NEXTera® ENERGY SEABROOK

April 28, 2023
Docket No. 50-443
SBK-L-23044

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

Seabrook Station
2022 Annual Radiological Environmental Operating Report

Pursuant to the requirements of 10 CFR 50.36a(a)(2) and Seabrook Station Technical Specification 6.8.1.3, NextEra Energy Seabrook, LLC submits the 2022 Annual Radiological Environmental Operating Report. The report summarizes the implementation of the NextEra Energy Seabrook, LLC Radiological Environmental Monitoring Program (REMP). Attachment 1 to the report is the complete data set for the REMP samples.

A copy of this report is also being provided to the Commonwealth of Massachusetts, Department of Public Health; and the State of New Hampshire, Bureau of Radiological Health.

Should you require further information regarding this matter, please contact David Robinson, Chemistry and Radiation Protection Department Manager, at (603) 773-7496.

Sincerely,

NextEra Energy Seabrook, LLC

Matthew Levander
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cc: with enclosure

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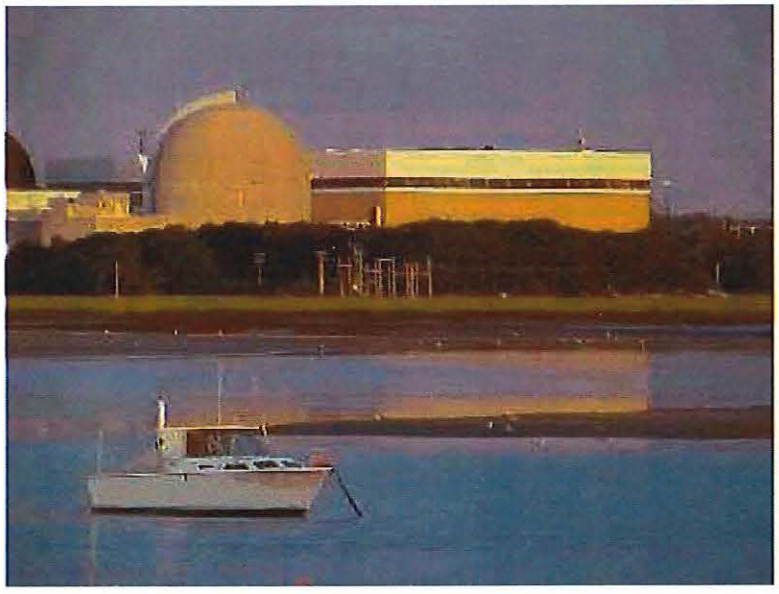
NEXTera ENERGY SEABROOK

2022 Annual Radiological Environmental Operating Report



April 2023

103-4041-000

SEABROOK STATION

ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

For the Period

January - December 2022

Docket No. 50-443

Prepared By:

NextEra Energy Seabrook, LLC
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And

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David Robinson, NextEra Energy Seabrook, LLC

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Executive Summary

Both the plant operations and Dry Fuel Storage Radiological Environmental Monitoring Programs (REMP) for Seabrook Station operated successfully for the period of January through December 2022. This report describes the REMP and its implementation as required by Technical Specifications and as defined in the Offsite Dose Calculation Manual (ODCM). It also contains analytical results, data evaluation, dose assessment (as needed), and data trends for each environmental sample medium. Also included are the results of the Land Use Census, historical data, and the environmental laboratory performance in the Quality Assurance Inter-comparison Program required by the ODCM.

Radioactivity levels in the vicinity of Seabrook Station from January 1 through December 31, 2022 in air, water, sediment, milk, fish, food crops, and vegetation, as well as direct radiation measurements have been analyzed, evaluated, and summarized. The results of the REMP are intended to supplement the results of the radiological effluent monitoring by verifying that any measurable concentration of radioactive materials and levels of radiation are not higher than expected on the basis of the effluent measurement and modeling of the environmental exposure pathways.

Radiation and radioactivity in the environment is monitored within a 10-mile radius of the site. Two types of samples are taken. The first type, control samples, is collected from areas that are beyond measurable influence of Seabrook Station. These samples are used as reference data. Normal background radiation levels, or radiation present due to causes other than Seabrook Station, can thus be compared to the environment surrounding the nuclear power station. Indicator samples are the second sample type obtained. These samples show how much measurable radiation or radioactivity (if any) is contributed to the environment by the site. Indicator samples are taken from areas close to the station where any plant contribution will be at the highest potential concentration. The ODCM minimum required plant operations REMP included the collection for 2022 of at least 576 samples, with a total of 2416 individual measurement analyses. In 2022, the total number of sample analysis sets (both required and non-required) equaled 811 taken from 98 locations around Seabrook Station. These were collected from aquatic, atmospheric, and terrestrial environments. An estimated 5111 individual measurement analyses were performed on these samples. The plant operations radiological environmental monitoring program is outlined in Table 2.0-1. Radiation environmental monitoring associated with Dry Fuel Storage (DFS) in 2022 included an additional 18 TLD direct radiation measurements beyond those listed as being part of the REMP. The DFS environmental monitoring program is shown on Table 4.0-1.

Prior to station operation, samples were collected and analyzed to determine the amount of radioactivity present in the area. The resulting values are used as a "pre-operational baseline." Current analysis results from the indicator samples are compared to both current control sample values and the pre-operational baseline to determine if changes in radioactivity levels are attributable to station operations.

A report is required to be submitted to the Nuclear Regulatory Commission when the level of radioactivity as a result of plant operations in an environmental sampling medium at a specified location exceeds the reporting level limits specified in the ODCM when averaged over any calendar quarter. Also, when more than one of the radionuclides is detected in the sampling medium, this report shall be submitted if:

$$\frac{\text{Concentration (1)}}{\text{Limit Level (1)}} + \frac{\text{Concentration (2)}}{\text{Limit Level (2)}} + \ldots \geq 1.0$$

Based on the analytical results of environmental samples during 2022, Seabrook Station reporting levels were not exceeded.

All off-site radioactivity detected was attributable to either naturally-occurring radionuclides, previous nuclear weapons tests, the Fukushima Daiichi nuclear accident in Japan on March 11, 2011, or other man-made sources.

In 2022, the maximum whole body dose to the hypothetically exposed individual due to Seabrook Station effluents and operations was estimated to be 0.18 mrem. This whole body dose is the sum of all the exposure pathways for liquid and gaseous effluents, plus the direct whole body dose from station sources. This total represents approximately 0.720% of the whole body dose limits for a member of the public as set forth in 40CFR190.

The average effective dose per individual in the U.S. population from ubiquitous or background radiation sources is about 3.11 mSv/yr (311 mrem/yr), with another 3.00 mSv/yr (300 mrem/yr) resulting from medical procedures and imaging (NCRP Report No. 160, "Ionizing Radiation Exposure of the Population of the United States" (2009)). The estimate for natural background includes radon gas which has always been present but has not always been included in previous estimates. In some regions of the country, the amount of natural radiation is significantly higher. Residents of Colorado, for example, receive an additional 60 mrem/yr due to the increase in cosmic and terrestrial radiation levels. In fact, for every 100 feet above sea level, a person will receive an additional 1 mrem/yr from cosmic radiation. In several regions of the world, naturally high concentrations of uranium and radium deposits result in doses of several thousand mrem/yr to their residents (CRC Handbook. "Radioecology: Nuclear Energy and the Environment", F. Ward Whicker and Vincent Schultz, Volume I, 1982).

Analytical results are divided into four categories based on exposure pathways: Airborne, direct radiation, ingestion, and waterborne. Each of these pathways is described below:

- The airborne exposure pathway includes airborne iodine and airborne particulate. The 2022 results were similar to previous years, excluding the Fukushima Daiichi event in 2011. There was no notable increase in natural products and no detectable fission products or other plant-related radionuclides in the airborne particulate media during the year.

- The direct exposure pathway measures environmental radiation exposures by use of thermoluminescent dosimeters (TLDs). TLD results have indicated a trend that compares with previous years which reflect the natural variability of background radiation from one location to another. The exposure rate response at some individual monitoring stations has exhibited step changes at some point in the past that appear to be related to changes in local conditions in the area of the dosimeter measurement. These step observations have been noted at various locations (both control and indicator stations) with no correlation with distance from Seabrook Station, leading to the conclusion that the changes in local TLD responses are not related to Seabrook operations. As a result, no detectable radiation contribution from Seabrook Station sources was identified via TLD environmental measurements off-site during the course of 2022 from either plant operations or from the spent fuel in the Dry Fuel Storage Facility.

- The ingestion exposure pathway includes milk, fish, shellfish, terrestrial food products and leafy vegetation samples. The gamma spectroscopy analyses indicated the most prominent positive results were for potassium-40 (K-40) at average environmental levels. Other naturally-occurring radionuclides were also periodically detected. However, past world-wide nuclear events such as atmospheric testing of nuclear weapons and the Fukushima Daiichi nuclear accident did result in detectable fallout of fission related radioactivity (Cs-137) in milk. Neither fish, shellfish, nor terrestrial food products (blueberries, green beans, lettuce and tomatoes) had any detectable fission product related radioactivity. No radionuclides related to plant effluents were detected in any of these sample media during 2022. For the one fission product (Cs-137) detected in milk, the concentration falls within the range of past and pre-operational measurements and can be attributed to past weapons testing fallout.

- The waterborne exposure pathway includes surface (ocean) water, drinking water supply, shallow well water, sea algae (Irish Moss) and sediment. Water samples were analyzed for tritium, gross-beta and gamma-emitting radionuclides. Irish Moss was analyzed for gamma-emitting radionuclides. Tritium was not identified in the water samples analyzed. For groundwater, the gross beta activity detected at all locations is similar to what was detected in the pre-operational program and is consistent with results from previous years of commercial operations. Gamma analysis of samples indicated no plant-related gamma-emitting radionuclides above detection limits.

The results of the 2022 REMP continue to clearly demonstrate that there is no significant short term or chronic long-term radiological impact on the environment in the vicinity of Seabrook Station from plant operations and that there is no detectable impact to members of the public associated with the DFS facility. The REMP monitoring did detect local area fallout related to past global nuclear events, such as atmospheric weapons testing and the Japanese nuclear accident in March 2011, thereby demonstrating the sensitivity and capability of the REMP to detect low level radiological changes in the environment and the likely source. The

REMP confirmed that plant effluents in 2022 did not contribute measurable radiation exposure to the general public. This finding is consistent with previous years' monitoring conclusions. As a result, no increasing or changing trends in plant related radiological impacts on the environment are found.

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1.0 Introduction

NextEra Energy Seabrook, LLC's Radiological Environmental Monitoring Program (REMP) consists of two interconnected sample collection and measurement schedules that look for environmental influences from: (1) plant operations which release to the environment radioactive materials in liquid and gaseous effluents, and direct radiation from plant facilities inside the power block Protected Area, and (2) direct radiation from used fuel placed in the Dry Fuel Storage (DFS) facility located in the West Southwest sector approximately 0.38 miles from the Containment Building. Several monitoring locations provide data that are shared or used in the assessment of both plant and DFS operations.

The plant operations REMP at Seabrook Station has been designed and carried out to achieve the following specific objectives:

- To provide an indication of the appearance or accumulation of any radioactive material in the environment caused by the operation of the nuclear power station.
- To provide assurance to regulatory agencies and the public that the station's environmental impact is known and within anticipated limits.
- To verify the adequacy and proper functioning of station effluent controls and monitoring systems.
- To provide standby monitoring capability for rapid assessment of risk to the general public in the event of unanticipated or accidental releases of radioactive material.

In July 2008, the plant operations REMP was supplemented with the DFS environmental monitoring for direct radiation when used nuclear fuel assemblies were for the first time transferred to the on-site DFS facility located WSW of the power block.

NextEra Energy Seabrook, LLC staff collected the terrestrial samples. Normandeau Associates, Inc. collected the marine and sediment samples. After initial sample preparation for shipment, the samples were sent to GEL Laboratories, Inc. of Charleston, SC for analysis. The Environmental Dosimetry Company located in Sterling, MA processed the environmental TLDs for the entire year.

This report is a summary of the findings of the REMP for 2022. It is being provided in compliance with Part A of Seabrook Station's ODCM and Technical Specification 6.8.1.3.

2.0 Plant Operations Environmental Monitoring Program

Table 2.0-1 outlines the plant operations monitoring program as specified in the Seabrook Station ODCM, Part B, Section 4. Table 2.0-2 lists the operational sampling stations and their specific locations (distances are measured from the center of the Unit 1 Containment Building). The sampling locations are shown on maps in Figures 2.1 through 2.6. The sampling and analysis program as described above fulfills the minimum requirements for environmental sample collection and analysis as contained in ODCM Table A.9.1-1 and includes additional sampling of various pathways and locations beyond the minimum requirements.

Below are listed the two-letter media codes and what they represent:

AP	Air Particulate
CF	Charcoal Filter
TM	Milk
WG	Ground Water
WS	Surface (Sea) Water
SE	Sediment
FH	Fish
HA	Lobsters
MU	Mussels (Shellfish – edible portion only)
MS	Mussels (Shellfish – shell portion only)
TL	Direct Radiation (TLD)
AL	Irish Moss (algae)
TF	Food Crop
TG	Vegetation (broad-leaf)

Table 2.0-1

Plant Operations Radiological Environmental Monitoring Program

Media	Sampling Frequency	Required Analyses
Air Particulate (AP)	-Bi-Weekly -Quarterly Composite	Gross Beta Gamma spectroscopy
Charcoal Filter (CF)	-Bi-Weekly	I-131
Milk (TM)*	-Monthly (Semimonthly when animals are on pasture)	Gamma spectroscopy I-131
Surface (Sea) Water (WS)	-Monthly -Quarterly Composite	Gamma spectroscopy H-3 (composite)
Sediment (SE)	-Semiannually	Gamma spectroscopy
Fish & Invertebrates (FH, HA, MU)	-Quarterly or -Semiannually	Gamma spectroscopy
Direct Radiation (TL)	-Quarterly	Integrated gamma exposure
Irish Moss (AL)	-Semiannually	Gamma spectroscopy
Ground Water (WG)	-Quarterly	Gamma spectroscopy Gross Beta H-3
Food Crops (TF)	-Monthly/Growing Season	Gamma spectroscopy
Vegetation (TG)	-Monthly/Growing Season	Gamma spectroscopy I-131

* Note that broad leaf vegetation is substituted for milk due to insufficient number of required milk sampling locations in the site area.

Table 2.0-2

Plant Operations Radiological Environmental Monitoring Locations[a] [b]
2022

Station Code (Media - Sta. No.)	Station Description	Zone	Approx. Distance From Plant (km)	Direction From Plant
AP/CF-01+	PSNH Barge Landing Area	1	2.6	ESE
AP/CF-02+	Hampton Marina (Harbor Rd)	1	2.5	E
AP/CF-03+	Southwest Boundary (Rock Pile)	1	1.0	SW
AP/CF-04+	West Boundary (Plate Yard)	1	1.2	W
AP/CF-05	Winnacunnet High School	1	4.0	NNE
AP/CF-07+	PSNH Substation	1	5.7	NNW
AP/CF-08	E&H Substation	1	3.4	SSE
AP/CF-09+	Georgetown Electric Light Co.	2	21.4	SSW
TM-15	Hampton Falls, NH	1	6.9	NW
WG-01	Seabrook Town Wells	1	5.6	W
WG-13	Seabrook Station Well No.13	1	1.0	N
WG-14	Brimmer's Lane	1	1.3	NNW
WS-01+	Hampton-Discharge Area	1	5.1	E
WS-51+	Ipswich Bay	2	26.2	SSE
WS-10 *	Seabrook Marsh	1	0.18	SSE
SE-02	Hampton-Discharge Area	1	5.2	E
SE-07	Hampton Beach	1	3.3	E
SE-08+	Seabrook Beach	1	3.3	ESE
SE-52	Ipswich Bay	2	26.2	SSE
SE-57	Plum Island Beach	2	22.4	SSE
FH-03+	Hampton-Discharge Area	1	5.0	ESE
FH-53+	Ipswich Bay	2	23.3	SSE
FH-06	Hampton-Discharge Area	1	5.2	E
HA-04+	Hampton-Discharge Area	1	5.1	E
HA-54+	Ipswich Bay	2	27.9	SSE
MU-06+	Hampton-Discharge Area	1	5.2	E
MU-09	Hampton Harbor	1	2.5	E
MU-56+	Ipswich Bay	2	28.6	SSE
MU-59	Plum Island	2	22.0	SSE
MS-06	Hampton-Discharge Area	1	5.2	E
MS-56	Ipswich Bay	2	28.6	SSE
AL-05	Hampton-Discharge Area	1	5.2	E
AL-55	Ipswich Bay	2	28.7	SSE
TF-02	Hampton Falls, NH	1	5.0	WNW
TF-03	Salisbury, MA	1	5.1	SW
TF-06	Ipswich, MA	2	26.0	S

Table 2.0-2 (Cont'd)

Plant Operations Radiological Environmental Monitoring Locations[a] [b]
2022

Station Code (Media - Sta. No.)	Station Description	Zone	Approx. Distance From Plant (km)	Direction From Plant
TG-08+	North Access Rd, Site Boundary	1	1.05	W
TG-09+	General Office Bld. Site Boundary	1	0.97	SW
TG-10+	Georgetown Electric Light Co.	2	21.4	SSW
TL-01+	Brimmer's Lane, Hampton Falls	I	0.97	N
TL-02+	Landing Road, Hampton	I	3.0	NNE
TL-03+	Glade Path, Hampton Beach	I	2.9	NE
TL-04+	Island Path, Hampton Beach	I	2.3	ENE
TL-05+	Harbor Road, Hampton Beach	I	2.5	E
TL-06+	PSNH Barge Landing Area	I	2.7	ESE
TL-07+	Cross Road, Seabrook Beach	I	2.6	SE
TL-08+	Farm Lane, Seabrook	I	1.3	SSE
TL-09+	Farm Lane, Seabrook	I	1.3	S
TL-10+	Site Boundary Fence	I	1.1	SSW
TL-11+	Site Boundary Fence	I	1.0	SW
TL-12+	Site Boundary Fence	I	1.2	WSW
TL-13+	Inside Site Boundary	I	1.2	W
TL-14+	Trailer Park, Seabrook	I	1.3	WNW
TL-15+	Brimmer's Lane, Hampton Falls	I	1.4	NW
TL-16+	Brimmer's Lane Hampton Falls	I	1.2	NNW
TL-17+	South Road, North Hampton	0	7.8	N
TL-18+	Mill Road, North Hampton	0	7.6	NNE
TL-19+	Appledore Avenue, North Hampton	0	7.7	NE
TL-20+	Ashworth Avenue, Hampton Beach	0	3.2	ENE
TL-21+	Route 1A, Seabrook Beach	0	3.7	SE
TL-22+	Cable Avenue, Salisbury Beach	0	7.6	SSE
TL-23+	Ferry Road, Salisbury	0	8.1	S
TL-24+	Ferry Lots Lane, Salisbury	0	7.2	SSW
TL-25+	Elm Street, Amesbury	0	7.6	SW
TL-26+	Route 107A, Amesbury	0	8.1	WSW
TL-27+	Highland St. S. Hampton	0	7.5	W
TL-28+	Rte. 150, Kensington	0	7.5	WNW
TL-29+	Frying Pan Ln., Hampton Falls	0	7.2	NW
TL-30+	Route 27, Hampton	0	7.6	NNW

Table 2.0-2 (Cont'd)

Plant Operations Radiological Environmental Monitoring Locations[a] [b]
2022

Station Code (Media - Sta. No.)	Station Description	Zone	Approx. Distance From Plant (km)	Direction From Plant
TL-31+	Alumni Drive, Hampton	S	3.8	NNE
TL-32+	Seabrook Elementary School	S	2.0	S
TL-33+	Dock Area, Newburyport	S	9.8	S
TL-34+	Bow Street, Exeter	S	12.0	NW
TL-35+	Lincoln Ackerman School	S	2.3	NNW
TL-36+	Route 97, Georgetown	2	22.6	SSW
TL-37+	Post Office Plaistow, NH	2	21.5	WSW
TL-38+	Emerson St. Hampstead, NH	2	27.7	W
TL-39+	Fremont, NH	2	27.0	WNW
TL-40+	Newmarket, NH	2	21.6	NNW
TL-41	Portsmouth, NH	2	21.0	NNE
TL-42	Ipswich, MA	2	22.8	SSE
TL-44	Education (Science & Nature) Center	S	0.6	SW
TL-45	Hampton Fire Station	S	4.4	NE
TL-46	Seabrook Beach (near Police Station)	S	2.8	ESE
TL-47	Hampton Falls, NH	S	4.1	WNW

Zone indices are: 1 = Indicator Stations; 2 = Control Stations; 0 = Outer Ring TLD;
I = Inner Ring TLD; S = Special Interest TLD

+ = Sample Locations required by the Off-Site Dose Calculation Manual (ODCM)
* Note that WS-10 is the same location as WS-02 reported in previous reports.

(a) Dry Fuel Storage (DFS) locations are listed on Table 4.0-1.

(b) Table reflects those locations included in the 2022 sample collection program.

Figure 2.1 Radiological Environmental Monitoring Locations Within 4 Km of Seabrook Station

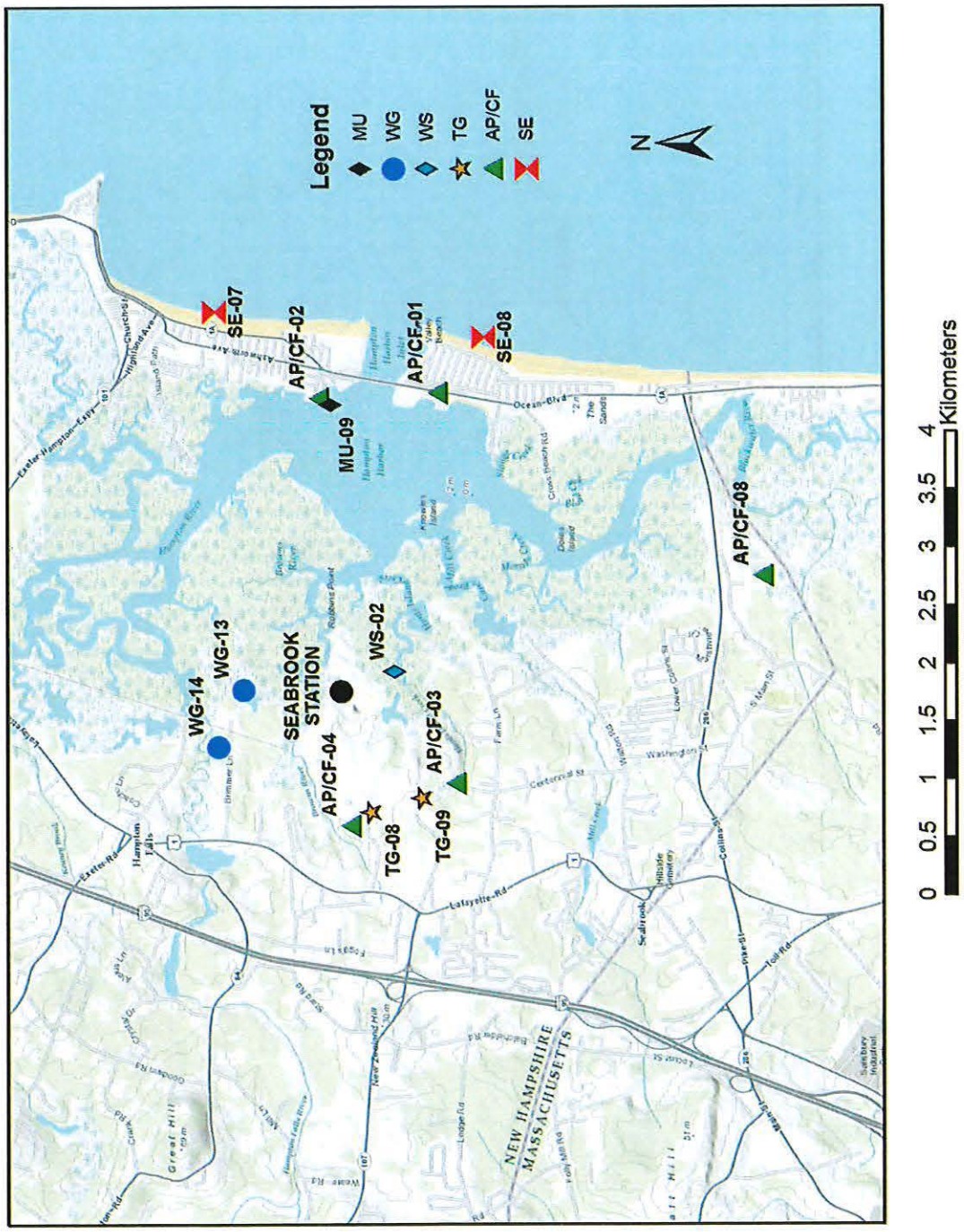


Figure 2.2 Radiological Environmental Monitoring Locations Between 4 & 12 Km of Seabrook Station

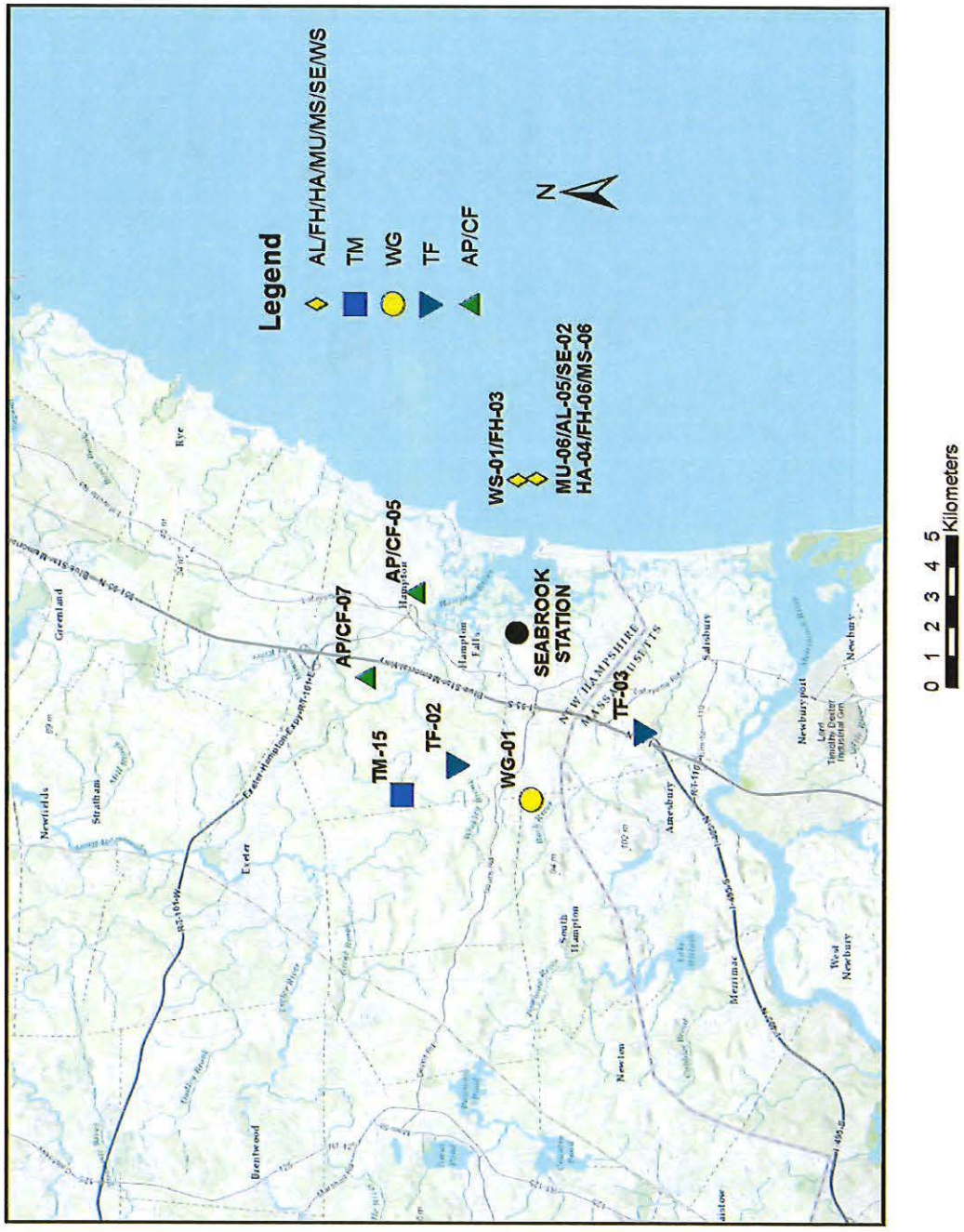


Figure 2.3 Radiological Environmental Monitoring Locations Outside 12 Km of Seabrook Station

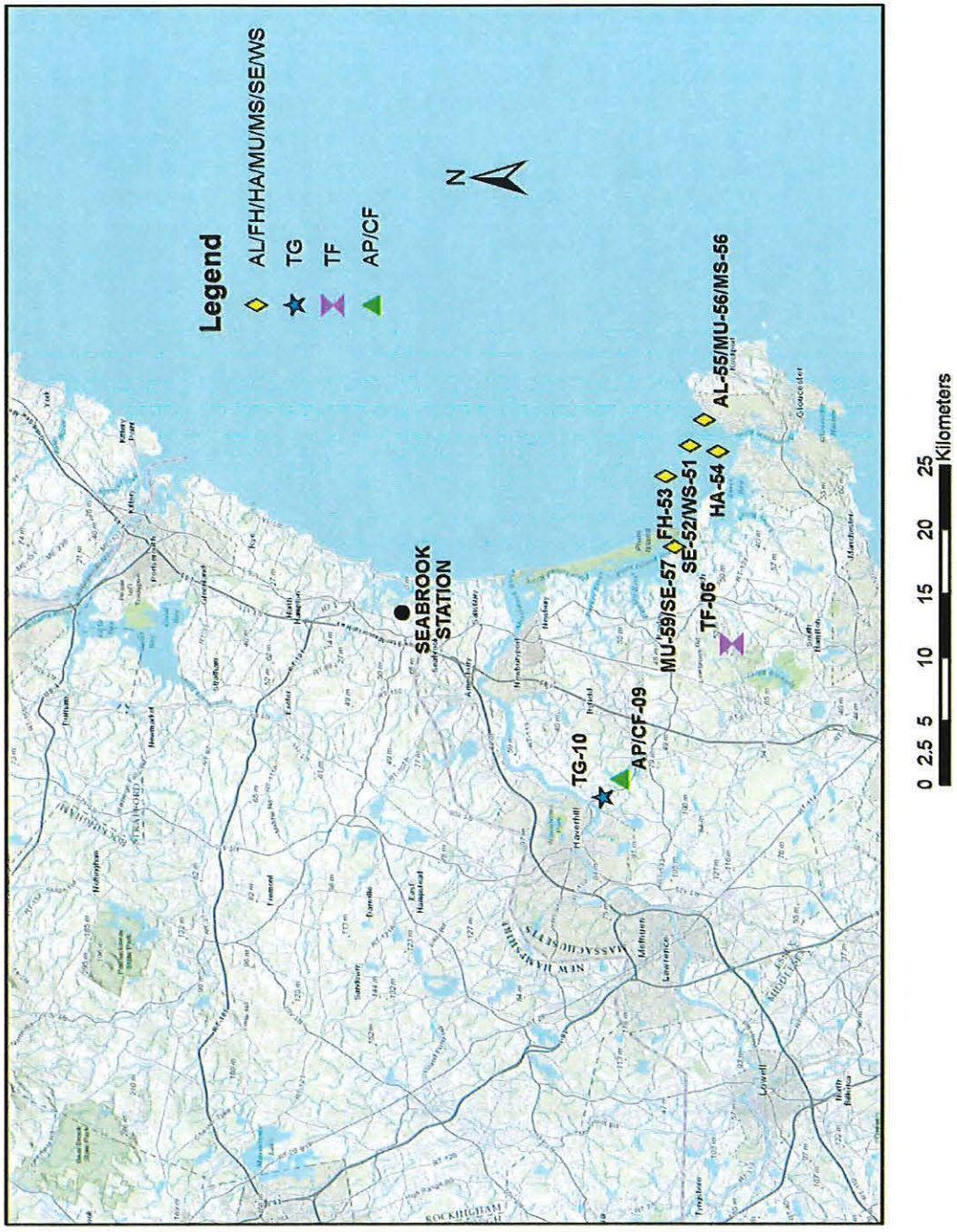


Figure 2.4 Direct Radiation Monitoring Locations Within 4 Km of Seabrook Station

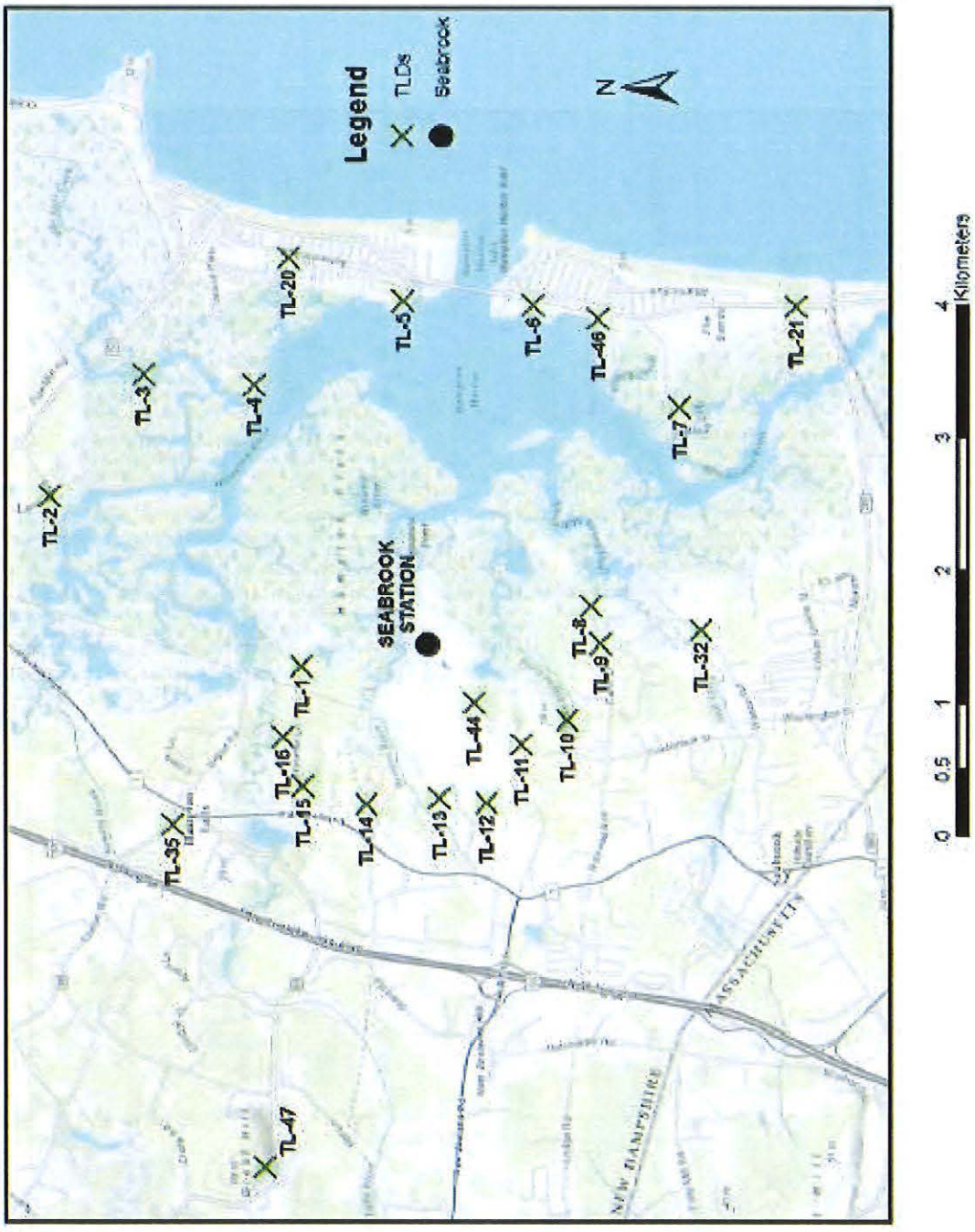


Figure 2.5 Direct Radiation Monitoring Locations Between 4 & 12 Km of Seabrook Station

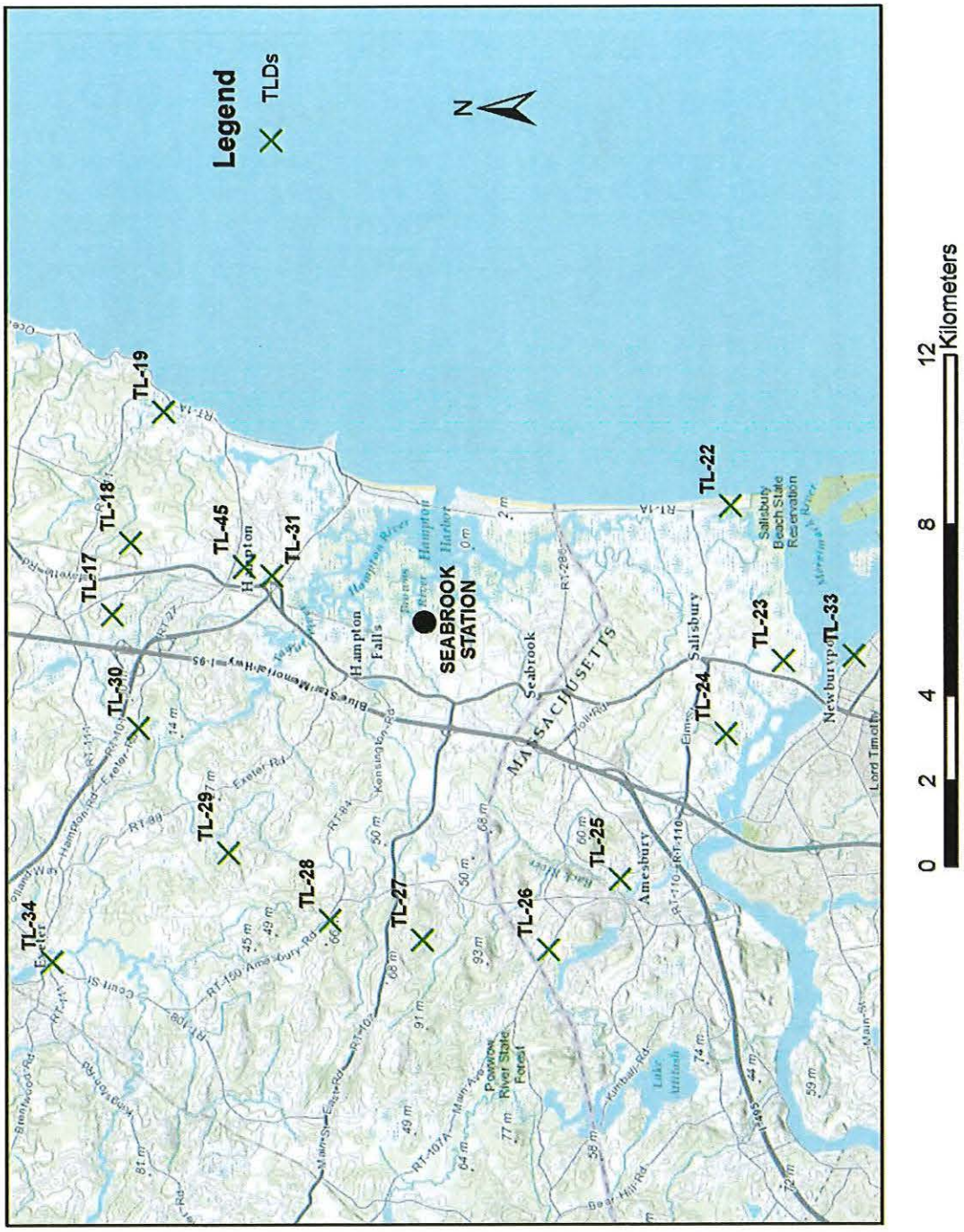
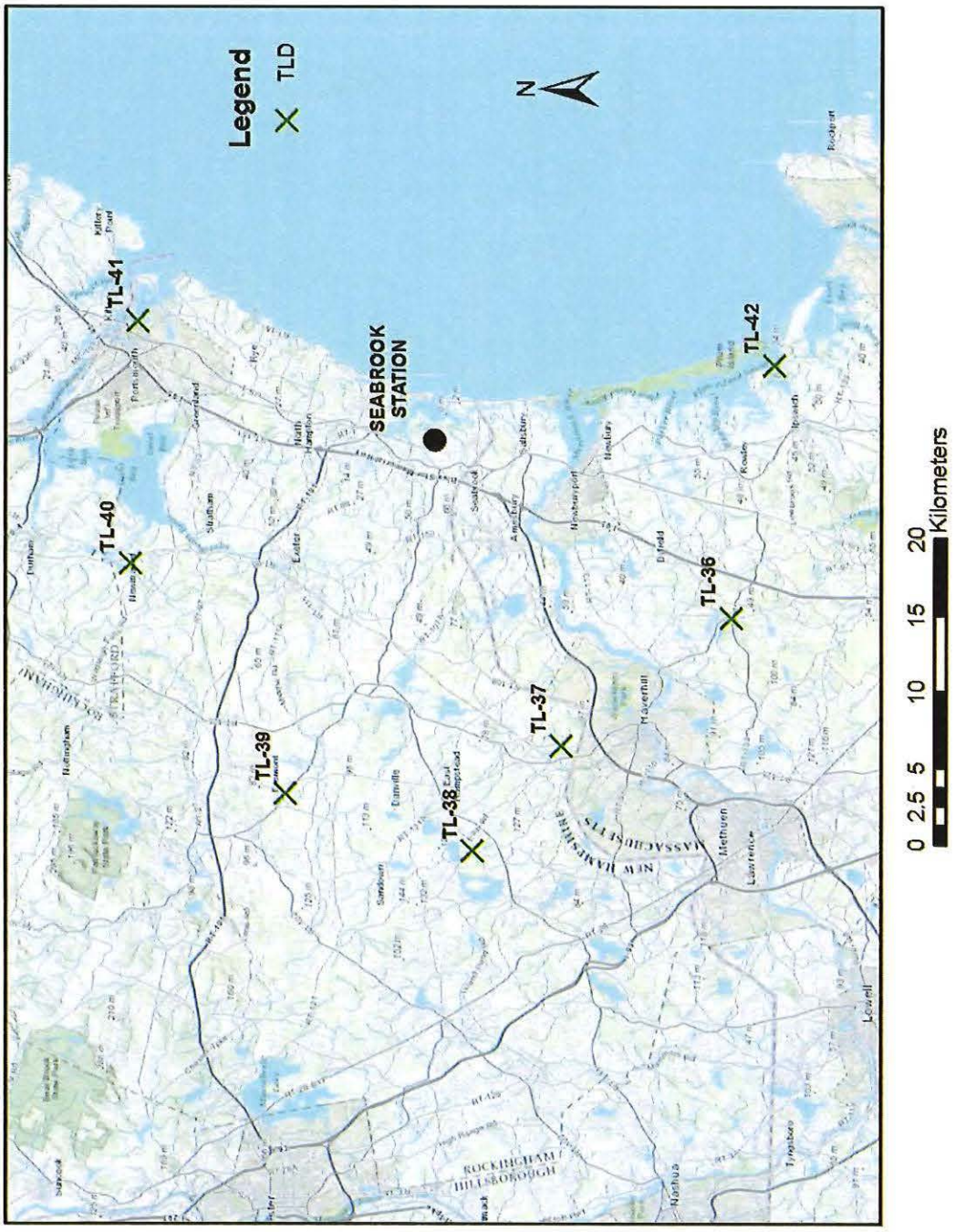


Figure 2.6 Direct Radiation Monitoring Locations Outside 12 Km of Seabrook Station



3.0 Summary of Plant Operations Radiological Environmental Monitoring Data

The following pages summarize the analytical results of the plant operations environmental samples collected in 2022. Each environmental media category is presented as a separate subsection. A table that summarizes the data follows a discussion of the sampling requirements and results for each media type. Listed at the top of each table are the units of measurement for each medium. The left-hand column contains the radionuclide which is being reported, total number of analyses of that radionuclide, and the number of measurements that exceed the required reporting level as documented in Table A.9.1-3 of the ODCM. The latter are classified as "non-routine" measurements. The next column lists the Lower Limit of Detection (LLD) for those radionuclides that have detection capability requirements specified in the ODCM.

Those sampling stations which are adjacent to the plant and which could conceivably be affected by the operation of Seabrook Station are called "Indicator" or "Zone 1" stations. Distant stations, which are beyond potential plant influences, are called "Control" or "Zone 2" stations.

A set of statistical parameters is calculated for each radionuclide. This set of statistical parameters includes separate analyses for (1) the indicator stations, (2) the station having the highest annual mean concentration for that radionuclide, and (3) control stations. For each of the three groups of data, these parameters are as follows:

- The mean value of all concentrations,
- The range of values and
- The number of positive measurements (a concentration which is greater than the MDC for the measurement) divided by the total number of measurements.

Each radioactivity measurement datum in this report is based on a single measurement and is reported as a concentration plus or minus a one standard deviation uncertainty. The quoted uncertainty term represents only the random uncertainty associated with the radioactive decay process (counting statistics), and not the propagation of all possible uncertainties in the analytical procedure.

Attachment 1 contains the data for the samples collected in 2022. The results are organized as follows: (1) by sample type; (2) within each sample type the data are alphabetical by nuclide; and (3) within each radionuclide listing the data are chronologically arranged by end date (date of sample collection).

The radionuclide value concentrations have been corrected for radioactive decay. For composite samples, such as air particulates and airborne iodine, the GEL laboratory uses the mid-point of the collection period as the reference for decay correction until time of analysis.

3.1 Air Particulate

Air monitoring stations were established at a total of eight locations, six locations required by the ODCM, Table A.9.1-1, and two additional sites included to supplement the program. Seven of the locations are indicators, while the remaining one is a control station located more than 21 km away from the plant.

Airborne particulates (AP) are collected by passing the air through a glass-fiber filter. In 2022, these filters were typically collected bi-weekly and held for a period (typically 100 hours or more) before being analyzed for gross-beta activity (indicated as BETA in Table 3.1-1) to allow for the decay of Radon and Thoron daughter products. Continuous automated and real-time remote monitoring of vital air sampling system parameters is performed with telemetry that detects power outages, pump failures, filter degradation, tubing failures and excessive filter loading. The telemetry communicates by cellular transmission to a web server that communicates to a shift technician's pager when set-point thresholds are reached, providing 24/7 alert notification. This capability provides for timely identification of problems and corrective actions that reduce the potential loss of air sampling. If periods of high dust loading during the collection period cause a higher than normal differential pressure drop across the collection filters, the collection period may be reduced to weekly cycles to reduce the dust loading. There were no recorded collection cycle reductions due to dust loading in 2022. For the year, 199 particulate filters were collected and analyzed for gross beta activity.

The 2022 gross beta activity analyses for the indicator locations were found to be statistically equivalent to that seen at the control station (positive activity for all samples). The gross beta results are also similar to what was seen in the pre-operational program and for the last thirty years of commercial operation, with the exception of the Fukushima Daiichi related spike in 2011. All filter samples from all stations showed similar trends lines (see Figure 3.1) over the course of the year and from previous years (see Figures 3.1.1, 3.1.2, and 3.1.3). Figure 3.1.4 compares the quarterly average gross beta response of all indicator air sampling stations to the control location over the last 28 years and shows no significant difference in the two data sets. It is also noted that no plant-related radionuclides (by gamma spectroscopy) were identified in any of the quarterly filter composite samples for 2022. The overall fluctuations at all stations seen in the gross beta activity throughout the year can be attributed to changes in environmental conditions unrelated to plant operations. Natural environmental processes such as wind direction, precipitation, snow cover, and soil temperature and moisture affect concentrations of naturally-occurring radionuclides in the atmosphere directly above land.

Gamma isotopic analyses of particulate filters are summarized on Table 3.1-1. The only radionuclides detected were naturally-occurring Be-7, which indicated positive in all air particulate samples, K-40, which occurred in five samples, and Th-228, which was positive in one sample. Be-7 is of cosmogenic origin, and its presence is consistent with previous years in both the pre-operational and operational periods.

Near the end of 2010, analysis of environmental samples was changed from the AREVA Environmental Laboratory to GEL Laboratory after the AREVA lab discontinued operations. In comparing long term trends in gross beta activity, the results since 2011 appear to reflect a step increase at the time of the transition between labs. The reason for the step increase is related to the change in the gross beta counting equipment configurations and reference calibration standards used by the AREVA lab and GEL. Both labs use(d) gas proportional counting of the filter element. However, AREVA applied a Cs-137 calibration source while the GEL lab uses a Tc-99 calibration source. In the case of the AREVA data record, the Cs-137 detection efficiency (typically 34%) was applied to the "gross" counts to determine the apparent activity. This inherently presumes that the radioactivity in a field sample is all Cs-137. In the case of the GEL data record, the Tc-99 efficiency (20.6%), is applied to the same "gross" counts as if all the radioactivity in this case is Tc-99. The end result is two different gross beta radioactivity determinations for the same level of environmental activity. In application, this is not an adverse condition in that the gross beta counting is used as a qualitative indicator of changes in environmental conditions, not as a quantitative measure of the actual radioactivity. Since the comparison of the response curves for each monitoring station, including the control station, are similar over time, the curves indicate that there is no detectable influence from a single nearby point source such as Seabrook Station.

The air particulate sampling program demonstrated no off-site dose to the public or impact to the environment from this pathway as the result of plant operations. This is consistent with previous years and the pre-operational program. The REMP Summary Table 3.1-1 lists the range of analysis results by

radionuclide for Indicator and Control Stations for the air particulate environmental media. Attachment 1 to this report lists the individual analysis results for each measurement of air particulates under the Sample Type code AP.

Air particulate sample collection and analysis deviations from the ODCM required program (if any) are described in Section 5.

FIGURE 3.1

GROSS-BETA MEASUREMENTS OF AIR PARTICULATE FILTERS
SEABROOK STATION

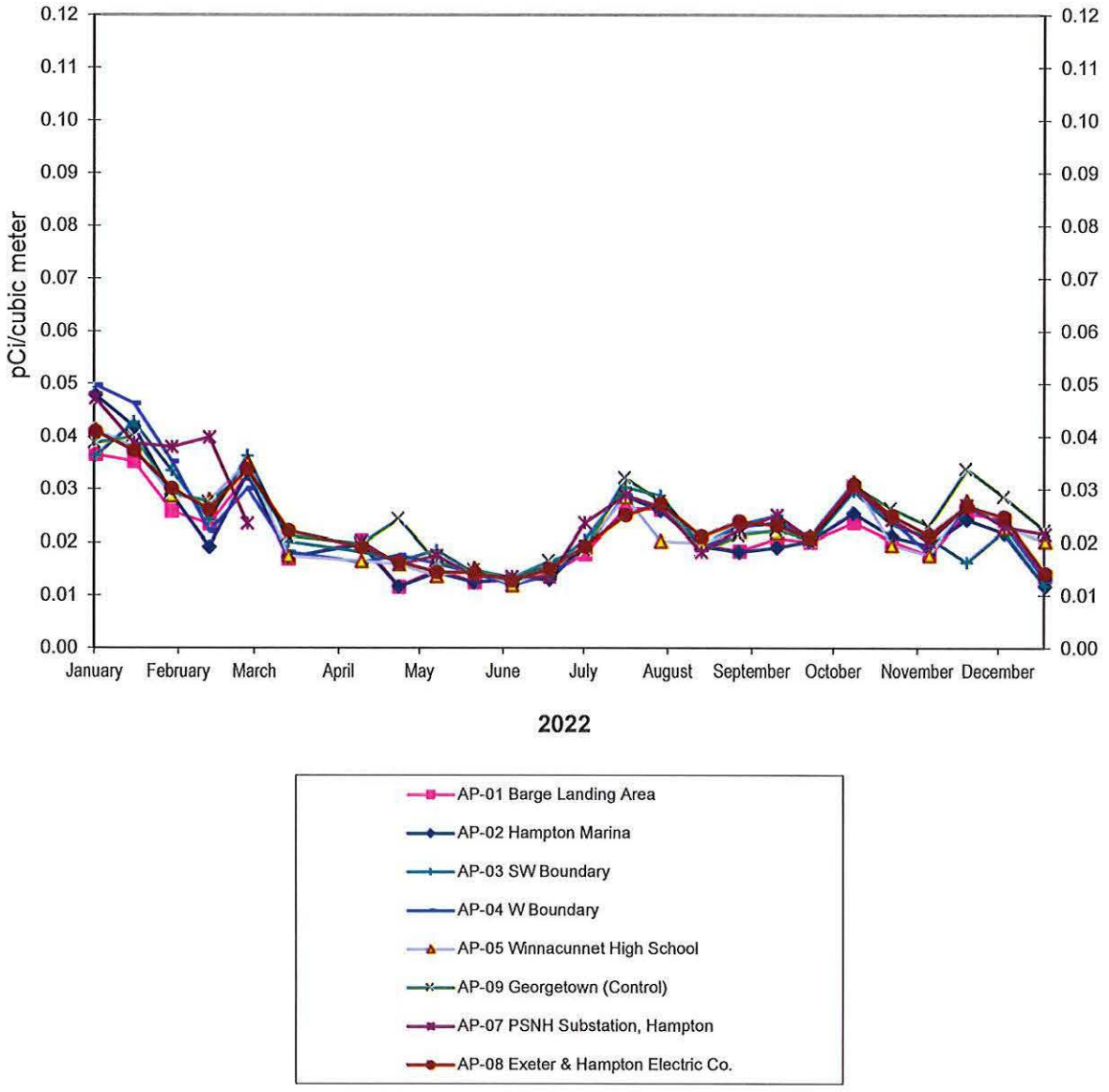


FIGURE 3.1.1

GROSS-BETA MEASUREMENTS OF AIR PARTICULATE FILTERS QUARTERLY AVERAGES
SEABROOK STATION

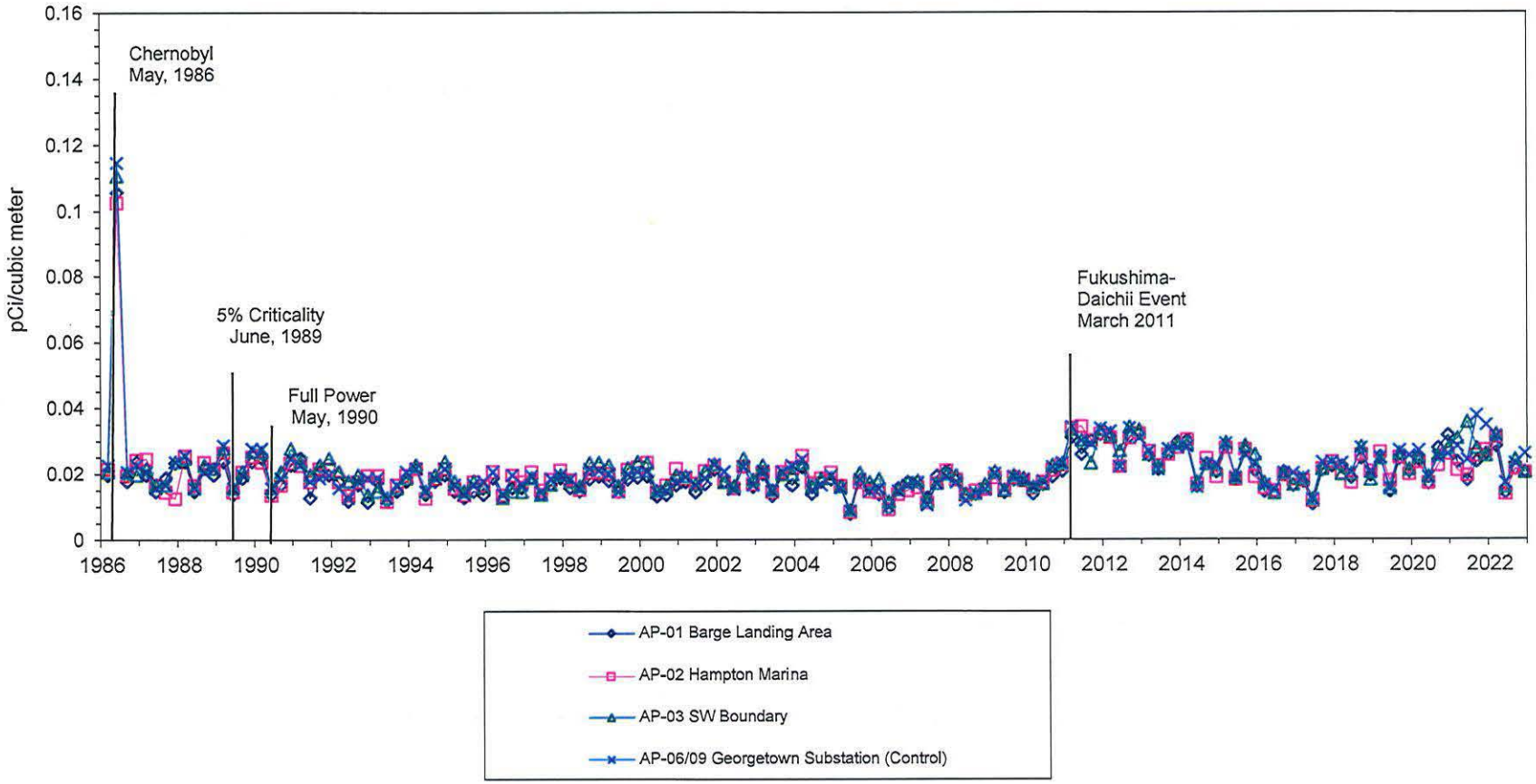


FIGURE 3.1.2

GROSS-BETA MEASUREMENTS OF AIR PARTICULATE FILTERS QUARTERLY AVERAGES
SEABROOK STATION

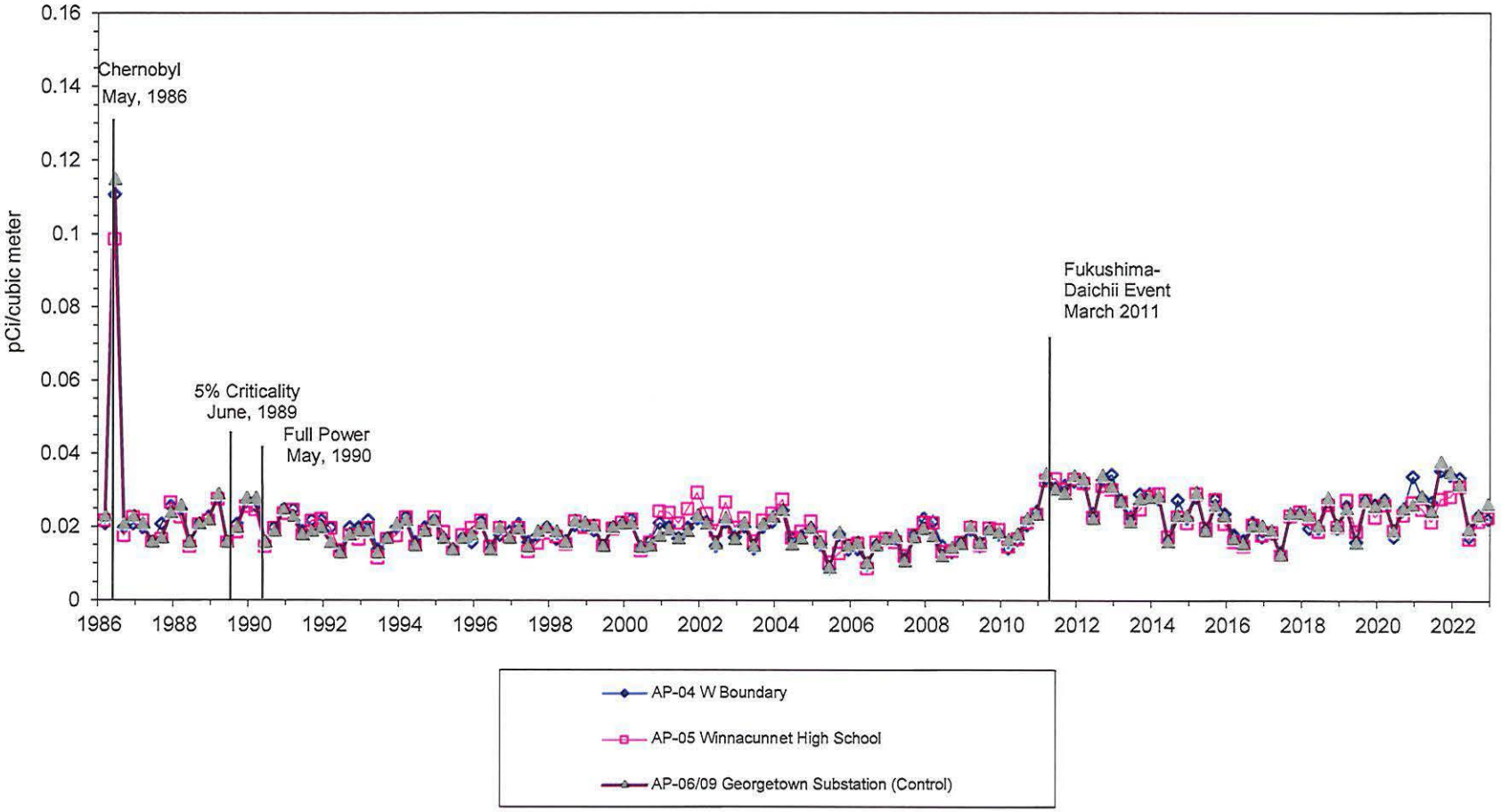


FIGURE 3.1.3

GROSS-BETA MEASUREMENTS OF AIR PARTICULATE FILTERS QUARTERLY AVERAGES
SEABROOK STATION

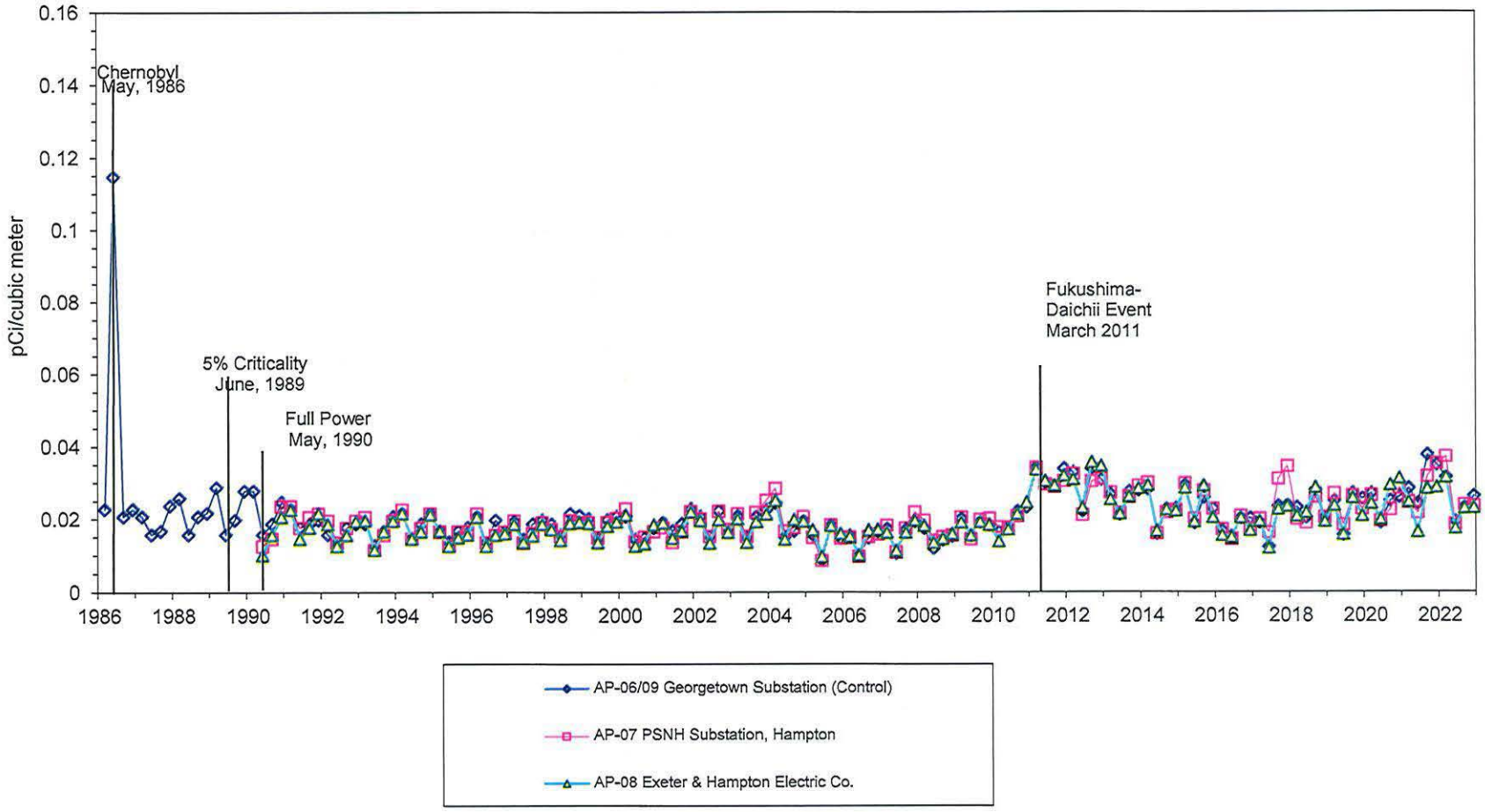


FIGURE 3.1.4

GROSS-BETA ON AIR PARTICULATE FILTERS
QUARTERLY AVERAGES
SEABROOK STATION

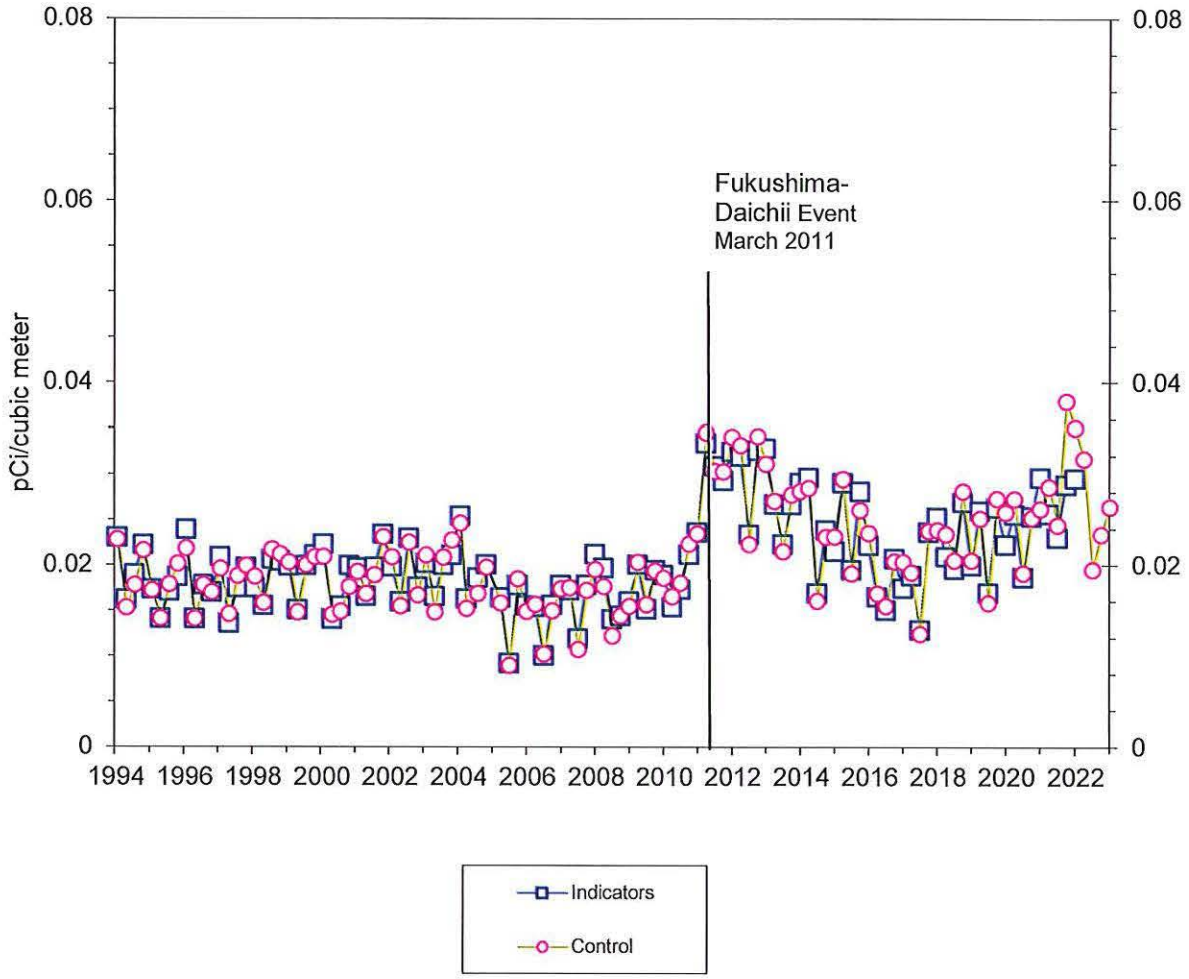


Table 3.1-1
Radiological Environmental Program Summary
Seabrook Nuclear Power Station, Seabrook, NH
(January - December 2022)

MEDIUM: Air Particulates (AP) UNITS: pCi/cubic meter

Radionuclides (No. Analyses) (Non-Routine*)		Required LLD	Indicator Stations Mean Range (No. Detected**)	Station With Highest Mean Station	 Mean Range (No. Detected**)	Control Stations Mean Range (No. Detected**)
BETA	(199)	0.01	2.3E -2	09	2.5E -2	2.5E -2
	(0)		(1.2 - 5.0)E -2 (174/ 174)		(1.3 - 4.0)E -2 (25/ 25)	(1.3 - 4.0)E -2 (25/ 25)
Be-7	(32)		9.3E -2	09	1.0E -1	1.0E -1
	(0)		(6.5 - 15.0)E -2 (28/ 28)		(8.0 - 11.3)E -2 (4/ 4)	(8.0 - 11.3)E -2 (4/ 4)
K-40	(32)		9.1E -4	09	2.6E -3	2.6E -3
	(0)		(-3.5 - 6.3)E -3 (4/ 28)		(-5.2 - 79.5)E -4 (1/ 4)	(-5.2 - 79.5)E -4 (1/ 4)
Cr-51	(32)		2.2E -4	02	5.1E -3	1.1E -3
	(0)		(-1.2 - 0.9)E -2 (0/ 28)		(3.1 - 8.7)E -3 (0/ 4)	(-2.7 - 4.3)E -3 (0/ 4)
Mn-54	(32)		0.0E 0	05	8.0E -5	3.1E -5
	(0)		(-1.8 - 3.6)E -4 (0/ 28)		(-1.6 - 3.6)E -4 (0/ 4)	(-7.0 - 13.2)E -5 (0/ 4)
Co-57	(32)		1.0E -5	07	4.8E -5	1.8E -5
	(0)		(-7.9 - 8.1)E -5 (0/ 28)		(2.0 - 8.1)E -5 (0/ 4)	(-6.1 - 10.7)E -5 (0/ 4)
Co-58	(32)		-2.1E -5	01	1.3E -4	8.6E -5
	(0)		(-4.2 - 2.4)E -4 (0/ 28)		(4.2 - 22.0)E -5 (0/ 4)	(2.7 - 13.0)E -5 (0/ 4)
Fe-59	(32)		1.7E -4	07	5.2E -4	2.7E -4
	(0)		(-1.1 - 1.5)E -3 (0/ 28)		(-2.6 - 12.0)E -4 (0/ 4)	(-9.1 - 82.3)E -5 (0/ 4)
Co-60	(32)		-1.0E -5	07	1.1E -4	2.6E -5
	(0)		(-2.6 - 3.2)E -4 (0/ 28)		(-1.1 - 31.5)E -5 (0/ 4)	(-3.1 - 9.7)E -5 (0/ 4)
Zn-65	(32)		-3.6E -5	08	4.9E -5	-8.0E -5
	(0)		(-2.7 - 2.9)E -4 (0/ 28)		(-1.3 - 2.2)E -4 (0/ 4)	(-1.9 - 1.8)E -4 (0/ 4)
Se-75	(32)		4.0E -5	07	2.1E -4	-8.6E -5
	(0)		(-2.7 - 4.1)E -4 (0/ 28)		(5.3 - 40.5)E -5 (0/ 4)	(-1.4 - 0.3)E -4 (0/ 4)
Nb-95	(32)		-5.9E -5	05	1.6E -5	0.0E 0
	(0)		(-5.3 - 3.9)E -4 (0/ 28)		(-2.2 - 1.2)E -4 (0/ 4)	(-2.3 - 1.6)E -4 (0/ 4)
Zr-95	(32)		6.8E -5	08	2.4E -4	-1.6E -4
	(0)		(-4.7 - 9.2)E -4 (0/ 28)		(-5.2 - 41.8)E -5 (0/ 4)	(-6.6 - 3.4)E -4 (0/ 4)
Ru-103	(32)		1.1E -4	07	2.7E -4	9.6E -5
	(0)		(-5.1 - 12.8)E -4 (0/ 28)		(-3.0 - 12.8)E -4 (0/ 4)	(-6.1 - 43.3)E -5 (0/ 4)

* Non-Routine refers to those radionuclides that exceeded the Reporting Levels in ODCM Table A.9.1-3.
** The fraction of detectable measurements (i.e., > MDC with no uncertain identification) is shown in parentheses.

Table 3.1-1 (Continued)
Radiological Environmental Monitoring Program Summary
Seabrook Nuclear Power Station, Seabrook, NH
(January - December 2022)

MEDIUM: Air Particulates (AP) UNITS: pCi/cubic meter

Radionuclides (No. Analyses) (Non-Routine*)		Required LLD	Indicator Stations Mean Range (No. Detected**)	Station With Highest Mean Station	Mean Range (No. Detected**)	Control Stations Mean Range (No. Detected**)
Ru-106	(32)		-1.6E -4	04	2.9E -4	-3.7E -4
	(0)		(-1.4 - 2.1)E -3 (0/ 28)		(-1.1 - 2.1)E -3 (0/ 4)	(-7.3 - -1.7)E -4 (0/ 4)
Ag-108m	(32)		1.4E -5	05	8.7E -5	2.1E -5
	(0)		(-8.4 - 21.4)E -5 (0/ 28)		(-1.6 - 21.4)E -5 (0/ 4)	(-1.1 - 1.3)E -4 (0/ 4)
Ag-110m	(32)		-1.8E -5	03	9.7E -5	-1.0E -4
	(0)		(-4.1 - 2.5)E -4 (0/ 28)		(-8.0 - 24.7)E -5 (0/ 4)	(-1.7 - -0.2)E -4 (0/ 4)
Sb-124	(32)		2.0E -4	04	6.0E -4	-5.1E -5
	(0)		(-1.2 - 2.1)E -3 (0/ 28)		(5.7 - 94.7)E -5 (0/ 4)	(-6.2 - 7.1)E -4 (0/ 4)
Sb-125	(32)		4.3E -5	07	1.7E -4	-5.9E -5
	(0)		(-3.2 - 4.5)E -4 (0/ 28)		(-2.2 - 3.8)E -4 (0/ 4)	(-2.3 - 1.5)E -4 (0/ 4)
I-131	(32)		-5.4E -2	01	-8.9E -3	-7.6E -2
	(0)		(-5.1 - 0.1)E -1 (0/ 28)		(-3.2 - 0.0)E -2 (0/ 4)	(-2.8 - 0.2)E -1 (0/ 4)
Cs-134	(32)	0.05	2.8E -5	07	5.4E -5	-1.7E -5
	(0)		(-1.7 - 2.5)E -4 (0/ 28)		(1.4 - 8.7)E -5 (0/ 4)	(-1.0 - 1.3)E -4 (0/ 4)
Cs-137	(32)	0.06	0.0E 0	09	9.7E -5	9.7E -5
	(0)		(-3.7 - 2.3)E -4 (0/ 28)		(-1.2 - 1.9)E -4 (0/ 4)	(-1.2 - 1.9)E -4 (0/ 4)
Ba-140	(32)		2.3E -3	01	2.4E -2	-5.7E -3
	(0)		(-6.7 - 8.6)E -2 (0/ 28)		(-1.1 - 8.6)E -2 (0/ 4)	(-4.7 - 2.6)E -2 (0/ 4)
La-140	(32)		-5.3E -3	07	-7.1E -4	-6.2E -3
	(0)		(-3.1 - 1.1)E -2 (0/ 28)		(-7.9 - 9.4)E -3 (0/ 4)	(-1.5 - 0.0)E -2 (0/ 4)
Ce-141	(32)		-3.3E -4	08	2.1E -4	-1.7E -4
	(0)		(-2.4 - 1.0)E -3 (0/ 28)		(-6.5 - 9.8)E -4 (0/ 4)	(-1.4 - 1.2)E -3 (0/ 4)
Ce-144	(32)		0.0E 0	07	1.1E -4	-1.7E -4
	(0)		(-5.4 - 8.2)E -4 (0/ 28)		(-1.9 - 5.8)E -4 (0/ 4)	(-4.4 - -0.1)E -4 (0/ 4)
Ac-228	(32)		3.0E -4	05	6.0E -4	4.2E -4
	(0)		(-5.7 - 14.0)E -4 (0/ 28)		(2.7 - 10.0)E -4 (0/ 4)	(0.0 - 1.2)E -3 (0/ 4)
Th-228	(32)		1.5E -4	04	2.8E -4	2.0E -4
	(0)		(-8.3 - 79.0)E -5 (1/ 28)		(2.2 - 79.0)E -5 (1/ 4)	(0.0 - 3.2)E -4 (0/ 4)

* Non-Routine refers to those radionuclides that exceeded the Reporting Levels in ODCM Table A.9.1-3.
** The fraction of detectable measurements (i.e., > MDC with no uncertain identification) is shown in parentheses.

3.2 Charcoal Filters

Charcoal filter (CF) cartridges are placed in series behind the air particulate glass-fiber filters at each of the air sampling locations. Monitoring stations were established at a total of eight locations. Seven of these are indicators and one is a control. Charcoal filters from the air sampling stations were collected and analyzed for I-131 activity to a lower limit of detection (LLD) of 0.07 pCi/m^3 or lower.

During 2022, a total of 200 charcoal cartridges from eight locations were analyzed. As described for the air particulate samplers (see Section 3.1), the collection cycles for the charcoal filters were biweekly during 2022. Off-normal conditions, such as observed high differential pressure across the associated particulate filter (none detected in 2022) which might be indicative of excessive dust loading, could prompt switching to a temporary weekly cycle (see Section 3.1).

No sample analyses indicated a detectable level for I-131 that was statistically relevant (positive) at any of the air sampling locations during the year. Figure 3.2 shows the I-131 measurement responses in 2022 for all air sampling stations. All analyses were below their respective measurement minimum detectable concentrations (MDC).

From initial criticality in June 1989 to the Fukushima Daiichi accident in March 2011, the Seabrook REMP program had not detected I-131 at any offsite air sample locations. Following the March – April 2011 air concentration spikes of I-131 related to the Fukushima Daiichi accident releases, no detectable I-131 has been observed. The pre-operational data for I-131 are consistent with present (2022) data. Therefore, there are no increasing or decreasing trends related to Seabrook Station operations for airborne I-131. The potential organ doses from I-131 in gaseous effluents, if assumed to be released at the MDA, are well below the 10CFR50, Appendix I dose criteria.

The REMP Summary Table 3.2-1 list the range of analysis results for iodine (I-131) at both Indicator and Control Stations. Attachment 1 to this report lists the individual analysis results for each air sample measurement under the Sample Type code CF.

Charcoal filter sample collection and analysis deviations from the ODCM required program (if any) are described in Section 5.

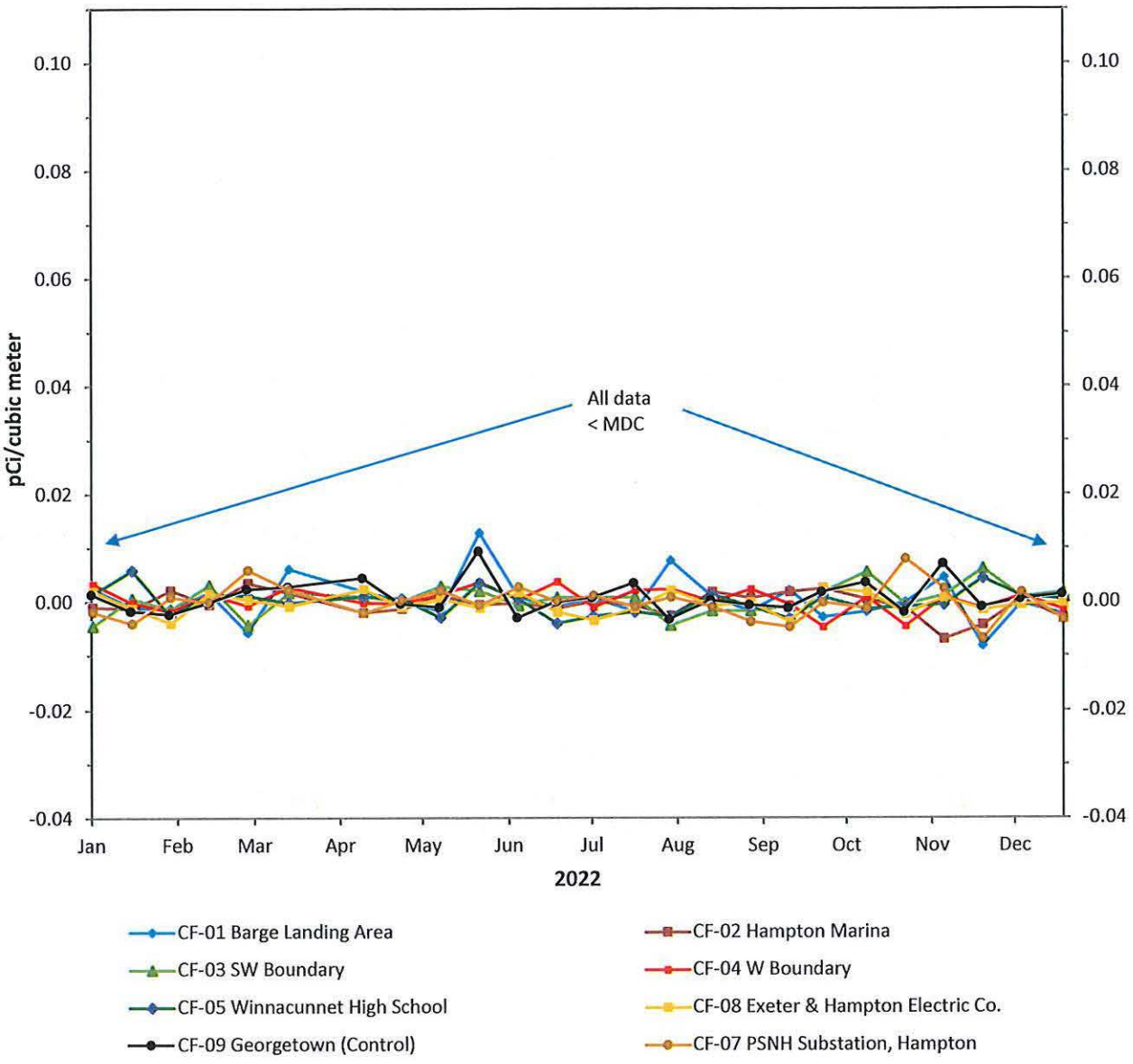
Table 3.2-1
Radiological Environmental Monitoring Program Summary
Seabrook Nuclear Power Station, Seabrook, NH
(January - December 2022)

MEDIUM: Charcoal Cartridge (CF) UNITS: pCi/cubic meter

Radionuclides (No. Analyses) (Non-Routine*)		Required LLD	Indicator Stations: Mean Range (No. Detected**)	Station With Highest Mean: Station	Station With Highest Mean: Mean Range (No. Detected**)	Control Stations: Mean Range (No. Detected**)
I-131	(200) (0)	0.07	1.4E -4 (-8.1 - 12.9)E -3 (0/ 175)	09	9.0E -4 (-3.3 - 9.4)E -3 (0/ 25)	9.0E -4 (-3.3 - 9.4)E -3 (0/ 25)

* Non-Routine refers to those radionuclides that exceeded the Reporting Levels in ODCM Table A.9.1-3.
** The fraction of detectable measurements (i.e., > MDC with no uncertain identification) is shown in parentheses.

FIGURE 3.2
I-131 MEASUREMENTS OF AIR CHARCOAL CARTRIDGES
SEABROOK STATION



3.3 Milk

Milk samples (TM) were collected semi-monthly during the pasture season and monthly at other times. Samples are analyzed for low level I-131 and gamma-emitting radionuclides.

The ODCM (Table A.9.1-1) requires that milk samples be collected from three locations within 5 km of the plant having the highest dose potential. If there are none, then one sample is required from milking animals in each of three areas between 5 to 8 km from the plant where the doses are calculated to be greater than 1 mrem/yr. Due to the limited inventory of milk animals in the site area, as reconfirmed by the 2022 Land Use Census, the number of available sample locations required by the ODCM sampling program could not be met (insufficient numbers of milk animals within 5 km, and only one milk location [designated TM-15] between 5 and 8 km). The ODCM allows for broad leaf vegetation samples to be collected if milk sampling cannot be performed in accordance with the REMP requirements. As a result, two site boundary locations and one control location are sampled for vegetation to compensate for the limited milk availability (see Section 3.12).

A total of 18 milk samples were collected during the year from one available location. Each sample was analyzed for gamma emitting radionuclides. In addition, all samples were evaluated for low levels of I-131 through an iodine extraction process. The gamma analyses on samples indicated that naturally-occurring K-40 was detectable in all milk samples and naturally-occurring Bi-214 was detected in one sample. Also detected in twelve milk samples was Cs-137 at an average concentration of 6.23 pCi/kg (positive measurements only) which falls in the range of past and pre-operational measurements. The highest single Cs-137 analysis result in 2022 was 13.7 pCi/kg. Though the Fukushima Daiichi event in March 2011 may have contributed to the Cs-137 levels observed in milk in 2022, Cs-137 has historically been detected at similar levels in milk before the nuclear accident in Japan. Residual Cs-137 from past weapons testing fallout has been the major contributor attributed to the currently observed values in milk. Figures 3.3, 3.3.1 and 3.3.2 illustrate the analysis results (without regard to whether individual analysis indicated detectable or statistically not detectable concentrations) for Cs-137 in milk over the current period (2022) and previous years.

Iodine-131 was not positively identified at any location for the year. This is consistent with previous years for both the pre-operational and operational phases of the program. No increasing or decreasing trends in the radioactivity content of milk were observed.

The REMP Summary Table 3.3-1 lists the range of analysis results by radionuclide for the Indicator station (Historical Control Stations for the milk have ceased operations). Attachment 1 to this report lists the individual analysis results for each measurement of milk under the Sample Type code TM. Section 5 identifies deviations in the sample measurement program (if any), such as missed lower limits of detection (LLD) requirements.

FIGURE 3.3

CESIUM-137 IN MILK
SEABROOK STATION

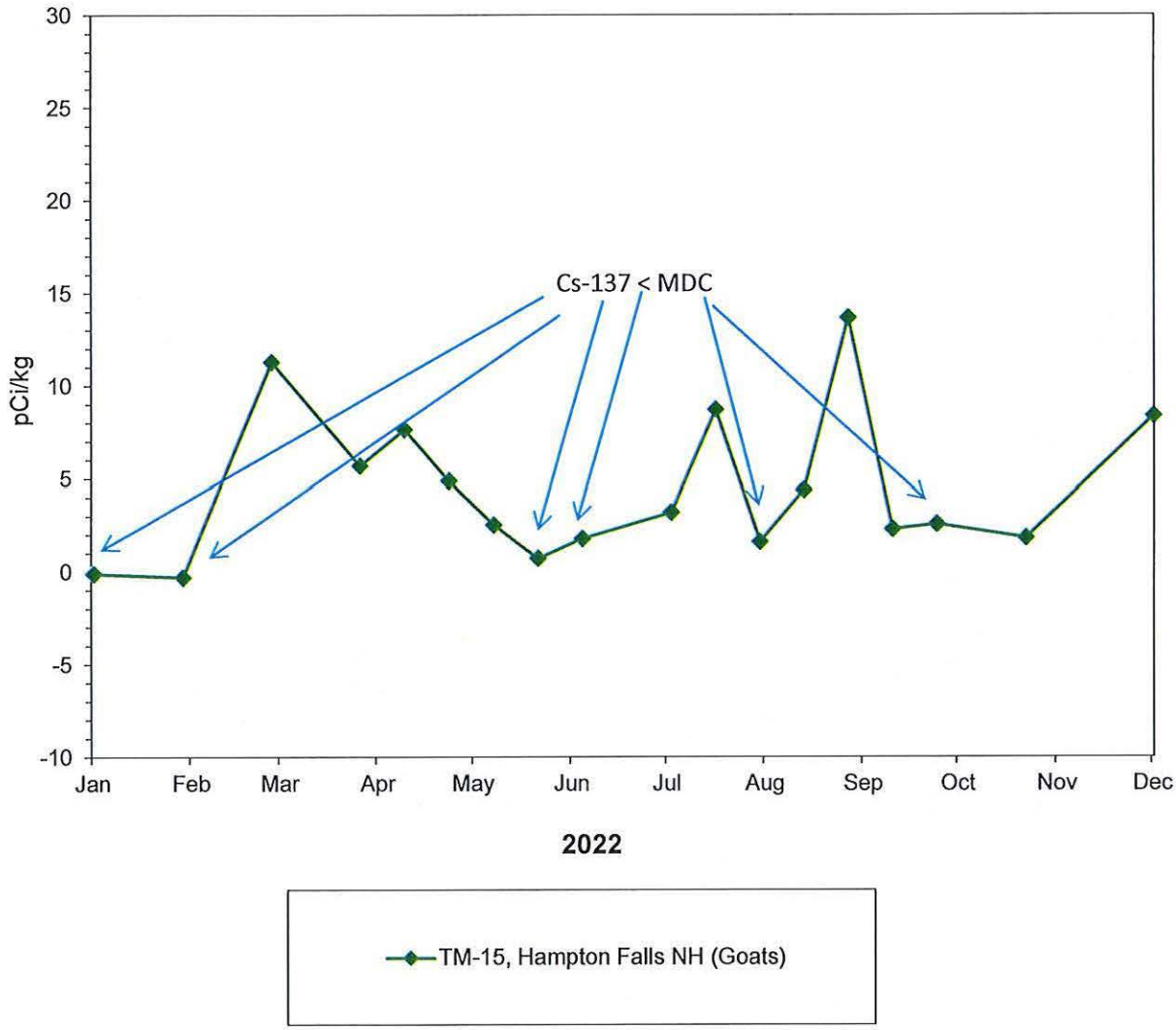


FIGURE 3.3.1

CESIUM-137 IN MILK
ANNUAL AVERAGE CONCENTRATIONS

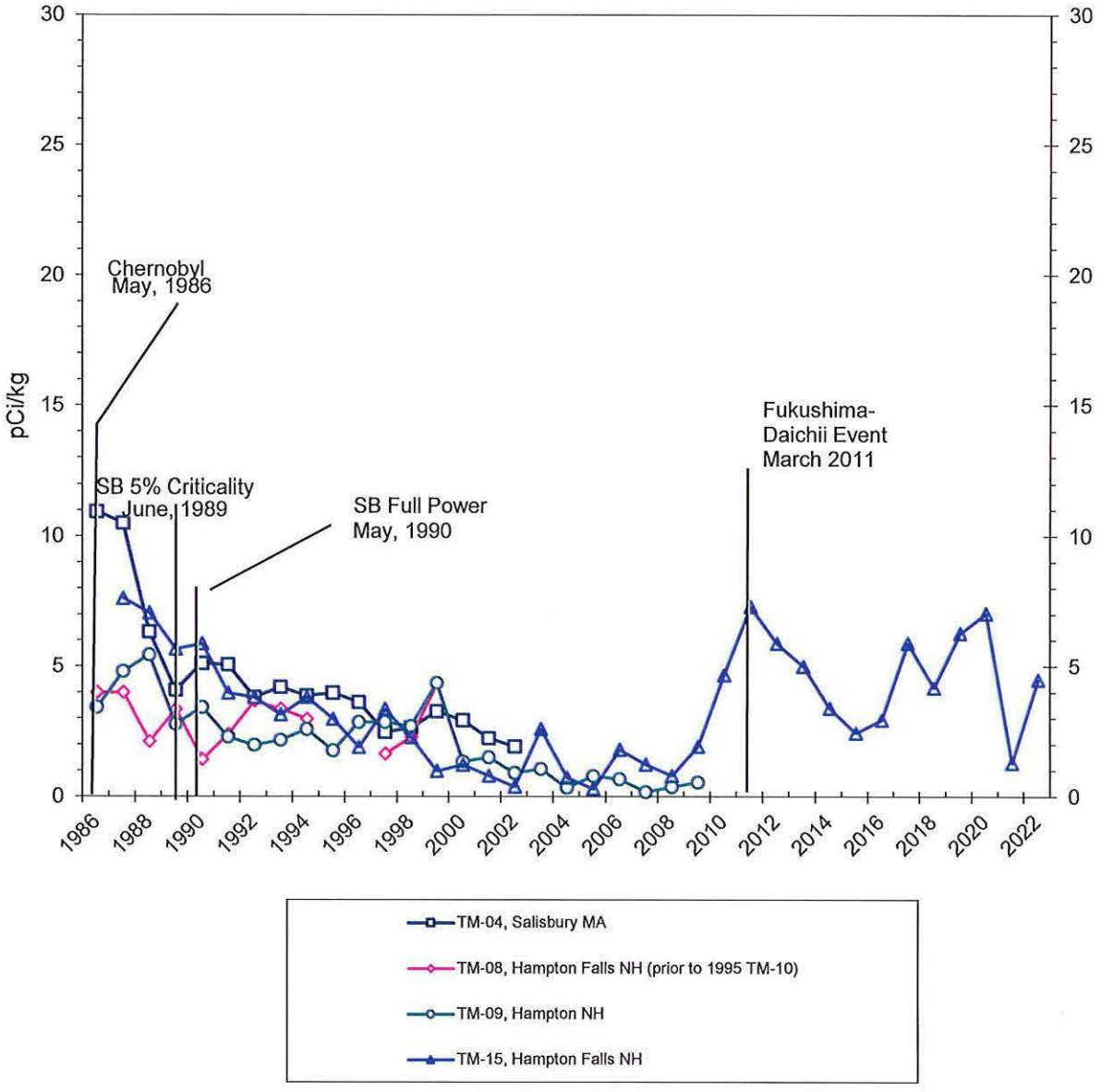


FIGURE 3.3.2

CESIUM-137 IN MILK
ANNUAL AVERAGE CONCENTRATIONS

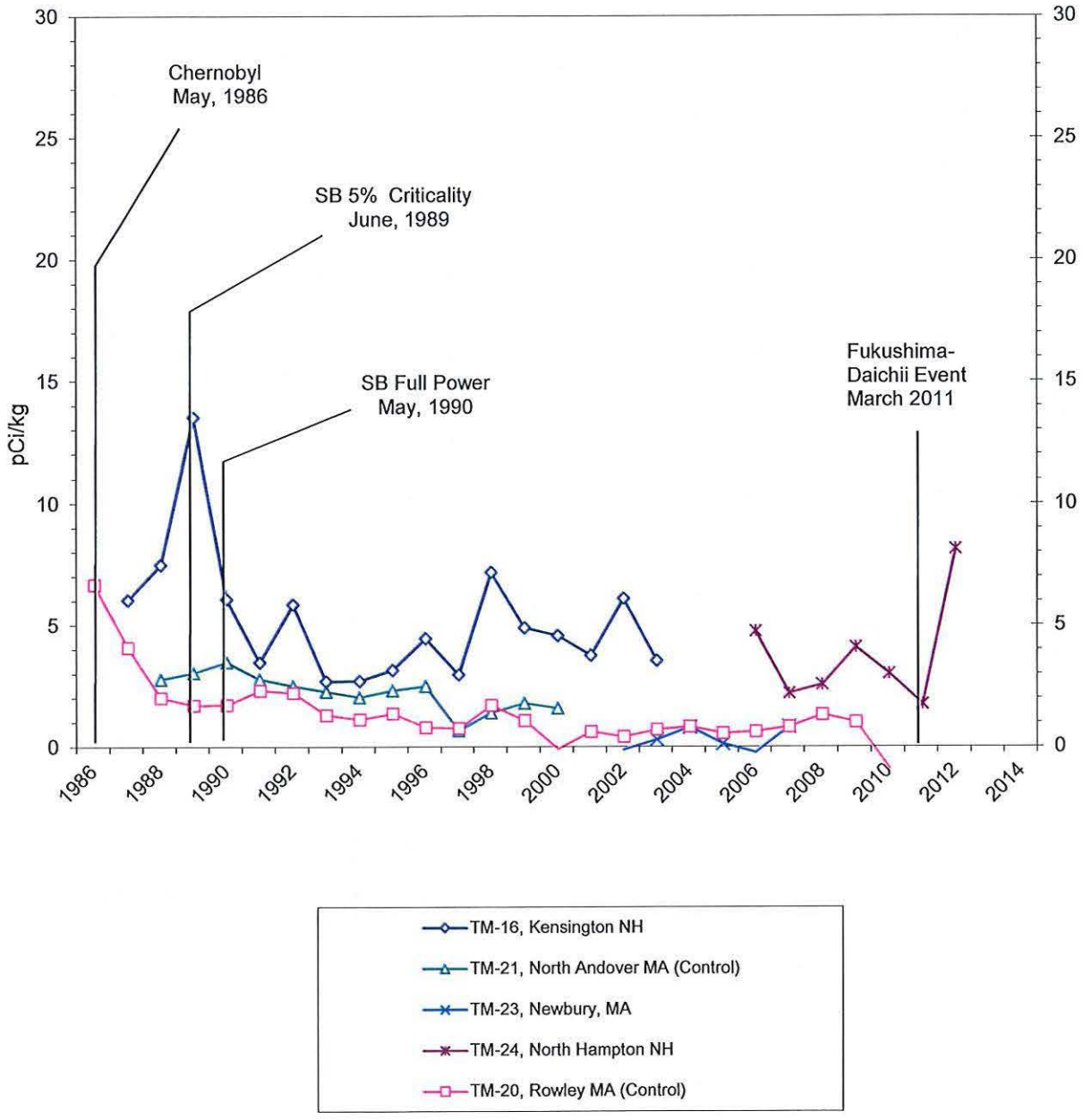


Table 3.3-1
Radiological Environmental Program Summary
Seabrook Nuclear Power Station, Seabrook, NH
(January - December 2022)

MEDIUM: Milk (TM) UNITS: pCi/kg

Radionuclides (No. Analyses) (Non-Routine*)		Required LLD	Indicator Stations Mean Range (No. Detected**)	Station With Highest Mean Station	Station With Highest Mean Mean Range (No. Detected**)	Control Stations Mean Range (No. Detected**)
Be-7	(18)		-1.8E 0	15	-1.8E 0	NO DATA
	(0)		(-1.2 - 1.1)E 1 (0/ 18)		(-1.2 - 1.1)E 1 (0/ 18)	
K-40	(18)		1.7E 3	15	1.7E 3	NO DATA
	(0)		(1.5 - 2.0)E 3 (18/ 18)		(1.5 - 2.0)E 3 (18/ 18)	
Cr-51	(18)		-2.3E 0	15	-2.3E 0	NO DATA
	(0)		(-7.7 - 3.5)E 0 (0/ 18)		(-7.7 - 3.5)E 0 (0/ 18)	
Mn-54	(18)		-7.9E -2	15	-7.9E -2	NO DATA
	(0)		(-9.6 - 7.8)E -1 (0/ 18)		(-9.6 - 7.8)E -1 (0/ 18)	
Co-57	(18)		-1.7E -2	15	-1.7E -2	NO DATA
	(0)		(-1.8 - 0.9)E 0 (0/ 18)		(-1.8 - 0.9)E 0 (0/ 18)	
Co-58	(18)		-1.9E -1	15	-1.9E -1	NO DATA
	(0)		(-7.0 - 10.3)E -1 (0/ 18)		(-7.0 - 10.3)E -1 (0/ 18)	
Fe-59	(18)		-4.0E -1	15	-4.0E -1	NO DATA
	(0)		(-2.6 - 1.1)E 0 (0/ 18)		(-2.6 - 1.1)E 0 (0/ 18)	
Co-60	(18)		-1.5E -1	15	-1.5E -1	NO DATA
	(0)		(-1.3 - 0.8)E 0 (0/ 18)		(-1.3 - 0.8)E 0 (0/ 18)	
Zn-65	(18)		-8.2E -1	15	-8.2E -1	NO DATA
	(0)		(-2.1 - 1.0)E 0 (0/ 18)		(-2.1 - 1.0)E 0 (0/ 18)	
Se-75	(18)		-4.8E -2	15	-4.8E -2	NO DATA
	(0)		(-1.4 - 1.0)E 0 (0/ 18)		(-1.4 - 1.0)E 0 (0/ 18)	
Nb-95	(18)		1.4E -2	15	1.4E -2	NO DATA
	(0)		(-1.4 - 1.6)E 0 (0/ 18)		(-1.4 - 1.6)E 0 (0/ 18)	
Zr-95	(18)		-2.5E -1	15	-2.5E -1	NO DATA
	(0)		(-2.5 - 1.9)E 0 (0/ 18)		(-2.5 - 1.9)E 0 (0/ 18)	
Ru-103	(18)		-5.6E -1	15	-5.6E -1	NO DATA
	(0)		(-1.6 - 0.9)E 0 (0/ 18)		(-1.6 - 0.9)E 0 (0/ 18)	
Ru-106	(18)		-1.8E 0	15	-1.8E 0	NO DATA
	(0)		(-2.5 - 0.8)E 1 (0/ 18)		(-2.5 - 0.8)E 1 (0/ 18)	
Ag-108m	(18)		-2.4E -1	15	-2.4E -1	NO DATA
	(0)		(-1.6 - 0.6)E 0 (0/ 18)		(-1.6 - 0.6)E 0 (0/ 18)	

* Non-Routine refers to those radionuclides that exceeded the Reporting Levels in ODCM Table A.9.1-3.
** The fraction of detectable measurements (i.e., > MDC with no uncertain identification) is shown in parentheses.

Table 3.3-1 (Continued)
Radiological Environmental Monitoring Program Summary
Seabrook Nuclear Power Station, Seabrook, NH
(January - December 2022)

MEDIUM: Milk (TM) UNITS: pCi/kg

Radionuclides (No. Analyses) (Non-Routine*)		Required LLD	Indicator Stations	Station With Highest Mean		Control Stations
			Mean Range (No. Detected**)	Station	Mean Range (No. Detected**)	Mean Range (No. Detected**)
Ag-110m	(18)		1.3E -1	15	1.3E -1	NO DATA
	(0)		(-1.2 - 1.9)E 0 (0/ 18)		(-1.2 - 1.9)E 0 (0/ 18)	
Sb-124	(18)		-2.8E -1	15	-2.8E -1	NO DATA
	(0)		(-2.0 - 1.6)E 0 (0/ 18)		(-2.0 - 1.6)E 0 (0/ 18)	
Sb-125	(18)		2.6E -1	15	2.6E -1	NO DATA
	(0)		(-2.0 - 1.9)E 0 (0/ 18)		(-2.0 - 1.9)E 0 (0/ 18)	
I-131	(18)	1	4.8E -3	15	4.8E -3	NO DATA
	(0)		(-4.3 - 4.0)E -1 (0/ 18)		(-4.3 - 4.0)E -1 (0/ 18)	
Cs-134	(18)	15	-2.8E -2	15	-2.8E -2	NO DATA
	(0)		(-2.5 - 2.6)E 0 (0/ 18)		(-2.5 - 2.6)E 0 (0/ 18)	
Cs-137	(18)	18	4.5E 0	15	4.5E 0	NO DATA
	(0)		(-2.6 - 137.0)E -1 (12/ 18)		(-2.6 - 137.0)E -1 (12/ 18)	
Ba-140	(18)	15	5.0E -1	15	5.0E -1	NO DATA
	(0)		(-9.0 - 6.0)E 0 (0/ 18)		(-9.0 - 6.0)E 0 (0/ 18)	
La-140	(18)	15	-7.0E -1	15	-7.0E -1	NO DATA
	(0)		(-3.2 - 1.3)E 0 (0/ 18)		(-3.2 - 1.3)E 0 (0/ 18)	
Ce-141	(18)		-1.6E 0	15	-1.6E 0	NO DATA
	(0)		(-7.3 - 1.6)E 0 (0/ 18)		(-7.3 - 1.6)E 0 (0/ 18)	
Ce-144	(18)		-1.6E 0	15	-1.6E 0	NO DATA
	(0)		(-6.4 - 2.9)E 0 (0/ 18)		(-6.4 - 2.9)E 0 (0/ 18)	
Pb-212	(18)		1.2E 0	15	1.2E 0	NO DATA
	(0)		(-2.5 - 4.6)E 0 (0/ 18)		(-2.5 - 4.6)E 0 (0/ 18)	
Pb-214	(18)		2.9E -1	15	2.9E -1	NO DATA
	(0)		(-4.4 - 5.8)E 0 (0/ 18)		(-4.4 - 5.8)E 0 (0/ 18)	
Bi-214	(18)		1.0E 0	15	1.0E 0	NO DATA
	(0)		(-1.9 - 6.1)E 0 (1/ 18)		(-1.9 - 6.1)E 0 (1/ 18)	
Ac-228	(18)		-2.7E -1	15	-2.7E -1	NO DATA
	(0)		(-8.4 - 8.6)E 0 (0/ 18)		(-8.4 - 8.6)E 0 (0/ 18)	
Th-228	(18)		1.2E 0	15	1.2E 0	NO DATA
	(0)		(-2.5 - 4.6)E 0 (0/ 18)		(-2.5 - 4.6)E 0 (0/ 18)	

* Non-Routine refers to those radionuclides that exceeded the Reporting Levels in ODCM Table A.9.1-3.
** The fraction of detectable measurements (i.e., > MDC with no uncertain identification) is shown in parentheses.

3.4 Surface Water

Surface water (seawater - WS) grab samples are required at two locations (control and indicator) monthly. The indicator (WS-01) is over the vicinity of the plant's submerged discharge structure. The control location (WS-51) is situated in Ipswich Bay, MA, approximately 26.2 km from the plant. A gamma analysis is performed on each sample. A tritium analysis is performed on the quarterly composite of samples from each ODCM required location. Additional samples were collected from the Seabrook Marsh (WS-10) which borders the immediate plant property. The marsh samples are intended to provide indication of any ground water movement across the site area that might carry contamination into the surface waters of the marsh. Each of these samples is analyzed for both gamma emitters and tritium.

For 2022, a total of 24 gamma analyses were performed on surface water samples. The only radionuclides detected were naturally-occurring K-40, which was detected in all 24 samples, naturally-occurring Ac-228 in one sample, and naturally-occurring Bi-214, which was detected in one sample. No plant-related nuclides were detected. The present data for gamma emitters in seawater is consistent with that of the pre-operational program and previous years of operations. Therefore, no increasing or decreasing trends were observed.

Quarterly composites for the required off-shore locations (Stations WS-01 and WS-51) were analyzed for tritium. A total of 6 off-shore samples (composites) were analyzed in 2022, plus two additional samples from the non-ODCM required location (WS-10) situated approximately 600 feet SSE from the Containment Building in Seabrook Marsh. The quarterly composite samples showed no indication of tritium. All samples met the required minimum LLD (3000 pCi/kg) for tritium in seawater. These results are consistent with pre-operational tritium data. The achieved tritium Minimum Detectable Concentration (MDC) for the quarterly off-shore composite samples averaged 486 pCi/kg.

The calculated dose as the result of plant effluents is not evaluated due to the fact that no plant-related radionuclides were or have been detected in the past. Therefore, no increasing or decreasing trends in dose were observed. This sampling program demonstrates that there is no impact to the public or environment, through this pathway from plant operations.

The REMP Summary Table 3.4-1 lists the range of analysis results by radionuclide for Indicator and Control Stations for the sea water environmental media. Attachment 1 to this report lists the individual analysis results for each measurement of sea water under the Sample Type code WS.

Any sample collection and analysis deviations from the ODCM required program or reportable concentrations that may have occurred during the year are described in Section 5.

Table 3.4-1
Radiological Environmental Program Summary
Seabrook Nuclear Power Station, Seabrook, NH
(January - December 2022)

MEDIUM: Sea Water (WS) UNITS: pCi/kg

Radionuclides (No. Analyses) (Non-Routine*)		Required LLD	Indicator Stations Mean Range (No. Detected**)	Station With Highest Mean Station	 Mean Range (No. Detected**)	Control Stations Mean Range (No. Detected**)
H-3	(8)	3000	1.4E 2	10	1.8E 2	1.4E 2
	(0)		(1.6 - 28.0)E 1 (0/ 5)		(8.4 - 28.0)E 1 (0/ 2)	(-1.7 - 24.1)E 1 (0/ 3)
Be-7	(24)		-4.6E -1	10	1.6E 0	1.2E 0
	(0)		(-1.7 - 0.8)E 1 (0/ 13)		(6.9 - 25.4)E -1 (0/ 2)	(-2.9 - 6.5)E 0 (0/ 11)
K-40	(24)		3.2E 2	01	3.4E 2	3.2E 2
	(0)		(1.4 - 4.4)E 2 (13/ 13)		(2.9 - 4.4)E 2 (11/ 11)	(2.6 - 3.6)E 2 (11/ 11)
Cr-51	(24)		-6.7E -1	51	7.3E -1	7.3E -1
	(0)		(-1.4 - 0.9)E 1 (0/ 13)		(-6.0 - 9.8)E 0 (0/ 11)	(-6.0 - 9.8)E 0 (0/ 11)
Mn-54	(24)	15	-1.1E -1	10	-1.0E -1	-3.4E -1
	(0)		(-1.7 - 1.2)E 0 (0/ 13)		(-2.6 - 0.6)E -1 (0/ 2)	(-1.6 - 0.6)E 0 (0/ 11)
Co-57	(24)		2.2E -1	10	6.5E -1	-1.0E -1
	(0)		(-7.1 - 8.0)E -1 (0/ 13)		(5.0 - 8.0)E -1 (0/ 2)	(-7.8 - 4.9)E -1 (0/ 11)
Co-58	(24)	15	-1.9E -1	51	1.0E -2	1.0E -2
	(0)		(-7.3 - 3.0)E -1 (0/ 13)		(-5.1 - 7.1)E -1 (0/ 11)	(-5.1 - 7.1)E -1 (0/ 11)
Fe-59	(24)	30	-2.7E -1	10	5.8E -1	3.0E -1
	(0)		(-4.4 - 1.2)E 0 (0/ 13)		(0.0 - 1.2)E 0 (0/ 2)	(-8.7 - 20.1)E -1 (0/ 11)
Co-60	(24)	15	2.4E -1	01	3.0E -1	1.4E -1
	(0)		(-9.2 - 14.7)E -1 (0/ 13)		(-9.2 - 14.7)E -1 (0/ 11)	(-8.1 - 7.0)E -1 (0/ 11)
Zn-65	(24)	30	2.8E -1	10	9.1E -1	-4.7E -1
	(0)		(-1.7 - 2.2)E 0 (0/ 13)		(6.3 - 11.8)E -1 (0/ 2)	(-3.0 - 0.9)E 0 (0/ 11)
Se-75	(24)		2.6E -1	01	3.4E -1	1.1E -1
	(0)		(-1.5 - 1.2)E 0 (0/ 13)		(-9.1 - 12.4)E -1 (0/ 11)	(-9.9 - 7.6)E -1 (0/ 11)
Nb-95	(24)	15	1.7E -1	10	3.6E -1	6.3E -2
	(0)		(-7.6 - 10.7)E -1 (0/ 13)		(-3.4 - 10.7)E -1 (0/ 2)	(-1.8 - 0.7)E 0 (0/ 11)
Zr-95	(24)	15	2.9E -1	10	1.5E 0	-1.0E -1
	(0)		(-1.7 - 2.1)E 0 (0/ 13)		(9.0 - 20.8)E -1 (0/ 2)	(-1.4 - 1.7)E 0 (0/ 11)
Ru-103	(24)		-3.3E -1	01	-2.5E -1	-3.4E -1
	(0)		(-1.3 - 0.7)E 0 (0/ 13)		(-1.2 - 0.7)E 0 (0/ 11)	(-1.0 - 0.4)E 0 (0/ 11)
Ru-106	(24)		2.8E -1	10	2.2E 0	-1.9E 0
	(0)		(-5.1 - 9.3)E 0 (0/ 13)		(-4.8 - 9.3)E 0 (0/ 2)	(-8.7 - 3.7)E 0 (0/ 11)

* Non-Routine refers to those radionuclides that exceeded the Reporting Levels in ODCM Table A.9.1-3.
** The fraction of detectable measurements (i.e., > MDC with no uncertain identification) is shown in parentheses.

Table 3.4-1 (Continued)

Radiological Environmental Monitoring Program Summary
Seabrook Nuclear Power Station, Seabrook, NH
(January - December 2022)

MEDIUM: Sea Water (WS) UNITS: pCi/kg

Radionuclides (No. Analyses) (Non-Routine*)		Required LLD	Indicator Stations Mean Range (No. Detected**)	Station With Highest Mean Station	Station With Highest Mean Mean Range (No. Detected**)	Control Stations Mean Range (No. Detected**)
Ag-108m	(24)		1.2E -2	10	3.4E -1	3.4E -2
	(0)		(-7.4 - 7.3)E -1 (0/ 13)		(3.4 - 3.5)E -1 (0/ 2)	(-5.1 - 4.8)E -1 (0/ 11)
Ag-110m	(24)		-1.6E -1	10	3.1E -2	-3.9E -1
	(0)		(-2.5 - 0.8)E 0 (0/ 13)		(-5.0 - 5.6)E -1 (0/ 2)	(-1.2 - 0.1)E 0 (0/ 11)
Sb-124	(24)		-8.1E -2	01	5.9E -2	-2.5E -1
	(0)		(-1.5 - 1.4)E 0 (0/ 13)		(-8.0 - 14.1)E -1 (0/ 11)	(-1.8 - 1.7)E 0 (0/ 11)
Sb-125	(24)		-2.0E -1	10	9.1E -2	5.6E -2
	(0)		(-2.6 - 1.8)E 0 (0/ 13)		(-6.0 - 7.8)E -1 (0/ 2)	(-2.7 - 2.6)E 0 (0/ 11)
I-131	(24)	15	-1.3E -1	51	3.5E -1	3.5E -1
	(0)		(-4.6 - 3.3)E 0 (0/ 13)		(-6.9 - 17.3)E -1 (0/ 11)	(-6.9 - 17.3)E -1 (0/ 11)
Cs-134	(24)	15	3.0E -1	01	3.3E -1	-3.7E -2
	(0)		(-7.4 - 17.8)E -1 (0/ 13)		(-7.4 - 17.8)E -1 (0/ 11)	(-1.4 - 1.0)E 0 (0/ 11)
Cs-137	(24)	18	-4.1E -3	10	2.0E -1	-4.5E -1
	(0)		(-3.9 - 1.1)E 0 (0/ 13)		(-1.3 - 5.3)E -1 (0/ 2)	(-3.5 - 0.9)E 0 (0/ 11)
Ba-140	(24)	15	8.9E -1	01	1.1E 0	-5.9E -1
	(0)		(-4.6 - 8.0)E 0 (0/ 13)		(-3.4 - 8.0)E 0 (0/ 11)	(-1.1 - 0.6)E 1 (0/ 11)
La-140	(24)	15	-4.2E -1	10	3.0E 0	-3.4E -1
	(0)		(-2.5 - 4.5)E 0 (0/ 13)		(1.5 - 4.5)E 0 (0/ 2)	(-3.0 - 2.1)E 0 (0/ 11)
Ce-141	(24)		-8.7E -1	10	7.2E -1	-2.8E -1
	(0)		(-3.3 - 2.1)E 0 (0/ 13)		(-3.7 - 18.2)E -1 (0/ 2)	(-3.2 - 2.3)E 0 (0/ 11)
Ce-144	(24)		4.5E -1	51	9.0E -1	9.0E -1
	(0)		(-3.0 - 5.1)E 0 (0/ 13)		(-2.3 - 7.2)E 0 (0/ 11)	(-2.3 - 7.2)E 0 (0/ 11)
Pb-212	(24)		5.0E -1	10	2.4E 0	6.0E -1
	(0)		(-2.0 - 2.6)E 0 (0/ 13)		(2.2 - 2.6)E 0 (0/ 2)	(-1.6 - 3.2)E 0 (0/ 11)
Pb-214	(24)		-1.2E 0	51	-4.5E -1	-4.5E -1
	(0)		(-4.3 - 0.4)E 0 (0/ 13)		(-5.3 - 2.2)E 0 (0/ 11)	(-5.3 - 2.2)E 0 (0/ 11)

* Non-Routine refers to those radionuclides that exceeded the Reporting Levels in ODCM Table A.9.1-3.
** The fraction of detectable measurements (i.e., > MDC with no uncertain identification) is shown in parentheses

Table 3.4-1 (Continued)

Radiological Environmental Monitoring Program Summary
Seabrook Nuclear Power Station, Seabrook, NH
(January - December 2022)

MEDIUM: Sea Water (WS) UNITS: pCi/kg

Radionuclides (No. Analyses) (Non-Routine*)		Required LLD	Indicator Stations Mean Range (No. Detected**)	Station With Highest Mean Station	Station With Highest Mean Mean Range (No. Detected**)	Control Stations Mean Range (No. Detected**)
Bi-214	**(24)**		2.0E -1	10	4.0E 0	1.5E 0
	(0)		(-3.6 - 4.2)E 0 (0/ 13)		(3.7 - 4.2)E 0 (0/ 2)	(-2.0 - 5.3)E 0 (1/ 11)
Ac-228	**(24)**		-3.9E -1	10	2.4E 0	9.8E -1
	(0)		(-1.1 - 0.4)E 1 (0/ 13)		(1.1 - 3.7)E 0 (0/ 2)	(-6.3 - 10.9)E 0 (1/ 11)
Th-228	**(24)**		5.0E -1	10	2.4E 0	6.0E -1
	(0)		(-2.0 - 2.6)E 0 (0/ 13)		(2.2 - 2.6)E 0 (0/ 2)	(-1.6 - 3.2)E 0 (0/ 11)

* Non-Routine refers to those radionuclides that exceeded the Reporting Levels in ODCM Table A.9.1-3.
** The fraction of detectable measurements (i.e., > MDC with no uncertain identification) is shown in parentheses.

3.5 Ground Water

There is no requirement in the ODCM to collect ground water (WG) samples. For the year, quarterly ground water samples were collected when available from three locations. These samples were collected from the town water line (WG-01) supplied to the Site (by the Town of Seabrook), from an inactive well (WG-13) located approximately 1 km north of the plant, and from a private well 1.3 km NNW (WG-14). For 2022, a total of 12 samples were collected. All samples were analyzed for gross-beta activity, gamma-emitters and tritium.

Gross beta activity was detected in eight of the twelve samples due to naturally-occurring radium and its daughter products. The gross beta activity is consistent with results from previous years of commercial operations. Figures 3.5 and 3.5.1 indicate the current year (2022) and the long-term measurement history for gross beta in well waters. No tritium or plant-related gamma emitters were detected in any of the ground water samples collected during the year. Table 3.5-1 identifies the results of the search for radionuclides of which only naturally-occurring Ac-228 was detected in one sample, Pb-214 in four samples, and Bi-214 in six of 12 samples.

The dose potential to the public from drinking ground water is not evaluated due to the fact that plant-related radionuclides have not been detected. Therefore, no increasing or decreasing trends were observed. There is no impact to the public, through this pathway, from plant operations.

The REMP Summary Table 3.5-1 lists the range of analysis results by radionuclide for all ground water environmental samples. Attachment 1 to this report lists the individual analysis results for each measurement of ground water under the Sample Type code WG.

Any reportable sample concentrations that may have occurred during the year are described in Section 5.

FIGURE 3.5

GROSS-BETA MEASUREMENTS OF GROUND WATER
SEABROOK STATION

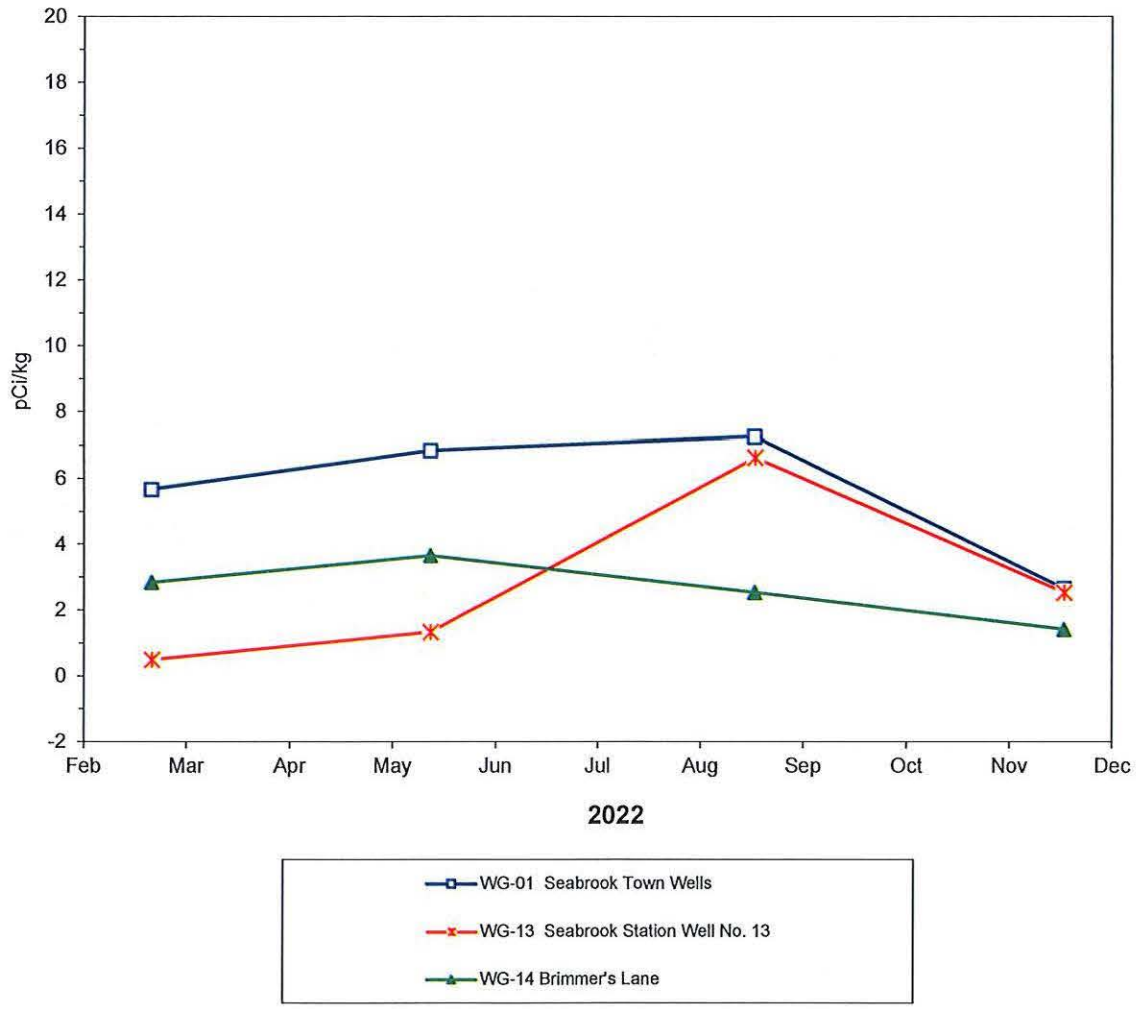


FIGURE 3.5.1

GROSS-BETA MEASUREMENTS OF GROUND WATER
SEMI-ANNUAL AVERAGES
SEABROOK STATION

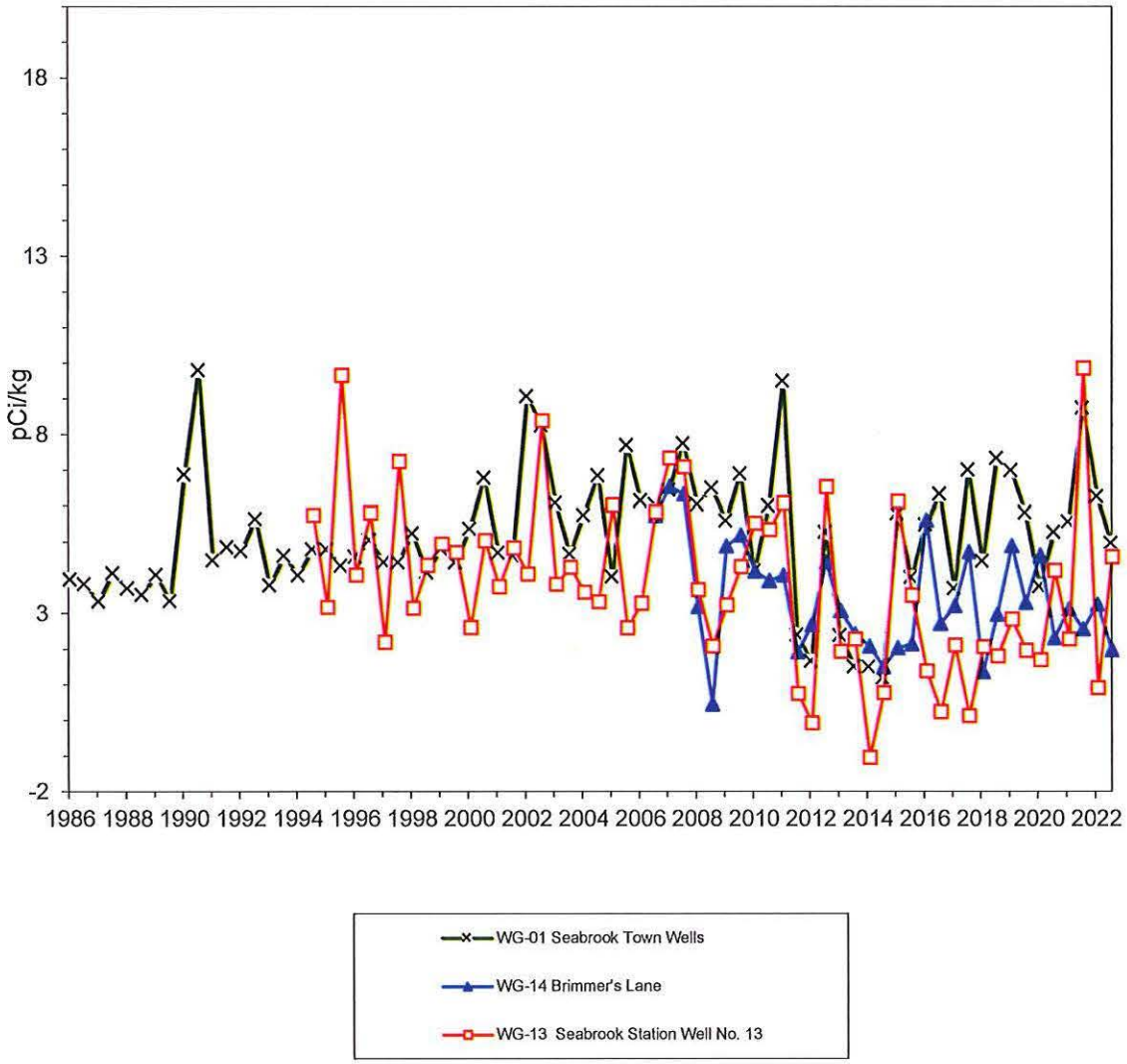


Table 3.5-1
Radiological Environmental Program Summary
Seabrook Nuclear Power Station, Seabrook, NH
(January - December 2022)

MEDIUM: Ground Water (WG) UNITS: pCi/liter

Radionuclides (No. Analyses) (Non-Routine*)		Required LLD	Indicator Stations Mean Range (No. Detected**)	Station With Highest Mean Station	 Mean Range (No. Detected**)	Control Stations Mean Range (No. Detected**)
BETA	(12)	4	3.7E 0 (5.2 - 72.7)E -1 (8/ 12)	01	5.6E 0 (2.7 - 7.3)E 0 (4/ 4)	NO DATA
	(0)					
H-3	(12)	3000	-6.6E 1 (-4.3 - 3.1)E 2 (0/ 12)	13	2.0E 1 (-2.5 - 3.1)E 2 (0/ 4)	NO DATA
	(0)					
Be-7	(12)		2.4E 0 (-1.3 - 6.8)E 0 (0/ 12)	14	5.7E 0 (5.0 - 6.8)E 0 (0/ 4)	NO DATA
	(0)					
K-40	(12)		-2.0E 0 (-3.2 - 1.3)E 1 (0/ 12)	13	3.3E 0 (0.0 - 1.3)E 1 (0/ 4)	NO DATA
	(0)					
Cr-51	(12)		1.1E 0 (-7.6 - 9.8)E 0 (0/ 12)	01	4.1E 0 (6.4 - 97.8)E -1 (0/ 4)	NO DATA
	(0)					
Mn-54	(12)	15	-8.4E -2 (-9.5 - 5.2)E -1 (0/ 12)	13	6.7E -2 (-3.3 - 5.2)E -1 (0/ 4)	NO DATA
	(0)					
Co-57	(12)		-2.8E -3 (-7.6 - 9.0)E -1 (0/ 12)	13	2.3E -1 (-5.4 - 9.0)E -1 (0/ 4)	NO DATA
	(0)					
Co-58	(12)	15	3.5E -2 (-4.9 - 4.3)E -1 (0/ 12)	01	1.2E -1 (-4.8 - 4.3)E -1 (0/ 4)	NO DATA
	(0)					
Fe-59	(12)	30	-2.0E -1 (-2.3 - 1.7)E 0 (0/ 12)	01	1.9E -1 (-1.1 - 1.7)E 0 (0/ 4)	NO DATA
	(0)					
Co-60	(12)	15	6.9E -2 (-1.1 - 1.0)E 0 (0/ 12)	13	2.3E -1 (-2.0 - 4.4)E -1 (0/ 4)	NO DATA
	(0)					
Zn-65	(12)	30	5.3E -1 (-7.3 - 19.1)E -1 (0/ 12)	13	6.0E -1 (-2.7 - 16.5)E -1 (0/ 4)	NO DATA
	(0)					
Se-75	(12)		1.6E -1 (-6.6 - 10.8)E -1 (0/ 12)	01	3.0E -1 (-1.9 - 6.5)E -1 (0/ 4)	NO DATA
	(0)					
Nb-95	(12)	15	4.0E -1 (-5.3 - 13.8)E -1 (0/ 12)	13	5.5E -1 (-2.7 - 12.8)E -1 (0/ 4)	NO DATA
	(0)					

* Non-Routine refers to those radionuclides that exceeded the Reporting Levels in ODCM Table A.9.1-3.
** The fraction of detectable measurements (i.e., > MDC with no uncertain identification) is shown in parentheses.

Table 3.5-1 (Continued)

Radiological Environmental Monitoring Program Summary
Seabrook Nuclear Power Station, Seabrook, NH
(January - December 2022)

MEDIUM: Ground Water (WG) UNITS: pCi/kg

Radionuclides (No. Analyses) (Non-Routine*)		Required LLD	Indicator Stations Mean Range (No. Detected**)	Station With Highest Mean Station	Station With Highest Mean Mean Range (No. Detected**)	Control Stations Mean Range (No. Detected**)
Zr-95	(12)	15	3.3E -1	01	8.7E -1	NO DATA
	(0)		(-9.3 - 21.5)E -1 (0/ 12)		(2.0 - 215.0)E -2 (0/ 4)	
Ru-103	(12)		-3.7E -1	14	-1.6E -1	NO DATA
	(0)		(-1.1 - 0.6)E 0 (0/ 12)		(-4.7 - 4.6)E -1 (0/ 4)	
Ru-106	(12)		3.3E 0	13	5.2E 0	NO DATA
	(0)		(-5.7 - 9.9)E 0 (0/ 12)		(-6.5 - 94.0)E -1 (0/ 4)	
Ag-108m	(12)		2.8E -2	01	1.2E -1	NO DATA
	(0)		(-5.8 - 7.0)E -1 (0/ 12)		(9.6 - 238.0)E -3 (0/ 4)	
Ag-110m	(12)		2.8E -1	13	4.0E -1	NO DATA
	(0)		(-3.3 - 8.5)E -1 (0/ 12)		(2.3 - 6.3)E -1 (0/ 4)	
Sb-124	(12)		-3.7E -1	13	2.9E -1	NO DATA
	(0)		(-2.7 - 1.2)E 0 (0/ 12)		(-8.3 - 63.9)E -2 (0/ 4)	
Sb-125	(12)		4.3E -1	01	1.4E 0	NO DATA
	(0)		(-2.1 - 2.8)E 0 (0/ 12)		(8.6 - 18.9)E -1 (0/ 4)	
I-131	(12)	15	1.7E -1	01	9.5E -1	NO DATA
	(0)		(-3.7 - 3.1)E 0 (0/ 12)		(-7.0 - 30.7)E -1 (0/ 4)	
Cs-134	(12)	15	7.3E -2	14	1.7E -1	NO DATA
	(0)		(-7.9 - 7.7)E -1 (0/ 12)		(-2.8 - 5.7)E -1 (0/ 4)	
Cs-137	(12)	18	5.2E -1	14	6.2E -1	NO DATA
	(0)		(-3.1 - 13.0)E -1 (0/ 12)		(5.7 - 130.0)E -2 (0/ 4)	
Ba-140	(12)	15	7.4E -1	14	1.7E 0	NO DATA
	(0)		(-3.1 - 4.0)E 0 (0/ 12)		(7.1 - 34.1)E -1 (0/ 4)	
La-140	(12)	15	-8.4E -2	14	6.5E -1	NO DATA
	(0)		(-1.3 - 1.3)E 0 (0/ 12)		(-1.4 - 13.0)E -1 (0/ 4)	
Ce-141	(12)		-1.0E -1	13	1.1E 0	NO DATA
	(0)		(-3.5 - 2.7)E 0 (0/ 12)		(1.0 - 26.5)E -1 (0/ 4)	

* Non-Routine refers to those radionuclides that exceeded the Reporting Levels in ODCM Table A.9.1-3.
** The fraction of detectable measurements (i.e., >3 standard deviations with no uncertain identification) is shown in parentheses.

Table 3.5-1 (Continued)
Radiological Environmental Monitoring Program Summary
Seabrook Nuclear Power Station, Seabrook, NH
(January - December 2022)

MEDIUM: Ground Water (WG) UNITS: pCi/kg

Radionuclides (No. Analyses) (Non-Routine*)		Required LLD	Indicator Stations Mean Range (No. Detected**)	Station With Highest Mean Station	Station With Highest Mean Mean Range (No. Detected**)	Control Stations Mean Range (No. Detected**)
Ce-144	(12)		-3.9E -1	01	1.3E -1	NO DATA
	(0)		(-4.1 - 1.8)E 0		(-4.1 - 1.8)E 0	
			(0/ 12)		(0/ 4)	
Pb-212	(12)		-3.6E -1	01	1.7E -1	NO DATA
	(0)		(-3.6 - 1.6)E 0		(-6.1 - 16.2)E -1	
			(0/ 12)		(0/ 4)	
Pb-214	(12)		1.6E 1	14	3.8E 1	NO DATA
	(0)		(-7.5 - 853.0)E -1		(4.2 - 85.3)E 0	
			(4/ 12)		(3/ 4)	
Bi-214	(12)		1.4E 1	14	3.2E 1	NO DATA
	(0)		(-6.6 - 838.0)E -1		(0.0 - 8.4)E 1	
			(6/ 12)		(3/ 4)	
Ac-228	(12)		-2.0E 0	13	7.7E -1	NO DATA
	(0)		(-1.6 - 1.6)E 1		(-1.9 - 4.5)E 0	
			(1/ 12)		(0/ 4)	
Th-228	(12)		-3.6E -1	01	1.7E -1	NO DATA
	(0)		(-3.6 - 1.6)E 0		(-6.1 - 16.2)E -1	
			(0/ 12)		(0/ 4)	

* Non-Routine refers to those radionuclides that exceeded the Reporting Levels in ODCM Table A.9.1-3.
** The fraction of detectable measurements (i.e., > MDC with no uncertain identification) is shown in parentheses.

3.6 Sediment

Semiannual sediment sampling is required at one indicator location, although a total of five locations, three indicators and two controls, are collected. The indicator stations are comprised of two sets of beach sediment cores from Hampton Beach (SE-07) and Seabrook Beach (SE-08), plus two sub-tidal sediment cores taken from near the discharge structure (SE-02). The control locations, Plum Island Beach (SE-57) and sub-tidal Ipswich Bay (SE-52), are both located within Ipswich Bay. A total of 10 samples were collected for the year from all locations. All cores were analyzed as single or whole samples without segmenting. A gamma analysis was performed on each core.

Table 3.6-1 identifies the results of the search for radionuclides of which several naturally-occurring were detected. The naturally-occurring radionuclides include K-40 and nuclides of the Uranium-238 decay chain (Th-230, Ra-226, Pb-214 and Bi-214) and the Thorium-232 decay chain (Ac-228, Th-228, Pb-212, and Tl-208). No plant-related radionuclides were detected in any core. No increasing or decreasing trends were observed. This is consistent with the pre-operational program and with previous years of plant operations. There is no plant related dose to the public or impact to the environment from any pathways associated with this media.

The REMP Summary Table 3.6-1 lists the range of analysis results by radionuclide for Indicator and Control Stations for the sediment environmental media. Attachment 1 to this report lists the individual analysis results for each measurement of sediment under the Sample Type code SE.

Any sample collection and analysis deviations from the ODCM required program, or reportable concentrations that may have occurred during the year are described in Section 5.

Table 3.6-1
Radiological Environmental Program Summary
Seabrook Nuclear Power Station, Seabrook, NH
(January - December 2022)

MEDIUM: Sediment (SE) UNITS: pCi/kg

Radionuclides (No. Analyses) (Non-Routine*)		Required LLD	Indicator Stations	Station With Highest Mean		Control Stations
			Mean Range (No. Detected**)	Station	Mean Range (No. Detected**)	Mean Range (No. Detected**)
Be-7	(10)		1.2E 1	57	1.0E 2	8.5E 1
	(0)		(-9.1 - 5.6)E 1 (0/ 6)		(6.7 - 14.0)E 1 (0/ 2)	(3.8 - 14.0)E 1 (0/ 4)
K-40	(10)		1.8E 4	08	2.1E 4	1.7E 4
	(0)		(1.2 - 2.6)E 4 (6/ 6)		(1.7 - 2.6)E 4 (2/ 2)	(1.2 - 2.5)E 4 (4/ 4)
Cr-51	(10)		7.6E 1	52	2.3E 2	1.2E 2
	(0)		(-1.7 - 2.3)E 2 (0/ 6)		(-1.2 - 46.7)E 1 (0/ 2)	(-1.2 - 46.7)E 1 (0/ 4)
Mn-54	(10)		4.8E 0	52	2.3E 1	1.9E 1
	(0)		(0.0 - 1.2)E 1 (0/ 6)		(4.7 - 40.7)E 0 (0/ 2)	(4.7 - 40.7)E 0 (0/ 4)
Co-57	(10)		-3.1E 0	57	5.7E 0	3.8E 0
	(0)		(-1.7 - 0.5)E 1 (0/ 6)		(3.1 - 8.3)E 0 (0/ 2)	(-6.0 - 9.7)E 0 (0/ 4)
Co-58	(10)		6.7E 0	08	1.3E 1	-9.2E 0
	(0)		(-8.4 - 21.1)E 0 (0/ 6)		(4.3 - 21.1)E 0 (0/ 2)	(-2.0 - 0.3)E 1 (0/ 4)
Fe-59	(10)		1.5E 1	07	5.0E 1	-5.1E 1
	(0)		(-5.2 - 5.3)E 1 (0/ 6)		(4.7 - 5.3)E 1 (0/ 2)	(-9.6 - -1.8)E 1 (0/ 4)
Co-60	(10)		2.3E 0	02	1.3E 1	1.1E 0
	(0)		(-1.6 - 3.0)E 1 (0/ 6)		(-2.9 - 29.5)E 0 (0/ 2)	(-2.7 - 7.2)E 0 (0/ 4)
Zn-65	(10)		-9.5E 0	02	2.3E 1	-8.9E 0
	(0)		(-5.1 - 4.8)E 1 (0/ 6)		(-1.8 - 47.6)E 0 (0/ 2)	(-4.7 - 2.8)E 1 (0/ 4)
Se-75	(10)		-1.4E 1	52	1.5E 0	-7.4E 0
	(0)		(-4.0 - 0.0)E 1 (0/ 6)		(-8.6 - 11.6)E 0 (0/ 2)	(-2.6 - 1.2)E 1 (0/ 4)
Nb-95	(10)		-1.1E 1	52	5.0E -1	-7.1E 0
	(0)		(-2.7 - -0.3)E 1 (0/ 6)		(-5.9 - 6.9)E 0 (0/ 2)	(-2.1 - 0.7)E 1 (0/ 4)
Zr-95	(10)		2.8E 1	02	7.5E 1	2.1E 1
	(0)		(-9.2 - 97.7)E 0 (0/ 6)		(5.2 - 9.8)E 1 (0/ 2)	(-3.7 - 11.3)E 1 (0/ 4)
Ru-103	(10)		1.7E 0	52	1.3E 1	1.1E 1
	(0)		(-1.2 - 1.1)E 1 (0/ 6)		(-4.4 - 31.2)E 0 (0/ 2)	(-4.4 - 31.2)E 0 (0/ 4)

* Non-Routine refers to those radionuclides that exceeded the Reporting Levels in ODCM Table A.9.1-3.
** The fraction of detectable measurements (i.e., > MDC with no uncertain identification) is shown in parentheses.

Table 3.6-1 (Continued)
Radiological Environmental Monitoring Program Summary
Seabrook Nuclear Power Station, Seabrook, NH
(January - December 2022)

MEDIUM: Sediment (SE) UNITS: pCi/kg

Radionuclides (No. Analyses) (Non-Routine*)		Required LLD	Indicator Stations Mean Range (No. Detected**)	Station With Highest Mean Station	 Mean Range (No. Detected**)	Control Stations Mean Range (No. Detected**)
Ru-106	(10) (0)		2.6E 1 (-7.0 - 15.9)E 1 (0/ 6)	02	5.9E 1 (-4.0 - 15.9)E 1 (0/ 2)	-2.2E 1 (-9.5 - 5.4)E 1 (0/ 4)
Ag-108m	(10) (0)		-4.1E -1 (-1.0 - 1.3)E 1 (0/ 6)	07	5.9E 0 (-1.5 - 13.3)E 0 (0/ 2)	1.1E 0 (-8.8 - 57.1)E -1 (0/ 4)
Ag-110m	(10) (0)		1.1E 1 (-4.6 - 28.0)E 0 (0/ 6)	02	2.7E 1 (2.6 - 2.8)E 1 (0/ 2)	8.1E 0 (-8.5 - 15.4)E 0 (0/ 4)
Sb-124	(10) (0)		1.5E 1 (-1.0 - 3.9)E 1 (0/ 6)	52	4.0E 1 (-2.7 - 81.7)E 0 (0/ 2)	2.4E 1 (-3.4 - 81.7)E 0 (0/ 4)
Sb-125	(10) (0)		9.4E 0 (-5.1 - 5.9)E 1 (0/ 6)	02	4.6E 1 (3.2 - 5.9)E 1 (0/ 2)	1.7E 1 (-6.2 - 45.3)E 0 (0/ 4)
I-131	(10) (0)		2.3E 1 (-5.8 - 22.7)E 1 (0/ 6)	07	1.1E 2 (-7.1 - 227.0)E 0 (0/ 2)	4.0E -2 (-2.7 - 3.2)E 1 (0/ 4)
Cs-134	(10) (0)	150	1.1E 1 (0.0 - 4.2)E 1 (0/ 6)	08	2.2E 1 (2.4 - 41.9)E 0 (0/ 2)	8.4E 0 (-5.1 - 38.8)E 0 (0/ 4)
Cs-137	(10) (0)	180	3.5E 0 (8.5 - 53.3)E -1 (0/ 6)	57	5.1E 0 (0.0 - 1.0)E 1 (0/ 2)	2.1E -1 (-1.8 - 1.0)E 1 (0/ 4)
Ba-140	(10) (0)		1.0E 1 (-1.8 - 2.7)E 2 (0/ 6)	02	1.4E 2 (0.0 - 2.7)E 2 (0/ 2)	-7.9E 1 (-3.0 - 0.3)E 2 (0/ 4)
La-140	(10) (0)		9.8E -1 (-6.3 - 10.8)E 1 (0/ 6)	02	3.5E 1 (-3.9 - 10.8)E 1 (0/ 2)	-1.6E 1 (-9.4 - 2.9)E 1 (0/ 4)
Ce-141	(10) (0)		-2.8E 1 (-6.6 - -0.9)E 1 (0/ 6)	52	-3.9E 0 (-1.5 - 0.7)E 1 (0/ 2)	-1.3E 1 (-2.2 - 0.7)E 1 (0/ 4)
Ce-144	(10) (0)		-6.9E 1 (-2.0 - 0.0)E 2 (0/ 6)	57	2.1E 1 (2.1 - 2.2)E 1 (0/ 2)	-5.3E 0 (-5.0 - 2.2)E 1 (0/ 4)
TL-208	(10) (0)		2.9E 2 (8.5 - 83.7)E 1 (6/ 6)	52	7.6E 2 (6.3 - 9.0)E 2 (2/ 2)	4.6E 2 (1.4 - 9.0)E 2 (4/ 4)

* Non-Routine refers to those radionuclides that exceeded the Reporting Levels in ODCM Table A.9.1-3.
** The fraction of detectable measurements (i.e., > MDC with no uncertain identification) is shown in parentheses.

Table 3.6-1 (Continued)
Radiological Environmental Monitoring Program Summary
Seabrook Nuclear Power Station, Seabrook, NH
(January - December 2022)

MEDIUM: Sediment (SE) UNITS: pCi/kg

Radionuclides (No. Analyses) (Non-Routine*)		Required LLD	Indicator Stations Mean Range (No. Detected**)	Station With Highest Mean Station	 Mean Range (No. Detected**)	Control Stations Mean Range (No. Detected**)
Pb-212	**(10)**		1.1E 3	52	2.6E 3	1.5E 3
	(0)		(3.4 - 31.2)E 2 (6/ 6)		(2.1 - 3.1)E 3 (2/ 2)	(3.0 - 31.3)E 2 (4/ 4)
Pb-214	**(10)**		7.4E 2	52	1.9E 3	1.1E 3
	(0)		(2.8 - 19.9)E 2 (6/ 6)		(1.6 - 2.2)E 3 (2/ 2)	(3.3 - 22.1)E 2 (4/ 4)
Bi-214	**(10)**		7.0E 2	52	1.5E 3	9.4E 2
	(0)		(2.6 - 18.7)E 2 (6/ 6)		(1.5 - 1.6)E 3 (2/ 2)	(2.7 - 15.7)E 2 (4/ 4)
Ra-226	**(10)**		7.4E 2	52	1.9E 3	1.1E 3
	(0)		(2.8 - 19.9)E 2 (6/ 6)		(1.5 - 2.2)E 3 (2/ 2)	(2.7 - 22.1)E 2 (4/ 4)
Ac-228	**(10)**		1.0E 3	52	2.4E 3	1.4E 3
	(0)		(3.1 - 28.2)E 2 (6/ 6)		(2.1 - 2.7)E 3 (2/ 2)	(3.9 - 26.7)E 2 (4/ 4)
Th-228	**(10)**		1.1E 3	52	2.6E 3	1.5E 3
	(0)		(3.4 - 31.2)E 2 (6/ 6)		(2.1 - 3.1)E 3 (2/ 2)	(3.0 - 31.3)E 2 (4/ 4)
Th-230	**(10)**		7.4E 2	52	1.9E 3	1.1E 3
	(0)		(2.8 - 19.9)E 2 (6/ 6)		(1.5 - 2.2)E 3 (2/ 2)	(2.7 - 22.1)E 2 (4/ 4)

* Non-Routine refers to those radionuclides that exceeded the Reporting Levels in ODCM Table A.9.1-3.
** The fraction of detectable measurements (i.e., > MDC with no uncertain identification) is shown in parentheses.

3.7 Fish

Semiannual fish (FH) and invertebrate samples are required by the ODCM REMP from two locations. Quarterly collections are attempted to ensure the sampling requirements are met. This section presents the results for fish sampling only. Invertebrate results may be found in Sections 3.8 and 3.9, entitled Lobsters and Shellfish, respectively.

During the year, a total of 11 fish samples were collected. The fish species available from Station FH-03 (indicator station) and Station FH-53 (control station) were dominated by Winter Flounder which are bottom dwelling species. Two samples of Cunner, and one sample of Sculpin were also collected from sample location FH-03 (Hampton Bay in the area of the plant's discharge). Two samples of Cod and one sample of Haddock were collected from sample location FH-53 (control station).

A gamma analysis was performed on the edible portion of each sample collected. In 2022, the only radionuclide detected was naturally-occurring K-40 (11 of 11 samples). Table 3.7-1 summarizes the results for radionuclides in fish. Similar to past years, no plant-related radionuclides were detected in any samples. As a result, no increasing or decreasing trends were observed. Subsequently, there is no dose to the public or impact to the environment through this pathway due to plant operations. This is consistent with previous years of plant operations, as well as the pre-operational program.

In addition to the required program for fish as defined in the ODCM, sampling was attempted to collect a local fish species (Cunner fish) that resides in the upper regions of the water column using an alternate collection method from that used for the more prevalent bottom species (Flounder). For 2022, two Cunner samples were collected from Hampton Bay. The results are listed in Attachment 1 as laboratory number 581280001 (05/26/2022) and 596890001 (10/12/2022). No plant radionuclides were detected in the Cunner fish samples, with only naturally-occurring K-40 being found.

The REMP Summary Table 3.7-1 also lists the range of analysis results by radionuclide for Indicator and Control Stations for all fish environmental media. Attachment 1 to this report lists the individual analysis results for each measurement of fish under the Sample Type code FH.

Any sample collection and analysis deviations from the ODCM required program, or reportable concentrations that may have occurred during the year are described in Section 5.

Table 3.7-1
Radiological Environmental Program Summary
Seabrook Nuclear Power Station, Seabrook, NH
(January - December 2022)

MEDIUM: Fish (FH) UNITS: pCi/kg

Radionuclides (No. Analyses) (Non-Routine*)		Required LLD	Indicator Stations Mean Range (No. Detected**)	Station With Highest Mean Station	 Mean Range (No. Detected**)	Control Stations Mean Range (No. Detected**)
Be-7	(11) (0)		-1.0E 1 (-1.2 - 1.1)E 2 (0/ 7)	01	1.1E 2 (0/ 1)	-1.9E 1 (-5.5 - 0.6)E 1 (0/ 4)
K-40	(11) (0)		3.1E 3 (2.4 - 3.8)E 3 (7/ 7)	53	3.5E 3 (3.3 - 3.7)E 3 (4/ 4)	3.5E 3 (3.3 - 3.7)E 3 (4/ 4)
Cr-51	(11) (0)		3.2E 1 (-3.2 - 14.7)E 1 (0/ 7)	01	1.5E 2 (0/ 1)	-2.6E 1 (-3.5 - -1.7)E 1 (0/ 4)
Mn-54	(11) (0)	130	2.7E 0 (-1.2 - 2.5)E 1 (0/ 7)	01	1.1E 1 (0/ 1)	-3.6E 0 (-8.5 - 1.2)E 0 (0/ 4)
Co-57	(11) (0)		2.1E 0 (-2.5 - 8.9)E 0 (0/ 7)	01	4.1E 0 (0/ 1)	1.0E 0 (-6.4 - 19.6)E -1 (0/ 4)
Co-58	(11) (0)	130	-6.2E 0 (-3.5 - 0.4)E 1 (0/ 7)	53	2.1E 0 (2.2 - 72.6)E -1 (0/ 4)	2.1E 0 (2.2 - 72.6)E -1 (0/ 4)
Fe-59	(11) (0)	260	8.5E 0 (-6.1 - 46.1)E 0 (0/ 7)	03	1.2E 1 (-1.6 - 46.1)E 0 (0/ 4)	5.9E 0 (-2.8 - 11.1)E 0 (0/ 4)
Co-60	(11) (0)	130	-3.6E -1 (-1.8 - 2.1)E 1 (0/ 7)	01	2.1E 1 (0/ 1)	-1.8E 0 (-7.5 - 1.4)E 0 (0/ 4)
Zn-65	(11) (0)	260	-1.4E 0 (-1.1 - 0.6)E 2 (0/ 7)	01	6.2E 1 (0/ 1)	6.0E 0 (-7.7 - 30.9)E 0 (0/ 4)
Se-75	(11) (0)		-1.3E 0 (-1.9 - 0.6)E 1 (0/ 7)	03	1.7E 0 (-1.0 - 5.4)E 0 (0/ 4)	-3.8E 0 (-1.3 - 0.0)E 1 (0/ 4)
Nb-95	(11) (0)		1.7E -1 (-1.3 - 1.1)E 1 (0/ 7)	03	3.0E 0 (-2.2 - 111.0)E -1 (0/ 4)	-1.7E 0 (-4.0 - -0.5)E 0 (0/ 4)
Zr-95	(11) (0)		3.1E 0 (-1.6 - 4.1)E 1 (0/ 7)	01	4.1E 1 (0/ 1)	-1.7E -1 (-5.4 - 2.7)E 0 (0/ 4)
Ru-103	(11) (0)		-1.1E 0 (-1.1 - 1.2)E 1 (0/ 7)	06	5.9E 0 (-3.4 - 122.0)E -1 (0/ 2)	4.5E -1 (-4.2 - 19.5)E -1 (0/ 4)

* Non-Routine refers to those radionuclides that exceeded the Reporting Levels in ODCM Table A.9.1-3.
** The fraction of detectable measurements (i.e., > MDC with no uncertain identification) is shown in parentheses.

Table 3.7-1 (Continued)
Radiological Environmental Monitoring Program Summary
Seabrook Nuclear Power Station, Seabrook, NH
(January - December 2022)

MEDIUM: Fish (FH) UNITS: pCi/kg

Radionuclides (No. Analyses) (Non-Routine*)		Required LLD	Indicator Stations Mean Range (No. Detected**)	Station With Highest Mean Station	 Mean Range (No. Detected**)	Control Stations Mean Range (No. Detected**)
Ru-106	(11) (0)		-5.1E 1 (-1.6 - -0.1)E 2 (0/ 7)	53	1.6E 0 (-2.3 - 3.4)E 1 (0/ 4)	1.6E 0 (-2.3 - 3.4)E 1 (0/ 4)
Ag-108m	(11) (0)		2.9E 0 (-1.5 - 16.4)E 0 (0/ 7)	01	1.6E 1 (0/ 1)	2.0E 0 (-1.0 - 5.5)E 0 (0/ 4)
Ag-110m	(11) (0)		4.3E 0 (-1.1 - 15.4)E 0 (0/ 7)	06	7.2E 0 (-1.1 - 15.4)E 0 (0/ 2)	1.3E 0 (-1.9 - 5.4)E 0 (0/ 4)
Sb-124	(11) (0)		-9.6E -1 (-3.1 - 1.3)E 1 (0/ 7)	01	1.3E 1 (0/ 1)	-8.2E 0 (-2.6 - 0.0)E 1 (0/ 4)
Sb-125	(11) (0)		1.3E 1 (-1.1 - 5.4)E 1 (0/ 7)	06	3.2E 1 (1.1 - 5.4)E 1 (0/ 2)	1.4E 0 (-8.4 - 53.7)E -1 (0/ 4)
I-131	(11) (0)		2.0E 1 (-3.8 - 75.5)E 0 (0/ 7)	01	7.6E 1 (0/ 1)	-4.4E 0 (-7.4 - -1.2)E 0 (0/ 4)
Cs-134	(11) (0)	130	3.2E -2 (-5.5 - 10.1)E 0 (0/ 7)	06	5.7E 0 (1.3 - 10.1)E 0 (0/ 2)	-7.0E -1 (-4.1 - 1.5)E 0 (0/ 4)
Cs-137	(11) (0)	150	3.4E 0 (-1.6 - 1.4)E 1 (0/ 7)	01	1.2E 1 (0/ 1)	3.4E 0 (4.0 - 97.5)E -1 (0/ 4)
Ba-140	(11) (0)		-2.0E 1 (-1.4 - 0.4)E 2 (0/ 7)	53	8.8E 0 (-7.2 - 26.9)E 0 (0/ 4)	8.8E 0 (-7.2 - 26.9)E 0 (0/ 4)
La-140	(11) (0)		6.5E 0 (-3.1 - 7.3)E 1 (0/ 7)	06	3.2E 1 (-8.5 - 72.9)E 0 (0/ 2)	-4.4E 0 (-1.6 - 0.7)E 1 (0/ 4)
Ce-141	(11) (0)		-9.3E 0 (-3.5 - 1.2)E 1 (0/ 7)	01	1.2E 1 (0/ 1)	-2.8E 0 (-1.4 - 0.7)E 1 (0/ 4)
Ce-144	(11) (0)		-2.1E 1 (-1.3 - 0.2)E 2 (0/ 7)	06	1.2E 1 (1.0 - 1.4)E 1 (0/ 2)	3.2E 0 (0.0 - 7.0)E 0 (0/ 4)
TL-208	(11) (0)		-5.1E 0 (-2.5 - 0.1)E 1 (0/ 7)	01	0.0E 0 (0/ 1)	-4.5E -1 (-6.9 - 6.2)E 0 (0/ 4)

* Non-Routine refers to those radionuclides that exceeded the Reporting Levels in ODCM Table A.9.1-3.
** The fraction of detectable measurements (i.e., > MDC with no uncertain identification) is shown in parentheses.

Table 3.7-1 (Continued)
Radiological Environmental Monitoring Program Summary
Seabrook Nuclear Power Station, Seabrook, NH
(January - December 2022)

MEDIUM: Fish (FH) UNITS: pCi/kg

Radionuclides (No. Analyses) (Non-Routine*)		Required LLD	Indicator Stations Mean Range (No. Detected**)	Station With Highest Mean Station	 Mean Range (No. Detected**)	Control Stations Mean Range (No. Detected**)
Pb-212	(11) (0)		1.1E 1 (-2.1 - 42.6)E 0 (0/ 7)	01	4.3E 1 (0/ 1)	9.5E -1 (-3.1 - 6.0)E 0 (0/ 4)
Pb-214	(11) (0)		-4.4E 0 (-1.2 - 2.0)E 1 (0/ 7)	06	5.7E 0 (-8.1 - 19.5)E 0 (0/ 2)	-4.2E 0 (-1.2 - 0.3)E 1 (0/ 4)
Bi-214	(11) (0)		3.8E -1 (-7.9 - 5.6)E 1 (0/ 7)	06	3.6E 1 (1.7 - 5.6)E 1 (0/ 2)	5.9E 0 (0.0 - 1.6)E 1 (0/ 4)
Ra-226	(11) (0)		9.4E 0 (-1.2 - 5.6)E 1 (0/ 7)	06	3.8E 1 (2.0 - 5.6)E 1 (0/ 2)	-1.1E 0 (-1.2 - 0.7)E 1 (0/ 4)
Ac-228	(11) (0)		2.4E 1 (-3.5 - 19.9)E 1 (0/ 7)	01	2.0E 2 (0/ 1)	1.1E 0 (-1.7 - 1.4)E 1 (0/ 4)
Th-228	(11) (0)		1.1E 1 (-2.1 - 42.6)E 0 (0/ 7)	01	4.3E 1 (0/ 1)	9.5E -1 (-3.1 - 6.0)E 0 (0/ 4)
Th-230	(11) (0)		9.4E 0 (-1.2 - 5.6)E 1 (0/ 7)	06	3.8E 1 (2.0 - 5.6)E 1 (0/ 2)	-1.1E 0 (-1.2 - 0.7)E 1 (0/ 4)

* Non-Routine refers to those radionuclides that exceeded the Reporting Levels in ODCM Table A.9.1-3.
** The fraction of detectable measurements (i.e., > MDC with no uncertain identification) is shown in parentheses.

3.8 Lobsters

Semiannual fish and invertebrate samples were required from two locations. This section provides the results for one type of invertebrate – *Homarus americanus (*American lobsters) which is an important commercial food species from local waters. Lobsters (HA) were collected from an indicator location near the discharge (HA-04) and from a control location (HA-54) within Ipswich Bay. A total of four samples were collected for the year. Fish and shellfish results may be found in Sections 3.7 and 3.9, respectively.

A gamma analysis was performed on each sample. The only radionuclide detected in lobster samples in 2022 was naturally-occurring K-40 (all samples). Similar to past years, no plant-related radionuclides were detected in any sample. Therefore, no increasing or decreasing trends were observed. Consequently, there is no dose to the public or impact to the environment from this pathway due to plant operations. This is consistent with previous years as well as the pre-operational program.

The REMP Summary Table 3.8-1 also lists the range of analysis results by radionuclide for Indicator and Control Stations for all lobster samples. Attachment 1 to this report lists the individual analysis results for each measurement of lobsters under the Sample Type code HA.

Any sample collection and analysis deviations from the ODCM required program, or reportable concentrations that may have occurred during the year are described in Section 5.

Table 3.8-1
Radiological Environmental Program Summary
Seabrook Nuclear Power Station, Seabrook, NH
(January - December 2022)

MEDIUM: American Lobster (HA) UNITS: pCi/kg

Radionuclides (No. Analyses) (Non-Routine*)		Required LLD	Indicator Stations Mean Range (No. Detected**)	Station With Highest Mean Station	 Mean Range (No. Detected**)	Control Stations Mean Range (No. Detected**)
Be-7	(4)		6.6E -2	54	9.1E 0	9.1E 0
	(0)		(0.0 - 1.3)E -1 (0/ 2)		(-3.9 - 22.0)E 0 (0/ 2)	(-3.9 - 22.0)E 0 (0/ 2)
K-40	(4)		2.6E 3	04	2.6E 3	2.3E 3
	(0)		(2.2 - 3.0)E 3 (2/ 2)		(2.2 - 3.0)E 3 (2/ 2)	(2.1 - 2.6)E 3 (2/ 2)
Cr-51	(4)		9.3E 0	04	9.3E 0	9.0E 0
	(0)		(5.5 - 13.0)E 0 (0/ 2)		(5.5 - 13.0)E 0 (0/ 2)	(-5.1 - 23.1)E 0 (0/ 2)
Mn-54	(4)	130	-3.1E 0	54	1.8E 0	1.8E 0
	(0)		(-8.8 - 2.7)E 0 (0/ 2)		(1.0 - 2.6)E 0 (0/ 2)	(1.0 - 2.6)E 0 (0/ 2)
Co-57	(4)		-9.1E -1	54	1.0E 0	1.0E 0
	(0)		(-2.3 - 0.5)E 0 (0/ 2)		(-1.5 - 22.1)E -1 (0/ 2)	(-1.5 - 22.1)E -1 (0/ 2)
Co-58	(4)	130	-9.1E -1	54	1.8E 0	1.8E 0
	(0)		(-5.8 - 4.0)E 0 (0/ 2)		(1.2 - 2.4)E 0 (0/ 2)	(1.2 - 2.4)E 0 (0/ 2)
Fe-59	(4)	260	8.5E -1	54	5.3E 0	5.3E 0
	(0)		(-1.3 - 3.0)E 0 (0/ 2)		(4.1 - 6.5)E 0 (0/ 2)	(4.1 - 6.5)E 0 (0/ 2)
Co-60	(4)	130	5.3E 0	04	5.3E 0	2.2E 0
	(0)		(3.4 - 7.2)E 0 (0/ 2)		(3.4 - 7.2)E 0 (0/ 2)	(-3.9 - 48.3)E -1 (0/ 2)
Zn-65	(4)	260	1.7E 0	04	1.7E 0	-2.1E 0
	(0)		(-8.3 - 41.6)E -1 (0/ 2)		(-8.3 - 41.6)E -1 (0/ 2)	(-1.1 - 0.7)E 1 (0/ 2)
Se-75	(4)		1.5E 0	04	1.5E 0	2.9E -1
	(0)		(1.0 - 2.0)E 0 (0/ 2)		(1.0 - 2.0)E 0 (0/ 2)	(-8.8 - 14.7)E -1 (0/ 2)
Nb-95	(4)		-2.2E 0	54	2.4E 0	2.4E 0
	(0)		(-3.4 - -1.0)E 0 (0/ 2)		(-1.8 - 48.9)E -1 (0/ 2)	(-1.8 - 48.9)E -1 (0/ 2)
Zr-95	(4)		-5.4E 0	54	-4.3E 0	-4.3E 0
	(0)		(-1.4 - 0.3)E 1 (0/ 2)		(-8.5 - -0.1)E 0 (0/ 2)	(-8.5 - -0.1)E 0 (0/ 2)
Ru-103	(4)		-3.5E 0	54	1.1E 0	1.1E 0
	(0)		(-4.7 - -2.2)E 0 (0/ 2)		(4.2 - 18.2)E -1 (0/ 2)	(4.2 - 18.2)E -1 (0/ 2)

* Non-Routine refers to those radionuclides that exceeded the Reporting Levels in ODCM Table A.9.1-3.
** The fraction of detectable measurements (i.e., > MDC with no uncertain identification) is shown in parentheses.

Table 3.8-1 (Continued)
Radiological Environmental Monitoring Program Summary
Seabrook Nuclear Power Station, Seabrook, NH
(January - December 2022)

MEDIUM: American Lobster (HA) UNITS: pCi/kg

Radionuclides (No. Analyses) (Non-Routine*)		Required LLD	Indicator Stations Mean Range (No. Detected**)	Station With Highest Mean Station	Mean Range (No. Detected**)	Control Stations Mean Range (No. Detected**)
Ru-106	(4)		6.3E 1	04	6.3E 1	-1.4E 1
	(0)		(-4.3 - 130.0)E 0 (0/ 2)		(-4.3 - 130.0)E 0 (0/ 2)	(-1.5 - -1.2)E 1 (0/ 2)
Ag-108m	(4)		1.9E 0	04	1.9E 0	1.5E 0
	(0)		(1.4 - 2.4)E 0 (0/ 2)		(1.4 - 2.4)E 0 (0/ 2)	(-1.0 - 4.1)E 0 (0/ 2)
Ag-110m	(4)		5.4E 0	04	5.4E 0	5.0E -1
	(0)		(4.8 - 6.0)E 0 (0/ 2)		(4.8 - 6.0)E 0 (0/ 2)	(-7.7 - 17.6)E -1 (0/ 2)
Sb-124	(4)		-1.6E 0	54	-5.7E -1	-5.7E -1
	(0)		(-5.7 - 2.6)E 0 (0/ 2)		(-2.1 - 0.9)E 0 (0/ 2)	(-2.1 - 0.9)E 0 (0/ 2)
Sb-125	(4)		2.7E 0	04	2.7E 0	-3.8E -1
	(0)		(2.0 - 3.5)E 0 (0/ 2)		(2.0 - 3.5)E 0 (0/ 2)	(-1.9 - 1.2)E 0 (0/ 2)
I-131	(4)		-2.5E 0	54	5.9E 0	5.9E 0
	(0)		(-1.3 - 0.8)E 1 (0/ 2)		(4.4 - 7.3)E 0 (0/ 2)	(4.4 - 7.3)E 0 (0/ 2)
Cs-134	(4)	130	2.7E 0	04	2.7E 0	1.8E 0
	(0)		(9.8 - 535.0)E -2 (0/ 2)		(9.8 - 535.0)E -2 (0/ 2)	(3.9 - 32.3)E -1 (0/ 2)
Cs-137	(4)	150	9.3E 0	04	9.3E 0	-1.1E 0
	(0)		(1.8 - 16.9)E 0 (0/ 2)		(1.8 - 16.9)E 0 (0/ 2)	(-1.9 - -0.3)E 0 (0/ 2)
Ba-140	(4)		1.6E 0	54	1.2E 1	1.2E 1
	(0)		(-1.5 - 1.8)E 1 (0/ 2)		(7.5 - 16.1)E 0 (0/ 2)	(7.5 - 16.1)E 0 (0/ 2)
La-140	(4)		-3.3E 0	54	9.5E -1	9.5E -1
	(0)		(-4.9 - -1.7)E 0 (0/ 2)		(9.4 - 9.6)E -1 (0/ 2)	(9.4 - 9.6)E -1 (0/ 2)
Ce-141	(4)		-6.1E 0	54	-3.1E 0	-3.1E 0
	(0)		(-1.5 - 0.3)E 1 (0/ 2)		(-5.0 - -1.2)E 0 (0/ 2)	(-5.0 - -1.2)E 0 (0/ 2)
Ce-144	(4)		4.7E 0	04	4.7E 0	1.3E 0
	(0)		(4.2 - 5.1)E 0 (0/ 2)		(4.2 - 5.1)E 0 (0/ 2)	(1.3 - 25.6)E -1 (0/ 2)
Ac-228	(4)		-2.3E 1	54	-1.3E 1	-1.3E 1
	(0)		(-3.3 - -1.4)E 1 (0/ 2)		(-1.7 - -0.8)E 1 (0/ 2)	(-1.7 - -0.8)E 1 (0/ 2)
Th-228	(4)		8.7E 0	04	8.7E 0	7.0E 0
	(0)		(5.5 - 11.9)E 0 (0/ 2)		(5.5 - 11.9)E 0 (0/ 2)	(-4.2 - 18.1)E 0 (0/ 2)

* Non-Routine refers to those radionuclides that exceeded the Reporting Levels in ODCM Table A.9.1-3.
** The fraction of detectable measurements (i.e., > MDC with no uncertain identification) is shown in parentheses.

3.9 Shellfish

Semiannual fish and invertebrate samples are required by the ODCM from two locations. This section provides the results for shellfish (MU) samples only. In 2022, four locations (two indicators and two controls) were included in the sample collections. Fish and lobster results may be found in the Sections 3.7 and 3.8, entitled Fish and Lobsters, respectively.

During the year there were two species of mussels (MU) harvested for analysis. *Modiolus (horse mussels)* was collected by divers from near the discharge outfall (indicator station MU-06) and from Ipswich Bay (control MU-56). *Mytilus* (blue mussels) were collected from the intertidal areas of Hampton Harbor (indicator MU-09) and Plum Island (control MU-59). A total of eight samples were collected in 2022 and analyzed for radioactivity in the edible portion or meat of the shellfish.

The only radionuclides detected in edible shellfish body samples in 2022 were naturally-occurring K-40 (8 of 8 samples), and Be-7 (two of 8 samples). Similar to past years, no plant-related gamma emitting radionuclides were detected in any sample. Therefore, no increasing or decreasing trends were observed. Consequently, there is no dose to the public or impact to the environment from this pathway due to plant operations. This is consistent with the pre-operational program and with previous years of plant operations.

Additional analyses were conducted on the May and November shellfish collections from both indicator (MS-06) and control (MS-56) locations. Mussel shells (MS) were analyzed for Strontium 89 and 90 (four samples) to see if there was any indication of strontium uptake into the shell. For 2022, no Sr-89/90 was detected in any sample. No shell analyses are required by the REMP as defined in the ODCM.

The REMP Summary Table 3.9-1 (mussel bodies) and Table 3.9-2 (mussel shells) list the range of analysis results by radionuclide for Indicator and Control Stations for all shellfish samples. Attachment 1 to this report lists the individual analysis results for each measurement of shellfish under the Sample Type code MU for the edible portions and MS for shells only.

Any sample collection and analysis deviations from the ODCM required program, or reportable concentrations that may have occurred during the year, are described in Section 5.

Table 3.9-1
Radiological Environmental Program Summary
Seabrook Nuclear Power Station, Seabrook, NH
(January - December 2022)

MEDIUM: Mussel Body (MU) UNITS: pCi/kg

Radionuclides (No. Analyses) (Non-Routine*)		Required LLD	Indicator Stations Mean Range (No. Detected**)	Station With Highest Mean Station	Station With Highest Mean Mean Range (No. Detected**)	Control Stations Mean Range (No. Detected**)
Be-7	(8)		2.9E 1	09	3.9E 1	2.3E 1
	(0)		(-1.8 - 68.1)E 0 (1/ 4)		(9.7 - 68.1)E 0 (1/ 2)	(-1.5 - 7.0)E 1 (1/ 4)
K-40	(8)		1.3E 3	56	1.4E 3	1.4E 3
	(0)		(1.1 - 1.5)E 3 (4/ 4)		(1.3 - 1.4)E 3 (2/ 2)	(1.1 - 1.6)E 3 (4/ 4)
Cr-51	(8)		2.5E 1	09	7.2E 1	-5.3E -1
	(0)		(-3.5 - 15.5)E 1 (0/ 4)		(-1.1 - 15.5)E 1 (0/ 2)	(-1.1 - 1.1)E 1 (0/ 4)
Mn-54	(8)	130	-3.1E -1	59	2.4E 0	1.2E 0
	(0)		(-2.7 - 1.3)E 0 (0/ 4)		(1.8 - 2.9)E 0 (0/ 2)	(-7.3 - 29.0)E -1 (0/ 4)
Co-57	(8)		-1.8E 0	56	7.0E -1	-1.2E -1
	(0)		(-8.0 - 0.9)E 0 (0/ 4)		(4.8 - 9.2)E -1 (0/ 2)	(-1.4 - 0.9)E 0 (0/ 4)
Co-58	(8)	130	-3.6E 0	56	2.4E 0	1.2E 0
	(0)		(-1.5 - 0.2)E 1 (0/ 4)		(7.6 - 41.4)E -1 (0/ 2)	(-9.2 - 41.4)E -1 (0/ 4)
Fe-59	(8)	260	-1.9E 0	56	6.9E 0	6.1E 0
	(0)		(-4.8 - 3.2)E 0 (0/ 4)		(4.6 - 9.1)E 0 (0/ 2)	(4.6 - 9.1)E 0 (0/ 4)
Co-60	(8)	130	4.9E 0	09	1.1E 1	7.2E -1
	(0)		(-5.0 - 21.5)E 0 (0/ 4)		(6.6 - 215.0)E -1 (0/ 2)	(-3.1 - 22.7)E -1 (0/ 4)
Zn-65	(8)	260	2.1E 0	09	4.6E 0	-9.6E -1
	(0)		(-3.8 - 7.9)E 0 (0/ 4)		(1.4 - 7.9)E 0 (0/ 2)	(-8.1 - 8.0)E 0 (0/ 4)
Se-75	(8)		4.2E 0	09	7.7E 0	-4.6E -1
	(0)		(-2.4 - 17.8)E 0 (0/ 4)		(-2.4 - 17.8)E 0 (0/ 2)	(-3.0 - 3.3)E 0 (0/ 4)
Nb-95	(8)		2.3E 0	09	2.8E 0	-3.6E -1
	(0)		(-2.9 - 8.4)E 0 (0/ 4)		(-2.9 - 8.4)E 0 (0/ 2)	(-3.1 - 1.2)E 0 (0/ 4)
Zr-95	(8)		-5.2E 0	59	3.0E -2	-1.9E -1
	(0)		(-1.5 - 0.2)E 1 (0/ 4)		(-2.2 - 2.2)E 0 (0/ 2)	(-2.6 - 2.2)E 0 (0/ 4)
Ru-103	(8)		-6.8E -1	06	9.7E -1	-1.7E 0
	(0)		(-4.0 - 1.3)E 0 (0/ 4)		(6.5 - 13.0)E -1 (0/ 2)	(-5.5 - 0.2)E 0 (0/ 4)

* Non-Routine refers to those radionuclides that exceeded the Reporting Levels in ODCM Table A.9.1-3.
** The fraction of detectable measurements (i.e., > MDC with no uncertain identification) is shown in parentheses.

Table 3.9-1 (Continued)
Radiological Environmental Monitoring Program Summary
Seabrook Nuclear Power Station, Seabrook, NH
(January - December 2022)

MEDIUM: Mussel Body (MU) UNITS: pCi/kg

Radionuclides (No. Analyses) (Non-Routine*)		Required LLD	Indicator Stations Mean Range (No. Detected**)	Station With Highest Mean Station	Station With Highest Mean Mean Range (No. Detected**)	Control Stations Mean Range (No. Detected**)
Ru-106	(8)		2.2E 1	09	3.3E 1	-3.7E -1
	(0)		(-8.2 - 665.0)E -1 (0/ 4)		(-8.2 - 665.0)E -1 (0/ 2)	(-2.4 - 2.6)E 1 (0/ 4)
Ag-108m	(8)		-3.5E 0	59	-3.9E -1	-6.4E -1
	(0)		(-1.1 - 0.2)E 1 (0/ 4)		(-4.7 - -3.0)E -1 (0/ 2)	(-1.0 - -0.3)E 0 (0/ 4)
Ag-110m	(8)		-1.1E 0	56	3.5E -2	-4.4E -1
	(0)		(-2.4 - 0.1)E 0 (0/ 4)		(-2.2 - 2.3)E 0 (0/ 2)	(-3.8 - 2.3)E 0 (0/ 4)
Sb-124	(8)		4.8E 0	09	7.3E 0	-1.0E -1
	(0)		(-1.8 - 13.1)E 0 (0/ 4)		(1.5 - 13.1)E 0 (0/ 2)	(-6.0 - 4.7)E 0 (0/ 4)
Sb-125	(8)		-5.6E 0	06	1.5E 0	-1.6E 0
	(0)		(-3.0 - 0.6)E 1 (0/ 4)		(-2.6 - 5.6)E 0 (0/ 2)	(-7.7 - 6.9)E 0 (0/ 4)
I-131	(8)		2.7E 0	09	6.7E 0	4.9E 0
	(0)		(-5.6 - 8.2)E 0 (0/ 4)		(5.3 - 8.2)E 0 (0/ 2)	(2.0 - 10.6)E 0 (0/ 4)
Cs-134	(8)	130	4.4E 0	09	1.1E 1	-7.3E -1
	(0)		(-4.2 - 17.3)E 0 (0/ 4)		(5.0 - 17.3)E 0 (0/ 2)	(-1.9 - 0.4)E 0 (0/ 4)
Cs-137	(8)	150	2.9E 0	09	4.3E 0	4.6E -1
	(0)		(-1.3 - 10.0)E 0 (0/ 4)		(-1.3 - 10.0)E 0 (0/ 2)	(-1.4 - 2.4)E 0 (0/ 4)
Ba-140	(8)		5.9E -1	09	9.1E 0	-9.8E -1
	(0)		(-2.0 - 2.4)E 1 (0/ 4)		(-5.7 - 23.9)E 0 (0/ 2)	(-1.0 - 1.3)E 1 (0/ 4)
La-140	(8)		-2.9E 0	59	3.2E 0	8.0E -1
	(0)		(-4.4 - -1.1)E 0 (0/ 4)		(2.4 - 4.0)E 0 (0/ 2)	(-1.7 - 4.0)E 0 (0/ 4)
Ce-141	(8)		3.2E -1	06	4.1E 0	5.3E -1
	(0)		(-1.3 - 0.9)E 1 (0/ 4)		(-1.1 - 9.3)E 0 (0/ 2)	(-8.0 - 25.9)E -1 (0/ 4)
Ce-144	(8)		2.2E 0	09	2.3E 0	-7.4E 0
	(0)		(-3.2 - 45.4)E -1 (0/ 4)		(0.0 - 4.5)E 0 (0/ 2)	(-1.5 - 0.3)E 1 (0/ 4)
TL-208	(8)		7.5E 0	09	8.8E 0	6.4E -1
	(0)		(1.1 - 16.5)E 0 (0/ 4)		(1.1 - 16.5)E 0 (0/ 2)	(-2.0 - 3.8)E 0 (0/ 4)

* Non-Routine refers to those radionuclides that exceeded the Reporting Levels in ODCM Table A.9.1-3.
** The fraction of detectable measurements (i.e., > MDC with no uncertain identification) is shown in parentheses.

Table 3.9-1 (Continued)
Radiological Environmental Monitoring Program Summary
Seabrook Nuclear Power Station, Seabrook, NH
(January - December 2022)

MEDIUM: Mussel Body (MU) UNITS: pCi/kg

Radionuclides (No. Analyses) (Non-Routine*)		Required LLD	Indicator Stations Mean Range (No. Detected**)	Station With Highest Mean Station	Station With Highest Mean Mean Range (No. Detected**)	Control Stations Mean Range (No. Detected**)
Pb-212	(8)		6.2E 0	09	1.6E 1	2.8E 0
	(0)		(-1.5 - 2.2)E 1 (0/ 4)		(1.1 - 2.2)E 1 (0/ 2)	(0.0 - 5.6)E 0 (0/ 4)
Pb-214	(8)		1.4E 1	09	1.8E 1	7.1E -1
	(0)		(2.9 - 29.0)E 0 (0/ 4)		(6.6 - 29.0)E 0 (0/ 2)	(-4.8 - 6.3)E 0 (0/ 4)
Bi-214	(8)		7.1E 0	09	1.2E 1	6.6E 0
	(0)		(-2.1 - 14.8)E 0 (0/ 4)		(8.9 - 14.8)E 0 (0/ 2)	(-3.1 - 18.3)E 0 (0/ 4)
Ra-226	(8)		6.3E 0	09	7.8E 0	5.7E 0
	(0)		(2.9 - 8.9)E 0 (0/ 4)		(6.6 - 8.9)E 0 (0/ 2)	(-3.9 - 18.3)E 0 (0/ 4)
Ac-228	(8)		1.7E 1	09	3.1E 1	-3.6E 0
	(0)		(-5.6 - 63.8)E 0 (0/ 4)		(-2.2 - 63.8)E 0 (0/ 2)	(-1.7 - 0.8)E 1 (0/ 4)
Th-228	(8)		6.2E 0	09	1.6E 1	2.8E 0
	(0)		(-1.5 - 2.2)E 1 (0/ 4)		(1.1 - 2.2)E 1 (0/ 2)	(0.0 - 5.6)E 0 (0/ 4)
Th-230	(8)		6.3E 0	09	7.8E 0	5.7E 0
	(0)		(2.9 - 8.9)E 0 (0/ 4)		(6.6 - 8.9)E 0 (0/ 2)	(-3.9 - 18.3)E 0 (0/ 4)

* Non-Routine refers to those radionuclides that exceeded the Reporting Levels in ODCM Table A.9.1-3.
** The fraction of detectable measurements (i.e., > MDC with no uncertain identification) is shown in parentheses.

Table 3.9-2
Radiological Environmental Program Summary
Seabrook Nuclear Power Station, Seabrook, NH
(January - December 2022)

MEDIUM: Mussel Shell (MS) UNITS: pCi/kg

Radionuclides (No. Analyses) (Non-Routine*)		Required LLD	Indicator Stations Mean Range (No. Detected**)	Station With Highest Mean Station	 Mean Range (No. Detected**)	Control Stations Mean Range (No. Detected**)
Sr-89	**(4)**	300	2.3E 1	06	2.3E 1	-4.3E 1
	(0)		(-7.8 - 12.3)E 1 (0/ 2)		(-7.8 - 12.3)E 1 (0/ 2)	(-1.1 - 0.2)E 2 (0/ 2)
Sr-90	**(4)**	300	-9.9E 1	56	-5.1E 0	-5.1E 0
	(0)		(-1.7 - -0.3)E 2 (0/ 2)		(-1.4 - 0.3)E 1 (0/ 2)	(-1.4 - 0.3)E 1 (0/ 2)

* Non-Routine refers to those radionuclides that exceeded the Reporting Levels in ODCM Table A.9.1-3.
** The fraction of detectable measurements (i.e., > MDC with no uncertain identification) is shown in parentheses.

3.10 Irish Moss

There is no REMP technical requirement defined in the ODCM to collect Irish Moss (algae) samples. As a supplement to the required REMP, semiannual Chondrus (Irish Moss) samples were collected from an indicator area (AL-05) near the plant discharge and a control location (AL-55) within Ipswich Bay. If plant-related radionuclides were re-concentrating in the aquatic environment, an early indication of this might be shown in this type of environmental species. Four routine samples (two indicators and two controls) were collected for the year.

A gamma analysis was performed on each sample. Although not required by Table 5.2-1, the LLDs associated with food products were applied to ensure adequate counting statistics. Naturally-occurring K-40, Be-7, Pb-212, and Th-228 were detected in both indicator and control samples. No plant-related radionuclides were detected in any of the samples. Therefore, no plant-related increasing or decreasing trends were observed. Subsequently, there is no dose or impact to the environment from plant operations. This is consistent with the pre-operational program and previous years of plant operations.

The REMP Summary Table 3.10-1 lists the range of analysis results by radionuclide for Indicator and Control Stations for Irish Moss samples. Attachment 1 lists the individual analysis results for each measurement of Irish moss under the Sample Type code AL.

Any sample collection and analysis deviations from the ODCM defined program, or reportable concentrations that may have occurred during the year, are described in Section 5.

Table 3.10-1
Radiological Environmental Program Summary
Seabrook Nuclear Power Station, Seabrook, NH
(January - December 2022)

MEDIUM: Irish Moss (AL) UNITS: pCi/kg

Radionuclides (No. Analyses) (Non-Routine*)		Required LLD	Indicator Stations Mean Range (No. Detected**)	Station With Highest Mean Station	 Mean Range (No. Detected**)	Control Stations Mean Range (No. Detected**)
Be-7	(4)		7.7E 1	55	4.3E 2	4.3E 2
	(0)		(-3.3 - 18.8)E 1 (1/ 2)		(3.9 - 4.6)E 2 (2/ 2)	(3.9 - 4.6)E 2 (2/ 2)
K-40	(4)		6.8E 3	05	6.8E 3	5.2E 3
	(0)		(6.2 - 7.4)E 3 (2/ 2)		(6.2 - 7.4)E 3 (2/ 2)	(4.1 - 6.4)E 3 (2/ 2)
Cr-51	(4)		-2.2E 1	55	-2.0E 1	-2.0E 1
	(0)		(-4.2 - -0.2)E 1 (0/ 2)		(-8.1 - 4.1)E 1 (0/ 2)	(-8.1 - 4.1)E 1 (0/ 2)
Mn-54	(4)		3.0E 0	05	3.0E 0	-2.7E 0
	(0)		(9.8 - 586.0)E -2 (0/ 2)		(9.8 - 586.0)E -2 (0/ 2)	(-4.6 - -0.9)E 0 (0/ 2)
Co-57	(4)		-5.1E -1	55	7.5E -2	7.5E -2
	(0)		(-5.8 - -4.4)E -1 (0/ 2)		(-1.0 - 1.2)E 0 (0/ 2)	(-1.0 - 1.2)E 0 (0/ 2)
Co-58	(4)		2.2E 0	05	2.2E 0	-9.0E -1
	(0)		(1.2 - 3.2)E 0 (0/ 2)		(1.2 - 3.2)E 0 (0/ 2)	(-2.2 - 0.4)E 0 (0/ 2)
Fe-59	(4)		-6.5E 0	05	-6.5E 0	-8.5E 0
	(0)		(-9.7 - -3.3)E 0 (0/ 2)		(-9.7 - -3.3)E 0 (0/ 2)	(-9.3 - -7.6)E 0 (0/ 2)
Co-60	(4)		-3.2E 0	55	2.9E 0	2.9E 0
	(0)		(-3.5 - -2.9)E 0 (0/ 2)		(-4.3 - 62.4)E -1 (0/ 2)	(-4.3 - 62.4)E -1 (0/ 2)
Zn-65	(4)		1.8E 0	05	1.8E 0	-2.5E -1
	(0)		(-1.5 - 5.2)E 0 (0/ 2)		(-1.5 - 5.2)E 0 (0/ 2)	(-1.1 - 1.0)E 1 (0/ 2)
Se-75	(4)		9.8E 0	05	9.8E 0	-2.1E 0
	(0)		(9.0 - 10.6)E 0 (0/ 2)		(9.0 - 10.6)E 0 (0/ 2)	(-3.4 - -0.8)E 0 (0/ 2)
Nb-95	(4)		3.9E 0	05	3.9E 0	-7.7E -1
	(0)		(3.1 - 4.7)E 0 (0/ 2)		(3.1 - 4.7)E 0 (0/ 2)	(-6.6 - 5.1)E 0 (0/ 2)
Zr-95	(4)		-2.8E 0	55	3.8E 0	3.8E 0
	(0)		(-3.3 - -2.4)E 0 (0/ 2)		(1.2 - 6.4)E 0 (0/ 2)	(1.2 - 6.4)E 0 (0/ 2)
Ru-103	(4)		2.0E 0	55	2.2E 0	2.2E 0
	(0)		(8.4 - 30.7)E -1 (0/ 2)		(1.4 - 2.9)E 0 (0/ 2)	(1.4 - 2.9)E 0 (0/ 2)

* Non-Routine refers to those radionuclides that exceeded the Reporting Levels in ODCM Table A.9.1-3.
** The fraction of detectable measurements (i.e., > MDC with no uncertain identification) is shown in parentheses.

Table 3.10-1
Radiological Environmental Monitoring Program Summary
Seabrook Nuclear Power Station, Seabrook, NH
(January - December 2022)

MEDIUM: Irish Moss (AL) UNITS: pCi/kg

Radionuclides (No. Analyses) (Non-Routine*)		Required LLD	Indicator Stations Mean Range (No. Detected**)	Station With Highest Mean Station	Mean Range (No. Detected**)	Control Stations Mean Range (No. Detected**)
Ru-106	(4)		-3.2E 1	55	4.5E 0	4.5E 0
	(0)		(-4.2 - -2.2)E 1 (0/ 2)		(-1.8 - 2.7)E 1 (0/ 2)	(-1.8 - 2.7)E 1 (0/ 2)
Ag-108m	(4)		-2.3E 0	05	-2.3E 0	-2.7E 0
	(0)		(-4.1 - -0.5)E 0 (0/ 2)		(-4.1 - -0.5)E 0 (0/ 2)	(-3.1 - -2.3)E 0 (0/ 2)
Ag-110m	(4)		-4.5E -1	55	2.0E 0	2.0E 0
	(0)		(-2.7 - 1.8)E 0 (0/ 2)		(7.5 - 33.4)E -1 (0/ 2)	(7.5 - 33.4)E -1 (0/ 2)
Sb-124	(4)		4.5E 0	05	4.5E 0	-1.2E 1
	(0)		(2.9 - 6.1)E 0 (0/ 2)		(2.9 - 6.1)E 0 (0/ 2)	(-1.4 - -1.0)E 1 (0/ 2)
Sb-125	(4)		-5.3E 0	55	-2.3E 0	-2.3E 0
	(0)		(-1.8 - 0.7)E 1 (0/ 2)		(-6.3 - 1.7)E 0 (0/ 2)	(-6.3 - 1.7)E 0 (0/ 2)
I-131	(4)	60	1.2E 0	05	1.2E 0	2.6E -1
	(0)		(-2.0 - 4.4)E 0 (0/ 2)		(-2.0 - 4.4)E 0 (0/ 2)	(-5.2 - 5.7)E 0 (0/ 2)
Cs-134	(4)	60	4.1E -1	55	7.3E -1	7.3E -1
	(0)		(-1.7 - 2.6)E 0 (0/ 2)		(3.3 - 11.2)E -1 (0/ 2)	(3.3 - 11.2)E -1 (0/ 2)
Cs-137	(4)	80	2.9E 0	05	2.9E 0	2.9E 0
	(0)		(7.5 - 50.9)E -1 (0/ 2)		(7.5 - 50.9)E -1 (0/ 2)	(2.1 - 3.7)E 0 (0/ 2)
Ba-140	(4)		1.1E 0	55	8.1E 0	8.1E 0
	(0)		(-1.9 - 4.1)E 0 (0/ 2)		(2.2 - 14.0)E 0 (0/ 2)	(2.2 - 14.0)E 0 (0/ 2)
La-140	(4)		7.9E -1	05	7.9E -1	-3.1E 0
	(0)		(-4.5 - 20.3)E -1 (0/ 2)		(-4.5 - 20.3)E -1 (0/ 2)	(-6.5 - 0.4)E 0 (0/ 2)
Ce-141	(4)		-1.7E -1	05	-1.7E -1	-2.8E 0
	(0)		(-3.4 - 0.0)E -1 (0/ 2)		(-3.4 - 0.0)E -1 (0/ 2)	(-2.8 - -2.8)E 0 (0/ 2)

* Non-Routine refers to those radionuclides that exceeded the Reporting Levels in ODCM Table A.9.1-3.
** The fraction of detectable measurements (i.e., > MDC with no uncertain identification) is shown in parentheses.

Table 3.10-1
Radiological Environmental Monitoring Program Summary
Seabrook Nuclear Power Station, Seabrook, NH
(January - December 2022)

MEDIUM: Irish Moss (AL) UNITS: pCi/kg

Radionuclides (No. Analyses) (Non-Routine*)		Required LLD	Indicator Stations Mean Range (No. Detected**)	Station With Highest Mean Station	 Mean Range (No. Detected**)	Control Stations Mean Range (No. Detected**)
Ce-144	(4)		-6.3E 0	55	5.8E 0	5.8E 0
	(0)		(-9.0 - -3.6)E 0		(-1.5 - 2.6)E 1	(-1.5 - 2.6)E 1
			(0/ 2)		(0/ 2)	(0/ 2)
Ac-228	(4)		-1.8E 0	55	2.2E 1	2.2E 1
	(0)		(-1.5 - 1.1)E 1		(2.9 - 41.0)E 0	(2.9 - 41.0)E 0
			(0/ 2)		(0/ 2)	(0/ 2)
Th-228	(4)		1.6E 1	55	3.6E 1	3.6E 1
	(0)		(1.5 - 1.7)E 1		(3.2 - 4.1)E 1	(3.2 - 4.1)E 1
			(1/ 2)		(2/ 2)	(2/ 2)
Th-230	(2)		1.1E 1	55	1.4E 1	1.4E 1
	(0)					
			(0/ 1)		(0/ 1)	(0/ 1)

* Non-Routine refers to those radionuclides that exceeded the Reporting Levels in ODCM Table A.9.1-3.
** The fraction of detectable measurements (i.e., > MDC with no uncertain identification) is shown in parentheses.

3.11 Food Crop

There is no requirement for food crop or vegetation samples as long as the required milk locations are available. As noted in Section 3.3, milk sampling at the minimum required number of locations in 2022 was not possible due to the limited inventory of milk animal sites in the plant vicinity. To compensate for this, vegetation samples were collected as part of the REMP. Section 3.12 describes the alternate broad leafy vegetation (TG) collections.

In addition to the broad leafy vegetation sampling, nine food crop (TF) samples were collected from three locations listed on Table 2.0-2 (two indicator stations, TF-02 and TF-03, and one control station, TF-06) during the growing season months (June, July and August). These included blueberries and tomatoes in June (Lab numbers 583546004, 5 & 6), green beans and lettuce in July (Lab numbers 586097004, 5 and 6), and green beans and lettuce in August (Lab numbers 589646004, 5 and 6).

A gamma analysis was performed on each sample. Naturally-occurring K-40 was detected in all samples for both indicator and control stations and naturally-occurring Be-7 was detected in one sample for the control station. Similar to past years, no plant-related radionuclides were detected in any samples. Therefore, no increasing or decreasing trends are identified. Subsequently, there is no dose to the public or impact on the environment through this pathway due to plant operations. This is consistent with the pre-operational program and with previous years of plant operations.

The following REMP Summary (Table 3.11-1) lists the range of analysis results by radionuclide for indicator and control stations for the Food Crop environmental media. Attachment 1 to this report lists the individual analysis results for each measurement of Food Crops under the Sample Type code TF.

Any sample collection and analysis deviations from the ODCM defined program, or reportable concentrations that may have occurred during the year, are described in Section 5.

Table 3.11-1
Radiological Environmental Monitoring Program Summary
Seabrook Nuclear Power Station, Seabrook, NH
(January - December 2022)

MEDIUM: Food Crop (TF) UNITS: pCi/kg

Radionuclides (No. Analyses) (Non-Routine*)		Required LLD	Indicator Stations Mean Range (No. Detected**)	Station With Highest Mean Station	 Mean Range (No. Detected**)	Control Stations Mean Range (No. Detected**)
Be-7	(9)		-4.2E 0	06	2.5E 1	2.5E 1
	(0)		(-2.4 - 2.5)E 1 (0/ 6)		(-3.4 - 6.4)E 1 (1/ 3)	(-3.4 - 6.4)E 1 (1/ 3)
K-40	(9)		2.1E 3	02	2.2E 3	1.8E 3
	(0)		(1.5 - 2.8)E 3 (6/ 6)		(1.6 - 2.8)E 3 (3/ 3)	(1.4 - 2.4)E 3 (3/ 3)
Cr-51	(9)		-4.6E 0	02	8.1E 0	5.2E -1
	(0)		(-5.1 - 2.7)E 1 (0/ 6)		(-2.0 - 26.7)E 0 (0/ 3)	(-9.7 - 19.8)E 0 (0/ 3)
Mn-54	(9)		1.3E 0	02	1.7E 0	6.3E -1
	(0)		(-1.6 - 5.0)E 0 (0/ 6)		(-1.8 - 44.9)E -1 (0/ 3)	(-1.8 - 3.7)E 0 (0/ 3)
Co-57	(9)		-7.8E -2	02	4.5E -1	3.6E -1
	(0)		(-3.6 - 1.5)E 0 (0/ 6)		(0.0 - 7.9)E -1 (0/ 3)	(-1.5 - 3.6)E 0 (0/ 3)
Co-58	(9)		4.9E -1	03	1.8E 0	-3.6E 0
	(0)		(-3.0 - 6.8)E 0 (0/ 6)		(-1.7 - 6.8)E 0 (0/ 3)	(-4.8 - -1.3)E 0 (0/ 3)
Fe-59	(9)		1.8E -1	03	1.9E 0	-3.8E 0
	(0)		(-3.0 - 3.5)E 0 (0/ 6)		(2.2 - 35.3)E -1 (0/ 3)	(-6.6 - 1.3)E 0 (0/ 3)
Co-60	(9)		1.2E 0	06	3.1E 0	3.1E 0
	(0)		(-2.2 - 4.5)E 0 (0/ 6)		(1.5 - 67.9)E -1 (0/ 3)	(1.5 - 67.9)E -1 (0/ 3)
Zn-65	(9)		-2.7E 0	02	-2.3E 0	-9.6E 0
	(0)		(-5.6 - 1.1)E 0 (0/ 6)		(-4.4 - -0.3)E 0 (0/ 3)	(-2.2 - 0.1)E 1 (0/ 3)
Se-75	(9)		-1.9E 0	06	-5.8E -1	-5.8E -1
	(0)		(-6.3 - 2.6)E 0 (0/ 6)		(-1.6 - 1.3)E 0 (0/ 3)	(-1.6 - 1.3)E 0 (0/ 3)
Nb-95	(9)		2.0E 0	02	2.4E 0	-1.3E 0
	(0)		(-1.1 - 5.2)E 0 (0/ 6)		(1.4 - 4.3)E 0 (0/ 3)	(-6.3 - 2.3)E 0 (0/ 3)
Zr-95	(9)		-2.6E 0	02	-9.3E -1	-9.4E -1
	(0)		(-1.1 - 0.0)E 1 (0/ 6)		(-1.5 - -0.1)E 0 (0/ 3)	(-5.8 - 2.8)E 0 (0/ 3)
Ru-103	(9)		-1.6E 0	02	-1.3E 0	-1.7E 0
	(0)		(-7.5 - 1.1)E 0 (0/ 6)		(-2.1 - -0.7)E 0 (0/ 3)	(-2.0 - -1.2)E 0 (0/ 3)
Ru-106	(8)		-3.4E 0	06	5.7E 1	5.7E 1
	(0)		(-2.9 - 2.1)E 1 (0/ 6)		(2.7 - 8.8)E 1 (0/ 2)	(2.7 - 8.8)E 1 (0/ 2)

* Non-Routine refers to those radionuclides that exceeded the Reporting Levels in ODCM Table A.9.1-3.
** The fraction of detectable measurements (i.e., > MDC with no uncertain identification) is shown in parentheses.

Table 3.11-1 (Continued)
Radiological Environmental Monitoring Program Summary
Seabrook Nuclear Power Station, Seabrook, NH
(January - December 2022)

MEDIUM: Food Crop (TF) UNITS: pCi/kg

Radionuclides (No. Analyses) (Non-Routine*)		Required LLD	Indicator Stations Mean Range (No. Detected**)	Station With Highest Mean Station	Station With Highest Mean Mean Range (No. Detected**)	Control Stations Mean Range (No. Detected**)
Ru-106	(9)		-3.4E 0	06	5.3E 1	5.3E 1
	(0)		(-2.9 - 2.1)E 1 (0/ 6)		(2.7 - 8.8)E 1 (0/ 3)	(2.7 - 8.8)E 1 (0/ 3)
Ag-108m	(9)		-1.2E -1	06	2.2E 0	2.2E 0
	(0)		(-3.0 - 3.0)E 0 (0/ 6)		(1.2 - 3.3)E 0 (0/ 3)	(1.2 - 3.3)E 0 (0/ 3)
Ag-110m	(9)		1.7E 0	06	4.6E 0	4.6E 0
	(0)		(-3.5 - 5.8)E 0 (0/ 6)		(-1.4 - 15.1)E 0 (0/ 3)	(-1.4 - 15.1)E 0 (0/ 3)
Sb-124	(9)		3.7E 0	03	6.0E 0	-3.6E 0
	(0)		(-2.7 - 19.8)E 0 (0/ 6)		(-2.7 - 19.8)E 0 (0/ 3)	(-1.0 - 0.2)E 1 (0/ 3)
Sb-125	(9)		-2.0E -2	03	4.0E 0	-3.2E 0
	(0)		(-5.3 - 14.2)E 0 (0/ 6)		(-3.5 - 14.2)E 0 (0/ 3)	(-4.8 - -0.2)E 0 (0/ 3)
I-131	(9)	60	1.1E 0	02	2.2E 0	-6.9E -1
	(0)		(-2.4 - 9.3)E 0 (0/ 6)		(-2.4 - 9.3)E 0 (0/ 3)	(-3.9 - 1.6)E 0 (0/ 3)
Cs-134	(9)	60	-2.7E -1	03	1.1E 0	7.2E -1
	(0)		(-3.9 - 2.0)E 0 (0/ 6)		(0.0 - 2.0)E 0 (0/ 3)	(-1.3 - 1.8)E 0 (0/ 3)
Cs-137	(9)	80	-2.3E -1	02	2.4E 0	1.1E 0
	(0)		(-5.9 - 6.0)E 0 (0/ 6)		(8.6 - 598.0)E -2 (0/ 3)	(-1.3 - 3.1)E 0 (0/ 3)
Ba-140	(9)		-1.1E 0	03	8.1E 0	-4.5E 0
	(0)		(-2.9 - 2.7)E 1 (0/ 6)		(-2.8 - 26.7)E 0 (0/ 3)	(-8.0 - 0.0)E 0 (0/ 3)
La-140	(9)		5.3E -1	03	3.1E 0	-1.5E -1
	(0)		(-7.4 - 7.4)E 0 (0/ 6)		(1.8 - 74.1)E -1 (0/ 3)	(-4.1 - 3.6)E 0 (0/ 3)
Ce-141	(9)		-5.1E -1	03	2.9E 0	-4.3E 0
	(0)		(-4.7 - 5.1)E 0 (0/ 6)		(-1.0 - 5.1)E 0 (0/ 3)	(-6.1 - -1.8)E 0 (0/ 3)
Ce-144	(9)		-8.5E 0	06	-1.9E -1	-1.9E -1
	(0)		(-2.0 - 0.5)E 1 (0/ 6)		(-1.6 - 0.9)E 1 (0/ 3)	(-1.6 - 0.9)E 1 (0/ 3)
Ac-228	(9)		-2.3E -1	02	1.9E 0	1.1E 0
	(0)		(-1.1 - 1.9)E 1 (0/ 6)		(-1.1 - 1.9)E 1 (0/ 3)	(-2.8 - 4.1)E 0 (0/ 3)
Th-228	(9)		-1.5E 0	06	6.9E 0	6.9E 0
	(0)		(-7.1 - 5.0)E 0 (0/ 6)		(2.3 - 9.9)E 0 (0/ 3)	(2.3 - 9.9)E 0 (0/ 3)

* Non-Routine refers to those radionuclides that exceeded the Reporting Levels in ODCM Table A.9.1-3.
** The fraction of detectable measurements (i.e., > MDC with no uncertain identification) is shown in parentheses.

3.12 Vegetation

In lieu of milk sampling, the ODCM, Table A.9.1-1, requires that broad leafy vegetation (TG) samples grown in the nearest of two different offsite locations with the highest D/Q, and from one control location 15-30 km distant in the least prevalent wind direction, be collected when available (growing season). Offsite locations are defined in the UFSAR as the land beyond a 3000-foot radius of the two Containment Building centerlines. The analysis of garden locations in the Land Use Census provides a ranking of potential sampling sites for use in determining sampling locations in the general population. Since sampling of broad leaf garden vegetables at high D/Q locations is not feasible due to uncertain availability, other types of broad leafy vegetation were utilized.

Two locations at the site boundary with a maximum D/Q (higher values than determined in the 2022 Land Use Census garden listing) were selected over ranked D/Q gardens in the general population. These two Indicator locations (TG-08 and TG-09) are on site property in areas with available sample media. A third far-field control location (TG-10) was selected in Georgetown, MA. Samples consisted of tree leaves, as broad leaf vegetation provides increased reliability for sample availability. For 2022, a total of 18 monthly (growing season) broad leaf vegetation samples were collected and analyzed by gamma spectroscopy.

A gamma analysis was performed on each sample. Naturally-occurring Be-7 and K-40 were detected in nearly all samples for both indicator and control stations (17/18 and 18/18, respectively). Naturally-occurring Ac-228 was detected in one sample. Cesium-137 was not detected in 2022, but has been detected in broad leafy vegetation in the past and evaluated as to the source. The conclusion of the assessment was that world-wide fallout from events un-related to Seabrook operations, such as the March 11, 2011 Fukushima Daiichi accident in Japan and past atmospheric nuclear weapons testing, have led to Cs-137 being deposited on the ground surface in the northeast United States with subsequent root uptake into leaves of long-lived vegetation. This conclusion continues to be supported by the fact that Seabrook Station had no detectable Cs-137 in any gaseous effluents in recent years, including 2022, and by the prevalence of detectable Cs-137 at the control location compared to in-close indicator sampling points. Utilizing the results of broad leaf vegetation sampling for broad leaf food products, it is concluded that there was no dose impact to the public or to the environment through this food ingestion pathway from Seabrook plant operations.

The following REMP Summary (Table 3.12-1) lists the range of analysis results by radionuclide for indicator and control stations for the broad leaf vegetation environmental media. Attachment 1 to this report lists the individual analysis results for each measurement of broad leaf vegetation under the Sample Type code TG.

Any sample collection and analysis deviations from the ODCM required program, or reportable concentrations that may have occurred during the year, are described in Section 5.

Table 3.12-1
Radiological Environmental Monitoring Program Summary
Seabrook Nuclear Power Station, Seabrook, NH
(January - December 2022)

MEDIUM: Vegetation (TG) UNITS: pCi/kg

Radionuclides (No. Analyses) (Non-Routine*)		Required LLD	Indicator Stations Mean Range (No. Detected**)	Station With Highest Mean Station	Station With Highest Mean Mean Range (No. Detected**)	Control Stations Mean Range (No. Detected**)
Be-7	(18)		7.7E 2	08	8.7E 2	5.8E 2
	(0)		(1.4 - 22.0)E 2 (11/ 12)		(3.3 - 22.0)E 2 (6/ 6)	(3.1 - 12.2)E 2 (6/ 6)
K-40	(18)		4.5E 3	09	5.2E 3	3.6E 3
	(0)		(2.9 - 5.6)E 3 (12/ 12)		(4.5 - 5.6)E 3 (6/ 6)	(3.1 - 4.1)E 3 (6/ 6)
Cr-51	(18)		7.6E 0	09	2.0E 1	-1.6E 1
	(0)		(-4.7 - 11.2)E 1 (0/ 12)		(-4.7 - 11.2)E 1 (0/ 6)	(-8.4 - 3.7)E 1 (0/ 6)
Mn-54	(18)		1.0E 0	10	5.4E 0	5.4E 0
	(0)		(-1.1 - 1.4)E 1 (0/ 12)		(-2.1 - 178.0)E -1 (0/ 6)	(-2.1 - 178.0)E -1 (0/ 6)
Co-57	(18)		-3.5E -1	10	1.8E 0	1.8E 0
	(0)		(-3.2 - 3.0)E 0 (0/ 12)		(-5.4 - 9.3)E 0 (0/ 6)	(-5.4 - 9.3)E 0 (0/ 6)
Co-58	(18)		-1.7E 0	09	2.1E 0	-2.6E 0
	(0)		(-1.6 - 1.0)E 1 (0/ 12)		(-3.6 - 9.8)E 0 (0/ 6)	(-7.9 - 12.8)E 0 (0/ 6)
Fe-59	(18)		1.1E 0	08	5.7E 0	-9.4E 0
	(0)		(-1.3 - 1.6)E 1 (0/ 12)		(-8.0 - 15.9)E 0 (0/ 6)	(-3.5 - 0.5)E 1 (0/ 6)
Co-60	(18)		-4.5E -1	10	4.7E 0	4.7E 0
	(0)		(-1.3 - 1.4)E 1 (0/ 12)		(-6.3 - 13.0)E 0 (0/ 6)	(-6.3 - 13.0)E 0 (0/ 6)
Zn-65	(18)		-4.5E 0	09	-3.2E 0	-5.2E 0
	(0)		(-2.7 - 1.5)E 1 (0/ 12)		(-1.6 - 0.4)E 1 (0/ 6)	(-5.2 - 2.3)E 1 (0/ 6)
Se-75	(18)		2.9E 0	09	5.5E 0	-6.5E 0
	(0)		(-1.1 - 1.8)E 1 (0/ 12)		(-2.0 - 12.4)E 0 (0/ 6)	(-1.7 - 0.6)E 1 (0/ 6)
Nb-95	(18)		-4.8E -1	10	1.8E 0	1.8E 0
	(0)		(-1.7 - 0.9)E 1 (0/ 12)		(-5.3 - 10.7)E 0 (0/ 6)	(-5.3 - 10.7)E 0 (0/ 6)
Zr-95	(18)		1.9E 0	09	2.3E 0	1.9E 0
	(0)		(-1.7 - 1.6)E 1 (0/ 12)		(-1.8 - 10.6)E 0 (0/ 6)	(-9.7 - 10.6)E 0 (0/ 6)
Ru-103	(18)		2.1E 0	09	5.3E 0	-9.7E -1
	(0)		(-1.4 - 1.1)E 1 (0/ 12)		(7.9 - 110000.0)E -4 (0/ 6)	(-6.2 - 4.4)E 0 (0/ 6)
Ru-106	(18)		-1.9E 0	09	7.2E 0	-6.2E 0
	(0)		(-9.3 - 8.4)E 1 (0/ 12)		(-9.3 - 8.4)E 1 (0/ 6)	(-4.7 - 4.5)E 1 (0/ 6)

* Non-Routine refers to those radionuclides that exceeded the Reporting Levels in ODCM Table A.9.1-3.
** The fraction of detectable measurements (i.e., > MDC with no uncertain identification) is shown in parentheses.

Table 3.12-1 (Continued)
Radiological Environmental Monitoring Program Summary
Seabrook Nuclear Power Station, Seabrook, NH
(January - December 2022)

MEDIUM: Vegetation (TG) UNITS: pCi/kg

Radionuclides (No. Analyses) (Non-Routine*)		Required LLD	Indicator Stations Mean Range (No. Detected**)	Station With Highest Mean Station	 Mean Range (No. Detected**)	Control Stations Mean Range (No. Detected**)
Ag-108m	(18)		8.5E -1	08	2.5E 0	5.8E -2
	(0)		(-2.6 - 4.2)E 0 (0/ 12)		(4.7 - 42.3)E -1 (0/ 6)	(-9.8 - 16.1)E 0 (0/ 6)
Ag-110m	(18)		-2.2E 0	08	-2.1E 0	-4.6E 0
	(0)		(-1.0 - 0.7)E 1 (0/ 12)		(-1.0 - 0.4)E 1 (0/ 6)	(-8.5 - 1.1)E 0 (0/ 6)
Sb-124	(18)		-4.6E 0	09	1.2E 0	-9.2E -1
	(0)		(-2.5 - 1.6)E 1 (0/ 12)		(-8.8 - 15.9)E 0 (0/ 6)	(-3.3 - 2.0)E 1 (0/ 6)
Sb-125	(18)		-3.1E 0	10	9.4E 0	9.4E 0
	(0)		(-2.5 - 1.2)E 1 (0/ 12)		(-1.3 - 5.6)E 1 (0/ 6)	(-1.3 - 5.6)E 1 (0/ 6)
I-131	(18)	60	-5.8E -1	08	5.9E 0	-5.2E 0
	(0)		(-1.2 - 2.6)E 1 (0/ 12)		(-8.7 - 25.5)E 0 (0/ 6)	(-1.6 - 0.9)E 1 (0/ 6)
Cs-134	(18)	60	1.9E 0	08	5.1E 0	-1.3E 0
	(0)		(-1.9 - 1.3)E 1 (0/ 12)		(-3.8 - 128.0)E -1 (0/ 6)	(-1.8 - 1.3)E 1 (0/ 6)
Cs-137	(18)	80	3.8E 0	10	8.6E 0	8.6E 0
	(0)		(-1.0 - 1.7)E 1 (0/ 12)		(-3.8 - 15.6)E 0 (0/ 6)	(-3.8 - 15.6)E 0 (0/ 6)
Ba-140	(18)		5.2E 0	09	1.5E 1	-1.3E 1
	(0)		(-2.5 - 3.6)E 1 (0/ 12)		(-1.0 - 3.6)E 1 (0/ 6)	(-5.7 - 2.8)E 1 (0/ 6)
La-140	(18)		-3.5E 0	08	-3.0E 0	-4.0E 0
	(0)		(-2.3 - 1.9)E 1 (0/ 12)		(-9.8 - 6.3)E 0 (0/ 6)	(-1.5 - 0.9)E 1 (0/ 6)
Ce-141	(18)		-5.8E 0	09	-3.7E 0	-1.7E 1
	(0)		(-3.8 - 1.1)E 1 (0/ 12)		(-1.9 - 1.1)E 1 (0/ 6)	(-3.2 - -0.2)E 1 (0/ 6)
Ce-144	(18)		-5.1E 0	09	1.3E 1	-4.5E 0
	(0)		(-1.0 - 0.5)E 2 (0/ 12)		(-2.2 - 5.3)E 1 (0/ 6)	(-2.6 - 1.6)E 1 (0/ 6)
Ac-228	(18)		3.6E 1	09	4.9E 1	1.4E 1
	(0)		(-3.5 - 16.5)E 1 (1/ 12)		(-2.1 - 16.5)E 1 (1/ 6)	(-4.5 - 6.5)E 1 (0/ 6)
Th-228	(18)		3.6E 0	09	5.4E 0	4.7E 0
	(0)		(-3.4 - 2.7)E 1 (0/ 12)		(-1.8 - 2.7)E 1 (0/ 6)	(-1.8 - 1.8)E 1 (0/ 6)

* Non-Routine refers to those radionuclides that exceeded the Reporting Levels in ODCM Table A.9.1-3.
** The fraction of detectable measurements (i.e., > MDC with no uncertain identification) is shown in parentheses.

3.13 Direct Radiation

Direct gamma radiation exposure was measured with thermoluminescent dosimeters (TLDs). Two TLD badges are placed at each of the designated monitoring stations. Each TLD badge has three $CaSO_4$:Tm elements. The badges were collected and read on a quarterly schedule. A location result is an average of six independent readings per quarter. A total of forty-six stations are located offsite, thirty-seven of which are required by the ODCM.

The exposure rates were normalized to a standard 91-day quarter so that quarterly results from any monitoring location can be compared to another location based on an equivalent time period of exposure. A summary of the 2022 data for the plant operational REMP is shown in Table 3.13-1. Figures 3.6 through 3.14 provide a comparison of quarterly TLD location responses in 2022 and illustrate the naturally variation in exposure rates quarter to quarter. Figures 3.6.1 through 3.14.1 provide a long term trend line for each of the environmental TLD locations.

The exposure rate response at individual monitoring stations have occasionally exhibited step changes at some point in the past that are related to changes in local conditions in the area of the dosimeter measurement. As an example, the outer ring TL-33 (a parking lot located 9.8 km south of the plant) was observed for several quarters during 2011 through 2016 to approach or exceed the normal expected environmental fluctuations based on observed history. The average TLD exposure rate from the 2nd quarter 2011 through the 4th quarter of 2013 is reported as 21.8 mR/quarter. For the seven prior quarters (3rd quarter 2009 to the 1st quarter 2011), the average TLD response was 18.6 mR/quarter, or approximately 17% lower than the most recent trend history. Since no other TLDs in the same sector or closer to the plant showed an average increase in measured response above the expected, the change at TL-33 was attributed to a local change in the background radiation associated with parking lot modifications and not with Seabrook Station operations. Field investigations of TL-33 indicated that the parking lot appeared to be re-graded with new fill/gravel material which could have increased the natural concentration of background radiation that the TLD measures. The expected background exposure level for location TL-33 was re-indexed to 20.6 mR/quarter in 2013 to reflect the observed change in background radiation. Three other locations (TL-01, TL-69 and TL-18) also indicated changes in background exposure rates trends over time (un-related to Seabrook operations) and had their expected background exposure levels re-indexed to 17.4 mR/quarter, 13.7 mR/quarter, and 16.3 mR/quarter respectively, in 2013 (for TL-01 and TL-69) and 2019 (for TL-18).

Overall, the REMP direct radiation program showed no statistically significant indication of increased direct radiation above the variable background measured exposure rate in unrestricted areas. This is demonstrated by the fact that indicator location results (as a group) are statistically the same as control locations. The 2022 annual mean of all indicator locations was 16.4 mR/91-day quarter while the mean of all control locations was 17.4 mR/91-day quarter. This indicates that collectively there is no statistical difference in the annual direct dose as a function of distance from the plant. As a result, no direct radiation dose beyond the site boundary was attributed to station operation during 2022.

Starting in 2015, a supplemental analytical method was implemented to evaluate the TLD measurements. Using the method described in ANSI/HPS N13.37-2014, quarterly and annual baseline dose for each TLD location was determined using appropriate statistical analytical methods considering data from 2004 through 2014. Quarterly and annual dose for 2022 was compared to baseline values to determine if an Investigation Level had been exceeded for evaluation of potential dose to a member of the public. An Investigation Level is considered to be exceeded under the following conditions:

$$\text{Quarterly: If } M_Q > (B_Q + MDD_Q), \text{ then } F_Q = M_Q - B_Q$$

Where:

M_Q is the normalized quarterly field measurement result
B_Q is the quarterly baseline background dose
MDD_Q is the quarterly minimum differential dose and
F_Q is the quarterly facility related dose

Or: Annually: If $M_A > (B_A + MDD_A)$, then $F_A = M_A - B_A$

Where:

M_A is the sum of the four normalized quarterly measurement values
B_A is the annual baseline background dose
MDD_A is the annual minimum differential dose
F_A is the annual facility related dose

Table 3.13-3 summarizes the evaluation of the TLD measurements using the methodology described in ANSI/HPS N13.37-2014. No TLD location exceeded the quarterly or annual investigation level in 2022. Therefore, no evaluation of dose to a member of the public from direct or scattered radiation was performed.

The direct radiation-monitoring program demonstrated that no increasing or decreasing trends were detected. Therefore, there was no offsite dose to the public or impact to the environment from the operation of the plant.

Any TLD collection and analysis deviations from the ODCM required program that may have occurred during the year are described in Section 5.

Table 3.13-1

Environmental TLD Measurements
Net Exposure in mR/Standard Quarter (91 days)

2022

Sta. No.	Description	1st Quarter Exp.	S.D.	2nd Quarter Exp.	S.D.	3rd Quarter Exp.	S.D.	4th Quarter Exp.	S.D.	Qtr Ave. Exp.
TL-01	Brimmer's Lane	16.6	± 0.6	18.7	± 0.8	18.7	± 0.8	19.2	± 0.7	18.3
TL-02	Landing Road	12.9	± 0.5	14.7	± 0.5	14.4	± 0.6	15.1	± 0.6	14.3
TL-03	Glade Path	13.6	± 0.4	14.9	± 0.7	14.4	± 0.7	15.7	± 0.7	14.7
TL-04	Island Path	14.2	± 0.5	16.2	± 0.6	16.5	± 0.7	16.7	± 0.6	15.9
TL-05	Harbor Road	13.8	± 0.5	15.0	± 0.7	14.7	± 0.7	16.2	± 0.9	14.9
TL-06	Barge Landing	13.4	± 0.5	14.3	± 0.6	14.4	± 0.8	14.9	± 0.5	14.3
TL-07	Cross Road	11.8	± 0.7	13.5	± 0.7	12.8	± 0.6	13.9	± 0.5	13.0
TL-08	Farm Lane	13.7	± 0.4	15.6	± 0.7	15.4	± 0.6	16.3	± 0.6	15.3
TL-09	Farm Lane	15.5	± 0.6	17.0	± 0.7	17.0	± 0.7	17.9	± 0.6	16.9
TL-10	Site Boundary	13.8	± 0.7	16.2	± 0.7	16.3	± 0.7	17.2	± 0.6	15.9
TL-11	Site Boundary	15.9	± 0.8	19.1	± 0.8	18.2	± 1.0	19.7	± 0.9	18.2
TL-12	Site Boundary	16.9	± 0.5	19.2	± 0.8	19.4	± 0.7	20.0	± 0.8	18.9
TL-13	Inside Site Boundary	16.7	± 0.6	19.0	± 0.7	18.5	± 1.0	19.7	± 0.7	18.5
TL-14	Trailer Park	14.9	± 0.5	16.7	± 0.6	16.9	± 0.7	17.3	± 0.6	16.5
TL-15	Brimmer's Lane	16.9	± 0.6	18.7	± 0.8	19.7	± 0.9	19.2	± 0.9	18.6
TL-16	Brimmer's Lane	15.4	± 0.7	17.2	± 0.7	17.5	± 1.0	18.0	± 0.8	17.0
TL-17	South Road	13.1	± 0.5	15.8	± 0.6	15.7	± 0.6	16.2	± 0.7	15.2
TL-18	Mill Road	16.9	± 0.6	17.7	± 0.8	18.5	± 0.7	18.8	± 0.8	18.0
TL-19	Appledore Avenue	14.0	± 0.6	15.2	± 0.6	15.8	± 0.9	16.1	± 0.6	15.3
TL-20	Ashworth Avenue	15.2	± 0.6	16.4	± 0.7	16.2	± 0.7	17.6	± 0.6	16.4
TL-21	Route 1A	16.3	± 0.7	18.2	± 0.8	17.5	± 0.8	19.0	± 0.6	17.8
TL-22	Cable Avenue	14.8	± 0.7	16.4	± 0.5	16.5	± 0.7	16.5	± 0.6	16.1
TL-23	Ferry Road	14.0	± 0.5	15.5	± 0.6	16.3	± 0.7	16.5	± 0.6	15.6
TL-24	Ferry Lots Lane	15.0	± 0.5	17.4	± 0.7	18.6	± 0.9	17.5	± 0.6	17.1
TL-25	Elm Street	15.8	± 0.9	17.7	± 0.8	17.5	± 0.7	18.1	± 0.7	17.3
TL-26	Route 107A	13.5	± 0.6	15.2	± 0.7	16.1	± 0.7	16.3	± 0.7	15.3
TL-27	Highland Street	16.8	± 0.5	17.9	± 0.6	18.5	± 0.8	19.1	± 0.7	18.1
TL-28	Route 150	15.2	± 0.8	17.4	± 0.8	18.0	± 0.8	18.0	± 0.6	17.2
TL-29	Frying Pan Lane	13.9	± 0.5	16.2	± 0.5	16.6	± 0.6	16.5	± 0.6	15.8
TL-30	Route 27	15.4	± 0.7	16.8	± 0.6	17.9	± 0.6	17.8	± 0.8	17.0
TL-31	Alumni Drive	12.9	± 0.5	14.0	± 0.5	14.7	± 0.6	14.9	± 0.6	14.1
TL-32	SB Elementary School	16.8	± 0.6	18.1	± 0.7	18.6	± 0.9	18.8	± 0.9	18.1
TL-33	Dock Area	10.9	± 0.4	11.3	± 0.6	12.5	± 0.6	11.4	± 0.5	11.5
TL-34	Bow Street	19.1	± 0.7	20.7	± 0.9	21.8	± 0.8	21.1	± 1.0	20.7
TL-35	Lincoln Ack. School	16.6	± 0.6	18.4	± 1.0	17.6	± 0.7	17.3	± 0.6	17.5
TL-36	Route 97(Control)	14.6	± 0.7	14.6	± 0.5	16.3	± 0.7	15.5	± 0.6	15.3
TL-37	Plaistow, NH (Control)	16.9	± 0.6	17.7	± 0.8	18.7	± 0.7	19.0	± 0.9	18.1
TL-38	Hampstead, NH (Control)	17.0	± 0.6	18.5	± 0.7	19.8	± 0.9	19.8	± 0.7	18.8

Table 3.13-1 (Continued)

Environmental TLD Measurements
Net Exposure in mR/Standard Quarter (91 days)

2022

Sta. No.	Description	1st Quarter Exp.	S.D.	2nd Quarter Exp.	S.D.	3rd Quarter Exp.	S.D.	4th Quarter Exp.	S.D.	Qtr. Ave. Exp.
TL-39	Fremont, NH (Control)	19.7	± 0.8	21.1	± 0.7	22.6	± 1.0	21.9	± 0.9	21.3
TL-40	Newmarket, NH (Control)	15.1	± 0.6	17.4	± 0.6	18.2	± 0.7	18.2	± 0.5	17.2
TL-41	Portsmouth, NH (Control)	15.6	± 0.6	16.6	± 0.7	17.3	± 0.9	17.0	± 0.8	16.6
TL-42	Ipswich, MA (Control)	14.1	± 0.4	14.3	± 0.5	15.7	± 0.7	15.2	± 0.7	14.8
TL-44	SB Education Center	13.0	± 0.7	14.1	± 0.5	15.1	± 0.9	15.6	± 0.7	14.5
TL-45	Hampton Fire Station	14.4	± 0.8	18.0	± 0.9	17.3	± 1.0	17.9	± 0.8	16.9
TL-46	SB Police Station	15.4	± 0.6	16.8	± 0.7	16.9	± 0.8	17.6	± 0.8	16.7
TL-47	Route 84	15.2	± 0.6	16.5	± 0.6	17.4	± 0.7	17.3	± 0.7	16.6
	Mean of Indicators	14.9		16.6		16.8		17.3		16.4
	Mean of Controls	16.1		17.2		18.4		18.1		17.4

Table 3.13-2

Pre-Operational Environmental TLD Measurements
Net Exposure in mR/Standard Quarter (91 days)

	1st Quarter Exp.	2nd Quarter Exp.	3rd Quarter Exp.	4th Quarter Exp.	Qtr Ave Over Yr Exp.
1982					
Mean of Indicators	--	17.1	18.1	17.5	17.6
Mean of Controls	--	16.9	18.1	17.9	16.8
1983					
Mean of Indicators	16.7	17.1	18.8	17.9	17.6
Mean of Controls	16.9	17.5	18.7	18.4	17.9
1984					
Mean of Indicators	16.1	17.1	16.9	17.5	17.0
Mean of Controls	17.6	17.4	15.8	18.7	17.4
1985					
Mean of Indicators	16.9	18.0	18.9	16.1	17.4
Mean of Controls	16.8	17.7	18.9	16.1	17.4
1986					
Mean of Indicators	14.0	15.5	15.3	15.0	15.0
Mean of Controls	13.9	18.0	16.8	15.1	16.0
1987					
Mean of Indicators	12.7	14.8	15.0	14.4	14.2
Mean of Controls	13.0	14.8	15.3	15.0	14.6
1988					
Mean of Indicators	13.5	14.1	14.7	14.9	14.3
Mean of Controls	13.3	14.4	18.1	14.6	15.1
1989					
Mean of Indicators	14.4	14.3	--	--	14.4
Mean of Controls	14.0	14.4	--	--	14.2
All Pre-Operational					
Mean of Indicators	14.9	16.0	16.8	16.2	15.9
Mean of Controls	15.1	16.4	17.4	16.5	16.2

Table 3.13-3

Facility Related Dose using ANSI/HPS N13.37-2014 Methodology

		Quarterly Ave.					Quarterly Facility Dose				Annual	2022	Annual Facility Dose
		Baseline, B_Q	2022 Quarterly Monitoring Data, M_Q (mR/qtr)				$F_Q = M_Q - (B_Q + MDD_Q)$				Baseline, B_A	2022 Annual TLD Data, M_A	$F_A = M_A - (B_A + MDD_A)$
		mR	1	2	3	4	1	2	3	4	mR	mR	
TL-01	Brimmer's Lane	18.6	16.6	18.7	18.7	19.2	ND	ND	ND	ND	74.5	73.2	ND
TL-02	Landing Road	13.8	12.9	14.7	14.4	15.1	ND	ND	ND	ND	55.1	57.1	ND
TL-03	Glade Path	14.9	13.6	14.9	14.4	15.7	ND	ND	ND	ND	59.5	58.6	ND
TL-04	Island Path	15.9	14.2	16.2	16.5	16.7	ND	ND	ND	ND	63.7	63.6	ND
TL-05	Harbor Road	14.6	13.8	15.0	14.7	16.2	ND	ND	ND	ND	58.1	59.7	ND
TL-06	Barge Landing	14.6	13.4	14.3	14.4	14.9	ND	ND	ND	ND	58.6	57.0	ND
TL-07	Cross Road	12.5	11.8	13.5	12.8	13.9	ND	ND	ND	ND	50.0	52.1	ND
TL-08	Farm Lane	15.8	13.7	15.6	15.4	16.3	ND	ND	ND	ND	63.1	61.1	ND
TL-09	Farm Lane	16.3	15.5	17.0	17.0	17.9	ND	ND	ND	ND	65.3	67.4	ND
TL-10	Site Boundary	17.2	13.8	16.2	16.3	17.2	ND	ND	ND	ND	68.7	63.5	ND
TL-11	Site Boundary	17.5	15.9	19.1	18.2	19.7	ND	ND	ND	ND	69.9	72.9	ND
TL-12	Site Boundary	18.2	16.9	19.2	19.4	20.0	ND	ND	ND	ND	72.6	75.5	ND
TL-13	Inside Site Boundary	19.2	16.7	19.0	18.5	19.7	ND	ND	ND	ND	77.0	73.9	ND
TL-14	Trailer Park	15.9	14.9	16.7	16.9	17.3	ND	ND	ND	ND	63.5	65.8	ND
TL-15	Brimmer's Lane	18.8	16.9	18.7	19.7	19.2	ND	ND	ND	ND	75.0	74.5	ND
TL-16	Brimmer's Lane	16.2	15.4	17.2	17.5	18.0	ND	ND	ND	ND	64.8	68.2	ND
TL-17	South Road	16.3	13.1	15.8	15.7	16.2	ND	ND	ND	ND	65.2	60.8	ND
TL-18	Mill Road	16.3	16.9	17.7	18.5	18.8	ND	ND	ND	ND	65.0	71.9	ND
TL-19	Appledore Avenue	15.5	14.0	15.2	15.8	16.1	ND	ND	ND	ND	62.1	61.1	ND
TL-20	Ashworth Avenue	17.5	15.2	16.4	16.2	17.6	ND	ND	ND	ND	70.2	65.3	ND
TL-22	Route 1A	16.6	14.8	16.4	16.5	16.5	ND	ND	ND	ND	66.3	64.2	ND
TL-22	Cable Avenue	16.3	14.8	16.4	16.5	16.5	ND	ND	ND	ND	65.4	64.2	ND
TL-23	Ferry Road	15.7	14.0	15.5	16.3	16.5	ND	ND	ND	ND	62.7	62.3	ND

Table 3.13-3 (Continued)

Facility Related Dose using ANSI/HPS N13.37-2014 Methodology

		Baseline B_Q	Quarterly Ave. 2022 Quarterly Monitoring Data, M_Q (mR/qtr)				Quarterly Facility Dose $F_Q = M_Q - (B_Q+MDD_Q)$				Annual Baseline B_A	2022 Annual TLD Data, M_A	Annual Facility Dose $F_A = M_A - (B_A+MDD_A)$
		mR	1	2	3	4	1	2	3	4	mR	mR	
TL-24	Ferry Lots Lane	16.0	15.0	17.4	18.6	17.5	ND	ND	ND	ND	63.9	68.4	ND
TL-25	Elm Street	15.6	15.8	17.7	17.5	18.1	ND	ND	ND	ND	62.3	69.1	ND
TL-26	Route 107A	15.4	13.5	15.2	16.1	16.3	ND	ND	ND	ND	61.8	61.1	ND
TL-27	Highland Street	16.1	16.8	17.9	18.5	19.1	ND	ND	ND	ND	64.3	72.2	ND
TL-28	Route 150	16.2	15.2	17.4	18.0	18.0	ND	ND	ND	ND	64.9	68.6	ND
TL-29	Frying Pan Lane	15.4	13.9	16.2	16.6	16.5	ND	ND	ND	ND	61.6	63.2	ND
TL-30	Route 27	15.7	15.4	16.8	17.9	17.8	ND	ND	ND	ND	62.9	67.9	ND
TL-31	Alumni Drive	14.3	12.9	14.0	14.7	14.9	ND	ND	ND	ND	57.0	56.5	ND
TL-32	SB Elementary School	17.8	16.8	18.1	18.6	18.8	ND	ND	ND	ND	71.2	72.3	ND
TL-33	Dock Area	11.5[1]	10.9	11.3	12.5	11.4	ND	ND	ND	ND	45.8[1]	46.1	ND
TL-34	Bow Street	19.5	19.1	20.7	21.8	21.1	ND	ND	ND	ND	78.2	82.7	ND
TL-35	Lincoln Ack. School	18.2	16.6	18.4	17.6	17.3	ND	ND	ND	ND	72.6	69.9	ND
TL-36	Route 97(Control)	15.4	14.6	14.6	16.3	15.5	ND	ND	ND	ND	61.9	61.0	ND
TL-37	Plaistow, NH (Control)	18.0	16.9	17.7	18.7	19.0	ND	ND	ND	ND	72.0	72.3	ND
TL-38	Hampstead, NH (Control)	19.8	17.0	18.5	19.8	19.8	ND	ND	ND	ND	79.3	75.1	ND
TL-39	Fremont, NH (Control)	21.3	19.7	21.1	22.6	21.9	ND	ND	ND	ND	85.2	85.3	ND
TL-40	Newmarket, NH (Control)	16.7	15.1	17.4	18.2	18.2	ND	ND	ND	ND	66.9	68.9	ND
TL-41	Portsmouth, NH (Control)	16.9	15.6	16.6	17.3	17.0	ND	ND	ND	ND	67.6	66.4	ND
TL-42	Ipswich, MA (Control)	14.3	14.1	14.3	15.7	15.2	ND	ND	ND	ND	57.2	59.3	ND
TL-44	SB Education Center	14.8	13.0	14.1	15.1	15.6	ND	ND	ND	ND	59.0	57.8	ND

Table 3.13-3 (Continued)

Facility Related Dose using ANSI/HPS N13.37-2014 Methodology

		Baseline B_Q	Quarterly Ave. 2022 Quarterly Monitoring Data, M_Q (mR/qtr)				Quarterly Facility Dose $F_Q = M_Q - (B_Q+MDD_Q)$				Annual Baseline B_A	2022 Annual TLD Data, M_A	Annual Facility Dose $F_A = M_A - (B_A+MDD_A)$
		mR	1	2	3	4	1	2	3	4	mR	mR	
TL-45	Hampton Fire Station	16.9	14.4	18.0	17.3	17.9	ND	ND	ND	ND	67.7	67.6	ND
TL-46	SB Police Station	16.7	15.4	16.8	16.9	17.6	ND	ND	ND	ND	66.7	66.7	ND
TL-47	Route 84	15.6	15.2	16.5	17.4	17.3	ND	ND	ND	ND	62.4	66.3	ND

MDD_Q = 4.55 = minimum differential exposure, quarterly, 3 times 90th percentile S_Q determined from analysis in mR.

MDD_A = 8.97 = minimum differential exposure, annual, 3 times 90th percentile S_A determined from analysis in mR.

B_Q = Quarterly baseline exposure (mR).

M_Q = location's 91 day standard quarterly exposure (mR).

L_Q = Quarterly Investigative Level exposure (mR).

B_A = Quarterly baseline background average exposure (mR).

M_A = Annual monitoring data, determined by summing the quarterly data over all four quarters (mR).

L_A = Annual Investigative Level exposure (mR).

ND = Facility contribution to exposure "Not Detected"

[1] A step change was noted for the TL-33 location in 2017 (see Figure 3.12.1). Using the average of measurements from 2017-2021 (excluding 2019 since the TLD was missing during the 2nd quarter), an updated quarterly average baseline value of 11.5 and an annual average baseline value of 45.8 were determined.

FIGURE 3.6

ENVIRONMENTAL RADIATION MEASUREMENTS (USING TLDs) SEABROOK STATION

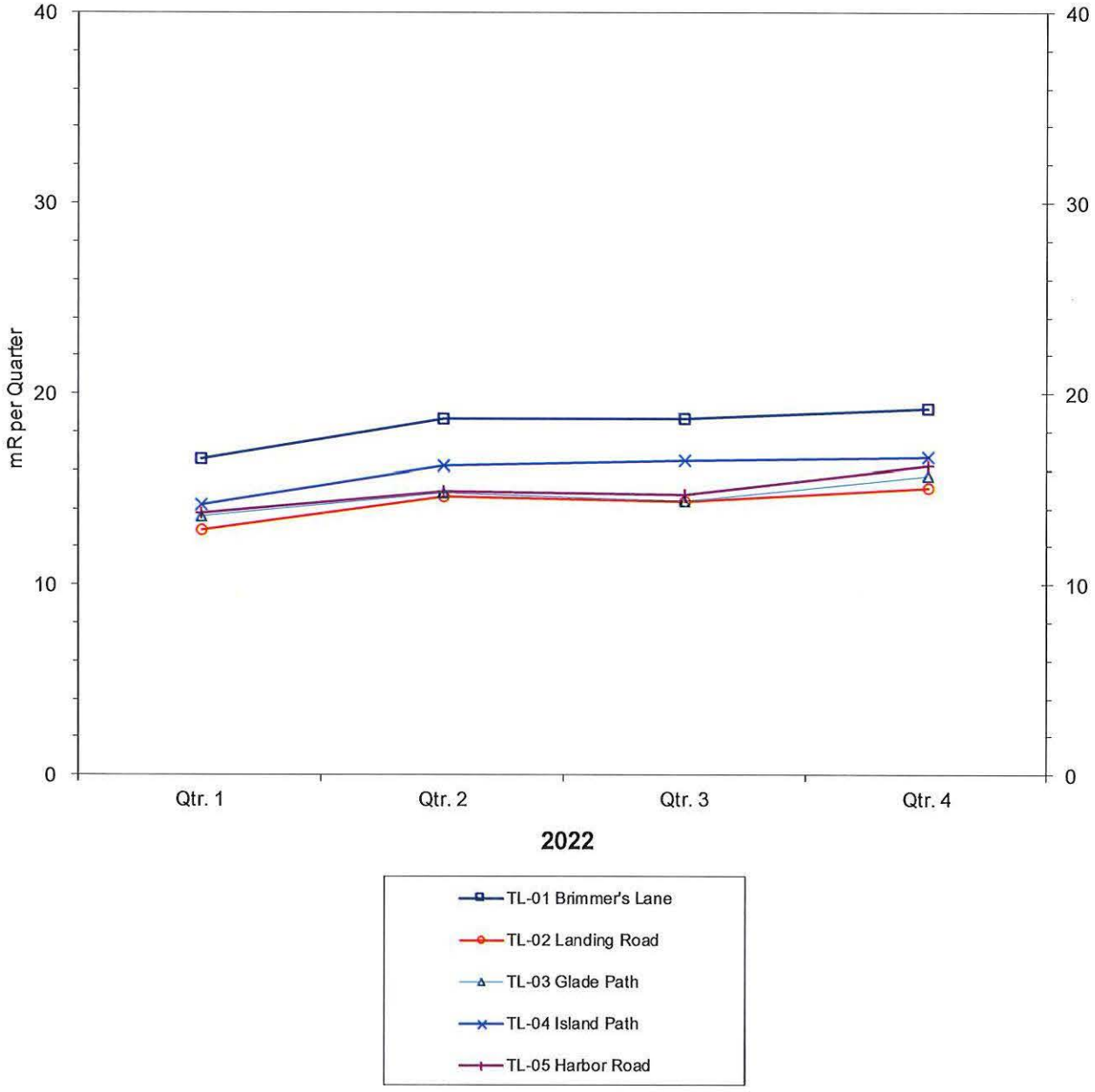


FIGURE 3.6.1

ENVIRONMENTAL RADIATION MEASUREMENTS (USING TLDs)
SEABROOK STATION

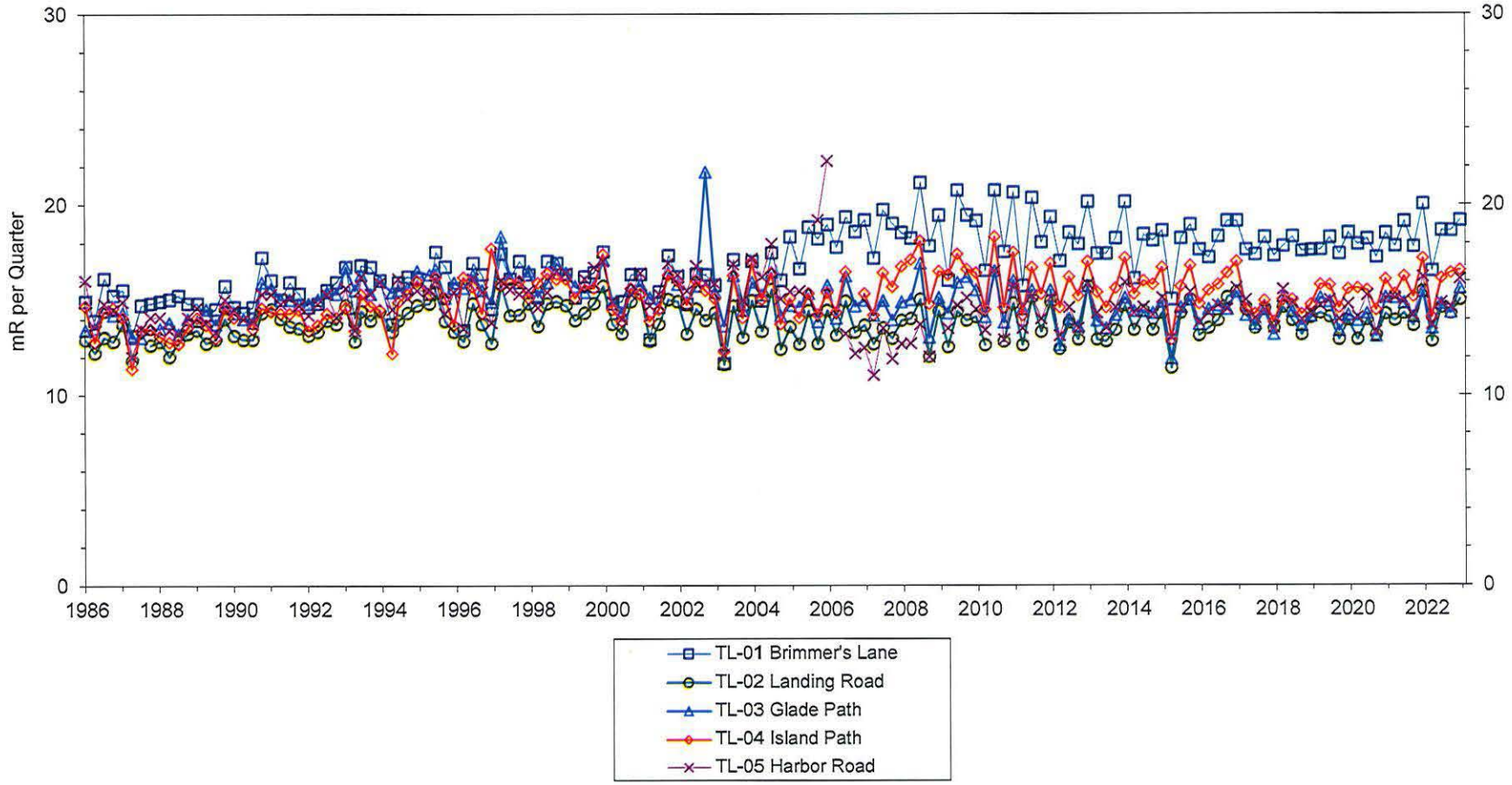


FIGURE 3.7

ENVIRONMENTAL RADIATION MEASUREMENTS (USING TLDs)
SEABROOK STATION

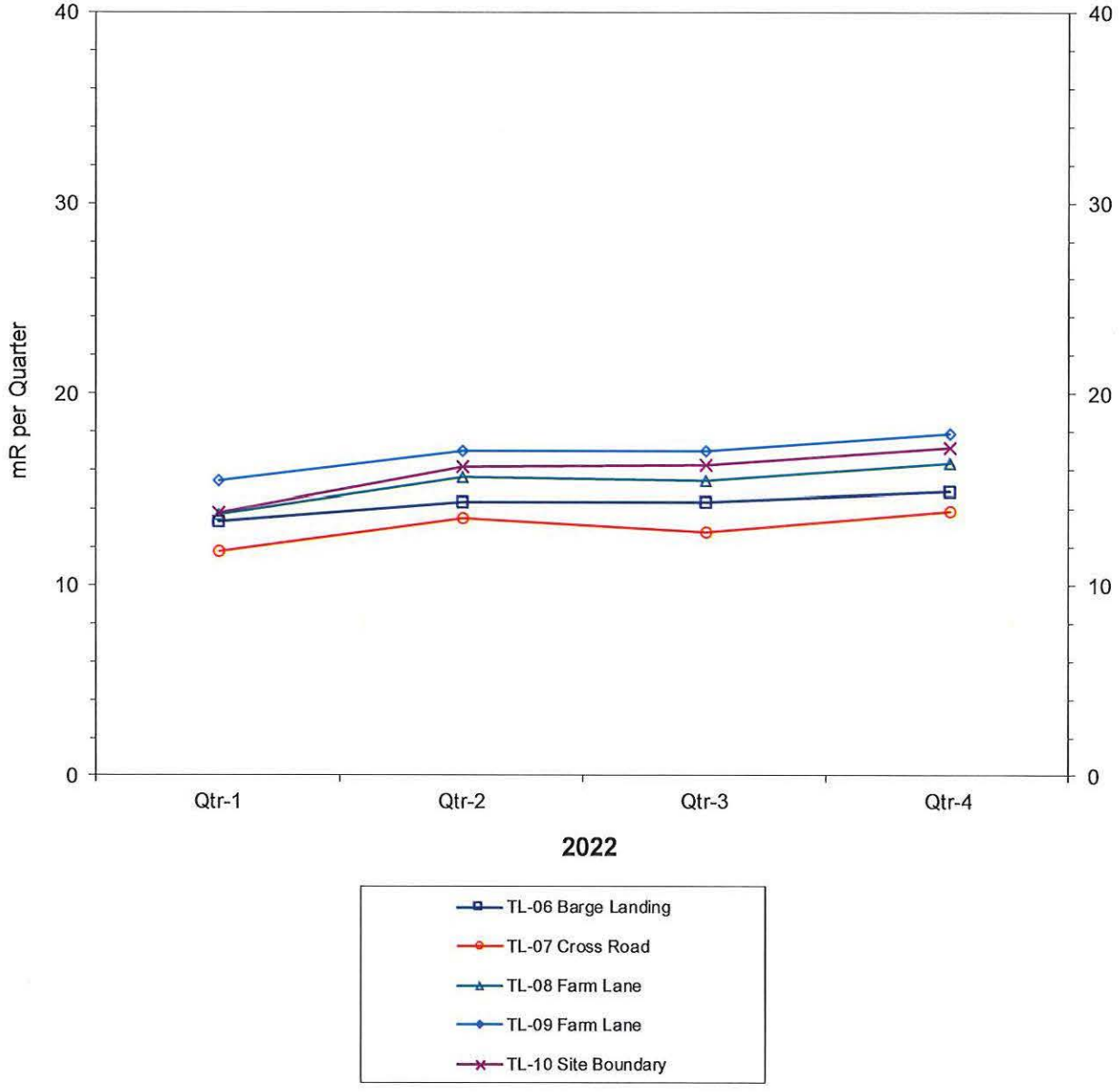


FIGURE 3.7.1

ENVIRONMENTAL RADIATION MEASUREMENTS (USING TLDs)
SEABROOK STATION

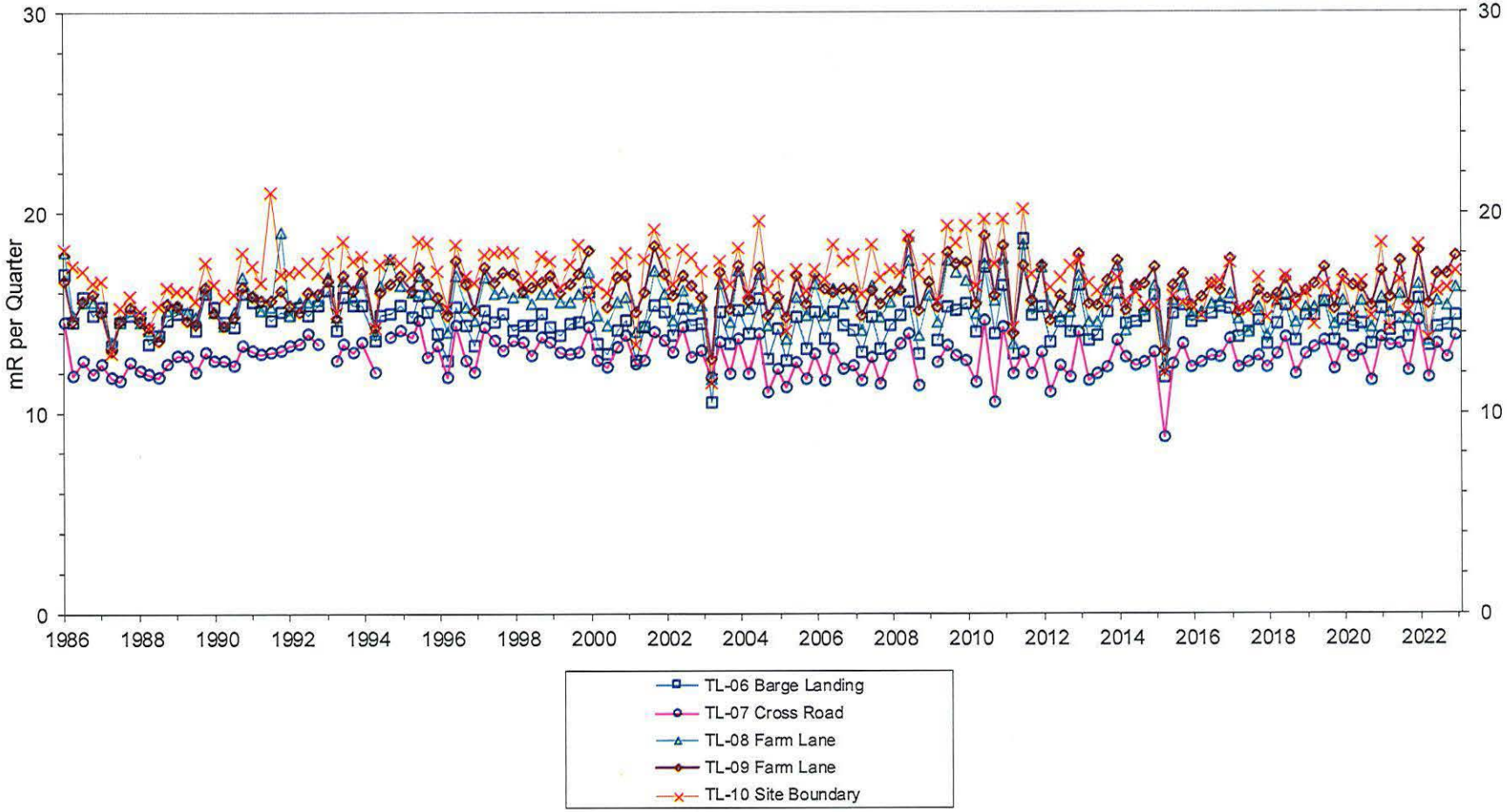


FIGURE 3.8

ENVIRONMENTAL RADIATION MEASUREMENTS (USING TLDs)
SEABROOK STATION

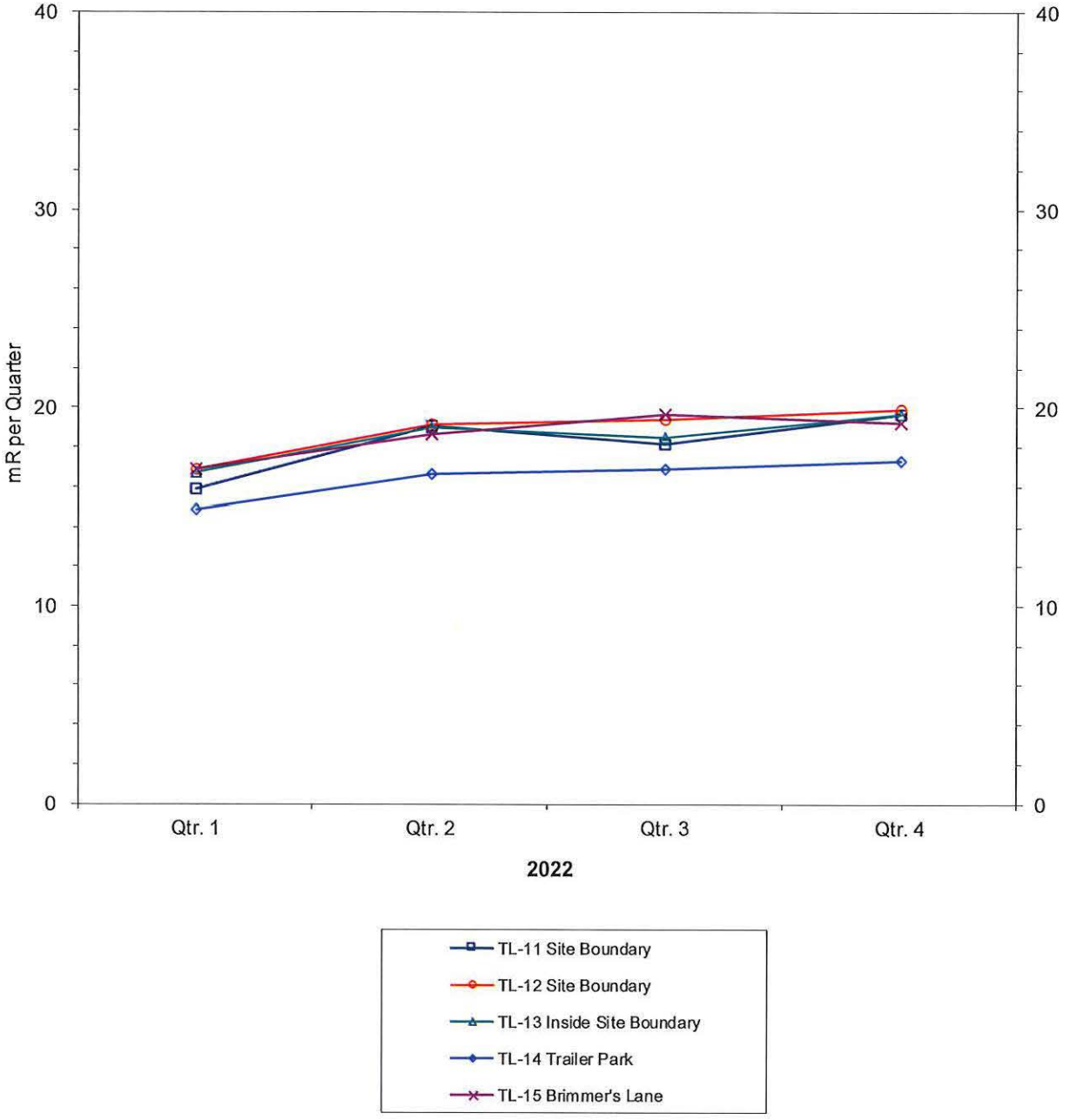


FIGURE 3.8.1

ENVIRONMENTAL RADIATION MEASUREMENTS (USING TLDs)
SEABROOK STATION

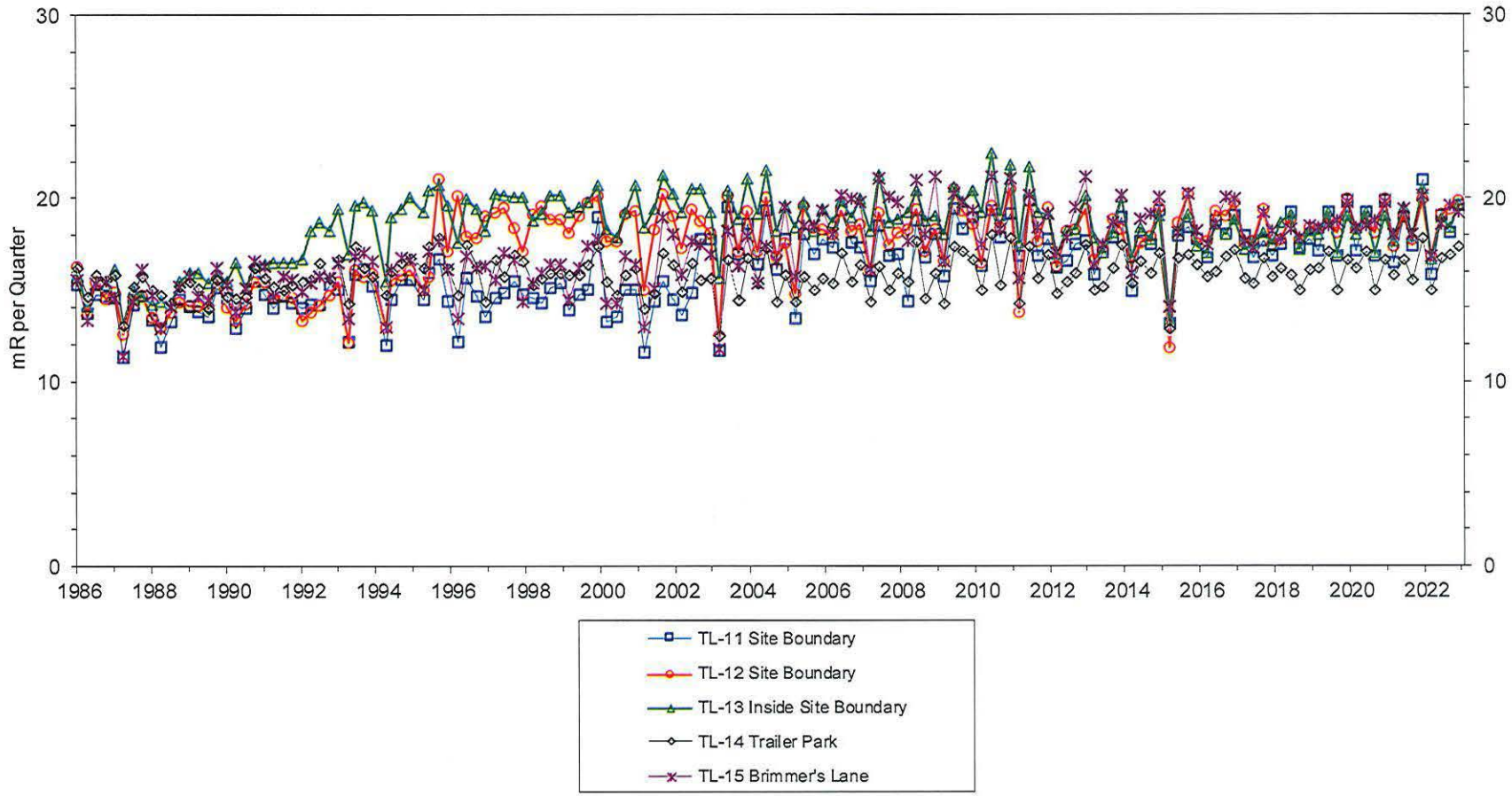


FIGURE 3.9

ENVIRONMENTAL RADIATION MEASUREMENTS (USING TLDs) SEABROOK STATION

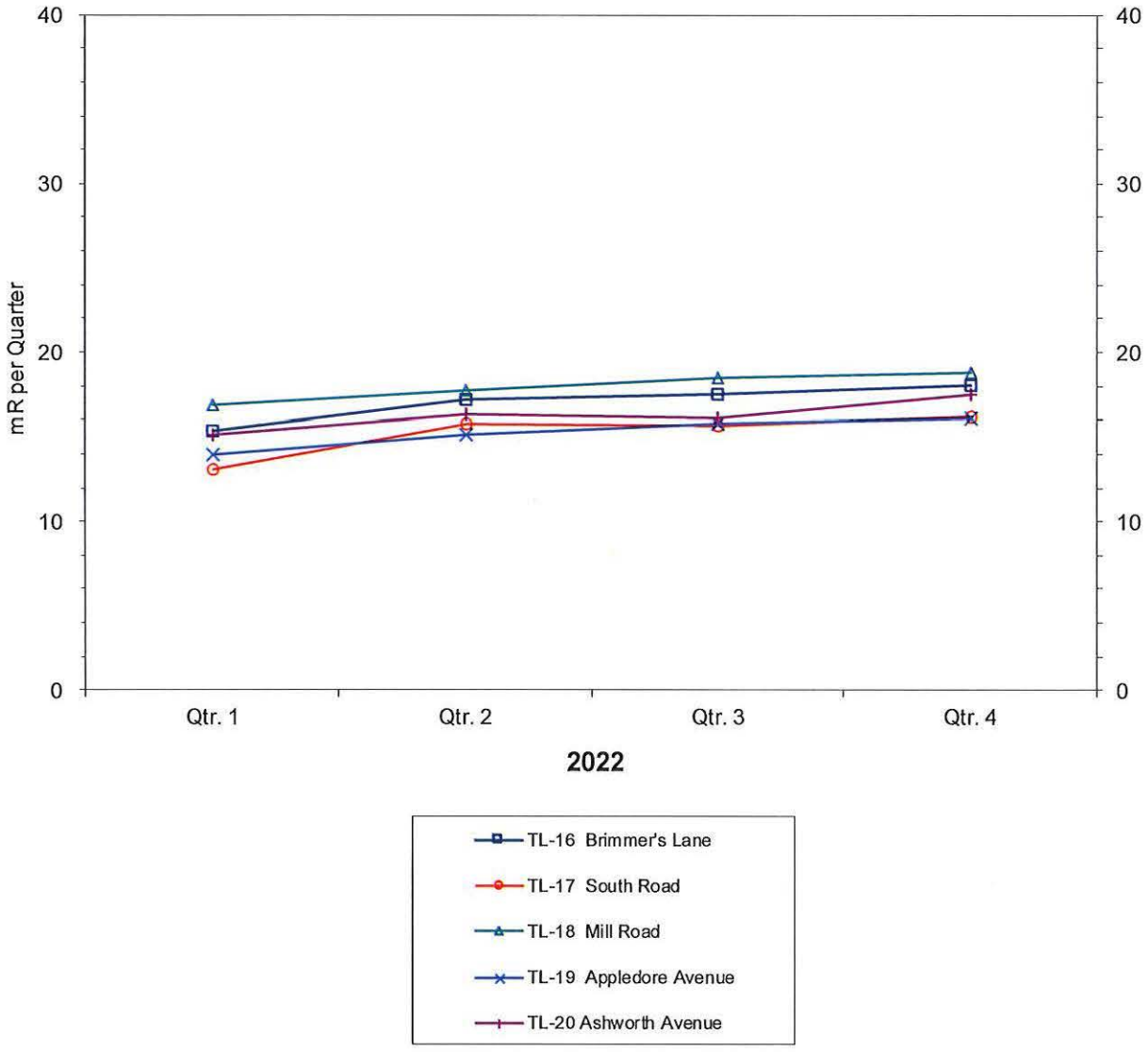


FIGURE 3.9.1

ENVIRONMENTAL RADIATION MEASUREMENTS (USING TLDs) SEABROOK STATION

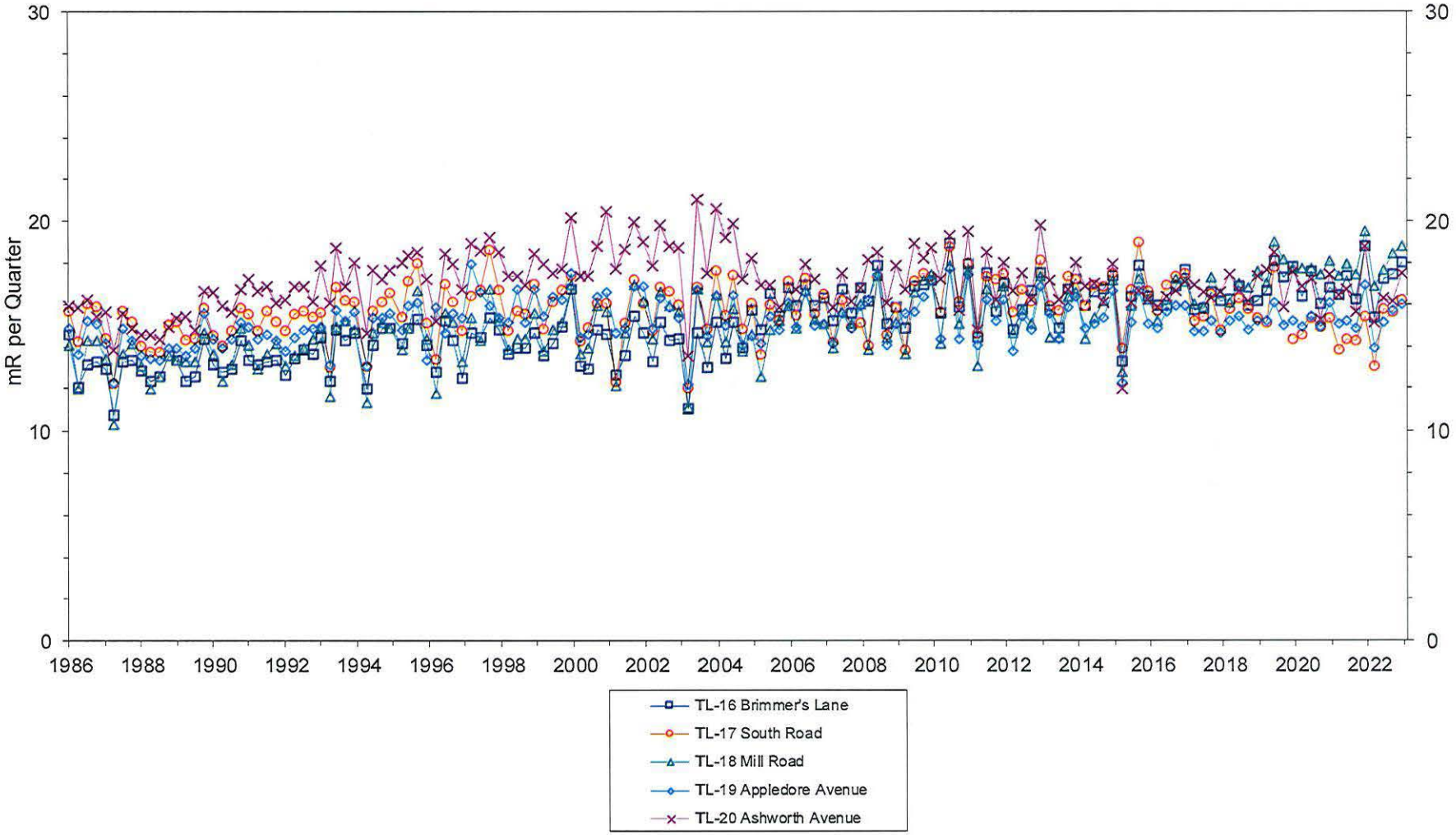


FIGURE 3.10

ENVIRONMENTAL RADIATION MEASUREMENTS (USING TLDs)
SEABROOK STATION

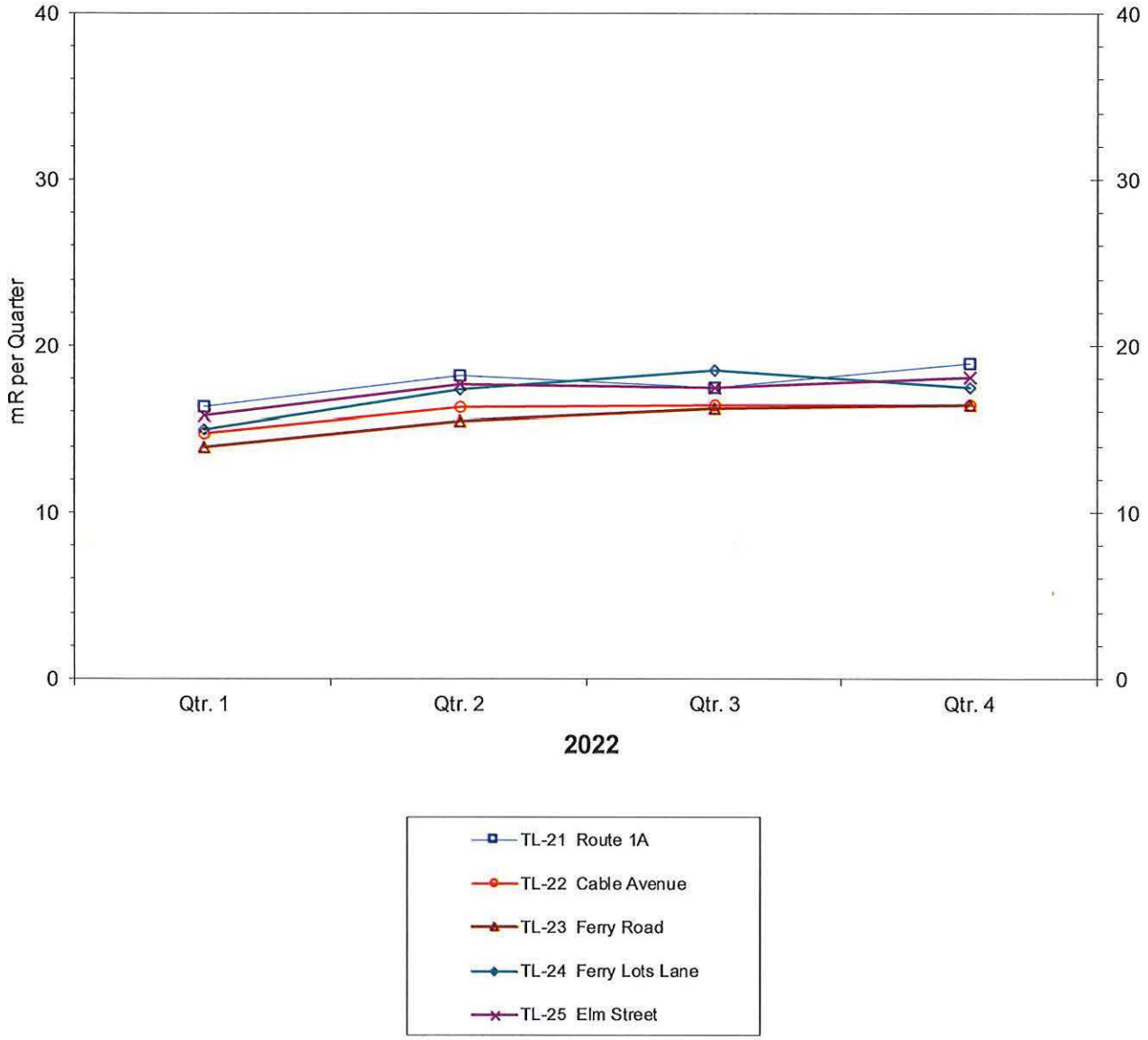


FIGURE 3.10.1

ENVIRONMENTAL RADIATION MEASUREMENTS (USING TLDs)
SEABROOK STATION

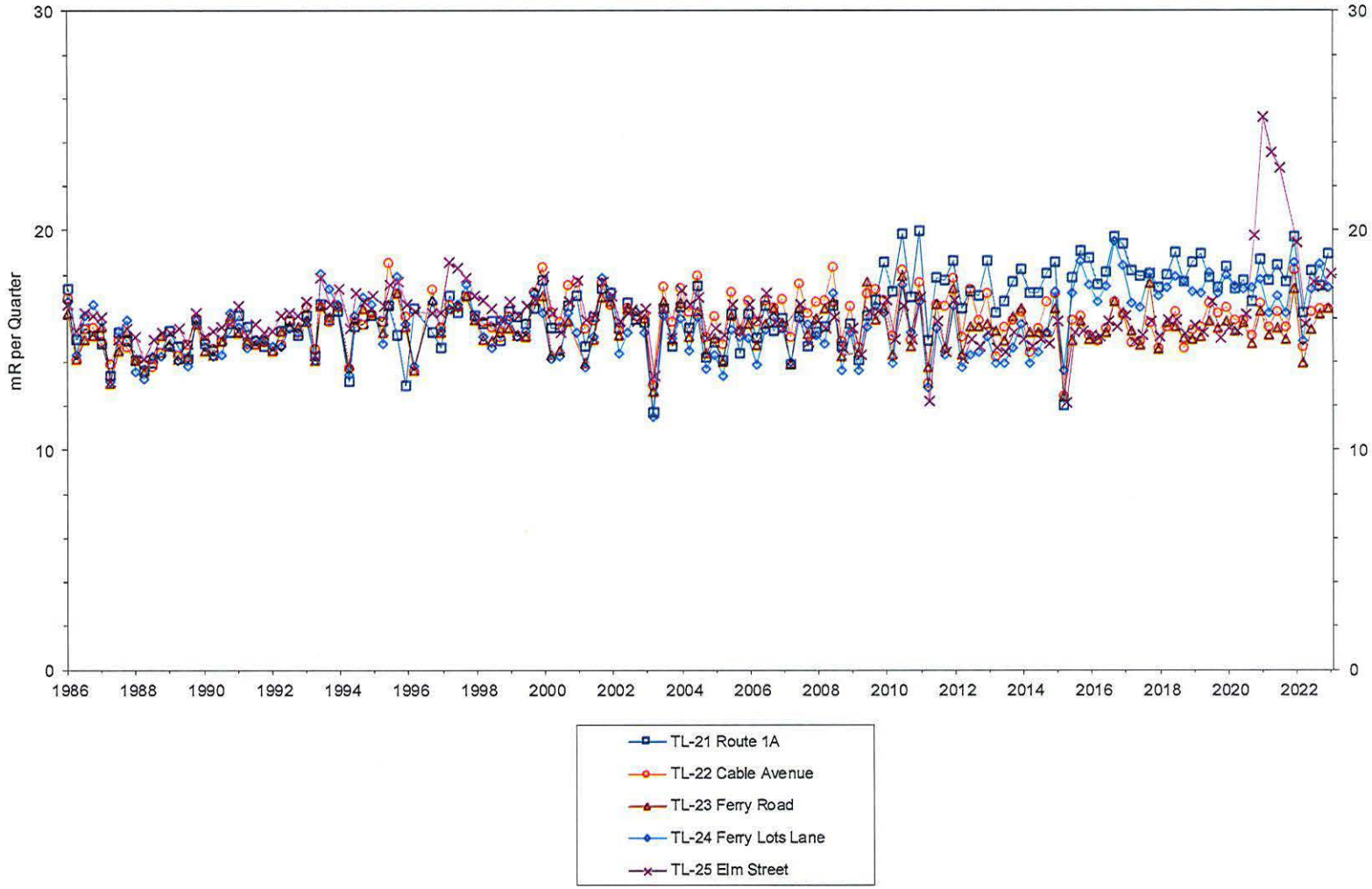


FIGURE 3.11

ENVIRONMENTAL RADIATION MEASUREMENTS (USING TLDs) SEABROOK STATION

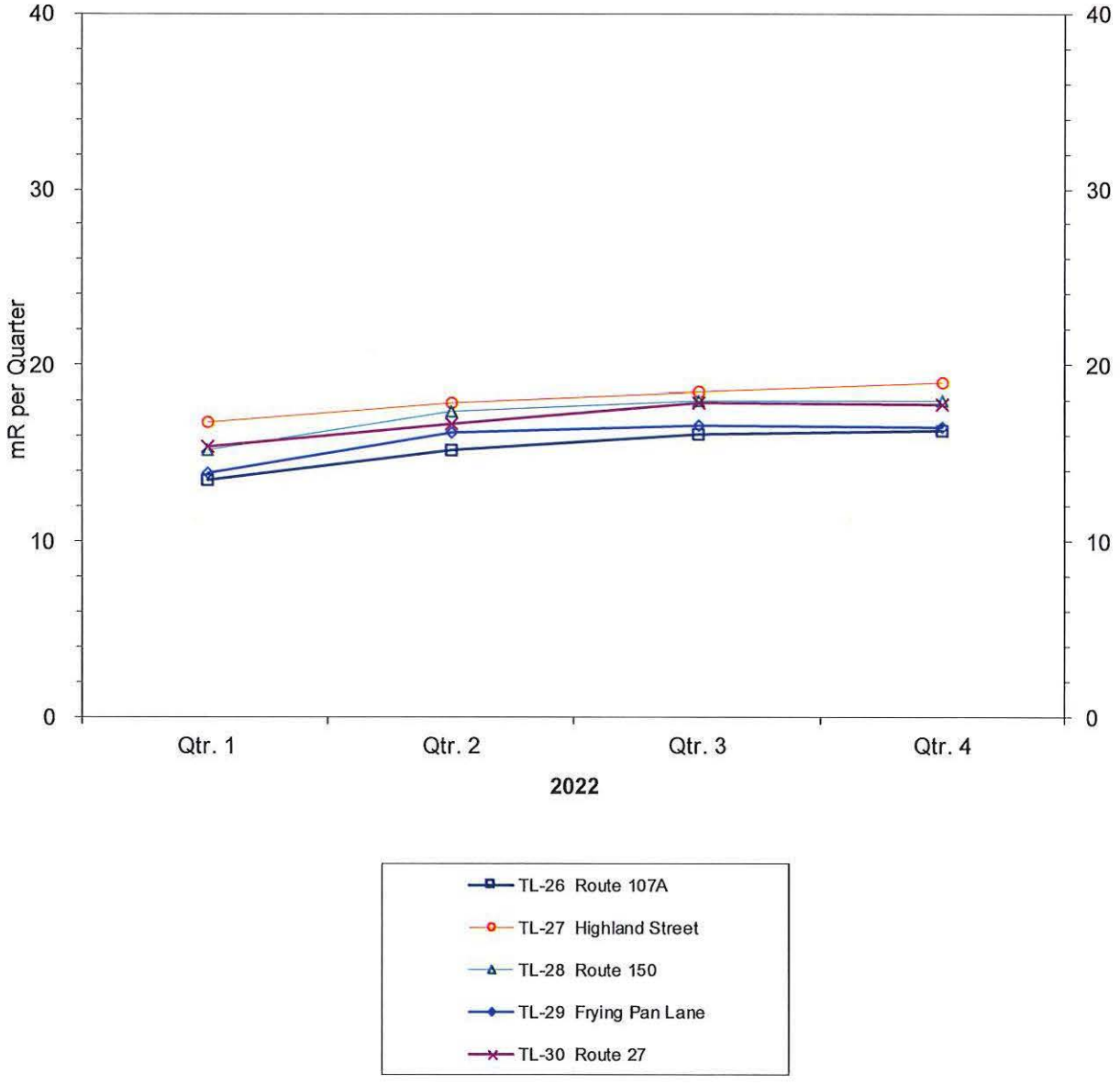


FIGURE 3.11.1

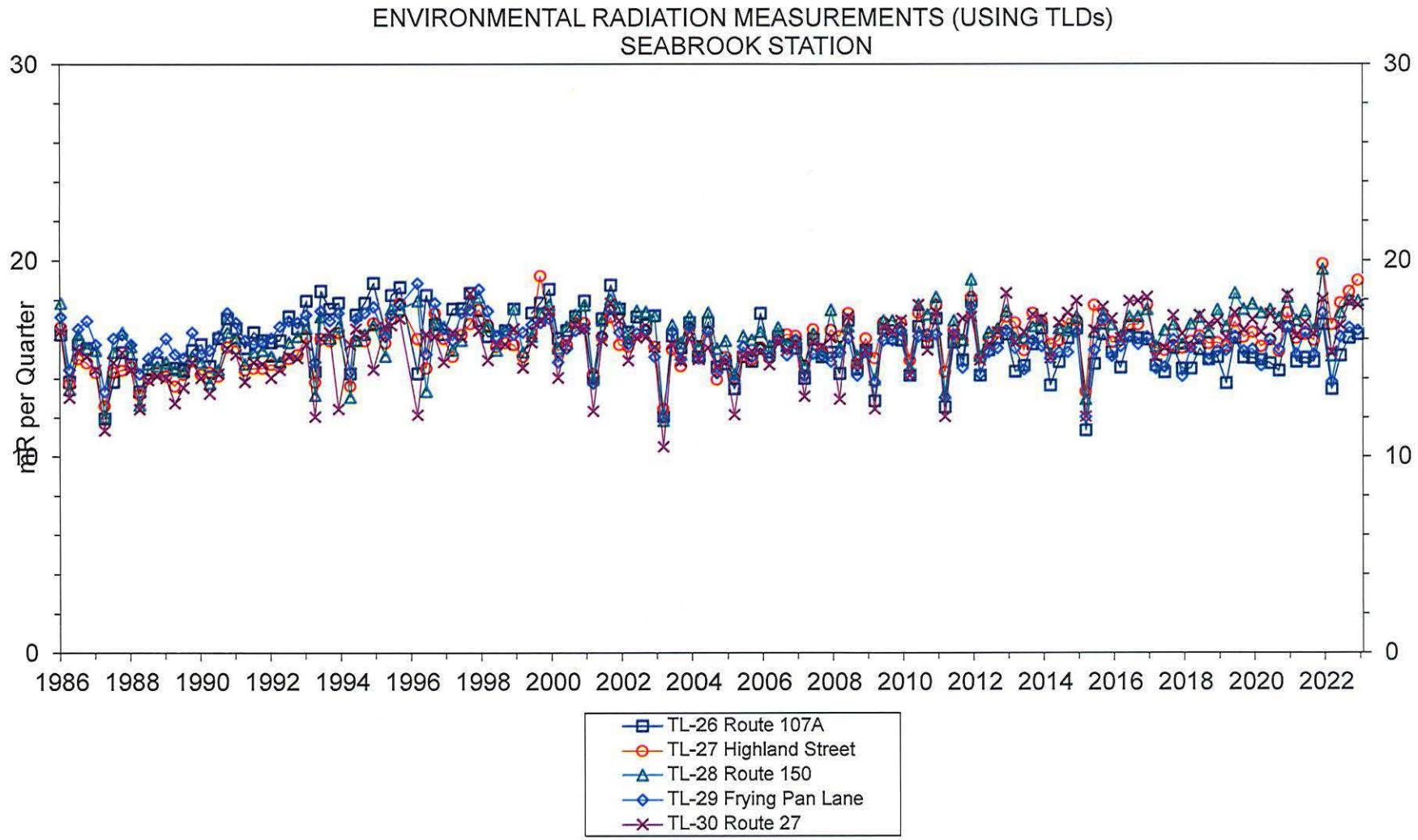

ENVIRONMENTAL RADIATION MEASUREMENTS (USING TLDs)
SEABROOK STATION
mR per Quarter
30
20
10
0
1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020 2022
TL-26 Route 107A
TL-27 Highland Street
TL-28 Route 150
TL-29 Frying Pan Lane
TL-30 Route 27

FIGURE 3.12

ENVIRONMENTAL RADIATION MEASUREMENTS (USING TLDs)
SEABROOK STATION

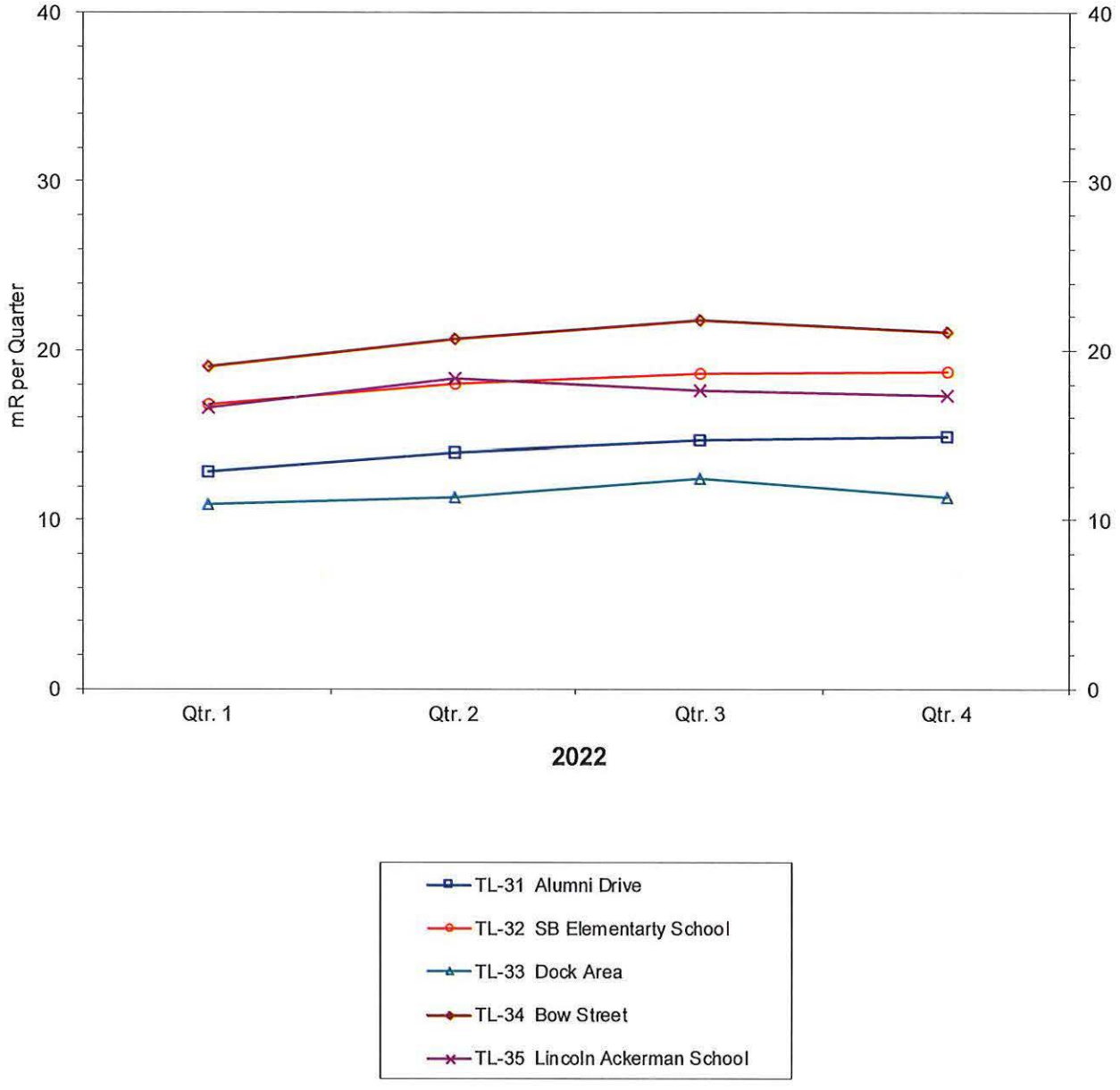


FIGURE 3.12.1

ENVIRONMENTAL RADIATION MEASUREMENTS (USING TLDs)
SEABROOK STATION

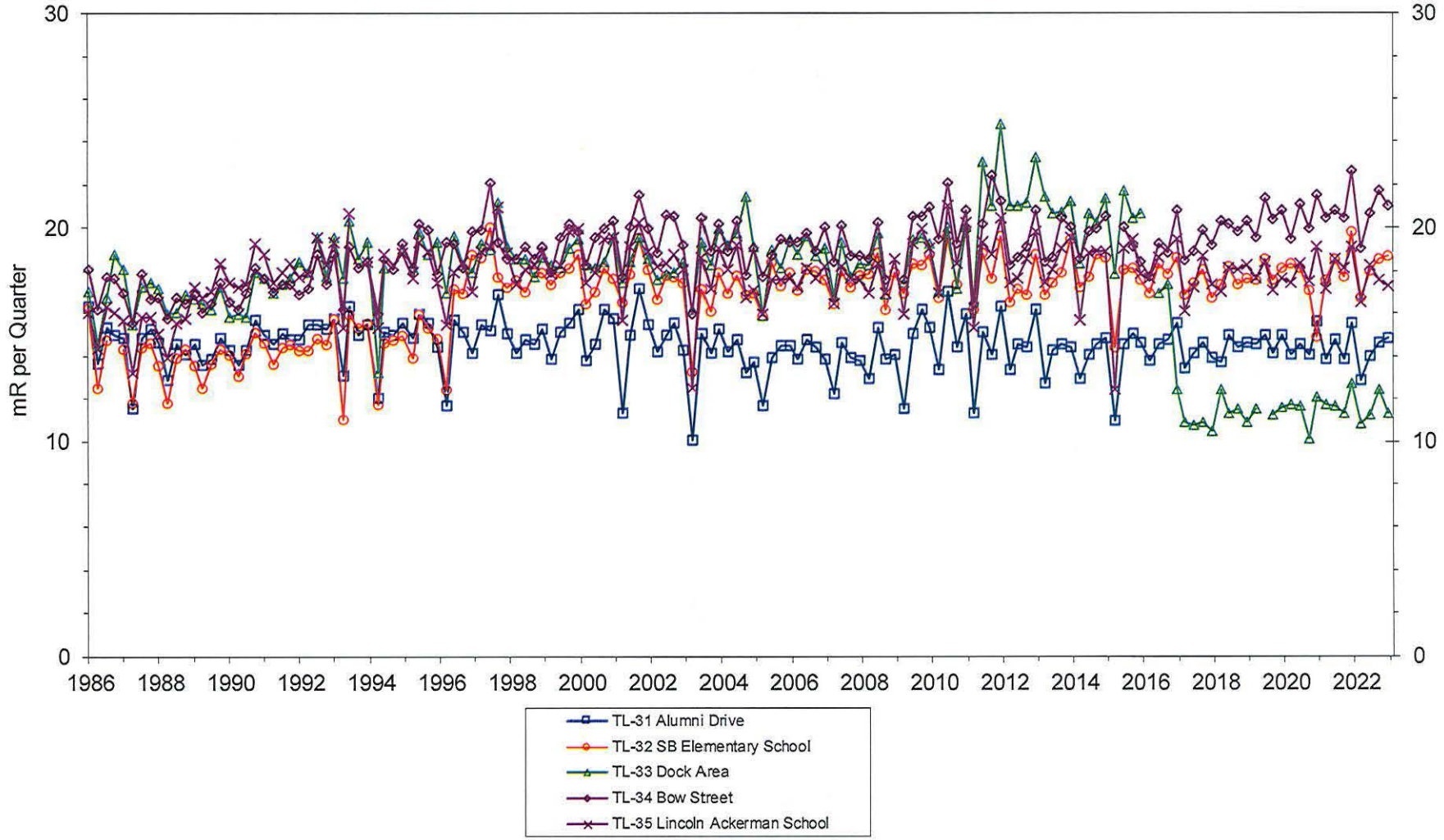


FIGURE 3.13

ENVIRONMENTAL RADIATION MEASUREMENTS (USING TLDs) SEABROOK STATION

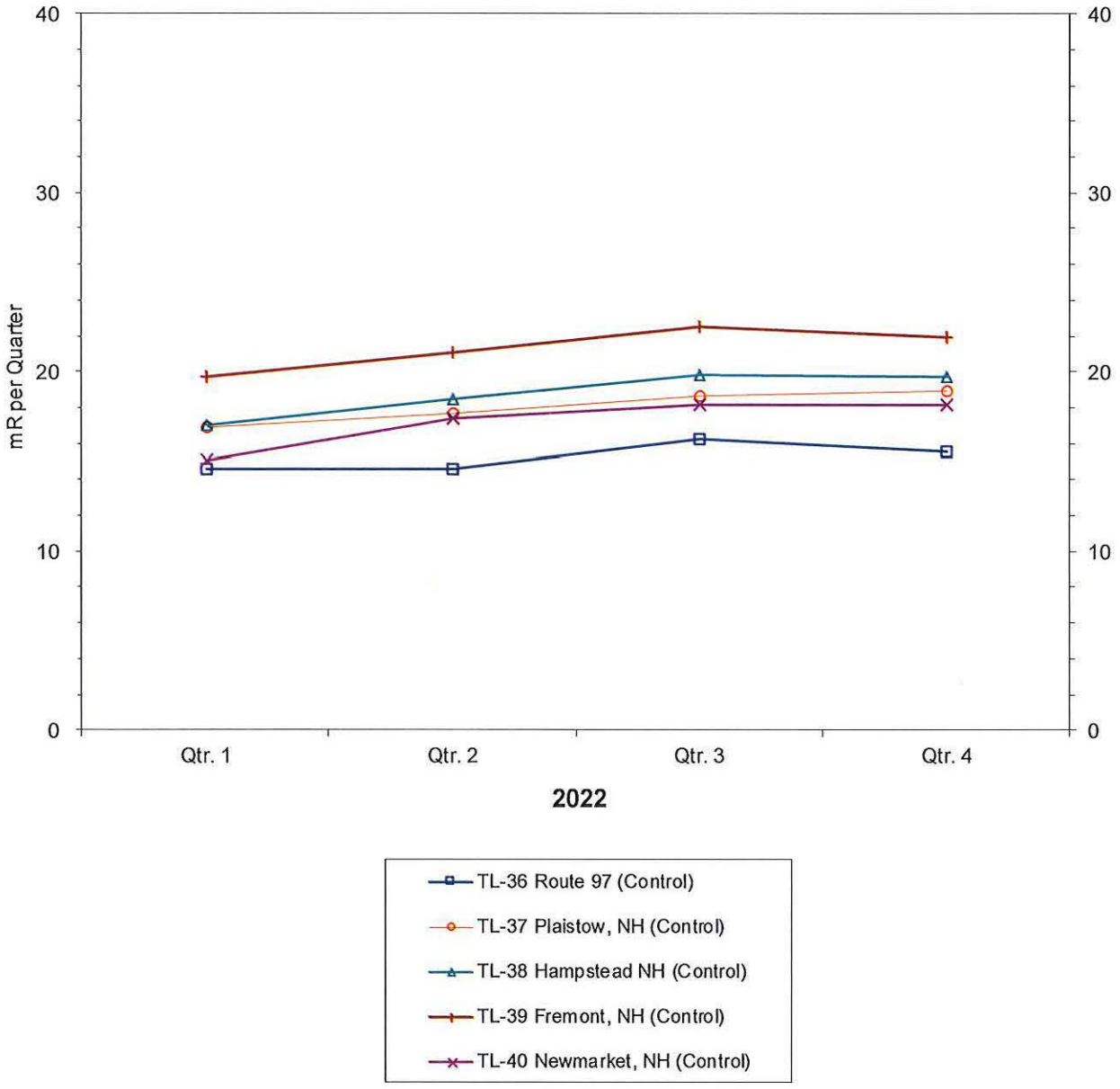


FIGURE 3.13.1

ENVIRONMENTAL RADIATION MEASUREMENTS (USING TLDs)
SEABROOK STATION

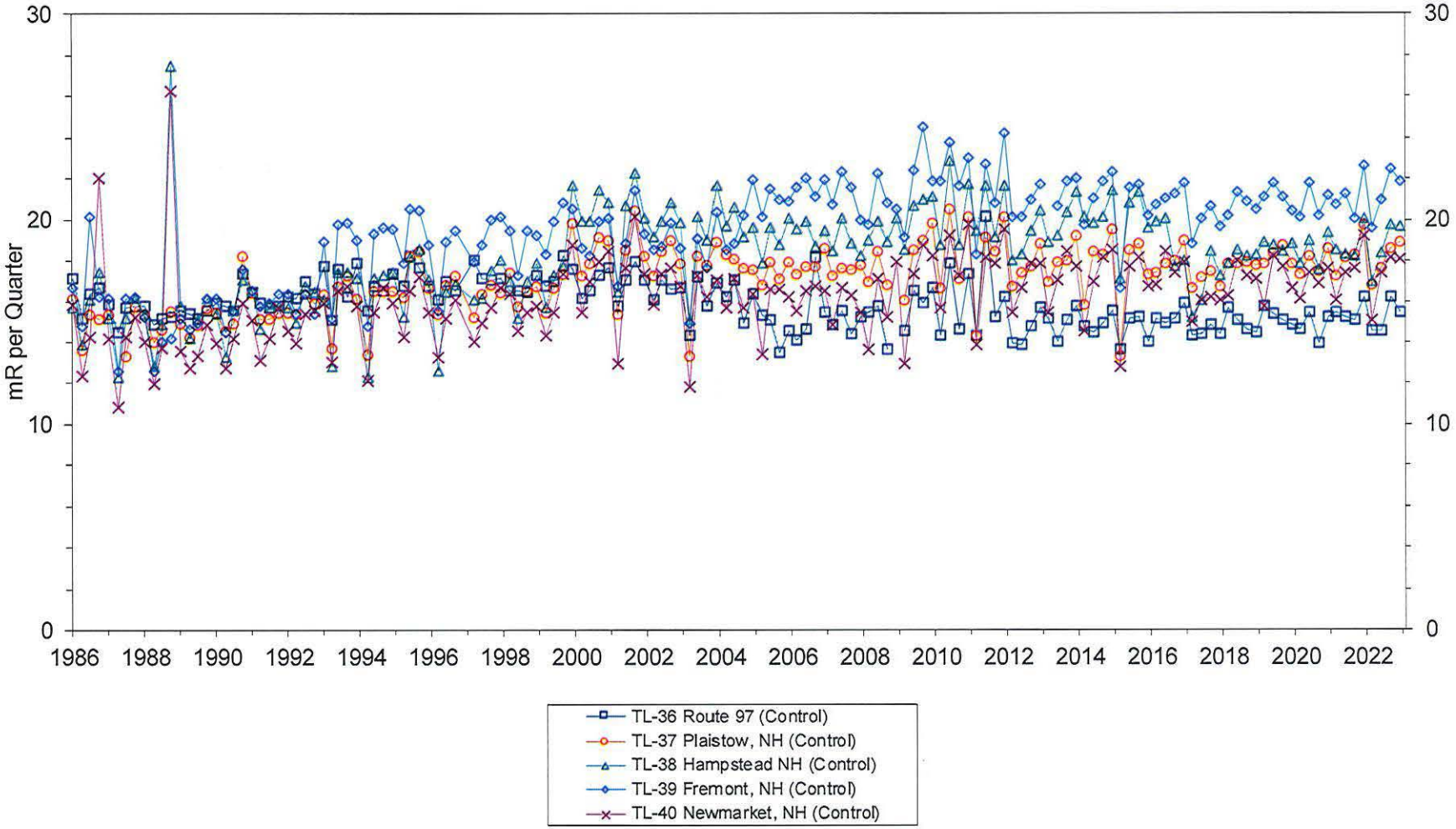


FIGURE 3.14

ENVIRONMENTAL RADIATION MEASUREMENTS (USING TLDs)
SEABROOK STATION

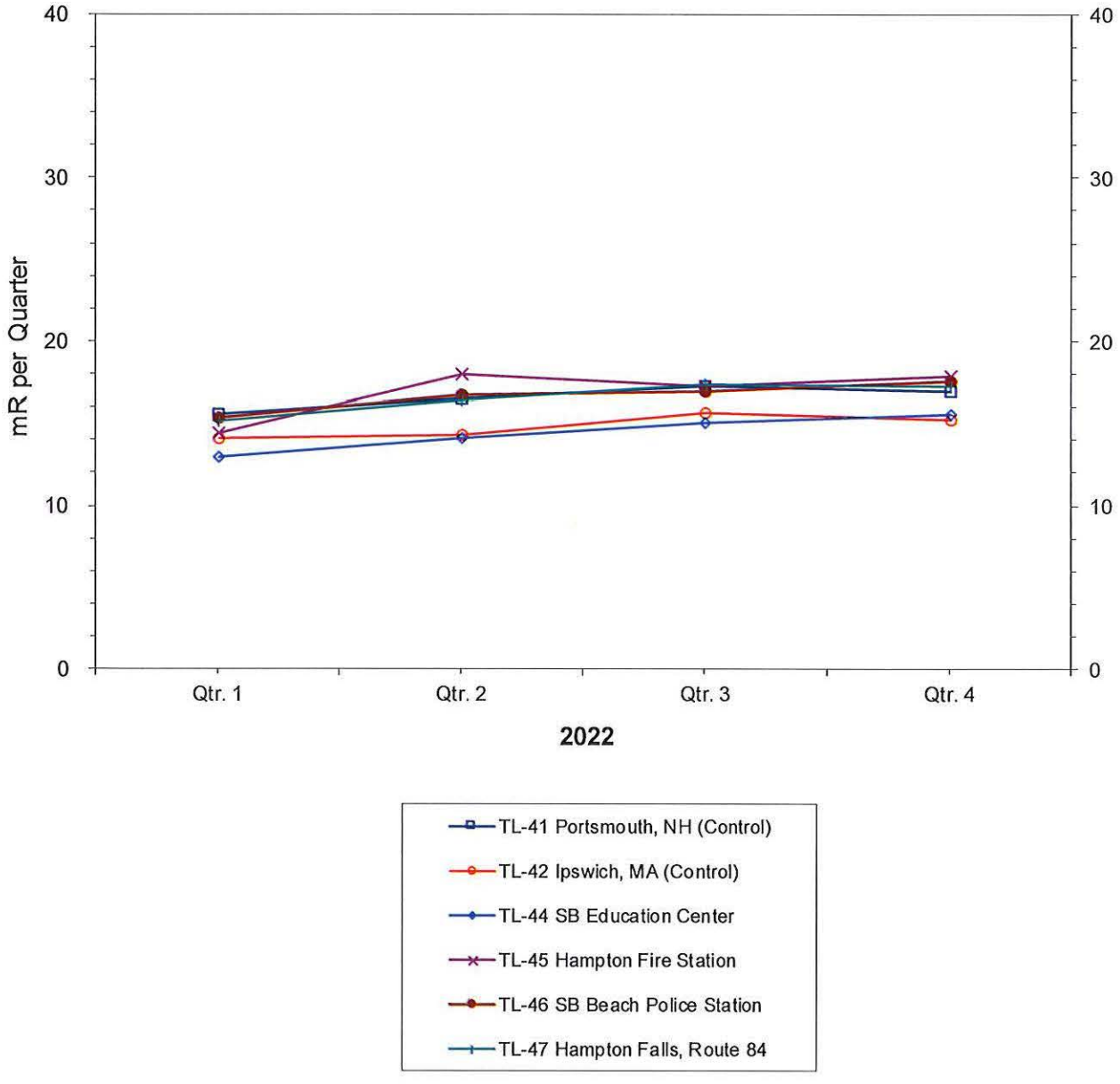
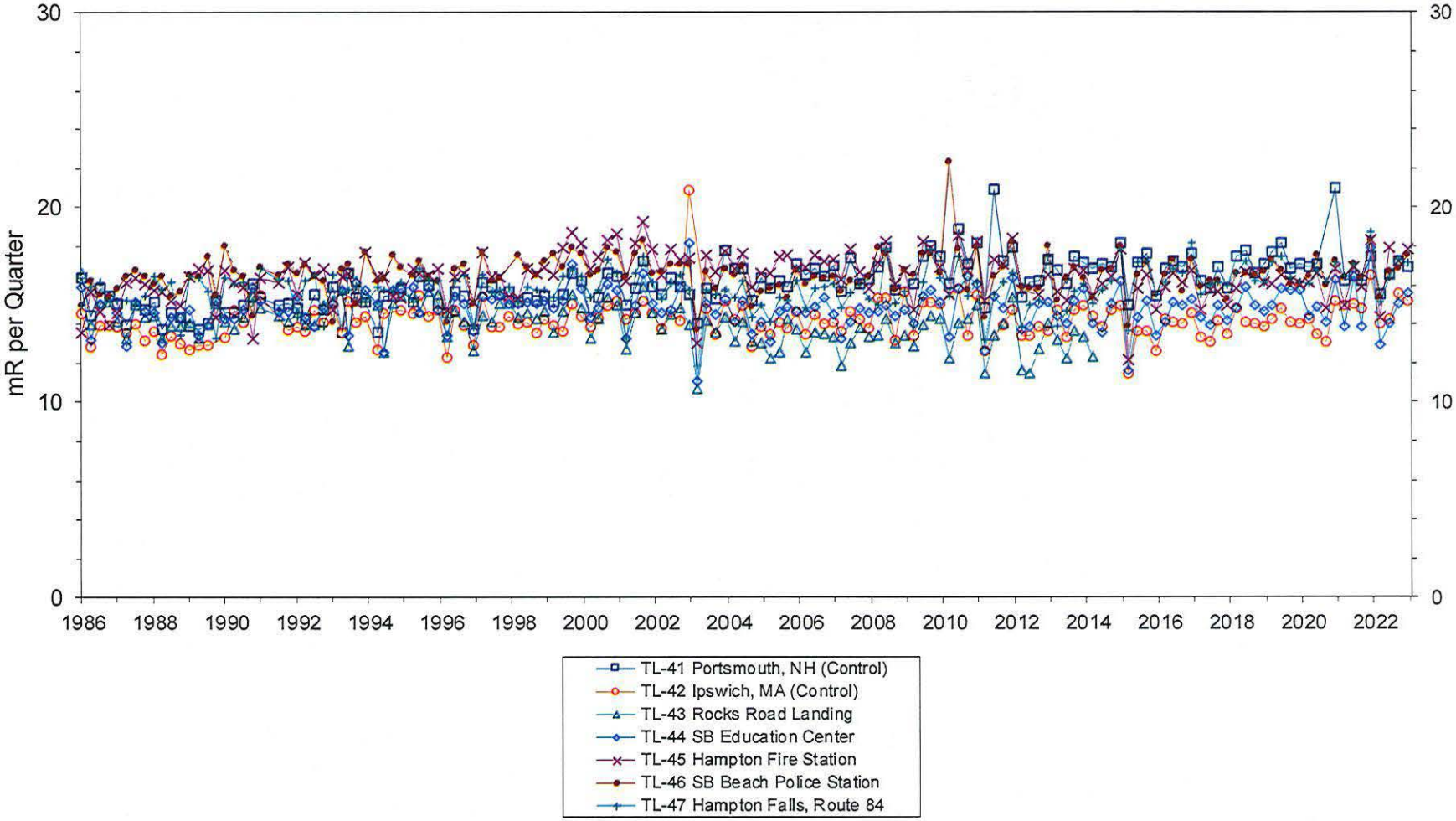


FIGURE 3.14.1

ENVIRONMENTAL RADIATION MEASUREMENTS (USING TLDs)
SEABROOK STATION



4.0 Dry Fuel Storage REMP & Data Summary

The Dry Fuel Storage (DFS) radiological environmental monitoring program required by ODCM Control C.9.4.1 provides representative measurements of direct (including scattered) radiation exposure at those locations that have the highest potential for dose to members of the public resulting from dry fuel storage operations. The design of the storage facility is such that there are no liquid or gaseous effluents released to the environment from DFS and, therefore, no associated exposure pathways for liquids and gases requiring the collection and analysis of such sample media. As a result, only direct (including scattered) radiation from the DFS modules need to be monitored for integrated exposures in areas where doses to members of the public need to be limited.

At locations near the DFS where members of the public might be present (off-site areas near the site boundary and on-site special use locations, i.e., the Science and Nature Center, the new Fitness Center located in the High Rise office building east of the DFS facility and the Firing Range located on the west site boundary), TLDs were placed at least 1 year (4 quarterly measurements) prior to used fuel being placed into storage. The DFS received its first load of fuel for storage on July 28, 2008. A total of 6 fuel canisters were placed in the NUHOMS© Horizontal Storage Modules (HSM) on the DFS pad during 2008 with the last one being loaded on September 4, 2008. A second fuel transfer campaign was conducted during August and September, 2013, with an additional 8 fuel canisters placed into storage, a third fuel transfer campaign during August – October, 2017, with an additional 8 fuel canisters, and a fourth fuel transfer campaign was conducted during August and September, 2022, with an additional 8 fuel canisters placed in storage, bringing the total to 30 canisters in storage.

The DFS radiological environmental monitoring stations are listed in Table 4.0-1. At the end of 2013, TLD location SB-35, which was located inside the old Fitness Center, and location TL-67 (first quarter of 2014), which was located outside the old Fitness Center south of the DFS, were removed from the program due to the relocation of the fitness center to the High Rise Office Building. TLD locations SB-32 and SB-33 now provide monitoring for the new Fitness Center location. The measurement locations with respect to the Seabrook site area are shown on Figure 4.0.1.

4.1 Direct Radiation from DFS

As with the plant operations TLD program described in Section 3.13, the DFS TLD exposure rates were normalized to a standard 91-day quarter. A summary of the 2022 data for the DFS REMP is shown in Table 4.1-1. Figures 4.1, 4.2 and 4.3 show the quarterly 2022 TLD trend lines for the control and indicator monitoring locations. Figures 4.4, 4.5 and 4.6 provide a comparison of long term trend lines (12 years) for the same control locations, site boundary and special use sites.

Overall, the direct radiation program showed no statistically significant indication of increased direct radiation above the variable background measured exposure rate in unrestricted areas. The 2022 annual mean of all indicator locations for the DFS was 17.3 mR/91-day quarter while the mean of all control locations was 17.4 mR/91-day quarter. There was no notable difference detected in the annual exposure rates in areas where members of the public could occupy (site boundary and inside special use locations) and the control locations. Starting in the 4th quarter of 2013, location TL-67 indicated a notable measurement increase in exposure rate following the expansion of fuel storage in the DFS facility in the third quarter of 2013. However, by late November 2013, the fitness center operations had been transferred from its original location south of the DFS to the High Rise Office Building east of the DFS, thereby ending use of the original fitness center facility and its parking lot by members of the public.

Starting in 2015, an additional analytical method was implemented to evaluate the TLD measurements. Using the method described in ANSI/HPS N13.37-2014, quarterly and annual baseline dose for each DFS TLD location was determined using appropriate statistical analytical methods considering data from 2004 through 2014. Quarterly and annual dose for 2022 was compared to baseline values to determine if an Investigation Level had been exceeded for evaluation of potential dose to a member of the public. An Investigation Level is considered to be exceeded under the following conditions:

$$\text{Quarterly: If } M_Q > (B_Q + MDD_Q), \text{ then } F_Q = M_Q - B_Q$$

Where:

M_Q is the normalized quarterly field measurement result
B_Q is the quarterly baseline background dose
MDD_Q is the quarterly minimum differential dose and
F_Q is the quarterly facility related dose

or: Annually: If $M_A > (B_A + MDD_A)$, then $F_A = M_A - B_A$

Where:

M_A is the sum of the four normalized quarterly measurement values
B_A is the annual baseline background dose
MDD_A is the annual minimum differential dose
F_A is the annual facility related dose

Table 4.1-2 summarizes the evaluation of the TLD measurements using the methodology described in ANSI/HPS N13.37-2014. As noted in Table 4.1-2, TLD location SB-33 (High-Rise Building 1st floor, Fitness Center) was found to have a calculated annual facility related dose of 21.8 mR when comparing the measured TLD value against the annual baseline values. However, as this is an onsite fitness center under Station control, an annual occupancy factor for this location of 0.0416 (1 hour per day x 7 days a week x 52 weeks per year / 8760 hours) can be applied. This results in an annual dose of 0.9 mR, which is considered not detectable per ANSI/HPS 13.37-2014 methodology. It is also noted in note 2 to Table 4.1-2 that Figure 4.6 shows a step increase in the quarterly TLD values for TLD location SB-33 starting in the 3rd quarter of 2015. Since this step increase does not correspond to a DFS fuel transfer campaign, and there is a lack of a similar step increase in nearby TLD location SB-32 (same building, but on the 3rd floor), this dose is unlikely DFS facility related. Seabrook Station suspects that the observed step change is due to the TLD being repositioned into the new fitness center from its original location in a 1st floor office on the southeast corner of the building. For this reason, the location will continue to be monitored and the quarterly and annual baseline values for this location will be adjusted, as necessary.

Any sample collection and analysis deviations from the ODCM required program, or reportable concentrations that may have occurred during the year are described in Section 5.

Figure 4.0.1
Dry Fuel Storage TLD Environmental Monitoring Locations

Table 4.0-1

Dry Fuel Storage (DFS) TLD Monitoring Locations

Site Designation Code	TLD Sample Location Description[3]	Distance From DFS Pad (km)	Direction From DFS Pad
TL-44	On-site, outside Science & Nature Center [1][2]	0.21	ESE
SB-36	On-site, inside Science & Nature Center	0.24	SE
SB-32	High-Rise Building, 3rd Floor[1]	0.23	E
SB-33	High-Rise Building, 1st Floor (new Fitness Center)[1]	0.23	E
TL-68	Nearby site boundary (firing range) to DFS	0.45	W
TL-69	Nearby site boundary (Rocks Rd) to DFS	0.47	W
TL-10	Site Boundary Fence [2]	0.77	S
TL-11	Site Boundary Fence [2]	0.52	SSW
TL-12	Site Boundary fence [2]	0.53	WSW
TL-13	Inside Site Boundary [2]	0.61	WNW
TL-14	Trailer Park, Seabrook [2]	0.94	NW
TL-36	Rt 97, Georgetown (Control) [2]	22	SSW
TL-37	Plaistow, NH (Control) [2]	21	WSW
TL-38	Hampstead, NH (Control) [2]	27	W
TL-39	Fremont, NH (Control) [2]	27	WNW
TL-40	Newmarket, NH (Control) [2]	22	NNW
TL-41	Portsmouth, NH (Control) [1][2]	22	NNE
TL-42	Ipswich, MA (Control) [1][2]	22	SSE

(1) This location is not part of the required DFS radiological monitoring program as defined in Table A.9.4-1 of the Seabrook ODCM.

(2) Shared environmental monitoring locations for both Seabrook Station REMP and DFS monitoring.

(3) TL-67 and SB-35 locations were removed in 2014 due to relocation of the Fitness Center to the High Rise office building.

Table 4.1-1

DFS Environmental TLD Measurements
Net Exposures in mR/Standard Quarter (91 days)

2022

No.	Description	1st Quarter Exp.	S.D.	2nd Quarter Exp.	S.D.	3rd Quarter Exp.	S.D	4th Quarter Exp.	S.D.	Qtr Ave Exp.
TL-44	Outside Science & Nature C.(1)	13.0	± 0.7	14.1	± 0.5	15.1	± 0.9	15.6	± 0.7	14.5
SB-36	Inside Science & Nature C.	15.6	± 0.6	17.0	± 0.8	17.1	± 0.8	18.3	± 0.7	17.0
SB-32	High-Rise 3rd Floor (1)	13.7	± 0.6	14.8	± 1.2	14.9	± 0.7	16.4	± 0.5	15.0
SB-33	High-Rise 1st Fl.(Fitness Cntr)(1)	21.1	± 0.8	22.3	± 1.1	22.3	± 1.2	25.3	± 0.9	22.8
TL-68	Nearby Site Boundary to DFS	17.4	± 0.7	18.3	± 0.6	20.0	± 0.8	19.1	± 0.8	18.7
TL-69	Nearby Site Boundary to DFS	13.8	± 0.9	14.9	± 0.5	15.6	± 0.7	15.9	± 0.5	15.1
TL-10	Site Boundary Fence (2)	13.8	± 0.7	16.2	± 0.7	16.3	± 0.7	17.2	± 0.6	15.9
TL-11	Site Boundary Fence (2)	15.9	± 0.8	19.1	± 0.8	18.2	± 1.0	19.7	± 0.9	18.2
TL-12	Site Boundary Fence (2)	16.9	± 0.5	19.2	± 0.8	19.4	± 0.7	20.0	± 0.8	18.9
TL-13	Inside Site Boundary (2)	16.7	± 0.6	19.0	± 0.7	18.5	± 1.0	19.7	± 0.7	18.5
TL-14	Trailer Park Seabrook (2)	14.9	± 0.5	16.7	± 0.6	16.9	± 0.7	17.3	± 0.6	16.5
TL-36	Rt 97, Georgetown (control)(2)	14.6	± 0.7	14.6	± 0.5	16.3	± 0.7	15.5	± 0.6	15.3
TL-37	Plaistow, NH (Control)(2)	16.9	± 0.6	17.7	± 0.8	18.7	± 0.7	19.0	± 0.9	18.1
TL-38	Hampstead, NH (Control)(2)	17.0	± 0.6	18.5	± 0.7	19.8	± 0.9	19.8	± 0.7	18.8
TL-39	Fremont, NH (Control)(2)	19.7	± 0.8	21.1	± 0.7	22.6	± 1.0	21.9	± 0.9	21.3
TL-40	Newmarket, NH (Control)(2)	15.1	± 0.6	17.4	± 0.6	18.2	± 0.7	18.2	± 0.5	17.2
TL-41	Portsmouth, NH (Control)(1)(2)	15.6	± 0.6	16.6	± 0.7	17.3	± 0.9	17.0	± 0.8	16.6
TL-42	Ipswich, MA (Control)(1)(2)	14.1	± 0.4	14.3	± 0.5	15.7	± 0.7	15.2	± 0.7	14.8
	Mean of Indicators	15.7		17.4		17.7		18.6		17.3
	Mean of Controls	16.1		17.2		18.4		18.1		17.4

(1) This location is not part of the DFS required program defined by the ODCM.
(2) Shared environmental monitoring locations for both plant REMP and DFS monitoring.

Table 4.1-2

DFS Facility Related Dose using ANSI/HPS N13.37-2014 Methodology

		Quarterly Ave. Baseline, B_Q	2022 Quarterly Monitoring Data, M_Q (mR/qtr)				Quarterly Facility Dose $F_Q = M_Q - (B_Q+MDD_Q)$				Annual Baseline, B_A	2022 Annual TLD Data, M_A	Annual Facility Dose $F_A = M_A - (B_A+MDD_A)$
		mR	1	2	3	4	1	2	3	4	mR	mR	
TL-44	On-site, outside Science & Nature Center	14.8	13.0	14.1	15.1	15.6	ND	ND	ND	ND	59.0	57.8	ND
SB-36	On-site, inside Science & Nature Center	16.2	15.6	17.0	17.1	18.3	ND	ND	ND	ND	64.7	68.1	ND
SB-32	High-Rise Building, 3rd floor	14.0	13.7	14.8	14.9	16.4	ND	ND	ND	ND	55.7	59.8	ND
SB-33	High-Rise Building 1st floor, Fitness Center	17.5	21.1	22.3	22.3	25.3	ND	ND[1]	ND[1]	ND[1]	69.2	91.0	ND[1,2]
TL-68	Nearby site boundary (firing Range)	17.7	17.4	18.3	20.0	19.1	ND	ND	ND	ND	70.8	74.9	ND
TL-69	Nearby site boundary (Rocks Rd)	14.6	13.8	14.9	15.6	15.9	ND	ND	ND	ND	58.2	60.2	ND
TL-10	Site Boundary	17.2	13.8	16.2	16.3	17.2	ND	ND	ND	ND	68.7	63.5	ND
TL-11	Site Boundary	17.5	15.9	19.1	18.2	19.7	ND	ND	ND	ND	69.9	72.9	ND
TL-12	Site Boundary	18.2	16.9	19.2	19.4	20.0	ND	ND	ND	ND	72.6	75.5	ND
TL-13	Inside Site Boundary	19.2	16.7	19.0	18.5	19.7	ND	ND	ND	ND	77.0	73.9	ND
TL-14	Trailer Park	15.9	14.9	16.7	16.9	17.3	ND	ND	ND	ND	63.5	65.8	ND
TL-36	Route 97(Control)	15.4	14.6	14.6	16.3	15.5	ND	ND	ND	ND	61.9	61.0	ND
TL-37	Plaistow, NH (Control)	18.0	16.9	17.7	18.7	19.0	ND	ND	ND	ND	72.0	72.3	ND
TL-38	Hampstead, NH (Control)	19.8	17.0	18.5	19.8	19.8	ND	ND	ND	ND	79.3	75.1	ND
TL-39	Fremont, NH (Control)	21.3	19.7	21.1	22.6	21.9	ND	ND	ND	ND	85.2	85.3	ND
TL-40	Newmarket, NH (Control)	16.7	15.1	17.4	18.2	18.2	ND	ND	ND	ND	66.9	68.9	ND
TL-41	Portsmouth, NH (Control)	16.9	15.6	16.6	17.3	17.0	ND	ND	ND	ND	67.6	66.4	ND
TL-42	Ipswich, MA (Control)	14.3	14.1	14.3	15.7	15.2	ND	ND	ND	ND	57.2	59.3	ND

Table 4.1-2 (cont'd)

DFS Facility Related Dose using ANSI/HPS N13.37-2014 Methodology

MDD_Q = 4.48 = minimum differential exposure, quarterly, 3 times 90th percentile S_Q determined from analysis in mR.

MDD_A = 10.17 = minimum differential exposure, annual, 3 times 90th percentile S_A determined from analysis in mR.

B_Q = Quarterly baseline exposure (mR).

M_Q = location's 91 day standard quarterly exposure (mR).

L_Q = Quarterly Investigative Level exposure (mR).

B_A = Quarterly baseline background average exposure (mR).

M_A = Annual monitoring data, determined by summing the quarterly data over all four quarters (mR).

L_A = Annual Investigative Level exposure (mR).

ND = Facility contribution to exposure "Not Detected"

[1] Note that this location is a fitness center and is not occupied full time. Applying an occupancy factor for this location of 0.0416 (1 hour per day x 7 days a week x 13 weeks per quarter / 2184 hours) to the measured net quarterly doses of 4.8 mR for the 2nd and 3rd quarters and 7.8 mR for the 4th quarter, results in a calculated quarterly facility dose of <1.0 mR, which is reported as ND (not detected) in accordance with the ANSI/HPS N13.37-2014 methodology. Similarly, applying an annual occupancy factor for this location of 0.0416 (1 hour per day x 7 days a week x 52 weeks per year / 8760 hours) to the measured net annual dose of 21.8 mR, results in a calculated annual facility dose of 0.9 mR, which is reported as ND (not detected) in accordance with the ANSI/HPS N13.37-2014 methodology.

[2] The baseline values for TLD location SB-33 were calculated with the ANSI/HPS N13.37-2014 methodology using data from 2008 to 2014. However, Figure 4.6 shows step increases in the quarterly TLD values for this location starting in the 3rd quarter of 2015 and again in the 2021 timeframe. Since these step increases do not correspond to DFS fuel transfer campaigns, and there is a lack of similar step increases in nearby TLD SB-32 (same building, but on the 3rd floor), this dose is unlikely DFS facility related. Seabrook Station suspects that the observed step change in the 3rd quarter of 2015 is due to the TLD being repositioned into the new fitness center from its original location in a 1st floor office in the southern corner of the building, and that the step change observed in 2021 is due to the TLD being repositioned in the 2nd quarter 2020 onto a vertical beam that supports an exterior stairwell on the west side of the building. For this reason, the location will continue to be monitored and the quarterly and annual baseline values for this location will be adjusted, as necessary.

FIGURE 4.1

DFS CONTROL RADIATION MEASUREMENTS (USING TLDs)
SEABROOK STATION

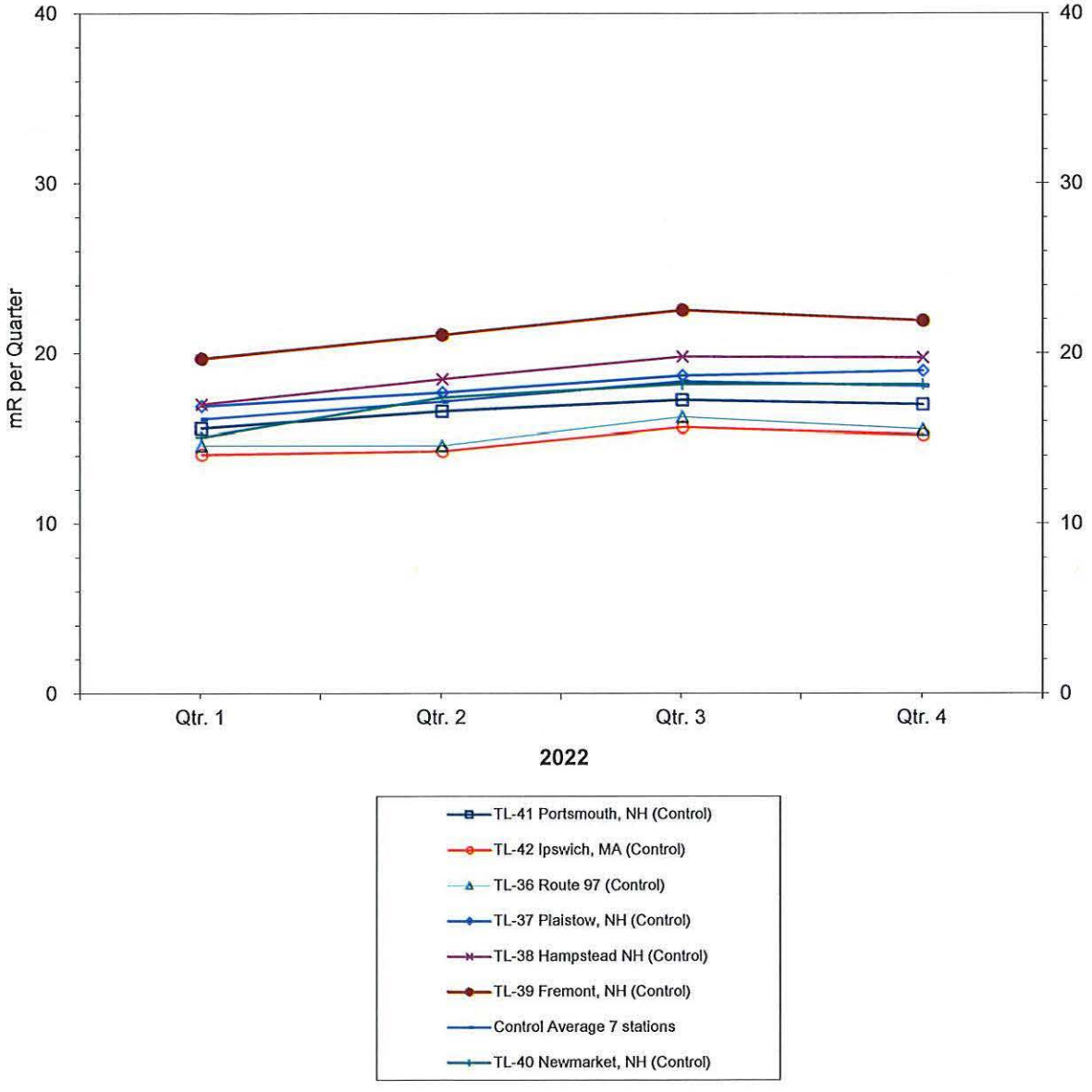


FIGURE 4.2

DFS ENVIRONMENTAL RADIATION MEASUREMENTS (USING TLDs)
SEABROOK STATION

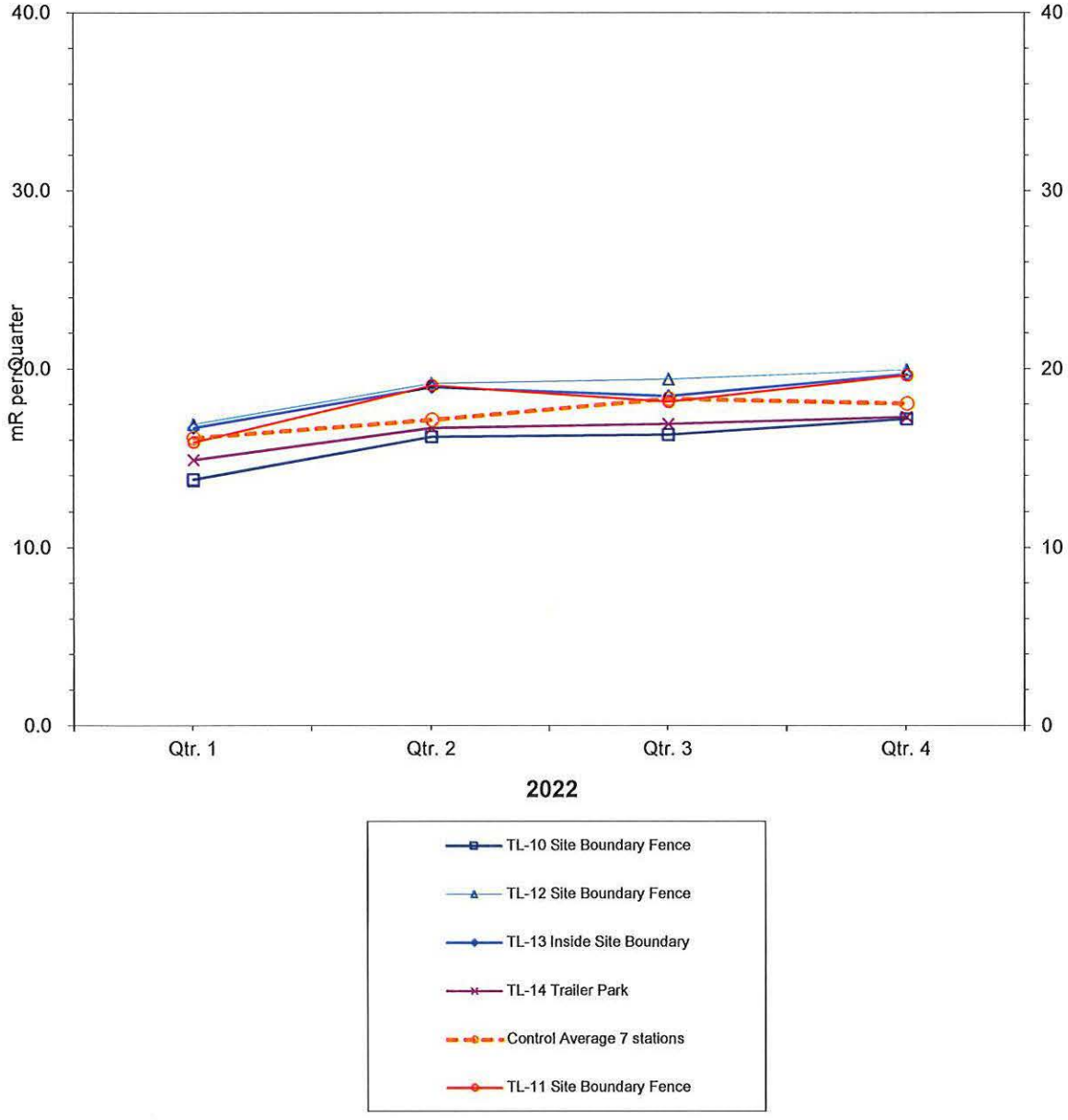


FIGURE 4.3

DFS ENVIRONMENTAL RADIATION MEASUREMENTS (USING TLDs)
SEABROOK STATION

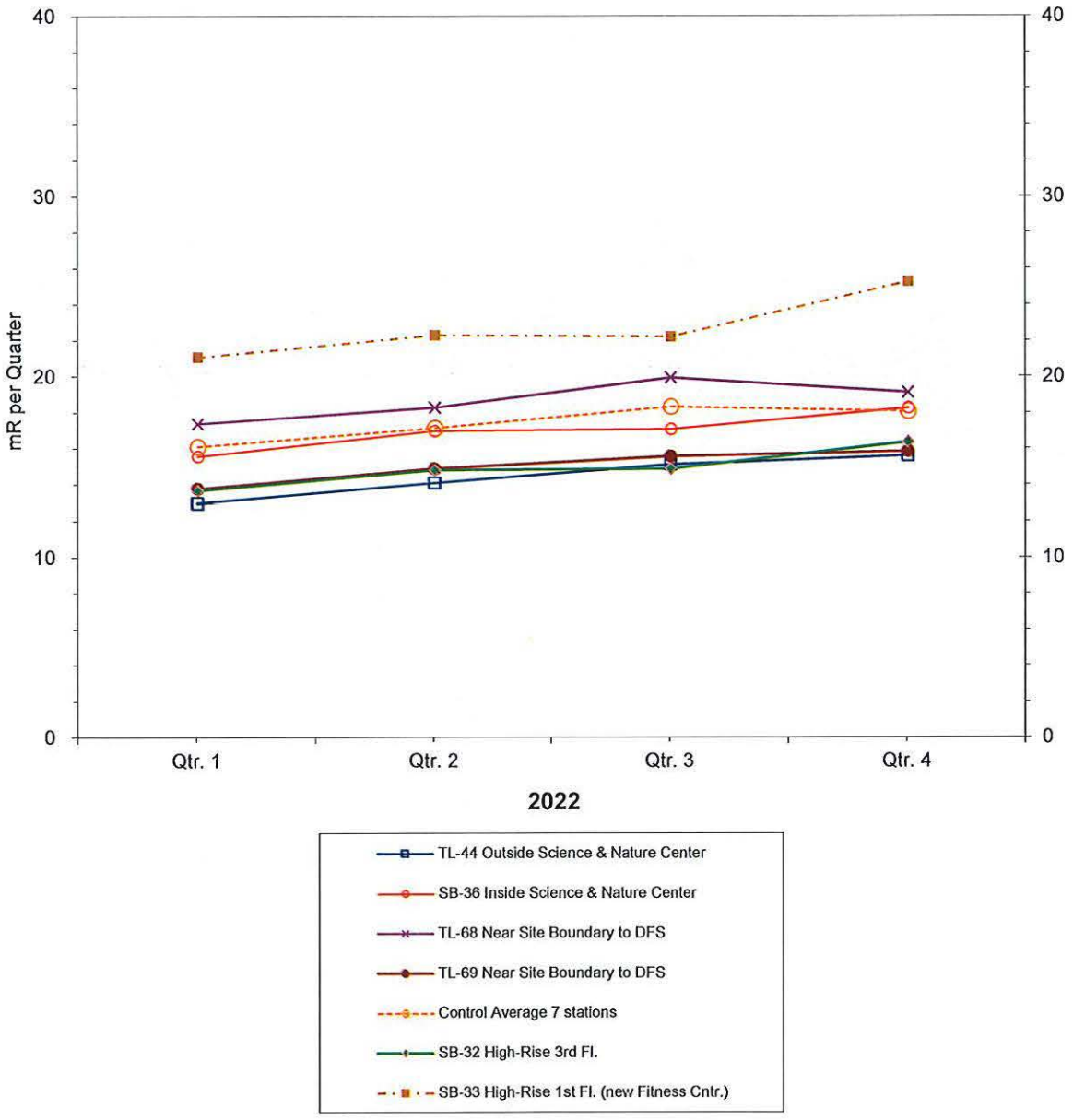


FIGURE 4.4

DFS CONTROL RADIATION MEASUREMENTS (USING TLDs)
SEABROOK STATION

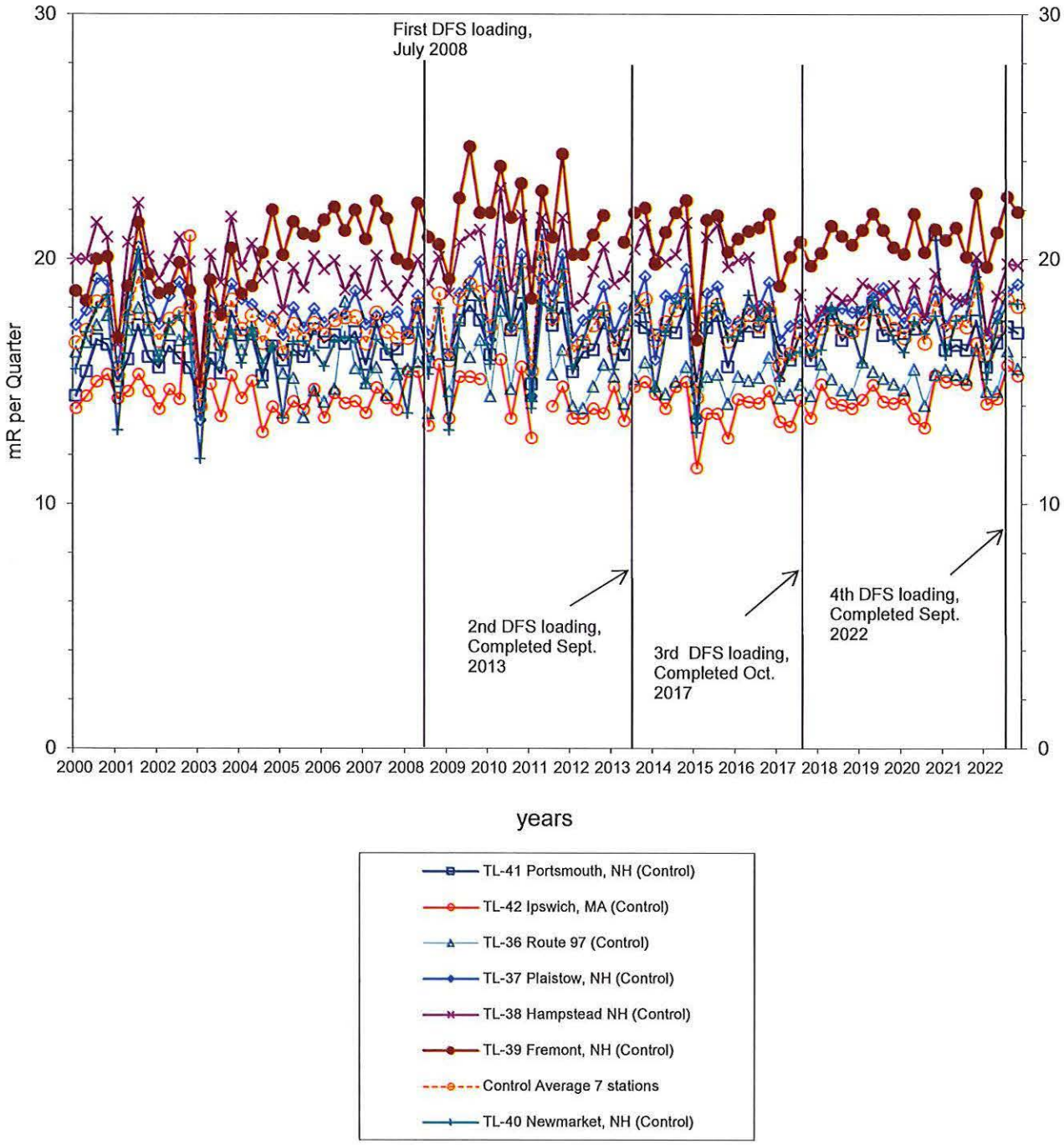


FIGURE 4.5

DFS RADIATION MEASUREMENTS TRENDS (USING TLDs)
SEABROOK STATION

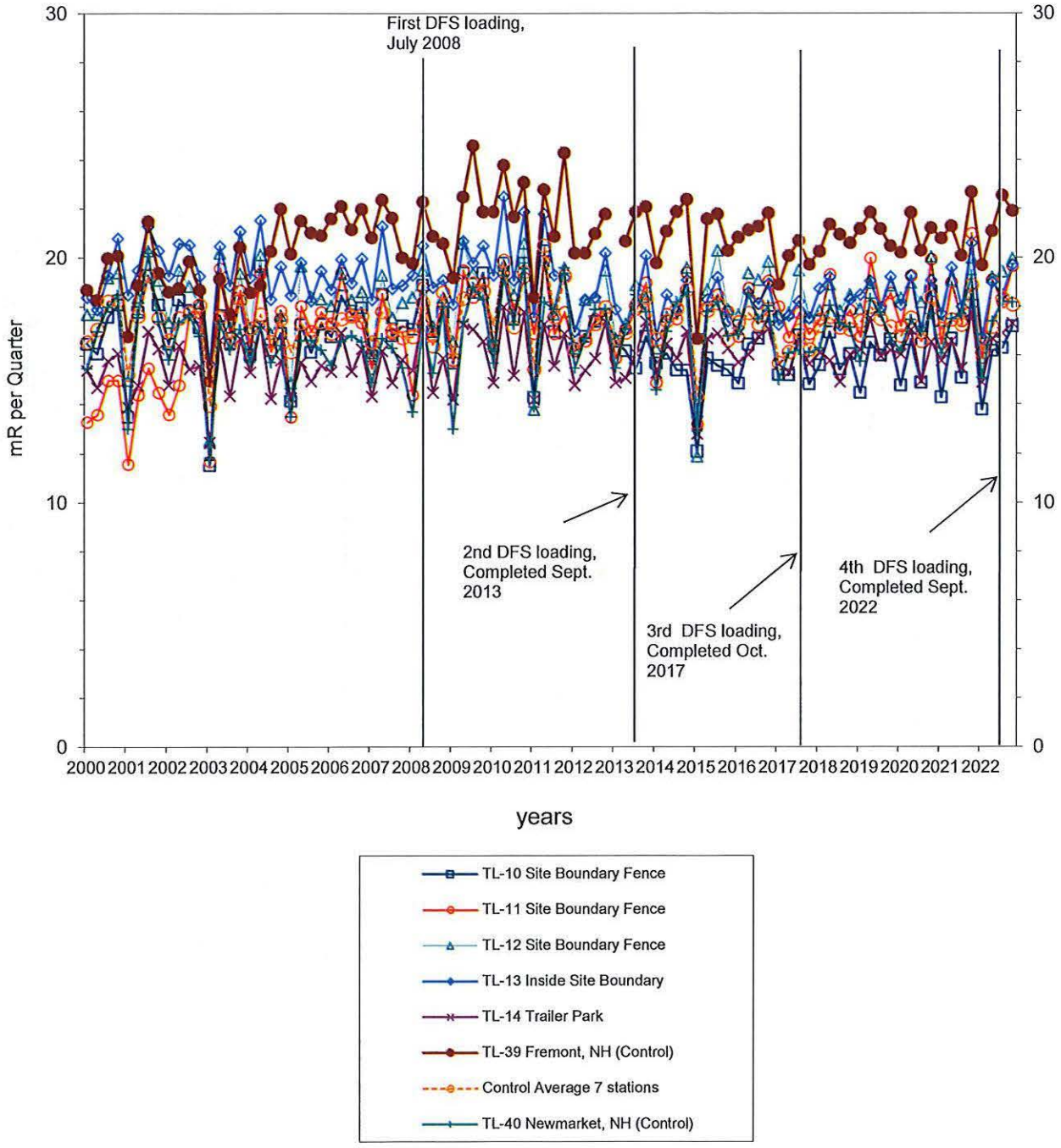
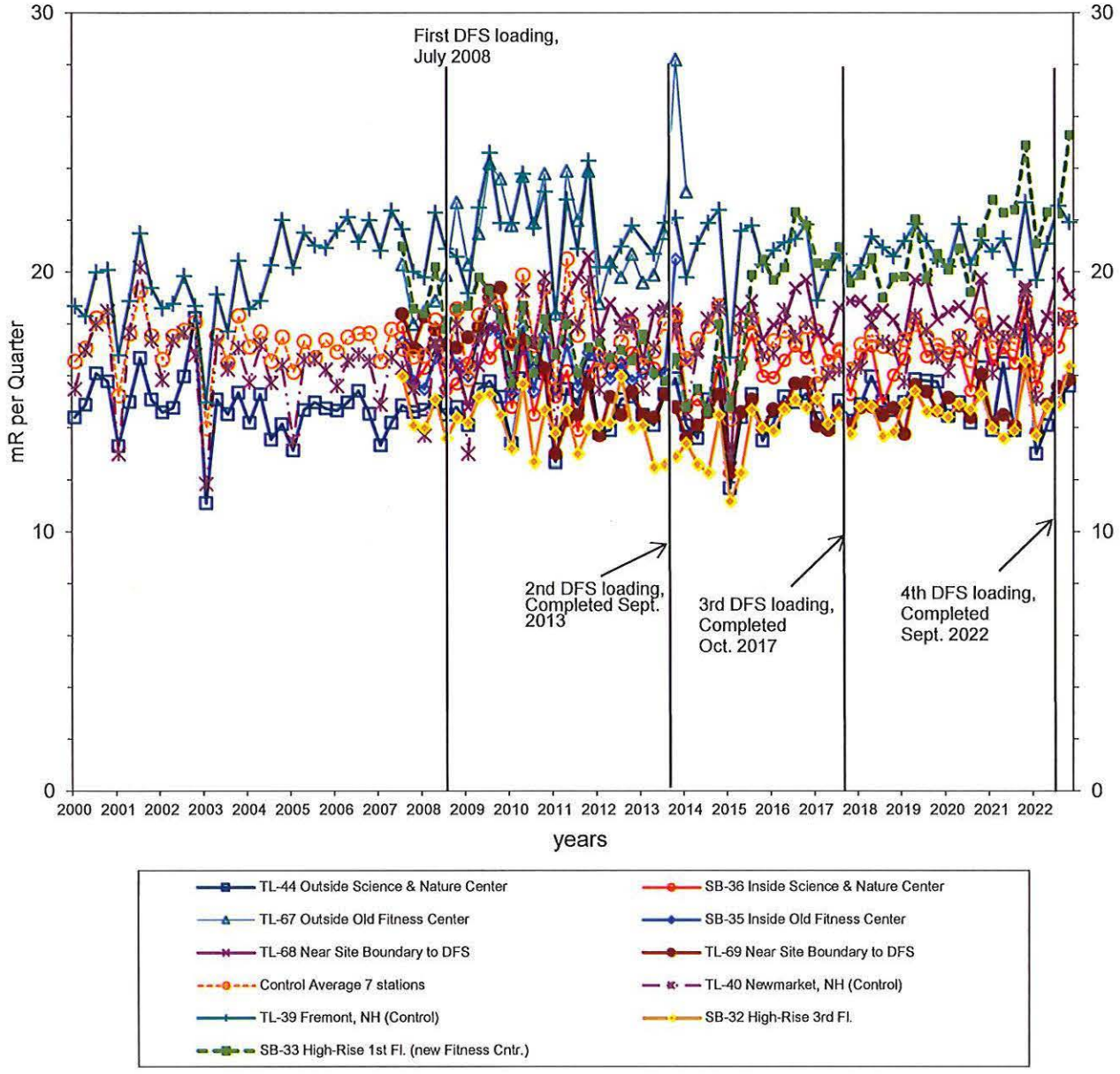


FIGURE 4.6

DFS RADIATION MEASUREMENTS TRENDS (USING TLDs)
SEABROOK STATION



5.0 Program Deviations and Reporting

5.1 Sampling Program Deviations

Table A.9.1-1 of the Offsite Dose Calculation Manual (ODCM) allows for deviations in the REMP sampling schedule "if specimens are unobtainable due to circumstances such as hazardous conditions, seasonal unavailability and malfunction of automatic sampling equipment." All deviations from the sampling schedule shall be documented each year in the Radiological Environmental Operating Report. The deviations for 2022 are as follows:

- On January 28, 2022, GEL received a batch of AP samples for analysis (week three; 1/12/2022 – 1/26/2022); however, the sample for station AP-07 was missing. Therefore, there is no gross Beta analysis for LSN 568902006. AR 2453641 was written to document and track this issue.
- No AP samples were sent to the laboratory for week 13 (3/24/2022 – 4/6/2022). AR 2453642 was written to document and track this issue.
- On December 28, 2022, Normandeau Associates shipped WS samples to GEL but the samples were lost in shipment. Therefore, there are no Gamma analyses for surface water for December. AR 2453643 was written to document and track this issue.
- Third quarter WS samples were sent to GEL but the H-3 composite analyses were not performed. Seabrook AR 2454819 and GEL CARR 230420-1451 were written to document and track this issue.

5.2 Comparison of Achieved LLDs with Requirements

Table A.9.1-2 of the ODCM indicates the required Lower Limits of Detection (LLDs) for environmental sample analyses. (This table is duplicated in Table 5.2-1 of this report.) Occasionally an LLD for short-lived radionuclides is not achieved due to low sample volume or delays between sample collection and time of analysis. In such cases, ODCM Table A.9.1-2 requires a discussion of the event in the annual Radiological Environmental Operating Report.

For each analysis having an LLD requirement in ODCM Table A.9.1-2, the *a posteriori* (after the fact) Minimum Detectable Concentration (MDC) calculated for that analysis was compared with the required LLD. During 2022, 1321 analyses had an LLD requirement listed in Table 5.2-1, and in all cases except three (missed LLDs for Ba-140 in surface water), the LLD requirements were met.

For the missed LLDs, the following explanations are provided:

- LSN 581020001 (missed LLD for Ba-140 in surface water) – Due to the short half-life of the isotope being analyzed.
- LSN 571366001, 571366002 (missed LLD for Ba-140 in surface water) - Due to short half-life of the isotope being analyzed.

5.3 Comparison of Results against Reporting Levels

Seabrook Station ODCM Section 10.1 requires the notification of the NRC by special report within 30 days of receipt from the environmental laboratory whenever a Reporting Level in Table 5.3-1 is exceeded. Reporting Levels are the environmental concentrations that relate to the ALARA design dose objectives of 10 CFR 50, Appendix I. It should be noted that environmental concentrations are averaged over calendar quarters for the purposes of this comparison, and that Reporting Levels apply only to measured levels of radioactivity due to plant effluents. During 2022, no Reporting Levels were exceeded.

Table 5.2-1

DETECTION CAPABILITIES FOR ENVIRONMENTAL SAMPLE ANALYSIS[a]

Lower Limit of Detection (LLD)

Analysis	Water (pCi/kg)	Airborne Particulate or Gas (pCi/m³)	Fish and Invertebrates (pCi/kg, wet)	Milk (pCi/kg)	Food Products (pCi/kg, wet)	Sediment (pCi/kg, dry)
Gross Beta	4	0.01				
H-3	3,000					
Mn-54	15		130			
Fe-59	30		260			
Co-58, 60	15		130			
Zn-65	30		260			
Zr-Nb-95	15[c]					
I-131	15	0.07		1	60[b]	
Cs-134	15	0.05	130	15	60	150
Cs-137	18	0.06	150	18	80	180
Ba-La-140	15[c]			15		

a. Reference Seabrook Station ODCM, Table A.9.1-2 for clarifications.
b. Broad leaf vegetation only.
c. Parent only.

Table 5.3-1

REPORTING LEVELS FOR RADIOACTIVITY CONCENTRATIONS IN ENVIRONMENTAL SAMPLES[a]

Analysis	Water (pCi/kg)	Airborne Particulate or Gas (pCi/m^3)	Fish and Invertebrates (pCi/kg, wet)	Milk (pCi/kg)	Food Products (pCi/kg, wet)
H-3	30,000				
Mn-54	1,000		30,000		
Fe-59	400		10,000		
Co-58	1,000		30,000		
Co-60	300		10,000		
Zn-65	300		20,000		
Zr-Nb-95	400				
I-131	100	0.9		3	100[b]
Cs-134	30	10	1,000	60	1,000
Cs-137	50	20	2,000	70	2,000
Ba-La-140	200			300	

a. Reference Seabrook Station ODCM Table A.9.1-3 for clarifications.
b. Broad leaf vegetation only.

6.0 QUALITY ASSURANCE PROGRAM

6.1 GEL Laboratories QA

GEL's primary goals are to ensure that all measurement data generated are scientifically and legally defensible, of known and acceptable quality per the data quality objectives (DQOs), and thoroughly documented to provide sound support for environmental decisions. In addition, GEL continues to ensure compliance with all contractual requirements, environmental standards, and regulations established by local, state and federal authorities.

GEL administers the QA program in accordance with their Quality Assurance Plan, GL-QS-B-001. The Quality Systems include all quality assurance (QA) policies and quality control (QC) procedures necessary to plan, implement, and assess the work that GEL performs. GEL's QA Program establishes a quality management system (QMS) that governs all of the activities of the organization.

The results of GEL's assessment of their laboratory activities listed in this section entails their quality assurance program for the proficiency testing (PT) and environmental monitoring aspects of GEL for 2022. GEL's QA Program is designed to monitor the quality of analytical processing associated with environmental, radiobioassay, effluent (10 CFR Part 50), and waste (10 CFR Part 61) sample analysis.

This summary was extracted from GEL Laboratories report entitled "2022 Annual Quality Assurance Report for the Radiological Environmental Monitoring Program (REMP)", dated March 28, 2023, and includes:

- Intra-laboratory QC results analyzed during 2022.
- Inter-laboratory QC results analyzed during 2022 where known values were available.

Quality Assurance Programs for Inter-laboratory, Intra-laboratory and Third Party Cross Check

In addition to internal and client audits, GEL's laboratory participates in annual performance evaluation studies conducted by independent providers. GEL routinely participates in the following types of performance audits:

- Proficiency testing and other inter-laboratory comparisons
- Performance requirements necessary to retain Certifications
- Evaluation of recoveries of certified reference and in-house secondary reference materials using statistical process control data.
- Evaluation of relative percent difference between measurements through statistical process control (SPC) data.

GEL also participates in a number of proficiency testing programs for federal and state agencies and as required by contracts. It is GEL's policy that no proficiency evaluation samples be analyzed in any special manner. GEL's annual performance evaluation participation generally includes a combination of studies that support the following:

- US Environmental Protection Agency (EPA) Discharge Monitoring Report, Quality Assurance Program (DMR-QA) - An annual national program sponsored by the EPA for laboratories engaged in the analysis of samples associated with the NPDES monitoring program. Participation is mandatory for all holders of NPDES permits. The permit holder must analyze for all of the parameters listed on the discharge permit. Parameters include general chemistry, metals, BOD/COD, oil and grease, ammonia, nitrates, etc.

- Department of Energy (DOE) Mixed Analyte Performance Evaluation Program (MAPEP) - A semiannual program developed by DOE in support of DOE contractors performing waste