Exelon Generation®

Technical Specifications

NMP1L3340
May 15, 2020

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

Nine Mile Point Nuclear Station, Units 1 and 2
Renewed Facility Operating License Nos. DPR-63 and NPF-69
Docket Nos. 50-220 and 50-410

Subject: 2019 Annual Radiological Environmental Operating Report

In accordance with the Technical Specifications for Nine Mile Point Nuclear Station, Units 1 and 2, attached is the 2019 Annual Radiological Environmental Operating Report for the period of January 1, 2019 through December 31, 2019.

This submittal does not contain any regulatory commitments.

Should you have questions regarding the information in this submittal, please contact Mark Greer, Site Chemistry & Radwaste Manager, at (315) 349-5226.

Sincerely,

Todd A. Tierney
Plant Manager, Nine Mile Point Nuclear Station
Exelon Generation Company, LLC

TAT/KES

Enclosure: Nine Mile Point Nuclear Station, LLC
2019 Annual Radiological Environmental Operating Report

cc: NRC Regional Administrator, Region I
NRC Project Manager
NRC Resident Inspector
R. Rolph, NRC
T. Rice, NYSDEC
C. Costello, NYSDOH
T. Bennett, Oswego County Emergency Management

IE25

Enclosure

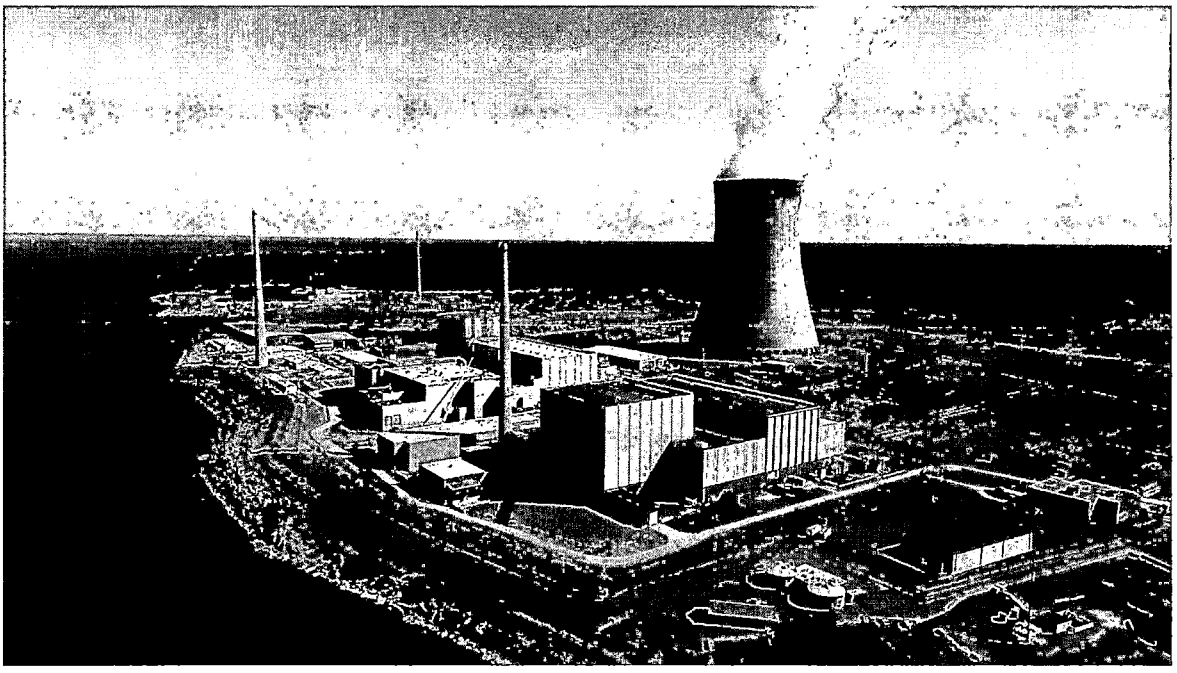
Nine Mile Point Nuclear Station, LLC

2019 Annual Radiological Environmental Operating Report

JAMES A. FITZPATRICK NUCLEAR POWER PLANT

AND

NINE MILE POINT NUCLEAR STATION



2019 ANNUAL

RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

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ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

January 1, 2019 - December 31, 2019

for

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
Facility Operating License No. DPR-59, Docket No. 50-333

NINE MILE POINT NUCLEAR STATION UNIT 1
Facility Operating License No. DPR-63, Docket No. 50-220

NINE MILE POINT NUCLEAR STATION UNIT 2
Facility Operating License No. NPF-69, Docket No. 50-410

Exelon Generation Company, LLC

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1.0 PURPOSE

The Annual Radiological Environmental Operating Report is published in accordance with the James A. FitzPatrick Nuclear Power Plant (JAFNPP) Offsite Dose Calculation Manual (ODCM), Part I, Section 6.1., Section 6.6.2 Nine Mile Point 1 (NMP1) Technical Specifications and Section 5.6.2 of the Nine Mile Point Unit 2 (NMP2) Technical Specifications. The ODCM requires that the results from the annual Radiological Environmental Monitoring Program (REMP) be provided to the Nuclear Regulatory Commission by May 15th of each year.

This report describes the Radiological Environmental Monitoring Program (REMP), the implementation of the program, and the results obtained as required by the ODCM. The report also contains the analytical results tables, data evaluation, dose assessment, and data trends for each environmental sample media. Also included are results of the land use census, historical data, and the Environmental Laboratory's performance in the Quality Assurance Interlaboratory Comparison Program.

The REMP is a comprehensive surveillance program, which is implemented to assess the impact of site operations on the environment and compliance with 10 CFR 20, 40 CFR 190 and 10 CFR 72. Samples are collected from the aquatic and terrestrial pathways applicable to the site. The aquatic pathways include Lake Ontario fish, surface water and lakeshore sediment. The terrestrial pathways include airborne particulate and radioiodine, milk, food products and direct radiation.

During 2019 there were 2,190 analyses performed on environmental media collected as part of the REMP. These results demonstrated that there is no significant or measurable radiological impact from the operation of the James A. FitzPatrick Nuclear Power Plant, Nine Mile Point Nuclear Unit 1 or Nine Mile Point Nuclear Unit 2. The 2019 results for all pathways sampled are consistent with the previous five-year historical results and exhibited no adverse trends.

In summary, the analytical results from the 2019 Radiological Environmental Monitoring Program demonstrate that the routine operation at James A. FitzPatrick, Nine Mile Point 1 and Nine Mile Point 2 had no significant or measurable radiological impact on the environment. The program continues to demonstrate that the dose to a member of the public, as a result of the operation of all sites, remains significantly below the federally required dose limits specified in 10 CFR 20, 40 CFR 190 and 10 CFR 72.

2.0 INTRODUCTION

The James A. FitzPatrick Nuclear Power Plant, owned by Exelon FitzPatrick, LLC, and Nine Mile Point Unit 1 and Nine Mile Point Unit 2, owned by Nine Mile Point Nuclear Station, LLC are operated by the Nuclear Regulatory Commission (NRC) licensee, Exelon Generation Company, LLC. This report is submitted in accordance with James A. FitzPatrick Nuclear Power Plant's Offsite Dose Calculation Manual, Part 1, Section 6.1 to License DPR-59 Docket No. 50-333, Appendix A (Technical Specifications) Section 6.6.2 to License DPR-63, Docket No. 50-220 for Nine Mile Point Nuclear Station Unit 1, and Appendix A (Technical Specifications) Section 5.6.2 to License NPF-69, Docket No. 50-410 for Nine Nile Point Nuclear Station, Unit 2. This report covers the calendar year 2019.

James A. FitzPatrick Nuclear Power Plant (JAFNPP), Nine Mile Point Unit 1 (NMP1) and Nine Mile Point Unit 2 (NMP2) Radiological Environmental Monitoring Program (REMP) requirements reside within each unit's Offsite Dose Calculation Manual (ODCM). Throughout this report, references will be made to the ODCM. This refers to each unit's ODCM.

2.1 PROGRAM HISTORY

Environmental monitoring at the Nine Mile Point site has been ongoing since 1964. The program includes five years of pre-operational data, which was conducted prior to any reactor operations. In 1968, the Niagara Mohawk Power Company began the required pre-operational environmental site testing program. This pre-operational data serves as a reference point to compare later data obtained during reactor operation. In 1969, the Nine Mile Point Unit 1 reactor, a 628 megawatt electric (MWe) Boiling Water Reactor (BWR) began full power operation. In 1975, the James A. FitzPatrick Nuclear Power Plant, owned and operated at that time by the New York Power Authority, began full power operation. The FitzPatrick plant, an 892 MWe (rated) BWR, occupies the east sector of the Nine Mile Point site, approximately 0.57 miles east of Nine Mile Point Unit 1. In 1988, the Nine Mile Point Unit 2 reactor also owned and operated by Nine Mile Point Nuclear Station, LLC, began full power operation. This 1363 MWe BWR is located between the Nine Mile Point Unit 1 and FitzPatrick sites.

In 1985, the individual Plant Effluent Technical Specifications were standardized to the generic Radiological Effluent Technical Specifications, much of which was common to the two reactors, and subsequently Nine Mile Point Unit 2. Subsequent Technical Specification amendments relocated the REMP requirements to the ODCM for all three plants. Data generated by the Radiological Environmental Monitoring Program (REMP) is shared between each unit. On November 21, 2000 the ownership and operation of the James A. FitzPatrick Nuclear Power Plant was transferred from the New York Power Authority to Entergy Nuclear FitzPatrick, LLC and Entergy Nuclear Operations, Inc. The Facility Operating License No. DPR-59 and Docket No. 50-333 remained the same and in March 2017, ownership and operation of the James A. FitzPatrick Nuclear Power Plant was transferred to Exelon Generation Company, LLC. On November 7, 2001, the ownership of the Nine Mile Point Unit 1 and 2 facilities was transferred to Constellation Energy Nuclear Group (CENG). Nine Mile Point Nuclear Station, LLC, operates the two facilities. In March 2012

Constellation Energy merged with Exelon Generation and prior to March 25, 2014, Exelon Generation was an intermediate 50.01 percent parent company of CENG, which is the parent company owner of Nine Mile Point Nuclear Station, LLC. Following the transfer, Exelon Generation remains an intermediate parent company and became the co-licensee of Nine Mile Point Nuclear Station, LLC and the operator of NMP1 and NMP2. Exelon Generation Company, LLC took over ownership and operation of the Nine Mile Point Unit 1 and 2 facilities in 2014.

In summary, three Boiling Water Reactors, which together generate 2883 MWe, have operated collectively at the Nine Mile Point site since 1988. A large database of environmental results from the exposure pathways have been collected and analyzed to evaluate the potential impact from reactor operations.

2.2 SITE DESCRIPTION

The Nine Mile Point (NMP) site is located on the southeast shore of Lake Ontario in the town of Scriba, approximately 6.2 miles northeast of the city of Oswego. The nearest metropolitan area is located approximately 36 miles southeast of the site. The reactors and support buildings occupy a small shoreline portion of the 1600-acre site. The land, soil of glacier deposits, rises gently from the lake in all directions. Oswego County is a rural environment, with about 15% of the land devoted to agriculture.

2.3 PROGRAM OBJECTIVES

The objectives of the Radiological Environmental Monitoring Program (REMP) are to:

1. Measure and evaluate the effects of plant operation on the environs and to verify the effectiveness of the controls on radioactive material sources.

2. Monitor natural radiation levels in the environs of the NMP nuclear site.

3. Demonstrate compliance with the requirements of applicable federal regulatory agencies, site Technical Specifications and Offsite Dose Calculation Manual.

3.0 PROGRAM DESCRIPTION

To achieve the objectives listed in Section 2.3, an extensive sampling and analysis program is conducted every year. The James A. FitzPatrick Nuclear Power Plant (JAFNPP), Nine Mile Point Unit 1 and Nine Mile Point Unit 2 Radiological Environmental Monitoring Program (REMP) consists of sampling and analysis of various media that include:

- Air
- Fish
- Food Products
- Milk
- Shoreline Sediment
- Surface Waters

In addition, direct radiation measurements are performed using thermoluminescent dosimeters (TLDs). These sampling programs are outlined in Table 3.0-1, Table 3.0-2, and Table 3.0-3. The JAFNPP and Nine Mile Point Nuclear Station (NMPNS) REMP sampling locations are selected and verified by an annual Land Use Census. The accuracy and precision of the program is assured by participation in an Interlaboratory Comparison Quality Assurance Program (ICQAP). In addition to NMPNS's participation in the ICQAP, sample splits are provided to the New York State Department of Health for cross-checking purposes.

Sample collections for the radiological program are accomplished via a coordinated effort between site Chemistry and site Environmental. The site staff is assisted by a contracted environmental company, EA Science and Technology, Inc. (EA).

TABLE 3.0-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

REQUIRED SAMPLE COLLECTION AND ANALYSIS

James A. FitzPatrick Nuclear Power Plant

Exposure Pathway and/or Sample	Number of Samples and Sample Locations [a]	Sampling and Collection Frequency [a]	Type of Analysis and Frequency
AIRBORNE			
Radioiodine and Particulates	Samples from 5 locations: a. 3 Samples from offsite locations in different sectors of the highest calculated site average D/Q (based on all licensed site reactors) b. 1 sample from the vicinity of a community having the highest calculated site average D/Q (based on all licensed site reactors) c. 1 sample from a control location 9 to 20 miles distant and in the least prevalent wind direction[d]	Continuous sample operation with sample collection weekly or as required by dust loading, whichever is more frequent	Radioiodine Canisters: Analyze weekly for I-131 Particulate Samples: Gross beta radioactivity following filter change [b], composite (by location) for gamma isotopic[c] quarterly (as a minimum)
DIRECT RADIATION[e]	32 stations with two or more dosimeters placed as follows: a. An inner ring of stations in the general area of the Site Boundary b. An outer ring in the 4 to 5 mile range from the site with a station in each of the land based sectors. There are 16 land based sectors in the inner ring, and 8 land based sectors in the outer ring c. The balance of the stations (8) are placed in special interest areas such as population centers, nearby residences, schools, and in 2 or 3 areas to serve as control stations	Quarterly	Gamma dose monthly or quarterly

TABLE 3.0-1 (continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

REQUIRED SAMPLE COLLECTION AND ANALYSIS

James A. FitzPatrick Nuclear Power Plant

Exposure Pathway and/or Sample	Number of Samples and Sample Locations [a]	Sampling and Collection Frequency [a]	Type of Analysis and Frequency
INGESTION			
Milk	a. Samples from milch animals in 2 locations within 3.5 miles distant having the highest calculated site average D/Q. If there are none, then 1 sample from milch animals in each of the 3 areas 3.5 to 5.0 miles distant having the highest calculated site average D/Q (based on all licensed site reactors)[h]	Twice per month, April through December (samples will be collected in January through March if I-131 is detected in November and December of the preceding year)	Gamma isotopic and I-131 analysis twice per month when milch animals are on pasture (April through December); monthly (January through March), if required[c]
	b. 1 sample from milch animals at a control location (9 to 20 miles distant and in a less prevalent wind direction)[d]		
Fish	a. 1 sample of 2 commercially or recreationally important species in the vicinity of a site discharge point	Twice per year	Gamma isotopic[c] analysis of edible portions.
	b. 1 sample of 2 species (same as in a. above or of a species with similar feeding habits) from an area at least 5 miles distant from the site[d]		
Food Products	a. In lieu of the garden census as specified in Part 1, Section 5.2, samples of at least 3 different kinds of broad leaf vegetation (such as vegetables) grown nearest each of two different offsite locations of highest predicted site average D/Q (based on all licensed site Reactors)	Once during harvest	Gamma isotopic[c] analysis of edible portions. (Isotopic to Include I-131)
	b. One (1) sample of each of the similar broad leaf vegetation grown at least 9.3 miles distant in a least prevalent wind direction sector [d]		

TABLE 3.0-1 (continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

REQUIRED SAMPLE COLLECTION AND ANALYSIS

James A. FitzPatrick Nuclear Power Plant

Exposure Pathway and/or Sample	Number of Samples and Sample Locations [a]	Sampling and Collection Frequency [a]	Type of Analysis and Frequency
WATERBORNE			
Surface[f]	a. 1 sample upstream[d] b. 1 sample from the site's most downstream cooling water intake	Composite sample over a one month period[g]	Gamma isotopic analysis monthly. Composite for Tritium analysis quarterly[c]
Sediment from Shoreline	1 sample from a downstream area with existing or potential recreational value	Twice per year	Gamma isotopic analysis semi-annually[c]

NOTES FOR TABLE 3.0-1

(a) It is recognized that, at times, it may not be possible or practical to obtain samples of the media of choice at the most desired location or time. In these instances suitable alternative media and locations may be chosen for the particular pathway in question. Actual locations (distance and directions) from the site shall be provided in the Annual Radiological Environmental Operating Report. Calculated site averaged D/Q values and meteorological parameters are based on historical data (specified in the ODCM) for all licensed site reactors.

(b) Particulate sample filters should be analyzed for gross beta 24 hours or more after sampling to allow for radon and thoron daughter decay. If gross beta activity in air particulate samples is greater than 10 times a historical yearly mean of control samples, gamma isotopic analysis shall be performed on the individual samples.

(c) Gamma isotopic analysis means the identification and quantification of gamma emitting radionuclides that may be attributable to the effluents from the plant.

(d) The purpose of these samples is to obtain background information. If it is not practical to establish control locations in accordance with the distance and wind direction criteria, other sites which provide valid background data may be substituted.

(e) One or more instruments, such as a pressurized ion chamber, for measuring and recording dose rate continuously may be used in place of, or in addition to, integrating dosimeters. For the purpose of this table, a thermoluminescent dosimeter may be considered to be one phosphor and two or more phosphors in a packet may be considered as two or more dosimeters. Film badges shall not be used for measuring direct radiation.

(f) The "upstream sample" shall be taken at a distance beyond significant influence of the discharge. The "downstream sample" shall be taken in an area beyond, but near, the mixing zone, if practical.

(g) Composite samples should be collected with equipment (or equivalent) which is capable of collecting an aliquot at time intervals which are very short (e.g., hourly) relative to the compositing period (e.g., monthly) in order to ensure that a representative sample is obtained.

(h) A milk sampling location, as required in Table 5.1-1 of the ODCM, is defined as a location having at least 10 milking cows present at a designated milk sample location. It has been found from past experience, and as a result of conferring with local farmers, that a minimum of 10 milking cows is necessary to guarantee an adequate supply of milk twice per month for analytical purposes. Locations with less than 10 milking cows are usually utilized for breeding purposes which eliminates a stable supply of milk for samples as a result of suckling calves and periods when the adult animals are dry. In the event that 3 milk sample locations cannot meet the requirement for 10 milking cows, then a sample location having less than 10 milking cows can be used if an adequate supply of milk can reasonably and reliably be obtained based on communications with the farmer.

TABLE 3.0-2

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

REQUIRED SAMPLE COLLECTION AND ANALYSIS

Nine Mile Point Unit 1

Exposure Pathway and/or Sample	Number of Samples and Sample Locations [a]	Sampling and Collection Frequency [a]	Type of Analysis and Frequency
AIRBORNE			
Radioiodine and Particulates	Samples from 5 locations: 1) 3 samples from offsite locations in different sectors of the highest calculated site average D/Q (based on all site licensed reactors). 2) 1 sample from the vicinity of an established year round community having the highest calculated site average D/Q (based on all site licensed reactors). 3) 1 sample from a control location 10-17 miles distant and in a least prevalent wind direction [d].	Continuous sampler operation with sample collection weekly or as required by dust loading, whichever is more frequent.	Radioiodine Canisters Analyze once per week for I-131. Particulate Samplers Gross beta radioactivity following filter change [b]. Composite (by location) for gamma isotopic analysis [c] once per 3 months (as a minimum).
Direct Radiation [e]	32 stations with two or more dosimeters to be placed as follows: an inner ring of stations in the general area of the site boundary and an outer ring in the 4 to 5 mile range from the site with a station in each land based sector [*]. The balance of the stations should be placed in special interest areas such as population centers, nearby residences, schools and in 2 or 3 areas to serve as control stations.	Once per 3 months.	Gamma dose once per 3 months.

[*] At this distance, 8 wind rose sectors, (W, WNW, NW, NNW, N, NNE, NE, and ENE) are over Lake Ontario.

TABLE 3.0-2 (continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

REQUIRED SAMPLE COLLECTION AND ANALYSIS

Nine Mile Point Unit 1

Exposure Pathway and/or Sample	Number of Samples and Sample Locations [a]	Sampling and Collection Frequency [a]	Type of Analysis and Frequency
WATERBORNE			
Surface [f]	1) 1 sample upstream. 2) 1 sample from the site's downstream cooling water intake.	Composite sample over 1 month period [g].	Gamma isotopic analysis [c] once per month. Composite for once per 3 months tritium analysis.
Sediment from Shoreline	One sample from a downstream area with existing or potential recreational value.	Twice per year.	Gamma isotopic analysis[c].
INGESTION			
a. Milk	1) Samples from milk sampling locations in three locations within 3.5 miles distance having the highest calculated site average D/Q. If there are none, then one sample from milking animals in each of 3 areas 3.5 – 5.0 miles distant having the highest calculated site average D/Q (based on all site licensed reactors). 2) One sample from a milk sampling location at a control location (9-20 miles distant and in a least prevalent wind direction) [d].	Twice per month, April – December (samples will be collected in January – March if I-131 is detected in November and December of the preceding year).	Gamma isotopic [c] and I-131 analysis twice per month when animals are on pasture (April – December); once per month at other times (January – March) if required.

TABLE 3.0-2 (continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

REQUIRED SAMPLE COLLECTION AND ANALYSIS

Nine Mile Point Unit 1

Exposure Pathway and/or Sample	Number of Samples and Sample Locations [a]	Sampling and Collection Frequency [a]	Type of Analysis and Frequency
b. Fish	1) One sample each of two commercially or recreationally important species in the vicinity of a plant discharge area [h].	Twice per year.	Gamma isotopic analysis [c] on edible portions twice per year.
	2) One sample each of the same species from an area at least 5 miles distant from the site [d].		
c. Food Products	1) Samples of three different kinds of broad leaf vegetation (such as vegetables) grown nearest to each of two different off-site locations of highest calculated site average D/Q (based on all licensed site reactors).	Once per year during harvest season.	Gamma isotopic [c] analysis of edible portions (Isotopic to include I-131 or a separate I-131 analysis may be performed) once during the harvest season.
	2) One sample of each of the similar broad leaf vegetation grown at least 9.3 – 20 miles distant in a least prevalent wind direction.		

NOTES FOR TABLE 3.0-2

(a) It is recognized that, at times, it may not be possible or practical to obtain samples of the media of choice at the most desired location or time. In these instances, suitable alternative media and locations may be chosen for the particular pathway in question and may be substituted. Actual locations (distance and directions) from the site shall be provided in the Annual Radiological Environmental Operating Report. Highest D/Q locations are based on historical meteorological data for all site licensed reactors.

(b) Particulate sample filters should be analyzed for gross beta 24 hours or more after sampling to allow for radon and thoron daughter decay. If the gross beta activity in air is greater than 10 times a historical yearly mean of control samples, gamma isotopic analysis shall be performed on the individual samples.

(c) Gamma isotopic analysis means the identification and quantification of gamma-emitting radionuclides that may be attributable to the effluents from the facility.

(d) The purpose of these samples is to obtain background information. If it is not practical to establish control locations in accordance with the distance and wind direction criteria, other sites, such as historical control locations which provide valid background data may be substituted.

(e) One or more instruments, such as a pressurized ion chamber, for measuring and recording dose rate continuously, may be used in place of, or in addition to, integrating dosimeters. For the purpose of this table, a thermoluminescent dosimeter may be considered to be one phosphor, and two or more phosphors in a packet may be considered as two or more dosimeters. Film badges shall not be used for measuring direct radiation.

(f) The "upstream sample" should be taken at a distance beyond significant influence of the discharge. The "downstream sample" should be taken in an area beyond but near the mixing zone, if possible.

(g) Composite samples should be collected with equipment (or equivalent) which is capable of collecting an aliquot at time intervals which are very short (e.g. hourly) relative to the compositing period (e.g. monthly) in order to assure obtaining a representative sample.

(h) In the event commercial or recreational important species are not available as a result of three attempts, then other species may be utilized as available.

TABLE 3.0-3

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

REQUIRED SAMPLE COLLECTION AND ANALYSIS

Nine Mile Point Unit 2

Exposure Pathway and/or Sample	Number of Samples and Sample Locations [a]	Sampling and Collection Frequency [a]	Type of Analysis and Frequency
a. Direct Radiation	32 routine monitoring stations [b], placed as follows: 1) An inner ring of stations, one in each meteorological sector in the general area of the Site Boundary. 2) An outer ring of stations, one in each land base meteorological sector in the 4 to 5 mile [c] range from the site. 3) The balance of the stations should be placed in special interest areas such as population centers, nearby residences, schools, and in one of two areas to serve as control stations [d].	Once per 3 months	Gamma dose: once per 3 months.

TABLE 3.0-3 (continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

REQUIRED SAMPLE COLLECTION AND ANALYSIS

Nine Mile Point Unit 2

Exposure Pathway and/or Sample	Number of Samples and Sample Locations [a]	Sampling and Collection Frequency [a]	Type of Analysis and Frequency
AIRBORNE			
Radioiodine and Particulates	Samples from 5 locations: 1. 3 samples from off-site locations close to the site boundary (within one mile) in different sectors of the highest calculated annual site average ground-level D/Q (based on all site licensed reactors)[e]. 2. 1 sample from the vicinity of an established year-round community having the highest calculated annual site average ground-level D/Q (based on all site licensed reactors)[e]. 3. 1 sample from a control location at least 10 miles distant and in a least prevalent wind direction [d].	Continuous sampler operation with sample collection weekly, or more frequently if required by dust loading.	<u>Radioiodine Canister:</u> I-131 analysis weekly. <u>Particulate Sampler:</u> 1. Gross beta radioactivity analysis ≥ 24 hours following filter change[f], 2. Gamma isotopic analysis on each sample where gross beta activity is >10 times the previous yearly mean of control samples, and 3. Gamma isotopic analysis [g] of composite sample (by location) once per 3 months.
WATERBORNE			
a. Surface	1. 1 sample upstream [d] [h]. 2. 1 sample from the site's downstream cooling water intake [h].	Composite sample over 1-month period [i].	1) Gamma isotopic analysis [g] once per month 2) Tritium analysis of each composite once per 3 months.

TABLE 3.0-3 (continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

REQUIRED SAMPLE COLLECTION AND ANALYSIS

Nine Mile Point Unit 2

Exposure Pathway and/or Sample	Number of Samples and Sample Locations [a]	Sampling and Collection Frequency [a]	Type of Analysis and Frequency
b. Ground	Samples from one or two sources if likely to be affected [j].	Grab sample once per 3 months.	Gamma isotopic [g] and tritium analysis once per 3 months.
c. Drinking	One sample each of one to three of the nearest water supplies that could be affected by its discharge [k].	When I-131 analysis is performed, a composite sample over a 2-week period[i]; otherwise, a composite sample monthly.	1) I-131 analysis on each composite when the dose calculated for the consumption of the water is greater than 1 mrem per year[l]. 2) Composite for gross beta and gamma isotopic analyses [g] monthly. 3) Composite for tritium analysis once per 3 months.
d. Sediment from Shoreline	One sample from a downstream area with existing or potential recreational value.	Twice per year.	Gamma isotopic analysis[g].

TABLE 3.0-3 (continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

REQUIRED SAMPLE COLLECTION AND ANALYSIS

Nine Mile Point Unit 2

Exposure Pathway and/or Sample	Number of Samples and Sample Locations [a]	Sampling and Collection Frequency [a]	Type of Analysis and Frequency
INGESTION			
a. Milk	1. Samples from Milk Sampling Locations in 3 locations within 3.5 miles [e]. 2. If there are none, then 1 sample from Milk Sampling Locations in each of three areas 3.5 – 5.0 miles [e]. 3. 1 sample from a Milk Sample Location at a control location 9 - 20 miles distant and in a least prevalent wind direction [d].	Twice per month, April – December [m].	1) Gamma isotopic [g] and I-131 analysis twice per month when animals are on pasture (April – December); 2) Gamma isotopic [g] and I-131 analysis once per month at other times [m].
b. Fish	1. 1 sample each of two commercially or recreationally important species in the vicinity of a plant discharge area [n]. 2. 1 sample of the same species in areas not influenced by station discharge [d].	Twice per year.	Gamma isotopic analysis [g] on edible portions twice per year.

TABLE 3.0-3 (continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

REQUIRED SAMPLE COLLECTION AND ANALYSIS

Nine Mile Point Unit 2

Exposure Pathway and/or Sample	Number of Samples and Sample Locations [a]	Sampling and Collection Frequency [a]	Type of Analysis and Frequency
c. Food Products	1) 1 sample of each principal class of food products from any area that is irrigated by water in which liquid plant wastes have been discharged [o].	At time of harvest [p].	Gamma isotopic [g] and I-131 analysis of each sample of edible portions.
	2) Samples of 3 different kinds of broad leaf vegetation (such as vegetables) grown nearest to each of 2 different off-site locations of highest calculated annual site average D/Q (based on all licensed site reactors)[e].	Once per year during the harvest season.	
	3) 1 sample of each of the similar broad leaf vegetation grown at least 9.3 miles distant in a least prevalent wind direction.	Once per year during the harvest season.	

NOTES FOR TABLE 3.0-3

(a) Specific parameters of distance and direction sector from the centerline of one reactor, and additional descriptions where pertinent, shall be provided for each and every sample location in Table 3.0-3. Refer to NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants," October 1978, and to Radiological Assessment Branch Technical Position on Environmental Monitoring, Revision 1, November 1979. Deviations are permitted from the required sampling schedule if specimens are unobtainable because of such circumstances as hazardous conditions, seasonal unavailability (which includes theft and uncooperative residents), or malfunction of automatic sampling equipment.

(b) One or more instruments, such as a pressurized ion chamber, for measuring and recording dose rate continuously, may be used in place of, or in addition to, integrating dosimeters. Each of the 32 routine monitoring stations shall be equipped with 2 or more dosimeters or with 1 instrument for measuring and recording dose rate continuously. For the purpose of this table, a thermoluminescent dosimeter (TLD) is considered to be one phosphor, two or more phosphors in a packet are considered as two or more dosimeters. Film badges shall not be used as dosimeters for measuring direct radiation.

(c) At this distance, 8 wind rose sectors, (W, WNW, NW, NNW, N, NNE, NE, and ENE) are over Lake Ontario.

(d) The purpose of these samples is to obtain background information. If it is not practical to establish control locations in accordance with the distance and wind direction criteria, other sites, which provide valid background data, may be substituted.

(e) Having the highest calculated annual site average ground-level D/Q based on all site licensed reactors.

(f) Airborne particulate sample filters shall be analyzed for gross beta radioactivity 24 hours or more after sampling to allow for radon and thoron daughter decay.

(g) Gamma isotopic analysis means the identification and quantification of gamma-emitting radionuclides that may be attributable to the effluents from the facility.

(h) The "upstream" sample shall be taken at a distance beyond significant influence of the discharge. The "downstream" sample shall be taken in an area beyond but near the mixing zone.

(i) In this program, representative composite sample aliquots shall be collected at time intervals that are very short (e.g., hourly) relative to the compositing period (e.g., monthly) in order to assure obtaining a representative sample.

(j) Groundwater samples shall be taken when this source is tapped for drinking or irrigation purposes in areas where the hydraulic gradient or recharge properties are suitable for contamination.

(k) Drinking water samples shall be taken only when drinking water is a dose pathway.

(l) Analysis for I-131 may be accomplished by Ge-Li analysis, provided that the lower limit of detection (LLD) for I-131 in water samples found on Table 3.8-1 can be met. Doses shall be calculated for the maximum organ and age group.

NOTES FOR TABLE 3.0-3 (continued)

(m) Samples will be collected January through March if I-131 is detected in November and December of the preceding year.

(n) In the event two commercially or recreationally important species are not available after three attempts of collection, then two samples of one species or other species not necessarily commercially or recreationally important may be utilized.

(o) Applicable only to major irrigation projects within 9 miles of the site in the general down current direction.

(p) If harvest occurs more than once/year, sampling shall be performed during each discrete harvest. If harvest occurs continuously, sampling shall be taken monthly. Attention shall be paid to including samples of tuberous and root food products.

3.1 SAMPLE COLLECTION METHODOLOGY

3.1.1 SHORELINE SEDIMENTS

Shoreline sediment is collected at one area of existing or potential recreational value. One sample is also collected from a location beyond the influence of the site. Samples are collected as surface scrapings to a depth of approximately one inch and then are placed in plastic bags, sealed and shipped to the lab for analysis. Sediment samples are analyzed for gamma emitting radionuclides.

Shoreline sediment sample locations are listed in Section 3.3, Table 3.3-1 and shown in Figure 3.3-5.

3.1.2 FISH

Samples of available fish species that are commercially or recreationally important to Lake Ontario; such as Brown Trout, Lake Trout, Chinook Salmon and Smallmouth Bass, are collected twice per year, once in the spring and again in the fall. Indicator samples are collected from a combination of the two onsite sample transects located offshore from the site. One set of control samples are collected at an offsite sample transect located offshore 8-10 miles west of the site. Available species are selected using the following guidelines:

1. A minimum of two species that are commercially or recreationally important are to be collected from each sample location. Samples selected are limited to edible and/or sport species when available.

2. Samples are composed of the edible portion only.

Selected fish samples are frozen immediately after collection and segregated by species and location. Samples are shipped frozen in insulated containers for analysis. Edible portions of each sample are analyzed for gamma emitting radionuclides.

Fish sample locations are listed in Section 3.3, Table 3.3-1 and shown in Figure 3.3-5.

3.1.3 SURFACE WATER

Surface water samples are taken from the respective inlet canals of the JAFNPP and NRG's Oswego Steam Station. The JAFNPP facility draws water from Lake Ontario on a continuous basis. This is used for the "downstream" or indicator sampling point for the Nine Mile Point site. The Oswego Steam Station inlet canal draws water from Lake Ontario at a point approximately 7.6 miles west of the site. This "upstream" location is considered a control location because of the distance from the site, as well as the result of the lake current patterns and current patterns from the Oswego River located nearby.

Samples from the JAFNPP facility are composited from automatic sampling equipment which discharges into a compositing tank. Samples are collected monthly from the compositor and analyzed for gamma emitters. Samples from the Oswego Steam Station are also obtained using automatic sampling equipment and collected in a holding tank. Representative samples from this location are obtained weekly and are composited to form a monthly composite sample. The monthly samples are analyzed for gamma emitting radionuclides.

A portion of the monthly sample from each of the locations is saved and composited to form quarterly composite samples, which are analyzed for tritium.

In addition to the sample results for the JAFNPP and Oswego Steam Station collection sites, data is presented for the Nine Mile Point Unit 1 and Unit 2 facility inlet canal samples and from the City of Oswego drinking water supply. The latter three locations are not required by the ODCM. These locations are optional sample points, which are collected and analyzed to enhance the surface water sampling program. Monthly composite samples from these three locations are analyzed for gamma emitting nuclides, and quarterly composite samples are analyzed for tritium.

Surface water sample locations are listed in Section 3.3, Table 3.3-1 and shown in Figure 3.3-4.

3.1.4 AIR PARTICULATE / IODINE

The air sampling stations required by the ODCM are located in the general area of the site boundary. The sampling stations are sited within a distance of 0.2 miles of the site boundary in sectors with the highest calculated deposition factor (D/Q) based on historical meteorological data. These stations (R1, R2, R3, and R4) are located in the E, ESE, and SE sectors as measured from the center of the Nine Mile Point Nuclear Station Unit 2 Reactor Building. The ODCM also requires that one of the four air sampling stations be located in the vicinity of a year-round community. Station R4 fulfills this requirement and is located in the SE sector at a distance of 1.8 miles. A fifth station required by the ODCM is a control location designated as Station R5. Station R5 is located 16.2 miles from the site in the NE meteorological sector.

In addition to the five ODCM required locations, there are ten additional sampling stations. Six of these sampling stations are located within the site boundary of NMPNS and JAFNPP and are designated as Onsite Stations D1, G, H, I, J, and K. One air sampling station is located offsite in the southwest sector in the vicinity of the City of Oswego and is designated as Station G Offsite. Three remaining air sampling stations are located in the ESE, SSE, and SSW sectors and range in distance from 7.1 to 9.0 miles. These are designated as Offsite Stations D2, E, and F respectively.

Each station collects airborne particulates using glass fiber filters (47 millimeter diameter) and radioiodine using charcoal cartridges (2x1 inch). The samplers run continuously and the charcoal cartridges and particulate filters are changed on a weekly basis. Sample volume is determined by use of calibrated gas flow meters located at the sample discharge. Gross beta analysis is performed on each particulate filter. Charcoal cartridges are analyzed for radioiodine using gamma spectral analysis. The particulate filters are composited quarterly by location and analyzed for gamma emitting radionuclides.

Air sampling station locations are listed in Section 3.3, Table 3.3-1 and shown in Figures 3.3-2 and 3.3-3.

3.1.5 TLD (DIRECT RADIATION)

Thermoluminescent dosimeters (TLDs) are used to measure direct radiation (gamma dose) in the environment. Environmental TLDs are supplied and processed quarterly by Stanford Dosimetry. The vendor utilizes a Panasonic based system using UD-814 dosimeters, which contain three $CaSO_4$ phosphor elements under 1000mg of lead and one lithium borate element.

1. **Environmental TLDs**

Environmental TLDs are placed in five different geographical regions around site to evaluate effects of direct radiation as a result of plant operations. The following is a description of the five TLD geographical categories used in the NMPNS and JAFNPP Environmental Monitoring Program and the TLDs that make up each region:

TLD Geographical Category	Description
Onsite	TLDs placed at various locations within the site boundary, with three exceptions, are not required by the ODCM. (TLD locations comprising this group are: 3, 4, 5, 6, 7*, 18*, 23*, 24, 25, 26, 27, 28, 29, 30, 31, 39, 47, 103, 106 and 107)
Site Boundary	An inner ring of TLDs placed in the general area of the site boundary in each of the sixteen meteorological sectors. This category is required by the ODCM. (TLD locations comprising this group are: 7*, 18*, 23*, 75*, 76*, 77*, 78*, 79*, 80*, 81*, 82*, 83*, 84*, 85*, 86*, and 87*)
Offsite	An outer ring of TLDs placed 4 to 5 miles from the site in each of the 8 land based meteorological sectors. This category is required by the ODCM. (TLD locations comprising this group are 88*, 89*, 90*, 91*, 92*, 93*, 94*, and 95*)
Special Interest	TLDs placed in special interest areas of high population density and use. These TLDs are located at or near large industrial sites, schools, or nearby towns or communities. This category is required by the ODCM. (TLD locations comprising this group are: 9, 10, 11, 12, 13, 15*, 19, 51, 52, 53, 54, 55, 56*, 58*, 96*, 97*, 98*, 99, 100, 101, 102, 108, and 109)
Control	TLDs placed in areas beyond significant influence of the site and plant operations. These TLDs are located to the SW, S and NE of the site at distances of 12.6 to 24.7 miles. This category is also required by the ODCM. (TLD locations comprising this group are 8*, 14*, 49*, 111, 113)

* TLD location required by the ODCM, TLD 98 required by NMP1 and NMP2 ODCM

Although the ODCM requires a total of 32 TLD stations; environmental TLDs are also placed at additional locations not required by the ODCM, within the Onsite, Special Interest and Control TLD categories to supplement the ODCM required Direct Radiation readings.

Two dosimeters are placed at each TLD monitoring location. The TLDs are sealed in polyethylene packages to ensure dosimeter integrity and placed in open webbed plastic holders and attached to supporting structures, such as utility poles.

Environmental TLD locations are listed in Section 3.3, Table 3.3-1 and show in Figures 3.3-2 and 3.3-3.

2. **JAFNPP Independent Spent Fuel Storage Installation (ISFSI)**

In order to provide adequate spent fuel storage capacity at JAFNPP, Entergy constructed an onsite Independent Spent Fuel Storage Installation (ISFSI). On April 25, 2002, the ISFSI facility was placed in service.

TLDs are used to monitor direct radiation levels in the vicinity of the ISFSI facility. Twelve (12) TLD locations were established around the ISFSI pad on the perimeter fence. Six (6) additional TLD locations are located at varying distances from the pad to determine dose rates at points of interest relative to the storage area and are designated as optional locations. Background data was collected starting in October, 2000 at eight of the TLD locations on the perimeter fence. The remaining locations were established in October 2001.

Two dosimeters are placed at each TLD monitoring location. The TLDs are sealed in polyethylene packages to ensure dosimeter integrity and placed in the field using a supporting structure such as a fence or other immovable object.

ISFSI TLD locations are listed in Section 3.3, Table 3.3-1.

3. **NMPNS Independent Spent Fuel Storage Installation (ISFSI)**

In order to provide adequate spent fuel storage capacity at NMP1 and NMP2, NMPNS constructed an ISFSI onsite west of NMP1. During 2012 the NMPNS ISFSI facility was placed into service.

TLDs are used to monitor direct radiation levels in the vicinity of the ISFSI facility. Sixteen (16) TLD locations were established around the site boundary. Background data has been collected from the initiation of the NMPNS REMP TLD program in 1985.

In addition, fourteen (14) Optically Stimulated Luminescence Dosimeters (OSDLs) are located around the ISFSI and in areas where personnel are assigned routine work activities.

These locations are designated as optional locations. Background data was collected starting in June 2011.

ISFSI OSLD and REMP TLD locations are listed in Section 3.3, Table 3.3-1 and REMP TLDs are shown in Figures 3.3-2 & 3.3-3.

3.1.6 MILK

Milk samples are routinely collected from farms during the sampling year. These farms include one indicator location and one control location. Samples are normally collected April through December of the sample year. If plant related radionuclides are detected in samples in November and December of the previous year, milk collections are continued into the following year starting in January. If radionuclides are not detected in the November and December samples, then milk collections do not commence until April of the following sampling year. Milk samples were not collected in January through March of 2019 as there were no positive detections of radionuclides in samples collected during November and December of 2018.

The ODCM also requires that a sample be collected from a control location nine to twenty miles from the site and in a less prevalent wind direction. This location is in the south sector at a distance of 16 miles and serves as the control location.

Milk samples are collected in polyethylene bottles from a bulk storage tank at each sampled farm. Before the sample is drawn, the tank contents are agitated to assure a homogenous mixture of milk and butter fat. The samples are chilled, preserved, and shipped fresh to the analytical laboratory within thirty-six hours of collection in insulated shipping containers.

The milk sample locations are listed in Section 3.3, Table 3.3-1 and shown on Figure 3.3-4.

3.1.7 FOOD PRODUCTS (VEGETATION)

Food products are collected once per year during the late summer harvest season. A minimum of three different kinds of broad leaf vegetation (edible or inedible) are collected from three different indicator garden locations. Sample locations are selected from available gardens identified in the annual census that have the highest estimated deposition values (D/Q) based on historical site meteorological data. Control samples are also collected from available locations greater than 9.3 miles distance from the site in a less prevalent wind direction. Control samples are of the same or similar type of vegetation when available.

Food product samples are analyzed for gamma emitters using gamma isotopic analysis.

Food product locations are listed in Section 3.3, Table 3.3-1 and shown on Figure 3.3-5.

3.1.8 GROUNDWATER MONITORING PROGRAM

The Nuclear Energy Institute (NEI) Ground Water Protection Initiative was established to determine the potential impact Nuclear Power Plants may have on the surrounding environment due to unplanned releases of radioactive liquids. Under NEI 07-07, Industry Ground Water Protection Initiative Final Guidance Document, August 2007, ground water monitoring is accomplished through sampling of the water table around the plant and analyzing it for gamma emitters and tritium.

In addition to the groundwater monitoring requirements specified in the ODCM, NMPNS started monitoring groundwater in October 2005 and has been monitoring the plant dewatering systems as part of the response to Generic Letter 80-10 for several years.

JAFNPP has twenty-two groundwater wells. Groundwater Monitoring well samples collected in 2019 were analyzed annually for plant related gamma emitters, gross alpha and strontium, and quarterly for tritium.

NMPNS has nineteen groundwater wells and nine piezometers. NMPNS Groundwater Monitoring wells are analyzed annually for plant related gamma emitters, gross alpha, gross beta and strontium, and quarterly for tritium.

Ground water results are documented in the Annual Radiological Effluent Release Report.

Historical groundwater data is presented in Section 7, Historical Data Tables.

3.2 ANALYSES PERFORMED

Environmental sample analyses are performed by a contract laboratory. The following analyses were performed:

1. Air Particulate Filter – Gross Beta
2. Air Particulate Filter Composites – Gamma Spectral Analysis
3. Airborne Radioiodine – Gamma Spectral Analysis
4. Direct Radiation using Thermoluminescent Dosimeters (TLDs)
5. Fish – Gamma Spectral Analysis
6. Food Products (vegetation) – Gamma Spectral Analysis
7. Milk – Gamma Spectral Analysis and I-131
8. Shoreline Sediment – Gamma Spectral Analysis
9. Special Samples (soil, food, bottom sediment, etc.) – Gamma Spectral Analysis
10. Surface Water Monthly Composites – Gamma Spectral Analysis, I-131
11. Surface Water Quarterly Composites – Tritium
12. JAFNPP Groundwater Biennial, Annual and Quarterly Samples – Gamma Spectral Analysis, Gross Alpha, Strontium, and Tritium
13. NMPNS Groundwater Annual and Quarterly Samples – Gamma Spectral Analysis, Gross Alpha, Gross Beta, Strontium, and Tritium

3.3 SAMPLE LOCATIONS

This section provides maps illustrating sample locations. Sample locations referenced as letters and numbers on the report period data tables are consistent with designations plotted on the maps.

This section also contains an environmental sample location reference table (Table 3.3-1). This table contains the following information:

1. Sample Medium
2. Map Designation (this column contains the key for the sample location and is consistent with the designation on the sample location maps and on the sample results data tables)
3. Location Description
4. Degrees and Distance of the sample location from the site

3.3.1 LIST OF FIGURES

TABLE 3.3-1
ENVIRONMENTAL SAMPLE LOCATIONS

SAMPLE MEDIUM	MAP DESIGNATION	FIGURE NUMBER	LOCATION DESCRIPTION	DEGREES & DISTANCE (1)		
Shoreline Sediment	05*	Figure 3.3-5	Sunset Bay	84°	at	1.2 miles
	06	Figure 3.3-5	Lang's Beach, Control	232°	at	4.8 miles
Fish	02*	Figure 3.3-5	Nine Mile Point Transect	290°	at	0.4 miles
	03*	Figure 3.3-5	FitzPatrick Transect	62°	at	0.8 miles
	00*	Figure 3.3-5	Oswego Transect	237°	at	5.9 miles
Surface Water	03*	Figure 3.3-4	FitzPatrick Inlet	53°	at	0.6 miles
	08*	Figure 3.3-4	Oswego Steam Station Inlet (Control)	237°	at	7.6 miles
	09	Figure 3.3-4	NMP Unit 1 Inlet	319°	at	0.3 miles
	10	Figure 3.3-4	Oswego City Water	240°	at	7.8 miles
	11	Figure 3.3-4	NMP Unit 2 Inlet (Split intake with two locations)	336°	at	0.3 miles
				353°	at	0.3 miles
Air Radioiodine and	R1*	Figure 3.3-2	R1 Station, Nine Mile Point Road	92°	at	1.8 miles
Particulates	R2*	Figure 3.3-3	R2 Station, Lake Road	107°	at	1.1 miles
	R3*	Figure 3.3-3	R3 Station, Co. Rt. 29	133°	at	1.4 miles
	R4*	Figure 3.3-3	R4 Station, Village of Lycoming, Co. Rt. 29	145°	at	1.8 miles
	R5*	Figure 3.3-2	R5 Station, Montario Point Rd. (Control)	42°	at	16.2 miles
	D1	Figure 3.3-3	D1 Onsite Station	71°	at	0.3 miles
	G On	Figure 3.3-3	G Onsite Station	245°	at	0.7 miles
	H	Figure 3.3-3	H Onsite Station	73°	at	0.8 miles
	I	Figure 3.3-3	I Onsite Station	95°	at	0.8 miles
	J	Figure 3.3-3	J Onsite Station	109°	at	0.9 miles
	K	Figure 3.3-3	K Onsite Station	132°	at	0.5 miles
	G Off	Figure 3.3-2	G Offsite Station, Saint Paul Street	226°	at	5.4 miles
	D2	Figure 3.3-2	D2 Offsite Station, Rt. 64	118°	at	9.0 miles
	E	Figure 3.3-2	E Offsite Station, Rt. 4	162°	at	7.1 miles
	F	Figure 3.3-2	F Offsite Station, Dutch Ridge Road	192°	at	7.6 miles
Nearest Residence (NMP) Based on NMP Unit 2 Centerline – Refer to Figure 3.3-6b Nearest Residence (JAF) Based on JAF Centerline – Refer to Figure 3.3-6a						

(1) Degrees and distance based on Nine Mile Point Unit 2 Reactor Centerline rounded to the nearest 1/10 of a mile.
* Sample location required by ODCM

TABLE 3.3-1 (Continued)
ENVIRONMENTAL SAMPLE LOCATIONS

SAMPLE MEDIUM	MAP DESIGNATION	FIGURE NUMBER	LOCATION DESCRIPTION	DEGREES & DISTANCE (1)		
Thermoluminescent	3	Figure 3.3-3	D1 Onsite	71°	at	0.3 miles
Dosimeters (TLD)	4	Figure 3.3-3	D2 Onsite	143°	at	0.4 miles
	5	Figure 3.3-3	E Onsite	180°	at	0.3 miles
	6	Figure 3.3-3	F Onsite	213°	at	0.5 miles
	7*	Figure 3.3-3	G Onsite	245°	at	0.7 miles
	8*	Figure 3.3-2	R5 Offsite Control	42°	at	16.2 miles
	9	Figure 3.3-2	D1 Offsite	80°	at	11.4 miles
	10	Figure 3.3-2	D2 Offsite	118°	at	9.0 miles
	11	Figure 3.3-2	E Offsite	162°	at	7.1 miles
	12	Figure 3.3-2	F Offsite	192°	at	7.6 miles
	13	Figure 3.3-2	G Offsite	226°	at	5.4 miles
	14*	Figure 3.3-2	DeMass Rd., SW Oswego - Control	227°	at	12.5 miles
	15*	Figure 3.3-2	Pole 66, W. Boundary - Bible Camp	240°	at	0.9 miles
	18*	Figure 3.3-3	Energy Info. Center - Lamp Post, SW	268°	at	0.4 miles
	19	Figure 3.3-2	East Boundary - JAF, Pole 9	83°	at	1.4 miles
	23*	Figure 3.3-3	H Onsite	73°	at	0.8 miles
	24	Figure 3.3-3	I Onsite	95°	at	0.8 miles
	25	Figure 3.3-3	J Onsite	109°	at	0.9 miles
	26	Figure 3.3-3	K Onsite	132°	at	0.5 miles
	27	Figure 3.3-3	N. Fence, N. of Switchyard, JAF	60°	at	0.4 miles
	28	Figure 3.3-3	N. Light Pole,N. of Screenhouse, JAF	68°	at	0.5 miles
	29	Figure 3.3-3	N. Fence, N. of W. Side	65°	at	0.5 miles
	30	Figure 3.3-3	N. Fence, (NW) JAF	57°	at	0.4 miles
	31	Figure 3.3-3	N. Fence, (NW) NMP-1	279°	at	0.2 miles
	39	Figure 3.3-3	N. Fence, Rad. Waste-NMP-1	298°	at	0.2 miles
	47	Figure 3.3-3	N. Fence, (NE) JAF	69°	at	0.6 miles
	49*	Figure 3.3-2	Phoenix, NY-Control	168°	at	19.7 miles
	51	Figure 3.3-2	Liberty & Bronson Sts., E of OSS	234°	at	7.3 miles
	52	Figure 3.3-2	E. 12th & Cayuga Sts., Oswego School	227°	at	5.9 miles
	53	Figure 3.3-2	Broadwell & Chestnut Sts. Fulton H.S.	183°	at	13.7 miles

(1) Degrees and distance based on Nine Mile Point Unit 2 Reactor Centerline rounded to the nearest 1/10 of a mile.
* Sample location required by ODCM

TABLE 3.3-1 (Continued)
ENVIRONMENTAL SAMPLE LOCATIONS

SAMPLE MEDIUM	MAP DESIGNATION	FIGURE NUMBER	LOCATION DESCRIPTION	DEGREES & DISTANCE (1)		
Thermoluminescent	54	Figure 3.3-2	Mexico High School	115°	at	9.4 miles
Dosimeters (TLD)	55	Figure 3.3-2	Gas Substation Co. Rt. 5-Pulaski	75°	at	13.0 miles
(Continued)	56*	Figure 3.3-2	Rt. 104-New Haven Sch. (SE Corner)	124°	at	5.2 miles
	58*	Figure 3.3-2	Co Rt. 1A-Novelis (E. of E. Entrance Rd.)	222°	at	3.0 miles
	75*	Figure 3.3-3	Unit 2, N. Fence, N. of Reactor Bldg.	354°	at	0.1 miles
	76*	Figure 3.3-3	Unit 2, N. Fence, N. of Change House	25°	at	0.1 miles
	77*	Figure 3.3-3	Unit 2, N. Fence, N. of Pipe Bldg.	36°	at	0.2 miles
	78*	Figure 3.3-3	JAF. E. of E. Old Lay Down Area	85°	at	1.0 miles
	79*	Figure 3.3-3	Co. Rt. 29, Pole #63, 0.2 mi. S. of Lake Rd.	120°	at	1.2 miles
	80*	Figure 3.3-3	Co. Rt. 29, Pole #54, 0.7 mi. S. of Lake Rd.	136°	at	1.5 miles
	81*	Figure 3.3-3	Miner Rd., Pole #16, 0.5 mi. W. of Rt. 29	159°	at	1.6 miles
	82*	Figure 3.3-3	Miner Rd., Pole # 1-1/2, 1.1 mi. W. of Rt. 29	180°	at	1.6 miles
	83*	Figure 3.3-3	Lakeview Rd., Tree 0.45 mi. N. of Miner Rd.	203°	at	1.2 miles
	84*	Figure 3.3-3	Lakeview Rd., N., Pole #6117, 200ft. N. of Lake Rd.	226°	at	1.1 miles
	85*	Figure 3.3-3	Unit 1, N. Fence, N. of W. Side of Screen House	292°	at	0.2 miles
	86*	Figure 3.3-3	Unit 2, N. Fence, N of W. Side of Screen House	311°	at	0.1 miles
	87*	Figure 3.3-3	Unit 2, N. Fence, N. of E. Side of Screen House	333°	at	0.1 miles
	88*	Figure 3.3-2	Hickory Grove Rd., Pole #2, 0.6 mi. N. of Rt. 1	97°	at	4.5 miles
	89*	Figure 3.3-2	Leavitt Rd., Pole #16, 0.4 mi. S. of Rt.1	112°	at	4.3 miles
	90*	Figure 3.3-2	Rt. 104, Pole #300, 150 ft. E. of Keefe Rd.	135°	at	4.2 miles
	91*	Figure 3.3-2	Rt 51A, Pole #59, 0.8 mi. W. of Rt. 51	157°	at	4.9 miles
	92*	Figure 3.3-2	Maiden Lane Rd., Power Pole, 0.6 mi. S. of Rt. 104	183°	at	4.4 miles
	93*	Figure 3.3-2	Rt. 53 Pole 1-1, 120 ft. S. of Rt. 104	206°	at	4.4 miles
	94*	Figure 3.3-2	Rt. 1, Pole #82, 250 ft. E. of Kocher Rd. (Co. Rt. 63)	224°	at	4.4 miles
	95*	Figure 3.3-2	Novelis W access Rd., Joe Fultz Blvd, Pole #21	239°	at	3.7 miles
	96*	Figure 3.3-2	Creamery Rd., 0.3 mi. S. of Middle Rd., Pole 1-1/2	199°	at	3.6 miles
	97*	Figure 3.3-3	Rt. 29, Pole #50, 200ft. N. of Miner Rd.	145°	at	1.8 miles
	98*	Figure 3.3-2	Lake Rd., Pole #145, 0.15 mi. E. of Rt 29	102°	at	1.2 miles

(1) Degrees and distance based on Nine Mile Point Unit 2 Reactor Centerline rounded to the nearest 1/10 of a mile.
* Sample location required by ODCM, TLD #98 is applicable to NMP1 and NMP2 ODCM

TABLE 3.3-1 (Continued)
ENVIRONMENTAL SAMPLE LOCATIONS

SAMPLE MEDIUM	MAP DESIGNATION	FIGURE NUMBER	LOCATION DESCRIPTION	DEGREES & DISTANCE (1)
Thermoluminescent Dosimeters (TLD) (Continued)	99	Figure 3.3-2	NMP Rd., 0.4 mi. N. of Lake Rd., Env. Station R1	92° at 1.8 miles
	100	Figure 3.3-3	Rt. 29 & Lake Rd., Env. Station R2	107° at 1.1 miles
	101	Figure 3.3-3	Rt. 29, 0.7 mi. S. of Lake Rd., Env. Station R3	133° at 1.4 miles
	102	Figure 3.3-2	EOF, Rt. 176, E. Driveway, Lamp Post	175° at 11.9 miles
	103	Figure 3.3-3	EIC, East Garage Rd., Lamp Post	268° at 0.4 miles
	104	Figure 3.3-2	Parkhurst Rd., Pole #23, 0.1 mi. S. of Lake Rd.	102° at 1.4 miles
	105	Figure 3.3-3	Lakeview Rd. Pole #36, 0.5 mi. S. of Lake Rd.	199° at 1.4 miles
	106	Figure 3.3-3	Shoreline Cove, W. of NMP-1, Tree on W. Edge	274° at 0.3 miles
	107	Figure 3.3-3	Shoreline Cove, W. of NMP-1, 30 ft SSW of #106	273° at 0.3 miles
	108	Figure 3.3-3	Lake Rd., Pole #142, 300 ft E. of Rt. 29 S.	105° at 1.1 miles
	109	Figure 3.3-3	Tree North of Lake Rd., 300 ft E. of Rt. 29 N	104° at 1.1 miles
	111	Figure 3.3-2	Control, State Route 38, Sterling, NY	214° at 21.8 miles
	112	Figure 3.3-2	EOF, Oswego County Airport Control	175° at 11.9 miles
	113	Figure 3.3-2	Baldwinsville, NY	178° at 24.7 miles
Cow's Milk				
	55**	Figure 3.3-4	Indicator Location	97° at 8.7 miles
	77*	Figure 3.3-4	Control Location	190° at 16.0 miles
Food Products				
	144*	Figure 3.3-5	Indicator Location – Whaley	139° at 1.6 miles
	484*	Figure 3.3-5	Indicator Location – O'Connor	132° at 1.4 miles
	C2 (145)*	Figure 3.3-5	Control Location – Flack	222° at 15.4 miles
	69*	Figure 3.3-5	Indicator Location – Lawton	123° at 2.3 miles
	48(134)*	Figure 3.3-5	Indicator Location – Kronenbitter	84° at 1.5 miles
	240*(2)	Figure 3.3-5	Indicator Location – Braves	96° at 1.8 miles

(1) Degrees and distance based on Nine Mile Point Unit 2 Reactor Centerline
(2) Food Product Location 240 required by JAFNPP ODCM
* Sample location required by ODCM
** Optional sample

TABLE 3.3-1 (Continued)
ENVIRONMENTAL SAMPLE LOCATIONS

SAMPLE MEDIUM	LOCATION DESIGNATION	FIGURE NUMBER	LOCATION DESCRIPTION
Thermoluminescent Dosimeters (TLD) JAFNPP ISFSI	I-1*		ISFSI West Fence, South End of Storage Pad
	I-2*		ISFSI West Fence, Center of Storage Pad
	I-3*		ISFSI West Fence, North End of Storage Pad
	I-4*		ISFSI North Fence, West End of Storage Pad
	I-5*		ISFSI North Fence, Center of Storage Pad
	I-6*		ISFSI North Fence, East End of Storage Pad
	I-7*		ISFSI East Fence, North End of Storage Pad
	I-8*		ISFSI East Fence, Center of Storage Pad
	I-9*		ISFSI East Fence, South End of Storage Pad
	I-10*		ISFSI South Fence, East End of Storage Pad
	I-11*		ISFSI South Fence, Center of Storage Pad
	I-12*		ISFSI South Fence, West End of Storage Pad
	I-13**		ISFSI Building and Grounds Garage, East of Pad
	I-14**		ISFSI Tree ~100 yards South of Pad
	I-15**		ISFSI Transmission Line Tower South of Pad at East /West Access Road
	I-16**		ISFSI Perimeter Fence ~100 yards West of Pad on Pad Centerline
	I-17**		ISFSI North Fence of Main Switch Yard on Pad Centerline
	I-18**		ISFSI North Inner Perimeter Fence at Lake Shore on Pad Centerline
Optically Stimulated Luminescence Dosimeters (OSLD) NMPNS	233**		ISFSI West Northwest Fence
	234**		ISFSI West Southwest Fence
	235**		ISFSI South Fence
	236**		ISFSI South Southeast Fence
	237**		ISFSI Southeast
	238**		ISFSI East Southeast Fence

* Sample location required by ODCM
** Indicates Optional TLD location

TABLE 3.3-1 (Continued)
ENVIRONMENTAL SAMPLE LOCATIONS

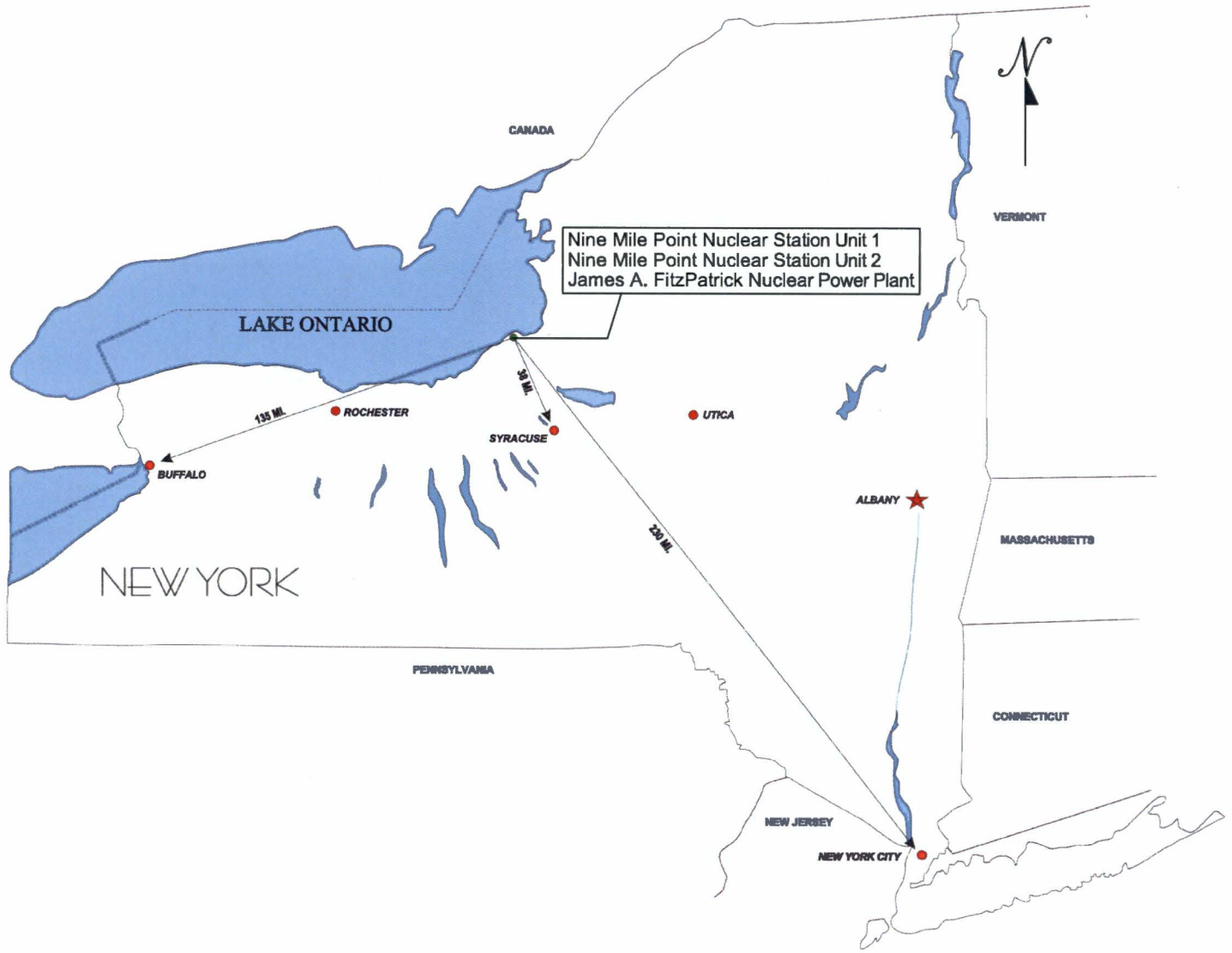
SAMPLE MEDIUM	LOCATION DESIGNATION	FIGURE NUMBER	LOCATION DESCRIPTION	DEGREES & DISTANCE (1)
Optically Stimulated Luminescence Dosimeters (OSLD) NMPNS (continued)	239**		ISFSI East Fence	
	240**		ISFSI North East Fence	
	241**		ISFSI North Fence	
	242**		ISFSI North East Fence	
	243**		ISFSI North Northwest Fence	
	244**		ISFSI Northeast Fence	
	245**		ISFSI Northeast Fence	
	246**		ISFSI East Northeast Fence	
Groundwater NMPNS	MW 1, 5-13, 15-21	Figure 3.3-7b	Down Gradient Wells – Indicators	258° to 78° at <0.3 miles
	GMX-MW-1	Figure 3.3-7b	Upland Well – Control	160° at 0.3 miles
	MW-14	Figure 3.3-7b	Upland Well – Control	187° at 0.2 miles
	PZ-1 – PZ-8	Figure 3.3-7b	Piezometer Wells	North NMP1 Reactor Building
	PZ-9	Figure 3.3-7b	Piezometer Wells - Control	South NMP1 on Transformer Road

(1) Degrees and distance based on Nine Mile Point Unit 2 Reactor Centerline
** Indicate optional TLD/OSLD Locations

TABLE 3.3-1 (Continued)
ENVIRONMENTAL SAMPLE LOCATIONS

SAMPLE MEDIUM	LOCATION DESIGNATION	FIGURE	LOCATION DESCRIPTION
JAFNPP Ground Water Monitoring Wells	MW-1 (A)	Figure 3.3-7a	Southwest of Reactor Building
	MW-1 (B)	Figure 3.3-7a	Southwest of Reactor Building
	MW-2 (A)	Figure 3.3-7a	Northwest of Reactor Building
	MW-2 (B)	Figure 3.3-7a	Northwest of Reactor Building
	MW-3 (A)	Figure 3.3-7a	Northwest of Reactor Building
	MW-3 (B)	Figure 3.3-7a	Northwest of Reactor Building
	MW-4 (A)	Figure 3.3-7a	Northeast of Reactor Building
	MW-4 (B)	Figure 3.3-7a	Northeast of Reactor Building
	MW-5	Figure 3.3-7a	Northwest Edge of Property
	MW-6	Figure 3.3-7a	North / Northwest Edge of Property
	MW-7	Figure 3.3-7a	North Edge of Property
	MW-8	Figure 3.3-7a	North / Northeast Edge of Property
	MW-9	Figure 3.3-7a	Northeast Edge of Property
	MW-10 (A)	Figure 3.3-7a	Southeast of Reactor Building
	MW-10 (B)	Figure 3.3-7a	Southeast of Reactor Building
	MW-13	Figure 3.3-7a	West of Reactor Building
	MW-14	Figure 3.3-7a	East of Reactor Building
	MW-15	Figure 3.3-7a	South of Reactor Building
	MW-16	Figure 3.3-7a	Northwest of Reactor Building
	MW-19	Figure 3.3-7a	Northwest Edge of Property
	MW-20	Figure 3.3-7a	Southwest Edge of Property (Control)
	MW-21	Figure 3.3-7a	South of Reactor Building (Outside protected area) (Control)

FIGURE 3.3-1
New York State Map



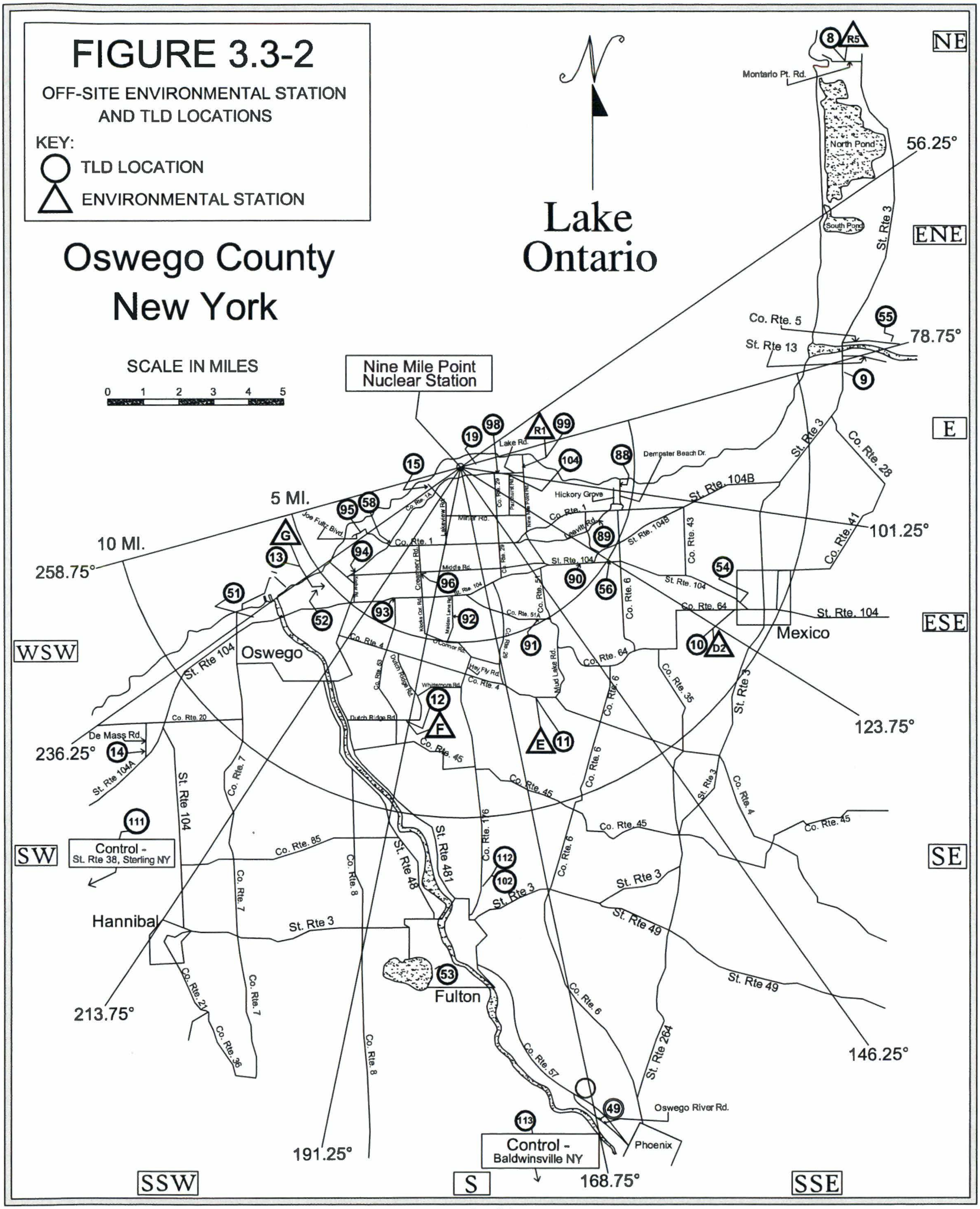


FIGURE 3.3-2
OFF-SITE ENVIRONMENTAL STATION AND TLD LOCATIONS
KEY:
TLD LOCATION
ENVIRONMENTAL STATION
Oswego County
New York
SCALE IN MILES
0 1 2 3 4 5
Lake Ontario
Nine Mile Point Nuclear Station
NE
ENE
E
ESE
SE
SSE
S
SSW
SW
WSW
56.25°
78.75°
101.25°
123.75°
146.25°
168.75°
191.25°
213.75°
236.25°
258.75°
5 MI.
10 MI.
Montario Pt. Rd.
North Pond
South Pond
St. Rte 3
Co. Rte. 5
St. Rte 13
Dempster Beach Dr.
Hickory Grove
St. Rte. 104B
Co. Rte. 28
Co. Rte. 41
Co. Rte. 43
Lake Rd.
Co. Rte. 1
Co. Rte. 1A
Miller Rd.
Joe Fultz Blvd.
Middle Rd.
St. Rte. 104
St. Rte 104
St. Rte. 104
Co. Rte. 6
Co. Rte. 64
Co. Rte. 51A
Co. Rte. 51
Co. Rte. 4
O'Connor Rd.
Hay Fly Rd.
Whittemore Rd.
Dutch Ridge Rd.
Co. Rte. 45
Mud Lake Rd.
Co. Rte. 35
Co. Rte. 20
De Mass Rd.
St. Rte 104A
Co. Rte. 7
St. Rte 104
Co. Rte. 85
Co. Rte. 8
St. Rte 48
St. Rte 481
Co. Rte. 176
St. Rte 3
St. Rte 49
St. Rte 264
Co. Rte. 57
Co. Rte. 21
Co. Rte. 36
Oswego River Rd.
Oswego
Mexico
Hannibal
Fulton
Phoenix
Control - St. Rte 38, Sterling NY
Control - Baldwinsville NY
8
R5
55
9
19
98
R1
99
15
104
88
95
58
G
13
94
89
96
90
56
54
51
52
93
92
91
10
D2
12
F
E
11
14
111
112
102
53
49
113

FIGURE 3.3-3

ONSITE ENVIRONMENTAL
STATION AND TLD LOCATIONS

KEY:

△ ENVIRONMENTAL STATION

○ TLD LOCATION

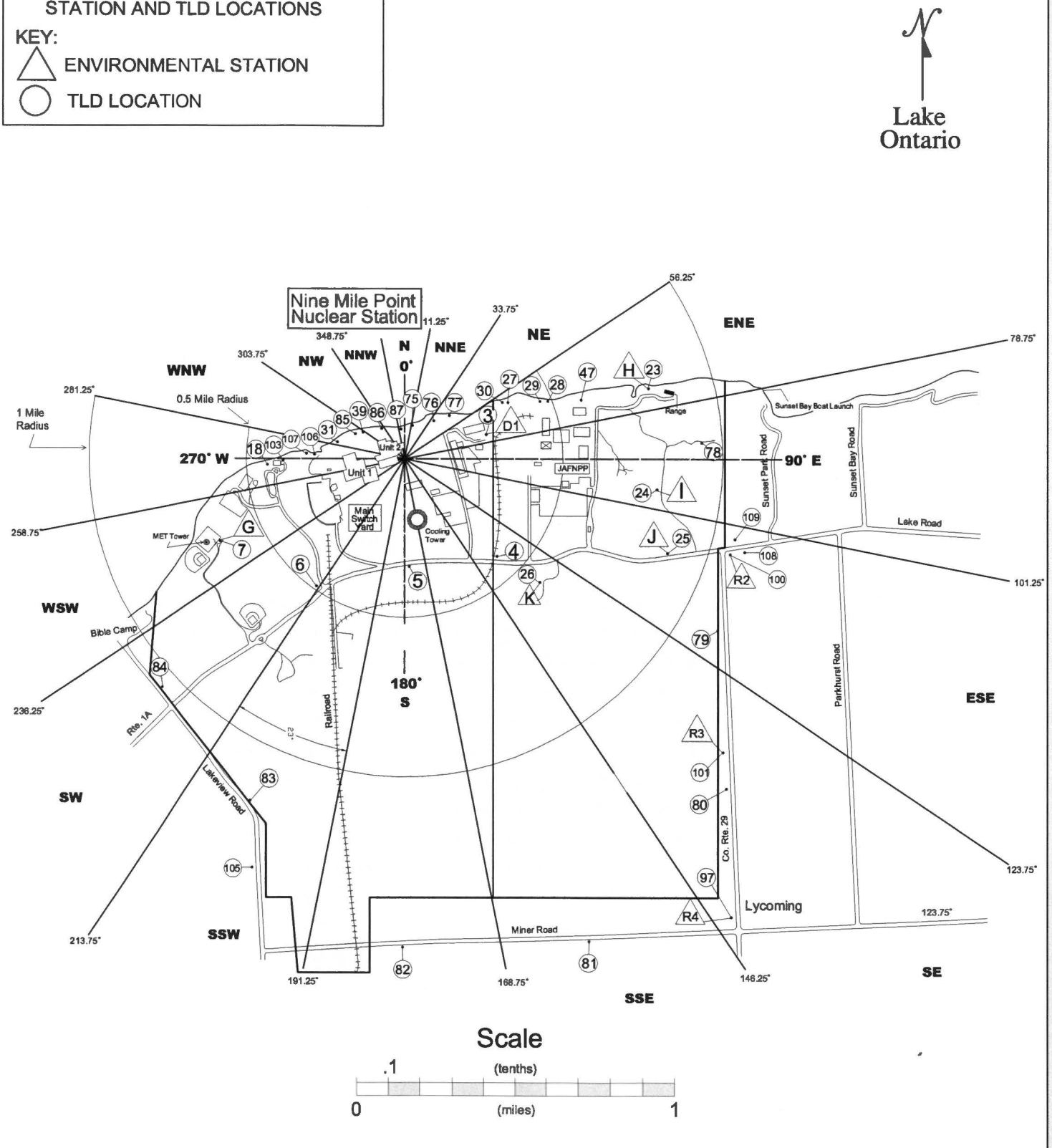


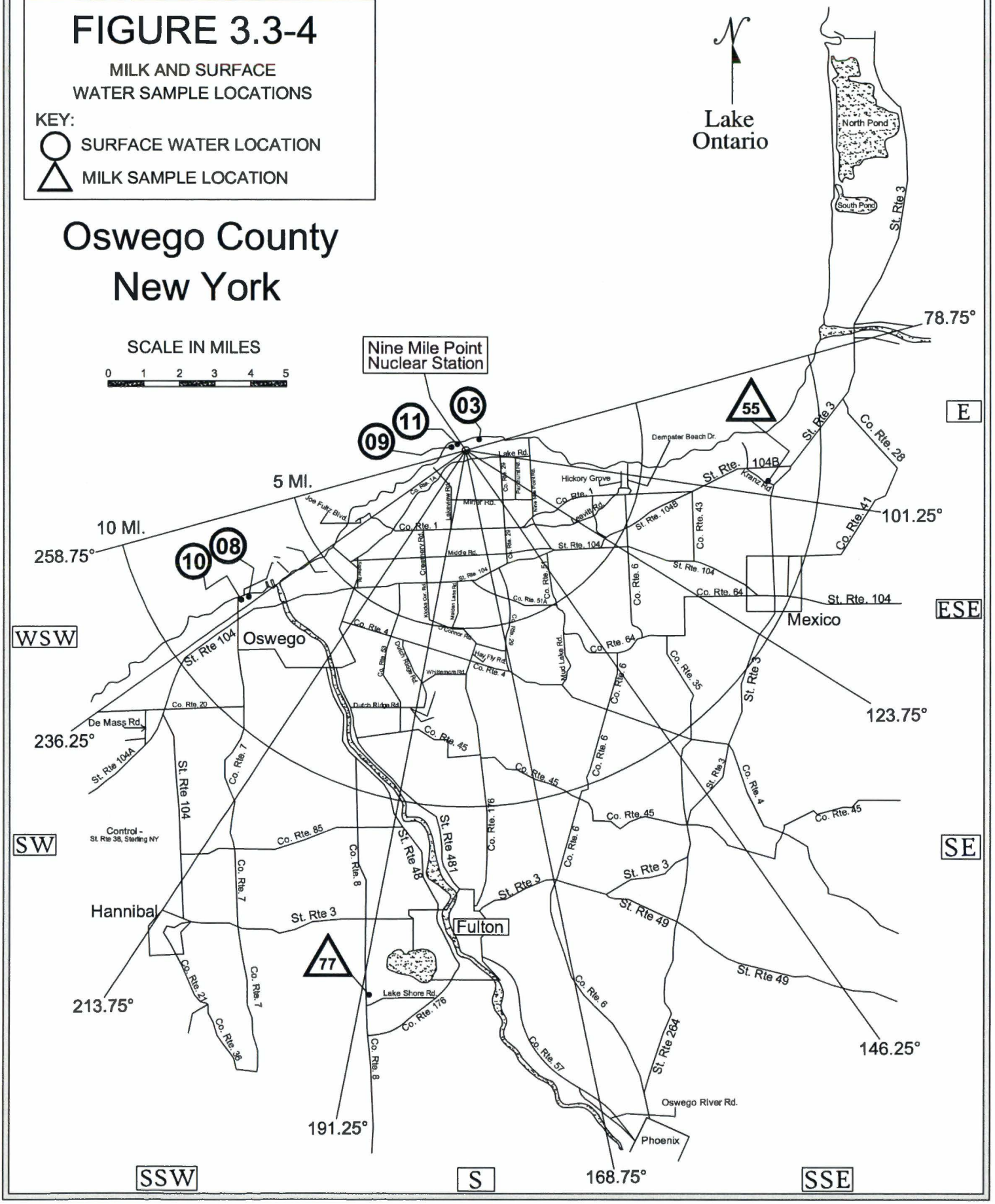
FIGURE 3.3-4

MILK AND SURFACE
WATER SAMPLE LOCATIONS

KEY:

SURFACE WATER LOCATION

MILK SAMPLE LOCATION



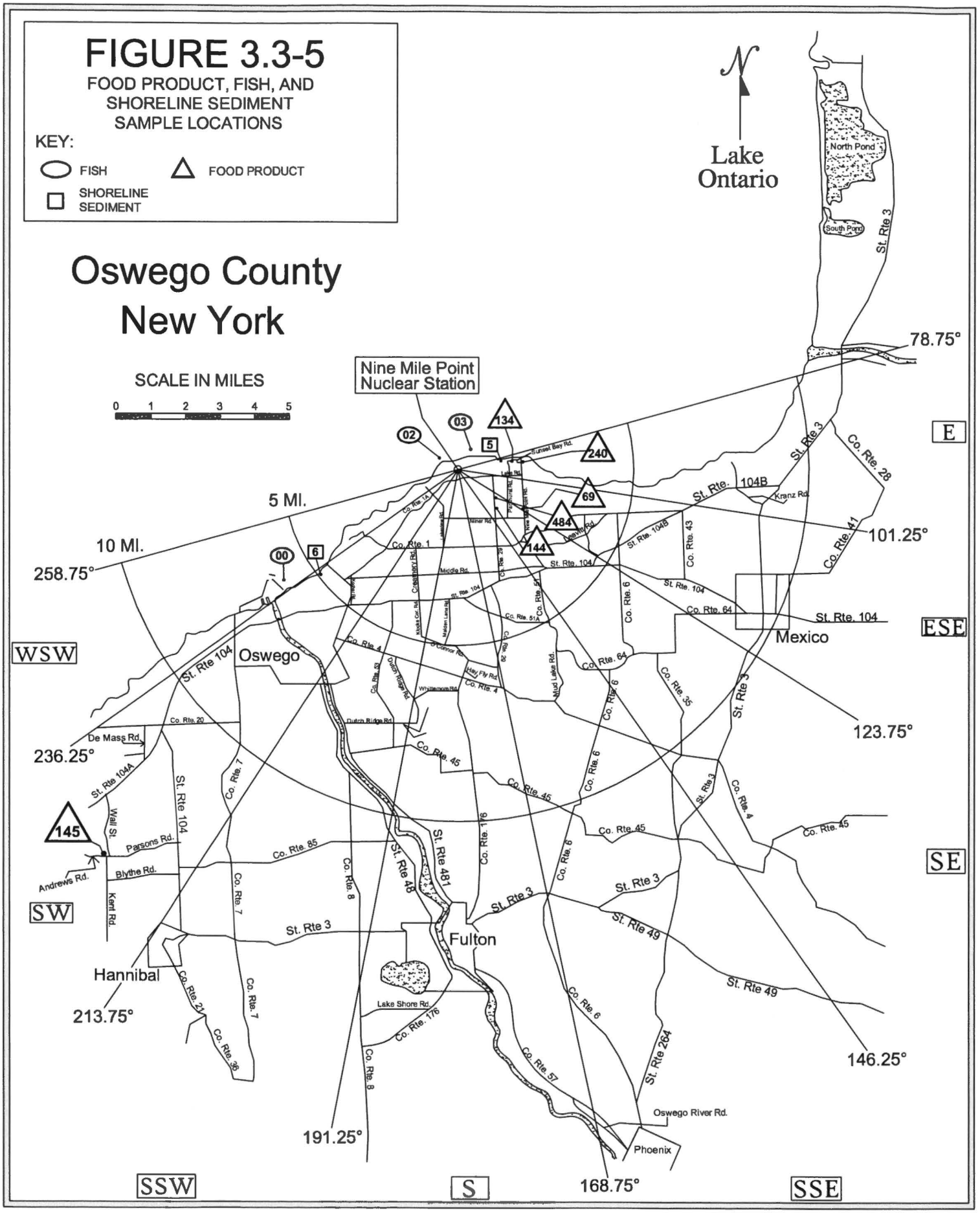


FIGURE 3.3-5
FOOD PRODUCT, FISH, AND SHORELINE SEDIMENT SAMPLE LOCATIONS
KEY:
FISH
FOOD PRODUCT
SHORELINE SEDIMENT
Oswego County New York
SCALE IN MILES
0 1 2 3 4 5
Lake Ontario
North Pond
South Pond
St. Rte 3
Nine Mile Point Nuclear Station
02
03
134
5
240
69
484
144
00
6
145
5 Mi.
10 Mi.
258.75°
78.75°
101.25°
123.75°
146.25°
168.75°
191.25°
213.75°
236.25°
E
ESE
SE
SSE
S
SSW
SW
WSW
Oswego
Mexico
Fulton
Hannibal
Phoenix
Sunset Bay Rd.
Lake Rd.
Co. Rte. 1A
Co. Rte. 1
Miner Rd.
Kenwood Rd.
Middle Rd.
St. Rte. 104
St. Rte. 104B
Kranz Rd.
Co. Rte. 28
Co. Rte. 41
Co. Rte. 43
Co. Rte. 6
Co. Rte. 64
Co. Rte. 4
Co. Rte. 4A
Co. Rte. 52
Co. Rte. 51
Co. Rte. 51A
Co. Rte. 28
Co. Rte. 35
Mud Lake Rd.
Hall Fly Rd.
Whitaker Rd.
Dutch Ridge Rd.
Co. Rte. 45
Co. Rte. 20
De Mass Rd.
St. Rte 104A
St. Rte 104
Co. Rte. 7
Wall St.
Parsons Rd.
Co. Rte. 85
Blythe Rd.
Andrews Rd.
Kent Rd.
Co. Rte. 8
St. Rte 48
St. Rte 481
Co. Rte. 176
St. Rte 3
St. Rte 49
St. Rte 264
Co. Rte. 57
Lake Shore Rd.
Co. Rte. 24
Co. Rte. 36
Oswego River Rd.

FIGURE 3.3-6a

JAMES A. FITZPATRICK
NUCLEAR POWER PLANT
NEAREST RESIDENCE

- Year-Round Residence
- Seasonal Residence

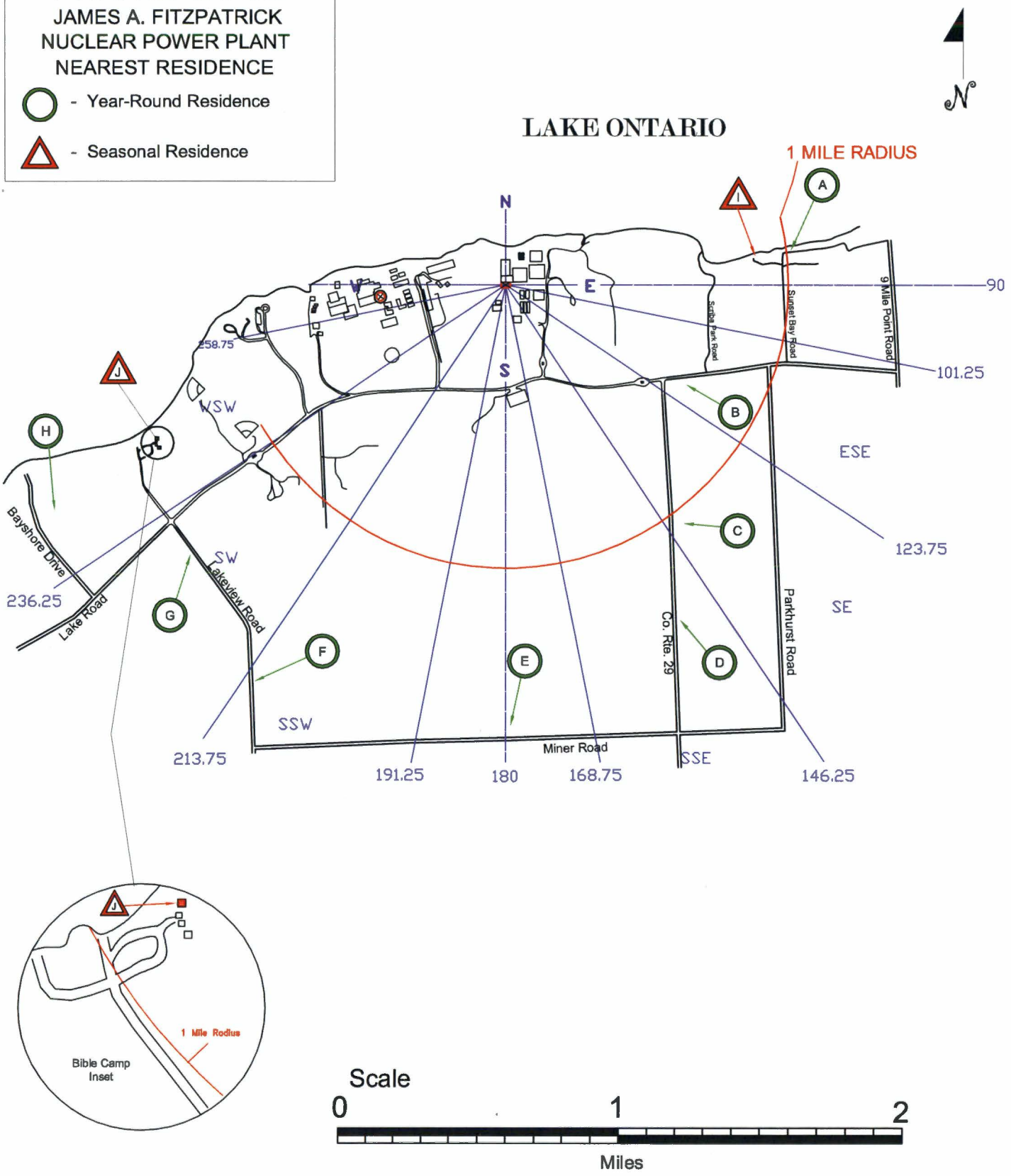
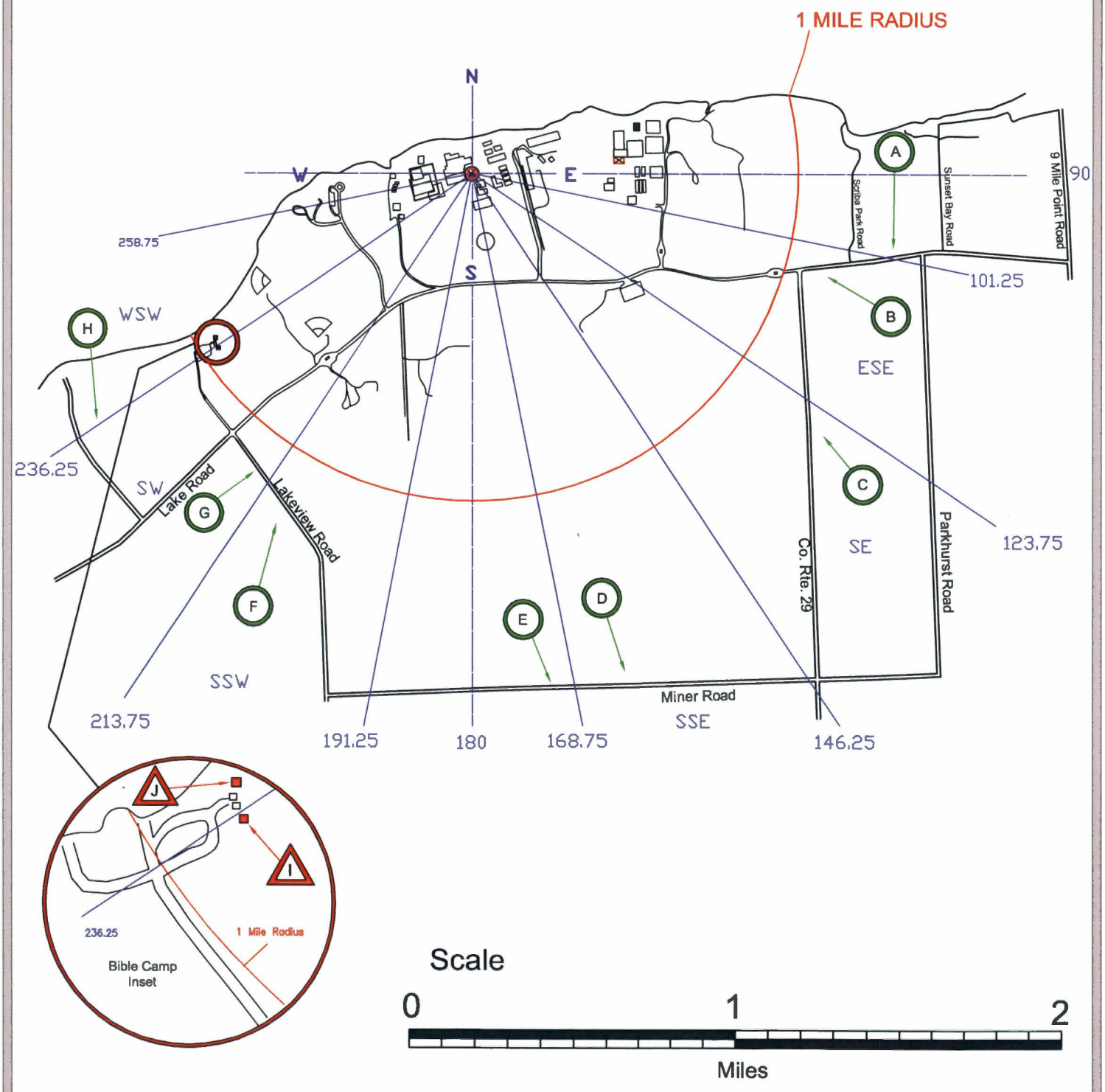


FIGURE 3.3-6b

NINE MILE POINT
NUCLEAR STATION
NEAREST RESIDENCE

- Year-Round Residence
- Seasonal Residence



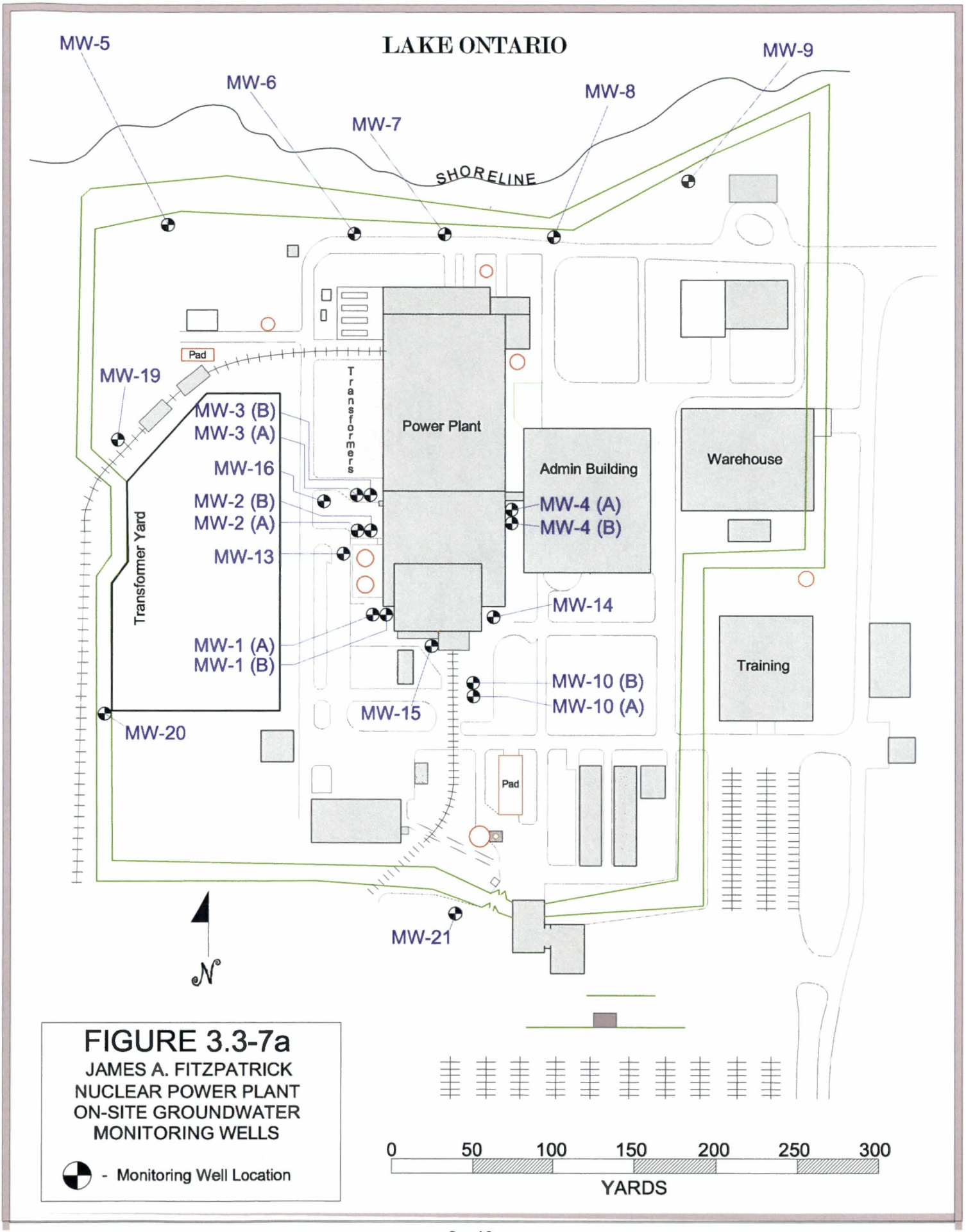


FIGURE 3.3-7a

JAMES A. FITZPATRICK
NUCLEAR POWER PLANT
ON-SITE GROUNDWATER
MONITORING WELLS

- Monitoring Well Location

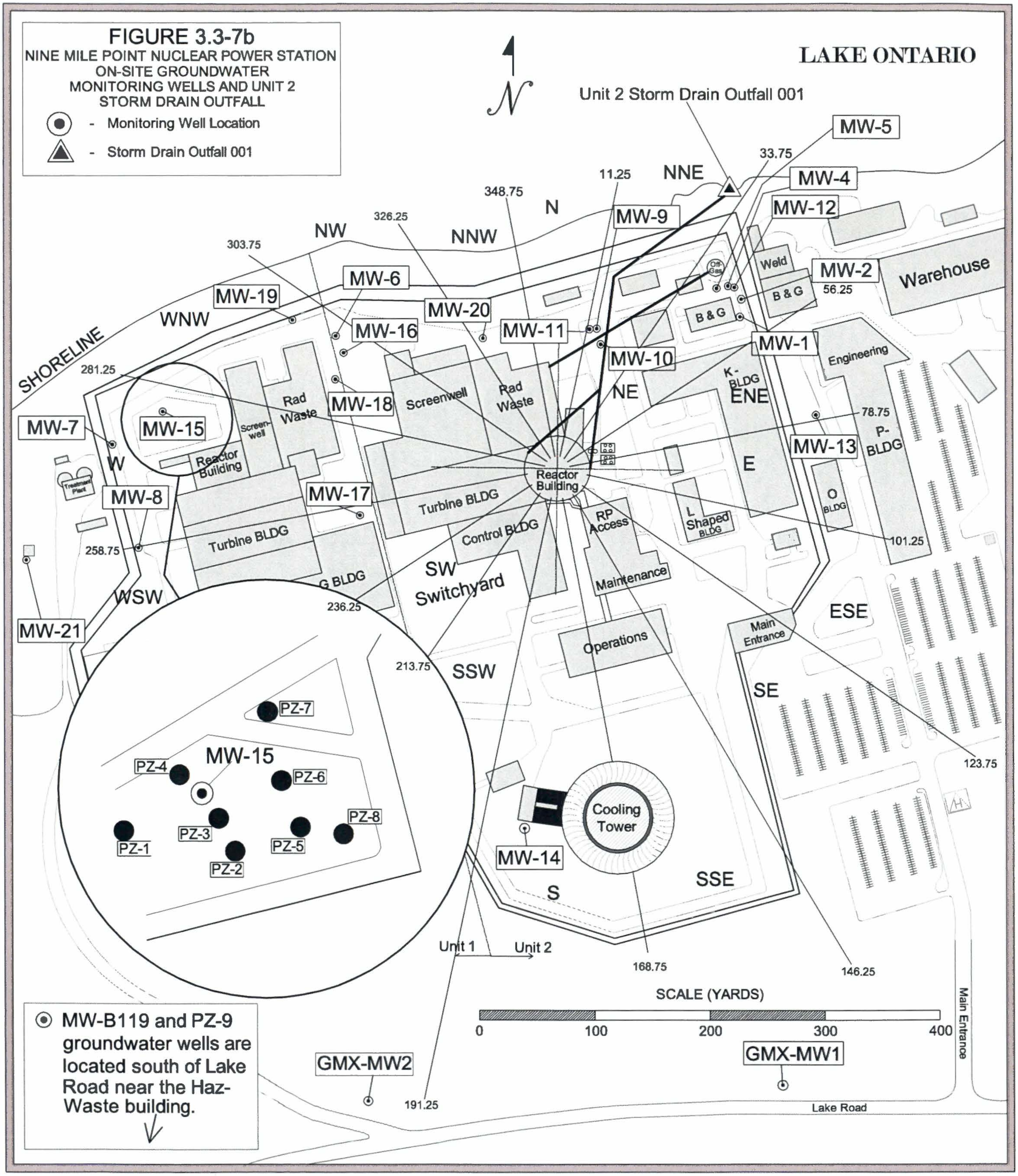


FIGURE 3.3-7b
NINE MILE POINT NUCLEAR POWER STATION
ON-SITE GROUNDWATER
MONITORING WELLS AND UNIT 2
STORM DRAIN OUTFALL
- Monitoring Well Location
- Storm Drain Outfall 001
LAKE ONTARIO
Unit 2 Storm Drain Outfall 001
MW-5
MW-4
MW-12
MW-9
MW-2
MW-6
MW-19
MW-20
MW-16
MW-11
MW-1
MW-10
MW-18
MW-7
MW-15
MW-13
MW-8
MW-17
MW-21
MW-14
GMX-MW2
GMX-MW1
SHORELINE
Warehouse
Engineering
Weld
B & G
K-BLDG
P-BLDG
O BLDG
L Shaped BLDG
Rad Waste
Screenwell
Reactor Building
Turbine BLDG
Control BLDG
RP Access
Maintenance
Operations
Main Entrance
Switchyard
Cooling Tower
Treatment Plant
PZ-1
PZ-2
PZ-3
PZ-4
PZ-5
PZ-6
PZ-7
PZ-8
Unit 1
Unit 2
SCALE (YARDS)
0
100
200
300
400
Lake Road
Main Entrance
MW-B119 and PZ-9 groundwater wells are located south of Lake Road near the Haz-Waste building.

3.4 LAND USE CENSUS

The ODCM requires that a milch animal census and a residence census be conducted annually out to a distance of five miles. Milch animals are defined as any animal that is routinely used to provide milk for human consumption.

The milch animal census is an estimation of the number of cows and goats within an approximate ten-mile radius of the Nine Mile Point site. The census is done once per year in the summer. It is conducted by sending questionnaires to previous milch animal owners, and by road surveys to locate any possible new owners. In the event that questionnaires are not answered, the owners are contacted by telephone or in person. The Oswego County Cooperative Extension Service was also contacted to provide any additional information.

The residence census is conducted each year to identify the closest residence in each of the 22.5 degree meteorological sectors out to a distance of five miles. A residence, for the purposes of this census, is a residence that is occupied on a part time basis (such as a summer camp), or on a full time, year-round basis. Eight of the site meteorological sectors are over Lake Ontario; therefore, there are only eight sectors over land where residences are located within five miles.

In addition to the milch animal and residence census, a garden census was performed for the 2019 growing season. The census is conducted each year to identify the gardens nearest the site, within a 5-mile radius, that are to be used for the collection of food product samples.

3.5 CHANGES TO THE REMP PROGRAM

Based upon the results of the 2019 Land Use Census, there were no changes to the 2019 sampling program.

3.6 DEVIATIONS AND EXCEPTIONS TO THE PROGRAM

The noted exceptions to the 2019 sample program address only those samples or monitoring requirements which are required by the ODCM. This section satisfies the reporting requirements of Part I, Section 5.1.1.c.1 of the JAFNPP ODCM, Section D 6.9.1.d of the NMP1 ODCM and Section D 4.1.2 of the NMP2 ODCM.

3.6.1 ODCM Program Deviations

The following are deviations from the program specified by the ODCM:

01/2/19-01/08/19	Station F Off Air Particulate and Charcoal were unable to be analyzed due to the pump being disconnected.

3.6.2 Air Sampling Station Operability Assessment

The ODCM required air sampling program consists of 5 individual sampling locations. The collective operable time period for the air monitoring stations was 43,524.9 hours out of a possible 43,800 hours. The air sampling availability factor for the report period was 99.4%.

Air sampling equipment found inoperable were returned to service. Identification of locations for obtaining replacement samples were not required.

3.7 STATISTICAL METHODOLOGY

There are a number of statistical calculation methodologies used in evaluating the data from the environmental monitoring program. These methodologies include determination of standard deviation, the mean and associated error for the mean, and the lower limit of detection (LLD).

3.7.1 ESTIMATION OF THE MEAN AND STANDARD DEVIATION

The mean (X) and standard deviation(s) were used in the reduction of the data generated by the sampling and analysis of the various media in the JAFNPP and Nine Mile Point Radiological Environmental Monitoring Programs (REMP). The following equations were utilized to compute the mean (X) and the standard deviation(s):

1. **Mean**

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

Where,

$\overline{X}$ = estimate of the mean

i = individual sample

N, n = total number of samples with positive indications

X_i = value for sample i above the lower limit of detection.

2. **Standard Deviation**

$$s = \left[\frac{\sum_{i=1}^{n} (X_i - \overline{X})^2}{(N-1)} \right]^{1/2}$$

Where,

$\overline{X}$ = mean for the values of X

s = standard deviation for the sample population

3.7.2 ESTIMATION OF THE MEAN & THE ESTIMATED ERROR FOR THE MEAN

In accordance with program policy, when the initial count indicates the presence of a plant related radionuclide(s) in a sample, two recounts of the sample may be required. 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 positive sample result exists, the mean of the sample results and the estimated error for the mean are reported in the Annual Report.

The following equations were utilized to estimate the mean ($\overline{X}$) and the associated propagated error.

1. **Mean**

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

Where,

$\overline{X}$	=	estimate of the mean
i	=	individual sample
N,n	=	total number of samples with positive indications
X_i	=	value for sample i above the lower limit of detection

2. **Error of the Mean**

$$ERROR\ MEAN = \frac{\left[\sum_{i=1}^{n} (ERROR)^2\right]^{1/2}}{N}$$

Where,

ERROR MEAN	=	propagated error
i	=	individual sample
ERROR	=	1 sigma* error of the individual analysis
N, n	=	number of samples with positive indications

* Sigma (σ)

Sigma is the Greek letter used to represent the mathematical term Standard Deviation.

Standard Deviation is a measure of dispersion from the arithmetic mean of a set of numbers.

3.7.3 LOWER LIMIT OF DETECTION (LLD)

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

The LLDs are specified by the ODCM for radionuclides in specific media and are determined by taking into account the overall measurement methods. The equation used to calculate the LLD is:

$$LLD = \frac{4.66\, S_b}{(E)(V)\,(2.22)\,(Y)\exp\,(-\lambda\Delta t)}$$

Where:

LLD = the a priori lower limit of detection, as defined above (in picocuries per unit mass or volume)

S_b = the standard deviation of the background counting rate or of the counting rate of a blank sample, as appropriate (in counts per minute)

E = the counting efficiency (in counts per disintegration)

V = the sample size (in units of mass or volume)

2.22 = the number of disintegrations per minute per picocurie

Y = the fractional radiochemical yield (when applicable)

λ = the radioactive decay constant for the particular radionuclide

Δt = the elapsed time between sample collection (or end of the sample collection period) and time of counting

The ODCM LLD formula assumes that:

1. The counting times for the sample and background are equal

2. The count rate of the background is approximately equal to the count rate of the sample

In the ODCM program, LLDs are used to ensure that minimum acceptable detection capabilities are met with specified statistical confidence levels (95% detection probability with 5% probability of a false negative). Table 3.8-1 lists the ODCM program required LLDs for specific media and radionuclides as specified by the NRC. The LLDs actually achieved are routinely lower than those specified by the ODCM.

3.8 COMPLIANCE WITH REQUIRED LOWER LIMITS OF DETECTION (LLD)

JAF ODCM, Part 1, Table 5.1-3, NMP1 and NMP2 ODCM Tables D 4.6.20-1 and D 3.3.1-3, respectively, specifies the detection capabilities for environmental sample analysis (see report Table 3.8-1). JAF ODCM, Part 1, Section 6.1, NMP1 ODCM, Section D 6.9.1d and NMP2 ODCM, Section D 4.1.2 requires that a discussion of all analyses for which the required LLDs specified were not routinely achieved be included in the Annual Radiological Environmental Operating Report. Section 3.8 is provided pursuant to this requirement.

3.8.1 All sample analyses performed in 2019 as required by the ODCM, achieved the Lower Limit of Detection (LLD) as specified by JAF ODCM, Part 1, Table 5.1-3, NMP1 and NMP2 ODCM Tables D 4.6.20-1 and D 3.5.1-3, respectively. See Table 3.8-1 for required LLD values.

TABLE 3.8-1

REQUIRED DETECTION CAPABILITIES FOR ENVIRONMENTAL SAMPLE ANALYSIS LOWER LIMIT OF DETECTION (LLD)

Analysis	Water (pCi/l)	Airborne Particulate or Gases (pCi/m^3)	Fish (pCi/kg, wet)	Milk (pCi/l)	Food Products (pCi/kg, wet)	Sediment (pCi/kg, dry)
Gross Beta	4	0.01				
H-3	3000 (a)					
Mn-54	15		130			
Fe-59	30		260			
Co-58, Co-60	15		130			
Zn-65	30		260			
Zr-95, Nb-95	15					
I-131	15 (a)	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) No drinking water pathway exists at the Nine Mile Point site under normal operating conditions due to the direction and distance of the nearest drinking water intake. Therefore, the LLD value of 3,000 pCi/liter is used for H-3 and the LLD value of 15 pCi/liter is used for I-131.

3.9 REGULATORY LIMITS

Two federal agencies, the Nuclear Regulatory Commission and Environmental Protection Agency, have responsibility for regulations promulgated for protecting the public from radiation and radioactivity beyond the site boundary.

3.9.1 The Nuclear Regulatory Commission (NRC):

The NRC, in 10 CFR 20.1301, limits the levels of radiation in unrestricted areas resulting from the possession or use of radioactive materials such that they limit any individual to a dose of:

- less than or equal to 100 mrem per year to the total body.

In addition to this dose limit, the NRC has established design objectives for nuclear plant licensees. Conformance to these guidelines ensures that nuclear power reactor effluents are maintained as far below the legal limits as is reasonably achievable.

The NRC, in 10 CFR 50, Appendix I, establishes design objectives for the dose to a member of the general public from radioactive material in liquid effluents released to unrestricted areas to be limited to:

- less than or equal to 3 mrem per year to the total body, or
- less than or equal to 10 mrem per year to any organ.

The air dose due to release of Noble gases in gaseous effluents is restricted to:

- less than or equal to 10 mrad per year for gamma radiation, or
- less than or equal to 20 mrad per year for beta radiation.

The dose to a member of the general public from Iodine-131, tritium, and all particulate radionuclides with half-lives greater than 8 days in gaseous effluents is limited to:

- less than or equal to 15 mrem per year to any organ.

The NRC, in 10 CFR 72.104(a), establishes criteria for radioactive materials in effluents and direct radiation from an Independent Spent Fuel Storage Installation (ISFSI).

During normal operations and anticipated occurrences, the annual dose equivalent to any real individual who is located beyond the controlled area must not exceed:

- 25 mrem per year to the total body,
- 75 mrem per year to the thyroid, and
- 25 mrem per year to any other organ as a result of:
    1. Planned discharges of radioactive material, radon and its decay products excepted, to the environment,
    2. Direct radiation from ISFSI, and
    3. Any other radiation from uranium fuel cycle operations in the region.

3.9.2 Environmental Protection Agency (EPA)

The EPA, in 40 CFR 190.10, Subpart B, sets forth the environmental standards for the uranium fuel cycle. During normal operation, the annual dose to any member of the public from the entire uranium fuel cycle shall be limited to:

- less than or equal to 25 mrem per year to the total body,
- less than or equal to 75 mrem per year to the thyroid, and
- less than or equal to 25 mrem per year to any other organ

4.0 SAMPLE SUMMARY TABLES IN BRANCH TECHNICAL POSITION FORMAT

All sample data is summarized in table form. The tables are titled "Radiological Environmental Monitoring Program Annual Summary" and use the following format as specified in the NRC Branch Technical Position:

Column

1. Sample Medium

2. Type and Number of Analyses Performed

3. Required Lower Limits of Detection (LLD), see Section 3.8, Table 3.8-1. This wording indicates that inclusive data is based on 4.66 S_b (sigma) of background (See Section 3.7).

4. The mean and range of the positive measured values of the indicator locations.

5. The mean, range, and location of the highest indicator annual mean. Location designations are keyed to Table 3.3-1 in Section 3.3.

6. The mean and range of the positive measured values of the control locations.

7. The number of non-routine reports sent to the Nuclear Regulatory Commission.

NOTE: Only positive measured values are used in statistical calculations.

TABLE 4.0-1
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY
JANUARY - DECEMBER 2019*

MEDIUM (UNITS)	TYPE AND NUMBER OF ANALYSES*	LLD(a)	INDICATOR LOCATIONS: MEAN (f)/RANGE	LOCATION (b) OF HIGHEST ANNUAL MEAN; LOCATION & MEAN (f)/RANGE	CONTROL LOCATION: MEAN (f)/RANGE	NUMBER OF NONROUTINE REPORTS
Shoreline Sediment (pCi/kg-dry)	GSA (4): (Gamma-Spectrum Analysis)					
	Cs-134	150	<LLD	<LLD	<LLD	0
	Cs-137	180	<LLD	<LLD	<LLD	0
Fish (pCi/kg-wet)	GSA (18):					
	Mn-54	130	<LLD	<LLD	<LLD	0
	Co-58	130	<LLD	<LLD	<LLD	0
	Fe-59	260	<LLD	<LLD	<LLD	0
	Co-60	130	<LLD	<LLD	<LLD	0
	Zn-65	260	<LLD	<LLD	<LLD	0
	Cs-134	130	<LLD	<LLD	<LLD	0
	Cs-137	150	<LLD	<LLD	<LLD	0

TABLE 4.0-1
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY
JANUARY - DECEMBER 2019*

MEDIUM (UNITS)	TYPE AND NUMBER OF ANALYSES*	LLD(a)	INDICATOR LOCATIONS: MEAN (f)/RANGE	LOCATION (b) OF HIGHEST ANNUAL MEAN; LOCATION & MEAN (f)/RANGE	CONTROL LOCATION: MEAN (f)/RANGE	NUMBER OF NONROUTINE REPORTS
Surface Water (pCi/liter)	H-3 (8):	3000(c)	<LLD	<LLD	<LLD	0
	GSA (24):					
	Mn-54	15	<LLD	<LLD	<LLD	0
	Fe-59	30	<LLD	<LLD	<LLD	0
	Co-58	15	<LLD	<LLD	<LLD	0
	Co-60	15	<LLD	<LLD	<LLD	0
	Zn-65	30	<LLD	<LLD	<LLD	0
	Zr-95	15	<LLD	<LLD	<LLD	0
	Nb-95	15	<LLD	<LLD	<LLD	0
	I-131	15(c)	<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
TLD (mrem per standard month)	Gamma Dose (128) (i)	(d)	5.3 (116/116) 3.0-9.9	TLD #87 (g) 9.2 (4/4) 0.1 MILES at 333° 8.6-9.5	4.8 (12/12) 3.3-5.6	0

TABLE 4.0-1
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY
JANUARY - DECEMBER 2019*

MEDIUM (UNITS)	TYPE AND NUMBER OF ANALYSES*	LLD(a)	INDICATOR LOCATIONS: MEAN (f)/RANGE	LOCATION (b) OF HIGHEST ANNUAL MEAN; LOCATION & MEAN (f)/RANGE	CONTROL LOCATION: MEAN (f)/RANGE	NUMBER OF NONROUTINE REPORTS
Air Particulates ($10E^{-3}$ pCi/m^3)	Gross Beta (260):	10	14.4 (208/208) 8.1-25.8	R-4 14.6 (52/52) 1.8 MILES at 145° 8.9-23.0	14.6 (52/52) 8.0-23.9	0
	I-131 (260):	70	<LLD	<LLD	<LLD	0
	GSA (20):					
	Cs-134	50	<LLD	<LLD	<LLD	0
	Cs-137	60	<LLD	<LLD	<LLD	0
Milk (pCi/liter)	GSA (36): (e) (h)					
	Cs-134	15	<LLD	<LLD	<LLD	0
	Cs-137	18	<LLD	<LLD	<LLD	0
	Ba/La140	15	<LLD	<LLD	<LLD	0
	I-131 (36): I-131	1	<LLD	<LLD	<LLD	0
Food Products (pCi/kg-wet)	GSA (12):					
	I-131	60	<LLD	<LLD	<LLD	0
	Cs-134	60	<LLD	<LLD	<LLD	0
	Cs-137	80	<LLD	<LLD	<LLD	0

TABLE NOTES:

* = Data for Table 4.0-1 is based on ODCM required samples only.

(a) = LLD values as required by the ODCM. LLD units are specified in the medium column.

(b) = Location is distance in miles and direction in compass degrees based on NMP-2 reactor center-line rounded to the nearest 1/10 mile. Units in this column are specified in medium column.

(c) = The ODCM specifies an I-131 and tritium LLD value for surface water analysis (non-drinking water) of 15 pCi/liter and 3000 pCi/liter respectively.

(d) = The ODCM does not specify a particular LLD value to environmental TLDs.

(e) = The ODCM criteria for indicator milk sample locations include locations within 5.0 miles of the site. There are no milk sample locations within 5.0 miles of the site. Therefore, the only sample location required by the ODCM is the control location. There was one optional location for 2019. The data is being included in the summary.

(f) = Fraction of number of detectable measurements to total number of measurements. Mean and range results are based on detectable measurements only.

Example: $\frac{\text{Mean of detectable measurements (detectable measurements/total measurements)}}{\text{Minimum detectable-Maximum detectable}}$

(g) = This dose is not representative of doses to a member of the public since this area is located near the north shoreline which is in close proximity to the generating facility and is not accessible to members of the public (See Section 5.2.4, TLDs).

(h) = Data includes results from optional samples in addition to samples required by the ODCM.

(i) = Indicator TLD locations are: #7, 15, 18, 23, 56, 58, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, and 98**. Control TLDs are TLDs located beyond the influence of the site (TLD #: 8, 14 and 49).

** - NMP1 and NMP2 additional TLD

5.0 DATA EVALUATION AND DISCUSSION

Introduction

Each year the results of the annual Radiological Environmental Monitoring Program (REMP) are evaluated considering plant operations at the site, the natural processes in the environment, and the archive of historical environmental radiological data. A number of factors are considered in the course of evaluating and interpreting the annual environmental radiological data. This interpretation can be made using several methods including trend analysis, population dose estimates, risk estimates to the general population based on significance of environmental concentrations, effectiveness of plant effluent controls, and specific research areas. The report not only presents the data collected during the 2019 sample program but also assesses the significance of radionuclides detected in the environment. It is important to note that detection of a radionuclide is not, of itself, an indication of environmental significance. Evaluation of the impact of the radionuclide in terms of potential increased dose to man, in relation to natural background, is necessary to determine the true significance of any detection.

Units of Measure

Some of the units of measure used in this report are explained below.

Radioactivity is the number of atoms in a material that decay per unit of time. Each time an atom decays, radiation is emitted. The *curie* (Ci) is the unit used to describe the activity of a material and indicates the rate at which the atoms are decaying. One curie of activity indicates the decay of 37 billion atoms per second.

The mass, or weight, of radioactive material that would result in one curie of activity depends on the disintegration rate or half-life. For example, one gram of radium-226 contains one curie of activity, but it would require about 1.5 million grams of natural uranium to equal one curie. Radium-226 is more radioactive than natural uranium on a weight or mass basis.

Smaller units of the curie are used in this report. Two common units are the *microcurie* (μCi), which is one millionth (0.000001) of a curie, and the *picocurie* (pCi), which is one trillionth (0.000000000001) of a curie. The picocurie (pCi) is the unit of radiation that is routinely used in this report.

Dose/Dose to Man

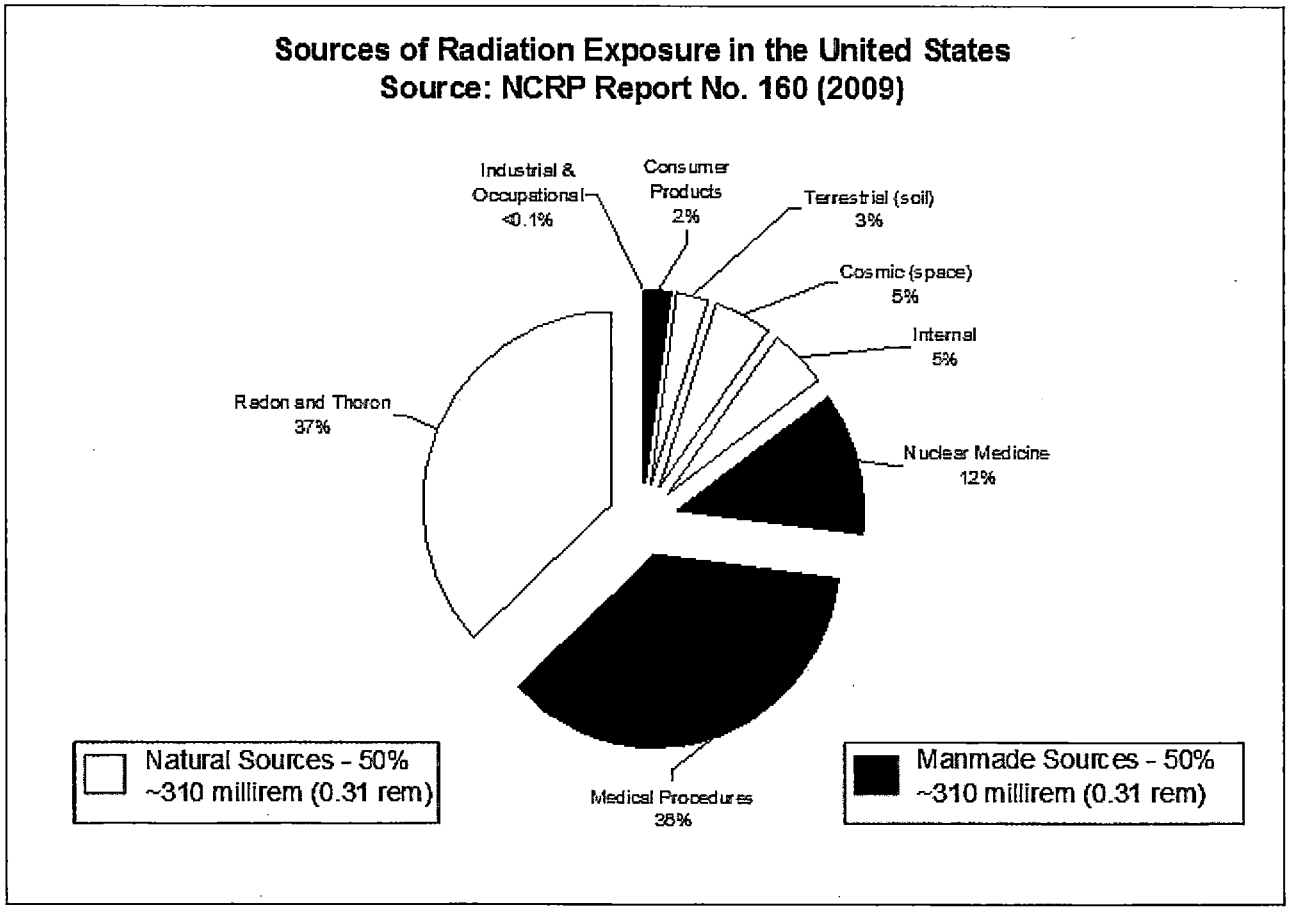
The dose or dose equivalent, simply put, is the amount of ionizing energy deposited or absorbed in living tissue. The amount of energy deposited or ionization caused is dependent on the type of radiation. For example, alpha radiation can cause dense localized ionization that can be up to 20 times the amount of ionization for the same energy imparted as from gamma or x-rays. Therefore, a quality factor must be applied to account for the different ionizing capabilities of various types of radiation. When the quality factor is multiplied by the absorbed dose, the result is the dose equivalent, which is an estimate of the possible biological damage resulting from exposure to any type of ionizing radiation. The dose equivalent is measured in rem (roentgen equivalent man). In terms of environmental radiation, the rem is a large unit. Therefore, a smaller unit, the millirem (mrem) is often used. One millirem (mrem) is equal to 0.001 of a rem.

The term "dose to man" refers to the dose or dose equivalent that is received by members of the general public at or beyond the site boundary. The dose is calculated based on concentrations of radioactive material measured in the environment. The primary pathways that contribute to the dose to man are; the inhalation pathway, the ingestion pathway, and direct radiation.

Discussion

In the United States, a person's average annual radiation dose is 620 mrem. About half that amount comes from naturally occurring radionuclides. Radon and thoron gases account for two-thirds of this exposure, while cosmic, terrestrial, and internal radiation account for the remainder. The other half comes from manmade sources and is mostly from diagnostic medical procedures.

The pie chart below shows a breakdown of radiation sources that contribute to the average annual U.S. radiation dose of 620 mrem. Nearly three-fourths of this dose is split between radon/thoron gas (naturally occurring) and diagnostic medical procedures (manmade).



There are three separate groups of radionuclides that were measured and analyzed for in the 2019 environmental sampling program.

1. The first of these groups consists of the radionuclides that are naturally occurring. The environment contains a significant inventory of naturally occurring radioactive elements. The components of natural or background radiation include the decay of radioactive elements in the earth's crust, a steady stream of high-energy particles from space called cosmic radiation and naturally-occurring radioactive isotopes in the human body like Potassium-40.

   A number of naturally occurring radionuclides are present in the environment. These are expected to be present in many of the environmental samples collected in the vicinity of the Nine Mile Point Site. Some of the radionuclides normally present include:

   - *Beryllium*-7, present as a result of the interaction of cosmic radiation with the upper atmosphere
   - *Potassium*-40 and *Radium*-226, naturally occurring radionuclides found in the human body and throughout the environment

   Beryllium-7 and Potassium-40 are especially common in REMP samples. Since they are naturally occurring and are abundant, positive results for these radionuclides are reported in some cases in Section 6.0 of this report. Comparisons of program samples to naturally occurring radiation are made throughout this section to help put program results into perspective and to aid the reader in determining what, if any, significant impact is demonstrated by the REMP results.

2. The second group consists of radionuclides that may be detected in the environment as a result of the detonation of thermonuclear devices in the earth's atmosphere. Atmospheric nuclear testing during the early 1950's produced a measurable inventory of radionuclides presently found in the lower atmosphere, as well as in ecological systems. In 1963, an Atmospheric Test Ban Treaty was signed. Since the treaty, the global inventory of manmade radioactivity in the environment has been greatly reduced through the decay of short lived radionuclides and the removal of radionuclides from the food chain by such natural processes as weathering and sedimentation. This process is referred to in this report as ecological cycling. Since 1963, several atmospheric weapons tests have been conducted by the People's Republic of China and underground weapons testing by India, Pakistan & North Korea. In some cases, the usual radionuclides associated with nuclear detonations were detected for several months following the test, and then after a peak detection period, diminished to a point where most could not be detected. Although reduced in frequency, atmospheric testing continued into the 1980's. The resulting fallout or deposition from these most recent tests has influenced the background radiation in the vicinity of the site and was evident in many of the sample media analyzed over the years. Fallout radionuclides from nuclear weapons testing included Cesium-137 and Strontium-90. The highest weapons testing concentrations were noted in samples collected for the 1981 REMP. Cs-137 was the major byproduct of this testing and is still occasionally detected in a few select number of environmental media.

3. The third group consists of radionuclides that may be detected in the environment are related to nuclear power technology. These radionuclides are the byproduct of the operation of light water reactors. These byproduct radionuclides, the same as those produced in atmospheric weapons testing, are found in the Chernobyl and Fukushima Daiichi Nuclear Power Station fallout. This commonality makes a determination of the source of these radionuclides, which may be detected in environmental samples, difficult. During 2019, there were no plant-related radionuclides detected in the REMP sampling.

   A number of factors must be considered in performing radiological sample data evaluation and interpretation. The evaluation is made using several approaches including trend analysis and dose to man. An attempt has been made not only to report the data collected during 2019, but also to assess the significance of the radionuclides detected in the environment as compared to naturally occurring and manmade radiation sources. It is important to note that detected concentrations of radionuclides in the local environment as a result of man's technology are very small and are of no, or little, significance from an environmental or dose to man perspective.

The 2009 per capita average dose was determined to be 620 mrem per year from all sources, as noted in National Council on Radiation Protection and Measurement (NCRP) Report No. 160. This average dose includes such exposure sources as industrial & occupational, consumer products, terrestrial, cosmic, internal, nuclear medicine, medical procedures, radon and thoron. The 2009 per capita dose rate due to naturally occurring sources was 310 mrem per year. The per capita radiation dose from nuclear power production nationwide is less than 1 mrem per year.

The naturally occurring gamma radiation in the environs of the Nine Mile Point site, resulting from radionuclides in the atmosphere and in the ground, accounts for approximately 50 mrem per year. This dose is a result of radionuclides of cosmic origin (for example, Be-7) and of primordial origin (Ra-226, K-40, and Th-232). A dose of 50 mrem per year, as a background dose, is significantly greater than any possible doses as a result of routine operations at the site during 2019.

The results of each sample medium are discussed in detail in Sections 5.1 and 5.2. This includes a summary of the results, the estimated environmental impact, a detailed review of any relevant findings with a dose to man estimate where appropriate, and an analysis of possible long-term and short-term trends.

During routine implementation of the REMP, additional or optional environmental pathway media are sampled and analyzed. These samples are obtained to:

- Expand the area covered by the program beyond that required by the ODCM
- Provide more comprehensive monitoring than is currently required
- Monitor the secondary dose to man pathways
- Maintain the analytical data base established when the plants began commercial operation

The optional samples that are collected will vary from year to year. In addition to the optional sample media, additional locations are sampled and analyzed for those pathways required by the ODCM. These additional sample locations are obtained to ensure that a variety of environmental pathways are monitored in a comprehensive manner. Data from additional sample locations that are associated with the required ODCM sample media are included in the data presentation and evaluation. When additional locations are included, the use of this data is specifically noted in Sections 5.1 and 5.2.

Section 6.0 contains the analytical results for the sample media addressed in the report. Tables are provided for each required sample medium analyzed during the 2019 program.

Section 7.0, titled Historical Data Tables, contains statistics from previous years' environmental sampling. The process of determining the impact of plant operation on the environment includes the evaluation of past analytical data to determine if trends are changing or developing. As state-of-the-art detection capabilities improve, data comparison is difficult in some cases. For example, Lower Limits of Detections (LLDs) have improved significantly since 1969 due to technological advances in laboratory procedures and analytical equipment.

5.1 AQUATIC PROGRAM

The aquatic program consists of samples collected from three environmental pathways.

These pathways are:

- Shoreline Sediment
- Fish
- Surface Water

Section 6.0, Tables 6-1 through 6-4 present the analytical results for the aquatic samples collected for the 2019 sampling period.

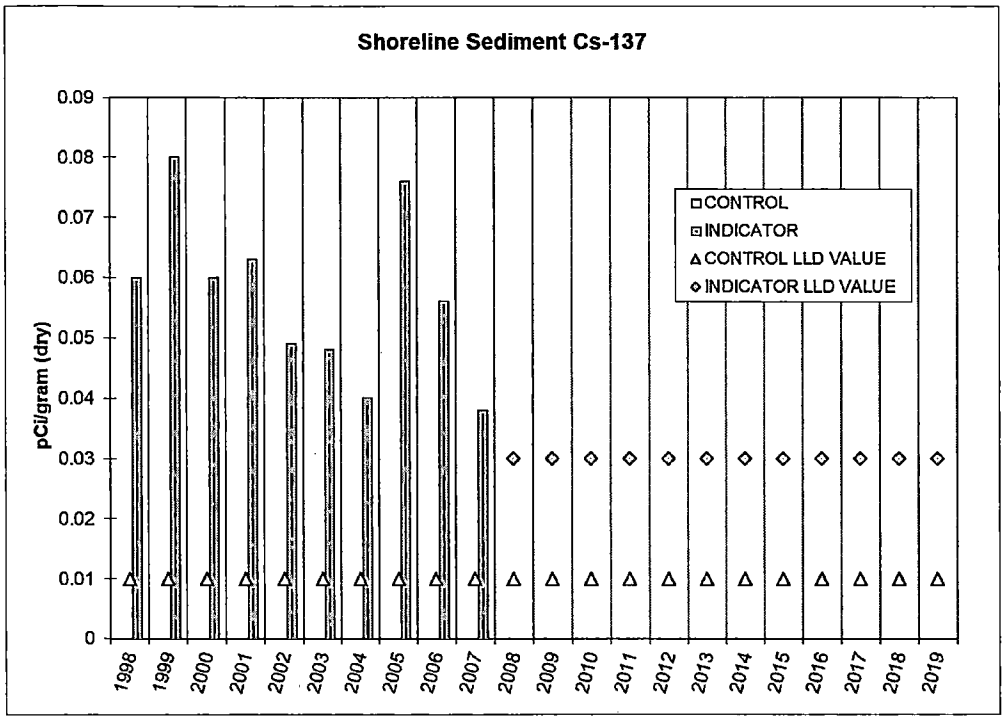
5.1.1 SHORELINE SEDIMENT RESULTS

A. Results Summary

Shoreline sediment samples were obtained in May and October of 2019 at one offsite control location (Lang's Beach located near Oswego Harbor) and at one indicator location (Sunset Bay) which is an area east of the site considered to have recreational value.

A total of four sediment samples were collected for the 2019 sample program, two indicator and two controls. No plant-related radionuclides were detected in the 2019 shoreline sediment samples.

The following is a graph of the average Cs-137 concentration in shoreline sediment samples over 22 years. The graph illustrates a general downward trend in the Cs-137 concentrations since 1997. No Cs-137 has been detected in shoreline sediment samples since 2007.



B. Data Evaluation and Discussion

Shoreline sediment samples are routinely collected twice per year from the shoreline of Lake Ontario. Samples are collected from one indicator location (Sunset Bay), and one control location (Lang's Beach). Samples were collected from both the indicator and control locations in May and October 2019. The results of these sample collections are presented in Section 6.0, Table 6-1, "Concentrations of Gamma Emitters in Shoreline Sediment Samples – 2019". Potassium–40 (K-40) and Radium-226 (Ra-226), Thorium-228 (Th-228) and Thorium-232 (Th-232) all naturally-occurring isotopes, were the only radionuclides detected in the sediment samples.

C. Dose Evaluation

The calculated potential whole body and skin doses which may result from the measured Cs-137 concentrations in previous years are extremely small and are insignificant when compared to natural background doses.

The radiological impact of Cs-137 measured in the shoreline sediment can be evaluated on the basis of dose to man. In the case of shoreline sediments, the critical pathway is direct radiation to the whole body and skin. Using the parameters provided in Regulatory Guide 1.109, the potential dose to man in mrem per year can be calculated. The following regulatory guide values were used in calculating the dose to man:

- A teenager spends 67 hours per year at the beach area or on the shoreline,
- The sediment has a mass of 40 kg/m^2 (dry) to a depth of 2.5 cm,
- The shoreline width factor is 0.3, and
- The maximum 2019 LLD concentration of <0.070 pCi/g (dry).

Using these conservative parameters, the potential dose to the maximum exposed individual (teenager) would be 0.00024 mrem/year to the whole body and 0.00028 mrem/year to the skin. This calculated dose is very small and is insignificant when compared to the natural background annual exposure of approximately 52 mrem as measured by control TLDs in the vicinity of the site.

D. Data Trends

Cs-137 was not detected at the indicator and control sample locations from 2008 through 2019.

The general absence of Cs-137 in the indicator and control samples can be attributed to changing lake levels and shoreline erosion. Recent soil samples, from locations beyond any expected influence from the site, have contained levels of Cs-137 equal to or greater than the concentrations found in shoreline samples collected in the past. Cs-137 is commonly found in soil samples and is attributed to weapons testing fallout.

The previous ten-year data trend for indicator shoreline samples showed an overall downward trend in concentration measured at the indicator sample locations. Over the previous ten-year period maximum concentration at the indicator locations was 0.04 pCi/g (dry) in 2007. Cs-137 was not detected at the indicator location for 2008 through 2019. This continues to support the long term decreasing trend in Cs-137 concentration in shoreline sediment samples. Cs-137 was not detected in the control samples collected over the previous ten years.

Shoreline sediment sampling at the indicator location commenced in 1985. Prior to 1985, no data was available for long term trend analysis.

Section 7.0, Tables 7-1 and 7-2 illustrate historical environmental data for shoreline sediment samples.

5.1.2 FISH SAMPLE RESULTS

A. Results Summary

A total of 18 fish samples were collected for the 2019 sample program. The analytical results for the 2019 fish samples showed no detectable concentration of radionuclides that would be attributable to plant operations at the site or past atmospheric weapons testing. Since 2002, Cs-137 has not been measured in fish samples. Over the previous 20 years prior to 2003, Cs-137 has been detected at a combination of both the indicator and/or control locations. (Refer to Tables 7-3 and 7-4). These low levels of Cs-137 represented no significant dose to man or impact on the environment.

The 2019 fish sample results demonstrate that plant operations at the Nine Mile Point Site have no measurable radiological environmental impact on the upper levels of the Lake Ontario food chain. The 2019 results are consistent with previous year's results in that they continue to support the general long-term downward trend in fish Cs-137 concentrations over the past 25 years. Cs-137 was not detected in fish samples collected from 2003 to 2019 at indicator locations.

B. Data Evaluation and Discussion

Fish collections were made utilizing gill nets at one location greater than five miles from the site (Oswego Harbor area) and at two locations in the vicinity of the lake discharges for the NMPNS and the JAFNPP facilities. The Oswego Harbor samples served as control samples while the NMPNS and JAFNPP samples served as indicator samples. All samples were analyzed for gamma emitters. Section 6.0, Table 6-2 shows individual results for all the samples collected in 2019 in units of pCi/kg (wet).

The spring fish collection was made up of nine individual samples representing three separate species. Brown Trout, Lake Trout, and Smallmouth Bass were collected.

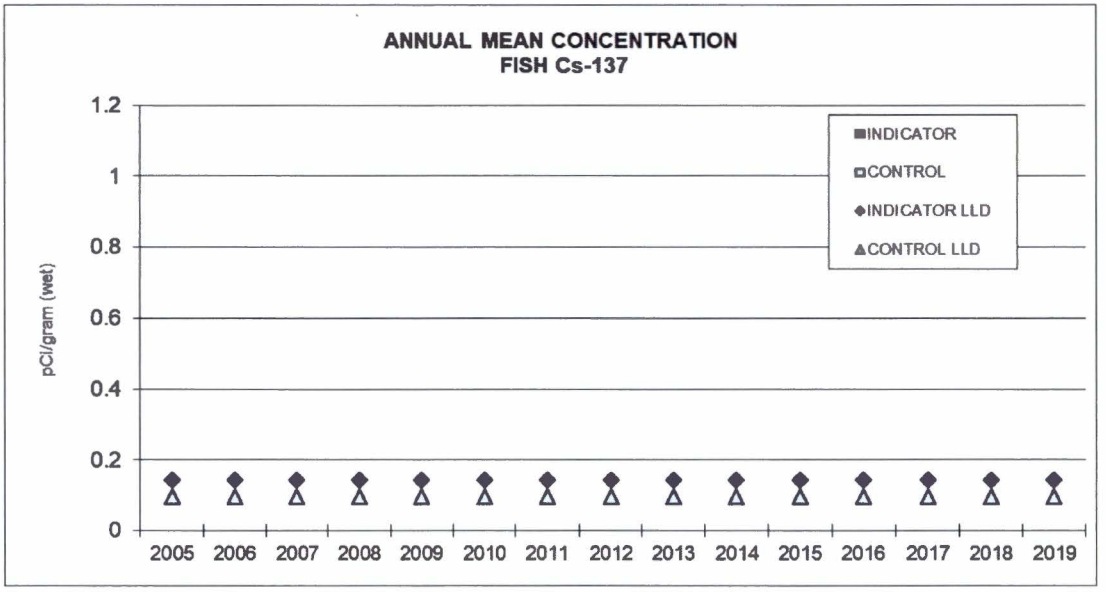
The summer fish collection was comprised of nine individual samples representing three individual species. Brown Trout, Chinook Salmon, and Smallmouth Bass were collected.

C. Dose Evaluation

Fish represent the highest level in the aquatic food chain and have the potential to be a contributor to the dose to man from the operations at the site. The lack of detectable concentrations of plant-related radionuclides in the 2019 fish samples demonstrates that there is no dose to man attributable from operations at the site through the aquatic pathway. Some Lake Ontario fish species may be considered an important food source due to the local sport fishing industry. Therefore, these fish are an integral part of the human food chain.

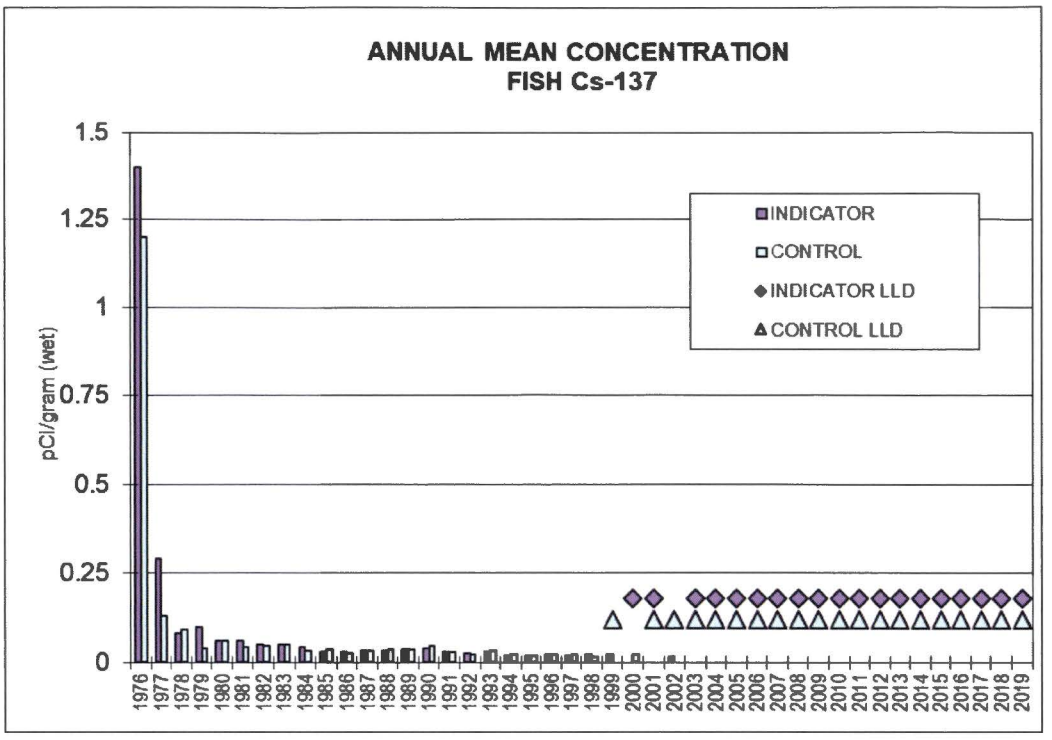
D. Data Trends

The positive detection of Cs-137 in fish samples ceased in 2003. The graph below illustrates the mean control and indicator Cs-137 concentrations for 2019 and the previous 15 years.



The general long-term decreasing trend for Cs-137, illustrated in the graph below, is most probably a result of the cesium becoming unavailable to the ecosystem due to ion exchange with soils and sediments and radiological decay. The concentrations of Cs-137 detected in fish since 1976 are considered to be the result of weapons testing fallout. The general downward trend in concentrations will continue as a function of additional ecological cycling and radiological decay.

The data trend shows a consistent level of Cs-137 measured in fish between 1997 and 1998. After 1998, the number of positive detections drops off as noted in the five-year trend. The 1996 through 2019 results, as a group, are the lowest Cs-137 concentrations measured over the existence of the sample program.



Section 7.0, Tables 7-3 and 7-4 show historical environmental sample data for fish.

5.1.3 SURFACE WATER (LAKE)

A. Results Summary

The ODCM requires that monthly surface water samples be taken from the respective inlet water supplies of the JAFNPP and NRG Energy's Oswego Steam Station. In conjunction with the required samples, three additional Lake Ontario surface water locations are sampled and analyzed. These additional locations are the Oswego City Water Intake, the NMP1 Intake and the NMP2 Intake. Gamma spectral analysis was performed on 24 monthly composite samples from the ODCM locations and on 36 monthly composite samples collected from the additional sample locations. The results of the gamma spectral analyses showed that only naturally-occurring radionuclides were detected in the 60 samples from the five locations collected for the 2019 Sampling Program. Monthly composite samples showed no presence of plant-related gamma emitting isotopes in the waters of Lake Ontario as a result of plant operations.

The monthly surface water samples are composited on a quarterly basis and are analyzed for tritium. A total of 20 samples were analyzed for tritium as part of the 2019 REMP program. The results for the 2019 samples showed no positive detection of tritium above 500 pCi/L except for 4th Qtr. at station Nine Mile Point Unit 2 (Inlet).

B. Data Evaluation and Discussion

Gamma spectral analysis was performed on monthly composite samples from five Lake Ontario sampling locations. No plant-related radionuclides were detected in the 2019 samples. This is consistent with historical data, which has not shown the presence of plant-related radionuclides in surface water samples.

The tritium results for the JAFNPP inlet canal samples contained no positive detections. The 2019 results had LLD values that ranged from <180 pCi/l to <198 pCi/l. The ODCM Control location (Oswego Steam Station inlet canal) results showed no positive detections and the sample results had LLD values in the range of <177 pCi/l to <196 pCi/l.

Tritium was detected in one optional Lake Ontario sample from station Nine Mile Point Unit 2 (Inlet) with a concentration of 1,126 pCi/l. Tritium was not detected in any of the remaining 11 optional Lake Ontario samples collected in the 2019 program.

The Oswego City Water Supply is sampled to monitor drinking water quality and is representative of a control location due to its distance from the site. The city water inlet is located 7.8 miles west of the site in an "upstream" direction based on the current patterns in the lake.

The following is a summary of LLD results for the 2019 sample program:

Sample Location	**Tritium Concentration pCi/liter**		
	Minimum	**Maximum**	**Mean (Annual)**
JAF Inlet (Indicator)*	<180	<198	<189
Oswego Steam Inlet (Control)*	<177	<196	<188
NMP #1 Inlet	<180	<193	<188
NMP #2 Inlet	<175	1126	<420
Oswego City Water Supply	<179	<195	<189

* Sample location required by ODCM

The above LLD values are below the ODCM required LLD value of 3000 pCi/l. Analytical results for surface water samples are found in Section 6.0, Tables 6-3 through 6-4.

C. Dose Evaluation

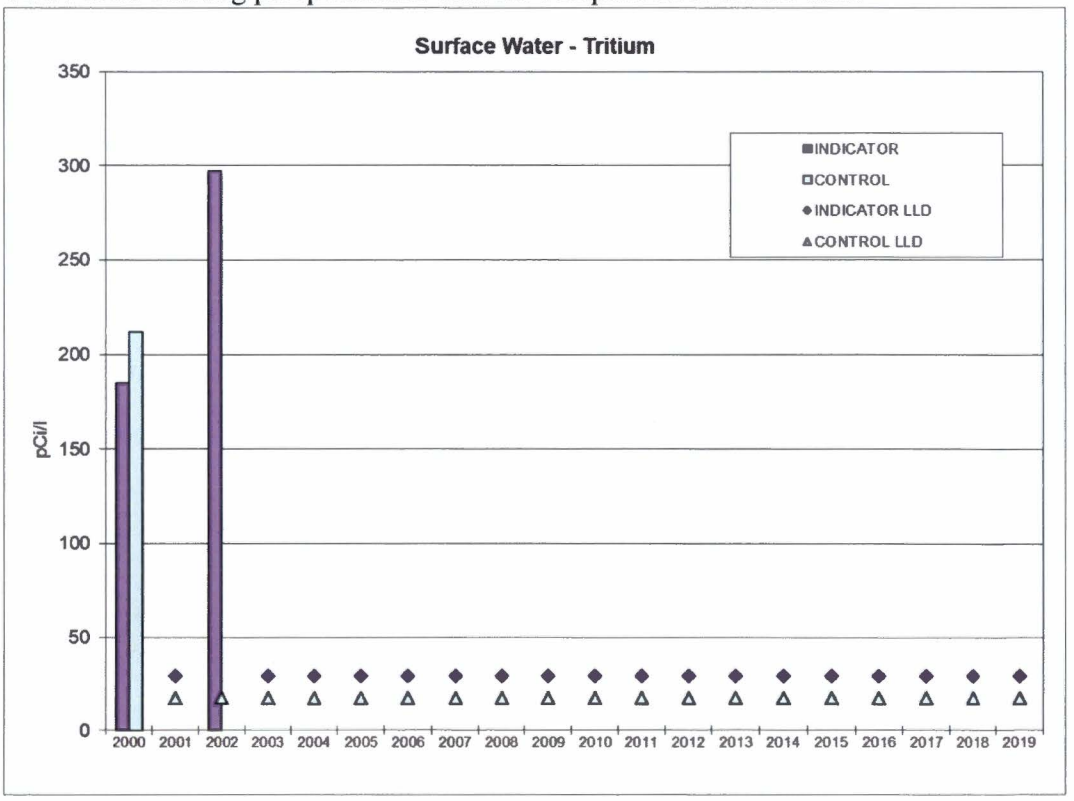
The radiological impact to members of the public from low levels of tritium in water is insignificant. This can be illustrated by calculating a dose to the whole body and maximum organ using the maximum LLD value and Regulatory Guide 1.109 methodology. Based on a water ingestion rate of 510 liters/yr and a maximum LLD concentration of 1126 pCi/l, the calculated dose would be less than 0.117 mrem per year to the child whole body and less than 0.117 mrem per year to the child liver (critical age group/organ).

D. Data Trends

There are no data trends for gamma emitters such as Cs-137 and Co-60 as historically these radionuclides have not been detected in lake water samples.

Tritium results for the 2019 lake water samples were consistent with results from the previous five years for both the indicator and control locations. The mean 2019 tritium concentrations were <188 pCi/l for the control and <189 pCi/l for the indicator locations. For the previous five years, there were no positive detections for the indicator and control locations. This previous five-year data set is consistent with long term tritium results measured at the site. The indicator data from the previous ten-year period, 2008 through 2019, tritium concentrations show no detectable levels of tritium measured. The 1999 mean control value of 365 pCi/l is the highest concentration measured since 1987 and is within the variability of results measured over the life of the program.

The following graph illustrates the concentrations of tritium measured in Lake Ontario over the previous 20 years at both an indicator and control location. Prior to 1985, the Oswego City Water Supply results were used as control location data as this location closely approximates the Oswego Steam Station, the current control location. There is no existing preoperational data for comparison to recent data.



Historical data for Surface Water Tritium is presented in Section 7.0, Tables 7-7 and 7-8

5.1.4 JAFNPP GROUNDWATER

A. Results Summary

A groundwater monitoring program is not required by the ODCM. The program is being implemented as the result of Nuclear Energy Institute (NEI) Ground Water Protection Plan Initiative. 88 groundwater samples were collected from a number of locations shown in Section 3.3, Figure 3.3-7a and listed in Table 3.3-1.

A total of 22 monitoring well locations were sampled for gamma emitters and tritium during the 2019 sample program using 20 indicator locations and two control locations. All sample results for 2019 groundwater monitoring program were less than the LLD for plant-related gamma emitters. Tritium was detected in groundwater monitoring samples at amounts consistent to historical results.

B. Data Evaluation and Discussion

Plant-related gamma emitters and tritium analyses were performed on indicator and control locations. No plant-related radionuclides were detected in the 2019 samples. This is consistent with historical data, which has not shown the presence of plant-related radionuclides in ground water samples.

Monitoring well tritium samples analyzed for the 2019 sample program were analyzed to an LLD of <200 pCi/l. The tritium results for the control locations ranged from <178 to <199 pCi/l and the results from the indicator locations ranged from <172 to 482 pCi/l.

C. Dose Evaluation

There were no groundwater sources in 2019 that were tapped for drinking or irrigation purposes in areas where the hydraulic gradient or recharge properties support contamination migration; therefore, drinking water was not a dose pathway during 2019.

To assess the dose associated with tritium, the highest positive value of 482 pCi/l was used:

- Maximum tritium concentration 482 pCi/l (highest value)
- 510 liters of water consumed per year.

The theoretical dose to the whole body and maximum organ using the maximum value and Regulatory Guide 1.109 methodology were determined. The calculated dose would be <0.050 mrem to the child whole body and <0.050 mrem to the child liver (critical age group/organ).

D. Data Trends

There are no data trends for plant-related gamma emitters or tritium as these radionuclides have not been detected in groundwater samples.

Groundwater tritium results are documented in the Annual Radiological Effluent Release Report for 2019. Historical data for groundwater tritium is present in Section

7.0, Tables 7-27, Historical Environmental Sample Data, Ground water Tritium (Control), Tables 7-28, Historical Environmental Sample Data, Groundwater Monitoring Wells Tritium (Indicator).

5.1.5 NMPNS GROUNDWATER

A. Results Summary

A groundwater monitoring program is not required by the ODCM. The program is being implemented as the result of Nuclear Energy Institute (NEI) Ground Water Protection Plan Initiative. Groundwater samples were collected from a number of locations shown in Section 3.3, Figure 3.3-7b and listed in Table 3.3-1.

A total of 112 tritium samples were collected for the 2019 sample program using 25 indicator locations and three control locations.

A total of 17 monitoring well locations were sampled for gamma emitters using 15 indicator locations and two control locations. A total of 17 wells were sampled for Strontium-89/90 (Sr-89/90) during the 2019 sample program using 17 indicator locations. A total of 28 monitoring well locations were sampled for tritium during the 2019 sample program using 25 indicator locations and three control locations. All sample results for 2019 groundwater monitoring program were less than the LLD for plant-related gamma emitters and Strontium 89/90.

B. Data Evaluation and Discussion

Plant-related gamma emitters and Sr-89/90 analyses were performed on indicator and control locations. No plant-related radionuclides were detected in the 2019 samples. This is consistent with historical data, which have not shown the presence of plant-related radionuclides in ground water samples.

Monitoring well tritium samples analyzed for the 2019 sample program were analyzed to an LLD of 200 pCi/l. The tritium results for the control locations ranged from <182 to 197 pCi/l and the results from the indicator locations ranged from <154 to 366 pCi/l.

C. Dose Evaluation

Sampling for groundwater, as found in Section D 3.5.1 of the NMP2 ODCM, was not required during 2019. There were no groundwater sources in 2019 that were tapped for drinking or irrigation purposes in areas where the hydraulic gradient or recharge properties support contamination migration; therefore, drinking water was not a dose pathway during 2019.

To assess the dose associated with tritium, the highest value was used:

- Maximum tritium concentration 366 pCi/l (highest value)
- 510 liters of water consumed per year.

The theoretical dose to the whole body and maximum organ using the maximum value and Regulatory Guide 1.109 methodology were determined. The calculated dose would be <0.038 mrem to the child whole body and <0.038 mrem to the child

liver (critical age group/organ).

D. Data Trends

There are no data trends for plant-related gamma emitters or Sr-89/90 as these radionuclides have not been detected in groundwater samples.

Groundwater tritium results are documented in the Annual Radiological Effluent Release Report for 2019. Historical data for groundwater tritium is present in Section 7.0, Tables 7-25, Historical Environmental Sample Data, Ground water Tritium (Control), Tables 7-26, Historical Environmental Sample Data, Groundwater Monitoring Wells Tritium (Indicator).

5.2 TERRESTRIAL PROGRAM

The terrestrial program consists of samples collected from four environmental pathways. These pathways are:

- Airborne particulate and radioiodine
- Direct Radiation
- Milk
- Food Products

Section 6.0, Tables 6-5 through 6-12 present the analytical results for the terrestrial samples collected for the 2019 reporting period.

5.2.1 AIR PARTICULATE GROSS BETA

A. Results Summary

Weekly air samples were collected and analyzed for particulate gross beta activity. For the 2019 program, a total of 52 samples were collected from control location R5 and 208 samples were collected from indicator locations R1, R2, R3, and R4. These five locations are required by the ODCM. Additional air sampling locations are maintained and are discussed in Section 5.2.1.B below. The mean gross beta concentration for samples collected from the control location (R5) in 2019 was 0.015 pCi/m^3. The mean gross beta concentration for the samples collected from the indicator locations (R1, R2, R3, and R4) in 2019 was 0.014 pCi/m^3. The consistency between the indicator and control mean values, demonstrates that there are no increased airborne radioactivity levels in the general vicinity of the site from plant effluents.

B. Data Evaluation and Discussion

The air monitoring system consists of 15 sample locations, five required by the ODCM

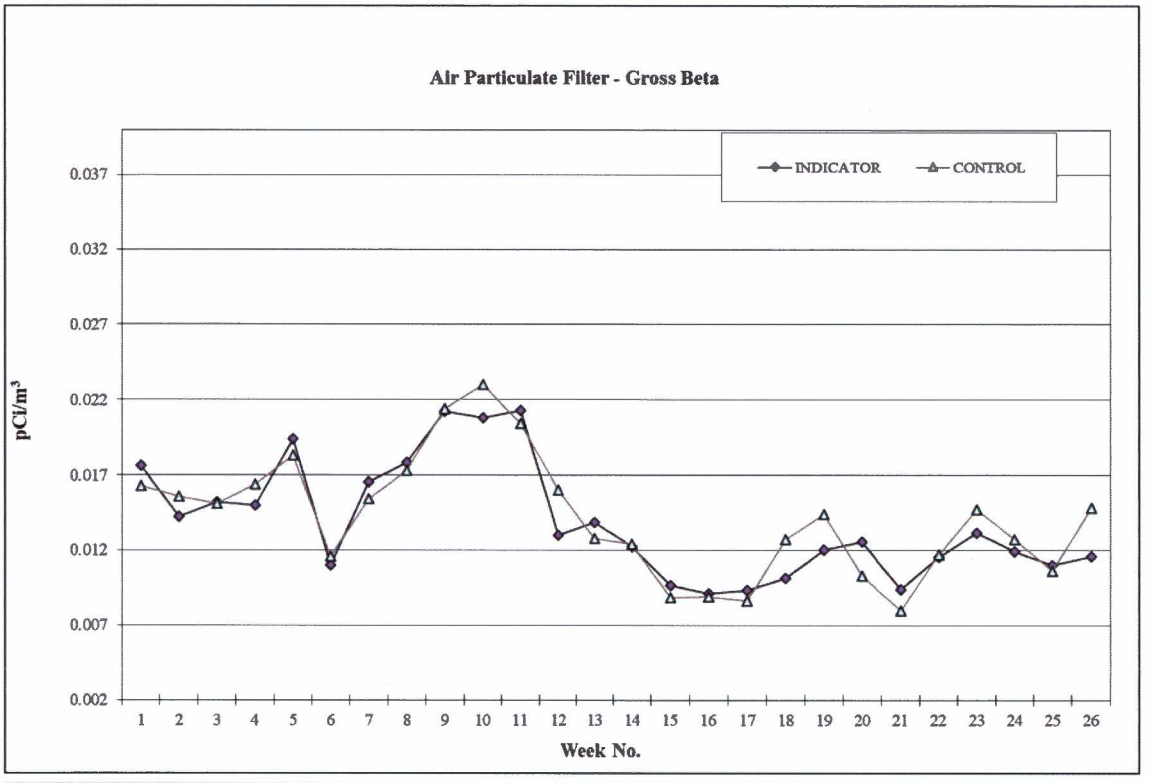
and ten optional locations. The optional offsite locations are designated as D2, E, F and G OFF. The optional onsite locations are designated as D1, G ON, H, I, J and K. Each location is sampled weekly for particulate gross beta activity. A total of 779 samples were collected and analyzed as part of the 2019 program. Gross beta analysis requires that the samples be counted no sooner than 24 hours after collection. This allows for the decay of short half-life naturally-occurring radionuclides, thereby increasing the sensitivity of the analysis for plant-related radionuclides.

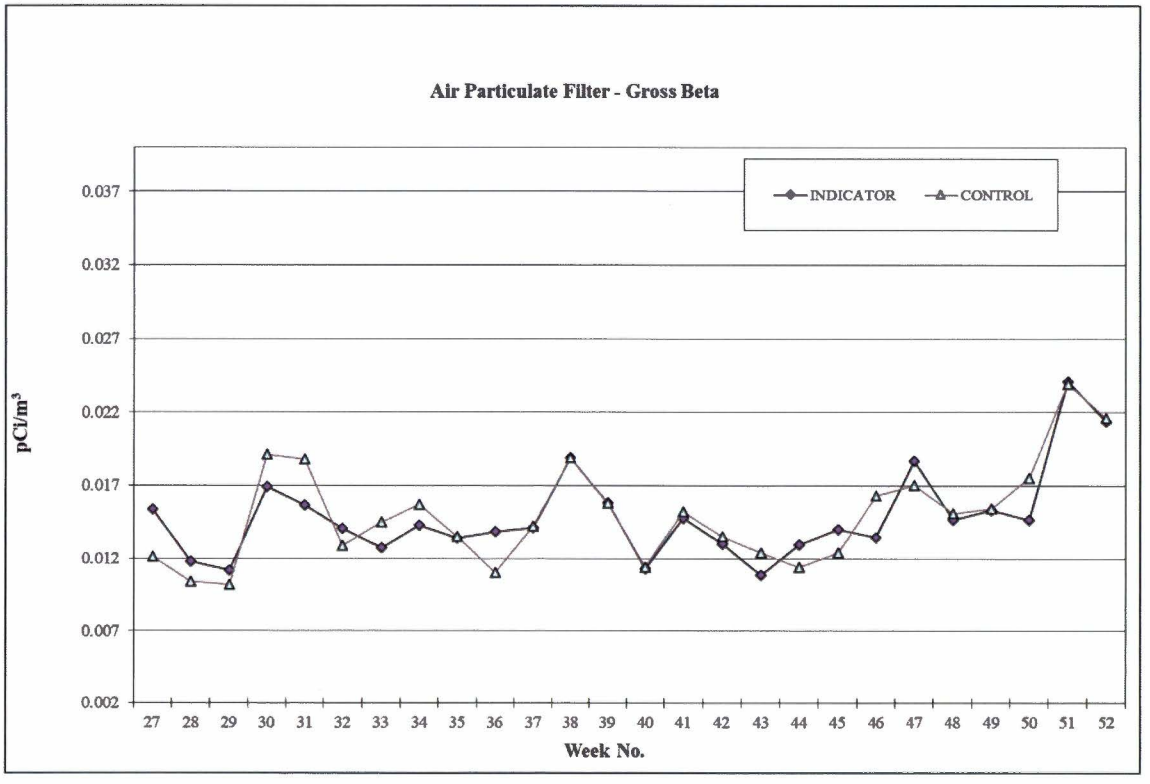
Section 6.0, Tables 6-5 and 6-6 present the weekly gross beta activity results for samples collected from the offsite and onsite locations.

The minimum, maximum and average gross beta results for sample locations required by the ODCM were as follows:

	Concentration pCi/m^3		
Location	Minimum	Maximum	Mean
R1	0.008	0.024	0.014
R2	0.008	0.025	0.015
R3	0.009	0.026	0.014
R4	0.009	0.023	0.015
R5 (control)	0.008	0.024	0.015

The mean weekly gross beta concentrations measured in 2019 are illustrated in the following graphs:





The fluctuations observed in the gross beta activity over the year can be attributed to changes in the environment, especially seasonal changes. The concentrations of naturally-occurring radionuclides in the lower levels of the atmosphere directly above the land are affected by time-related processes such as wind direction, precipitation, snow cover, soil temperature and soil moisture content.

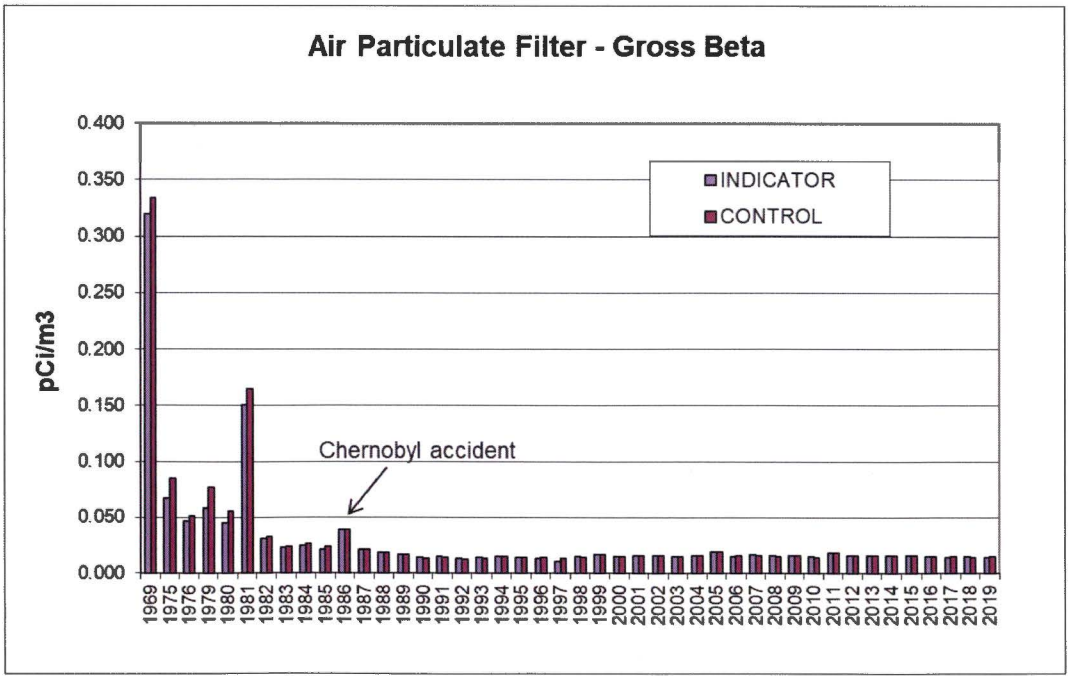
C. Dose Evaluation

Dose calculations are not performed based on gross beta concentrations. Dose to man as a result of radioactivity in air is calculated using the specific radionuclide and the associated dose factor. See Section 5.2.2.C for dose calculations from air concentrations. The dose received by man from air gross beta concentration is a component of the natural background.

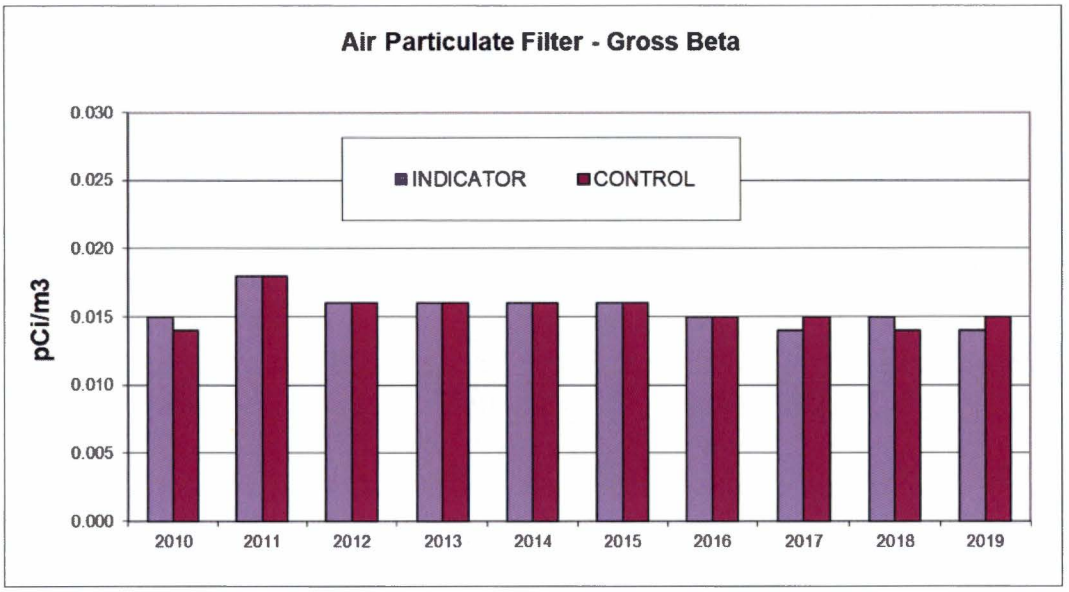
D. Data Trends

With the exception of the 1986 sample data, which was affected by the Chernobyl accident, the general trend in air particulate gross beta activity has been one of decreasing activity since 1981, when the mean control value was 0.165 pCi/m^3. The 1981 samples were affected by fallout from a Chinese atmospheric nuclear test which was carried out in 1980.

The mean gross beta concentration measured in 1969 to 2019 are illustrated in the following graph:



The trend for the previous five years represents a base line concentration or natural background level for gross beta concentrations. This trend is stable with minor fluctuations due to natural variations. The change in concentrations over the period of 2010 through 2019 is very small. This is illustrated by the following graph.



The mean annual gross beta concentration at the control station (R5) has remained steady with a narrow range of 0.014 pCi/m^3 to 0.018 pCi/m^3. The mean annual concentrations for the indicator stations for this same time period were similar to the control and ranged from a minimum of 0.014 pCi/m^3 to a maximum mean of 0.018 pCi/m^3 in 2011.

Historical data of air particulate gross beta activity are presented in Section 7.0, Tables 7-9 and 7-10.

5.2.2 QUARTERLY PARTICULATE COMPOSITES (GAMMA EMITTERS)

A. Results Summary

Fifteen air monitoring stations are maintained around JAFNPP, NMP1, and NMP2. Five of the 15 air monitoring stations are required by the ODCM and are located offsite near the site boundary and offsite as a control location. Ten additional air sampling stations are also maintained as part of the sampling program. Together, these 15 continuous air sampling stations make up a comprehensive environmental monitoring network for measuring radioactive air particulate concentrations in the environs of the site. Annually, the 15 air monitoring stations maintained around JAFNPP, NMP1 and NMP2 provide 780 individual air particulate samples which are assembled by location into 60 quarterly composite samples. The quarterly composites are analyzed using gamma spectroscopy.

No plant-related gamma emitting radionuclides were detected in any of the air particulate filter samples collected during 2019.

The gamma analysis results for the quarterly composite samples routinely showed positive detections of Be-7 and K-40. Both of these radionuclides are naturally occurring.

B. Data Evaluation Discussion

A total of 15 air sampling stations are in continuous operation and located both onsite and in the offsite sectors surrounding the Nine Mile Point Site. Each of the weekly air particulate filters collected for the quarter is assembled by location to form quarterly composite samples. The quarterly composite samples required by the ODCM are composite samples assembled for R1, R2, R3, R4 and R5. Other sample locations not required by the ODCM, for which analytical results have been provided, include six onsite locations and four offsite locations. The analytical results for the 60 air particulate filter composites in 2019 showed no detectable activity of plant related radionuclides.

The results of the quarterly composite samples are presented in Section 6.0, Table 6-9.

C. Dose Evaluation

The calculated dose as a result of plant effluents is not evaluated due to the fact that no plant related radionuclides were detected in 2019. The monthly air particulate sampling program demonstrated no offsite dose to man from this pathway as a result of operations of the plants located at the Nine Mile Point Site (NMP).

D. Data Trends

No plant related radionuclides were detected during 2019 at the offsite air monitoring locations.

The ten-year database of air particulate composite analysis shows that there is no buildup or routine presence of plant related radionuclides in particulate form in the atmosphere around the site. Historically Co-60 was detected in each of the years from 1977 through 1984 at both the indicator and control locations, with the exception of 1980 when Co-60 was not detected at the control location. The presence of Co-60 in the air samples collected during these years was the result of atmospheric weapons testing. Co-60 was again detected in an offsite 2000 indicator sample and was the only positive detection of Co-60 since 1984. The detection of Co-60 in the one 2000 sample was an isolated event associated with effluents from the NMP1 facility. There have been no subsequent measurable concentrations of Co-60 in the environment surrounding the NMP site.

Historical data shows that Cs-137 is the fission product radionuclide most frequently detected in the air particulate filter composites. Cs-137 was detected in each of the years from 1977 through 1983 at both the control and indicator sampling locations. The presence of Cs-137 in the air samples collected during these years was the result of atmospheric weapons testing. Cs-137 was again detected in 1986 as a result of the Chernobyl accident. Since 1986 there have been no detections of Cs-137 in the environment surrounding the NMP site.

Historical data for air particulate results are presented in Section 7.0, Tables 7-11 and 7-12.

5.2.3 AIRBORNE RADIOIODINE (I-131)

A. Results Summary

Iodine-131 was not detected in any of the 779 samples analyzed for the 2019 program.

B. Data Evaluation and Discussion

Airborne radioiodine (I-131) is monitored at the 15 air sampling stations also used to collect air particulate samples. There are five offsite locations, required by the ODCM. Ten air sampling locations are also maintained in addition to those required by the ODCM. Six of these stations D1, G, H, I, J and K are located onsite. D2, E, F and G are the optional stations located offsite. Samples are collected using activated charcoal cartridges. They are analyzed weekly for I-131.

The analytical data for radioiodine are presented in Section 6.0, Tables 6-7 and 6-8.

C. Dose Evaluation

The calculated dose as a result of I-131 in plant effluents is not evaluated due to the fact that no I-131 was detected in 2019. The I-131 sampling program demonstrated no offsite dose to man from this pathway as a result of operation of the plants located at Nine Mile Point.

D. Data Trends

There was no I-131 detected in any of the samples, collected from the 15 sample stations, for 2012 through 2019.

In 2011, I-131 was detected at all 15 sampling locations over a three-week period. The positive detections were the result of the Fukushima event. Prior to then, there had been no positive detection of I-131 in air samples collected from 2002 to 2010.

I-131 has previously been detected in samples collected in 1986 and 1987. The 1986 detection of I-131 was the result of the Chernobyl accident and the 1987 detection was the result of plant operations.

I-131 has been detected in the past at control locations. Control samples collected during 1976 had a mean I-131 concentration of 0.60 pCi/m^3. During 1977 this mean decreased to 0.32 pCi/m^3, and further decreased by a factor of ten to 0.03 pCi/m^3 in 1978. I-131 was not detected in samples collected from the control location during 1979 – 1981 and 1983 to 1985. I-131 was detected once at the control location during 1982 at a concentration of 0.039 pCi/m^3.

Historical data for I-131 are presented in Section 7.0, Tables 7-13 and 7-14.

5.2.4 DIRECT RADIATION THERMOLUMINESCENT DOSIMETERS (TLD)

A. Results Summary

Thermoluminescent dosimeters (TLDs) are used to measure direct radiation (gamma dose) in the environment. As part of the 2019 environmental monitoring program, TLDs were placed at a total of 72 different environmental TLD locations (32 required by the ODCM and 40 optional locations). These TLDs were placed, collected and read each quarter of 2019. As a result of placing two TLDs at each location, the results presented in this report are the average of two TLD readings obtained for a given location.

The TLDs were placed in the following five geographical locations around the site boundary:

- Onsite (areas within the site boundary, includes TLD #s 3, 4, 5, 6, 7, 23, 24, 25, 26; TLD #s 18, 27, 28, 29, 30, 31, 39, 47, 103, 106, 107 are excluded). The Onsite TLDs are optional and used for plant operations only.
- Site Boundary (area of the site boundary in each of the 16 meteorological sectors: Only TLD results that are not affected by radwaste building direct shine, includes TLD #s 7, 18, 78, 79, 80, 81, 82, 83, 84; TLD #s: 23, 75, 76, 77, 85, 86, 87 are excluded)
- Offsite Sector (area four to five miles from the site in each of the eight-land based meteorological sectors, includes TLD #s: 88, 89, 90, 91, 92, 93, 94, 95)
- Special Interest (areas of high population density, includes TLD #s 15, 56, 58, 96, 97, 98*)
- Control (areas beyond significant influence of the site, includes TLD #s 8, 14, 49)

* - TLD applicable to NMP1 and NMP2 ODCM

All geographical locations are required by the ODCM with the exception of the Onsite area which was optional. Description of the five geographical categories and the designation of specific TLD locations that make up each category is presented in Section 3.1.5, TLD (Direct Radiation) of this report.

A summary of the 2019 dose rates for each of the five geographical locations is as follows:

Geographic Category	Dose in mrem per standard month		
	Min	Max	Mean
Onsite (Optional)	3.0	13.2	5.4
Site Boundary (Inner Ring) *	3.0	5.6	4.6
Offsite Sectors (Outer Ring) *	3.2	5.6	4.5
Special Interest *	3.0	5.6	4.6
Control *	3.3	5.6	4.8

* Geographical locations required by the ODCM

Comparison of annual mean dose rates associated with each geographical location indicate that there is no statistical difference in annual dose as a function of distance from the site boundary. The measured annual dose rate at the nearest resident to the site was consistent with the dose rates measured at the site boundary and control locations. The results for the Site Boundary, Offsite Sectors and Special Interest (Offsite) were well within expected normal variation when compared to the Control TLD results.

The results for the 2019 environmental TLD monitoring program indicate that there was no significant increase in dose rates as a result of operations at the site. The Hydrogen Water Chemistry system and the Independent Spent Fuel Storage Installation (ISFSI) in use at the JAFNPP and NMPNS did not measurably increase the ambient radiation exposure rate beyond the site boundary.

B. Data Evaluation and Discussion

Direct Radiation (Gamma Dose) measurements were taken at 72 different environmental locations during 2019, 32 of which are required by ODCM. These locations are grouped into five geographical location categories for evaluation of results. The five categories include: Onsite, Site Boundary, Offsite Sector, Special Interest and Control locations. All categories are required by the ODCM with the exception of the Onsite TLDs. Onsite TLDs are placed at various locations within the site boundary to provide additional information on direct radiation levels at and around the NMP1, NMP2 and JAFNPP facilities.

Onsite TLD results ranged from 3.0 to 13.2 mrem per standard month resulting in an average dose rate of 5.4 mrem per standard month in 2019.

The highest dose rate measured at a location required by the ODCM was 9.9 mrem per standard month. This TLD, (TLD 85) represents the site boundary maximum dose and is located in the NNW sector along the lakeshore close to the plants (TLD #s: 23, 75, 76, 77, 85, 86 and 87) are influenced by radwaste buildings and radwaste shipping activities. These locations are not accessible to members of the public and the TLD

results for these areas are not representative of dose rates measured at the remaining site boundary locations.

Offsite Sector TLDs, required by the ODCM, located 4 to 5 miles from the site in each of the 8-land based meteorological sectors ranged from 3.2 to 5.6 mrem per standard month with an average dosed rate of 4.5 mrem per standard month.

Special Interest TLDs from all locations ranged from 3.0 to 5.6 mrem per standard month with an average dose rate of 4.6 mrem per standard month.

The Control TLD group required by the ODCM utilized locations positioned well beyond the site. 2019 Control TLD results ranged from 3.3 to 5.6 mrem per standard month with an annual average dose rate of 4.8 mrem standard month.

TLD analysis results are presented in Section 6.0, Table 6-10.

C. Dose Evaluation

2019 annual mean dose rates for each geographic location required by the ODCM (excluding TLD #s: 23, 75, 76, 77, 85, 86, 87) are as follows:

Site Boundary: 4.6 mrem per standard month (TLD #s: 7,18, 78, 79, 80, 81, 82, 83, 84)

Offsite Sectors: 4.5 mrem per standard month (TLD #s: 88, 89, 90, 91, 92, 93, 94, 95)

Special Interest: 4.6 mrem per standard month (TLD #s: 15, 56, 58, 96, 97,98*)

Control: 4.8 mrem per standard month (TLD #s: 8, 14, 49)

* - TLD 98 required by NMPNS ODCM

The measured mean dose rate in the proximity of the closest resident was 4.8 mrem per standard month (TLD #s: 108, 109) which is consistent with the control measurements of 4.8 mrem per standard month.

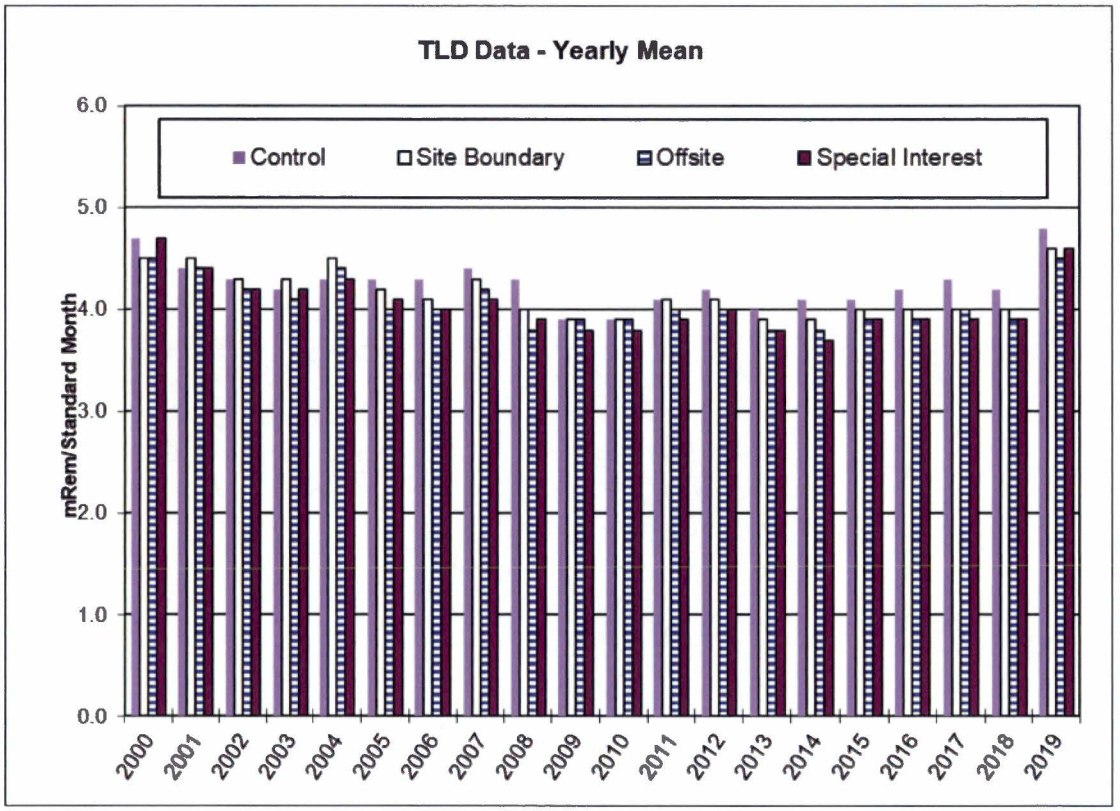
The mean annual dose for each of the geographic location categories demonstrates that there is no statistical difference in the annual dose as a function of distance from the site. The TLD program verifies that operations at the site do not measurably contribute to the levels of direct radiation present in the offsite environment.

D. Data Trends

A comparison of historical TLD results can be made using the different geographical categories of measurement locations. These include Site Boundary TLDs located in each of the 16 meteorological sectors, TLDs located offsite in each land based sector at a distance of 4 to 5 miles from the site, TLDs located at special interest areas and TLDs located at control locations. Site Boundary, Offsite Sector and Special Interest TLD

locations became effective in 1985; therefore, trends for these results can only be evaluated from 1985 to the present.

The following graph illustrates TLD results for the Control, Site Boundary, Offsite Sectors and Special Interest groups from 2000 through 2019:



The 2019 TLD program results, when compared to the previous ten years, showed no significant trends relative to increased dose rates in the environment.

Historical data for the various TLD groupings are presented in Section 7.0, Tables 7-15 through 7-20.

5.2.5 MILK

A. Results Summary

A total of 36 milk samples were collected during the 2019 program and analyzed for gamma emitting radionuclides using gamma spectroscopy. In addition, each sample undergoes an iodine extraction procedure to determine the presence of Iodine-131 (I-131).

I–131, a possible plant related radionuclide, is measured to evaluate the cow milk dose pathway to man. I-131 was not detected in any of the 36 milk samples collected in 2019 from the two milk sample locations.

Gamma spectral analyses of the milk samples showed only naturally occurring radionuclides, such as K-40, were detected in milk samples collected during 2019. K-40 was detected in all indicator and control samples. K-40 is a naturally occurring radionuclide and is found in many environmental sample media.

The 2019 results demonstrate that routine operations of the JAFNPP, NMP1, and NMP2 resulted in no measurable contribution to the dose to the public from the cow/milk pathway.

B. Sampling Overview

Milk samples were collected from one indicator location and one control location. The ODCM requires that three sample locations be within five miles of the site. Based on the milk animal census, there were no adequate milk sample locations within five miles of the site in 2019. Samples were collected from two farms located beyond the five- mile requirement to ensure the continued monitoring of this important pathway. The indicator location was located 8.7 miles from the site. The control samples were collected from a farm located 16.0 miles from the site and in a low frequency wind sector (upwind). The geographic location of each sample location is listed below:

Location No.	Direction From Site	Distance (Miles)
55	E	8.7
77 (Control)	S	16.0

Indicator location #55 and Control location #77 were sampled from April through December. Sampling occurs during the first and second half of each month. Samples were not required to be collected during January through March of 2019 due to I-131 not having been detected in samples collected during November and December of 2018, as stipulated in the ODCM.

C. Data Evaluation and Discussion

Each milk sample is analyzed for gamma emitters using gamma spectral analysis. The I-131 analysis is performed using resin extraction followed by spectral analysis for each sample. I-131 and gamma analysis results for milk samples collected during 2019 are provided in Section 6.0, Table 6-11.

Iodine-131 was not detected in any indicator or control milk samples analyzed during 2019. All I-131 milk results were reported as Lower Limits of Detection (LLD). No plant-related radionuclides were detected in any milk sample collected in 2019. K-40 was the most abundant radionuclide detected, and found in every indicator and control sample collected. K-40 is a naturally-occurring radionuclide and is found in many of the environmental media samples. Cs-137 was not detected in any indicator or control milk sample collected in 2019.

D. Dose Evaluation

The calculated dose as a result of plant effluents is not evaluated due to the fact that no plant related radionuclides were detected.

The dose to man from naturally occurring concentrations of K-40 in milk and other environmental media can be calculated. This calculation illustrates that the dose received due to exposure from plant effluents is negligible compared to the dose received from naturally occurring radionuclides. Significant levels of K-40 have been measured in environmental samples. A 70-kilogram (154 pound) adult contains approximately 0.1 microcuries of K-40 as a result of normal life functions (inhalation, consumption, etc.). The dose to bone tissue is about 20 mrem per year as a result of internal deposition of naturally-occurring K-40.

E. Data Trends

Man-made radionuclides are not routinely detected in milk samples. In the past thirty years, Cs-137 was only detected in 1986, 1987, and 1988. The mean Cs-137 indicator activities for those years were 8.6, 7.4 and 10.0 pCi/l, respectively. I-131 was measured in two milk samples collected in 1997 from a single sample location, having a mean concentration of 0.35 pCi/l and was of undetermined origin. The previous detection was in 1986 with a mean concentration of 13.6 pCi/l. The 1986 activity was a result of the Chernobyl accident.

The comparison of 2019 data to historical results over the operating life of the plants shows that Cs-137 and I-131 levels in milk dropped to less than the lower limit of detection since 1988.

Historical data of milk sample results for Cs-137 and I-131 are presented in Section 7.0, Tables 7-21 and 7-22.

5.2.6 FOOD PRODUCTS (VEGETATION)

A. Results Summary

There were no plant-related radionuclides detected in the twelve food product samples collected and analyzed for the 2019 program.

Detectable levels of naturally occurring K–40 were measured in all of the indicator and control samples collected for the 2019 program. Be-7 a naturally-occurring radionuclide, was also detected in all samples collected in 2019. These results are consistent with the levels measured in 2016 and previous years.

The results of the 2019 sampling program demonstrate that there is no measurable impact on the dose to the public from the garden pathway as a result of plant operations.

B. Data Analysis and Discussion

Food product samples were collected from three indicator locations and one control location. The indicator locations are represented by nearby gardens in areas of highest D/Q (deposition factor) values based on historical meteorology and an annual garden census. The control location was a garden 15.4 miles away in a predominately upwind direction.

Food product samples collected during 2019 included both edible and nonedible vegetation. Nonedible samples include rhubarb leaves, corn leaves and blackberry leaves. The edible vegetation used in this year's sampling include horseradish leaves, squash leaves and grape leaves. The leaves of these plants were sampled as representative of broadleaf vegetation, which is a measurement of radionuclide deposition. Samples were collected during the late summer/fall harvest season. Each sample was analyzed for gamma emitters using gamma spectroscopy.

The analysis of food product samples collected during 2019 did not detect any plant-related radionuclides. Results for the past five years also demonstrate that there is no buildup of plant-related radionuclides in the garden food products grown in areas close to the site.

Naturally-occurring Be-7 was detected in all the food product samples. The results for naturally-occurring radionuclides are consistent with the data of prior years.

Analytical results for food products are found in Section 6.0, Table 6-12.

C. Dose Evaluation

The calculated dose as a result of plant effluents is not evaluated due to the fact that no plant-related radionuclides were detected. The food product sampling program demonstrated no measurable offsite dose to man from this pathway as a result of operations of the plants located at Nine Mile Point.

D. Data Trends

Food product/vegetation sample results for the last five years demonstrate that there is no chronic deposition or buildup of plant-related radionuclides in the garden food products in the environs near the site.

The last positive indication was for Cs-137 which was detected at one indicator location in 1999 with a concentration of 0.007 pCi/g (wet).

Historically, Cs-137 had been detected in ten separate years since 1976 ranging from a maximum mean concentration of 0.047 pCi/g (wet) in 1985 to a minimum of 0.004 pCi/g (wet) in 1980. The trend for Cs-137 is a general reduction in concentration to non detectable levels in samples collected during the 2000 through 2019 sample programs.

Historical data of food product results are presented in Section 7.0, Tables 7-23 and 7-24.

5.2.7 LAND USE CENSUS RESULTS

A. Results Summary

The ODCM requires that an annual land use census be performed to identify potential new locations for milk sampling and for calculating the dose to man from plant effluents. In 2019 a milk animal census, a nearest resident census, and a garden census were performed.

B. Data Evaluation and Discussion

A land use census is conducted each year to determine the utilization of land in the vicinity of the Nine Mile Point site. The land use census consists of two types of surveys. A milk animal census is conducted to identify all milk animals within a distance of 10-miles from the site. This census, covering areas out to a distance of 10-miles exceeds the 5-mile distance required by the ODCM.

A total of 189 milk cows and 169 heifers were observed. Additionally, approximately four goats were counted at one location during the survey. Attempts to contact the land owner were made by phone, post card and visitation but no response was received. The milking/non-milking status of these approximately four goats is currently unknown. There are no farms with milking animals with the 5-mile radius of the site. The results of the milk census, showing the applicable sectors and direction and distance of each milk location, are found in Section 6.0, Table 6-13.

The second type of census conducted is a residence census. The census is conducted in order to identify the closest residence within 5 miles in each of the 22.5 degree land-based meteorological sectors. There are only eight sectors over land where residences are located within 5 miles. The survey for 2019 found no new construction in residential areas for both FitzPatrick and Nine Mile Point since 2016. The results of the nearest residence census, showing the applicable sectors and direction and distance of each of the nearest residence, are found in Section 6.0, Table 6-14 and Table 6-15. The nearest resident locations are illustrated in Section 3.3, Figure 3.3-6a and Figure 3.3-6b.

The results of the nearest residence census conducted in 2019 required no change to FitzPatrick or Nine Milk Point ODCM's closest resident location.

A garden census is performed to identify appropriate garden sampling locations and dose calculation receptors. The 2019 garden census identified a total of 34 gardens for consideration for the sampling program. Garden samples were collected from three locations (69, 144, and 484) as well as a control location (NMPNS C2 or JAFNPP 145) identified in census as active for 2019. See Table 3.3-1 for 2019 sampling locations.

5.2.8 JAFNPP DIRECT RADIATION, THERMOLUMINESCENT DOSIMETERS (TLD)

Independent Spent Fuel Storage Installation (ISFSI)

A. Results Summary

Thermoluminescent Dosimeters (TLDs) are used to measure direct radiation (gamma dose) in the localized environment of the ISFSI pad. Eighteen TLD locations are in place around the perimeter of the ISFSI pad. TLDs were placed at these locations prior to loading the first storage casks for baseline dose rate determination in the general area of the pad.

As of the last ISFSI Campaign which ended in the fourth quarter of 2019 there are a total of 32 cask stored at the facility.

The analysis of offsite doses from direct radiation measurements, presented in Section 5.2.4 of this report, concludes that there is no significant difference in annual dose to the public at or beyond the site boundary. The measured annual dose rate at the nearest residence to the site was consistent with the dose rates measured at the site boundary and the offsite control locations. The results for the Site Boundary, Offsite Sectors, and Special Interest (offsite) were well within expected normal variation when compared to the Control TLD results. The results for the 2019 environmental TLD monitoring program indicate that there is no significant increase in dose rates as a result of operations at the site. The use of hydrogen injection and the implementation of the Independent Spent Fuel Storage Installation (ISFSI) at the FitzPatrick plant did not measurably increase the ambient radiation exposure rate at or beyond the site boundary. The lack of a dose rate increase at or beyond the site boundary is consistent with design calculations performed to evaluate compliance with 10 CFR 72.104(a).

The measured results of the 2019 TLD monitoring program demonstrate compliance with the offsite dose limits to members of the public specified in 40 CFR 190 and 10 CFR 72.104(a).

B. Program Design

An array of eight TLD locations was established around the perimeter of the ISFSI pad 18 months prior to facility usage. Six months prior to the facility becoming operational, an additional 10 TLD locations were established at areas of interest on the facility perimeter. These preoperational TLDs were used for baseline dose rate determination. The TLDs are placed, collected and read each quarter. Two dosimeters are placed at each location and the average of the two dosimeters is reported. The quarterly results are compared to baseline data to assess the contribution to ambient dose rates in the vicinity of the storage facility from casks as they are placed on the storage pad.

C. Dose Evaluation

A maximum dose rate of 261.6 mrem per standard month above the baseline dose rate was measured at the west perimeter fence. This result was due to locating the four cask from the 2018 ISFSI Campaign in close proximity to this TLD location. The lowest measured dose rate of 2019 was 20.8 mrem per standard month above the baseline dose rate and was measured at the east perimeter fence.

An evaluation of Site Boundary TLDs and Control TLDs results for 2019 shows that there is no increase in dose rate at or beyond the site boundary. A detailed discussion of this evaluation is found in Section 5.2.4. The Environmental TLD results for this period show no significant difference in control and site boundary dose rates compared to 2018.

2019 DOSE IN MREM PER STANDARD MONTH

	Minimum	Maximum	Mean
Site Boundary	3.0	5.6	4.6
Control	3.3	5.6	4.8

5.2.9 NMPNS DIRECT RADIATION, THERMOLUMINESCENT DOSIMETERS (TLD)

Independent Spent Fuel Storage Installation (ISFSI)

A. Results Summary

TLDs are used to measure direct radiation (gamma dose) at the site boundary and Optically Stimulated Luminescence Dosimeters (OSLDs) are used to measure direct radiation (gamma dose) in the localized environment of the ISFSI pad. Sixteen TLDs are located around the site, one in each of the sixteen compass sectors, and fourteen OSLDs are located around the perimeter of the ISFSI pad and specific areas of interest. OSLDs were placed at these locations prior to loading the first storage casks for baseline dose rate determination in the general area of the pad.

During 2019, there were five casks moved to the storage facility. The total number of casks in storage is forty.

The implementation and loading of the ISFSI project has resulted in no increase in dose at the site boundary or to the public. The analysis of offsite doses from direct radiation measurements, presented in Section 5.2.4 of this report, concludes that there is no significant difference in annual dose to the public at or beyond the site boundary. The measured annual dose rate at the nearest residence to the site was consistent with the dose rates measured at the site boundary and the offsite control locations. The results for the Site Boundary, Offsite Sectors, and Special Interest (offsite) were well within expected normal variation when compared to the Control TLD results. The results for the 2019 environmental TLD monitoring program indicate that there is no significant increase in dose rates as a result of operations at the site. The implementation of the ISFSI at the NMPNS plant did not measurably increase the ambient radiation exposure rate at or beyond the site boundary. The lack of a dose rate increase at or beyond the site boundary is consistent with design calculations performed to evaluate compliance with 10 CFR 72.104(a).

The measured results of the 2019 TLD monitoring program demonstrate compliance with the offsite dose limits to members of the public specified in 40 CFR 190 and 10 CFR 72.104(a).

B. Program Design

An array of ten OSLD locations was established around the perimeter of the ISFSI pad and four OSLD locations were placed in specific areas of interest twelve months prior to facility usage. These pre-operational OSLDs were used for baseline dose rate determination. The OSLDs are placed, collected and read each quarter. Two dosimeters are placed at each location and the average of the two dosimeters is reported. The quarterly results are compared to baseline data to assess the contribution to ambient dose rates in the vicinity of the storage facility from casks as they are placed on the storage pad.

C. Dose Evaluation

The pre-operation minimum and maximum dose rates were 2.9 and 6.3 mrem per standard month, respectively. During 2019, the maximum dose rate of 22.1 mrem per standard month was measured at OSLD location 241, north of the ISFSI.

The following table presents the pre-operation dose rate data and the operational dose rate data for 2019:

OSLD Number	Sector	Pre-Operation	2019
		mrem per Standard month	mrem per Standard Month
233	WNW	3.5	14.6
234	WSW	2.9	14.9
235	S	4.2	12.6
236	SSE	3.8	10.4
237	SE	3.0	10.1
238	ESE	3.5	9.1
239	E	4.0	14.6
240	NE	3.6	13.1
241	N	5.1	22.1
242	NE	6.3	11.4
243	NNW	4.8	16.1
244	NE	4.6	9.1
245	NE	4.0	13.4
246	ENE	4.8	13.4

An evaluation of Site Boundary TLDs and Control TLDs results for 2019 shows that there is no increase in dose rate at or beyond the site boundary. A detailed discussion of this evaluation is found in Section 5.2.4. The Environmental TLD results for this period show no significant difference in control and site boundary dose rates compared to 2018 and preoperational data gathered in 2012.

2019 DOSE IN MREM PER STANDARD MONTH

	Minimum	Maximum	Mean
Site Boundary	3.0	5.6	4.6
Control	3.3	5.6	4.8

5.3 CONCLUSION

The Radiological Environmental Monitoring Program (REMP) is an ongoing program implemented to measure and document the radiological impact of Nine Mile Point facility operations on the local environment. The program is designed to detect and evaluate small changes in the radiological environment surrounding the site. Environmental media representing food sources consumed at the higher levels of the food chain, such as fish, food products and milk, are part of a comprehensive sampling program. Results of all samples are reviewed closely to determine any possible impact to the environment or to man. In addition, program results are evaluated for possible short-term and long-term historical trends.

The federal government has established dose limits to protect the public from radiation and radioactivity. The Nuclear Regulatory Commission (NRC) specifies a whole-body dose limit of 100 mrem/yr to be received by the maximum exposed member of the general public. This limit is set forth in Section 1301, Part 20, Title 10 of the U.S. Code of Federal Regulations (10 CFR 20). The Environmental Protection Agency (EPA) limits the annual whole-body dose to 25 mrem/yr, which is specified in Section 10, Part 190, Title 40, of the Code of Federal Regulations (40 CFR 190). Radiation exposure to members of the public, calculated based on the results of the REMP, is extremely small. The dose to members of the public from operations at the Nine Mile Point site, based on environmental measurement and calculations made from effluent releases, is determined to be a fraction of limits set forth by the NRC and EPA.

The REMP continues to demonstrate that the effluents from the site to the environment contribute no significant or even measurable radiation exposures to the general public as confirmed by the sampling and analysis of environmental media from recognized environmental pathways. Based on TLD results there was no measurable increase in radiation levels beyond the site boundary as a result of the hydrogen water chemistry and ISFSI programs. Environmental radiation levels measured at the nearest residence are at the background level based on control station TLD results. The only measurable radiological impact on the environment continues to be the result of atmospheric weapons testing conducted in the early 1980's, the 1986 accident at the Chernobyl Nuclear Power Plant, and the March 11, 2011 accident at the Fukushima Daiichi Nuclear Power Station.

The REMP did not detect any plant-related radionuclide in the sample media collected during 2019. Dose from man-made sources in the environment is very small when compared to the dose originating from naturally-occurring sources of radioactivity.

Radiation from naturally-occurring radionuclides such as K-40 and Ra-226 contributed the vast majority of the total annual dose to members of the general public. The dose to members of the public, resulting from plant operations, is extremely small in comparison to the dose contribution from natural background levels and sources other than the plants. The whole body dose in Oswego County due to natural sources is approximately 50 mrem per individual per year as demonstrated by control environmental TLDs. The fraction of the annual dose to man, attributable to site operation, remains insignificant.

Based upon the overall results of the 2019 Radiological Environmental Monitoring Program, it can be concluded that the levels and variation of radioactivity in the environment samples were consistent with background levels. Effluents from the site to the environment contribute no significant or even measurable radiation exposures to the general public.

5.4 REFERENCES

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

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14. National Council on Radiation Protection and Measurements (NCRP), Exposure of the Population in the United States and Canada from National Background Radiation, NCRP Report No. 94, 1987.

15. National Council on Radiation Protection and Measurements (NCRP), Ionizing Radiation Exposure of the Population of the United States, NCRP Report No. 160, 2009.

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6.0 REPORT PERIOD ANALYTICAL RESULTS TABLES

Environmental sample data is summarized in table format. Tables are provided for select sample media and contain data based on actual values obtained over the year. These values are comprised of both positive values and LLD (Lower Limit of Detection) values where applicable.

The LLD is the smallest concentration of radioactive material in a sample that will be detected with 95% probability and with 5% probability of falsely concluding that a blank observation represents a "real" signal (see Section 3.7.3 for detailed explanation).

When the initial count of a sample indicates the presence of radioactivity, two recounts are normally performed. When a radionuclide is positively identified in two or more counts, the analytical results for that radionuclide are reported as the mean of the positive detections and the associated error for that mean (see Section 3.7.2 for methodology).

Many of the tables are footnoted with the term "Plant Related Radionuclides". Plant Related Radionuclides are radionuclides that are produced in the reactor as a result of plant operation, either through the activation or fission process.

TABLE 6-1
CONCENTRATIONS OF GAMMA EMITTERS IN SHORELINE SEDIMENT SAMPLES - 2019

Results in Units of pCi/kg (dry) ± 1 Sigma

SAMPLE LOCATION***	COLLECTION DATE	K-40	Co-60	Zn-65	Cs-134	Cs-137	Others †
SUNSET BAY* (05)							
	05/16/19	19400 ± 831	< 65	< 154	< 74	< 70	< LLD
	10/16/19	15910 ± 568	< 37	< 97	< 51	< 48	< LLD
LANG'S BEACH (06, Control)							
	05/16/19	7931 ± 402	< 35	< 76	< 39	< 31	< LLD
	10/16/19	9648 ± 500	< 46	< 83	< 56	< 45	< LLD

* Sample required by the ODCM

*** Corresponds to sample location noted on Figure 3.3-5

† Plant related radionuclides

TABLE 6-2
CONCENTRATIONS OF GAMMA EMITTERS IN FISH SAMPLES - 2019

Results in Units of pCi/kg (wet) ± 1 Sigma

SAMPLE LOCATION***	COLLECTION DATE	DESCRIPTION	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Cs-134	Cs-137	Others †
OSWEGO HARBOR* (00, Control)											
	05/07/19	LAKE TROUT	2549 ± 508	< 65	< 65	< 152	< 63	< 172	< 73	< 64	< LLD
	05/07/19	BROWN TROUT	3381 ± 479	< 57	< 53	< 85	< 45	< 143	< 60	< 56	< LLD
	05/08/19	SMALLMOUTH BASS	4768 ± 588	< 75	< 72	< 142	< 69	< 150	< 68	< 73	< LLD
	09/06/19	BROWN TROUT	3105 ± 478	< 59	< 56	< 124	< 35	< 149	< 60	< 58	< LLD
	09/06/19	CHINOOK SALMON	3352 ± 483	< 58	< 50	< 106	< 57	< 102	< 63	< 63	< LLD
	09/06/19	SMALLMOUTH BASS	3098 ± 505	< 66	< 67	< 99	< 64	< 126	< 76	< 67	< LLD
NINE MILE POINT* (02)											
	05/07/19	LAKE TROUT	3322 ± 486	< 61	< 52	< 113	< 65	< 151	< 52	< 59	< LLD
	05/07/19	BROWN TROUT	3755 ± 584	< 67	< 58	< 123	< 75	< 132	< 64	< 67	< LLD
	05/07/19	SMALLMOUTH BASS	3317 ± 534	< 46	< 62	< 99	< 58	< 112	< 56	< 54	< LLD
	09/06/19	BROWN TROUT	1974 ± 408	< 69	< 65	< 146	< 93	< 141	< 71	< 76	< LLD
	09/06/19	CHINOOK SALMON	4028 ± 499	< 52	< 51	< 118	< 62	< 138	< 72	< 63	< LLD
	09/06/19	SMALLMOUTH BASS	3131 ± 427	< 44	< 44	< 102	< 48	< 120	< 51	< 48	< LLD
FITZPATRICK* (03)											
	05/07/19	LAKE TROUT	3606 ± 456	< 62	< 54	< 124	< 58	< 108	< 58	< 48	< LLD
	05/07/19	BROWN TROUT	3702 ± 415	< 48	< 57	< 102	< 53	< 147	< 53	< 54	< LLD
	05/07/19	SMALLMOUTH BASS	3275 ± 365	< 45	< 41	< 92	< 45	< 85	< 51	< 43	< LLD
	09/06/19	BROWN TROUT	2728 ± 516	< 57	< 48	< 130	< 65	< 115	< 70	< 73	< LLD
	09/06/19	CHINOOK SALMON	3301 ± 424	< 47	< 59	< 146	< 59	< 162	< 58	< 69	< LLD
	09/06/19	SMALLMOUTH BASS	3228 ± 421	< 47	< 44	< 105	< 53	< 98	< 47	< 42	< LLD

* Sample required by the ODCM

*** Corresponds to sample location noted on Figure 3.3-5

† Plant related radionuclides

TABLE 6-3
CONCENTRATIONS OF TRITIUM IN SURFACE WATER SAMPLES - 2019

Results in Units of pCi/liter ± 1 Sigma

SAMPLE LOCATION***	COLLECTION DATE	DESCRIPTION	H-3
FITZPATRICK* (03, INLET)			
	01/03/19 - 04/03/19	First Quarter	< 187
	04/03/19 - 06/30/19	Second Quarter	< 198
	06/30/19 - 10/03/19	Third Quarter	< 189
	10/03/19 - 01/07/20	Fourth Quarter	< 180
OSWEGO STEAM STATION* (08, CONTROL)			
	12/28/18 - 03/29/19	First Quarter	< 177
	03/29/19 - 06/28/19	Second Quarter	< 196
	06/28/19 - 09/27/19	Third Quarter	< 194
	09/27/19 - 01/03/20	Fourth Quarter	< 183
NINE MILE POINT UNIT 1** (09, INLET)			
	12/28/18 - 03/29/19	First Quarter	< 180
	03/29/19 - 06/28/19	Second Quarter	< 193
	06/28/19 - 09/27/19	Third Quarter	< 189
	09/27/19 - 01/03/20	Fourth Quarter	< 189
OSWEGO CITY WATER** (10)			
	12/28/18 - 03/29/19	First Quarter	< 179
	03/29/19 - 06/28/19	Second Quarter	< 195
	06/28/19 - 09/27/19	Third Quarter	< 192
	09/27/19 - 01/03/20	Fourth Quarter	< 188
NINE MILE POINT UNIT 2** (11, INLET)			
	12/28/18 - 03/29/19	First Quarter	< 175
	03/29/19 - 06/28/19	Second Quarter	< 192
	06/28/19 - 09/27/19	Third Quarter	< 187
	09/27/19 - 01/03/20	Fourth Quarter	1126 ± 119

* Sample required by the ODCM
** Optional sample location
*** Corresponds to sample location noted on Figure 3.3-4

TABLE 6-4
CONCENTRATIONS OF GAMMA EMITTERS IN SURFACE WATER SAMPLES - 2019

Results in Units of pCi/liter ± 1 Sigma

SAMPLE LOCATION***	COLLECTION DATE	I-131	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137	Ba-La-140
FITZPATRICK* (03, INLET)												
	01/31/19	< 0.4	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 7
	03/04/19	< 0.7	< 2	< 2	< 5	< 2	< 3	< 2	< 4	< 2	< 2	< 6
	04/03/19	< 0.7	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 8
	05/01/19	< 0.9	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 6
	06/03/19	< 0.4	< 2	< 2	< 4	< 2	< 4	< 2	< 4	< 2	< 2	< 7
	06/30/19	< 0.9	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 5
	08/03/19	< 0.6	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 6
	09/03/19	< 0.7	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 7
	10/03/19	< 0.7	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 7
	11/04/19	< 0.6	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 7
	12/06/19	< 0.8	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 7
	01/07/20	< 0.4	< 2	< 2	< 4	< 2	< 4	< 2	< 3	< 2	< 2	< 5
OSWEGO STEAM STATION* (08, CONTROL)												
	02/01/19	< 0.4	< 2	< 2	< 4	< 1	< 3	< 2	< 3	< 2	< 2	< 5
	03/01/19	< 0.5	< 2	< 2	< 5	< 2	< 4	< 2	< 3	< 2	< 2	< 7
	03/29/19	< 0.8	< 2	< 2	< 4	< 2	< 4	< 2	< 4	< 2	< 2	< 7
	05/03/19	< 0.6	< 2	< 2	< 5	< 2	< 3	< 2	< 4	< 2	< 2	< 6
	05/31/19	< 0.7	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 6
	06/28/19	< 0.8	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 6
	08/02/19	< 0.9	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 6
	08/30/19	< 0.7	< 1	< 2	< 4	< 1	< 3	< 2	< 3	< 2	< 1	< 6
	09/27/19	< 0.9	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 7
	11/01/19	< 0.8	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 7
	12/02/19	< 0.7	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 5
	01/03/20	< 0.6	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 5

* Sample required by the ODCM

*** Corresponds to sample location noted on Figure 3.3-4

TABLE 6-4 (continued)
CONCENTRATIONS OF GAMMA EMITTERS IN SURFACE WATER SAMPLES - 2019

Results in Units of pCi/liter ± 1 Sigma

SAMPLE LOCATION***	COLLECTION DATE	I-131	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137	Ba-La-140
NINE MILE POINT UNIT 1** (09, INLET)												
	02/01/19	< 12	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 7
	03/01/19	< 12	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 7
	03/29/19	< 14	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 9
	05/03/19	< 13	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 7
	05/31/19	< 9	< 1	< 2	< 4	< 1	< 3	< 2	< 3	< 2	< 1	< 5
	06/28/19	< 8	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 5
	08/02/19	< 10	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 5
	08/30/19	< 15	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 7
	09/27/19	< 13	< 2	< 2	< 5	< 2	< 3	< 2	< 3	< 2	< 2	< 7
	11/01/19	< 11	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 6
	12/02/19	< 9	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 6
	01/03/20	< 9	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 5
OSWEGO CITY WATER** (10)												
	02/01/19	< 11	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 6
	03/01/19	< 14	< 2	< 2	< 4	< 2	< 4	< 2	< 4	< 2	< 2	< 6
	03/29/19	< 14	< 2	< 2	< 4	< 2	< 3	< 2	< 4	< 2	< 2	< 7
	05/03/19	< 11	< 2	< 2	< 5	< 2	< 4	< 2	< 3	< 2	< 2	< 7
	05/31/19	< 10	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 6
	06/28/19	< 9	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 5
	08/02/19	< 10	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 6
	08/30/19	< 14	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 7
	09/27/19	< 13	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 7
	11/01/19	< 14	< 2	< 2	< 5	< 2	< 4	< 2	< 3	< 2	< 2	< 8
	12/02/19	< 8	< 1	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 5
	01/03/20	< 9	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 6

** Optional sample location

*** Corresponds to sample location noted on Figure 3.3-4

TABLE 6-4 (continued)
CONCENTRATIONS OF GAMMA EMITTERS IN SURFACE WATER SAMPLES - 2019

Results in Units of pCi/liter ± 1 Sigma

SAMPLE LOCATION***	COLLECTION DATE	I-131	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137	Ba-La-140
NINE MILE POINT UNIT 2** (11, INLET)												
	02/01/19	< 11	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 5
	03/01/19	< 14	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 8
	03/29/19	< 14	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 8
	05/03/19	< 11	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 6
	05/31/19	< 10	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 6
	06/28/19	< 8	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 5
	08/02/19	< 11	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 6
	08/30/19	< 13	< 2	< 2	< 4	< 2	< 4	< 2	< 4	< 2	< 2	< 8
	09/27/19	< 15	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 7
	11/01/19	< 13	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 7
	12/02/19	< 8	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 6
	01/03/20	< 10	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 6

** Optional sample location

*** Corresponds to sample location noted on Figure 3.3-4

TABLE 6-5
ENVIRONMENTAL AIRBORNE PARTICULATE SAMPLES - OFFSITE SAMPLE LOCATIONS - 2019

GROSS BETA ACTIVITY 10E-3 pCi/m^3 ± 1 Sigma

COLLECTION DATE	R1*	R2*	R3*	R4*	R5*	D2**	E**	F**	G**
01/02/19 - 01/08/19	18 ± 1	20 ± 1	15 ± 1	17 ± 1	16 ± 1	16 ± 1	17 ± 1	(1)	17 ± 1
01/08/19 - 01/15/19	16 ± 1	15 ± 1	12 ± 1	14 ± 1	16 ± 1	14 ± 1	12 ± 1	15 ± 1	11 ± 1
01/15/19 - 01/22/19	15 ± 1	15 ± 1	16 ± 1	15 ± 1	15 ± 1	14 ± 1	16 ± 1	15 ± 1	14 ± 1
01/22/19 - 01/29/19	15 ± 1	16 ± 1	15 ± 1	15 ± 1	16 ± 1	17 ± 1	14 ± 1	14 ± 1	17 ± 1
01/29/19 - 02/05/19	18 ± 1	20 ± 1	19 ± 1	20 ± 1	18 ± 1	21 ± 1	17 ± 1	20 ± 1	18 ± 1
02/05/19 - 02/12/19	12 ± 1	11 ± 1	11 ± 1	11 ± 1	12 ± 1	12 ± 1	12 ± 1	12 ± 1	12 ± 1
02/12/19 - 02/19/19	16 ± 1	17 ± 1	18 ± 1	15 ± 1	15 ± 1	14 ± 1	16 ± 1	16 ± 1	15 ± 1
02/19/19 - 02/26/19	21 ± 1	16 ± 1	17 ± 1	18 ± 1	17 ± 1	17 ± 1	16 ± 1	15 ± 1	17 ± 1
02/26/19 - 03/05/19	24 ± 1	20 ± 1	20 ± 1	22 ± 1	21 ± 1	18 ± 1	17 ± 1	19 ± 1	20 ± 1
03/05/19 - 03/12/19	20 ± 1	21 ± 1	21 ± 1	21 ± 1	23 ± 2	22 ± 1	21 ± 1	23 ± 1	22 ± 1
03/12/19 - 03/19/19	23 ± 1	23 ± 1	20 ± 1	19 ± 1	20 ± 1	19 ± 1	17 ± 1	21 ± 1	19 ± 1
03/19/19 - 03/26/19	12 ± 1	13 ± 1	14 ± 1	13 ± 1	16 ± 1	15 ± 1	16 ± 1	13 ± 1	14 ± 1
03/26/19 - 04/02/19	15 ± 1	12 ± 1	15 ± 1	13 ± 1	13 ± 1	14 ± 1	13 ± 1	14 ± 1	14 ± 1
04/02/19 - 04/09/19	13 ± 1	12 ± 1	13 ± 1	11 ± 1	12 ± 1	15 ± 1	12 ± 1	14 ± 1	12 ± 1
04/09/19 - 04/16/19	9 ± 1	8 ± 1	11 ± 1	11 ± 1	9 ± 1	7 ± 1	11 ± 1	8 ± 1	11 ± 1
04/16/19 - 04/23/19	8 ± 1	8 ± 1	9 ± 1	11 ± 1	9 ± 1	8 ± 1	12 ± 1	10 ± 1	8 ± 1
04/23/19 - 04/30/19	10 ± 1	9 ± 1	10 ± 1	9 ± 1	9 ± 1	9 ± 1	11 ± 1	11 ± 1	9 ± 1
04/30/19 - 05/07/19	8 ± 1	10 ± 1	11 ± 1	11 ± 1	13 ± 1	9 ± 1	12 ± 1	12 ± 1	9 ± 1
05/07/19 - 05/14/19	12 ± 1	13 ± 1	12 ± 1	11 ± 1	14 ± 1	11 ± 1	10 ± 1	12 ± 1	13 ± 1
05/14/19 - 05/21/19	12 ± 1	13 ± 1	14 ± 1	12 ± 1	10 ± 1	11 ± 1	12 ± 1	13 ± 1	13 ± 1
05/21/19 - 05/29/19	8 ± 1	10 ± 1	9 ± 1	11 ± 1	8 ± 1	10 ± 1	11 ± 1	10 ± 1	10 ± 1
05/29/19 - 06/04/19	12 ± 1	10 ± 1	14 ± 1	11 ± 1	12 ± 1	10 ± 1	11 ± 1	11 ± 1	12 ± 1
06/04/19 - 06/11/19	14 ± 1	14 ± 1	12 ± 1	12 ± 1	15 ± 1	13 ± 1	13 ± 1	13 ± 1	12 ± 1
06/11/19 - 06/18/19	12 ± 1	11 ± 1	12 ± 1	13 ± 1	13 ± 1	14 ± 1	15 ± 1	12 ± 1	14 ± 1
06/18/19 - 06/25/19	8 ± 1	13 ± 1	10 ± 1	13 ± 1	11 ± 1	10 ± 1	11 ± 1	10 ± 1	10 ± 1

* Sample required by the ODCM

** Optional sample location

(1) No sample due to pump malfunction.

TABLE 6-5 (continued)
ENVIRONMENTAL AIRBORNE PARTICULATE SAMPLES - OFFSITE SAMPLE LOCATIONS - 2019

GROSS BETA ACTIVITY 10E-3 pCi/m^3 ± 1 Sigma

COLLECTION DATE	R1*	R2*	R3*	R4*	R5*	D2**	E**	F**	G**
06/25/19 - 07/02/19	10 ± 1	13 ± 1	10 ± 1	14 ± 1	15 ± 1	14 ± 1	12 ± 1	13 ± 1	12 ± 1
07/02/19 - 07/09/19	14 ± 1	16 ± 1	16 ± 1	15 ± 1	12 ± 1	12 ± 1	13 ± 1	15 ± 1	15 ± 1
07/09/19 - 07/16/19	12 ± 1	12 ± 1	12 ± 1	12 ± 1	10 ± 1	11 ± 1	13 ± 1	9 ± 1	12 ± 1
07/16/19 - 07/24/19	11 ± 1	10 ± 1	11 ± 1	13 ± 1	10 ± 1	11 ± 1	11 ± 1	8 ± 1	11 ± 1
07/24/19 - 07/30/19	16 ± 1	18 ± 1	16 ± 1	18 ± 1	19 ± 1	20 ± 2	19 ± 1	16 ± 1	18 ± 1
07/30/19 - 08/06/19	14 ± 1	17 ± 1	16 ± 1	16 ± 1	19 ± 1	16 ± 1	16 ± 1	15 ± 1	18 ± 1
08/06/19 - 08/13/19	11 ± 1	15 ± 1	16 ± 1	14 ± 1	13 ± 1	12 ± 1	12 ± 1	13 ± 1	15 ± 1
08/13/19 - 08/20/19	13 ± 1	13 ± 1	12 ± 1	14 ± 1	15 ± 1	14 ± 1	10 ± 1	13 ± 1	14 ± 1
08/20/19 - 08/27/19	13 ± 1	14 ± 1	13 ± 1	17 ± 1	16 ± 1	16 ± 1	15 ± 1	15 ± 1	12 ± 1
08/27/19 - 09/04/19	13 ± 1	15 ± 1	12 ± 1	14 ± 1	14 ± 1	11 ± 1	14 ± 1	15 ± 1	15 ± 1
09/04/19 - 09/10/19	13 ± 1	15 ± 1	14 ± 1	14 ± 1	11 ± 1	15 ± 1	13 ± 1	15 ± 1	14 ± 1
09/10/19 - 09/17/19	13 ± 1	14 ± 1	16 ± 1	14 ± 1	14 ± 1	13 ± 1	15 ± 1	13 ± 1	14 ± 1
09/17/19 - 09/24/19	18 ± 1	19 ± 1	18 ± 1	20 ± 1	19 ± 1	22 ± 1	19 ± 1	20 ± 1	16 ± 1
09/24/19 - 10/01/19	14 ± 1	17 ± 1	16 ± 1	17 ± 1	16 ± 1	16 ± 1	16 ± 1	18 ± 1	15 ± 1
10/01/19 - 10/08/19	11 ± 1	10 ± 1	11 ± 1	13 ± 1	11 ± 1	11 ± 1	10 ± 1	10 ± 1	11 ± 1
10/08/19 - 10/15/19	16 ± 1	16 ± 1	13 ± 1	14 ± 1	15 ± 1	15 ± 1	16 ± 1	15 ± 1	19 ± 1
10/15/19 - 10/22/19	13 ± 1	13 ± 1	12 ± 1	13 ± 1	14 ± 1	14 ± 1	12 ± 1	13 ± 1	13 ± 1
10/22/19 - 10/29/19	10 ± 1	11 ± 1	10 ± 1	11 ± 1	12 ± 1	13 ± 1	12 ± 1	10 ± 1	11 ± 1
10/29/19 - 11/05/19	11 ± 1	14 ± 1	14 ± 1	13 ± 1	11 ± 1	12 ± 1	10 ± 1	13 ± 1	12 ± 1
11/05/19 - 11/13/19	13 ± 1	13 ± 1	14 ± 1	16 ± 1	12 ± 1	14 ± 1	13 ± 1	14 ± 1	12 ± 1
11/13/19 - 11/19/19	14 ± 1	11 ± 1	15 ± 1	13 ± 1	16 ± 1	13 ± 1	11 ± 1	15 ± 1	13 ± 1
11/19/19 - 11/26/19	19 ± 1	19 ± 1	19 ± 1	18 ± 1	17 ± 1	20 ± 1	19 ± 1	18 ± 1	17 ± 1
11/26/19 - 12/03/19	14 ± 1	14 ± 1	15 ± 1	15 ± 1	15 ± 1	15 ± 1	16 ± 1	16 ± 1	15 ± 1
12/03/19 - 12/10/19	13 ± 1	17 ± 1	16 ± 1	16 ± 1	15 ± 1	13 ± 1	13 ± 1	17 ± 1	13 ± 1
12/10/19 - 12/17/19	14 ± 1	15 ± 1	15 ± 1	15 ± 1	18 ± 1	14 ± 1	15 ± 1	14 ± 1	13 ± 1
12/17/19 - 12/23/19	22 ± 2	25 ± 2	26 ± 2	23 ± 2	24 ± 2	22 ± 2	24 ± 2	20 ± 1	25 ± 2
12/23/19 - 12/31/19	24 ± 1	22 ± 1	18 ± 1	22 ± 1	22 ± 1	17 ± 1	25 ± 1	23 ± 1	19 ± 1

* Sample required by the ODCM
** Optional sample location

TABLE 6-6
ENVIRONMENTAL AIRBORNE PARTICULATE SAMPLES - ONSITE SAMPLE LOCATIONS - 2019

GROSS BETA ACTIVITY 10E-3 pCi/m^3 ± 1 Sigma

COLLECTION DATE	D1**	G**	H**	I**	J**	K**
12/31/18 - 01/07/19	17 ± 1	16 ± 1	15 ± 1	16 ± 1	13 ± 1	19 ± 1
01/07/19 - 01/14/19	14 ± 1	17 ± 1	15 ± 1	11 ± 1	13 ± 1	13 ± 1
01/14/19 - 01/22/19	12 ± 1	14 ± 1	12 ± 1	15 ± 1	13 ± 1	14 ± 1
01/21/19 - 01/28/19	14 ± 1	18 ± 1	13 ± 1	13 ± 1	15 ± 1	13 ± 1
01/28/19 - 02/04/19	18 ± 1	18 ± 1	17 ± 1	18 ± 1	19 ± 1	19 ± 1
02/04/19 - 02/11/19	12 ± 1	13 ± 1	14 ± 1	12 ± 1	10 ± 1	12 ± 1
02/11/19 - 02/18/19	14 ± 1	13 ± 1	14 ± 1	13 ± 1	14 ± 1	13 ± 1
02/18/19 - 02/26/19	15 ± 1	17 ± 1	15 ± 1	18 ± 1	12 ± 1	14 ± 1
02/25/19 - 03/05/19	23 ± 1	21 ± 1	21 ± 1	24 ± 2	18 ± 1	21 ± 1
03/04/19 - 03/11/19	18 ± 1	19 ± 1	18 ± 1	17 ± 1	17 ± 1	18 ± 1
03/11/19 - 03/18/19	17 ± 1	23 ± 1	18 ± 1	16 ± 1	16 ± 1	15 ± 1
03/18/19 - 03/25/19	13 ± 1	14 ± 1	15 ± 1	16 ± 1	16 ± 1	15 ± 1
03/25/19 - 04/01/19	13 ± 1	12 ± 1	13 ± 1	14 ± 1	15 ± 1	13 ± 1
04/01/19 - 04/09/19	10 ± 1	15 ± 1	11 ± 1	11 ± 1	13 ± 1	11 ± 1
04/08/19 - 04/16/19	8 ± 1	10 ± 1	11 ± 1	10 ± 1	9 ± 1	11 ± 1
04/15/19 - 04/24/19	7 ± 1	7 ± 1	9 ± 1	7 ± 1	10 ± 1	10 ± 1
04/23/19 - 04/30/19	9 ± 1	11 ± 1	7 ± 1	9 ± 1	11 ± 1	9 ± 1
04/29/19 - 05/06/19	11 ± 1	12 ± 1	9 ± 1	10 ± 1	11 ± 1	12 ± 1
05/06/19 - 05/13/19	13 ± 1	12 ± 1	12 ± 1	13 ± 1	14 ± 1	12 ± 1
05/13/19 - 05/20/19	13 ± 1	12 ± 1	11 ± 1	12 ± 1	12 ± 1	12 ± 1
05/20/19 - 05/28/19	9 ± 1	10 ± 1	8 ± 1	9 ± 1	9 ± 1	10 ± 1
05/28/19 - 06/03/19	12 ± 1	12 ± 1	11 ± 1	12 ± 1	13 ± 1	11 ± 1
06/03/19 - 06/10/19	12 ± 1	12 ± 1	11 ± 1	11 ± 1	12 ± 1	12 ± 1
06/10/19 - 06/17/19	13 ± 1	14 ± 1	11 ± 1	12 ± 1	12 ± 1	16 ± 1
06/17/19 - 06/24/19	11 ± 1	11 ± 1	10 ± 1	10 ± 1	9 ± 1	11 ± 1

** Optional sample location

TABLE 6-6 (continued)
ENVIRONMENTAL AIRBORNE PARTICULATE SAMPLES - ONSITE SAMPLE LOCATIONS - 2019

GROSS BETA ACTIVITY 10E-3 pCi/m^3 ± 1 Sigma

COLLECTION DATE	D1**	G**	H**	I**	J**	K**
06/24/19 - 07/01/19	15 ± 1	14 ± 1	13 ± 1	16 ± 1	14 ± 1	15 ± 1
07/01/19 - 07/08/19	12 ± 1	15 ± 1	12 ± 1	11 ± 1	15 ± 1	15 ± 1
07/08/19 - 07/15/19	11 ± 1	11 ± 1	10 ± 1	10 ± 1	14 ± 1	11 ± 1
07/15/19 - 07/22/19	10 ± 1	10 ± 1	10 ± 1	11 ± 1	10 ± 1	10 ± 1
07/22/19 - 07/29/19	14 ± 1	14 ± 1	13 ± 1	13 ± 1	15 ± 1	13 ± 1
07/29/19 - 08/05/19	17 ± 1	17 ± 1	15 ± 1	16 ± 1	17 ± 1	18 ± 1
08/05/19 - 08/12/19	12 ± 1	15 ± 1	12 ± 1	12 ± 1	13 ± 1	11 ± 1
08/12/19 - 08/19/19	17 ± 1	15 ± 1	15 ± 1	16 ± 1	16 ± 1	16 ± 1
08/19/19 - 08/26/19	14 ± 1	11 ± 1	14 ± 1	12 ± 1	15 ± 1	16 ± 1
08/26/19 - 09/03/19	13 ± 1	13 ± 1	14 ± 1	13 ± 1	13 ± 1	13 ± 1
09/03/19 - 09/09/19	16 ± 1	18 ± 1	15 ± 1	17 ± 1	16 ± 1	15 ± 1
09/09/19 - 09/16/19	13 ± 1	16 ± 1	13 ± 1	11 ± 1	14 ± 1	15 ± 1
09/16/19 - 09/23/19	21 ± 1	20 ± 1	20 ± 1	19 ± 1	20 ± 1	21 ± 1
09/23/19 - 09/30/19	14 ± 1	17 ± 1	16 ± 1	16 ± 1	16 ± 1	16 ± 1
09/30/19 - 10/07/19	11 ± 1	12 ± 1	11 ± 1	9 ± 1	14 ± 1	11 ± 1
10/07/19 - 10/14/19	17 ± 1	16 ± 1	14 ± 1	16 ± 1	17 ± 1	14 ± 1
10/14/19 - 10/21/19	13 ± 1	11 ± 1	17 ± 1	16 ± 1	17 ± 1	11 ± 1
10/21/19 - 10/28/19	13 ± 1	15 ± 1	12 ± 1	12 ± 1	13 ± 1	12 ± 1
10/28/19 - 11/04/19	14 ± 1	12 ± 1	8 ± 1	12 ± 1	10 ± 1	10 ± 1
11/04/19 - 11/12/19	13 ± 1	14 ± 1	9 ± 1	14 ± 1	15 ± 1	12 ± 1
11/12/19 - 11/18/19	14 ± 1	16 ± 1	10 ± 1	14 ± 1	16 ± 1	14 ± 1
11/18/19 - 11/25/19	14 ± 1	16 ± 1	12 ± 1	15 ± 1	16 ± 1	16 ± 1
11/25/19 - 12/02/19	18 ± 1	18 ± 1	16 ± 1	20 ± 1	21 ± 1	20 ± 1
12/02/19 - 12/09/19	15 ± 1	12 ± 1	13 ± 1	17 ± 1	14 ± 1	18 ± 1
12/09/19 - 12/16/19	12 ± 1	16 ± 1	14 ± 1	14 ± 1	14 ± 1	14 ± 1
12/16/19 - 12/23/19	18 ± 1	25 ± 2	18 ± 1	16 ± 1	20 ± 1	19 ± 1
12/23/19 - 12/31/19	25 ± 2	26 ± 2	22 ± 1	23 ± 1	27 ± 2	25 ± 2

** Optional sample location

TABLE 6-7
ENVIRONMENTAL CHARCOAL CARTRIDGE SAMPLES - OFFSITE SAMPLE LOCATIONS - 2019

I-131 ACTIVITY 10E-3 pCi/m^3 ± 1 Sigma

COLLECTION DATE	R1*	R2*	R3*	R4*	R5*	D2**	E**	F**	G**
01/02/19 - 01/08/19	< 29	< 28	< 29	< 8	< 23	< 22	< 22	< 29	< 28
01/08/19 - 01/15/19	< 15	< 14	< 14	< 11	< 27	< 26	< 26	< 27	< 15
01/15/19 - 01/22/19	< 13	< 34	< 32	< 25	< 25	< 25	< 26	< 25	< 32
01/22/19 - 01/29/19	< 28	< 27	< 29	< 15	< 17	< 17	< 17	< 17	< 29
01/29/19 - 02/05/19	< 23	< 21	< 23	< 30	< 12	< 29	< 29	< 29	< 22
02/05/19 - 02/12/19	< 17	< 17	< 18	< 26	< 10	< 26	< 25	< 25	< 18
02/12/19 - 02/19/19	< 28	< 28	< 28	< 13	< 24	< 24	< 24	< 24	< 26
02/19/19 - 02/26/19	< 31	< 30	< 31	< 10	< 28	< 28	< 28	< 28	< 29
02/26/19 - 03/05/19	< 26	< 27	< 28	< 9	< 22	< 22	< 22	< 22	< 27
03/05/19 - 03/12/19	< 16	< 16	< 15	< 9	< 23	< 22	< 22	< 22	< 16
03/12/19 - 03/19/19	< 22	< 22	< 9	< 12	< 31	< 29	< 30	< 29	< 22
03/19/19 - 03/26/19	< 23	< 24	< 25	< 16	< 28	< 28	< 29	< 29	< 24
03/26/19 - 04/02/19	< 25	< 26	< 26	< 22	< 22	< 12	< 23	< 22	< 26
04/02/19 - 04/09/19	< 28	< 28	< 27	< 17	< 31	< 31	< 31	< 31	< 27
04/09/19 - 04/16/19	< 18	< 20	< 21	< 13	< 23	< 24	< 24	< 24	< 19
04/16/19 - 04/23/19	< 19	< 19	< 20	< 10	< 17	< 18	< 18	< 18	< 18
04/23/19 - 04/30/19	< 20	< 20	< 22	< 22	< 21	< 22	< 21	< 12	< 20
04/30/19 - 05/07/19	< 13	< 13	< 13	< 17	< 16	< 16	< 16	< 5	< 12
05/07/19 - 05/14/19	< 19	< 19	< 18	< 17	< 13	< 17	< 16	< 16	< 18
05/14/19 - 05/21/19	< 18	< 18	< 8	< 20	< 18	< 20	< 20	< 10	< 18
05/21/19 - 05/29/19	< 16	< 15	< 15	< 25	< 9	< 24	< 24	< 22	< 15
05/29/19 - 06/04/19	< 20	< 20	< 19	< 32	< 30	< 14	< 33	< 31	< 19
06/04/19 - 06/11/19	< 26	< 27	< 26	< 10	< 25	< 22	< 22	< 23	< 27
06/11/19 - 06/18/19	< 27	< 29	< 28	< 15	< 12	< 15	< 17	< 16	< 28
06/18/19 - 06/25/19	< 12	< 13	< 12	< 13	< 16	< 15	< 15	< 15	< 13

* Sample required by the ODCM
** Optional sample location

TABLE 6-7 (continued)
ENVIRONMENTAL CHARCOAL CARTRIDGE SAMPLES - OFFSITE SAMPLE LOCATIONS - 2019

I-131 ACTIVITY 10E-3 pCi/m^3 ± 1 Sigma

COLLECTION DATE	R1*	R2*	R3*	R4*	R5*	D2**	E**	F**	G**
06/25/19 - 07/02/19	< 8	< 16	< 15	< 19	< 19	< 18	< 18	< 7	< 16
07/02/19 - 07/09/19	< 17	< 19	< 19	< 23	< 14	< 24	< 23	< 24	< 19
07/09/19 - 07/16/19	< 15	< 17	< 17	< 20	< 22	< 12	< 20	< 21	< 17
07/16/19 - 07/24/19	< 23	< 24	< 23	< 11	< 28	< 28	< 26	< 27	< 24
07/24/19 - 07/30/19	< 25	< 14	< 25	< 31	< 33	< 14	< 31	< 32	< 26
07/30/19 - 08/06/19	< 17	< 19	< 18	< 25	< 25	< 10	< 25	< 25	< 19
08/06/19 - 08/13/19	< 28	< 12	< 26	< 16	< 11	< 16	< 15	< 16	< 27
08/13/19 - 08/20/19	< 19	< 10	< 18	< 19	< 20	< 7	< 17	< 19	< 18
08/20/19 - 08/27/19	< 30	< 30	< 12	< 23	< 24	< 10	< 24	< 23	< 29
08/27/19 - 09/04/19	< 12	< 21	< 21	< 26	< 9	< 25	< 25	< 26	< 20
09/04/19 - 09/10/19	< 23	< 10	< 24	< 27	< 26	< 26	< 27	< 15	< 25
09/10/19 - 09/17/19	< 25	< 25	< 26	< 26	< 10	< 25	< 25	< 26	< 27
09/17/19 - 09/24/19	< 15	< 15	< 16	< 8	< 19	< 19	< 20	< 21	< 13
09/24/19 - 10/01/19	< 25	< 26	< 26	< 11	< 25	< 25	< 26	< 27	< 26
10/01/19 - 10/08/19	< 14	< 17	< 17	< 26	< 26	< 25	< 26	< 11	< 15
10/08/19 - 10/15/19	< 16	< 16	< 16	< 15	< 15	< 13	< 12	< 15	< 17
10/15/19 - 10/22/19	< 19	< 19	< 19	< 15	< 15	< 11	< 15	< 15	< 20
10/22/19 - 10/29/19	< 9	< 9	< 9	< 16	< 17	< 18	< 18	< 6	< 8
10/29/19 - 11/05/19	< 16	< 8	< 16	< 10	< 10	< 11	< 11	< 10	< 15
11/05/19 - 11/13/19	< 14	< 14	< 13	< 18	< 18	< 19	< 7	< 18	< 14
11/13/19 - 11/19/19	< 24	< 11	< 25	< 20	< 20	< 9	< 19	< 20	< 24
11/19/19 - 11/26/19	< 24	< 23	< 24	< 20	< 19	< 20	< 19	< 10	< 11
11/26/19 - 12/03/19	< 14	< 20	< 19	< 13	< 13	< 13	< 11	< 12	< 19
12/03/19 - 12/10/19	< 16	< 20	< 19	< 15	< 15	< 15	< 13	< 15	< 19
12/10/19 - 12/17/19	< 11	< 12	< 12	< 10	< 10	< 10	< 11	< 5	< 11
12/17/19 - 12/23/19	< 22	< 11	< 22	< 20	< 20	< 20	< 11	< 19	< 21
12/23/19 - 12/31/19	< 24	< 25	< 24	< 19	< 19	< 19	< 17	< 18	< 24

* Sample required by the ODCM
** Optional sample location

TABLE 6-8
ENVIRONMENTAL CHARCOAL CARTRIDGE SAMPLES - ONSITE SAMPLE LOCATIONS - 2019

I-131 ACTIVITY 10E-3 pCi/m^3 ± 1 Sigma

COLLECTION DATE	D1**	G**	H**	I**	J**	K**
12/31/18 - 01/07/19	< 32	< 12	< 17	< 34	< 31	< 32
01/07/19 - 01/14/19	< 27	< 13	< 11	< 27	< 28	< 27
01/14/19 - 01/22/19	< 33	< 30	< 18	< 35	< 33	< 33
01/21/19 - 01/28/19	< 31	< 14	< 12	< 30	< 30	< 31
01/28/19 - 02/04/19	< 22	< 13	< 10	< 21	< 22	< 22
02/04/19 - 02/11/19	< 30	< 16	< 14	< 30	< 30	< 31
02/11/19 - 02/18/19	< 36	< 13	< 13	< 34	< 36	< 35
02/18/19 - 02/26/19	< 32	< 14	< 11	< 26	< 30	< 31
02/25/19 - 03/04/19	< 17	< 13	< 15	< 19	< 17	< 17
03/04/19 - 03/11/19	< 29	< 14	< 12	< 27	< 28	< 28
03/11/19 - 03/18/19	< 14	< 24	< 12	< 14	< 14	< 14
03/18/19 - 03/25/19	< 32	< 15	< 14	< 31	< 30	< 31
03/25/19 - 04/01/19	< 32	< 10	< 13	< 32	< 32	< 32
04/01/19 - 04/09/19	< 24	< 13	< 11	< 19	< 24	< 24
04/08/19 - 04/16/19	< 21	< 9	< 8	< 23	< 20	< 21
04/15/19 - 04/24/19	< 13	< 7	< 9	< 10	< 12	< 13
04/23/19 - 04/30/19	< 16	< 11	< 16	< 19	< 17	< 17
04/29/19 - 05/06/19	< 19	< 8	< 8	< 19	< 20	< 20
05/06/19 - 05/13/19	< 19	< 9	< 8	< 19	< 20	< 20
05/13/19 - 05/20/19	< 12	< 20	< 15	< 14	< 14	< 14
05/20/19 - 05/28/19	< 26	< 14	< 10	< 27	< 26	< 25
05/28/19 - 06/03/19	< 23	< 18	< 9	< 24	< 23	< 22
06/03/19 - 06/10/19	< 11	< 12	< 10	< 10	< 10	< 11
06/10/19 - 06/17/19	< 29	< 13	< 13	< 28	< 28	< 30
06/17/19 - 06/24/19	< 12	< 6	< 13	< 11	< 10	< 13

** Optional sample location

TABLE 6-8 (continued)
ENVIRONMENTAL CHARCOAL CARTRIDGE SAMPLES - ONSITE SAMPLE LOCATIONS - 2019

I-131 ACTIVITY 10E-3 pCi/m^3 ± 1 Sigma

COLLECTION DATE	D1**	G**	H**	I**	J**	K**
06/24/19 - 07/01/19	< 9	< 17	< 23	< 22	< 21	< 22
07/01/19 - 07/08/19	< 12	< 21	< 26	< 27	< 40	< 29
07/08/19 - 07/15/19	< 13	< 18	< 12	< 13	< 14	< 13
07/15/19 - 07/22/19	< 17	< 13	< 16	< 15	< 16	< 16
07/22/19 - 07/29/19	< 18	< 26	< 18	< 18	< 18	< 17
07/29/19 - 08/05/19	< 27	< 17	< 27	< 28	< 12	< 27
08/05/19 - 08/12/19	< 29	< 29	< 29	< 29	< 29	< 13
08/12/19 - 08/19/19	< 14	< 19	< 14	< 14	< 13	< 14
08/19/19 - 08/26/19	< 20	< 30	< 20	< 19	< 17	< 20
08/26/19 - 09/03/19	< 25	< 22	< 25	< 24	< 24	< 11
09/03/19 - 09/09/19	< 16	< 27	< 37	< 38	< 38	< 36
09/09/19 - 09/16/19	< 21	< 12	< 21	< 22	< 18	< 21
09/16/19 - 09/23/19	< 23	< 18	< 23	< 23	< 10	< 22
09/23/19 - 09/30/19	< 30	< 10	< 30	< 30	< 13	< 29
09/30/19 - 10/07/19	< 28	< 20	< 27	< 28	< 12	< 27
10/07/19 - 10/14/19	< 18	< 8	< 17	< 18	< 15	< 17
10/14/19 - 10/21/19	< 23	< 11	< 23	< 23	< 10	< 23
10/21/19 - 10/28/19	< 19	< 9	< 19	< 20	< 10	< 19
10/28/19 - 11/04/19	< 16	< 16	< 16	< 16	< 13	< 16
11/04/19 - 11/12/19	< 26	< 15	< 26	< 26	< 11	< 26
11/12/19 - 11/18/19	< 15	< 27	< 15	< 15	< 15	< 15
11/18/19 - 11/25/19	< 12	< 26	< 12	< 12	< 10	< 12
11/25/19 - 12/02/19	< 15	< 21	< 15	< 15	< 15	< 13
12/02/19 - 12/09/19	< 28	< 22	< 12	< 28	< 27	< 28
12/09/19 - 12/16/19	< 19	< 11	< 8	< 19	< 18	< 19
12/16/19 - 12/23/19	< 14	< 20	< 15	< 14	< 14	< 14
12/23/19 - 12/31/19	< 20	< 13	< 20	< 20	< 20	< 17

** Optional sample location

TABLE 6-9
CONCENTRATIONS OF GAMMA EMITTERS IN QUARTERLY COMPOSITES
AIR PARTICULATE SAMPLES - 2019

Results in Units of 10E-3 pCi/m^3 ± 1 Sigma

OFFSITE SAMPLE LOCATIONS

SAMPLE LOCATION	COLLECTION DATE	Be-7	K-40	Mn-54	Co-58	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137
R1*	01/02/19 - 04/02/19	102 ± 10	< 24	< 2	< 2	< 1	< 3	< 2	< 4	< 2	< 1
	04/02/19 - 07/02/19	88 ± 9	< 21	< 1	< 2	< 2	< 3	< 2	< 3	< 1	< 1
	07/02/19 - 10/01/19	127 ± 9	< 19	< 1	< 2	< 1	< 4	< 2	< 3	< 2	< 1
	10/01/19 - 12/31/19	92 ± 9	< 16	< 1	< 1	< 1	< 3	< 2	< 3	< 0	< 1
R2*	01/02/19 - 04/02/19	126 ± 11	< 26	< 1	< 1	< 1	< 3	< 2	< 3	< 1	< 1
	04/02/19 - 07/02/19	115 ± 11	< 20	< 1	< 1	< 1	< 3	< 1	< 3	< 1	< 1
	07/02/19 - 10/01/19	128 ± 11	< 20	< 1	< 1	< 1	< 2	< 1	< 3	< 1	< 1
	10/01/19 - 12/31/19	68 ± 8	< 20	< 1	< 1	< 1	< 3	< 2	< 3	< 1	< 1
R3*	01/02/19 - 04/02/19	125 ± 9	< 18	< 1	< 1	< 1	< 2	< 1	< 3	< 1	< 1
	04/02/19 - 07/02/19	140 ± 12	< 18	< 2	< 2	< 2	< 4	< 3	< 4	< 2	< 2
	07/02/19 - 10/01/19	118 ± 9	< 24	< 1	< 2	< 1	< 3	< 2	< 3	< 1	< 1
	10/01/19 - 12/31/19	87 ± 9	< 24	< 1	< 2	< 1	< 3	< 2	< 4	< 1	< 1
R4*	01/02/19 - 04/02/19	126 ± 12	< 19	< 1	< 1	< 1	< 3	< 2	< 3	< 1	< 1
	04/02/19 - 07/02/19	106 ± 10	< 16	< 1	< 1	< 1	< 2	< 2	< 3	< 1	< 1
	07/02/19 - 10/01/19	147 ± 11	< 26	< 1	< 2	< 1	< 3	< 2	< 4	< 1	< 1
	10/01/19 - 12/31/19	85 ± 10	< 27	< 1	< 2	< 2	< 2	< 2	< 3	< 1	< 1
R5*	01/02/19 - 04/02/19	96 ± 8	< 11	< 1	< 2	< 1	< 3	< 2	< 3	< 1	< 1
	04/02/19 - 07/02/19	116 ± 10	< 16	< 1	< 1	< 1	< 2	< 2	< 3	< 1	< 1
	07/02/19 - 10/01/19	114 ± 10	< 18	< 1	< 1	< 1	< 3	< 2	< 4	< 1	< 1
	10/01/19 - 12/31/19	75 ± 8	< 19	< 1	< 1	< 2	< 2	< 1	< 3	< 1	< 1

* Sample required by the ODCM

TABLE 6-9 (continued)
CONCENTRATIONS OF GAMMA EMITTERS IN QUARTERLY COMPOSITES
AIR PARTICULATE SAMPLES - 2019

Results in Units of 10E-3 pCi/m^3 ± 1 Sigma

OFFSITE SAMPLE LOCATIONS

SAMPLE LOCATION	COLLECTION DATE	Be-7	K-40	Mn-54	Co-58	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137
D2**	01/02/19 - 04/02/19	110 ± 14	21 ± 7	< 2	< 2	< 2	< 3	< 2	< 4	< 1	< 1
	04/02/19 - 07/02/19	100 ± 8	< 14	< 1	< 2	< 1	< 3	< 2	< 3	< 1	< 1
	07/02/19 - 10/01/19	122 ± 11	< 16	< 1	< 3	< 1	< 3	< 2	< 3	< 1	< 1
	10/01/19 - 12/31/19	73 ± 8	< 20	< 1	< 1	< 1	< 3	< 2	< 3	< 1	< 1
E**	01/02/19 - 04/02/19	120 ± 10	< 14	< 1	< 2	< 1	< 2	< 2	< 3	< 1	< 1
	04/02/19 - 07/02/19	88 ± 8	< 18	< 1	< 2	< 1	< 3	< 1	< 4	< 1	< 1
	07/02/19 - 10/01/19	110 ± 12	< 23	< 1	< 2	< 2	< 4	< 2	< 4	< 2	< 1
	10/01/19 - 12/31/19	76 ± 8	< 23	< 1	< 2	< 1	< 3	< 2	< 3	< 2	< 1
F**	01/02/19 - 04/02/19	104 ± 9	< 16	< 2	< 2	< 2	< 4	< 2	< 4	< 2	< 1
	04/02/19 - 07/02/19	111 ± 16	< 29	< 2	< 3	< 2	< 4	< 3	< 4	< 2	< 2
	07/02/19 - 10/01/19	110 ± 11	< 23	< 1	< 2	< 1	< 4	< 2	< 4	< 1	< 1
	10/01/19 - 12/31/19	85 ± 12	< 28	< 2	< 3	< 2	< 5	< 3	< 5	< 2	< 2
G**	01/02/19 - 04/02/19	112 ± 10	< 24	< 1	< 2	< 1	< 3	< 2	< 3	< 1	< 1
	04/02/19 - 07/02/19	103 ± 11	< 27	< 2	< 2	< 2	< 4	< 2	< 3	< 2	< 1
	07/02/19 - 10/01/19	132 ± 10	< 21	< 1	< 2	< 1	< 3	< 2	< 3	< 1	< 1
	10/01/19 - 12/31/19	62 ± 8	< 13	< 1	< 1	< 1	< 3	< 2	< 2	< 1	< 1

** Optional sample location

TABLE 6-9 (continued)
CONCENTRATIONS OF GAMMA EMITTERS IN QUARTERLY COMPOSITES
AIR PARTICULATE SAMPLES - 2019

Results in Units of 10E-3 pCi/m^3 ± 1 Sigma

ONSITE SAMPLE LOCATIONS

SAMPLE LOCATION	COLLECTION DATE	Be-7	K-40	Mn-54	Co-58	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137
D1**	12/31/18 - 04/01/19	125 ± 12	19 ± 7	< 2	< 2	< 2	< 3	< 3	< 4	< 1	< 1
	04/01/19 - 07/01/19	76 ± 8	< 18	< 1	< 2	< 1	< 3	< 2	< 3	< 1	< 1
	07/01/19 - 09/30/19	125 ± 11	< 16	< 1	< 2	< 1	< 3	< 1	< 3	< 1	< 1
	09/30/19 - 12/30/19	85 ± 10	< 25	< 1	< 2	< 2	< 3	< 2	< 4	< 1	< 1
G**	12/31/18 - 04/01/19	97 ± 12	< 8	< 2	< 2	< 1	< 3	< 2	< 3	< 2	< 1
	04/01/19 - 07/01/19	118 ± 11	< 25	< 1	< 2	< 1	< 4	< 2	< 3	< 1	< 1
	07/01/19 - 09/30/19	122 ± 10	< 17	< 1	< 1	< 1	< 4	< 2	< 2	< 1	< 1
	09/30/19 - 12/30/19	77 ± 11	< 30	< 2	< 3	< 2	< 5	< 3	< 5	< 2	< 2
H**	12/31/18 - 04/01/19	102 ± 10	< 18	< 1	< 1	< 1	< 2	< 2	< 3	< 2	< 1
	04/01/19 - 07/01/19	98 ± 12	< 10	< 1	< 2	< 2	< 4	< 3	< 3	< 1	< 2
	07/01/19 - 09/30/19	99 ± 9	< 21	< 1	< 2	< 1	< 2	< 1	< 3	< 1	< 1
	09/30/19 - 12/30/19	61 ± 10	< 19	< 1	< 2	< 2	< 4	< 2	< 3	< 1	< 1
I**	12/31/18 - 04/01/19	108 ± 9	< 11	< 1	< 1	< 1	< 2	< 1	< 2	< 1	< 1
	04/01/19 - 07/01/19	89 ± 8	< 25	< 1	< 2	< 2	< 3	< 2	< 3	< 1	< 1
	07/01/19 - 09/30/19	122 ± 10	< 17	< 1	< 1	< 2	< 3	< 2	< 3	< 1	< 1
	09/30/19 - 12/30/19	75 ± 9	< 25	< 1	< 2	< 1	< 5	< 2	< 4	< 1	< 1
J**	12/31/18 - 04/01/19	143 ± 12	< 28	< 1	< 1	< 1	< 3	< 2	< 3	< 1	< 1
	04/01/19 - 07/01/19	127 ± 11	< 23	< 2	< 2	< 1	< 4	< 2	< 3	< 2	< 1
	07/01/19 - 09/30/19	130 ± 12	< 18	< 2	< 2	< 1	< 3	< 2	< 3	< 1	< 1
	09/30/19 - 12/30/19	83 ± 13	< 26	< 1	< 2	< 1	< 3	< 2	< 4	< 1	< 1
K**	12/31/18 - 04/01/19	101 ± 9	< 15	< 1	< 2	< 1	< 3	< 2	< 3	< 1	< 1
	04/01/19 - 07/01/19	133 ± 12	< 18	< 2	< 3	< 1	< 5	< 3	< 4	< 2	< 1
	07/01/19 - 09/30/19	123 ± 11	< 28	< 1	< 2	< 2	< 4	< 2	< 4	< 2	< 1
	09/30/19 - 12/30/19	90 ± 10	< 17	< 1	< 2	< 1	< 3	< 1	< 3	< 1	< 1

** Optional sample location

TABLE 6-10
DIRECT RADIATION MEASUREMENT RESULTS - 2019

Results in mrem/std. Month ± 1 Sigma

LOCATION NO.	DESCRIPTION	JAN - MAR	APR - JUN	JUL - SEP	OCT - DEC	DEGREES & DISTANCE (1)
3	D1 Onsite	11.4 ± 0.4	12.5 ± 0.3	12.1 ± 0.5	13.2 ± 0.6	71° at 0.3 miles
4	D2 Onsite	3.7 ± 0.2	5.0 ± 0.1	5.6 ± 0.2	5.2 ± 0.2	143° at 0.4 miles
5	E Onsite	3.9 ± 0.2	5.1 ± 0.2	5.4 ± 0.2	5.5 ± 0.2	180° at 0.3 miles
6	F Onsite	3.2 ± 0.2	4.4 ± 0.1	4.8 ± 0.2	4.7 ± 0.2	213° at 0.5 miles
7*	G Onsite	3.0 ± 0.2	4.2 ± 0.1	4.5 ± 0.2	4.5 ± 0.2	245° at 0.7 miles
8*	R5 Offsite Control	4.2 ± 0.3	5.1 ± 0.2	5.6 ± 0.2	5.3 ± 0.2	42° at 16.2 miles
9	D1 Offsite - State Route 3	3.3 ± 0.1	4.7 ± 0.2	4.9 ± 0.2	5.0 ± 0.2	80° at 11.4 miles
10	D2 Offsite	3.4 ± 0.2	4.5 ± 0.1	4.7 ± 0.2	4.8 ± 0.2	118° at 9.0 miles
11	E Offsite	3.4 ± 0.2	4.5 ± 0.2	4.6 ± 0.2	4.7 ± 0.2	162° at 7.1 miles
12	F Offsite	3.6 ± 0.2	4.5 ± 0.2	4.6 ± 0.2	4.7 ± 0.2	192° at 7.6 miles
13	G Offsite	3.7 ± 0.2	4.7 ± 0.2	5.0 ± 0.2	4.9 ± 0.2	226° at 5.4 miles
14*	DeMass Rd., SW Oswego - Control	3.6 ± 0.2	4.8 ± 0.2	5.1 ± 0.2	5.1 ± 0.2	227° at 12.5 miles
15*	Pole 66, W. Boundary - Bible Camp	3.2 ± 0.2	4.4 ± 0.1	4.9 ± 0.2	5.1 ± 0.2	240° at 0.9 miles
18*	Energy Info. Center - Lamp Post, SW	4.1 ± 0.2	5.1 ± 0.2	5.6 ± 0.2	5.5 ± 0.2	268° at 0.4 miles
19	East Boundary - JAF, Pole 9	3.7 ± 0.2	5.0 ± 0.2	5.5 ± 0.2	5.3 ± 0.2	83° at 1.4 miles
23*	H Onsite	4.4 ± 0.2	5.2 ± 0.2	5.5 ± 0.2	5.3 ± 0.2	73° at 0.8 miles
24	I Onsite	3.9 ± 0.2	4.5 ± 0.2	4.8 ± 0.2	4.7 ± 0.2	95° at 0.8 miles
25	J Onsite	3.6 ± 0.2	4.6 ± 0.1	5.1 ± 0.2	4.9 ± 0.2	109° at 0.9 miles
26	K Onsite	3.6 ± 0.2	4.4 ± 0.2	4.9 ± 0.2	4.6 ± 0.2	132° at 0.5 miles
27	N. Fence, N. of Switchyard, JAF	19.7 ± 0.8	20.8 ± 1.0	19.5 ± 0.7	21.6 ± 1.0	60° at 0.4 miles
28	N. Light Pole, N. of Screenhouse, JAF	21.6 ± 1.3	23.2 ± 1.5	22.3 ± 1.4	23.9 ± 1.6	68° at 0.5 miles
29	N. Fence, N. of W. Side	22.8 ± 1.2	24.8 ± 2.0	22.2 ± 1.6	25.8 ± 2.4	65° at 0.5 miles
30	N. Fence, (NW) JAF	11.0 ± 0.5	12.9 ± 0.8	11.8 ± 0.7	13.7 ± 1.0	57° at 0.4 miles
31	N. Fence, (NW) NMP-1	5.8 ± 0.3	7.5 ± 0.3	7.4 ± 0.3	8.1 ± 0.5	279° at 0.2 miles
39	N. Fence, Rad. Waste-NMP-1	8.1 ± 0.4	11.4 ± 0.5	10.4 ± 0.4	12.9 ± 0.8	298° at 0.2 miles
47	N. Fence, (NE) JAF	5.7 ± 0.3	7.5 ± 0.4	7.3 ± 0.3	8.1 ± 0.4	69° at 0.6 miles
49*	Phoenix, NY - Control	3.3 ± 0.2	4.9 ± 0.2	4.9 ± 0.2	5.2 ± 0.3	168° at 19.7 miles
51	Liberty & Bronson Sts., E. of OSS	3.5 ± 0.2	5.0 ± 0.2	5.3 ± 0.2	5.3 ± 0.2	234° at 7.3 miles
52	E. 12th & Cayuga Sts., Oswego School	3.4 ± 0.2	4.8 ± 0.2	5.1 ± 0.2	5.2 ± 0.2	227° at 5.9 miles
53	Broadwell & Chestnut Sts., Fulton H.S.	3.6 ± 0.2	5.3 ± 0.2	5.3 ± 0.3	5.6 ± 0.2	183° at 13.7 miles
54	Mexico High School	3.3 ± 0.1	4.7 ± 0.1	4.9 ± 0.2	4.9 ± 0.2	115° at 9.4 miles
55	Gas Substation Co. Rt. 5-Pulaski	3.3 ± 0.1	4.9 ± 0.2	5.0 ± 0.2	5.1 ± 0.2	75° at 13.0 miles
56*	Rt. 104-New Haven Sch. (SE Corner)	3.0 ± 0.3	4.9 ± 0.2	5.1 ± 0.2	5.1 ± 0.2	124° at 5.2 miles
58*	Co. Rt. 1A-Novelis (E. of E. Entrance Rd.)	3.6 ± 0.2	5.1 ± 0.2	5.6 ± 0.3	5.5 ± 0.4	222° at 3.0 miles
75*	Unit 2, N. Fence, N. of Reactor Bldg.	9.6 ± 0.5	8.5 ± 0.3	7.8 ± 0.3	8.4 ± 0.4	354° at 0.1 miles
76*	Unit 2, N. Fence, N. of Change House	5.6 ± 0.2	6.6 ± 0.3	6.6 ± 0.3	6.9 ± 0.3	25° at 0.1 miles

(1) Direction and distances based on NMP-2 reactor centerline.
* TLD required by ODCM

TABLE 6-10 (continued)
DIRECT RADIATION MEASUREMENT RESULTS - 2019

Results in mrem/std. Month ± 1 Sigma

LOCATION NO.	DESCRIPTION	JAN - MAR	APR - JUN	JUL - SEP	OCT - DEC	DEGREES & DISTANCE (1)
77*	Unit 2, N. Fence, N. of Pipe Bldg.	5.9 ± 0.3	7.3 ± 0.2	7.4 ± 0.3	7.6 ± 0.3	36° at 0.2 miles
78*	JAF. E. of E. Old Lay Down Area	3.6 ± 0.3	5.2 ± 0.2	5.4 ± 0.2	5.6 ± 0.2	85° at 1.0 miles
79*	Co. Rt. 29, Pole #63, 0.2 mi. S. of Lake Rd.	3.2 ± 0.2	4.6 ± 0.2	5.0 ± 0.2	5.1 ± 0.2	120° at 1.2 miles
80*	Co. Rt. 29, Pole #54, 0.7 mi. S. of Lake Rd.	3.5 ± 0.2	4.9 ± 0.2	5.1 ± 0.2	5.2 ± 0.2	136° at 1.5 miles
81*	Miner Rd., Pole # 16, 0.5 mi. W. of Rt. 29	3.2 ± 0.2	4.8 ± 0.2	4.8 ± 0.2	5.1 ± 0.2	159° at 1.6 miles
82*	Miner Rd., Pole # 1-1/2, 1.1 mi. W. of Rt. 29	3.1 ± 0.2	4.7 ± 0.1	4.9 ± 0.2	5.0 ± 0.2	180° at 1.6 miles
83*	Lakeview Rd., Tree 0.45 mi. N. of Miner Rd.	3.1 ± 0.2	4.6 ± 0.2	4.7 ± 0.2	5.2 ± 0.2	203° at 1.2 miles
84*	Lakeview Rd., N., Pole #6117, 200ft. N. of Lake Rd.	3.4 ± 0.2	4.9 ± 0.2	5.0 ± 0.2	5.3 ± 0.2	226° at 1.1 miles
85*	Unit 1, N. Fence, N. of W. Side of Screen House	6.2 ± 0.3	8.4 ± 0.4	8.0 ± 0.4	9.9 ± 0.6	292° at 0.2 miles
86*	Unit 2, N. Fence, N. of W. Side of Screen House	7.0 ± 0.4	8.6 ± 0.5	8.5 ± 0.5	9.6 ± 0.4	311° at 0.1 miles
87*	Unit 2, N. Fence, N. of E. Side of Screen House	9.5 ± 0.6	9.3 ± 0.4	8.6 ± 0.5	9.4 ± 0.5	333° at 0.1 miles
88*	Hickory Grove Rd., Pole #2, 0.6 mi. N. of Rt. 1	3.2 ± 0.2	4.8 ± 0.2	4.9 ± 0.2	5.0 ± 0.2	97° at 4.5 miles
89*	Leavitt Rd., Pole #16, 0.4 mi. S. of Rt. 1	3.7 ± 0.2	5.0 ± 0.2	5.1 ± 0.2	5.2 ± 0.2	112° at 4.3 miles
90*	Rt. 104, Pole #300, 150 ft. E. of Keefe Rd.	3.3 ± 0.2	4.9 ± 0.1	5.0 ± 0.2	5.0 ± 0.2	135° at 4.2 miles
91*	Rt. 51A, Pole #59, 0.8 mi. W. of Rt. 51	3.2 ± 0.1	4.7 ± 0.2	4.9 ± 0.2	5.0 ± 0.3	157° at 4.9 miles
92*	Maiden Lane Rd., Power Pole, 0.6 mi. S. of Rt. 104	3.4 ± 0.2	5.4 ± 0.2	5.6 ± 0.3	5.5 ± 0.3	183° at 4.4 miles
93*	Rt. 53 Pole 1-1, 120ft. S. of Rt. 104	3.5 ± 0.2	4.8 ± 0.2	4.9 ± 0.2	5.0 ± 0.2	206° at 4.4 miles
94*	Rt. 1, Pole #82, 250ft. E. of Kocher Rd. (Co. Rt. 63)	3.2 ± 0.2	4.5 ± 0.1	4.8 ± 0.2	5.0 ± 0.3	224° at 4.4 miles
95*	Novelis W. access Rd., Joe Fultz Blvd., Pole #21	3.2 ± 0.2	4.3 ± 0.2	4.5 ± 0.2	4.6 ± 0.2	239° at 3.7 miles
96*	Creamery Rd., 0.3 mi. S. of Middle Rd., Pole 1-1/2	3.3 ± 0.2	4.9 ± 0.2	4.8 ± 0.2	5.0 ± 0.2	199° at 3.6 miles
97*	Rt. 29, Pole #50, 200ft. N. of Miner Rd.	3.2 ± 0.1	4.7 ± 0.2	4.8 ± 0.2	5.0 ± 0.2	145° at 1.8 miles
98	Lake Rd., Pole #145, 0.15 mi. E. of Rt. 29	3.3 ± 0.2	4.9 ± 0.2	5.1 ± 0.2	5.2 ± 0.2	102° at 1.2 miles
99	NMP Rd., 0.4 mi. N. of Lake Rd., Env. Station R1	3.4 ± 0.2	4.9 ± 0.2	5.0 ± 0.2	5.2 ± 0.2	92° at 1.8 miles
100	Rt. 29 & Lake Rd. Env. Station R2	3.4 ± 0.2	4.7 ± 0.2	4.6 ± 0.2	5.0 ± 0.2	107° at 1.1 miles
101	Rt. 29, 0.7 mi. S. of Lake Rd. Env. Station R3	3.0 ± 0.2	4.4 ± 0.1	4.5 ± 0.2	4.7 ± 0.2	133° at 1.4 miles
102	EOF/Env. Lab, Rt. 176, E. Driveway, Lamp Post	3.3 ± 0.2	4.8 ± 0.2	4.7 ± 0.2	5.1 ± 0.2	175° at 11.9 miles
103	EIC, East Garage Rd., Lamp Post	4.0 ± 0.2	5.5 ± 0.2	5.5 ± 0.2	5.8 ± 0.2	268° at 0.4 miles
104	Parkhurst Rd., Pole #23, 0.1 mi. S. of Lake Rd.	3.2 ± 0.2	4.8 ± 0.2	5.0 ± 0.2	5.0 ± 0.2	102° at 1.4 miles
105	Lakeview Rd., Pole #36, 0.5 mi. S. of Lake Rd.	3.3 ± 0.2	4.8 ± 0.2	4.9 ± 0.2	5.1 ± 0.2	199° at 1.4 miles
106	Shoreline Cove, W. of NMP-1, Tree on W. Edge	4.2 ± 0.2	5.6 ± 0.2	5.7 ± 0.3	6.3 ± 0.2	274° at 0.3 miles
107	Shoreline Cove, W. of NMP-1, 30ft. SSW of #106	4.1 ± 0.2	5.4 ± 0.2	5.5 ± 0.2	5.9 ± 0.3	273° at 0.3 miles
108	Lake Rd., Pole #142, 300 ft. E. of Rt. 29 S.	3.4 ± 0.2	5.1 ± 0.2	5.2 ± 0.3	5.3 ± 0.3	105° at 1.1 miles
109	Tree North of Lake Rd., 300 ft. E. of Rt. 29 N.	3.6 ± 0.2	5.0 ± 0.2	5.2 ± 0.2	5.3 ± 0.3	104° at 1.1 miles
111	Control, State Route 38, Sterling, NY	3.3 ± 0.2	4.7 ± 0.2	4.6 ± 0.3	4.9 ± 0.2	214° at 21.8 miles
112	EOF/Env. Lab, Oswego County Airport	3.4 ± 0.2	4.6 ± 0.2	4.6 ± 0.2	4.9 ± 0.3	175° at 11.9 miles
113	Control, Baldwinsville, NY	3.3 ± 0.2	4.6 ± 0.1	4.7 ± 0.2	4.9 ± 0.2	178° at 24.7 miles

(1) Direction and distances based on NMP-2 reactor centerline.
* TLD required by ODCM

TABLE 6-11
CONCENTRATIONS OF IODINE-131 AND GAMMA EMITTERS IN MILK SAMPLES - 2019

Results in Units of pCi/liter ± 1 Sigma

SAMPLE LOCATION***	COLLECTION DATE	I-131	K-40	Cs-134	Cs-137	Ba-La-140	Others †
SAMPLE LOCATION** (55)							
	04/08/19	< 0.6	1221 ± 92	< 9	< 9	< 9	< LLD
	04/24/19	< 0.5	1175 ± 95	< 8	< 9	< 8	< LLD
	05/06/19	< 0.4	1171 ± 86	< 8	< 8	< 13	< LLD
	05/20/19	< 0.7	1191 ± 99	< 11	< 9	< 9	< LLD
	06/03/19	< 0.6	1358 ± 92	< 9	< 9	< 11	< LLD
	06/17/19	< 0.7	1245 ± 63	< 6	< 6	< 6	< LLD
	07/08/19	< 0.7	1285 ± 93	< 8	< 10	< 11	< LLD
	07/22/19	< 0.8	1314 ± 81	< 7	< 7	< 10	< LLD
	08/05/19	< 0.8	1291 ± 93	< 8	< 10	< 9	< LLD
	08/19/19	< 0.9	1313 ± 88	< 7	< 9	< 11	< LLD
	09/03/19	< 0.6	1251 ± 91	< 8	< 8	< 8	< LLD
	09/18/19	< 0.6	1209 ± 106	< 10	< 9	< 10	< LLD
	10/07/19	< 0.5	1314 ± 112	< 9	< 9	< 9	< LLD
	10/21/19	< 0.9	1432 ± 106	< 10	< 9	< 8	< LLD
	11/04/19	< 0.6	1404 ± 102	< 10	< 9	< 9	< LLD
	11/18/19	< 0.7	1515 ± 114	< 12	< 11	< 12	< LLD
	12/02/19	< 0.9	1213 ± 123	< 9	< 9	< 11	< LLD
	12/16/19	< 0.9	1273 ± 100	< 9	< 7	< 7	< LLD

** Optional sample location

*** Corresponds to sample location noted on Figure 3.3-4

† Plant related radionuclides

TABLE 6-11 (continued)
CONCENTRATIONS OF IODINE-131 AND GAMMA EMITTERS IN MILK SAMPLES - 2019

Results in Units of pCi/liter ± 1 Sigma

SAMPLE LOCATION***	COLLECTION DATE	I-131	K-40	Cs-134	Cs-137	Ba-La-140	Others †
SAMPLE LOCATION* (Control, 77)							
	04/08/19	< 0.7	1311 ± 81	< 11	< 11	< 9	< LLD
	04/24/19	< 0.7	1170 ± 72	< 10	< 9	< 11	< LLD
	05/06/19	< 0.7	1249 ± 82	< 8	< 7	< 8	< LLD
	05/20/19	< 0.8	1241 ± 88	< 7	< 9	< 5	< LLD
	06/03/19	< 0.9	1286 ± 94	< 9	< 9	< 12	< LLD
	06/17/19	< 0.5	1356 ± 72	< 6	< 5	< 5	< LLD
	07/08/19	< 0.6	1390 ± 98	< 11	< 8	< 6	< LLD
	07/22/19	< 0.7	1404 ± 100	< 8	< 6	< 8	< LLD
	08/05/19	< 0.6	1190 ± 93	< 8	< 6	< 5	< LLD
	08/19/19	< 1.0	1329 ± 79	< 8	< 9	< 10	< LLD
	09/03/19	< 0.9	1408 ± 100	< 9	< 9	< 10	< LLD
	09/18/19	< 1.0	1405 ± 99	< 10	< 9	< 10	< LLD
	10/07/19	< 0.6	1501 ± 108	< 11	< 9	< 7	< LLD
	10/21/19	< 0.8	1316 ± 75	< 7	< 7	< 7	< LLD
	11/04/19	< 0.9	1212 ± 103	< 9	< 8	< 8	< LLD
	11/18/19	< 0.8	1325 ± 92	< 8	< 10	< 5	< LLD
	12/02/19	< 1.0	1444 ± 96	< 8	< 10	< 9	< LLD
	12/16/19	< 0.7	1332 ± 100	< 8	< 9	< 8	< LLD

* Sample required by the ODCM

*** Corresponds to sample location noted on Figure 3.3-4

† Plant related radionuclides

TABLE 6-12
CONCENTRATIONS OF GAMMA EMITTERS IN FOOD PRODUCT SAMPLES - 2019

Results in Units of pCi/kg (wet) ± 1 Sigma

SAMPLE LOCATION***	COLLECTION DATE		Be-7	K-40	Zn-65	I-131	Cs-134	Cs-137	Others †
LAWTON* (69)									
	08/26/19	Squash Leaves	1330 ± 134	3198 ± 258	< 50	< 33	< 26	< 24	< LLD
	08/26/19	Blackberry Leaves	593 ± 113	1619 ± 164	< 51	< 28	< 30	< 28	< LLD
	08/26/19	Grape Leaves	1341 ± 151	1045 ± 248	< 64	< 35	< 29	< 30	< LLD
FLACK* (Control, C2, 145)									
	08/14/19	Horseradish Leaves	997 ± 124	3174 ± 273	< 58	< 35	< 18	< 20	< LLD
	08/14/19	Rhubarb Leaves	921 ± 147	6239 ± 353	< 59	< 40	< 27	< 29	< LLD
	08/14/19	Corn Leaves	1525 ± 157	3048 ± 275	< 41	< 40	< 26	< 26	< LLD
WHALEY* (144)									
	08/14/19	Grape Leaves	706 ± 119	1307 ± 198	< 62	< 39	< 31	< 28	< LLD
	08/14/19	Rhubarb Leaves	483 ± 101	3615 ± 248	< 51	< 35	< 24	< 24	< LLD
	08/14/19	Horseradish Leaves	917 ± 142	3831 ± 328	< 63	< 48	< 35	< 33	< LLD
O'CONNOR* (484)									
	08/14/19	Grape Leaves	1128 ± 171	1943 ± 237	< 56	< 49	< 27	< 25	< LLD
	08/14/19	Horseradish Leaves	485 ± 95	3533 ± 253	< 39	< 32	< 27	< 25	< LLD
	08/14/19	Rhubarb Leaves	430 ± 110	5167 ± 394	< 65	< 34	< 21	< 27	< LLD

* Sample required by the ODCM

*** Corresponds to sample location noted on Figure 3.3-5

† Plant related radionuclides

TABLE 6-13
MILK ANIMAL CENSUS
2019

Town or Area[a]	Location Designation[1]	Degrees[2]	Distance[2] (Miles)	Number of Milk Animals (Cows)
Richland	80	89°	9.7	23
Mexico	14	125°	9.1	56
	55*	97°	8.7	60
Granby (Control)	77**	190°	16.0	50

MILKING ANIMAL TOTALS: 189
(including control locations)

MILKING ANIMAL TOTALS: 139
(excluding control locations)

NOTES:
* Milk sample location
** Milk sample control location
(1) Reference Figure 3.3-4 for locations 55 and 77
(2) Degrees and distance are based on NMP-2 Reactor Building centerline
(a) Census performed out to a distance of approximately 10 miles

TABLE 6-14
JAF RESIDENCE CENSUS
2019

Meteorological Sector	Location	Map Location[1]	Direction[2]	Distance[2]
N	*	-	-	-
NNE	*	-	-	-
NE	*	-	-	-
ENE	*	-	-	-
E	80 Sunset Bay Road	A	83°	1.04 miles
ESE	161 Lake Road	B	116°	0.7 miles
SE	1216 County Route 29	C	143°	1.07 miles
SSE	1146 County Route 29	D	152°	1.29 miles
S	294 Miner Road	E	179°	1.57 miles
SSW	210 Lakeview Road	F	213°	1.65 miles
SW	319 Lakeview Road	G	230°	1.45 miles
WSW	85 Bayshore Drive	H	242°	1.81 miles
W	*	-	-	-
WNW	*	-	-	-
NW	*	-	-	-
NNW	*	-	-	-

NOTES:
* This meteorological sector is over Lake Ontario. There is no residence within five miles
(1) Corresponds to Figure 3.3-6a
(2) Direction and distance are based on JAFNPP Reactor Building centerline

TABLE 6-15
NMPNS RESIDENCE CENSUS
2019

Meteorological Sector	Location	Map Location[1]	Direction[2]	Distance[2]
N	*	-	-	-
NNE	*	-	-	-
NE	*	-	-	-
ENE	*	-	-	-
E	116 Lake Road	A	100°	1.29 miles
ESE	161 Lake Road	B	104°	1.11 miles
SE	1216 County Route 29	C	125°	1.35 miles
SSE	294 Miner Road	D	162°	1.59 miles
S	356 Miner Road	E	171°	1.57 miles
SSW	281 Lakeview Road	F	208°	1.18 miles
SW	319 Lakeview Road	G	217°	1.11 miles
WSW	85 Bayshore Drive	H	237°	1.38 miles
W	*	-	-	-
WNW	*	-	-	-
NW	*	-	-	-
NNW	*	-	-	-

NOTES:
* This meteorological sector is over Lake Ontario. There is no residence within five miles
(1) Corresponds to Figure 3.3-6b
(2) Direction and distance are based on NMP-Unit 2 Reactor Building centerline

7.0 HISTORICAL DATA TABLES

Sample Statistics from Previous Environmental Sampling

The mean, minimum value and maximum value were calculated for selected sample mediums and isotopes.

Special Considerations:

1. Sample data listed as 1969 was taken from the NINE MILE POINT, PREOPERATION SURVEY, 1969 and ENVIRONMENTAL MONITORING REPORT FOR NIAGARA MOHAWK POWER CORPORATION NINE MILE POINT NUCLEAR STATION, NOVEMBER, 1970.

2. Sample results listed as 1974 and 1975 were taken from the respective Annual Radiological Environmental Operating Reports for Nine Mile Point Unit 1 Nuclear Station. Sample results listed as 1986 through the current year were taken from the respective James A. FitzPatrick Nuclear Power Plant Annual Radiological Environmental Operating Reports.

3. Only measured values were used for statistical calculations.

4. The term MDL was used prior to 1979 to represent the concept of Lower Limit of Detection (LLD). MDL = Minimum Detectable Level.

TABLE 7-1
HISTORICAL ENVIRONMENTAL SAMPLE DATA
SHORELINE SEDIMENT
Results in pCi/g (dry)

LOCATION: CONTROL *									
Isotope	**Cs-134**			**Cs-137**			**Co-60**		
Year	**Min.**	**Max.**	**Mean**	**Min.**	**Max.**	**Mean**	**Min.**	**Max.**	**Mean**
1969†	**	**	**	**	**	**	**	**	**
1974†	**	**	**	**	**	**	**	**	**
1975†	**	**	**	**	**	**	**	**	**
1992	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1993	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1994	<LLD	<LLD	<LLD	0.027	0.027	0.027	<LLD	<LLD	<LLD
1995	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1996	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1997	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1998	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1999	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2000	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2001	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2002	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2003	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2004	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2005	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2006	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2007	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2008	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2009	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2010	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2011	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2012	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2013	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2014	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2015	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2016	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2017	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2018	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2019	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD

* Langs Beach – beyond influence of the site in a westerly direction.

** No data. Sample not required until new technical specifications implemented in 1985.

† 1969 data is considered to be pre-operational for the site. 1974 and 1975 data is considered to be pre-operational for the JAFNPP.

TABLE 7-2
HISTORICAL ENVIRONMENTAL SAMPLE DATA
SHORELINE SEDIMENT
Results in pCi/g (dry)

LOCATION: INDICATOR *									
Isotope	Cs-134			Cs-137			Co-60		
Year	Min.	Max.	Mean	Min.	Max.	Mean	Min.	Max.	Mean
1969†	**	**	**	**	**	**	**	**	**
1974†	**	**	**	**	**	**	**	**	**
1975†	**	**	**	**	**	**	**	**	**
1992	<LLD	<LLD	<LLD	0.12	0.14	0.13	<LLD	<LLD	<LLD
1993	<LLD	<LLD	<LLD	0.18	0.46	0.32	<LLD	<LLD	<LLD
1994	<LLD	<LLD	<LLD	0.06	0.37	0.22	<LLD	<LLD	<LLD
1995	<LLD	<LLD	<LLD	0.14	0.15	0.15	<LLD	<LLD	<LLD
1996	<LLD	<LLD	<LLD	0.15	0.17	0.16	<LLD	<LLD	<LLD
1997	<LLD	<LLD	<LLD	0.11	0.17	0.14	<LLD	<LLD	<LLD
1998	<LLD	<LLD	<LLD	0.06	0.06	0.06	<LLD	<LLD	<LLD
1999	<LLD	<LLD	<LLD	0.06	0.10	0.08	<LLD	<LLD	<LLD
2000	<LLD	<LLD	<LLD	0.06	0.07	0.06	<LLD	<LLD	<LLD
2001	<LLD	<LLD	<LLD	0.06	0.07	0.07	<LLD	<LLD	<LLD
2002	<LLD	<LLD	<LLD	0.05	0.05	0.05	<LLD	<LLD	<LLD
2003	<LLD	<LLD	<LLD	0.04	0.05	0.05	<LLD	<LLD	<LLD
2004	<LLD	<LLD	<LLD	0.04	0.04	0.04	<LLD	<LLD	<LLD
2005	<LLD	<LLD	<LLD	0.06	0.09	0.08	<LLD	<LLD	<LLD
2006	<LLD	<LLD	<LLD	0.06	0.06	0.06	<LLD	<LLD	<LLD
2007	<LLD	<LLD	<LLD	0.04	0.04	0.04	<LLD	<LLD	<LLD
2008	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2009	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2010	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2011	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2012	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2013	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2014	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2015	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2016	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2017	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2018	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2019	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD

* Sunset Beach - closest offsite location with recreational value.

** No data. Sample not required until new technical specifications implemented in 1985.

† 1969 data is considered to be pre-operational for the site. 1974 and 1975 data is considered to be pre-operational for the JAFNPP.

TABLE 7-3
HISTORICAL ENVIRONMENTAL SAMPLE DATA
FISH
Results in pCi/g (wet)

LOCATION: CONTROL *			
Isotope	**Cs-137**		
Year	**Min.**	**Max.**	**Mean**
1969†	No Data	No Data	No Data
1974†	0.94	0.94	0.94
1975†	<MDL	<MDL	<MDL
1992	0.019	0.026	0.022
1993	0.030	0.036	0.033
1994	0.014	0.031	0.022
1995	0.017	0.023	0.019
1996	0.018	0.022	0.020
1997	0.012	0.030	0.021
1998	0.013	0.013	0.013
1999	<LLD	<LLD	<LLD
2000	0.021	0.021	0.021
2001	<LLD	<LLD	<LLD
2002	<LLD	<LLD	<LLD
2003	<LLD	<LLD	<LLD
2004	<LLD	<LLD	<LLD
2005	<LLD	<LLD	<LLD
2006	<LLD	<LLD	<LLD
2007	<LLD	<LLD	<LLD
2008	<LLD	<LLD	<LLD
2009	<LLD	<LLD	<LLD
2010	<LLD	<LLD	<LLD
2011	<LLD	<LLD	<LLD
2012	<LLD	<LLD	<LLD
2013	<LLD	<LLD	<LLD
2014	<LLD	<LLD	<LLD
2015	<LLD	<LLD	<LLD
2016	<LLD	<LLD	<LLD
2017	<LLD	<LLD	<LLD
2018	<LLD	<LLD	<LLD
2019	<LLD	<LLD	<LLD

* Control location is at an area beyond the influence of the site (westerly direction).

† 1969 data is considered to be pre-operational for the site. 1974 and 1975 data is considered to be pre-operational for the JAFNPP.

TABLE 7-4
HISTORICAL ENVIRONMENTAL SAMPLE DATA
FISH
Results in pCi/g (wet)

LOCATION: INDICATOR * (NMP/JAF)			
Isotope	**Cs-137**		
Year	**Min.**	**Max.**	**Mean**
1969†	0.01	0.13	0.06
1974†	0.08	4.40	0.57
1975†	1.10	1.70	1.38
1992	0.014	0.030	0.024
1993	0.018	0.035	0.028
1994	0.015	0.023	0.019
1995	0.016	0.022	0.019
1996	0.016	0.025	0.020
1997	0.014	0.023	0.018
1998	0.021	0.021	0.021
1999	0.018	0.021	0.020
2000	<LLD	<LLD	<LLD
2001	<LLD	<LLD	<LLD
2002	0.016	0.016	0.016
2003	<LLD	<LLD	<LLD
2004	<LLD	<LLD	<LLD
2005	<LLD	<LLD	<LLD
2006	<LLD	<LLD	<LLD
2007	<LLD	<LLD	<LLD
2008	<LLD	<LLD	<LLD
2009	<LLD	<LLD	<LLD
2010	<LLD	<LLD	<LLD
2011	<LLD	<LLD	<LLD
2012	<LLD	<LLD	<LLD
2013	<LLD	<LLD	<LLD
2014	<LLD	<LLD	<LLD
2015	<LLD	<LLD	<LLD
2016	<LLD	<LLD	<LLD
2017	<LLD	<LLD	<LLD
2018	<LLD	<LLD	<LLD
2019	<LLD	<LLD	<LLD

* Indicator locations are in the general area of the NMP-1 and J.A. FitzPatrick cooling water discharge structures.

† 1969 data is considered to be pre-operational for the site. 1974 and 1975 data is considered to be pre-operational for the JAFNPP.

TABLE 7-5
HISTORICAL ENVIRONMENTAL SAMPLE DATA
SURFACE WATER
Results in pCi/liter

LOCATION: CONTROL †						
Isotope	**Cs-137**			**Co-60**		
Year	**Min.**	**Max.**	**Mean**	**Min.**	**Max.**	**Mean**
1969††	*	*	*	*	*	*
1974††	*	*	*	*	*	*
1975††	*	*	*	*	*	*
1992	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1993	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1994	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1995	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1996	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1997	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1998	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1999	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2000	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2001	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2002	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2003	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2004	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2005	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2006	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2007	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2008	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2009	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2010	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2011	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2012	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2013	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2014	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2015	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2016	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2017	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2018	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2019	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD

* No gamma analysis performed (not required).

† Location was the City of Oswego Water Supply for 1969-1984 and the Oswego Steam Station inlet canal for 1985-Present.

†† 1969 data is considered to be pre-operational for the site. 1974 and 1975 data is considered to be pre-operational for the JAFNPP.

TABLE 7-6
HISTORICAL ENVIRONMENTAL SAMPLE DATA
SURFACE WATER
Results in pCi/liter

LOCATION: INDICATOR †						
Isotope	**Cs-137**			**Co-60**		
Year	**Min.**	**Max.**	**Mean**	**Min.**	**Max.**	**Mean**
1969††	*	*	*	*	*	*
1974††	*	*	*	*	*	*
1975††	*	*	*	*	*	*
1992	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1993	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1994	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1995	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1996	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1997	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1998	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1999	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2000	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2001	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2002	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2003	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2004	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2005	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2006	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2007	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2008	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2009	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2010	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2011	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2012	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2013	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2014	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2015	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2016	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2017	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2018	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2019	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD

* No gamma analysis performed (not required).

† Indicator location was the NMP 1 Inlet Canal for the period 1969-1973, and the JAF Inlet Canal for 1974-Present.

†† 1969 data is considered to be pre-operational for the site. 1974 and 1975 data is considered to be pre-operational for the JAFNPP.

TABLE 7-7
HISTORICAL ENVIRONMENTAL SAMPLE DATA
SURFACE WATER TRITIUM
Results in pCi/liter

LOCATION: CONTROL *			
Isotope	**Tritium**		
Year	**Min.**	**Max.**	**Mean**
1969†	No Data	No Data	No Data
1974†	<MDL	<MDL	<MDL
1975†	311	414	362
1992	190	310	243
1993	160	230	188
1994	250	250	250
1995	230	230	230
1996	<LLD	<LLD	<LLD
1997	<LLD	<LLD	<LLD
1998	190	190	190
1999	220	510	365
2000	196	237	212
2001	<LLD	<LLD	<LLD
2002	<LLD	<LLD	<LLD
2003	<LLD	<LLD	<LLD
2004	<LLD	<LLD	<LLD
2005	<LLD	<LLD	<LLD
2006	<LLD	<LLD	<LLD
2007	<LLD	<LLD	<LLD
2008	<LLD	<LLD	<LLD
2009	<LLD	<LLD	<LLD
2010	<LLD	<LLD	<LLD
2011	<LLD	<LLD	<LLD
2012	<LLD	<LLD	<LLD
2013	<LLD	<LLD	<LLD
2014	<LLD	<LLD	<LLD
2015	<LLD	<LLD	<LLD
2016	<LLD	<LLD	<LLD
2017	<LLD	<LLD	<LLD
2018	<LLD	<LLD	<LLD
2019	<LLD	<LLD	<LLD

* Control location is the City of Oswego, drinking water for 1969-1984 and the Oswego Steam Station inlet canal for 1985-Present.

† 1969 data is considered to be pre-operational for the site. 1974 and 1975 data is considered to be pre-operational for the JAFNPP.

TABLE 7-8
HISTORICAL ENVIRONMENTAL SAMPLE DATA
SURFACE WATER TRITIUM
Results in pCi/liter

LOCATION: INDICATOR *			
Isotope	**Tritium**		
Year	**Min.**	**Max.**	**Mean**
1969†	No Data	No Data	No Data
1974†	380	500	440
1975†	124	482	335
1992	240	300	273
1993	200	280	242
1994	180	260	220
1995	320	320	320
1996	<LLD	<LLD	<LLD
1997	160	160	160
1998	190	190	190
1999	180	270	233
2000	161	198	185
2001	<LLD	<LLD	<LLD
2002	297	297	297
2003	<LLD	<LLD	<LLD
2004	<LLD	<LLD	<LLD
2005	<LLD	<LLD	<LLD
2006	<LLD	<LLD	<LLD
2007	<LLD	<LLD	<LLD
2008	<LLD	<LLD	<LLD
2009	<LLD	<LLD	<LLD
2010	<LLD	<LLD	<LLD
2011	<LLD	<LLD	<LLD
2012	<LLD	<LLD	<LLD
2013	<LLD	<LLD	<LLD
2014	<LLD	<LLD	<LLD
2015	<LLD	<LLD	<LLD
2016	<LLD	<LLD	<LLD
2017	<LLD	<LLD	<LLD
2018	<LLD	<LLD	<LLD
2019	<LLD	<LLD	<LLD

* Indicator location was the NMP-1 Inlet Canal during the period 1969-1973, and the JAF Inlet Canal for 1974-Present.

† 1969 data is considered to be pre-operational for the site. 1974 and 1975 data is considered to be pre-operational for the JAFNPP.

TABLE 7-9
HISTORICAL ENVIRONMENTAL SAMPLE DATA
AIR PARTICULATE GROSS BETA
Results in pCi/m^3

LOCATION: CONTROL *			
Isotope	**Gross Beta**		
Year	**Min.**	**Max.**	**Mean**
1969†	0.130	0.540	0.334
1974†	0.001	0.808	0.121
1975†	0.008	0.294	0.085
1992	0.006	0.020	0.012
1993	0.007	0.022	0.013
1994	0.008	0.025	0.015
1995	0.006	0.023	0.014
1996	0.008	0.023	0.014
1997	0.006	0.025	0.013
1998	0.004	0.034	0.014
1999	0.010	0.032	0.017
2000	0.006	0.027	0.015
2001	0.006	0.034	0.016
2002	0.008	0.027	0.016
2003	0.004	0.032	0.015
2004	0.008	0.032	0.016
2005	0.008	0.034	0.019
2006	0.007	0.033	0.016
2007	0.008	0.028	0.016
2008	0.007	0.031	0.015
2009	0.007	0.030	0.016
2010	0.004	0.026	0.014
2011	0.008	0.034	0.018
2012	0.005	0.025	0.016
2013	0.006	0.031	0.016
2014	0.006	0.030	0.016
2015	0.008	0.038	0.016
2016	0.008	0.023	0.014
2017	0.005	0.028	0.015
2018	0.007	0.029	0.014
2019	0.008	0.024	0.015

* Locations used for 1977-1984 were C offsite, D1 offsite, D2 offsite, E offsite, F offsite, and G offsite. Control location R5 offsite was used for 1986-Present (formerly C offsite location).

† 1969 data is considered to be pre-operational for the site. 1974 and 1975 data is considered to be pre-operational for the JAFNPP.

TABLE 7-10
HISTORICAL ENVIRONMENTAL SAMPLE DATA
AIR PARTICULATE GROSS BETA
Results in pCi/m^3

LOCATION: INDICATOR *			
Isotope	**Gross Beta**		
Year	**Min.**	**Max.**	**Mean**
1969†	0.130	0.520	0.320
1974†	0.003	0.885	0.058
1975†	0.001	0.456	0.067
1992	0.005	0.024	0.013
1993	0.005	0.023	0.014
1994	0.006	0.024	0.015
1995	0.004	0.031	0.014
1996	0.006	0.025	0.013
1997	0.001	0.018	0.010
1998	0.002	0.040	0.015
1999	0.009	0.039	0.017
2000	0.005	0.033	0.015
2001	0.004	0.037	0.016
2002	0.006	0.026	0.016
2003	0.005	0.035	0.015
2004	0.003	0.036	0.016
2005	0.007	0.041	0.019
2006	0.005	0.035	0.015
2007	0.007	0.028	0.016
2008	0.004	0.030	0.016
2009	0.006	0.032	0.016
2010	0.005	0.030	0.015
2011	0.007	0.034	0.018
2012	0.004	0.031	0.016
2013	0.007	0.032	0.016
2014	0.007	0.028	0.016
2015	0.007	0.041	0.016
2016	0.008	0.025	0.015
2017	0.004	0.025	0.014
2018	0.005	0.029	0.015
2019	0.008	0.026	0.014

* Locations used for 1969-1973 were D1 onsite, D2 onsite, E onsite, F onsite and G onsite. Locations used for 1974-1984 were D1 onsite, D2 onsite, E onsite, F onsite, G onsite, H onsite, I onsite, J onsite and K onsite, as applicable. 1986 – Present: locations were R1 offsite, R2 offsite, R3 offsite, and R4 offsite.

† 1969 data is considered to be pre-operational for the site. 1974 and 1975 data is considered to be pre-operational for the JAFNPP.

TABLE 7-11
HISTORICAL ENVIRONMENTAL SAMPLE DATA
AIR PARTICULATES
Results in pCi/m^3

LOCATION: CONTROL **						
Isotope	**Cs-137**			**Co-60**		
Year	**Min.**	**Max.**	**Mean**	**Min.**	**Max.**	**Mean**
1969†	*	*	*	*	*	*
1974†	*	*	*	*	*	*
1975†	*	*	*	*	*	*
1992	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1993	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1994	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1995	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1996	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1997	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1998	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1999	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2000	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2001	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2002	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2003	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2004	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2005	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2006	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2007	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2008	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2009	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2010	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2011	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2012	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2013	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2014	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2015	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2016	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2017	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2018	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2019	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD

* No data available (not required prior to 1977).

** Locations included composites of offsite air monitoring locations for 1977-1984. Sample location included only R5 air monitoring location for 1985-Present.

† 1969 data is considered to be pre-operational for the site. 1974 and 1975 data is considered to be pre-operational for the JAFNPP.

TABLE 7-12
HISTORICAL ENVIRONMENTAL SAMPLE DATA
AIR PARTICULATES
Results in pCi/m^3

LOCATION: INDICATOR **						
Isotope	**Cs-137**			**Co-60**		
Year	**Min.**	**Max.**	**Mean**	**Min.**	**Max.**	**Mean**
1969†	*	*	*	*	*	*
1974†	*	*	*	*	*	*
1975†	*	*	*	*	*	*
1992	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1993	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1994	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1995	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1996	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1997	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1998	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1999	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2000	<LLD	<LLD	<LLD	0.0048	0.0048	0.0048
2001	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2002	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2003	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2004	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2005	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2006	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2007	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2008	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2009	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2010	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2011	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2012	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2013	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2014	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2015	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2016	< LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2017	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2018	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2019	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD

* No data available (not required prior to 1977).

** Locations included composites of onsite air monitoring locations for 1977-1984. Sample locations included R1 through R4 air monitoring locations for 1985-Present.

† 1969 data is considered to be pre-operational for the site. 1974 and 1975 data is considered to be pre-operational for the JAFNPP.

TABLE 7-13
HISTORICAL ENVIRONMENTAL SAMPLE DATA
AIR RADIOIODINE
Results in pCi/m^3

LOCATION: CONTROL *			
Isotope	**Iodine-131**		
Year	**Min.**	**Max.**	**Mean**
1969†	**	**	**
1974†	**	**	**
1975†	<MDL	<MDL	<MDL
1992	<LLD	<LLD	<LLD
1993	<LLD	<LLD	<LLD
1994	<LLD	<LLD	<LLD
1995	<LLD	<LLD	<LLD
1996	<LLD	<LLD	<LLD
1997	<LLD	<LLD	<LLD
1998	<LLD	<LLD	<LLD
1999	<LLD	<LLD	<LLD
2000	<LLD	<LLD	<LLD
2001	<LLD	<LLD	<LLD
2002	<LLD	<LLD	<LLD
2003	<LLD	<LLD	<LLD
2004	<LLD	<LLD	<LLD
2005	<LLD	<LLD	<LLD
2006	<LLD	<LLD	<LLD
2007	<LLD	<LLD	<LLD
2008	<LLD	<LLD	<LLD
2009	<LLD	<LLD	<LLD
2010	<LLD	<LLD	<LLD
2011	0.034‡	0.093‡	0.055‡
2012	<LLD	<LLD	<LLD
2013	<LLD	<LLD	<LLD
2014	<LLD	<LLD	<LLD
2015	<LLD	<LLD	<LLD
2016	<LLD	<LLD	<LLD
2017	<LLD	<LLD	<LLD
2018	<LLD	<LLD	<LLD
2019	<LLD	<LLD	<LLD

* Locations D1 offsite, D2 offsite, E offsite, F offsite and G offsite used for 1976-1984. Location R5 offsite used for 1985-Present.

** No results - I-131 analysis not required.

† 1969 data is considered to be pre-operational for the site. 1974 and 1975 data is considered to be pre-operational for the JAFNPP.

‡ Iodine concentrations attributed to fallout from Fukushima accident.

TABLE 7-14
HISTORICAL ENVIRONMENTAL SAMPLE DATA
AIR RADIOIODINE
Results in pCi/m^3

LOCATION: INDICATOR *			
Isotope	**Iodine-131**		
Year	**Min.**	**Max.**	**Mean**
1969†	**	**	**
1974†	**	**	**
1975†	0.25	0.30	0.28
1992	<LLD	<LLD	<LLD
1993	<LLD	<LLD	<LLD
1994	<LLD	<LLD	<LLD
1995	<LLD	<LLD	<LLD
1996	<LLD	<LLD	<LLD
1997	<LLD	<LLD	<LLD
1998	<LLD	<LLD	<LLD
1999	<LLD	<LLD	<LLD
2000	<LLD	<LLD	<LLD
2001	<LLD	<LLD	<LLD
2002	<LLD	<LLD	<LLD
2003	<LLD	<LLD	<LLD
2004	<LLD	<LLD	<LLD
2005	<LLD	<LLD	<LLD
2006	<LLD	<LLD	<LLD
2007	<LLD	<LLD	<LLD
2008	<LLD	<LLD	<LLD
2009	<LLD	<LLD	<LLD
2010	<LLD	<LLD	<LLD
2011	0.021‡	0.11‡	0.055‡
2012	<LLD	<LLD	<LLD
2013	<LLD	<LLD	<LLD
2014	<LLD	<LLD	<LLD
2015	<LLD	<LLD	<LLD
2016	<LLD	<LLD	<LLD
2017	<LLD	<LLD	<LLD
2018	<LLD	<LLD	<LLD
2019	<LLD	<LLD	<LLD

* Locations used for 1985 - Present, were R1 offsite, R2 offsite, R3 offsite, and R4 offsite.

** No results. I-131 analysis not required.

† 1969 data is considered to be pre-operational for the site. 1974 and 1975 data is considered to be pre-operational for the JAFNPP.

‡ Iodine concentrations attributed to fallout from Fukushima accident.

TABLE 7-15
HISTORICAL ENVIRONMENTAL SAMPLE DATA
ENVIRONMENTAL TLD
Results in mrem/standard month

LOCATION: CONTROL * (2)			
Year	**Min.**	**Max.**	**Mean**
Preop†	(Note 1)	(Note 1)	(Note 1)
1974†	2.7	8.9	5.6
1975†	4.8	6.0	5.5
1992	(2.6) 2.6	(5.0) 4.7	(4.1) 3.9
1993	(3.4) 3.4	(5.6) 5.2	(4.4) 4.3
1994	(3.1) 3.1	(5.0) 4.6	(4.1) 3.9
1995	(3.4) 3.4	(5.7) 4.9	(4.4) 4.2
1996	(3.4) 3.4	(5.6) 5.6	(4.3) 4.2
1997	(3.7) 3.9	(6.2) 5.2	(4.7) 4.6
1998	(3.7) 3.7	(5.6) 4.8	(4.4) 4.2
1999	(3.6) 3.7	(7.1) 4.7	(4.6) 4.4
2000	(3.7) 3.7	(7.3) 5.5	(4.7) 4.3
2001	(3.6) 3.9	(5.4) 5.0	(4.4) 4.4
2002	(3.4) 3.4	(5.5) 5.2	(4.3) 4.1
2003	(3.4) 3.4	(5.5) 4.8	(4.2) 4.2
2004	(3.3) 3.3	(5.9) 5.9	(4.3) 4.5
2005	(3.3) 3.4	(5.1) 4.5	(4.1) 4.0
2006	(3.3) 3.3	(5.3) 5.3	(4.1) 4.3
2007	(3.2) 3.2	(5.8) 5.8	(4.4) 4.6
2008	(3.3) 3.3	(5.1) 5.1	(4.1) 4.3
2009	(3.2) 3.2	(4.8) 4.8	(3.9) 4.0
2010	(2.8) 2.8	(4.6) 4.6	(3.9) 3.9
2011	(2.6) 2.6	(5.5) 5.5	(4.0) 4.1
2012	(3.6) 3.6	(5.0) 5.0	(4.0) 4.2
2013	(3.2) 3.2	(4.9) 4.9	(3.9) 4.0
2014(3)	3.3	5.0	4.1
2015	3.0	5.4	4.1
2016	3.6	5.2	4.2
2017	3.7	4.9	4.3
2018	3.7	4.9	4.2
2019	3.3	5.6	4.8

* TLD #8 and 14 established 1974, TLD #49 established 1980, TLD #111 established 1988, TLD #113 established 1991.

† 1969 data is considered to be pre-operational for the site. 1974 and 1975 data is considered to be pre-operational for JAFNPP.

(1) Data not available.

(2) Data in parentheses is control data determined using TLDs #8, 14, 49, 111 and 113.

(3) Starting in 2014, only data from locations 8, 14, and 49 are reported.

TABLE 7-16
HISTORICAL ENVIRONMENTAL SAMPLE DATA
ENVIRONMENTAL TLD
Results in mrem per standard month

LOCATION: SITE BOUNDARY **			
Year	**Min.**	**Max.**	**Mean**
Preop†	*	*	*
1974†	*	*	*
1975†	*	*	*
1992	3.7	4.6	4.2
1993	3.8	4.8	4.3
1994	2.8	4.9	4.0
1995	3.5	5.1	4.4
1996	3.2	5.3	4.1
1997	3.5	5.9	4.6
1998	3.7	5.1	4.4
1999	3.3	7.5	4.7
2000	3.6	6.8	4.5
2001	3.6	5.3	4.5
2002	3.5	5.1	4.3
2003	3.2	4.9	4.3
2004	3.3	6.4	4.4
2005	3.4	4.8	4.2
2006	3.5	4.7	4.1
2007	3.2	5.4	4.3
2008	3.2	4.8	4.0
2009	3.1	4.5	3.9
2010	3.3	4.3	3.9
2011	3.1	5.3	4.1
2012	3.6	4.8	4.1
2013	3.5	4.7	3.9
2014	3.3	4.6	3.9
2015	2.9	5.1	4.0
2016	3.5	4.8	4.0
2017	3.6	4.7	4.0
2018	3.5	4.7	4.0
2019	3.0	5.6	4.6

* Data not available (not required prior to 1985).

TLD #23, 75, 76, 77, 85, 86 and 87 are in close proximity to operational buildings along the north boundary. This boundary is the lakeshore and is considered to be generally not accessible to the public. These locations are not used in the site boundary dose determination.

† 1969 data is considered to be pre-operational for the site. 1974 and 1975 data is considered to be pre-operational for the JAFNPP.

** TLD's used for statistics: 7, 18, 78, 79, 80, 81, 82, 83 & 84.

TABLE 7-17
HISTORICAL ENVIRONMENTAL SAMPLE DATA
ENVIRONMENTAL TLD
Results in mrem per standard month

LOCATION: OFFSITE SECTORS **			
Year	**Min.**	**Max.**	**Mean**
Preop†	*	*	*
1974†	*	*	*
1975†	*	*	*
1992	2.9	5.0	4.1
1993	3.4	6.3	4.5
1994	3.0	5.1	4.0
1995	3.2	5.2	4.3
1996	3.2	5.3	4.2
1997	3.5	5.8	4.4
1998	3.5	5.0	4.2
1999	3.6	5.6	4.4
2000	3.4	6.6	4.5
2001	3.6	5.4	4.4
2002	3.1	5.3	4.2
2003	3.4	4.8	4.1
2004	3.2	6.7	4.4
2005	3.2	4.7	4.0
2006	3.3	4.4	4.0
2007	3.1	5.1	4.2
2008	3.2	4.5	3.8
2009	3.3	4.5	3.9
2010	3.0	4.4	3.9
2011	3.0	5.3	4.0
2012	3.5	4.6	4.0
2013	3.2	4.5	3.8
2014	3.2	4.4	3.8
2015	2.9	4.8	3.9
2016	3.3	4.6	3.9
2017	3.4	4.8	4.0
2018	3.1	4.7	3.9
2019	3.2	5.6	4.5

* Data not available (not required prior to 1985).

** Includes TLD numbers 88, 89, 90, 91, 92, 93, 94 and 95.

† 1969 data is considered to be pre-operational for the site. 1974 and 1975 data is considered to be pre-operational for the JAFNPP.

TABLE 7-18
HISTORICAL ENVIRONMENTAL SAMPLE DATA
ENVIRONMENTAL TLD
Results in mrem per standard month

LOCATION: SPECIAL INTEREST **			
Year	**Min.**	**Max.**	**Mean**
Preop†	*	*	*
1974†	*	*	*
1975†	*	*	*
1992	3.0	4.8	4.1
1993	3.2	5.8	4.5
1994	2.9	4.8	4.1
1995	3.6	4.8	4.2
1996	3.2	5.1	4.2
1997	3.5	6.2	4.6
1998	3.7	5.6	4.4
1999	3.6	7.1	4.6
2000	3.6	7.3	4.7
2001	3.8	5.4	4.4
2002	3.5	5.5	4.2
2003	3.4	5.5	4.3
2004	3.0	5.9	4.2
2005	3.4	5.1	4.1
2006	3.5	5.3	4.1
2007	3.0	5.8	4.3
2008	3.1	5.1	4.0
2009	3.1	4.5	3.8
2010	3.2	4.7	3.9
2011	2.9	4.9	4.0
2012	3.4	4.7	4.0
2013	3.2	4.5	3.8
2014	2.9	4.3	3.8
2015	2.5	4.6	3.9
2016	3.5	4.4	3.9
2017	3.5	4.5	3.9
2018	3.5	4.7	3.9
2019	3.0	5.6	4.6

* Data not available (not required prior to 1985).

** Includes TLD numbers 15, 56, 58, 96, 97 and 98.

† 1969 data is considered to be pre-operational for the site. 1974 and 1975 data is considered to be pre-operational for the JAFNPP.

TABLE 7-19
HISTORICAL ENVIRONMENTAL SAMPLE DATA
ENVIRONMENTAL TLD
Results in mrem per standard month

LOCATION: ONSITE INDICATOR **			
Year	**Min.**	**Max.**	**Mean**
Preop†	*	*	*
1974†	3.1	10.6	5.7
1975†	4.6	16.0	7.3
1992	3.2	5.6	4.3
1993	3.1	13.6	5.2
1994	2.8	14.3	5.1
1995	3.5	28.6	6.2
1996	3.1	32.6	6.4
1997	3.5	28.8	8.1
1998	3.6	28.8	6.2
1999	3.3	28.4	6.6
2000	3.7	16.5	5.6
2001	3.8	14.5	5.6
2002	3.5	13.6	5.3
2003	3.2	12.9	5.3
2004	3.3	13.2	5.4
2005	3.4	14.1	5.4
2006	3.5	14.4	5.3
2007	3.2	14.8	5.6
2008	3.2	13.8	5.2
2009	3.1	13.6	4.9
2010	3.3	13.3	4.8
2011	3.1	13.0	5.1
2012	3.5	11.8	4.9
2013	3.3	12.2	5.0
2014	3.3	12.9	4.9
2015	2.8	13.2	5.1
2016	3.5	11.3	4.8
2017	3.6	12.7	5.0
2018	3.5	12.6	5.0
2019	3.0	13.2	5.4

* No data available.

** Includes TLD numbers 3, 4, 5, 6 and 7 (1970 – 1973). Includes TLD numbers 3, 4, 5, 6, 7, 23, 24, 25 and 26 (1974 – Present).

† 1969 data is considered to be pre-operational for the site. 1974 and 1975 data is considered to be pre-operational for the JAFNPP.

TABLE 7-20
HISTORICAL ENVIRONMENTAL SAMPLE DATA
ENVIRONMENTAL TLD
Results in mrem per standard month

LOCATION: OFFSITE INDICATOR **			
Year	**Min.**	**Max.**	Mean
Preop†	*	*	*
1974†	2.4	8.9	5.3
1975†	4.5	7.1	5.5
1992	3.1	5.2	4.1
1993	3.2	5.7	5.0
1994	3.0	5.1	4.1
1995	3.9	5.7	4.4
1996	3.3	5.5	4.1
1997	3.7	6.2	4.7
1998	3.9	5.6	4.5
1999	3.8	7.1	4.6
2000	3.8	7.3	4.6
2001	3.7	5.9	4.6
2002	3.6	5.5	4.4
2003	3.1	5.5	4.4
2004	3.2	6.5	4.5
2005	3.6	5.1	4.2
2006	3.9	5.3	4.2
2007	3.4	4.9	4.3
2008	3.3	4.5	4.0
2009	3.3	4.1	3.8
2010	3.5	4.0	3.7
2011	3.2	4.8	4.0
2012	3.6	4.3	4.0
2013	3.5	4.3	3.9
2014	3.3	4.2	3.8
2015	3.0	4.5	3.9
2016	3.7	4.5	4.0
2017	3.5	4.3	4.0
2018	3.6	4.2	3.9
2019	3.3	5.0	4.4

* No data available.

** Includes TLD numbers 9, 10, 11, 12 and 13.

† 1969 data is considered to be pre-operational for the site. 1974 and 1975 data is considered to be pre-operational for the JAFNPP.

TABLE 7-21
HISTORICAL ENVIRONMENTAL SAMPLE DATA
MILK
Results in pCi/liter

LOCATION: CONTROL **						
Isotope	**Cs-137**			**I-131**		
Year	**Min.**	**Max.**	**Mean**	**Min.**	**Max.**	**Mean**
1969†	*	*	*	*	*	*
1974†	*	*	*	*	*	*
1975†	*	*	*	*	*	*
1992	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1993	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1994	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1995	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1996	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1997	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1998	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1999	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2000	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2001	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2002	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2003	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2004	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2005	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2006	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2007	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2008	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2009	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2010	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2011	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2012	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2013	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2014	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2015	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2016	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2017	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2018	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2019	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD

* No data available (sample not required).

** Location used was an available milk sample location in a least prevalent wind direction greater than ten miles from the site.

† 1969 data is considered to be pre-operational for the site. 1974 and 1975 data is considered to be pre-operational for the JAFNPP.

TABLE 7-22
HISTORICAL ENVIRONMENTAL SAMPLE DATA
MILK
Results in pCi/liter

LOCATION: INDICATOR						
Isotope	**Cs-137**			**I-131**		
Year	**Min.**	**Max.**	**Mean**	**Min.**	**Max.**	**Mean**
1969†	*	*	*	*	*	*
1974†	1.6	39	10.5	0.70	2.00	1.23
1975†	6.0	22	16	0.01	2.99	0.37
1992	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1993	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1994	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1995	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1996	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1997	<LLD	<LLD	<LLD	0.25	0.44	0.35
1998	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
1999	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2000	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2001	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2002	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2003	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2004	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2005	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2006	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2007	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2008	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2009	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2010	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2011	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2012	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2013	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2014	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2015	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2016	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2017	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2018	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
2019	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD

* No data available (sample not required).

† 1969 data is considered to be pre-operational for the site. 1974 and 1975 data is considered to be pre-operational for the JAFNPP.

TABLE 7-23
HISTORICAL ENVIRONMENTAL SAMPLE DATA
FOOD PRODUCTS
Results in pCi/g (wet)

LOCATION: CONTROL *			
Isotope	**Cs-137**		
Year	**Min.**	**Max.**	**Mean**
1969†	**	**	**
1974†	**	**	**
1975†	**	**	**
1992	<LLD	<LLD	<LLD
1993	0.008	0.008	0.008
1994	<LLD	<LLD	<LLD
1995	<LLD	<LLD	<LLD
1996	<LLD	<LLD	<LLD
1997	<LLD	<LLD	<LLD
1998	<LLD	<LLD	<LLD
1999	<LLD	<LLD	<LLD
2000	<LLD	<LLD	<LLD
2001	<LLD	<LLD	<LLD
2002	<LLD	<LLD	<LLD
2003	<LLD	<LLD	<LLD
2004	<LLD	<LLD	<LLD
2005	<LLD	<LLD	<LLD
2006	<LLD	<LLD	<LLD
2007	<LLD	<LLD	<LLD
2008	<LLD	<LLD	<LLD
2009	<LLD	<LLD	<LLD
2010	<LLD	<LLD	<LLD
2011	<LLD	<LLD	<LLD
2012	<LLD	<LLD	<LLD
2013	<LLD	<LLD	<LLD
2014	<LLD	<LLD	<LLD
2015	<LLD	<LLD	<LLD
2016	<LLD	<LLD	<LLD
2017	<LLD	<LLD	<LLD
2018	<LLD	<LLD	<LLD
2019	<LLD	<LLD	<LLD

* Locations was an available food product sample location in a least prevalent wind direction greater than ten miles from the site.

** No data available (control samples not required).

† 1969 data is considered to be pre-operational for the site. 1974 and 1975 data is considered to be pre-operational for the JAFNPP.

TABLE 7-24
HISTORICAL ENVIRONMENTAL SAMPLE DATA
FOOD PRODUCTS
Results in pCi/g (wet)

LOCATION: INDICATOR *			
Isotope	**Cs-137**		
Year	**Min.**	**Max.**	**Mean**
1969†	**	**	**
1974†	0.04	0.34	0.142
1975†	<MDL	<MDL	<MDL
1992	<LLD	<LLD	<LLD
1993	<LLD	<LLD	<LLD
1994	0.006	0.012	0.010
1995	0.011	0.012	0.012
1996	<LLD	<LLD	<LLD
1997	0.013	0.013	0.013
1998	<LLD	<LLD	<LLD
1999	0.007	0.007	0.007
2000	<LLD	<LLD	<LLD
2001	<LLD	<LLD	<LLD
2002	<LLD	<LLD	<LLD
2003	<LLD	<LLD	<LLD
2004	<LLD	<LLD	<LLD
2005	<LLD	<LLD	<LLD
2006	<LLD	<LLD	<LLD
2007	<LLD	<LLD	<LLD
2008	<LLD	<LLD	<LLD
2009	<LLD	<LLD	<LLD
2010	<LLD	<LLD	<LLD
2011	<LLD	<LLD	<LLD
2012	<LLD	<LLD	<LLD
2013	<LLD	<LLD	<LLD
2014	<LLD	<LLD	<LLD
2015	<LLD	<LLD	<LLD
2016	<LLD	<LLD	<LLD
2017	<LLD	<LLD	<LLD
2018	<LLD	<LLD	<LLD
2019	<LLD	<LLD	<LLD

* Indicator locations were available downwind locations within ten miles of the site and with high deposition potential.

** No data available (control samples not required).

† 1969 data is considered to be pre-operational for the site. 1974 and 1975 data is considered to be pre-operational for the JAFNPP.

TABLE 7-25
HISTORICAL ENVIRONMENTAL SAMPLE DATA
NMPNS GROUNDWATER WELLS TRITIUM
Results in pCi/liter

LOCATION: CONTROL [a]			
Isotope	**TRITIUM**		
Year	**Min.**	**Max.**	**Mean**
2005	<854	<854	<854
2006[b]	<447	<825	<636
2007	<442	<445	<444
2008	<427	<439	<431
2009	<411	<418	<415
2010	<172	<410	<341
2011	<408	<424	<415
2012	<363	<499	<420
2013	<365	<381	<374
2014	<404	<493	<433
2015[c]	<108	215	<151
2016	<161	<199	<181
2017	<183	234	<193
2018	<178	<234	<205
2019	<178	<199	<189

(a) Control well locations (2) are upland wells located south of the protected area.

(b) Required LLD change to 500 pCi/l from 1000 pCi/l.

(c) Required LLD changed to 200 pCi/l.

TABLE 7-26
HISTORICAL ENVIRONMENTAL SAMPLE DATA
NMPNS GROUNDWATER WELLS TRITIUM
Results in pCi/liter

LOCATION: INDICATOR [a]			
Isotope	**TRITIUM**		
Year	**Min.**	**Max.**	**Mean**
2005	<854	<871	<863
2006[b]	<462	<933	<823
2007	<440	<461	<445
2008	<427	<439	<433
2009	<406	<424	<413
2010	<287	611	<384
2011	<407	<428	<414
2012	<314	<499	<395
2013	<365	820[c]	<382
2014	<365	<493	<436
2015[d]	<106	947	<196
2016	<108	749	<211
2017	<183	435	<201
2018	<176	470	<203
2019	<154	366	<197

(a) Indicator locations are down gradient wells located in the owner control area.

(b) Required LLD change to 500 pCi/l from 1000 pCi/l.

(c) Re-sample tritium concentration = <459 pCi/l.

(d) Required LLD changed to 200 pCi/l.

TABLE 7-27
HISTORICAL ENVIRONMENTAL SAMPLE DATA
JAFNPP GROUNDWATER WELLS TRITIUM
Results in pCi/liter

LOCATION: CONTROL [a]			
Isotope	**TRITIUM**		
Year	**Min.**	**Max.**	**Mean**
2007	<909	<909	<909
2008	<852	<923	<889
2009	<836	<848	<842
2010	<398	<850	<717
2011	<395	<594	<436
2012	<363	1036	<530
2013	<342	<710	<529
2014	<383	<791	<532
2015	<723	<934	<793
2016	<864	<902	<888
2017	<775	<930	<833
2018	<182	219	<193
2019	<178	<199	<192

(a) Indicator locations are down gradient wells located in the owner control area.

TABLE 7-28
HISTORICAL ENVIRONMENTAL SAMPLE DATA
JAFNPP GROUNDWATER WELLS TRITIUM
Results in pCi/liter

LOCATION: INDICATOR [a]			
Isotope	**TRITIUM**		
Year	**Min.**	**Max.**	**Mean**
2010	<410	1049	<794
2011	<390	<689	<421
2012	<356	<787	<417
2013	<338	<720	<395
2014	<383	<791	<490
2015	<723	1149	<796
2016	<864	<902	<886
2017	<775	<930	<834
2018	<184	654	250
2019	<172	482	230

(a) Indicator locations are down gradient wells located in the owner control area.

8.0 QUALITY ASSURANCE / QUALITY CONTROL PROGRAM

8.1 PROGRAM DESCRIPTION

The Offsite Dose Calculation Manual (ODCM), Part 1, Section 5.3 requires that the licensee participate in an Interlaboratory Comparison Program. The Interlaboratory Comparison Program shall include sample media for which samples are routinely collected and for which comparison samples are commercially available. Participation in an Interlaboratory Comparison Program ensures that independent checks on the precision and accuracy of the measurement of radioactive material in the environmental samples are performed as part of the Quality Assurance Program for environmental monitoring. To fulfill the requirement for an Interlaboratory Comparison Program, the Teledyne Brown Engineering (TBE) Environmental Services laboratory has engaged the services of Eckert & Ziegler Analytics, Incorporated in Atlanta, Georgia, The Department of Energy's (DOE) Mixed Analyte Performance Evaluation Program (MAPEP) located in Idaho Falls, Idaho, and Environmental Resource Associates (ERA) in Golden, Co.

The Interlaboratory Comparison providers supply sample media as blind sample spikes, which contain certified levels of radioactivity unknown to the analysis laboratory. These samples are prepared and analyzed by the Teledyne Brown Engineering Environmental Services laboratory using standard laboratory procedures.

8.2 PROGRAM SCHEDULE

SAMPLE MEDIA	LABORATORY ANALYSIS	SAMPLE PROVIDER ECKERT & ZIEGLER ANALYTICS
Milk	I-131	2
Milk	Mixed Gamma	2
Air	I-131	2
Air	Mixed Gamma	2
Soil	Mixed Gamma	1
SAMPLE MEDIA	**LABORATORY ANALYSIS**	**SAMPLE PROVIDER DOE MAPEP**
Air	Gr-Beta	2
Vegetation	Mixed Gamma	2
SAMPLE MEDIA	**LABORATORY ANALYSIS**	**SAMPLE PROVIDER ERA**
Water	I-131	2
Water	Mixed Gamma	2
Water	H-3	2
TOTAL SAMPLE INVENTORY		**19**

8.3 ACCEPTANCE CRITERIA

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

8.3.1 SAMPLE RESULTS EVALUATION

Analytics:

Analytics evaluation report provides a ratio of TBE's result and Analytics' known value.

Since flag values are not assigned by Analytics, TBE evaluates the reported ratios based on internal QC requirements, which are based on the DOE/MAPEP criteria. The ratio of 0.80 to 1.20 is evaluated as acceptable. The ratios of 0.70 to 0.80 and 1.20 to 1.30 are evaluated as acceptable with warning.

DOE Evaluation Criteria (Handbook for the Department of Energy's Mixed Analyte Performance Evaluation Program (MAPEP), Revision 13 (June 2012), pp 37-38, retrieved from http://www.id.energy.gov/resl/mapep/handbookv13.pdf)

MAPEP:

MAPEP's evaluation report provides an acceptance range with associated flag values. The MAPEP defines three levels of performance:

- Acceptable (flag = "A") – result within ± 20% of the reference value.
- Acceptable with Warning (flag = "W") - result falls in the ± 20% to ± 30% of the reference value.
- Not Acceptable (flag = "N") – bias is greater than 30% of the reference value.

Note: The Department of Energy (DOE) Mixed Analyte Performance Evaluation Program (MAPEP) samples are created to mimic Conditions found at DOE sites which do not resemble typical environmental samples obtained at commercial nuclear power facilities.

False positive/negative testing and sensitivity evaluations are used in radiological performance evaluations. The specific analytes used for testing vary among performance evaluation test sessions.

The MAPEP program uses false positive testing to identify laboratory results that indicate the presence of a particular radionuclide in a MAPEP sample when, in fact, the actual activity of the radionuclide is far below the detection limit of the measurement. Not acceptable ("N") performance, and hence a false positive result, is indicated when the range encompassing the result, plus or minus the total uncertainty at three standard deviations, does not include zero (e.g. 2.5 ± 0.2; range of 1.9 – 3.1). Statistically, the probability that a result can exceed the absolute value of its total uncertainty at three standard deviations by chance alone is less than 1%. The MAPEP uses a three standard deviation criterion for the false positive test to ensure confidence about issuing a false positive performance evaluation. A result that is greater than three times the total uncertainty of the measurement represents a statistically positive detection with over 99% confidence.

Sensitivity evaluations are routinely performed to complement the false positive tests. In a sensitivity evaluation the radionuclide is present at or near the detection limit, and the difference between the report result and the MAPEP reference value is compared to the propagated combined total uncertainties. The results are evaluated at three standard deviations. If the observed difference is greater than three time the combined total uncertainty, the sensitivity evaluation in "Not Acceptable". The probability that such a difference can occur by chance alone is less than 1%. If the participant did not report a statistically positive result, a "Not Detected" is noted in the text field of the MAPEP performance report. A non-detect is potentially a false negative result, dependent upon the laboratory's detection limit for the radionuclide.

False negative tests are also performed in combination with the sensitivity evaluations. In this scenario, the sensitivity of the reported measurement indicates that the known specific activity of the targeted radionuclide in the performance evaluation sample should have been detected, but was not, and a "Not Acceptable" performance evaluation is issued. The uncertainty of the MAPEP reference value and of the reported result at three standard deviations is used for the false negative test.

The false positive/negative and sensitivity evaluation tests are conducted in a manner that assists the participants with their measurement uncertainty estimates and helps ensure they are not under estimating or over inflating their total uncertainties. If the total uncertainty is over inflated to try to pass a false positive test, it will result in a "Not Detected" if the test is actually a sensitivity evaluation, and vice versa for a false positive test. False negatives and failed sensitivity evaluations can also result from under estimating the total uncertainty. An accurate estimate of measurement uncertainty is required for consistent performance at the acceptable level.

ERA:

The ERA's evaluation report provides an acceptance range for control and warning limits with associated flag values. The ERA's acceptance limits are established per the USEPA, National Environmental Laboratory Accreditation Conference (NELAC), state specific Performance Testing (PT) program requirements or ERA's SOP for the Generation of Performance Acceptance Limits, as applicable. The acceptance limits are either determined by a regression equation specific to each analyte or a fixed percentage limit promulgated under the appropriate regulatory document.

8.4 PROGRAM RESULTS SUMMARY

The Interlaboratory Comparison Program numerical results for the TBE Environmental Services laboratory are provided on Table 8-1 thru Table 8-3.

8.4.1 ECKERT & ZIEGLER ANALYTICS, DOE MAPEP, and ERA QA SAMPLES RESULTS

For the TBE laboratory, 119 out of 129 analyses performed met the specified acceptance criteria. Ten analyses did not meet the specified acceptance criteria for the following reasons and were addressed through the TBE Corrective Action Program.

1. The ERA April 2019 water Cs-134 result was evaluated as Not Acceptable. The reported value was 15.2 pCi/L (error 2.82 pCi/L) and the known result was 12.1 pCi/L (acceptance range of 8.39 - 14.4 pCi/L). With the error, the reported result overlaps the acceptable range. This sample was run as the workgroup duplicate on a different detector with a result of 10.7 pCi/L (within acceptable range). (NCR 19-10)

2. The ERA April 2019 water Sr-89 result was evaluated as Not Acceptable. The reported value was 44.9 pCi/L and the known result was 33.3 pCi/L (acceptance range of 24.5 - 40.1 pCi/L). The sample was only counted for 15 minutes instead of 200 minutes. The sample was re-prepped in duplicate and counted for 200 minutes with results of 30.7 ± 5.37 pCi/L and 33.0 ± 8.71 pCi/L. This was the 1st "high" failure for Sr-89 in 5 years. (NCR 19-11)

3. The MAPEP February 2019 soil Sr-90 result was not submitted and therefore evaluated as Not Acceptable. The sample was run in duplicate, with results of -1.32 ± 4.09 Bq/kg (<6.87) and -1.030 ± 3.55 Bq/kg (<5.97). The known result was a false positive test (no significant activity). TBE did not submit a result because it appeared that the results may not be accurate. TBE analyzed a substitute soil Sr-90 sample from another vendor, with a result within the acceptable range. (NCR 19-12)

4. The MAPEP February 2019 water Am-241 result was evaluated as Not Acceptable. The reported value was 0.764 ± 0.00725 Bq/L with a known result of 0.582 Bq/L (acceptable range 0.407 - 0.757 Bq/L). TBE's result falls within the upper acceptable range with the error. It appeared that a non-radiological interference was added and lead to an increased mass and higher result. (NCR 19-13)

5. The MAPEP February 2019 vegetation Sr-90 result was evaluated as Not Acceptable. The reported result was -0.1060 ± 0.0328 Bq/kg and the known result was a false positive test (no significant activity). TBE's result was correct in that there was no activity. MAPEP's evaluation was a "statistical failure" at 3 standard deviations. (NCR 19-14)

6. The ERA October 2019 water Gross Alpha result was evaluated as Not Acceptable. TBE's reported result was 40.5 ± 10.3 pCi/L and the known result was 27.6 pCi/L (ratio of TBE to known result at 135%). With the associated error, the result falls within the acceptable range (14.0 - 36.3 pCi/L). The sample was run as the workgroup duplicate on a different detector with a result of 30.8 ± 9.17 pCi/L (within the acceptable range). This was the first failure for drinking water Gr-A since 2012. (NCR 19-23)

7. The ERA October 2019 water Sr-90 result was evaluated as Not Acceptable. TBE's reported result was 32.5 ± 2.12 pCi/L and the known result was 26.5 pCi/L (ratio of TBE to known result at 123%). With the associated error, the result falls within the acceptable range (19.2 - 30.9 pCi/L). The sample was run as the workgroup duplicate on a different detector with a result of 20.0 ± 1.91 pCi/L (within the acceptable range). Both TBE results are within internal QC limits. A substitute "quick response" sample was analyzed with an acceptable result of 20.1 pCi/L (known range of 13.2 - 22.1 pCi/L). (NCR 19-24)

8. The MAPEP August 2019 soil Ni-63 result of 436 ± 22.8 Bq/kg was evaluated as Not Acceptable. The known result was 629 Bq/kg (acceptable range 440 - 818 Bq/kg). With the associated error, the TBE result falls within the lower acceptance range. All associated QC was acceptable. No reason for failure could be found. This is the first failure for soil Ni-63 since 2012. (NCR 19-25).

9. The MAPEP August 2019 water Am-241 result was not reported and therefore evaluated as Not Acceptable. Initial review of the results showed a large peak where Am-241 should be (same as the February, 2019 sample results). It is believed that Th-228 was intentionally added as an interference. The sample was re-prepped and analyzed using a smaller sample aliquot. The unusual large peak (Th-228) was seen again and also this time a smaller peak (Am-241). The result was 436 ± 22.8 Bq/L (acceptable range 0.365 ± 0.679 Bq/L). Th-228 is not a typical nuclide requested by clients, so there is no analytical purpose to take samples through an additional separation step. TBE will pursue using another vendor for Am-241 water cross-checks that more closely reflects actual customer samples. (NCR 19-26)

10. The Analytics September 2019 soil Cr-51 sample was evaluated as Not Acceptable. TBE's reported result of 0.765 ± 0.135 pCi/g exceeded the upper acceptance range (140% of the known result of 0.547 pCi/g). The TBE result was within the acceptable range (0.63 - 0.90 pCi/g) with the associated error. The Cr-51 result is very close to TBE's normal detection limit. In order to get a reportable result, the sample must be counted for 15 hours (10x longer than client samples). There is no client or regulatory requirement for this nuclide and TBE will remove Cr-51 from the reported gamma nuclides going forward. (NCR 19-27)

The Inter-Laboratory Comparison Program provides evidence of "in control" counting systems and methods, and that the laboratories are producing accurate and reliable data.

Table 8-1
Analytics Environmental Radioactivity Cross Check Program
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value [a]	Ratio of TBE to Analytics Result	Evaluation [b]
March 2019	E12468A	Milk	Sr-89	pCi/L	87.1	96	0.91	A
			Sr-90	pCi/L	12.6	12.6	1.00	A
	E12469A	Milk	Ce-141	pCi/L	113	117	0.97	A
			Co-58	pCi/L	153	143	1.07	A
			Co-60	pCi/L	289	299	0.97	A
			Cr-51	pCi/L	233	293	0.80	A
			Cs-134	pCi/L	147	160	0.92	A
			Cs-137	pCi/L	193	196	0.98	A
			Fe-59	pCi/L	153	159	0.96	A
			I-131	pCi/L	91.5	89.5	1.02	A
			Mn-54	pCi/L	149	143	1.04	A
			Zn-65	pCi/L	209	220	0.95	A
	E12470	Charcoal	I-131	pCi	77.5	75.2	1.03	A
	E12471	AP	Ce-141	pCi	60.7	70.2	0.87	A
			Co-58	pCi	87.9	85.8	1.02	A
			Co-60	pCi	175	179	0.98	A
			Cr-51	pCi	165	176	0.94	A
			Cs-134	pCi	91.2	95.9	0.95	A
			Cs-137	pCi	120	118	1.02	A
			Fe-59	pCi	108	95.3	1.13	A
			Mn-54	pCi	94.2	85.7	1.10	A
			Zn-65	pCi	102	132	0.77	W
	E12472	Water	Fe-55	pCi/L	2230	1920	1.16	A
	E12473	Soil	Ce-141	pCi/g	0.189	0.183	1.03	A
			Co-58	pCi/g	0.209	0.224	0.93	A
			Co-60	pCi/g	0.481	0.466	1.03	A
			Cr-51	pCi/g	0.522	0.457	1.14	A
			Cs-134	pCi/g	0.218	0.250	0.87	A
			Cs-137	pCi/g	0.370	0.381	0.97	A
			Fe-59	pCi/g	0.263	0.248	1.06	A
			Mn-54	pCi/g	0.248	0.223	1.11	A
			Zn-65	pCi/g	0.371	0.344	1.08	A
	E12474	AP	Sr-89	pCi	88.3	95.2	0.93	A
			Sr-90	pCi	11.7	12.5	0.94	A
August 2019	E12562	Soil	Sr-90	pCi/g	4.710	6.710	0.70	W

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

(b) Analytics evaluation based on TBE internal QC limits:

A = Acceptable - reported result falls within ratio limits of 0.80-1.20

W = Acceptable with warning - reported result falls within 0.70-0.80 or 1.20-1.30

N = Not Acceptable - reported result falls outside the ratio limits of < 0.70 and > 1.30

Table 8-1
Analytics Environmental Radioactivity Cross Check Program
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value [a]	Ratio of TBE to Analytics Result	Evaluation [b]
September 2019	E12475	Milk	Sr-89	pCi/L	70.0	93.9	0.75	W
			Sr-90	pCi/L	12.0	12.9	0.93	A
	E12476	Milk	Ce-141	pCi/L	150	167	0.90	A
			Co-58	pCi/L	170	175	0.97	A
			Co-60	pCi/L	211	211	1.00	A
			Cr-51	pCi/L	323	331	0.98	A
			Cs-134	pCi/L	180	207	0.87	A
			Cs-137	pCi/L	147	151	0.97	A
			Fe-59	pCi/L	156	148	1.05	A
			I-131	pCi/L	81.1	92.1	0.88	A
			Mn-54	pCi/L	160	154	1.04	A
			Zn-65	pCi/L	303	293	1.03	A
	E12477	Charcoal	I-131	pCi	95.9	95.1	1.01	A
	E12478	AP	Ce-141	pCi	129	138	0.93	A
			Co-58	pCi	128	145	0.88	A
			Co-60	pCi	181	174	1.04	A
			Cr-51	pCi	292	274	1.07	A
			Cs-134	pCi	166	171	0.97	A
			Cs-137	pCi	115	125	0.92	A
			Fe-59	pCi	119	123	0.97	A
			Mn-54	pCi	129	128	1.01	A
			Zn-65	pCi	230	242	0.95	A
	E12479	Water	Fe-55	pCi/L	1810	1850	0.98	A
	E12480	Soil	Ce-141	pCi/g	0.305	0.276	1.10	A
			Co-58	pCi/g	0.270	0.289	0.93	A
			Co-60	pCi/g	0.358	0.348	1.03	A
			Cr-51	pCi/g	0.765	0.547	1.40	N[1]
			Cs-134	pCi/g	0.327	0.343	0.95	A
			Cs-137	pCi/g	0.308	0.321	0.96	A
			Fe-59	pCi/g	0.257	0.245	1.05	A
			Mn-54	pCi/g	0.274	0.255	1.07	A
			Zn-65	pCi/g	0.536	0.485	1.11	A
	E12481	AP	Sr-89	pCi	95.9	91.9	1.04	A
			Sr-90	pCi	12.3	12.6	0.97	A
	E12563	Soil	Sr-90	pCi/g	0.392	0.360	1.09	A

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

(b) Analytics evaluation based on TBE internal QC limits:

A = Acceptable - reported result falls within ratio limits of 0.80-1.20

W = Acceptable with warning - reported result falls within 0.70-0.80 or 1.20-1.30

N = Not Acceptable - reported result falls outside the ratio limits of < 0.70 and > 1.30

*(1) See **NCR 19-27***

Table 8-2
DOE's Mixed Analyte Performance Evaluation Program (MAPEP)
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value [a]	Acceptance Range	Evaluation [b]
February 2019	19-GrF40	AP	Gross Alpha	Bq/sample	0.184	0.528	0.158 - 0.898	A
			Gross Beta	Bq/sample	0.785	0.948	0.474 - 1.422	A
	19-MaS40	Soil	Ni-63	Bq/kg	420	519.0	363 - 675	A
			Sr-90	Bq/kg			*(1)*	NR(3)
	19-MaW40	Water	Am-241	Bq/L	0.764	0.582	0.407 - 0.757	N(4)
			Ni-63	Bq/L	4.72	5.8	4.1 - 7.5	A
			Pu-238	Bq/L	0.443	0.451	0.316 - 0.586	A
			Pu-239/240	Bq/L	-0.00161	0.0045	*(2)*	A
	19-RdF40	AP	U-234/233	Bq/sample	0.1138	0.106	0.074 - 0.138	A
			U-238	Bq/sample	0.107	0.110	0.077 - 0.143	A
	19-RdV40	Vegetation	Cs-134	Bq/sample	2.14	2.44	1.71 - 3.17	A
			Cs-137	Bq/sample	2.22	2.30	1.61 - 2.99	A
			Co-57	Bq/sample	2.16	2.07	1.45 - 2.69	A
			Co-60	Bq/sample	0.02382		*(1)*	A
			Mn-54	Bq/sample	-0.03607		*(1)*	A
			Sr-90	Bq/sample	-0.1060		*(1)*	N(5)
			Zn-65	Bq/sample	1.35	1.71	1.20 - 2.22	W
August 2019	19-GrF41	AP	Gross Alpha	Bq/sample	0.192	0.528	0.158 - 0.898	W
			Gross Beta	Bq/sample	0.722	0.937	0.469 - 1.406	A
	19-MaS41	Soil	Ni-63	Bq/kg	436	629	440 - 818	N(6)
			Sr-90	Bq/kg	444	572	400 - 744	W
	19-MaW41	Water	Am-241	Bq/L				NR(7)
			Ni-63	Bq/L	7.28	9.7	6.8 - 12.6	W
			Pu-238	Bq/L	0.0207	0.0063	*(2)*	A
			Pu-239/240	Bq/L	0.741	0.727	0.509 - 0.945	A
	19-RdF41	AP	U-234/233	Bq/sample	0.0966	0.093	0.065 - 0.121	A
			U-238	Bq/sample	0.0852	0.096	0.067-0.125	A
	19-RdV41	Vegetation	Cs-134	Bq/sample	0.0197		*(1)*	A
			Cs-137	Bq/sample	3.21	3.28	2.30 - 4.26	A
			Co-57	Bq/sample	4.62	4.57	3.20 - 5.94	A
			Co-60	Bq/sample	4.88	5.30	3.71 - 6.89	A
			Mn-54	Bq/sample	4.54	4.49	3.14 - 5.84	A
			Sr-90	Bq/sample	0.889	1.00	0.70 - 1.30	A
			Zn-65	Bq/sample	2.78	2.85	2.00 - 3.71	A

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

(b) DOE/MAPEP evaluation:
A = Acceptable - reported result falls within ratio limits of 0.80-1.20
W = Acceptable with warning - reported result falls within 0.70-0.80 or 1.20-1.30
N = Not Acceptable - reported result falls outside the ratio limits of < 0.70 and > 1.30

(1) False positive test
(2) Sensitivity evaluation
*(3) See **NCR 19-12***
*(4) See **NCR 19-13***
*(5) See **NCR 19-14***
*(6) See **NCR 19-25***
*(7) See **NCR 19-26***

Table 8-3
ERA Environmental Radioactivity Cross Check Program
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value [a]	Acceptance Limits	Evaluation [b]
April 2019	Rad-117	Water	Ba-133	pCi/L	26.3	24.1	18.6 - 27.8	A
			Cs-134	pCi/L	15.2	12.1	8.39 - 14.4	N[1]
			Cs-137	pCi/L	33.6	33.1	28.8 - 39.4	A
			Co-60	pCi/L	11.9	11.5	8.67 - 15.5	A
			Zn-65	pCi/L	87.1	89.2	80.3 - 107	A
			GR-A	pCi/L	19	19.3	9.56 - 26.5	A
			GR-B	pCi/L	20.2	29.9	19.1 - 37.7	A
			U-Nat	pCi/L	55.5	55.9	45.6 - 61.5	A
			H-3	pCi/L	21500	21400	18700 - 23500	A
			Sr-89	pCi/L	44.9	33.3	24.5 - 40.1	N[2]
			Sr-90	pCi/L	24.5	26.3	19.0 - 30.7	A
			I-131	pCi/L	28.9	28.4	23.6 - 33.3	A
October 2019	Rad-119	Water	Ba-133	pCi/L	42.7	43.8	35.7 - 48.8	A
			Cs-134	pCi/L	53.5	55.9	45.2 - 61.5	A
			Cs-137	pCi/L	77.7	78.7	70.8 - 89.2	A
			Co-60	pCi/L	51.5	53.4	48.1 - 61.3	A
			Zn-65	pCi/L	36.6	34.0	28.5 - 43.1	A
			GR-A	pCi/L	40.5	27.6	14.0 - 36.3	N[3]
			GR-B	pCi/L	36.3	39.8	26.4 - 47.3	A
			U-Nat	pCi/L	27.66	28.0	22.6 - 31.1	A
			H-3	pCi/L	22800	23400	20500 - 25700	A
			Sr-89	pCi/L	47.1	45.5	35.4 - 52.7	A
			Sr-90	pCi/L	32.5	26.5	19.2 - 30.9	N[4]
			I-131	pCi/L	26.0	23.9	19.8 - 28.4	A
December 2019	QR 120419D	Water	Sr-90	pCi/L	20.1	18.6	13.2 - 22.1	A

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

(b) ERA evaluation:
A = Acceptable - Reported value falls within the Acceptance Limits
N = Not Acceptable - Reported value falls outside of the Acceptance Limits

*(1) See **NCR 19-10***
*(2) See **NCR 19-11***
*(3) See **NCR 19-23***
*(4) See **NCR 19-24***

ENVIRONMENTAL DOSIMETRY COMPANY

ANNUAL QUALITY ASSURANCE STATUS REPORT

January - December 2019

Prepared By: _____ Date: 3/25/20

Approved By: _____ Date: 3/25/20

Environmental Dosimetry Company
10 Ashton Lane
Sterling, MA 01564

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EXECUTIVE SUMMARY

Routine quality control (QC) testing was performed for dosimeters issued by the Environmental Dosimetry Company (EDC) .

During this annual period100% (72/72) of the individual dosimeters, evaluated against the EDC internal performance acceptance criteria (high-energy photons only), met the criterion for accuracy and 100% (72/72) met the criterion for precision (Table 1). In addition, 100% (12/12) of the dosimeter sets evaluated against the internal tolerance limits met EDC acceptance criteria (Table 2) and 100% (6/6) of independent testing passed the performance criteria (Table 3). Trending graphs, which evaluate performance statistic for high-energy photon irradiations and co-located stations are given in Appendix A.

One internal assessment was performed in 2019.There were no findings.

I. INTRODUCTION

The TLD systems at the Environmental Dosimetry Company (EDC) are calibrated and operated to ensure consistent and accurate evaluation of TLDs. The quality of the dosimetric results reported to EDC clients is ensured by in-house performance testing and independent performance testing by EDC clients, and both internal and client directed program assessments.

The purpose of the dosimetry quality assurance program is to provide performance documentation of the routine processing of EDC dosimeters. Performance testing provides a statistical measure of the bias and precision of dosimetry processing against a reliable standard, which in turn points out any trends or performance changes. Two programs are used:

A. QC Program

Dosimetry quality control tests are performed on EDC Panasonic 814 Environmental dosimeters. These tests include: (1) the in-house testing program coordinated by the EDC QA Officer and (2) independent test perform by EDC clients. In-house test are performed using six pairs of 814 dosimeters, a pair is reported as an individual result and six pairs are reported as the mean result.Results of these tests are described in this report.

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

B. QA Program

An internal assessment of dosimetry activities is conducted annually by the Quality Assurance Officer (Reference 1). The purpose of the assessment is to review procedures, results, materials or components to identify opportunities to improve or enhance processes and/or services.

II. PERFORMANCE EVALUATION CRITERIA

A. Acceptance Criteria for Internal Evaluations

1. Bias

For each dosimeter tested, the measure of bias is the percent deviation of the reported result relative to the delivered exposure. The percent deviation relative to the delivered exposure is calculated as follows:

$$\frac{(H_i' - H_i)}{H_i} 100$$

where:

H_i' = the corresponding reported exposure for the i^{th} dosimeter (i.e., the reported exposure)

H_i = the exposure delivered to the i^{th} irradiated dosimeter (i.e., the delivered exposure)

2. Mean Bias

For each group of test dosimeters, the mean bias is the average percent deviation of the reported result relative to the delivered exposure. The mean percent deviation relative to the delivered exposure is calculated as follows:

$$\sum\left(\frac{(H_i' - H_i)}{H_i}\right)100\left(\frac{1}{n}\right)$$

where:

H_i' = the corresponding reported exposure for the i^{th} dosimeter (i.e., the reported exposure)

H_i = the exposure delivered to the i^{th} irradiated test dosimeter (i.e., the delivered exposure)

n = the number of dosimeters in the test group

3. Precision

For a group of test dosimeters irradiated to a given exposure, the measure of precision is the percent deviation of individual results relative to the mean reported exposure. At least two values are required for the determination of precision. The measure of precision for the i^{th} dosimeter is:

$$\left(\frac{(H_i' - \bar{H})}{\bar{H}}\right)100$$

where:

H_i' = the reported exposure for the i^{th} dosimeter (i.e., the reported exposure)

$\bar{H}$ = the mean reported exposure; i.e., $\bar{H} = \sum H_i'\left(\frac{1}{n}\right)$

n = the number of dosimeters in the test group

4. EDC Internal Tolerance Limits

All evaluation criteria are taken from the "EDC Quality System Manual," (Reference 2). These criteria are only applied to individual test dosimeters irradiated with high-energy photons (Cs-137) and are as follows for Panasonic Environmental dosimeters: ± 15% for bias and ± 12.8% for precision.

B. QC Investigation Criteria and Result Reporting

EDC Quality System Manual (Reference 2) specifies when an investigation is required due to a QC analysis that has failed the EDC bias criteria. The criteria are as follows:

1. No investigation is necessary when an individual QC result falls outside the QC performance criteria for accuracy.

2. Investigations are initiated when the mean of a QC processing batch is outside the performance criterion for bias.

C. Reporting of Environmental Dosimetry Results to EDC Customers

1. All results are to be reported in a timely fashion.

2. If the QA Officer determines that an investigation is required for a process, the results shall be issued as normal. If the QC results prompting the investigation have a mean bias from the known of greater than ±20%, the results shall be issued with a note indicating that they may be updated in the future, pending resolution of a QA issue.

3. Environmental dosimetry results do not require updating if the investigation has shown that the mean bias between the original results and the corrected results, based on applicable correction factors from the investigation, does not exceed ±20%.

III. DATA SUMMARY FOR ISSUANCE PERIOD JANUARY-DECEMBER 2019

A. General Discussion

Results of performance tests conducted are summarized and discussed in the following sections. Summaries of the performance tests for the reporting period are given in Tables 1 through 3 and Figures 1 through 4.

Table 1 provides a summary of individual dosimeter results evaluated against the EDC internal acceptance criteria for high-energy photons only. During this period100% (72/72) of the individual dosimeters, evaluated against these criteria, met the tolerance limits for accuracy and 100% (72/72) met the criterion for precision. A graphical interpretation is provided in Figures 1 and 2.

Table 2 provides the bias and standard deviation results for each group (N=6) of dosimeters evaluated against the internal tolerance criteria. Overall,100% (12/12) of the dosimeter sets, evaluated against the internal tolerance performance criteria, met these criteria. A graphical interpretation is provided in Figure 3.

Table 3 presents the independent blind spike results for dosimeters processed during this annual period. All results passed the performance acceptance criterion. Figure 4 is a graphical interpretation of Seabrook Station blind co-located station results.

B. Result Trending

One of the main benefits of performing quality control tests on a routine basis is to identify trends or performance changes. The results of the Panasonic environmental dosimeter performance tests are presented in Appendix A. The results are evaluated against each of the performance criteria listed in Section II, namely: individual dosimeter accuracy, individual dosimeter precision, and mean bias.

All of the results presented in Appendix A are plotted sequentially by processing date.

IV. STATUS OF EDC CONDITION REPORTS (CR)

No condition reports were issued during this annual period.

V. STATUS OF AUDITS/ASSESSMENTS

1. Internal

   EDC Internal Quality Assurance Assessment was conducted during the fourth quarter 2019. There were no findings identified.

2. External

   None.

VI. PROCEDURES AND MANUALS REVISED DURING JANUARY - DECEMBER 2019

No procedures or manuals were revised in 2019.

VII. CONCLUSION AND RECOMMENDATIONS

The quality control evaluations continue to indicate the dosimetry processing programs at the EDC satisfy the criteria specified in the Quality System Manual. The EDC demonstrated the ability to meet all applicable acceptance criteria.

VIII. REFERENCES

1. EDC Quality Control and Audit Assessment Schedule, 2019.

2. EDC Manual 1, Quality System Manual, Rev. 3, August 1, 2017.

TABLE 1

PERCENTAGE OF INDIVIDUAL DOSIMETERS THAT PASSED EDC INTERNAL CRITERIA JANUARY – DECEMBER 2019[1], [2]

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

[1]This table summarizes results of tests conducted by EDC.
[2]Environmental dosimeter results are free in air.

TABLE 2

MEAN DOSIMETER ANALYSES (N=6) JANUARY – DECEMBER 2019[1], [2]

Process Date	Exposure Level	Mean Bias %	Standard Deviation %	Tolerance Limit +/- 15%
4/25/2019	26	1.8	1.7	Pass
4/29/2019	51	3.1	1.5	Pass
5/04/2019	85	-0.4	1.4	Pass
7/28/2019	75	5.9	1.1	Pass
7/30/2019	32	2.8	1.2	Pass
8/4/2019	107	-0.7	1.2	Pass
10/25/2019	64	1.8	1.2	Pass
11/04/2019	90	-0.5	1.8	Pass
11/05/2019	117	3.0	1.7	Pass
01/20/2020	45	1.0	2.0	Pass
01/30/2020	57	1.8	2.6	Pass
02/17/2020	121	-2.6	2.4	Pass

[1]This table summarizes results of tests conducted by EDC for TLDs issued in 2019.
[2]Environmental dosimeter results are free in air.

TABLE 3
SUMMARY OF INDEPENDENT DOSIMETER TESTING JANUARY – DECEMBER 2019[1], [2]

Issuance Period	Client	Mean Bias %	Standard Deviation %	Pass / Fail
1st Qtr. 2019	Millstone	0.6	2.6	Pass
2nd Qtr.2019	Seabrook	7.8	2.0	Pass
3rd Qtr. 2019	SONGS	0.1	2.4	Pass
3rd Qtr. 2019	Millstone	1.1	1.9	Pass
4th Qtr.2019	PSEG(PNNL)	-3.2	0.9	Pass
4th Qtr.2019	Seabrook	0.9	1.0	Pass

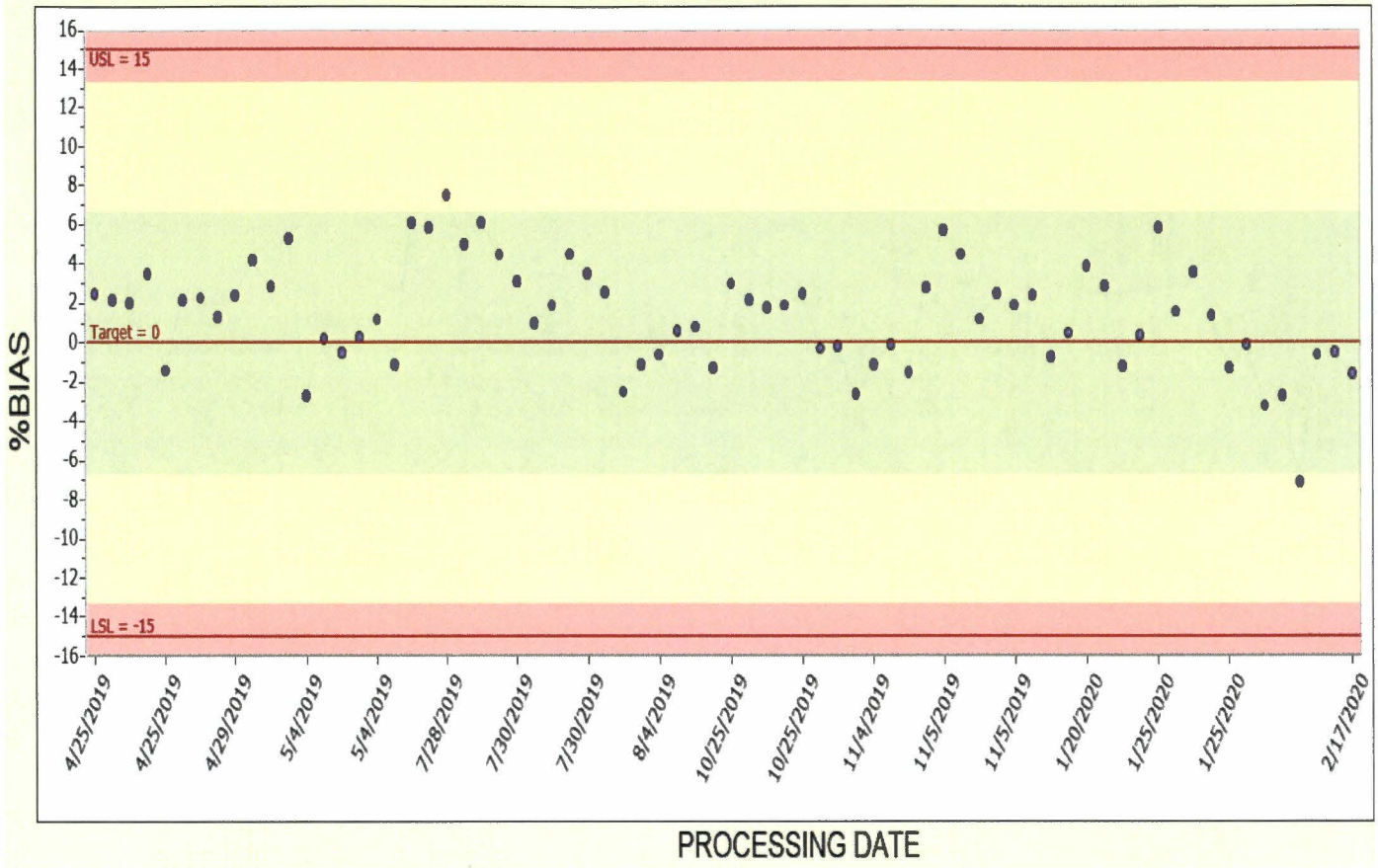
[1]Performance criteria are +/- 15%.
[2]Blind spikeirradiations using Cs-137

APPENDIX A

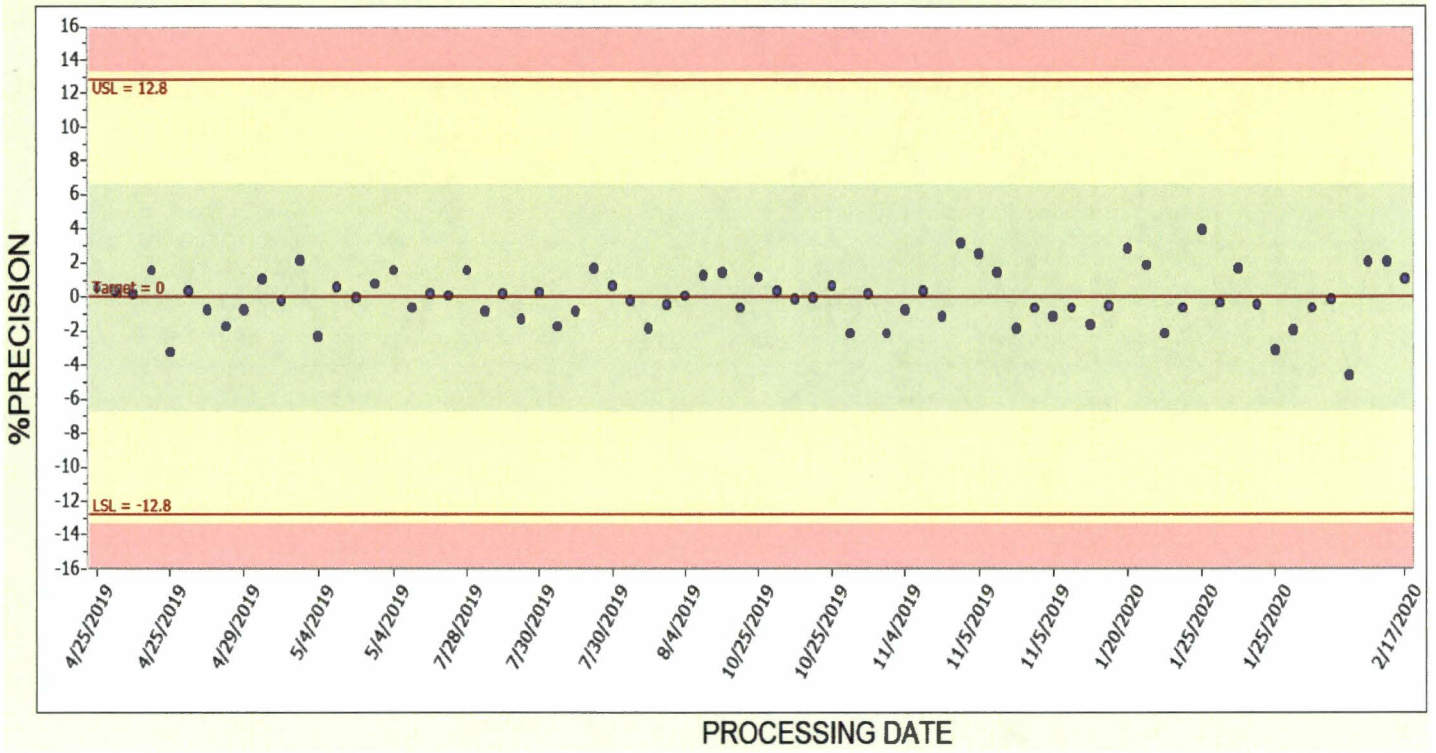
DOSIMETRY QUALITY CONTROL TRENDING GRAPHS

ISSUE PERIOD JANAURY - DECEMBER 2019

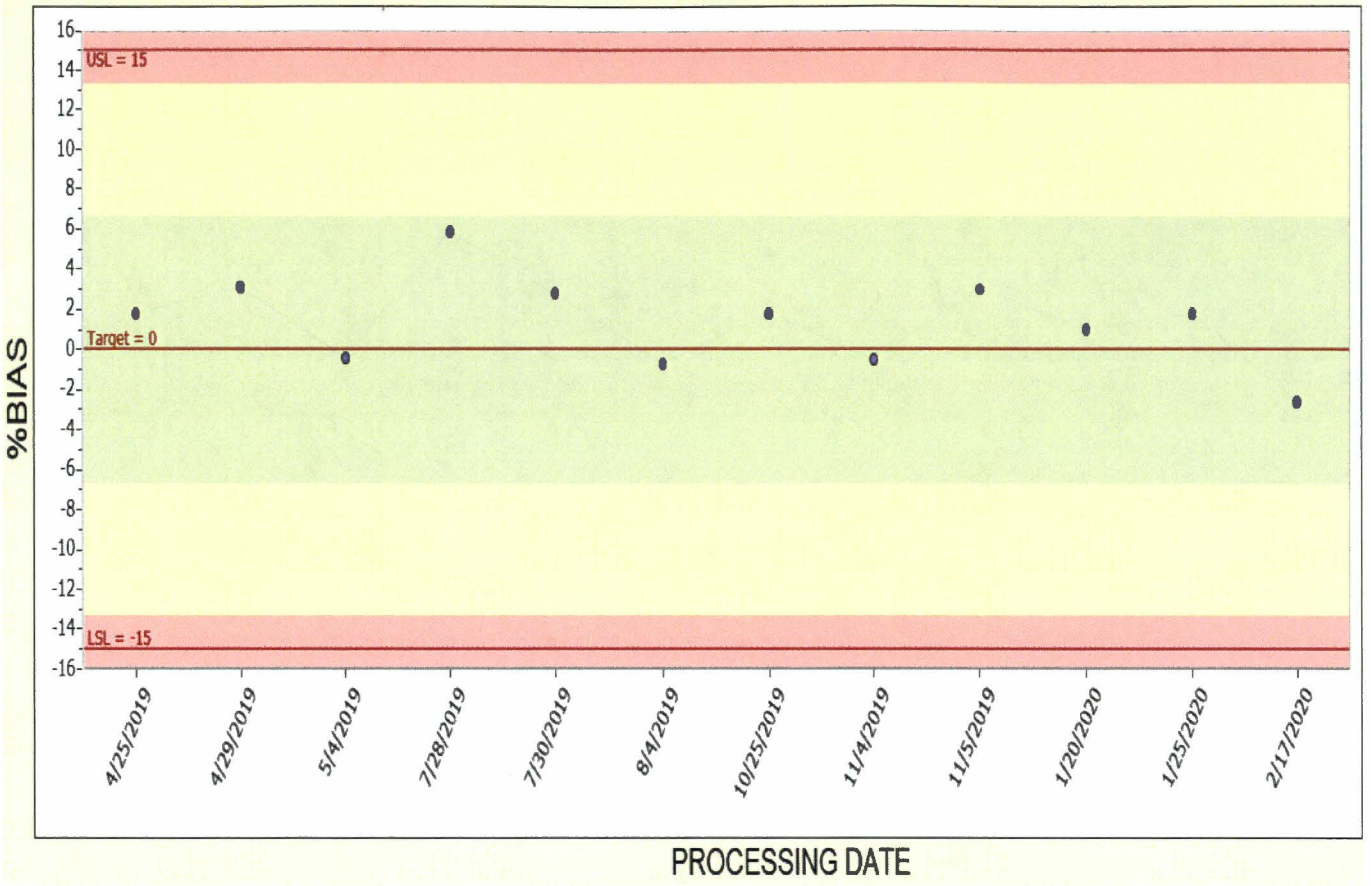
INDIVIDUAL ACCURACY ENVIRONMENTAL
FIGURE 1



INDIVIDUAL PRECISION ENVIRONMENTAL
FIGURE 2



MEAN ACCURACY ENVIRONMENTAL
FIGURE 3



SEABROOK CO-LOCATE ACCURACY
FIGURE 4