generally indistinguishable from naturally occurring background radiation. (Note: National Council on Radiation Protection and Measurements and the Environment Protection Agency report naturally occurring background to be between 300 and 400 millirem per year, depending on location.)

NRC Regulatory Guides[1] describe the computational method that NRC regards as an acceptable approach to estimate or project radiation dose to the public due to radiological releases to the atmosphere. The approach is dependent on several

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[1]1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents," for the Purpose of Evaluating Compliance with 10 CFR 50, Appendix I, and 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors."

variables, including atmospheric conditions, radiological characteristics of the gases, applicable atmospheric dispersion and radiological dose factors, wind speed and direction, atmospheric stability, and release elevation, concentration, rate, and duration. Consequently, estimates of radioactivity released versus dose consequence are highly dependent on the data and assumptions used, and vary accordingly. Notwithstanding, independent analysis, using a NRC computer code, based on these Regulatory Guides (PC-DOSE), conservative assumptions and actual radiological measurements confirmed that the total quantity of radioactive gases released as a result of the steam generator tube leak event did not result in any dose consequence distinguishable from naturally occurring background.

APPENDIX F

ADDENDA

APPENDIX F

The purpose of this section is to forward an inadvertently omitted table from the Indian Point Site Annual Radiological Environmental Operating Report (REOR) for year 1999. Indian Point Technical Specifications and Radiological Effluent Controls require, in part, that the results of analyses of all radiological environmental samples and of all environmental radiation measurements taken during the period pursuant to the locations specified in the table and figures in the ODCM be included in the Annual REOR.

Table xB-13, Concentrations of Gamma Emitters in Shoreline Soil Samples - 1999, was not included in the 1999 Annual REOR. As per Indian Point Technical Specifications, Radiological Effluent Controls and direct communication with NRC, these data are provided in the 2000 Annual REOR to correct the 1999 report.

TABLE xB-13

CONCENTRATION OF GAMMA EMITTERS IN SHORELINE SOIL SAMPLES-1999

Results in Units of pCi/Kg (dry) ± 1 sigma

#17 VERPLANK

Collection Date	Co-60	Cs-134	Cs-137	Ra-226*	Ac/Th-228*	Others
06/17/99	<24.35	<21.52	236.43±11.03	1318.67±177.5	695.37±38.66	ND
09/24/99	<22.63	<20.64	224.63±13.26	1304.33±248.25	590.63±41.84	ND

#28 LENTS COVE

Collection Date	Co-60	Cs-134	Cs-137	Ra-226*	Ac/Th-228*	Others
06/18/99	<35.86	<30.82	<43.88	4495.67±287.91	2343.33±94.49	ND
09/24/99	<35.93	45.82±13.3	140.33±12.07	2201±221.61	826.07±49.78	ND

#50 MANITOU INLET**

Collection Date	Co-60	Cs-134	Cs-137	Ra-226*	Ac/Th-228*	Others
06/18/99	<38.27	<43.49	378.1±23.51	2774.67±301.5	1224±89.68	ND
10/01/99	<60.38	<42.12	97.74±20.64	2407.33±453.69	1030.4±105.29	ND

#53 WHITE BEACH

Collection Date	Co-60	Cs-134	Cs-137	Ra-226*	Ac/Th-228*	Others
06/18/99	<19.35	<10.12	<15.15	939.9±194.9	221.2±50.54	ND
09/24/99	<10.1	<12.03	<12	710.7±183.4	152.5±28.62	ND

#84 COLD SPRING**

Collection Date	Co-60	Cs-134	Cs-137	Ra-226*	Ac/Th-228*	Others
06/18/99	<42.56	<26.73	<36.45	2296±409.1	884±107.6	ND
10/01/99	<29.87	<25.65	<29.04	113±373.5	358±80.7	ND

* Indicates naturally occurring
** Indicates control location