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United States Nuclear Regulatory Commission
Attn: Document Control Desk
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Washington, D.C. 20555

SUBJECT: JAMES A. FITZPATRICK NUCLEAR POWER PLANT RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT FACILITY OPERATING LICENSE DPR-59, DOCKET NO. 50-333

Gentlemen:

Enclosed please find the 2000 Radiological Environmental Operating Report which covers the operating period of January 1, 2000 through December 31, 2000. This report is submitted in accordance with the requirements of Amendment 93, Section 7.3.d of the James A. FitzPatrick Nuclear Power Plant Radiologically Effluent Technical Specifications.

Very truly yours,

T.A. SULLIVAN

TAS:BG:ls

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2000

Annual Radiological Environmental Operating Report

James A. FitzPatrick Nuclear Power Plant

ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

JANUARY 1, 2000 - DECEMBER 31, 2000

FOR

JAMES A. FITZPATRICK NUCLEAR POWER PLANT

ENTERGY NUCLEAR FITZPATRICK, LLC (ENF)

ENTERGY NUCLEAR OPERATIONS, INC (ENO)

FACILITY OPERATING LICENSE DPR-59

DOCKET NUMBER 50-333

TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

LIST OF TABLES

LIST OF FIGURES

1.0 EXECUTIVE SUMMARY

The Annual Radiological Environmental Operating Report is published pursuant to Section 7.3.d of the Radiological Effluent Technical Specifications (RETS). The RETS require that the results from the Annual Radiological Environmental Monitoring Program (REMP) be provided to the Nuclear Regulatory Commission.

This report describes the REMP program and its implementation as required by Technical Specifications. It also contains the analytical results, 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 Intercomparison Program required by Technical Specifications.

The REMP is implemented to measure radioactivity in the aquatic and the terrestrial pathways. The aquatic pathways include Lake Ontario fish, surface water, and lakeshore sediment. Measurement results of the samples representing these pathways contained naturally occurring background radionuclides and in two sample media, sediment and fish, very small concentrations of Cs-137, which are the result of past atmospheric nuclear testing. The 2000 results were consistent with the previous five year historical data.

Terrestrial pathways are monitored and include airborne particulate and radioiodine, milk, food products and direct radiation. One air particulate filter composite sample contained a measurable concentration of Co-60 at a site boundary sampling location. The presence of Co-60 in the sample composite is the result of plant effluent from the Nine Mile Point Unit 1 Facility. Co-60 was not measured in any other location or sample media. The calculated potential dose to man from this pathway was insignificant. Analysis of all terrestrial radiation pathways demonstrated that there has been no significant increased radiation level as a result of plant operation. Again, the 2000 results are consistent with the previous five year historical results and exhibit no adverse trends.

In summary, the analytical results from the 2000 Environmental Monitoring Program demonstrate that the routine operation of the James A. FitzPatrick Nuclear Power Plant had no significant or measurable radiological impact on the environment. No elevated radiation levels were detected in the off-site environment as a result of the hydrogen injection rates implemented at the plant during 2000 or from the processing and storage of radioactive waste at the site. The measured concentrations of radionuclides in the off-site environment surrounding the JAFNPP are not increasing as a result of plant operation. The 2000 report continues to document a downward trend or stabilization in the concentration of radionuclides in the environment created from past weapons testing. The results of the program continue to demonstrate that the operation of the plant did not result in a measurable dose of any significance to the general population, above natural background levels or adversely impact the environment as a result of radiological effluents.

2.0 INTRODUCTION

This report is submitted in accordance with Section 7.3.d of the Radiological Effluent Technical Specifications (RETS) to DPR-59, Docket 50-333, Amendment No. 268.

2.1 PROGRAM HISTORY

Environmental monitoring of the Nine Mile Point site has been on-going since 1964. The program includes five years of preoperational data which was conducted prior to any reactor operations. In 1968, the Niagara Mohawk Power Company began the required preoperational 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 620 Megawatt 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, a 870 Megawatt (Rated) BWR, occupies the east sector of the Nine Mile Point site, approximately 1/2 mile from Nine Mile Point Unit 1.

In 1985, the individual station Effluent Technical Specifications were standardized to the current Radiological Effluent Technical Specifications, much of which is common to both plants. Data generated by the Radiological Environmental Program is shared, but each utility reviews and publishes their own annual report. In 1988, The Nine Mile Point Unit 2 reactor, also owned and operated by Niagara Mohawk, began full power operation. This 1207 Megawatt BWR is located between Unit 1 and FitzPatrick. On November 21, 2000 the ownership and operation of the James A. FitzPatrick N.P.P. 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.

In summary, three Boiling Water Reactors, which together generate 2530 Megawatts, have operated collectively at the Nine Mile site since 1988. A large data base of environmental results from the exposure pathways have been collected and analyzed to determine the effect from reactor operations.

2.2 SITE DESCRIPTION

The Nine Mile Point site is located on the southeastern shore of Lake Ontario approximately seven miles east of the Oswego River and the City of Oswego. Syracuse, the nearest metropolitan area, is located 36 miles to the south. The reactors and support buildings occupy a small shoreline portion of the 700 acre site, which is partially wooded. The land, soil of glacial deposits, rises gently from the lake in all directions. Oswego County is a rural environment, with about approximately 34% of the land devoted to agriculture.

2.3 PROGRAM OBJECTIVES

The objectives of the Radiological Environmental Monitoring Program 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 JAFNPP site.

3. Demonstrate compliance with the various environmental conditions and requirements of applicable state and federal regulatory agencies including Technical Specifications and 40 CFR Part 190.

4. Provide information by which the general public can evaluate the environmental aspects of nuclear power using unbiased data.

5. Satisfy the community interest regarding the impact of the power plants on the environment.

3.0 PROGRAM DESCRIPTION

To achieve the objectives listed in Section 2.3, an extensive sampling and analysis program is conducted every year. The JAFNPP Radiological Environmental Monitoring Program (REMP) consists of sampling and analysis of various media that include:

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

In addition, direct radiation measurements are performed using thermoluminescent dosimeters (TLDs). These sampling programs are outlined in Table 3.0-1. The JAFNPP 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 (ICP). In addition to the participation in the ICP Program, quarterly sample splits are provided to the New York State Department of Health for cross checking purposes.

Sample collections for the radiological program are accomplished by a dedicated site environmental staff from both the James A. FitzPatrick Plant and the Nine Mile Point Stations. The site staff is assisted by a contracted environmental engineering company, EA Engineering, Science and Technology, Inc. (EA).

TABLE 3.0-1

OPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
REQUIRED SAMPLE COLLECTION AND ANALYSIS

Exposure Pathway and/or Sample	Number of Samples[a] and Locations	Sampling and Collection Frequency[a]	Type and Frequency of Analysis
AIRBORNE			
Radioiodine and Particulates	Samples from 5 locations: a. 3 samples from off-site 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 quarterly (as a minimum).
Direct Radiation[e]	32 stations with two or more dosimeters 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 of the land based sectors of each ring. There are 16 land based sectors in the inner ring, and 8 land based sectors in the outer ring. 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)

OPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

REQUIRED SAMPLE COLLECTION AND ANALYSIS

Exposure Pathway and/or Sample	Number of Samples [a] and Locations	Sampling and Collection Frequency[a]	Type and Frequency of Analysis
WATERBORNE			
Surface[f]	a. 1 sample upstream. b. 1 sample from the site's most downstream cooling water intake[d].	Composite sample over 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 semiannually[c].
INGESTION			
Milk	a. Samples from milk animals in 3 locations within 3.5 miles distant having the highest calculated site average D/Q. If there are none, then 1 sample from milk animals in each of 3 areas 3.5 to 5.0 miles distant having the highest calculated site average D/Q (based on all licensed site reactors)[h]. b. 1 sample from milk animals at a control location (9 to 20 miles distant and in a less prevalent wind direction)[d].	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 milk animals are on pasture (April through December); monthly (January through March), if required[c].

TABLE 3.0-1 (Continued)

OPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

REQUIRED SAMPLE COLLECTION AND ANALYSIS

Exposure Pathway and/or Sample	Number of Samples[a] and Locations	Sampling and Collection Frequency[a]	Type and Frequency of Analysis
FISH			
	a. 1 sample of each of 2 commerically 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 each 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 cenus as specified in 6.2, samples of at least 3 different kinds of broad leaf vegetation (such as vegetables) grown nearest each of two different off-site locations of highest predicted site average D/Q (based on all licensed site Reactors).	Once during harvest season.	Gamma isotopic[c] analysis of edible portions. (Isotopic to include I-131).
	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].		

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 thorium daughter decay. If 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 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 pocket 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.

NOTES FOR TABLE 3.0-1 (Continued)

(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 that a representative sample is obtained.

(h) A milk sampling location, as required in Table 1, 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.

3.1 SAMPLE COLLECTION METHODOLOGY

3.1.1 SURFACE WATER

Surface water samples are taken from the respective inlet canals of the JAFNPP and the Niagara Mohawk Oswego Steam Station (OSS) located in the City of Oswego. The FitzPatrick Facility draws water from Lake Ontario on a continuous basis. This is used for the "down-current" or indicator sampling point for the Nine Mile Point Site. The OSS inlet canal removes water from Lake Ontario at a point approximately 7.6 miles west of the site. This "up-current" location is considered a control location because of the distance from the site as well as its location relative to prevailing lake current directions and flow pattern of the nearby Oswego River.

Samples from the JAFNPP are composited using automatic sampling equipment which discharges into a compositing tank or bottles. Samples are collected monthly from the compositor and analyzed for gamma emitting radionuclides. Samples from the OSS 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 samples 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 for samples from the City of Oswego drinking water supply. The latter three locations are not required by the Technical Specifications. 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 emitters and quarterly composite samples are analyzed for tritium.

Surface water sample locations are shown in Section 3.3 on Figure 3.3-4.

3.1.2 AIR PARTICULATE/IODINE

The air sampling stations required by the Radiological Effluent Technical Specifications (RETS) 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 meteorological deposition factors (D/Q) based on historical meteorological data. These stations (R-1, R-2, and R-3) are located in the east, east-southeast, and southeast sectors as measured from the center of the NMPNS Unit 2 reactor building. The RETS also require that a fourth air sampling station be located in the vicinity of a year round community having the highest calculated dispersion factor (D/Q) based on historical meteorological data. This station is located in the southeast sector at a distance of 1.8 miles and is designated as location R-4. A fifth station required by the RETS is a control location, designated as station R-5. Station R-5 is located 16.4 miles from the site in the northeast meteorological sector.

In addition to the RETS required locations, there are ten additional sampling stations. Six of these sampling stations are located within the site boundary and are designated as on-site stations D1, G, H, I, J, and K. These locations are within the site boundary of the JAFNPP and NMPNS. One air sampling station is located off-site in the southwest sector in the vicinity of the City of Oswego and is designated as station G off-site. Three remaining air sampling stations are located in the ESE, SSE, and S sectors and range in distance from 7.2 to 9.0 miles. These are designated as off-site stations D2, E and F respectively.

Each station collects airborne particulates using glass fiber filters (47 millimeter diameter) and radioiodine using charcoal cartridges (2 x 1 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 monthly by location and analyzed for gamma emitting radionuclides.

Air sampling stations are shown in Section 3.3, Figures 3.3-2 and 3.3-3.

3.1.3 MILK

Milk samples are routinely collected from six farms during the year. These farms included five indicator locations and one control location. Samples are collected twice per month, April through December and each sample is analyzed for gamma emitting radionuclides and I-131. Samples are collected in January, February and March in the event that I-131 is detected in November and December of the preceding year.

The selection of milk sample locations is based on maximum deposition calculations (D/Q). Deposition values are generated using average historical meteorological data for the site. The Technical Specifications require three sample locations within 5.0 miles of the site with the highest calculated deposition value. During 1999 there were no milk sample locations within 5.0 miles that were suitable for sampling based on production capabilities. There were however, five optional locations beyond five miles that were sampled as indicator location for the routine milk sampling program.

The Technical Specifications also require that a sample be collected from a location greater than ten miles from the site and in a less prevalent wind direction. This location is in the southwest sector 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 butterfat. Two gallons are collected from each indicator and control location during the first half and second half of each month. 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 found in Section 3.3 in Figure 3.3-4. (Refer to Table 3.3-1, Section 3.3 for location designations and descriptions).

3.1.4 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 two different indicator garden locations. Sample locations are selected from 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 shown in Section 3.3 on Figure 3.3-5.

3.1.5 FISH SAMPLES

Samples of available fish species are selected from the Nine Mile Point Aquatic Ecology Study which monitors lake fish populations. Fish samples are collected twice per year, once in the spring and again in the fall. Indicator samples are collected from a combination of the four on-site sample transects located off shore from the site. One set of control samples are at an off-site sample transect located off shore 8 - 10 miles west of the site. Available species are selected using the following guidelines:

a) Samples are composed of 0.5 to 1 kilogram of the edible portion only. Maximum of three species per location are used.

b) Samples composed of more than 1 kilogram of a single species from the same location are divided into samples of 1 kilogram each. A maximum of three samples per species per location are used. Sample weights include only the edible portions.

c) Samples are limited to edible and or sport species when available.

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 collection locations are shown in Section 3.3 on Figure 3.3 -5.

3.1.6 SHORELINE SEDIMENTS

One kilogram of 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 1 inch. The samples are placed in plastic bags, sealed and shipped to the lab for analysis. Sediment samples are analyzed for gamma emitting radionuclides.

Shoreline sediment locations are shown in Section 3.3 on Figure 3.3-5.

3.1.7 TLD (DIRECT RADIATION)

Thermoluminescent dosimeters (TLDs) are used to measure direct radiation (gamma dose) in the environment. TLDs are supplied and processed quarterly by the J.A. FitzPatrick N.P.P. Environmental Laboratory. The laboratory utilizes a Panasonic based system using UD-814 dosimeters. Each dosimeter contains three calcium sulfate elements and one lithium borate element. Two dosimeters are placed at each monitoring location.

Five different regions around the site are evaluated using environmental TLDs.

- o On-site areas (areas within the site boundary not required by the RETS)
- o Site boundary area in each of the sixteen meteorological sectors
- o An outer ring of TLDs (located four to five miles from the site in the eight land based meteorological sectors)
- o Special interest TLDs (located at sites of high population density and use)

- o Control TLDs located at sites beyond significant influence of the site

Special interest TLDs are located at or near large industrial sites, schools, or nearby towns or communities. Control TLDs are located to the southwest, south and east-northeast of the site at distances of 12.6 to 19.8 miles.

TLDs used for the program are constructed of rectangular teflon wafers impregnated with 25 percent $CaSO_4$:Dy phosphor. Badges are sealed in polyethylene packages to ensure dosimeter integrity. TLD packages are placed in open webbed plastic holders and attached to supporting structures, such as utility poles.

Environmental TLD locations are shown in Section 3.3 on Figures 3.3-2 and 3.3-3.

3.2 ANALYSES PERFORMED

The majority of environmental sample analyses are performed by the James A. FitzPatrick Environmental Laboratory (JAFEL). Tritium in water analysis was performed by Environmental, Inc. Midwest Laboratory*. The following samples are analyzed at the JAFEL:

- Air Particulate Filter - gross beta
- Air Particulate Filter Composites - gamma spectral analysis
- Airborne Radioiodine - gamma spectral analysis
- Surface Water Monthly Composites - gamma spectral analysis/I-131
- Fish - gamma spectral analysis
- Shoreline Sediment - gamma spectral analysis
- Milk - gamma spectral analysis and I-131
- Direct Radiation - Thermoluminescent Dosimeters (TLDs)
- Special Samples (soil, food products, bottom sediment, etc.) - gamma spectral analysis

* Formerly Teledyne Midwest Laboratory Midwest.

3.3 SAMPLE LOCATION MAPS

Section 3.3 includes 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.

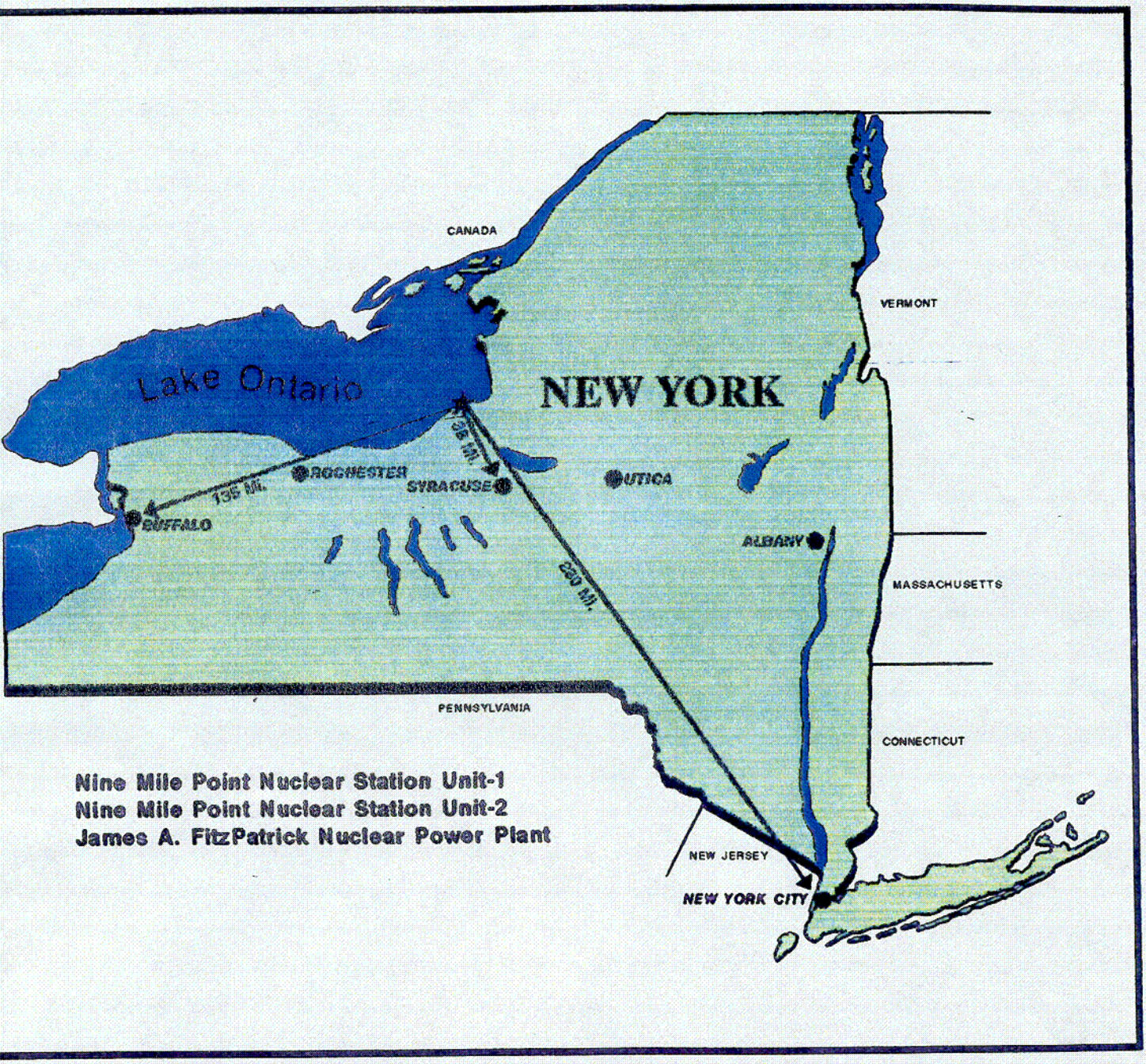
This section also contains an environmental sample location reference table (Table 3.3-1). This table contains the following information:

- Sample Medium
- Location 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).
- Location description
- Degrees and distance of the sample location from the site.

3.3.1 LIST OF FIGURES

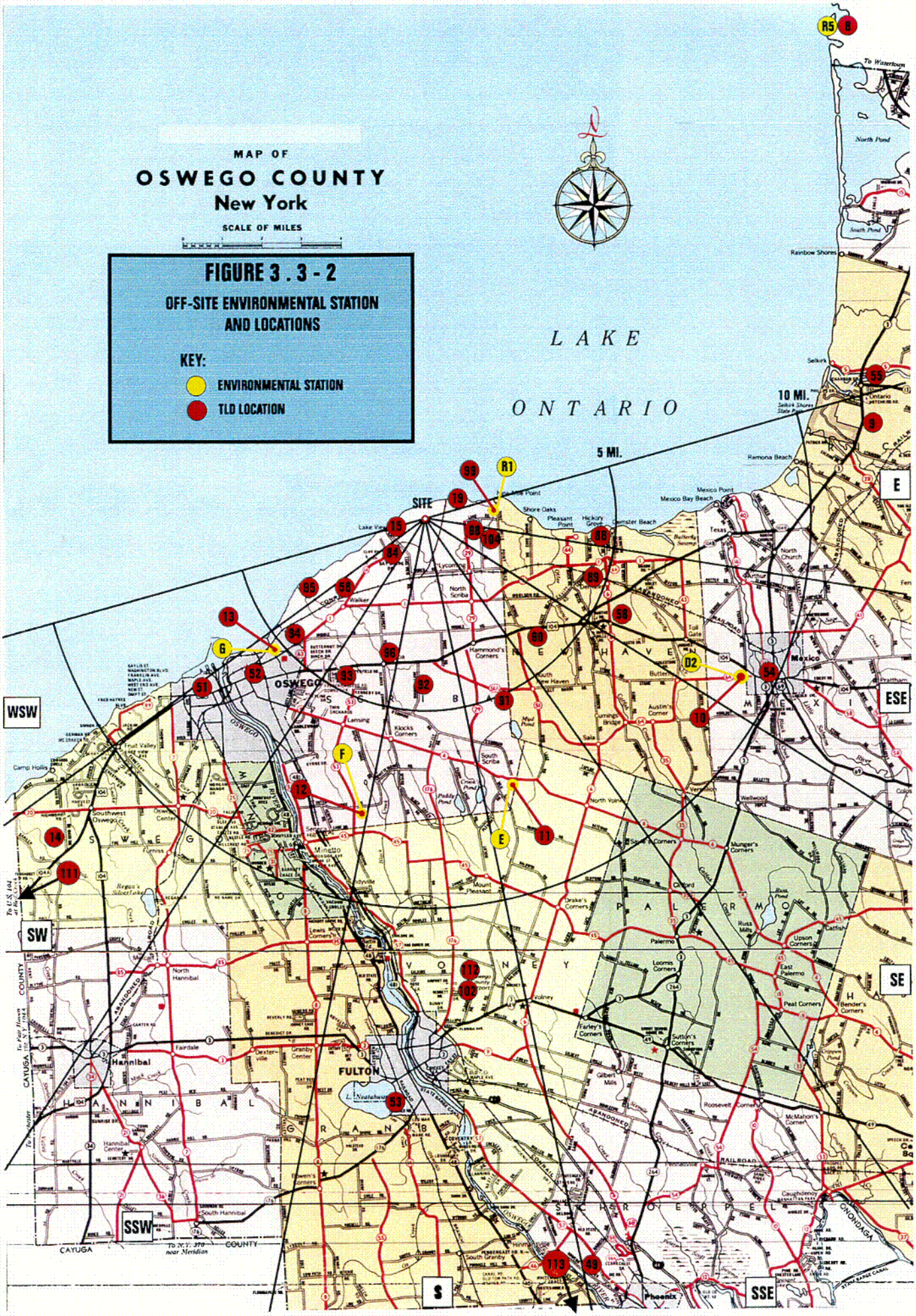
- Figure 3.3-1 - New York State Map
- Figure 3.3-2 - Off-site Environmental Station and TLD Location Map
- Figure 3.3-3 - On-site Environmental Station and TLD Location Map
- Figure 3.3-4 - Milk Animal Census, Milk Sample Location and Surface Water Sample Location Map
- Figure 3.3-5 - Nearest Resident, Food Product, Shoreline Sediment, Fish Sample Location Map

FIGURE 3.3-1
NEW YORK STATE MAP



Nine Mile Point Nuclear Station Unit-1
Nine Mile Point Nuclear Station Unit-2
James A. FitzPatrick Nuclear Power Plant

C01


MAP OF
OSWEGO COUNTY
New York
SCALE OF MILES
FIGURE 3 . 3 - 2
OFF-SITE ENVIRONMENTAL STATION AND LOCATIONS
KEY:
ENVIRONMENTAL STATION
TLD LOCATION
LAKE ONTARIO
10 MI.
5 MI.
SITE
OSWEGO
FULTON
Hannibal
Mexico
Phoenix
N
NNE
E
ESE
SE
SSE
S
SSW
SW
WSW
W

C02

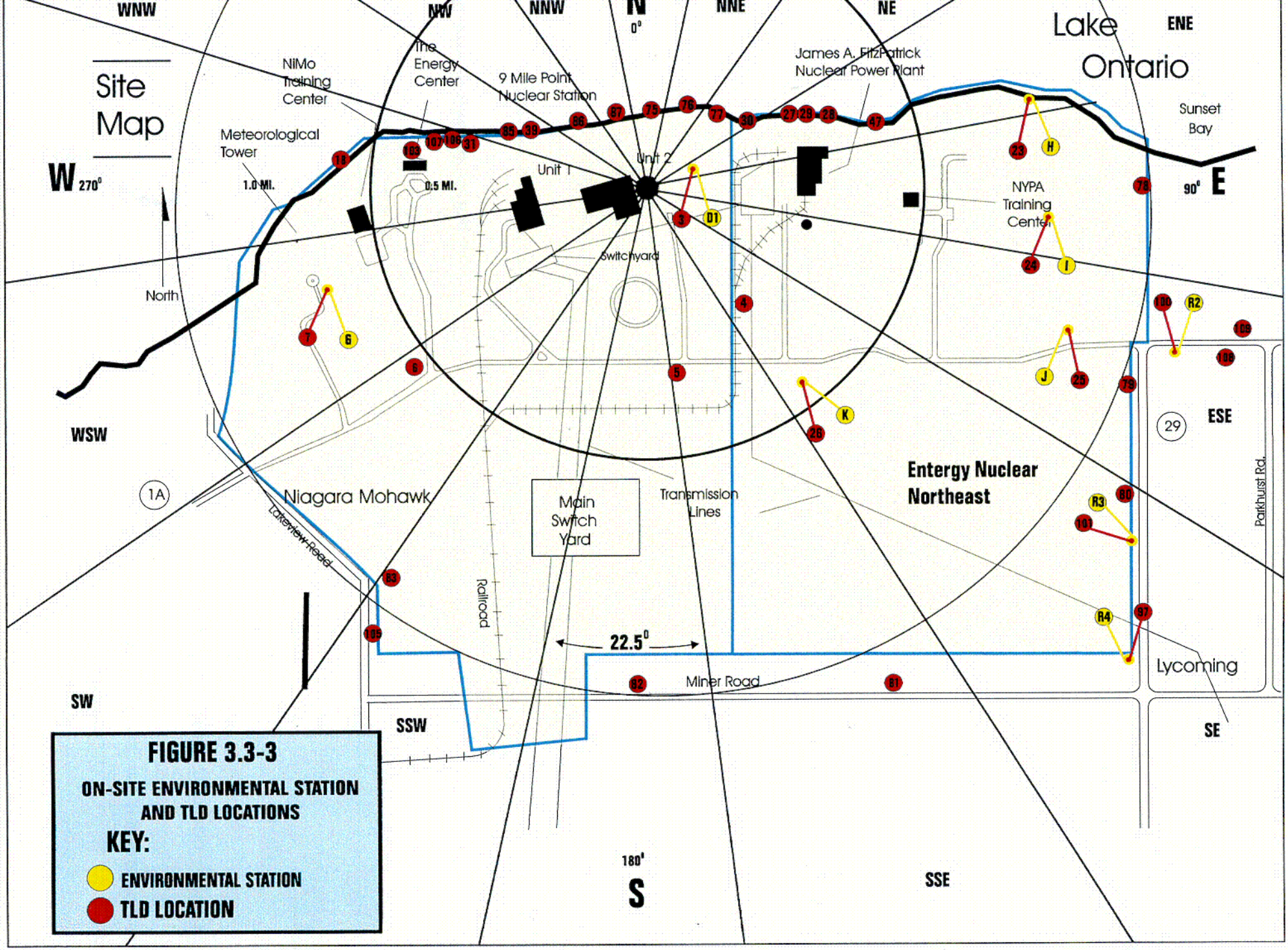


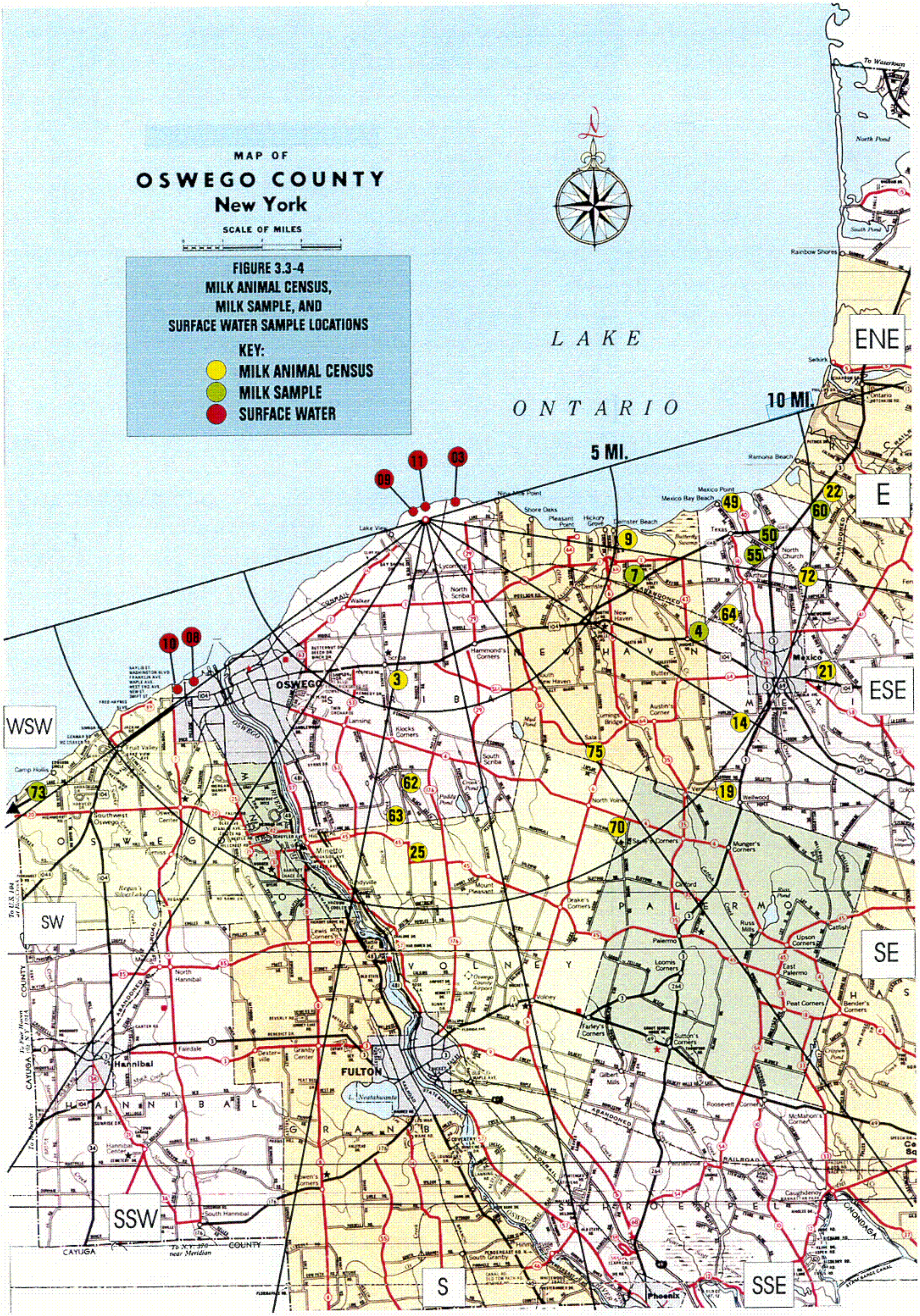
FIGURE 3.3-3

ON-SITE ENVIRONMENTAL STATION AND TLD LOCATIONS

KEY:

- ENVIRONMENTAL STATION
- TLD LOCATION

C03


MAP OF
OSWEGO COUNTY
New York
SCALE OF MILES
FIGURE 3.3-4
MILK ANIMAL CENSUS,
MILK SAMPLE, AND
SURFACE WATER SAMPLE LOCATIONS
KEY:
MILK ANIMAL CENSUS
MILK SAMPLE
SURFACE WATER
LAKE
ONTARIO
5 MI.
10 MI.
ENE
E
ESE
SE
SSE
S
SSW
SW
WSW
OSWEGO
FULTON
NEW HAVEN
MEXICO
SCRIBA
VOLNEY
PALERMO
HANNIBAL
GRANBY
SCHROEPPEL
03
08
09
10
11
3
4
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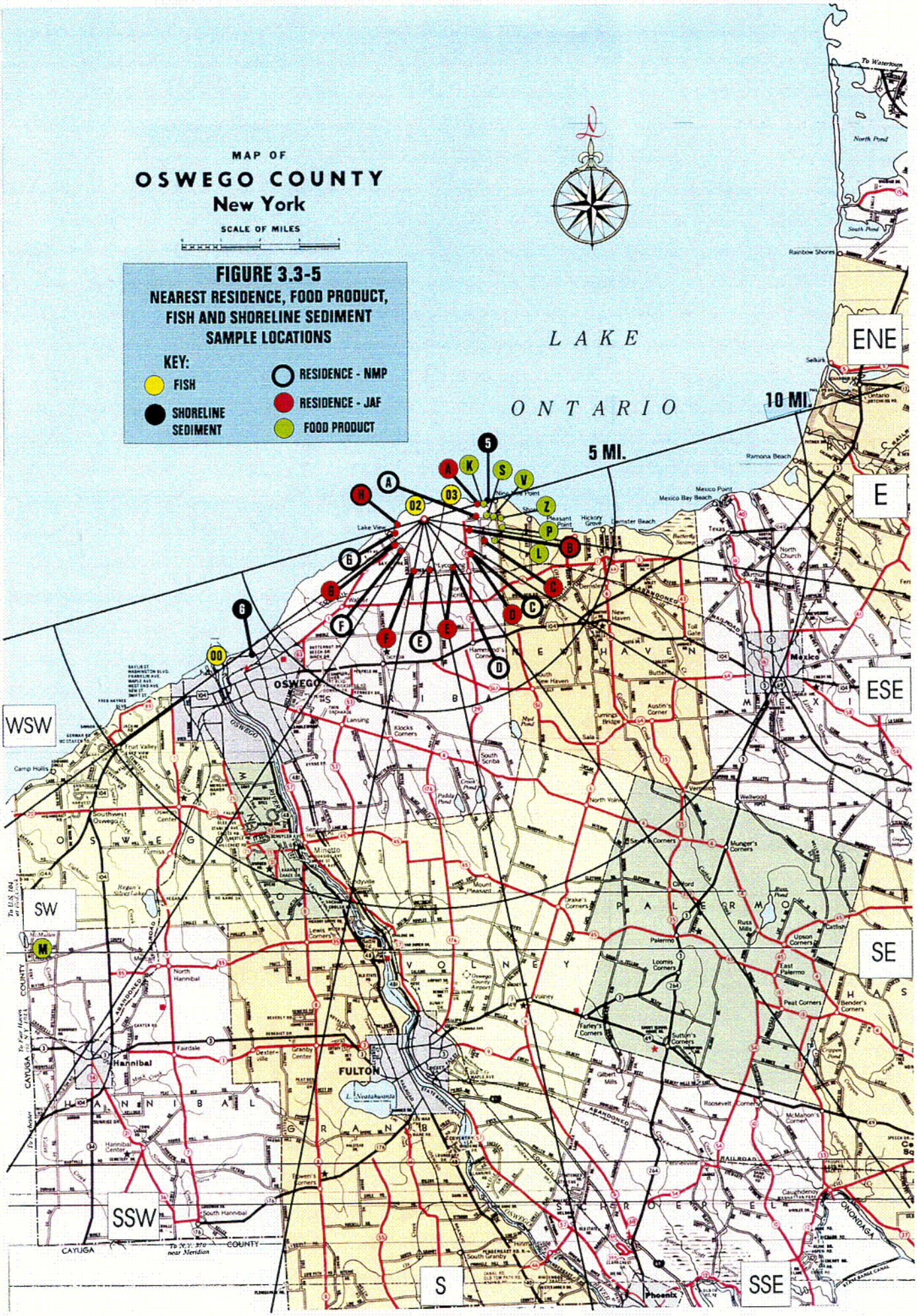
73
75

C04


MAP OF
OSWEGO COUNTY
New York
SCALE OF MILES
FIGURE 3.3-5
NEAREST RESIDENCE, FOOD PRODUCT, FISH AND SHORELINE SEDIMENT SAMPLE LOCATIONS
KEY:
FISH
SHORELINE SEDIMENT
RESIDENCE - NMP
RESIDENCE - JAF
FOOD PRODUCT
LAKE ONTARIO
10 MI.
5 MI.
ENE
E
ESE
SE
SSE
S
SSW
SW
WSW
OSWEGO
FULTON
Hannibal
Mexico
Phoenix

C05

TABLE 3.3-1

ENVIRONMENTAL SAMPLE LOCATIONS

SAMPLE MEDIUM	LOCATION DESIGNATION	LOCATION DESCRIPTION	DEGREES AND DISTANCE (1)
Shoreline Sediment	05*	Sunset Bay	80° at 1.5 miles
	06	Langs Beach, Control	230° at 5.8 miles
Fish	02*	Nine Mile Point Transect	315° at 0.3 miles
	03*	FitzPatrick Transect	55° at 0.6 miles
	00*	Oswego Transect	235° at 6.2 miles
Surface Water	03*	FitzPatrick Inlet	70° at 0.5 miles
	08*	Oswego Steam Station	235° at 7.6 miles
	09	Nine Mile Point Unit 1 Inlet	302° at 0.3 miles
	10	Oswego City Water	235° at 7.8 miles
	11	Nine Mile Point Unit 2 Inlet	341° at 0.1 miles
Air Radioiodine And Particulates	R-1*	R-1 Station, Nine Mile Pt. Rd.	88° at 1.8 miles
	R-2*	R-2 Station, Lake Road	104° at 1.1 miles
	R-3*	R-3 Station, Co. Rt. 29	132° at 1.5 miles
	R-4*	R-4 Station, Co. Rt. 29	143° at 1.8 miles
	R-5*	R-5 Station, Montario Point Rd.	42° at 16.4 miles
	D1	D1 On-site Station, On-site	69° at 1.5 miles
	D2	D2 Off-site Station, Co. Rt. 64	117° at 9.0 miles
	E	E Off-site Station, Co. Rt. 4	160° at 7.2 miles
	F	F Off-site Station, Dutch Ridge Rd.	190° at 7.7 miles
	G	G On-site Station, On-site	250° at 0.7 miles
	H	H On-site Station, On-site	70° at 0.8 miles
	I	I On-site Station, On-site	98° at 0.8 miles
	J	J On-site Station, On-site	110° at 0.9 miles
	K	K On-site Station, On-site	132° at 0.5 miles
	G	G Off-site Station, St. Paul St.	225° at 5.3 miles

* Technical Specification location

(1) Based on Nine Mile Point Unit 2 Reactor Centerline

TABLE 3.3-1 (Continued)

ENVIRONMENTAL SAMPLE LOCATIONS

SAMPLE MEDIUM	LOCATION DESIGNATION	LOCATION DESCRIPTION	DEGREES AND DISTANCE (1)
Thermo-Luminescent Dosimeters (TLDs)	3	D1 On-site Station	69° at 0.2 miles
	4	D2 On-site Station	140° at 0.4 miles
	5	E On-site Station	175° at 0.4 miles
	6	F On-site Station	210° at 0.5 miles
	7*	G On-site Station	250° at 0.7 miles
	8*	R-5 Off-site Station (Indicator/Control)	42° at 16.4 miles
	9	D1 Off-site Location	80° at 11.4 miles
	10	D2 Off-site Location	117° at 9.0 miles
	11	E Off-site Location	160° at 7.2 miles
	12	F Off-site Location	190° at 7.7 miles
	13	G Off-site Location	225° at 5.3 miles
	14*	SW Oswego - Control	226° at 12.6 miles
	15*	West Site Boundary	237° at 0.9 miles
	18*	Energy Information Center	265° at 0.4 miles
	19	East Site Boundary	81° at 1.3 miles
	23*	H On-site Station, On-site	70° at 0.8 miles
	24	I On-site Station, On-site	98° at 0.8 miles
	25	J On-site Station, On-site	110° at 0.9 miles
	26	K On-site Station, On-site	132° at 0.5 miles
	27	North Fence, JAFNPP	60° at 0.4 miles
	28	North Fence, JAFNPP	68° at 0.5 miles
	29	North Fence, JAFNPP	65° at 0.5 miles
	30	North Fence, JAFNPP	57° at 0.4 miles
	31	North Fence, NMP-1	276° at 0.2 miles
	39	North Fence, NMP-1	292° at 0.2 miles
	47	North Fence, JAFNPP	69° at 0.6 miles
	49*	Phoenix, NY - Control	170° at 19.8 miles
	51	Oswego Steam Station, East	233° at 7.4 miles
	52	Oswego Elementary School, East	227° at 5.8 miles

* Technical Specification location

TABLE 3.3-1 (Continued)

ENVIRONMENTAL SAMPLE LOCATIONS

SAMPLE MEDIUM	LOCATION DESIGNATION	LOCATION DESCRIPTION	DEGREES AND DISTANCE (1)
Thermo-Luminescent Dosimeters (TLDs)	53	Fulton High School	183° at 13.7 miles
	54	Mexico High School	115° at 9.3 miles
	55	Pulaski Gas Substation, Route 5	75° at 13.0 miles
	56*	New Haven Elementary School	123° at 5.3 miles
	58*	County Route 1 and Alcan	220° at 3.1 miles
	75*	North Fence, NMP-2	5° at 0.1 miles
	76*	North Fence, NMP-2	25° at 0.1 miles
	77*	North Fence, NMP-2	45° at 0.2 miles
	78*	East Boundary, JAFNPP	90° at 1.0 miles
	79*	County Route 29	115° at 1.1 miles
	80*	County Route 29	133° at 1.4 miles
	81*	Miner Road	159° at 1.6 miles
	82*	Miner Road	181° at 1.6 miles
	83*	Lakeview Road	200° at 1.2 miles
	84*	Lakeview Road	225° at 1.1 miles
	85*	North Fence, NMP-1	294° at 0.2 miles
	86*	North Fence, NMP-1	315° at 0.1 miles
	87*	North Fence, NMP-1	341° at 0.1 miles
	88*	Hickory Grove Road	97° at 4.5 miles
	89*	Leavitt Road	111° at 4.1 miles
	90*	Route 104 and Keefe Road	135° at 4.2 miles
	91*	County Route 51A	156° at 4.8 miles
	92*	Maiden Lane Road	183° at 4.4 miles
	93*	County Route 53	205° at 4.4 miles
	94*	Co. Rt. 1 & Kocher Road (Co. Rt.63)	223° at 4.7 miles
	95*	Lakeshore, ALCAN West Access Road	237° at 4.1 miles
	96*	Creamery Road	199° at 3.6 miles
	97*	County Route 29	143° at 1.8 miles
	98*	Lake Road	101° at 1.2 miles

* Technical Specification location

(1) Based on Nine Mile Point Unit 2 Centerline

TABLE 3.3-1 (Continued)

ENVIRONMENTAL SAMPLE LOCATIONS

SAMPLE MEDIUM	LOCATION DESIGNATION	LOCATION DESCRIPTION	DEGREES AND DISTANCE (1)
Thermo-Luminescent Dosimeters (TLDs)	99	Nine Mile Point Road	88° at 1.8 miles
	100	County Route 29 and Lake Road	104° at 1.1 miles
	101	County Route 29	132° at 1.5 miles
	102	Oswego County Airport	175° at 11.9 miles
	103	Energy Information Center, East	267° at 0.4 miles
	104	Parkhurst Road	102° at 1.4 miles
	105	Lakeview Road	198° at 1.4 miles
	106	Shoreline Cove, East of NMP-1	274° at 0.3 miles
	107	Shoreline Cove, East of NMP-1	272° at 0.3 miles
	108	Lake Road	104° at 1.1 miles
	109	Lake Road	103° at 1.1 miles
	111*	Sterling-Control	214° at 21.8 miles
	112	Emergency Off-Site Facility Env. Lab	179° at 11.9 miles
	113	Baldwinsville-Control	170° at 24.7 miles
Cows Milk	7	Indicator Location	107° at 5.5 miles
	50	Indicator Location	93° at 9.1 miles
	55	Indicator Location	95° at 9.0 miles
	60	Indicator Location	90° at 9.5 miles
	4	Indicator Location	113° at 7.8 miles
	73*	Control Location	234° at 13.9 miles
Food Products	P	Indicator Location	101° at 1.9 miles
	S*	Indicator Location	98° at 1.7 miles
	K*	Indicator Location	90° at 1.7 miles
	L	Indicator Location	112° at 1.9 miles
	M*	Control Location	225° at 15.6 miles
	V*	Indicator Location	98° at 1.8 miles
	Z*	Indicator Location	100° at 1.9 miles

* Technical Specification location

(1) Based on Nine Mile Point Unit 2 Centerline

3.4 LAND USE CENSUS

Technical Specifications require that a milch animal census and a residence census be conducted annually.

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. Several 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 is performed. The census is conducted each year to identify the gardens near the site that are to be used for the collection of food product samples. The results of the garden census are not provided in this report. The results are used only to identify appropriate sample locations. The garden census is not required by the Technical Specifications if broadleaf vegetation sampling and analysis is performed.

3.5 CHANGES TO THE REMP PROGRAM

3.5.1 The following changes were implemented during the 2000 sampling program.

A. Food Product/Vegetation

The food product/vegetation sample locations are evaluated each sampling season based on meteorology and product availability. The following sample location changes were implemented in 2000:

- Garden vegetation/food products were collected from locations P and Z for the 2000 sampling program. These locations were sampled in the previous years and were utilized in 2000 due to the availability of samples at harvest time. (ODCM Table H-1 Location No. 54 and 66).

There were no changes to the program required by the plant Technical Specifications.

3.6 DEVIATION AND EXCEPTIONS TO THE PROGRAM

Exceptions to the 2000 sample program concern those samples or monitoring requirements which are required by the Technical Specifications. This section addresses the reporting requirements of Section 6.1.a of the RETS.

The following are deviations from the program specified by the Technical Specifications:

A. 1. The air sampling pump at the R-3 off-site Environmental Sampling Station was inoperable for approximately 39 hours. The pump was inoperable due to an electrical breaker trip at the sampling station. The breaker was re-set and the sample pump demonstrated normal operation. Subsequent breaker trips were not experienced. The air sample pump was out of service for a 39 hour period between 01/09/00 (20:00 hrs) and 01/11/00 (11:00 hrs). No corrective action was implemented, (DER-01-01266 issued)*

2. The air sampling pumps at the R-1, R-2 and R-5 Environmental Sampling Stations were inoperable for approximately 11 hours on December 18, 2000 (0230 hrs. to 1330 hrs.). The inoperability of the sampling pumps was caused by a power outage, which was the result of a severe winter storm. No corrective action was implemented, (DER-01-01267 issued)*.

3. No other sample station inoperability was experienced during 2000 for any of the Technical Specification required air monitoring stations. Inoperability occurrences for the optional air sampling locations were experienced and documented internally for the report period. These periods of inoperability were minimal and are not listed here as their operability is not required by Technical Specifications.

*DER=Deficiency Event Report

B. AIR SAMPLING STATION OPERABILITY ASSESMENT

The Technical Specification required air sampling program consist of 5 individual sampling locations. The collective operable time period for the 5 air monitoring stations was 43,848 hours out of a possible 43,920 hours. The air sampling availability factor for the report period was 99.84 %.

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, ($\bar{X}$), 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 Radiological Environmental Monitoring Program (REMP). The following equations were utilized to compute the mean ($\bar{X}$) and the standard deviation (s):

A. Mean

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

where,

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

B. Standard Deviation

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

where,

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

s = standard deviation for the sample population.

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

In accordance with program policy, two recounts of samples are performed when the initial count indicates the presence of a plant related radionuclide(s). 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 is available, 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 ($\bar{X}$) and the associated propagated error.

A. Mean

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

where,

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

B. Error of the Mean (Reference 18)

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

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 Technical Specifications 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 is the a priori lower limit of detection, as defined above (in picocurie per unit mass or volume);

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

E is the counting efficiency (in counts per disintegration);

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

2.22 is the number of disintegrations per minute per picocurie;

Y is the fractional radiochemical yield (when applicable);

λ is the radioactive decay constant for the particular radionuclide;

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

The RETS LLD formula assumes that:

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

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

In the RETS 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 RETS program required LLDs for specific media and radionuclides as specified by the NRC. The LLDs actually achieved are routinely much lower than those specified by the RETS.

3.8 COMPLIANCE WITH REQUIRED LOWER LIMITS OF DETECTION (LLD)

Table 6.1-3 of the Radiological Effluent Technical Specification (RETS) specifies the detection capabilities for environmental sample analysis (see Report Table 3.8-1). Section 7.3.d of the RETS 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 2000, required by the RETS, achieved the Lower Limit of Detection (LLD) specified by RETS Table 6.1-3.

4.0 SAMPLE SUMMARY TABLES IN BRANCH TECHNICAL POSITION FORMAT

All sample data is summarized in table form. The tables are titled "Radiological 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 nonroutine reports sent to the Nuclear Regulatory Commission.

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

RADIOLOGICAL MONITORING PROGRAM ANNUAL SUMMARY

JAMES A. FITZPATRICK NUCLEAR POWER PLANT DOCKET NO. 50-333
OSWEGO COUNTY, STATE OF NEW YORK JANUARY - DECEMBER 2000

Medium (Units)	Type and Number of Analysis	LLD	Indicator Locations: Mean (a) Range	Location (b) of Highest Annual Mean: Locations & Designation	Mean (a) Range	Control Location: Mean (a) Range	Number of Nonroutine Reports
Surface (Lake) Water (pCi/liter)	H-3 (8):	3000	185 (3/4) 161 - 198	No. 3 0.5 @ 70°	185 (3/4) 161 - 198	212 (3/4) 196 - 237	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	<LLD		<LLD	<LLD	0
	Cs-134	15	<LLD		<LLD	<LLD	0
	Cs-137	18	<LLD		<LLD	<LLD	0
	Ba/La-140	15					

RADIOLOGICAL MONITORING PROGRAM ANNUAL SUMMARY

JAMES A. FITZPATRICK NUCLEAR POWER PLANT DOCKET NO. 50-333
OSWEGO COUNTY, STATE OF NEW YORK JANUARY - DECEMBER 2000

Medium (units)	Type and Number of Analysis	LLD	Indicator Locations: Mean (a) Range	Location (b) of Highest Annual Mean: Locations & Mean (a) Designation Range	Control Location: Mean (a) Range	Number of Nonroutine Reports
Shoreline Sediment (pCi/g-dry)	GSA (4):					
	Cs-134	0.15	<LLD	<LLD	<LLD	0
	Cs-137	0.18	0.068 (2/2) 0.060 - 0.076	No. 5 0.068 (2/2) 1.5 @ 80° 0.060 - 0.076	<LLD	0
Fish (pCi/g-wet)	GSA (21):					
	Mn-54	0.13	<LLD	<LLD	<LLD	0
	Fe-59	0.26	<LLD	<LLD	<LLD	0
	Co-58	0.13	<LLD	<LLD	<LLD	0
	Co-60	0.13	<LLD	<LLD	<LLD	0
	Zn-65	0.26	<LLD	<LLD	<LLD	0
	Cs-134	0.13	<LLD	<LLD	<LLD	0
	Cs-137	0.15	<LLD	<LLD	0.021 (1/7) 0.021-0.021	0
Food Products (pCi/g-wet)	GSA (16):					
	I-131	0.06	<LLD	<LLD	<LLD	0
	Cs-134	0.06	<LLD	<LLD	<LLD	0
	Cs-137	0.08	<LLD	<LLD	<LLD	0

RADIOLOGICAL MONITORING PROGRAM ANNUAL SUMMARY

JAMES A. FITZPATRICK NUCLEAR POWER PLANT DOCKET NO. 50-333

OSWEGO COUNTY, STATE OF NEW YORK JANUARY - DECEMBER 2000

Medium (units)	Type and Number of Analysis	LLD	Indicator Locations: Mean (a) Range	Location (b) of Highest Annual Mean: Locations & Mean (a) Designation Range	Control Location: Mean (a) Range	Number of Nonroutine Reports
Milk (f) (pCi/liter)	GSA (99):					
	Cs-134	15	<LLD	<LLD	<LLD	0
	Cs-137	18	<LLD	<LLD	<LLD	0
	Ba/La-140	15	<LLD	<LLD	<LLD	0
	I-131(99):	1	<LLD	<LLD	<LLD	0

RADIOLOGICAL MONITORING PROGRAM ANNUAL SUMMARY

JAMES A. FITZPATRICK NUCLEAR POWER PLANT DOCKET NO. 50-333
OSWEGO COUNTY, STATE OF NEW YORK JANUARY - DECEMBER 2000

Medium (units)	Type and Number of Analysis	LLD	Indicator Locations: Mean (a) Range	Location (b) of Highest Annual Mean: Locations & Designation	Mean (a) Range	Control Location: Mean (a) Range	Number of Nonroutine Reports
Air Particulate and Radioiodine (d) (pCi/m^3)	G.B. (260):	0.01	0.015 (208/208) 0.005 - 0.033	R-2 1.1 @ 104°	0.015 (52/52) 0.007 - 0.033	0.015 (52/52) 0.006 - 0.027	0
	I-131(260):	0.07	<LLD		<LLD	<LLD	0
	GSA (60):						
	Cs-134	0.05	<LLD		<LLD	<LLD	0
	Cs-137	0.06	<LLD		<LLD	<LLD	0
	Co-60	N/A	<LLD	R-2 1.1 @ 104°	0.048 (1/12) 0.048 - 0.048	<LLD	0
TLD (mrem per standard month)	Gamma Dose (128):	N/A	5.2 (120/120) (c) 3.4 - 10.0	No. 85 0.2 @ 294°	9.0 (4/4) (e) 8.2 - 10.0	4.31 (8/8) 3.7 - 5.5	0

ANNUAL SUMMARY TABLE NOTES

* = Data for the Annual Summary Tables is based on RETS required samples only.

N/A = Not applicable.

(a) = Fraction of detectable measurement to total measurement.

(b) = Location is distance in miles, and direction in compass degrees. Location numbers keyed to Table 3.3-1 and results table location designation numbers.

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

(d) = Indicator samples from environmental stations R1 off-site, R2 off-site, R3 off-site, and R4 off-site. Control samples are samples from R5 off-site environmental station.

(e) = 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).

(f) = The RETS criteria for indicator milk sample locations includes locations within 5.0 miles of the site. There are no milk sample locations within 5.0 miles of the site. Therefore, milk samples are collected from locations greater than 5.0 miles from the site based on the location D/Q values.

5.0 DATA EVALUATION AND DISCUSSION

A. Introduction

Each year the results of the Annual Radiological Environmental Monitoring Program 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 2000 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.

B. 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.

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

C. Dose/Dose to Man

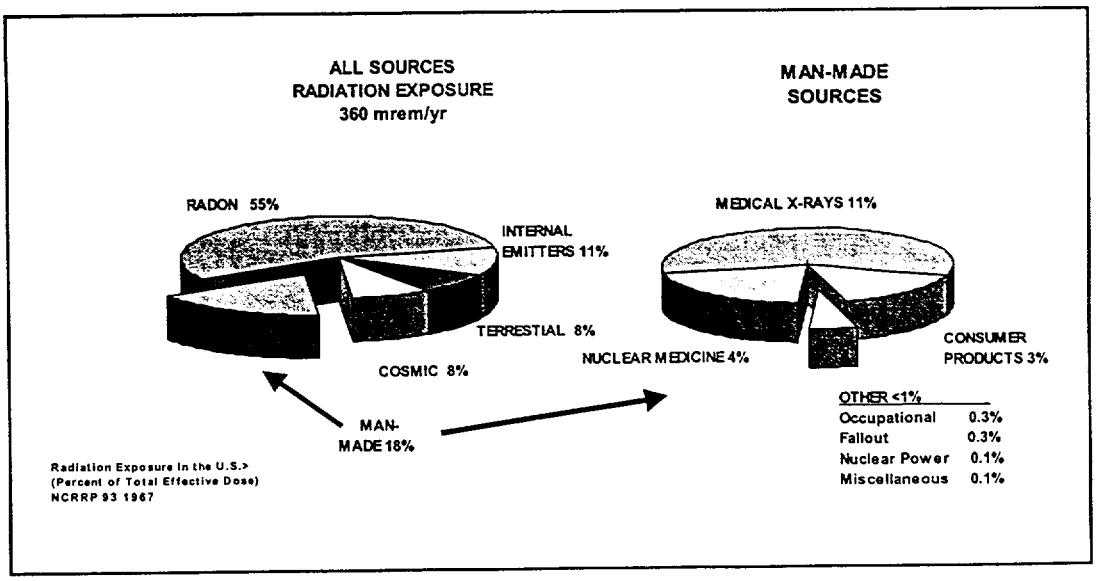
The dose or dose equivalent, simply put, is the amount of ionizing energy deposited or absorbed in living tissue. The amount of energy deposited or ionization caused is dependent on the type of radiation. For example, alpha radiation can cause dense localized ionization that can be up to 20 times the 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 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 measured 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.

D. Discussion

There are three separate groups of radionuclides that were measured in the environment in the media analyzed for the 2000 sampling program. The first of these groups consists of those 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, naturally-occurring radioactive isotopes in the human body like potassium-40, medical procedures, man-made phosphate fertilizers (phosphates and uranium are often found together in nature), and even household items like televisions. In the United States, a person's average annual exposure from background radiation is 360 mrem, as illustrated on the following Background Radiation Chart.

Background Radiation



A number of radionuclides are present in the environment due to sources such as cosmic radiation and fallout from nuclear weapons testing. These radionuclides 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:

- *tritium*, present as a result of the interaction of cosmic radiation with the upper atmosphere.
- *beryllium-7*, present as a result of the interaction of cosmic radiation with the upper atmosphere.
- *potassium-40, radium-226*, naturally occurring radionuclide found in the human body and throughout the environment, and
- *fallout radionuclides* from nuclear weapons testing, including cesium-137, strontium-89, and strontium-90.

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 natural background 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 Radiological Environmental Monitoring Program (REMP) results.

The second group of radionuclides that were detected are a result of the detonation of thermonuclear devices in the earth's atmosphere. Atmospheric nuclear testing during the early 1950s 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 man made 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. In each case, 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. The highest weapons testing concentrations were noted in samples collected for the 1981 Environmental Surveillance Program. Cs-137 was the major byproduct of this testing and is still detected in a number of environmental media.

The third group of radionuclides that may be detected in the environment are those that are related to nuclear power technology. These radionuclides are the byproduct of the operation of light water reactors. These byproduct radionuclides are the same as those produced in atmospheric weapons testing and found in the Chernobyl fallout. This commonality makes an evaluation of the source of these radionuclides that may be detected in environmental samples difficult to determine. During 2000, H-3, Co-60 and Cs-137 were the potentially plant-related radionuclides detected in the REMP samples.

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 2000, but also to assess the significance of the radionuclides detected in the environment as compared to natural and other man-made 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 1987 per capita dose was determined to be 360 mrem per year from all sources, as noted in NCRP Report No. 93 (Reference 17). This average dose includes such exposure sources as natural radiation, occupational exposure, weapons testing, consumer products, and nuclear medicine. The 1987 per capita dose rate due to natural sources was 295 mrem per year. The per capita radiation dose from nuclear power production nation wide is less than one mrem per year (Reference 10).

The natural background gamma radiation in the environs of the Nine Mile Point Site, resulting from radionuclides in the atmosphere and in the ground, accounts for approximately 60 - 65 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 60 mrem per year, as a background dose, is significantly greater than any possible doses as a result of routine operations at the site during 2000.

The results for each sample medium are discussed in detail in **Section 5.0**. This includes a summary of the results, the estimated environmental impact, a detailed review of any relevant detections with a dose to man estimate where appropriate, and an analysis of possible long term and short term trends.

In the routine implementation of the Radiological Environmental Monitoring Program, 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 operating license.

- Provide more comprehensive monitoring than is currently required.

- Monitor the secondary dose to man pathways.
- Maintain the analytical data base established in 1975 when the plant began commercial operation.

These additional samples may include: aquatic vegetation (cladophora); bottom sediment; mollusk; milk (Sr-90); meat; poultry; soil samples. 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 Technical Specifications. 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 Technical Specification sample media are included in the data presentation and evaluation. When additional locations are included, the use of this data is specifically noted in **Section 5.0**.

Section 6.0 contains the analytical results for the sample media addressed in this report. Tables are provided for each required sample medium analyzed during the 2000 program.

Section 7.0, titled HISTORICAL DATA, 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 from three environmental pathways. These pathways are:

- Shoreline Sediment
- Fish
- Surface Waters

Section 6.0, Tables 6.1 through 6.4 represent the analytical results for the aquatic samples collected for the 2000 sampling period.

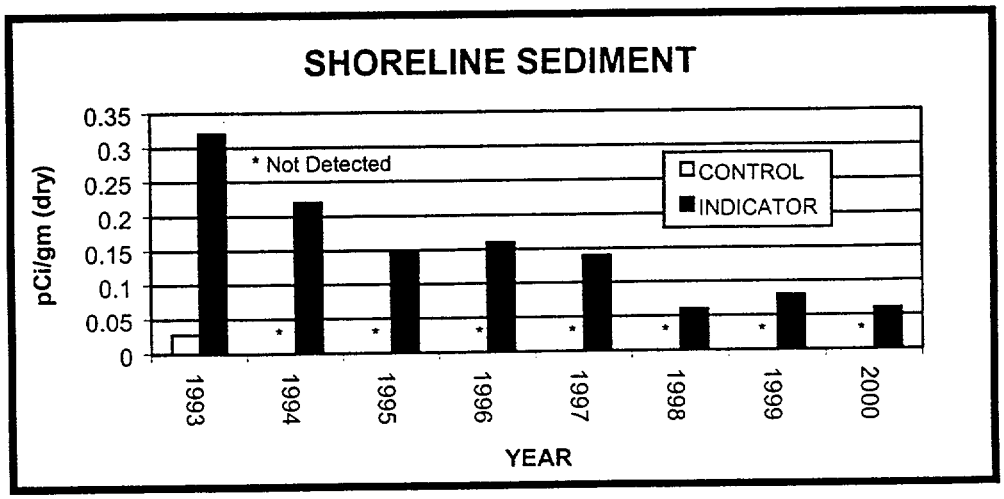
5.1.1 SHORELINE SEDIMENT RESULTS

A. Results Summary

Shoreline sediment samples were obtained in April and October of 2000 at one off-site control location (near Oswego Harbor) and at one indicator location which is an area east of the site considered to have recreational value. A total of four sediment samples were collected for the 2000 sample program, two indicator and two control. Cs-137 was detected in the two samples taken at Sunset Beach which is the indicator location. The Cs-137 concentrations ranged from a minimum of 0.060 pCi/g (dry) to a maximum of 0.076 pCi/g (dry). The mean concentration for the two samples was 0.065 pCi/g (dry). Cs-137 was not detected at the control location during 2000, however, it has been detected at the control intermittently in the past specifically 1979, 1980, 1982 and 1993. Historically, Cs-137 at previous control locations have ranged from 0.027 to 0.22 pCi/g (dry) as a reference. The source of the Cs-137 detected in the indicator shoreline sediment is considered to be the result of fallout from atmospheric nuclear weapons testing and not from operations at the site. The mean concentration of Cs-137 measured in the 2000 indicator samples is the second lowest measured concentration since sampling began in 1985. Historical mean concentrations measured at the indicator location ranged from a maximum of 0.32 pCi/g in 1993 to a minimum value of 0.06 pCi/g in 1998. The results for the 2000 control location were less than the detection limit. No other plant related radionuclides were detected in the 2000 shoreline sediment samples.

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

Below is a graph of the average Cs-137 concentration in shoreline sediment samples over the previous seven years. This graph illustrates a general downward trend in the Cs-137 concentrations since 1993.



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 Beach), and one control location (Lang's Beach). The first sample collection was made in April 2000 at both the indicator and control locations. The second shoreline sample collection was made in October 2000, again at both the indicator and the control locations. The results of these sample collections are presented in Section 6.0, Table 1. Cesium-137 (Cs-137) and Potassium-40 (K-40) were the significant radionuclides detected in the sediment samples.

Cs-137 was detected in the April and October indicator samples collected for the 2000 program. The measured concentrations for these samples were 0.060 pCi/g (dry) and 0.076 pCi/g (dry). The presence of Cs-137 in certain environmental sample media such as soil, shoreline sediment, and fish is routine. Cs-137 is a fission product that is produced in power reactors and during weapons testing. The Cesium-137 isotope has a halflife of 30.2 years. In addition to the Cs-137 found in the environment as a result of past weapons testing, a significant inventory of Cs-137 was also introduced globally as a result of the Chernobyl accident in 1986. Because Cs-137 is found in environmental samples as a result of weapons testing and Chernobyl, it is difficult to accurately determine the source of Cs-137

measured in the sediment sample. It is highly probable that the source of the cesium is from sources other than the operation of plants at the Nine Mile Point Site. It is likely that any sediment sample containing Cs-137 concentration which were the result of plant operation would also contain other plant related isotopes such as Co-60 and Cs-134. The absence of corroborating isotopes would indicate that the source of Cs-137 in sediment sample is from the existing background Cs-137 which is attributed to weapons testing. This assessment is further substantiated by the fact that Cs-137 was detected in 1993 sediment control sample. Cs-137 has been measured in the control samples of other environmental media such as fish and soil.

The routine absence of Cs-137 in the control samples from 1994 to present is attributed to the differences in the sediment types between the two sample locations. Few shoreline regions west of the site contain fine sediment and/or sand which would be representative of the indicator location. It is difficult to obtain control samples, which are comparable in physical and chemical characteristics to the indicator samples. Other factors, which include changing lake level and shoreline erosion, further complicate attempts at consistency in shoreline sediment sampling. 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 2000 shoreline sediment. Cs-137 is commonly found in soil samples and is attributed to weapons testing fallout. Shoreline samples containing soil or sediment are likely to contain Cs-137.

C. Dose Evaluation

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.
- The maximum measured concentration of 0.076 pCi/g (dry) remains constant for the year.

Using these conservative parameters, the potential dose to the maximum exposed individual (teenager) would be 0.0003 mrem/year to the whole body and 0.0004 mrem/year to the skin. This calculated dose is very small and is insignificant when compared to the natural background annual exposure of approximately 60 mrem.

D. Data Trends

The mean Cs-137 concentration for the shoreline sediment indicator samples for 2000 was 0.065 pCi/g (dry), which is the second lowest mean concentration measured since sediment sampling was initiated in 1985. Indicator samples collected in 1985 through 1988 contained no measurable concentrations of Cs-137. The mean values for previous ten years 1990 – 1999 ranged from a maximum of 0.32 pCi/g in 1998 to the minimum of 0.06 pCi/g in 1998. The mean results for the previous five year period ranged from a maximum of 0.16 pCi/g in 1996 to a low of 0.06 pCi/g.

The presence of Cs-137 in the 1993 control sample was the first positive measurement at the control location since sediment sampling was implemented in 1985. Cs-137 was not detected in the control sample in the 2000 samples.

A review of indicator and control sample results for 1985 - 1988 indicate only naturally occurring radionuclides present in shoreline sediment. The period from 1989 - 2000 shows the presence of Cs-137 in the indicator samples. The historical data shows an emergence of Cs-137 concentrations in 1989 which continues through 2000. The trend since 1989 shows a reduction in Cs-137 concentrations over the four year period to the concentration of 0.13 pCi/g (dry) measured in 1992. The 1993 sample showed an increase in Cs-137 concentration to 0.32 pCi/g (dry) followed by a reduction in concentration to 0.22 pCi/g (dry) in 1994 and continued general reductions through 2000 to 0.064 pCi/g (dry). The overall five year trend for Cs-137 concentrations in shoreline sediment is a steady reduction in concentrations from year to year to a low concentration of 0.064 pCi/g (dry) in 1998 and consistently low concentrations in 1999 and 2000.

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

Tables 1 and 2 in Section 7.0 illustrate historical environmental data for shoreline sediment samples.

5.1.2 FISH SAMPLE RESULTS

A. Results Summary

A total of 21 fish samples was collected for the 2000 sample program. Analysis of the 2000 fish samples showed a single detectable concentration of Cs-137 at the control location. The presence of Cs-137 in a control sample is a result of a past weapons testing. Cs-137 was not detected in the fourteen fish samples collected at the indicator location. The 2000 mean results for the control sample was 0.021 pCi/g (wet) which is consistent with the previous five year sample mean for both the indicator and control locations. The absence of Cs-137 in the indicator fish samples is significant in the fact that positive concentrations have been measured in samples collected in the previous 20 years at both the indicator and the control. Small concentrations of Cs-137 detected in the single fish sample represents approximately 5% of the total fish samples collected from both the on-site and off-site locations. This percentage is lower than the previous year which had positive detections in 9% of the sample collected and down significantly from 1994 when 37% of the samples showed Cs-137 concentrations. No other radionuclides were detected in the 2000 fish samples.

The detectable level of Cs-137 in the control fish sample was small with a measured activity of 0.021 pCi/g (wet). The positive detection was found in the walleye species of fish which is consistent with previous years. Cs-137 is routinely detected in a small percentage of the fish samples collected each year. Cs-137 has been measured in fish samples at both the indicator and control locations consistently over the last 20 years and beyond. Cesium-137 was also measured in samples collected in 1974, and earlier, which was preoperational for the FitzPatrick Plant. These low levels of Cs-137 represent no significant dose to man or impact on the environment. As noted above, the measured concentrations of Cs-137 in the fish samples are the result of fallout from past weapons testing. Comparable concentrations of Cs-137 are routinely found in samples of other aquatic media such as shoreline sediment, bottom sediment and aquatic vegetation. The potential whole body and critical organ doses calculated as a result of fish consumption by humans are extremely small. The dose that could result

from the Cs-137 in fish can be considered background exposure because of the sources of the Cs-137.

The 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 2000 results are consistent with the previous year's results and continue to support the general long term downward trend in fish Cs-137 concentrations over the last 26 years. The Cs-137 mean indicator concentration for 1994 through 2000, as a group, are the lowest measured concentrations since the beginning of the FitzPatrick Environmental Monitoring Program 26 years ago (1974).

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 Nine Mile Point Unit #1 (#02), and the James A. FitzPatrick (#03) generating facilities. The Oswego Harbor samples served as control samples while the NMP (#02) and JAF (#03) samples served as indicator samples. All samples were analyzed for gamma emitters. Table 6-2 shows individual results for all the samples in units of pCi/g (wet).

The spring fish collection was made up of twelve individual samples representing four separate species. Brown trout, smallmouth bass, lake trout and walleye were collected from all three sample locations.

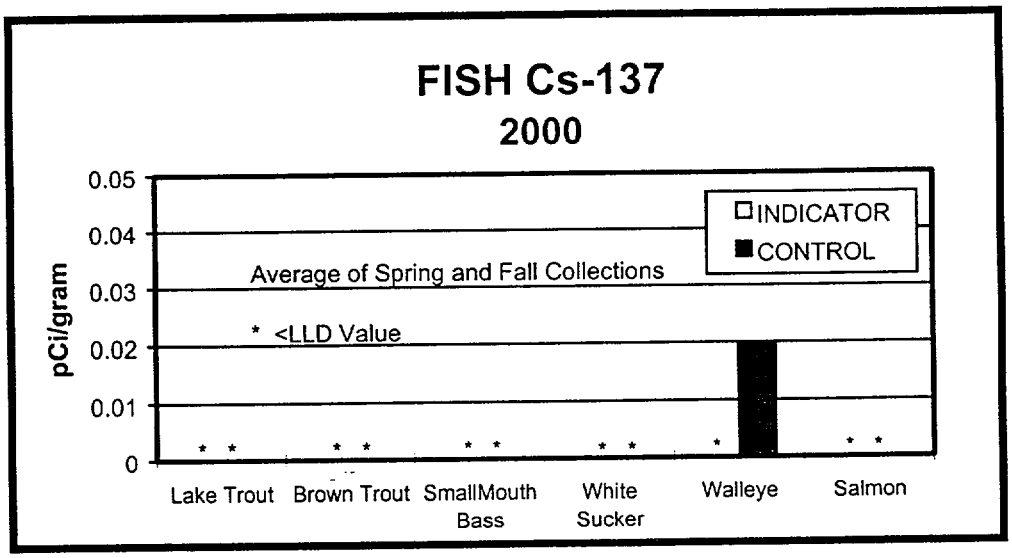
The total fall fish collection was comprised of nine individual samples representing three individual species. Brown trout, smallmouth bass and chinook salmon samples were collected at the indicator sampling locations (NMP and JAF) and the control location (Oswego Harbor).

Cs-137 was detected in one of the four control samples collected during the spring at a concentration of 0.021 pCi/g (wet). Cs-137 was not detected in the fish species collected at the indicator location for the same sample period.

In the fall sample collection, Cs-137 was not detected in any of the nine samples collected from the control or indicator locations.

The control 2000 single positive sample result was slightly higher than the 1998 control mean concentration of 0.013 pCi/g (wet). Cs-137 was not detected in the 1999 control samples. The 2000 results are consistent with the previous five years in terms of mean concentration. The source of the Cs-137 in fish samples is considered to be the existing Cs-137 background concentration in the environment from weapons testing and Chernobyl.

The following graph presents the measured Cs-137 concentrations for the fish species analyzed for 2000. Walleye samples yielded the only measurable Cs-137 concentration for the 2000 samples and was at the control location. Walleye samples from the indicator location showed no detectable Cs-137.



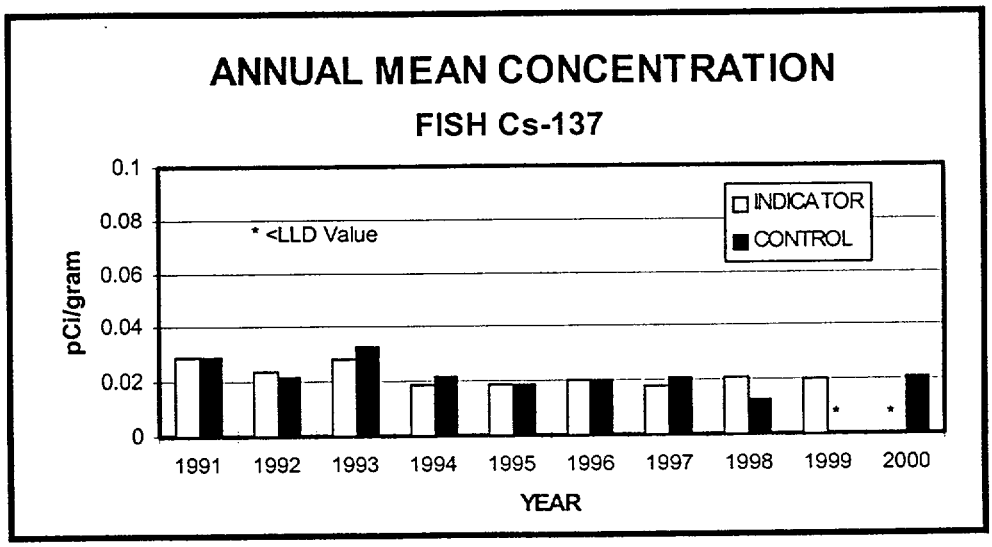
C. Dose Evaluation

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. Based on the use of fish in the local diet, a conservative estimate of potential dose to man can be calculated. Assuming that an adult consumes 21.0 kg of fish per year and a teen consumes 16 kg of fish per year (Regulatory Guide 1.109 maximum exposed age group) and the fish consumed contains a Cs-137 concentration of 0.021 pCi/g (wet) (maximum result for the indicator samples for 2000), the adult whole body dose received would be 0.032 mrem per year. The organ of interest for Cs-137 is the teen liver which would receive a calculated dose of 0.05 mrem per year. The Cs-137 whole body and organ doses are conservatively estimated doses based on the consumption of fish species from the Nine Mile Point area. Due to the long half life of Cs-137, no radiological decay is assumed for the calculation of doses.

In summary, the potential whole body and organ doses received as a result of fish consumption are very small. The dose to man that could be received from the indicator sample group is considered to be background exposures. Based on the 2000 monitoring program results there is no dose to man from operation of the plants at Nine Mile Point via the fish pathway.

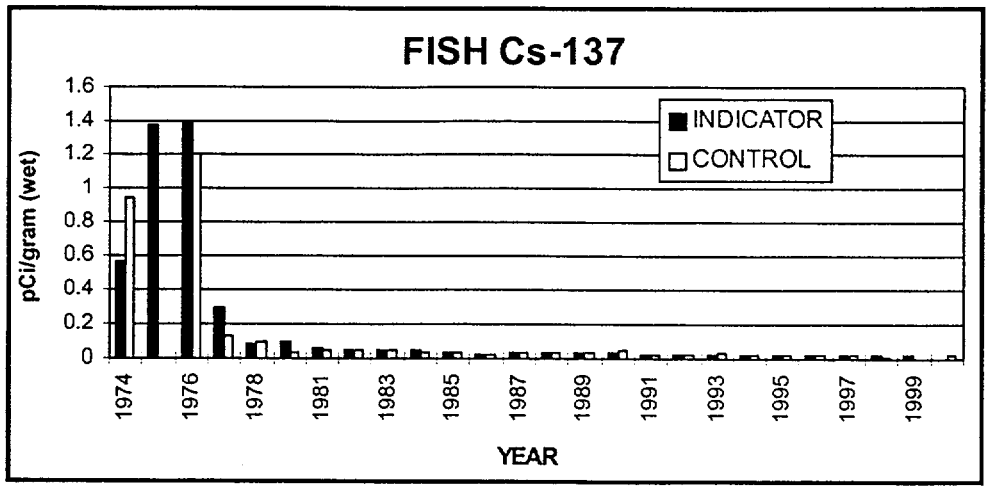
D. Data Trends

Results for the previous five years (1995 through 1999) have shown a generally steady trend for Cs-137 levels in the control and indicator samples. During the period of 1990 through 1994, control and indicator mean results were on a small downward trend with a small rise in 1993. The 1994 through 2000 results as a group are the lowest Cs-137 concentrations measured over the 20 year existence of the sampling program. The graph below illustrates the mean Cs-137 concentrations for 2000 and the previous nine years.



The long term trend shows that mean concentrations of Cs-137 for indicator samples has decreased from a maximum concentration of 1.4 pCi/g (wet) in 1976 to a minimum level of 0.018 pCi/g (wet) measured in 1997. The decreasing trend continued in 2000 with no detectable concentration of Cs-137 in the samples. Control sample Cs-137 results have also decreased from a maximum level of 1.2 pCi/g (wet) in 1976 to less than detectable levels in 1999. The 2000 control concentration showed a very small increase over the 1998 results.

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 a result of weapons testing fallout. The general downward trend in concentrations will continue as a function of additional ecological cycling and nuclear decay.



Control sample results have decreased from a maximum level of 1.2 pCi/g (wet) in 1976 to levels that were not detectable in 1999 and 0.021 pCi/g (wet) in 2000. Fish results for the 1998 control samples show a decrease in concentration by a factor of approximately 72 when compared to preoperational data (1974) and by a factor of about 92 compared to 1976. Indicator results have shown a similar reduction.

Tables 7-3 and 7-4 in Section 7.0 show historical environmental sample data for fish. Full size reproductions of the fish result graphs are found in Section 8.0.

5.1.3 SURFACE WATER (LAKE)

A. Results Summary

The Radiological Effluent Technical Specifications (RETS) require that monthly surface water samples be taken from the respective inlet water supply of the James A. FitzPatrick N.P.P. and Niagara Mohawk's Oswego Steam Station. In conjunction with the RETS samples, three additional Lake Ontario surface water locations are sampled and analyzed. These additional locations are the Oswego City Water Intake, the NMP Unit #1 Intake and the NMP Unit #2, Intake. Gamma spectral analysis was performed on 24 monthly composite samples from the RETS locations and on 36 monthly composite samples from the additional sample locations. The results of the gamma spectral analysis show that only two naturally occurring radionuclides were detected in the 60 samples from the five locations collected for the 2000 Sampling Program. The two naturally occurring radionuclides are K-40 and Ra-226 and are not related to operations of the plant. Monthly composite samples show no presence or buildup of plant related gamma emitting isotopes in the waters of Lake Ontario as a result of the operation of the plant.

Quarterly composite samples collected from the same locations are analyzed for tritium (H-3). Twenty tritium samples were collected and analyzed in 2000. Thirteen samples showed a positive tritium concentration. The 2000 mean tritium concentration for the Oswego Steam Station inlet (control location) was 212 pCi/l based on positive tritium results in three of the four samples. The mean concentration for the JAF inlet, which serves as the indicator location, was 185 pCi/l based on three positive detections of tritium at this sample location in 2000. Tritium results for 2000 also showed positive detections of tritium at the Nine Mile Point Unit I and Unit II inlet canal sample locations with respective sample means of 187 pCi/l and 201 pCi/l. The measured concentrations of tritium at the locations are consistent with control results and historical background levels of tritium in Lake Ontario. The evaluation of surface water sample results demonstrates that there is no measurable radiological impact on the surface waters of Lake Ontario from tritium concentrations related to the operation of the facilities at the Nine Mile Point Site. Individual sample results from the control station were similar or higher than those measured

at the indicator location(s). The measured concentrations for all the indicator and control samples were within the normal historical variations for naturally occurring tritium in surface water.

B. Data Evaluation and Discussion

Gamma spectral analysis was performed on monthly composite samples from five Lake Ontario sampling locations. Only K-40 and Ra-226 were detected in samples from the five locations over the course of the 2000 sampling program. Both of these radionuclides are naturally occurring and are not plant related.

Tritium samples are quarterly samples that are a composite of the appropriate monthly samples. Tritium concentration for The James A. FitzPatrick inlet canal samples had a mean of 185 pCi/l for three positive detections and ranged from 161 pCi/l to 198 pCi/l. The Technical Specification control location (Oswego Steam Station inlet canal) results had a mean concentration of 212 pCi/l with a range of 196 pCi/l to 237 pCi/l.

Tritium was detected in seven of the twelve optional lake samples taken. The calculated mean concentrations for all three locations was 208 pCi/l and ranged from 179 pCi/l to 246 pCi/l.

Samples collected from the Oswego City water supply showed detectable tritium concentrations in the range of 224 pCi/l to 246 pCi/l with a mean concentration of 235 pCi/l.

A summary of tritium results for the 2000 sample program is listed below:

Sample Location	Tritium Concentration pCi/liter Minimum	Maximum	Mean (Annual)
JAF Inlet (TS* Indicator)	<176	198±87	185
Oswego Steam Inlet (TS* Control)	<180	237±89	212
NMP #1 Inlet	<157	188±97	187
NMP #2 Inlet	<180	229±97	201
Oswego City Water Supply	<180	246±98	235

* Technical Specification

C. Dose Evaluation

The Oswego Steam Station is used as a control location because of its distance from the site and the influence of lake current patterns and current patterns from the Oswego River located nearby. The current patterns distinguish the Oswego Steam Station intake and the nearby Oswego City water intake as an "up-current" sampling point and the JAFNPP inlet canal as a "down-current" sampling point. The Nine Mile Point Site is located such that it would not have a radiological impact on Oswego drinking water supply. The Oswego City water intake is located west of the Oswego Steam Station inlet placing it upstream from the Nine Mile Point Site. The tritium concentrations measured in these upstream or control locations are representative of natural background levels present in Lake Ontario.

The radiological impact to members of the public from natural background levels of tritium in water is insignificant. This can be illustrated by calculating a dose to the whole body and maximum organ using Regulatory Guide 1.109 methodology. Based on a water ingestion rate of 510 l/yr and the maximum measured concentration of 246 pCi/l the calculated dose would be 0.025 mrem to the child whole body and 0.026 mrem to the child liver (critical age group/organ). The drinking water sample is from the Oswego City intake which is drawn from Lake Ontario at a location more distant than the control location. The calculated dose from tritium at this location would be 0.025 mrem to the child whole body and 0.025 mrem to the child liver based on a concentration of 246 pCi/l. Doses received as a result of water ingestion are approximately the same regardless of the location. Doses from all water sampled are considered background doses and are negligible compared to the 300 mrem annual dose considered to the overall background annual dose.

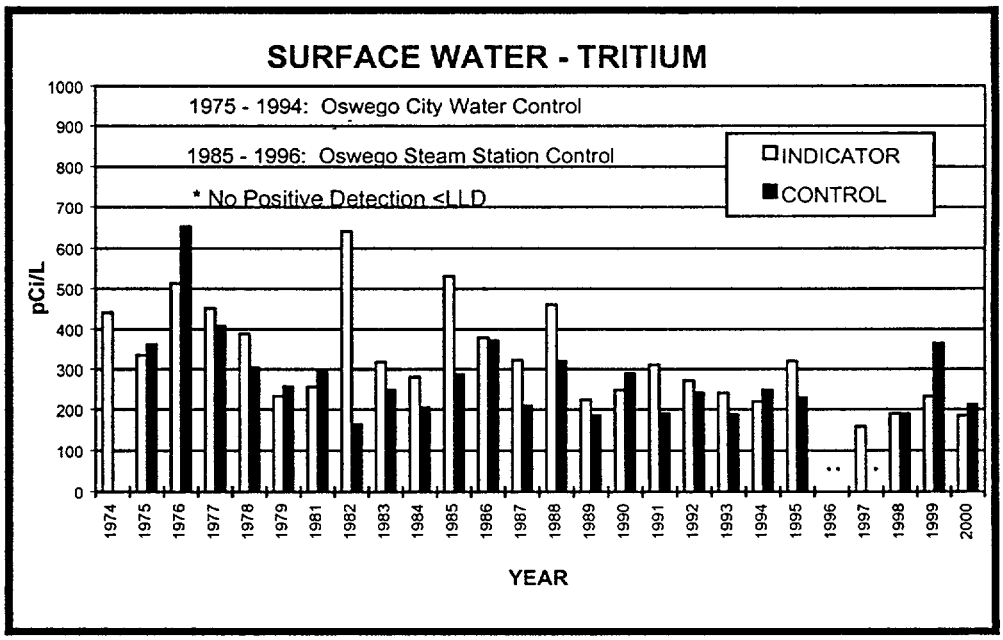
D. Data Trends

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 2000 lake water samples were consistent with results from the previous five years for both the indicator and control locations.

During the previous five year period the maximum mean indicator and control concentrations were measured in 1995 and 1999 respectively. The mean tritium concentrations for the previous five year period of 1995 - 1999 ranged from 190 pCi/l to 212 pCi/l for the control and 185 pCi/l to 320 pCi/l for the indicator locations. By comparison, the mean 2000 tritium concentrations were 212 pCi/l for the control and 185 pCi/l for the indicator locations. The previous five year data indicates no significant trends in either the indicator or the control mean concentrations. 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, 1990 through 1999, is representative of natural variations in environmental tritium concentrations. The 1999 mean control value of 365 pCi/l is the highest concentration measured since 1986 but is within the variability of results measured over the program life. The ten year historical results are within the range of the normal variance measured in background concentrations from year to year.

The following graph illustrates the concentrations of tritium measured in Lake Ontario over the past 25 years at both an indicator and control location. For the purpose of historical data, the Oswego City Water Supply results are used as the control location data prior to 1985, as this location closely approximates the Oswego Steam Station, the current control location.



5.2 TERRESTRIAL PROGRAM

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

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

Tables 6-5 through 6-14 represent the analytical results for the terrestrial samples collected for the 2000 reporting period.

5.2.1 AIR PARTICULATE GROSS BETA

A. Results Summary

Weekly, air samples were collected and analyzed for particulate gross beta particulate activity. For the 2000 program, a total of 52 samples were collected from the control location R-5, and 208 samples were collected from the indicator locations R-1, R-2, R-3, and R-4. These five locations are required by the Technical Specifications. Additional air sampling locations are maintained and discussed under Section 5.2.1.B below. The mean concentration of the control location, R-5, was 0.015 pCi/m^3 for 2000. The mean concentration for the indicator locations was 0.015 pCi/m^3 for 2000. The mean results for the indicator and the control stations were equal for 2000. The consistency of the two mean results demonstrates that there are no increased airborne radioactivity levels in the general vicinity of the site. The indicator results are constant with concentrations measured over the last twelve years. The consistency of these low concentrations over the past twelve years demonstrate that the natural baseline gross beta activity has been reached. The manmade radionuclide contribution to the natural background from atmospheric weapons testing and Chernobyl can no longer be detected above the background concentrations of naturally occurring beta emitting radionuclides.

B. Data Evaluation and Discussion

The air monitoring system consists of 15 sample locations, six on-site and nine off-site locations. Each location is sampled weekly for gross beta particulate activity. A total of 178 samples were collected and analyzed as part of the 2000 program. Five of the nine off-site locations are required by Technical Specifications. These locations are designated as R-1, R-2, R-3, R-4, and R-5. R-5 is a control location required by the Technical Specifications and is located beyond any local influence from the site. In addition, optional off-site and on-site air sample locations are maintained from which weekly samples are collected. The optional off-site locations are designated as D-2, E, F, and G. The optional on-site locations are designated as D-1, G, H, I, J, and K.

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.

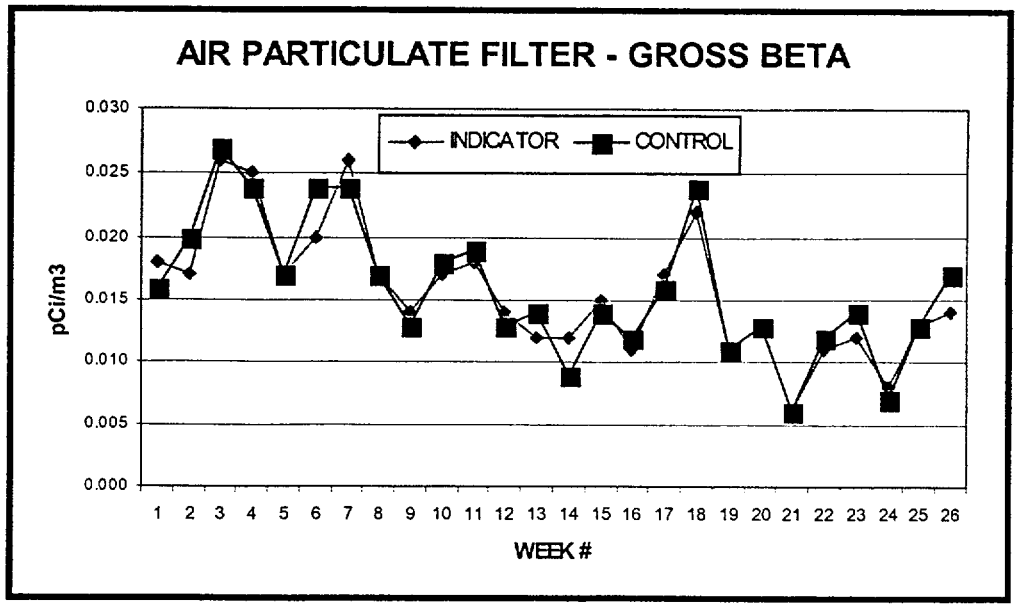
Tables 6-5 and 6-6 in Section 6.0 present the weekly gross beta activity results for the off-site and on-site stations.

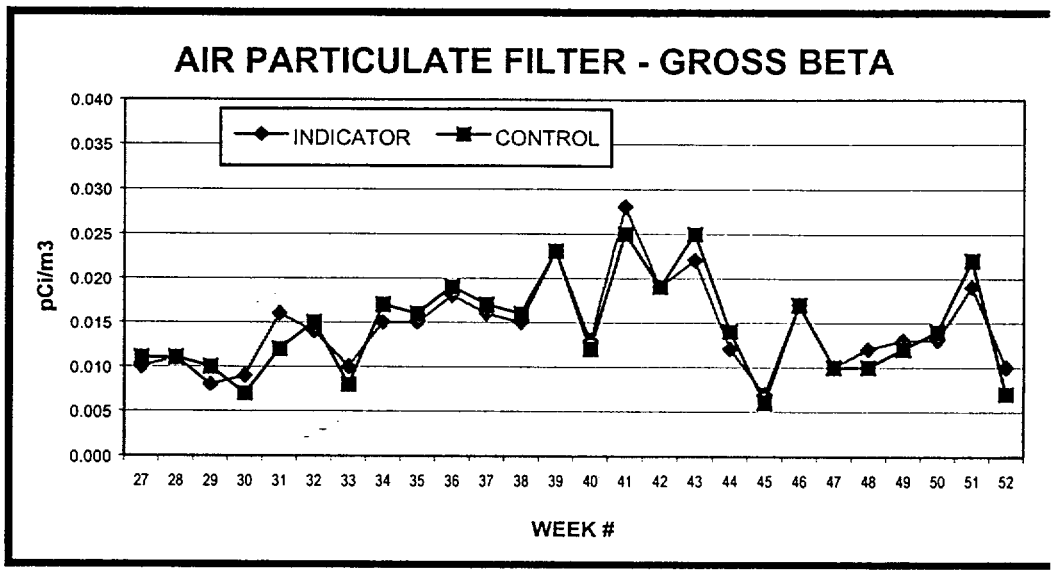
The average annual gross beta indicator concentrations for the indicator stations (R-1, R-2, R-3 and R-4) was 0.015 pCi/m^3. The off-site station (R-5) annual mean concentration was 0.015 pCi/m^3. The minimum, maximum, and average gross beta results for sample locations required by Technical Specifications were:

	Concentration pCi/m^3		
Location*	Minimum	Maximum	Average
R-1	0.007	0.028	0.015
R-2	0.007	0.033	0.015
R-3	0.005	0.026	0.015
R-4	0.005	0.029	0.015
R-5 (control)	0.006	0.027	0.015

* Locations required by Technical Specifications

The mean weekly gross beta concentrations measured in 2000 are illustrated in the graphs below.





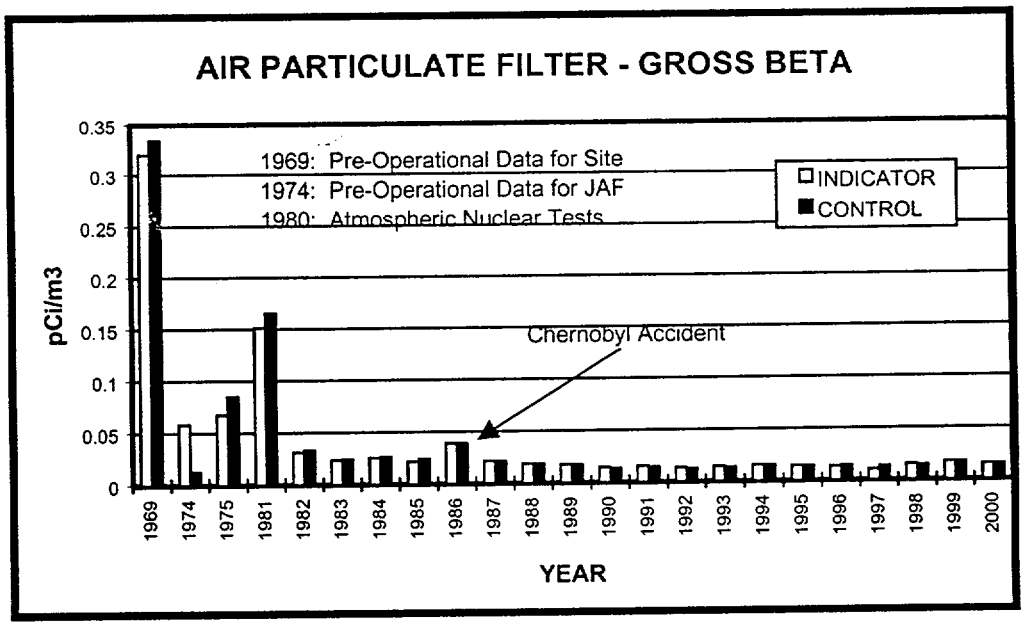
The fluctuations observed in the gross beta activity over the year can be attributed to changes in the environment, especially seasonal changes. The concentrations of naturally occurring radionuclides in the lower levels of the atmosphere directly above land are affected by time related processes such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

C. Dose Evaluation

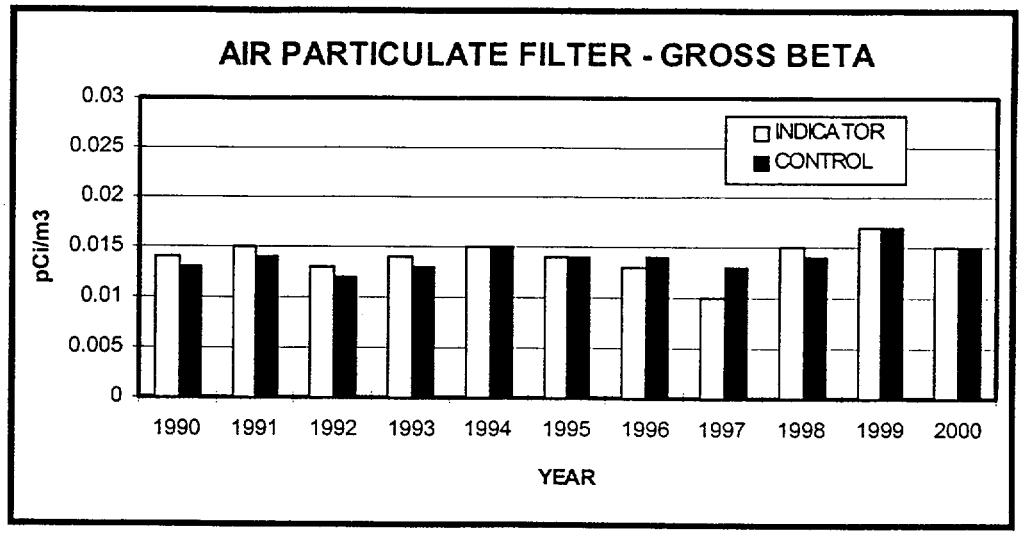
Dose calculations are not performed based on gross beta concentrations. Dose to man as a result of radioactivity in air is calculated using the specific radionuclide and the associated dose factor. See Section 5.2.2.C for dose calculations from air concentrations. The dose received by man from air gross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

D. Data Trends

With the exception of the 1986 sample data, which was effected by the Chernobyl accident, the general trend in air particulate gross beta activity has been one of decreasing activity since 1981. The 1981 samples were affected by fallout from a Chinese atmospheric nuclear test which was detonated in 1980.



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 1990 through 2000 is very small. This is illustrated by the following graph.



The air particulate gross beta indicator mean result for 2000 is a factor of 21 less than the concentrations measured in 1969 which are preoperational results for the site. For the operational period of 1990 - 2000, the mean annual gross beta concentration at the control station (R-5) has remained steady with a narrow range of 0.013 pCi/m^3 to 0.017 pCi/m^3. The mean annual concentrations for the indicator stations for this same time period ranged from a maximum of 0.017 pCi/m^3 in 1990 to a minimum of 0.010 pCi/m^3 in 1997. The 2000 gross beta results are at approximately mid range relative to this 10 year period.

Historical data and graphic representations of air particulate gross beta activity are presented in Sections 7.0 and 8.0, respectively.

5.2.2 MONTHLY PARTICULATE COMPOSITES (GAMMA EMITTERS)

A. Results Summary

A comprehensive network of 15 air monitoring stations is maintained around the site. The stations are used to collect air particulate and air borne radioiodine samples on a weekly basis. The air particulate filters are analyzed for gross beta activity and the weekly samples are assembled by location into monthly composite samples. The monthly composites are analyzed using gamma spectroscopy. Plant related radionuclides are not routinely detected in the air composite samples. One plant related isotope was detected in one of the 180 composite samples analyzed for the 2000 program. Cobalt-60 was detected in the R-2 off-site environmental station air particulate filter composite for the month of September 2000. The mean measured concentration was 0.0048 picocuries per cubic meter. The R-2 sampling station is located 0.7 miles from the JAF Rx building in the ESE quadrant at the corner of County Rt. 29 and Lake Rd. The concentration of Co-60 detected was very small and is near the threshold of detectability using standard laboratory procedures and processes. The dose to the public that would be associated with this concentration of Co-60 is extremely small and is of little or no significance. The origin of the measured Co-60 concentration is attributed to effluents from the Nine Mile Point Unit 1 facility.

The gamma analysis results for the monthly composite samples routinely showed positive detections of Be-7, K-40, Ra-226, and AcTh-228. Each of these radionuclides is naturally occurring.

Be-7 was detected in all the monthly composite samples for the indicator and control locations. K-40, Ra-226, and AcTh-228 were found intermittently in the monthly composite samples from all locations.

B. Data Evaluation Discussion

A total of fifteen continuous air sampling locations are in constant operation both onsite and in the offsite sectors surrounding the Nine Mile Point Site. Five sampling locations are required by Technical Specifications and ten optional stations are in operation to provide an

effective monitoring network. Composite air filter samples are assembled for each of the fifteen sampling locations. Each of the four weekly air particulate samples for the month are assembled by location to form monthly composite samples. The monthly composite samples required by Technical Specifications are R-1, R-2, R-3, R-4, and R-5. Other sample locations not required by the Technical Specifications for which analytical results have been provided include six on-site locations and four off-site locations. The analytical results for the 180 air particulate filter composites in 2000 showed no detectable activity with the exception of one composite sample. Cobalt-60 was detected in the R-2 off-site environmental station air particulate filter composite for the month of September 2000. The R-2 sampling station is located 0.7 miles from the JAF Rx building in the ESE quadrant at the corner of County Rt. 29 and Lake Rd. The mean measured concentration of Co-60 was 0.0048 picocuries per cubic meter. The composite sample was disassembled and the 5 individual weekly filters making up the monthly composite were counted individually. Co-60 was not detected in the individual filter analysis. The process of compositing the weekly filters into monthly composite samples increases the sensitivity of the analysis due to the collective volume of the composite sample. A reanalysis of the composite sample by an independent vendor laboratory did not detect the presence of Co-60 in the sample. The independent laboratory analysis was reported as less than 0.001 picocuries per cubic meter. There was no indication of sample contamination at the analysis laboratory that would have affected the original analysis at the JAFEL.

The concentration of Co-60 detected was very small and is near the threshold of detectability using standard laboratory procedures and processes. The presence of the Co-60 is the result of airborne effluents from the Nine Mile Point Unit 1 (NMP-1) facility. The R-2 air particulate filter gross beta result for week number 39 (9/25/00-10/02/00) was slightly elevated when compared to weekly offsite mean result. The gross beta result for Station R-2 was 0.033 pCi/m^3. The 9 station offsite mean for this week was 0.0213 pCi/m^3. The higher gross beta result is a validation that Co-60 was present in the sample. The gamma spectral analysis of this individual filter had a Co-60 result of <0.014 pCi/m^3.

A review of JAF and the Nine Mile Point Unit 1 & 2 effluent records

shows an elevated concentration of Co-60 in the Nine Mile Point Unit 1 stack effluent during the week of 9/25/00 through 10/02/00. The level of Co-60 in the NMP-1 stack effluent was above the normal operating average, but within technical specifications and operating limits. The increased activity occurred as a result of reactor water clean-up filter transfer operations that occurred during this period. Site meteorological records show that there were periods during the sample week when winds were in the general direction of the R-2 sample station. Based on the analytical results for the R-2 particulate filter composite, Nine Mile Unit 1 plant operating records and site meteorological records, the Co-60 measured in the R-2 September air particulate filter composite is attributed to the effluents from the Nine Mile Point Unit 1 facility.

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

C. Dose Evaluation

The air particulate sampling program demonstrated that there was no significant dose to man from this pathway as a result of operations of the plants at the site. The calculated dose to man from the measured concentration of Co-60 in the September composite sample can be estimated using calculational methods found in Regulatory Guide 1.109 (reference 2). Based on the usage factors for the inhalation pathway, a conservative estimate of the potential dose to man can be calculated. Using the standard man model an adult breaths 8000 m^3/year and a teen 3700 m^3/year (Regulatory Guide 1.109 maximum exposed age groups). Applying the mean measured air concentration for Co-60 of 0.0048 pCi/m^3, the adult whole body dose would calculate to be 0.000006 mrem. The teen whole body dose would calculate to be 0.000008 mrem. The critical organ dose would calculate to be 0.00349 mrem to the teenage lung. The dose calculations are adjusted to a 31 day inhalation period which is consistent with the sample period. This adjustment results in a total inhalation volume of 679 cubic meters for the calculations.

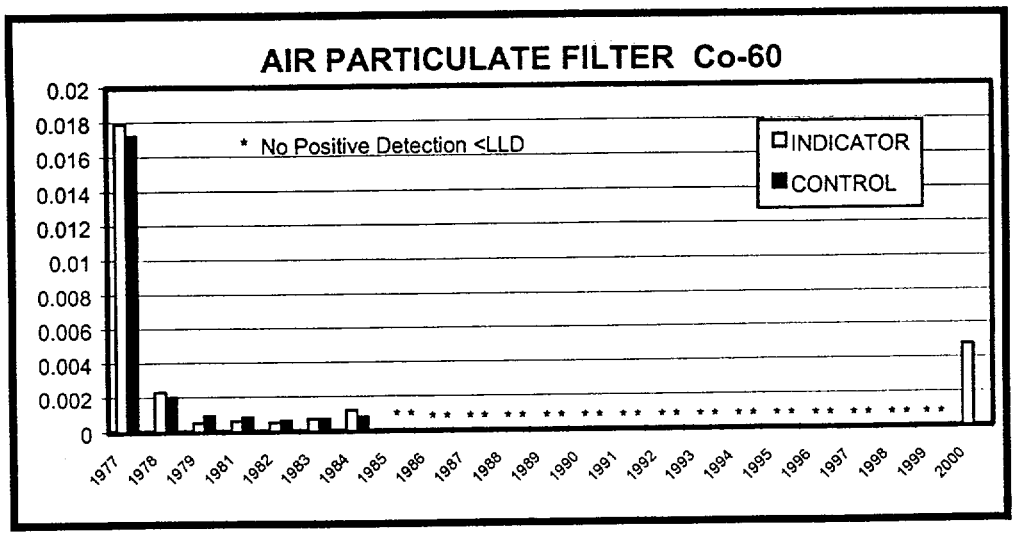
In summary, these calculated doses are conservative estimates. The potential whole body and organ doses received from the inhalation pathway are extremely small. The doses to man that could be received from the

measured concentration are considered to be equivalent to routine background exposures.

D. Data Trends

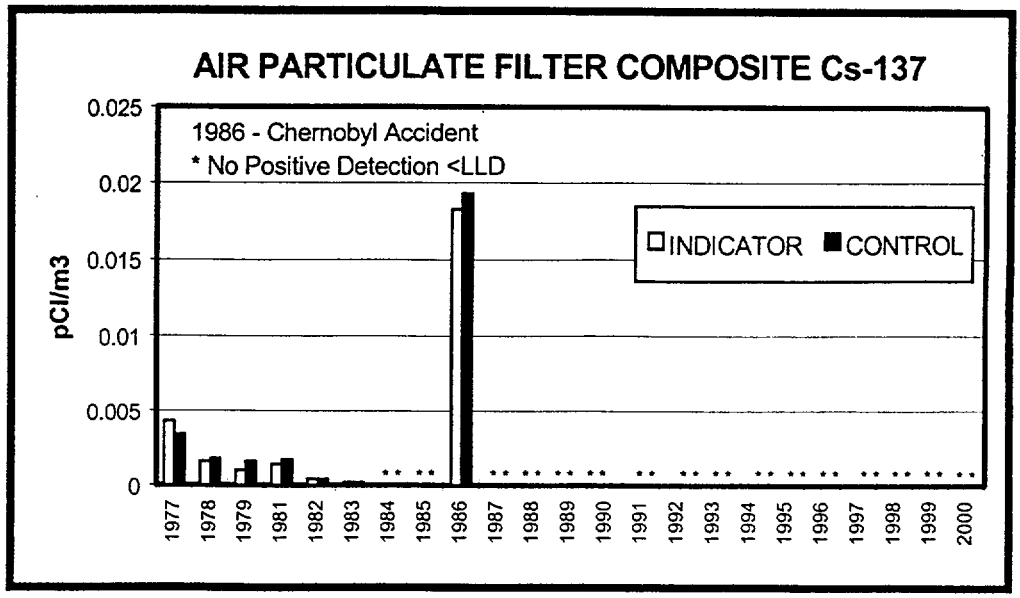
Cobalt-60, a plant related radionuclide was detected during 2000 at one off-site air monitoring locations.

The five 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. The maximum yearly mean concentration detected during this period was in 1977 when the mean for the indicator results was 0.0179 pCi/m^3. The mean control value for this same year was 0.0172 pCi/m^3. The Co-60 in the air particulate samples trended downward during the 1977 through 1984 period to a low mean concentration of 0.0006 pCi/m^3 at the control location. The Co-60 concentration measured in the 2000 sample was the first positive detection of Co-60 in the previous 15 years. There is no trend for the presence of Co-60 in air particulate filter samples. The detection of Co-60 in the 2000 sample appears to be an isolated event with no precursors.



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 maximum concentrations for this period were measured in 1977 with a mean indicator concentration of 0.0043 pCi/m^3 and the corresponding control concentration of 0.0034 pCi/m^3. After 1977, the Cs-137 concentration showed a reduction by a factor of approximately two and remained constant through 1981. In 1982, a second reduction in Cs-137 concentration was measured followed by a further reduction in concentration in 1983. Cs-137 was not detected during 1984 and 1985 in any of the indicator or control air particulate composite samples.

For the period 1986 to 1991, Cs-137 was detected only in 1986, due to the fallout from the Chernobyl accident. The 1986 mean concentration of Cs-137 for the control location was 0.0193 pCi/m^3. The mean concentration of Cs-137 for the indicator location was 0.0183 pCi/m^3 for the sample period. This overall reduction in Cs-137 results since 1977 is attributed to nuclear decay and ecological cycling of Cs-137 initially produced as a result of weapons testing. The decrease in air particulate Cs-137 concentrations since 1977 is clearly illustrated on the following graph of historical data.



In the 1986 samples, a number of other radionuclides were detected in addition to Cs-137. The isotopes, Zr-95, Ce-141, Nb-95, I-131, Ce-144, Mn-54, Ru-103, Ru-106, Ba-140 were all detected. These isotopes were measured in air particulate composite samples as a result of the fallout from the Chernobyl accident. After 1986, no plant related or fallout radionuclides were detected in any of the off-site air particulate composite samples with the exception of the isolated detection of Co-60 in 2000 in a single sample. A review of the past five years data for air particulate filter composites indicates no plant related radiological impact on the environment. All the previous historical positive detections of fission product radionuclides were associated with atmospheric weapons testing or the Chernobyl accident.

Current air particulate filter composite results cannot be compared to preoperational data as none exists prior to 1977.

Historical data for air particulate results are presented in Section 7.0, Tables 7-11 and 7-12. Full page graphic presentation of air particulate composite Co-60 and Cs-137 concentrations are presented in Section 8.0.

5.2.3 AIRBORNE RADIOIODINE (I-131)

A. Results Summary

Iodine 131 was not detected in any of the 779 samples analyzed for the 2000 program. No radioiodine has been measured off-site at the constant air monitoring stations since 1986 when measurable levels of I-131 were found as a result of fallout from the Chernobyl accident.

B. Data Evaluation and Discussion

Airborne radioiodine is monitored at the fifteen air sampling stations also used to collect air particulate samples. There are nine off-site locations, five of which are required by Technical Specifications. The off-site locations required by Technical Specifications are designated as R-1, R-2, R-3, R-4 and R-5. R-5 is a control station located beyond any local influence from the plant. Ten air sampling locations are maintained in addition to those required by Technical Specifications. Six of these stations, D-1, G, H, I, J and K, are located on-site. D-2, E, F and G are the optional stations located off-site.

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, Table 6-7 and 6-8.

C. Dose Evaluation

The I-131 airborne sampling program demonstrated no dose to man due to the operation of the plant. No radioiodine was detected in any sampling location.

D. Data Trends

No radioiodine has been detected at air sampling locations required by Technical Specifications since 1987.

I-131 was detected twice over the last fifteen year period, in 1986 and 1987. The 1986 detection was the result of the Chernobyl accident and the 1987 detection was the result of plant operations.

Iodine - 131 (I-131) has been detected in the past at control locations. During 1976, the mean measured off-site I-131 concentration was 0.60 pCi/m^3. The 1977 mean I-131 concentration decreased to 0.323 pCi/m^3 and for 1978 the mean measured concentration decreased by a factor of ten to 0.032 pCi/m^3. During 1979 - 1981 and 1983 - 1985, I-131 was not detected at the control locations. I-131 was detected once at the control location during 1982 at a concentration of 0.039 pCi/m^3. I-131 was detected at the on-site locations in 1980 through 1983, 1986 and 1987. The mean concentrations ranged from 0.013 pCi/m^3 in 1980 to a maximum of 0.119 pCi/m^3 in 1986. The maximum I-131 concentration of 0.119 pCi/m^3 was the result of the Chernobyl accident. I-131 was detected in a total of 75 weekly samples collected during the 1986 sample program. The 1986 measured concentrations ranged from a minimum of 0.023 pCi/m^3 to a maximum of 0.36 pCi/m^3. Each of the positive detection of I-131 in 1986 was the direct result of the Chernobyl Nuclear accident.

Preoperational data for I-131 in air is limited. Results from 1974 showed no positive measurement of I-131. Current data, which showed no measured concentrations of I-131 are consistent with the 1969 and 1974 preoperational data.

A graphic presentation of airborne radioiodine is presented in Section 8.0.

5.2.4 DIRECT RADIATION THERMOLUMINESCENT DOSIMETERS (TLD)

A. Results Summary

A total of 72 Environmental TLD locations are used to measure direct radiation levels in the environment. The dosimeters are collected and read each quarter.

The 2000 results are consistent with those observed in 1999 and previous years. The results of the TLD program document and confirm that there are no increased levels of direct radiation at or beyond the site boundary. TLD results are evaluated by organizing the locations into five special groups by geographic location relative to the site. The five groups are on-site, site boundary, off-site, special interest and controls. A summary of the measured exposure in each group is as follows:

	Dose in mrem per standard month		
Location Groups	Minimum	Maximum	Mean
On-site indicators	3.7	16.5	5.6
Site boundary*†	3.6	10.0	5.5
Off-site indicators*	3.8	7.3	4.6
Site interest*	3.6	7.3	4.7
Controls*	3.7	5.5	4.3

* Location required by Technical Specifications

† Only includes TLD locations not affected by radwaste direct shine

The highest dose rate measured at a location required by Technical Specification was 10.0 mrem per standard month. This TLD, (No. 85) represents the site boundary maximum dose. Location No. 85 is in the WNW sector along the lake shore and is in close proximity to the NMP Unit #1 plant. The TLD locations along the lakeshore close to the plants are influenced by the radwaste building and radwaste shipping activities. These environmental dose rates are not representative of dose rates measured at the remaining site boundary locations. The remaining TLD locations which are located away from the plant are comparable to levels measured at the control or background locations.

Overall, the environmental direct radiation measurement results for 2000 showed no indication of increased direct radiation above background at or beyond the site boundary. This is demonstrated by the net site boundary dose rate. The TLD results show that the 2000 injection rate utilized at the FitzPatrick Plant for the hydrogen water chemistry program did not significantly increase the dose rate at the site boundary or the general off-site dose rate to the general public.

Quarter	Site Boundary*	Control*	Net Site Boundary Dose Rate*
1	4.1	4.5	- 0.4
2	4.1	4.2	- 0.1
3	5.3	5.7	- 0.4
4	4.4	4.4	+0.0

* Dose rate in mrem per standard month

The net site boundary dose was calculated from applicable site boundary TLD results and control TLD results. TLD results from TLDs located near the site boundary in sectors facing the land occupied by members of the public (excluding TLDs near the generating facilities and facing Lake Ontario) are compared to control TLD results. The site boundary TLDs include numbers 78, 79, 80, 81, 82, 83, 84, 7 and 18. Control TLDs include numbers 8, 14, 49, 111 and 113.

B. Data Evaluation and Discussion

Thermoluminescent dosimeters (TLDs) are used to measure direct radiation (gamma dose) in the environment. The TLDs used during 2000 were Panasonic UD-814 dosimeters.

TLDs from 72 environmental locations were collected and read on a quarterly basis during the sample year. The location results are an average of six independent readings per quarter at each location and are reported in mrem per standard month (See Section 6.0, Table 6-10). Of the 72 TLD locations, 33 are required by Technical Specifications.

The majority of the locations required by the Technical Specifications were initiated in 1985 as a result of the issuance of new Technical Specifications by the NRC. Therefore, the majority of 2000 results can only be compared to 1985 - 1997 results. Some locations, including a number required by the Technical Specifications (i.e., numbers 7, 14, 15, 18, 23, 49, 56, and 58), can be compared to earlier results as these TLDs were established prior to 1985.

On-site TLDs are located at special interest areas within the site boundary. With the exception of location numbers 7 and 23, these locations are not required by the Technical Specifications. Locations 7 and 23 are located near the generating facilities at previous or existing on-site air sampling stations and are used to evaluate meteorological sectors that do not extend beyond the site boundary. TLDs located at the on-site environmental monitoring stations include numbers 3, 4, 5, 6, 7, 23, 24, 25 and 26. The results for these locations are consistent with the previous year results. The 2000 results for the on-site group ranged from 3.7 to 16.5 mrem per standard month. Other on-site special interest TLDs are located near the north shoreline of the Nine Mile Point Unit 1, Unit 2 and JAF facilities. They are in close proximity to radwaste facilities and the Unit 1 reactor building. These locations include numbers 27, 28, 29, 30, 31, 39 and 47. Results for these TLDs during 2000 were widely variable and ranged from 5.9 to 30.6 mrem per standard month. These dose rates vary as a result of activities at the radwaste facilities and the operating modes of the generating plants. The results for 2000 are consistent with the ranges of variability noted in previous years for measurement at or near these locations.

Additional on-site TLD locations are located near the on-site Energy Center and the associated northeast shoreline. These locations include numbers 18, 103, 106 and 107. TLDs 103, 106, and 107 are located east of the Energy Center and west of the Unit 1 facility. TLD number 18 is located on the west side of the Energy Center. Results for this group ranged from 4.0 to 6.9 mrem per standard month for 2000 and were consistent with the 1999 results.

Site boundary TLDs are required by the Technical Specifications and are located in the approximate area of the site boundary with one in each of the sixteen 22.5 degree meteorological sectors. These TLDs include numbers 75, 76, 77, 23, 78, 79, 80, 81, 82, 83, 84, 7, 18, 85, 86 and 87. TLD numbers 78, 79, 80, 81, 82, 83, 84, 7 and 18 showed results that were consistent with

control TLD results and ranged from 3.6 to 10.0 mrem per standard month. Site boundary TLD results for 2000 were consistent with 1985 - 1998 results. TLD numbers 23, 75, 76, 77, 85, 86, and 87 showed results that ranged up to two times the results of the control TLDs. These results ranged from 4.8 to 10.0 mrem per standard month. TLDs in this latter group are located near the lake shoreline (approximately 100 feet from the shoreline), but are also located in close proximity to the reactor building and radwaste facilities of NMP Unit #1 and NMP Unit #2 and the radwaste facilities of the FitzPatrick plant.

A net site boundary dose can be estimated using site boundary TLD results and control TLD results. Results from TLDs located at the site boundary in land based sectors (excluding TLDs near the generating facilities and along the Lake Ontario shoreline) are compared to control TLD results. The site boundary TLDs include numbers 78, 79, 80, 81, 82, 83, 84, 7 and 18. Control TLDs include numbers 8, 14, 49, 111 and 113. Net site boundary doses for each quarter in mrem per standard month are as follows:

Quarter	Net Site Boundary Dose Rate*
1	- 0.4
2	- 0.1
3	- 0.5
4	+0.0
Net	+0.0

*Dose in mrem per standard month

Site boundary TLD numbers 75, 76, 77, 23, 85, 86, and 87 were excluded from the net site boundary dose calculation since these TLDs are not representative of doses at areas where a member of the public may be located. These areas are near the north shoreline, which are in close proximity to the generating facilities, and are not accessible to members of the public.

The third group of environmental TLDs is located four to five miles from the site in each of the eight land based 22.5 degree meteorological sectors. These locations are required by the Technical Specifications and are referred to an off-site sector TLDs. At this distance, badges are not present in eight of the sixteen meteorological sectors which are located over Lake Ontario.

Results for this group of TLDs during 2000 showed a range of 3.4 to 6.6 mrem per standard month. The range of results is caused by differences in the natural physical conditions of each site and the varying concentrations of naturally occurring radionuclides in the ground at each of the locations. These results are consistent with control TLD results during 2000 and with the 1986 - 1999 results. These TLDs were established in 1985 and include numbers 88, 89, 90, 91, 92, 93, 94, and 95.

The fourth group of environmental TLDs is made up of badges located near the site boundary and at special interest areas. Included in this group are 24 monitoring at locations such as industrial sites, schools, nearby communities, off-site air sampling stations, the closest residence to the site, and the off-site environmental laboratory. Six of the special interest TLDs are required by the Technical Specifications. The remaining locations for this group are optional. This group of locations include numbers 9, 10, 11, 12, 13, 15, 19, 51, 52, 53, 54, 55, 56, 58, 96, 97, 98, 99, 100, 101, 102, 108, and 109. The mean for the special interest group ranged from 3.5 to 6.6 mrem per standard month in 2000. TLD numbers 108 and 109 are locations that were established during 1988 and were added to assist in the evaluation of the nearest residence. In 2000, results ranged from 4.2 to 5.8 mrem per standard month for locations 108 and 109 with an annual mean of 4.7 mrem per standard month. All of the TLD results from this group were within the general variation of the control TLDs. Results during 2000 were consistent with the results for previous years.

The fifth category of TLDs is used to measure the dose rate at the control locations. These TLDs are required by the Technical Specifications and include numbers 14 and 49. Optional control locations are numbers 8, 111 and 113. Location number 111 was added to the program during 1988 to expand the data base for control measurements. Results for all control locations from 2000 ranged from 3.7 to 7.3 mrem per standard month. Results from 2000 were consistent with previous years' results.

C. Dose Evaluation

TLDs located at the site boundary averaged 4.5 mrem per standard month (No. 7, 18, 78, 79, 80, 81, 82 83, 84).

TLDs placed at the special interest locations averaged 4.5 mrem per standard month. (No. 15, 56, 58, 96, 97, 98).

The control TLD results averaged 4.7 mrem per standard month in 2000 (No. 8, 14, 49, 111, 113).

The measured mean dose rate in the proximity of the closest resident was 4.6 mrem per standard month (No. 108 and 109), which is consistent with the control measurements which was also 4.7 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 off-site environment.

D. Data Trends

A comparison of historical TLD results can be made using the different categories of measurement locations. These include site boundary TLDs in each meteorological sector (16 locations), TLDs located off-site in each land based sector at a distance of four to five miles (8 locations), badges located at special interest areas (6 locations) and TLDs located at control locations (5 locations). As noted previously, many of the present TLD locations became effective in 1985 and these results can only be evaluated for 1985 - 2000.

TLDs located at the site boundary averaged 5.8 mrem per standard month during 1990. During 1995, 1996, 1997, 1998, and 1999 site boundary dose rates averaged 5.4, 5.2, 5.9, 5.4, and 5.8 mrem per standard month, respectively. As noted previously, this group of TLDs exhibits fluctuating results because several of these TLDs are located in close proximity to the generating facilities and are influenced by operational modes. During 2000,

site boundary measurements averaged 5.6 mrem per standard month which is consistent with the previous five years.

TLDs located off-site at a distance of four to five miles from the site in each of the land based meteorological sectors (off-site sectors) averaged 4.8 mrem per standard month during 1990. During the previous five years, 1995 through 1999, the annual off-site sector dose rates averaged 4.3, 4.2, 4.4, 4.2 and 4.4 mrem per standard month, respectively. Results for the group averaged 4.5 mrem standard month over the five year period. The 2000 mean dose of 4.6 mrem per standard month is consistent with the previous five year mean and each individual yearly mean.

Special interest locations averaged 4.4 mrem per standard month over the previous five years (1995 – 1999). The 2000 results for these locations averaged 4.7 mrem per standard month. This is consistent with the previous five year average.

The last group of TLD locations required by the Technical Specifications is the control group. This group (No. 8, 14, 49, 111 and 113) utilizes locations positioned well beyond the site. Control location results for 1995, 1996, 1997, 1998 and 1999 averaged 4.4, 4.3, 4.7, 4.4 and 4.6 mrem per standard month, respectively with a five year mean of 4.5 mrem per standard month. Control results for 2000 averaged 4.7 mrem per standard month, which is consistent with the previous five year mean of 4.5 mrem per standard month. These results indicate that the 2000 data is representative of the natural background dose rate.

The 2000 TLD program results, when compared to the previous five years and pre-operational data, show no significant trends relative to increased dose rates in the environment.

Tables 7-15 and 7-16 show the historical environmental sample data for environmental TLDs. A graph of historical TLD data is presented in Section 8.0.

5.2.5 MILK

A. Results Summary

A total of 198 analyses were performed on the 99 milk samples collected and analyzed for the 2000 program. Each sample was 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).

Iodine-131, a possible plant related radionuclide, is measured to evaluate the land deposition, grass, cow, dose pathway to man. In 2000, I-131 was not detected in any of the 99 samples collected from the six milk sampling locations. The number of milk sampling locations was reduced from six to five farms in mid August when one of the sample farms went out of business and sold the milking herd to an existing farm. The farm, which obtained the herd, was an existing milk sampling location.

Gamma spectral analyses of the bimonthly samples showed that only naturally occurring radionuclides such as K-40 and Ra-226 were detected in milk samples during 2000. K-40 was detected in all indicator and control samples. Ra-226 was detected intermittently in milk samples. K-40 and Ra-226 are naturally occurring radionuclides and are found in many environmental sample media.

The 2000 results demonstrate that routine operation of the FitzPatrick Plant results in no contribution to the "dose to the public" from the cow/milk pathway.

B. Sampling Overview

Milk samples were collected from five indicator locations and one control location. Technical Specifications require 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 2000. Samples were collected from five farms located beyond the five mile requirement to ensure the continued monitoring of this important pathway. The five indicator

locations ranged from 5.5 to 9.5 miles from the site. The control samples were collected from a farm 13.2 miles from the site and in a low frequency wind sector (upwind). With the exception of indicator location No. 7 and the control location, each of the reported locations has been sampled since 1989. In August of 2000 milk sampling location No. 50 was removed from the sampling program. The milking herd at this location was sold off and milk production at this location ceased. Milk samples were collected from this location from April 3, 2000 through August 7, 2000. The geographical location of each location is listed below:

Location No.	Direction From Site	Direction (Miles)
50	E	9.1
55	E	9.0
60	E	9.5
4	ESE	7.8
7	ESE	5.5
73 Control	SW	13.2

Samples were collected at locations from April through December, during the first and second half of each month. Because I-131 was not detected in samples collected during November and December of 1998 additional samples were not required for January through March of 2000 as stipulated in the Technical Specifications.

C. Data Evaluation and Discussion

Each 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 analytical results and sample analysis results for gamma emitters are provided in Section 6.0, Table 6-11.

Iodine-131 was not detected in any indicator or control samples analyzed during 2000. All I-131 milk results were reported as lower limits of detection (LLD). The LLD results for all samples ranged from <0.31 to <1.00 pCi/liter. No plant related radionuclides were detected in the 2000 samples. K-40 was the most abundant radionuclide detected in milk samples collected. K-40 is a naturally occurring radionuclide and is found in many of the environmental

media samples. K-40 was detected in every indicator and control sample. K-40 concentration for all samples ranged from 956 to 1830 pCi/liter. Ra-226 was detected intermittently in the milk samples and is a naturally occurring radionuclide. During 2000, Cs-137 was not detected in any indicator or control milk samples.

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 as 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 (Eisenbud) as a result of internally deposited naturally occurring K-40.

E. Data Trends

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

The comparison of 2000 data to historical results over the operating life of the plant and preoperational data (1974) show that Cs-137 and I-131 levels have decreased significantly since 1974. The levels of Cs-137 and I-131 detected prior to the plant going into commercial operation were the result of activities not related to power production at the site.

Historical data and a graphic presentation of milk sample results for Cs-137 and I-131 are presented in Section 7.0, Tables 7-17 and 7-18 and in Section 8.0, respectively.

5.2.6 FOOD PRODUCTS (VEGETATION)

A. Results Summary

There were no plant related radionuclides detected in the 20 food product samples collected and analyzed for the 2000 program.

Detectable levels of naturally occurring K-40 were measured in all control and indicator samples collected for the 2000 program. Be-7, a second naturally occurring radionuclide, was also detected in all but two of the samples collected in 2000. These results are consistent with the levels measured in 1999 and previous years.

The results of the 2000 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 seven indicator locations and one control location. The collection of annual food product samples became a requirement as a result of Technical Specification Amendment 127 in 1985. 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 miles away in a predominately upwind direction.

Food product samples collected during 2000 included one variety that is considered edible broadleaf vegetables. Collard greens were collected at three indicator locations. The general lack of edible broadleaf vegetation samples is the result of grower preference and such varieties were not routinely available in local gardens. Where broadleaf vegetables were not available, non-edible broadleaf vegetation was collected. Non-edible broadleaf vegetation consisting of squash leaves, grape leaves, pepper leaves, and cucumber leaves were collected for the 2000 program. The leaves of these plants were sampled as representative of broadleaf vegetation which is a measurement of radionuclide deposition. In addition to the broadleaf vegetation, tomato samples were collected from two locations. Samples were collected during the

late-summer/fall harvest season. Each sample was analyzed for gamma emitters using gamma spectroscopy.

The results of the 2000 program did not detect any plant related radionuclides. Sample results from the previous five year period demonstrate that there is no build up of plant radionuclides in the garden produce grown in the area surrounding the plant.

Naturally occurring Be-7, K-40, Ra-226, and AcTh-228 were detected in food product samples. The concentration of Be-7 in vegetation samples ranged from 0.14 to 2.08 pCi/g (wet). The concentration of K-40 in indicator and control samples ranged from 1.78 pCi/g (wet) to 7.86 pCi/g (wet). Ra-226 and AcTh-228 were detected intermittently in the samples. The results for naturally occurring radionuclides are consistent with those of prior years. Analytical results for food products are found in Section 6.0, Table 6-13.

C. Dose Evaluation

There is no calculated dose to man from the garden/food products pathway. The year 2000 sampling program did not detect any plant related radionuclides in samples representing this pathway.

D. Data Trends

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

In the previous five year period, Cs-137 was detected in three of those years at the indicator location. Since operation began at the FitzPatrick Power Plant, Cs-137 has been detected in eight separate years. These historical Cs-137 concentrations for samples collected during J.A. FitzPatrick N.P.P. operational years ranged from a maximum level of 0.047 pCi/g (wet) in 1985 to a minimum level of 0.007 pCi/g (wet) in 1999. The maximum Cs-137 concentration was detected in 1974 at a concentration of 0.142 pCi/g (wet) which was pre-operational for JAF. The trend for Cs-137 is a general reduction in concentration to a baseline concentration in the range of 0.010 to 0.013 pCi/g for the previous five year period.

There is no measurable trend for Zn-65 in vegetation samples. Zn-65 was detected one time in 1997 in food products sampled as part of the Environmental Radiological Surveillance Program. Zn-65 was not detected in the 1999 or 2000 samples.

Historical data and graphic presentations of food product results are presented in Section 7.0, Tables 7-19 and 7-20, and in Section 8.0.

5.2.7 LAND USE CENSUS RESULTS

A. Results Summary

Technical Specifications require 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 2000, a milk animal census, a nearest resident census, and a garden survey were performed.

No changes were required to milk sampling indicator or control locations in 2000 based on the 2000 milk animal census.

The results of the closest residence census conducted in 2000 required no change to the Off-site Dose Calculation Manual (ODCM) closest resident location.

A garden census, not required by Technical Specifications, is performed to identify appropriate garden sampling locations and dose calculation receptors. Garden samples were collected from a number of locations listed in Table H-1 of the ODCM and identified in the census as active for 2000. See Table 3.3-1 for 2000 sampling locations.

B. Data Evaluation and Discussion

A land use census is conducted each year to determine the utilization of land in the vicinity of the 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. The census, covering areas out to a distance of 10 miles, exceeds the 5 mile distance required by the Technical Specifications. A resident census is conducted and is designed to identify the nearest resident in each meteorological sector out to a distance of five miles.

The milk 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 annual census is conducted during the first half of the grazing season by sending questionnaires to previous milk animal owners and also by road surveys to locate any possible new locations. In the event the questionnaires are not

answered, the owners are contacted by telephone or in person. The local county agricultural agency is also contacted as a further source of information concerning new milk animal locations in the vicinity of the site.

The number of milk animals located within an approximate ten mile radius of the site was estimated to be 643 cows and 3 goats based on the 2000 land use census. The number of cows increased by 53 and the number of goats decreased by three with respect to the 1999 census. The goats identified during the census were not milking goats.

The locations identified as a result of the milk animal census are illustrated on a map in Section 3.3, Figure 3.3-4.

The results of the milk animal census are found in Section 6.0, Table 6-12.

The second type of census conducted is the 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 water sectors include: N, NNE, NE, ENE, W, WNW, NW and NNW. The results of the residence census, showing the applicable sectors and degrees and distance of each of the nearest residence, are found in Section 6.0, Table 6-14. No changes were noted in the 2000 census for the closest resident in the land based meteorological sectors.

The nearest resident locations are illustrated on a map in Section 3.3, Figure 3.3-5.

5.3 CONCLUSION

The REMP is an ongoing program implemented to measure and document the radiological impact of JAFNPP 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 and long term historical trends.

The results of the 2000 Radiological Environmental Surveillance Program continues to clearly demonstrate that there is no significant short term or chronic long term radiological impact on the environment in the vicinity of the Nine Mile Point site. No unusual radiological characteristics were measured or observed in the local environment. The Environmental Monitoring Program continues to demonstrate that the effluents from the site to the environment contribute no significant measurable radiation exposures to the general public as confirmed by the sampling and analysis of environmental media from recognized environmental pathways. No increase in radiation levels in the environment beyond the site boundary were measured as a result of the hydrogen water chemistry program based on TLD results. Environmental radiation levels measured at the nearest resident are at the background level. The only measurable radiological impact on the environment continues to be the result of atmospheric weapons testing conducted in the early 1980s and the 1986 accident at the Chernobyl Nuclear Power Plant. Both of these source terms have contributed to a ubiquitous inventory of Cs-137 in the environment. The results for the 2000 sample program demonstrate that the concentrations of manmade radionuclides continue to decline. This reduction in environmental background concentrations will allow for the site environmental program to become more sensitive to the measurable impact of plant operations on the environment as time goes on.

The environmental monitoring program detected two fission product radionuclides in the sample media collected during 2000. Cs-137 was detected in shoreline sediment samples and fish samples. The source of the Cs-137 measured in these samples is considered to be fallout from past atmospheric nuclear weapons testing. The measured concentrations of Cs-137 in each of the samples was small and consistent with historical values.

Cobalt-60 was detected in one of the 180 routine air particulate filter composites samples analyzed during 2000. The presence of Co-60 in the air composite sample is attributed to

operations at the FitzPatrick plant. The measured concentration was very small and isolated to a one week period. The program results for the 2000 sampling program demonstrate that Co-60 is not an extensive or chronic constituent in the environment. The program results document that this was an isolated incident with no previous or subsequent presence in environmental media based on ten years of historical data. The maximum dose calculated dose to man from the inhalation pathway could be 0.00349 mrem to the lung of the critical individual. This calculated dose to man is a conservative estimate and is extremely small relative to routine background exposures.

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 contribution to the off-site whole body dose as a result of plant operations is extremely small in comparison to the dose contribution from natural background levels and sources other than the plant. Whole body dose in Oswego County due to all natural sources is approximately 50-60 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.

From the collective results of the 2000 Radiological Environmental Surveillance Program, it can be concluded that the levels and variation of radioactivity in the environmental samples were consistent with background levels that would be expected for the lakeshore environment of the site.

5.4 REFERENCES

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