Environmental Monitoring Report

For 2022

Pilgrim and Seabrook

Nuclear Power Stations

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EXECUTIVE SUMMARY

The Massachusetts Department of Public Health (MDPH) Bureau of Climate and Environmental Health's (MDPH/BCEH) Environmental Toxicology and Radiation Control Programs collaborate to conduct routine environmental monitoring for Massachusetts communities within a 10-mile radius of nuclear power stations that are currently operating, or undergoing decommissioning. This monitoring provides a system of watchfulness over environmental radiation in Massachusetts communities surrounding nuclear power plants. The monitoring areas include Massachusetts communities located within a 10-mile radius of Pilgrim Nuclear Power Station (Pilgrim) in Plymouth, MA and Seabrook Nuclear Power Station (Seabrook) in Seabrook, NH. The 10-mile radius surrounding Seabrook corresponds with Seabrook's Emergency Planning Zone (EPZ); as such environmental radiation monitoring is part of the MDPH's regulatory responsibility. Pilgrim ceased operations on May 31, 2019 and is undergoing decommissioning[1]. Although the 10-mile EPZ for Pilgrim has been eliminated[2], MDPH continues to conduct environmental monitoring while the power plant is being decommissioned. This report summarizes the 2022 monitoring activities and results for the Pilgrim and Seabrook nuclear plants.

Report Highlights

- Overall, no radiation indicators or radionuclides were detected at a level of health concern.
- Radiation monitoring results in 2022 for areas surrounding the two nuclear power stations -- Pilgrim and Seabrook -- have been either non-detect, naturally occurring, or at levels expected to be present in the environment from background fallout from historic bomb testing and past nuclear accidents.

[1]Pilgrim entered Phase I of plant decommissioning on June 11, 2019 when the nuclear fuel from the reactor was safely transferred into the spent fuel pool, and the site was certified by Federal regulators as having permanent cessation of operations and permanent removal of fuel. In August of 2019 Pilgrim was sold by the Entergy Corporation to Holtec International for completion of the remaining decommissioning steps.

[2] https://www.mass.gov/info-details/pilgrim-nuclear-power-station

1. INTRODUCTION

The MDPH/BCEH radiation environmental monitoring program is designed to monitor radiation levels and to protect residents in the Commonwealth from exposure to radiation. Samples of environmental media, collected within and just outside the 10-mile radius surrounding nuclear power plants by MDPH/BCEH or provided by the utilities that operate the nuclear power plants, are analyzed for radiation by the MDPH/BCEH Massachusetts Environmental Radiation Laboratory (MERL). Environmental media analyzed in 2022 include: air, surface water, milk, fish, shellfish, sediment, vegetation and food crops. In addition to the samples analyzed for radiation by MERL, MDPH/BCEH has a network of stationary monitors surrounding Pilgrim that measures gamma radiation in real-time. This network is monitored online by MDPH/BCEH staff. The C-l0 Research & Education Foundation, Inc., a non-profit organization under contract to MDPH/BCEH, conducts direct radiation monitoring in Massachusetts communities within the Seabrook EPZ and provides summary reports to MDPH/BCEH.

The radiation environmental monitoring of the areas around the Pilgrim and Seabrook plants has been in place since the 1980s. A focused investigation of tritium in groundwater on the Pilgrim Nuclear Power Plant property is ongoing and not part of this report. Updates on this monitoring effort are posted on the MDPH website: Tritium investigation update reports.

The NRC requires specific environmental monitoring and annual reporting by operating nuclear power plants. The NRC reports summarizing Seabrook's environmental monitoring can be found on its website: Seabrook's 2022 Radiological Environmental Operating Report.

This report contains background information regarding environmental radiation and laboratory methods used to analyze samples for radiation; sample location and analyses for the areas around the Pilgrim and Seabrook plants; and a summary of the monitoring results.

A. ENVIRONMENTAL RADIATION

Background radiation in the environment comes from three general sources: naturally occurring radiation, radioactive fallout from past weapons testing or nuclear accidents, and man-made sources.

Naturally occurring radionuclides, such as Potassium-40 and Beryllium-7, are present in most environmental media. Potassium-40 is a radioactive form of potassium, which is an essential nutrient. Beryllium-7 is produced when cosmic energy collides with nitrogen and oxygen in the atmosphere (Delaygue et al., 2015). Additional natural sources of radiation, including cosmic radiation, radon, and carbon-14, contribute to an annual background radiation dose of approximately 310 mrems/year (US NRC, 2017a, b). Man-made sources include medical procedures (e.g., diagnostic x-rays) and various consumer products (e.g., certain construction material, combustible fuels, televisions, smoke detectors) (US NRC 2017c). Background and man-made sources contribute to the estimated 620 mrem annual dose of environmental radiation for average U.S. residents (US NRC, 2017b).

Table 1. Background Radiation Dose for Average U.S. Resident

Source	Millirems/year
Natural background radiation	310
Man-made sources	310
Total of all sources	620

Source: US NRC, 2017c

Background radiation includes fallout radiation from historical weapons testing, which occurred primarily in the 1950s and 1960s, and from nuclear power plant accidents such as Chernobyl and Fukushima. This fallout includes radioisotopes such as Cesium-137 (Cs-137) and Strontium-90 (Sr-90), which persist in the environment due to their 28-30 year half-lives.

During active operation, nuclear power plants emit direct gamma radiation from nuclear reactor systems; noble gases, tritium, Iodine-131, Carbon-14, and particulates from the station's air stack; and discharge water containing tritium as well as other radionuclides that emit alpha, beta and gamma radiation (Luykx and Fraser, 1983; UNSCEAR, 2008). Noble gases are chemically inert, have short half-lives, disperse quickly in the environment, and do not bioconcentrate or easily incorporate into biological tissue. Tritium is created when water passes through the reactor core; the hydrogen atoms in the water molecules and other trace elements like boron absorb neutrons from the fission of the reactor fuel. Tritium is lighter and more mobile in water than other radionuclides and is a sentinel indicator of radionuclides in water bodies. Both Iodine-131 and particulates (notably Cesium-137, Cobalt-60, Iron-59, Magnesium-54, Stontium-90 and Zinc-65) have environmental and public health significance: their half-lives range from weeks to years, they are readily incorporated into biological tissue, and they will bioconcentrate. Iodine-131 is usually the first radioactive element detected in the event of an accidental release of power plant radiation (ATSDR, 2002). Carbon-14 is a naturally occurring radionuclide, which can also be released in relatively small amounts from nuclear power plants, primarily due to its formation in the coolant system (Yim and Caron, 2006).

Exposure to radiation from nuclear power plants may occur from permitted air or liquid discharges or from unmonitored releases or leaks. MDPH/BCEH evaluates possible routes of exposure for radionuclides, particularly those that accumulate in the food chain, and samples environmental media along these routes to measure potential exposure to radiation.

B. LABORATORY METHODS

The MDPH/BCEH Radiation Control Program's Massachusetts Environmental Radiation Laboratory (MERL) analyzes samples for a suite of more than 30 radioactive isotopes (e.g., radioisotopes, or radionuclides). Gamma spectroscopy is used to identify and detect environmentally significant and naturally occurring radioisotopes; gas proportion counters measure gross beta and alpha radiation; and liquid scintillation counters measure tritium. Environmental media sample results are compared to typical background levels. In the event that gamma emitters are present above typical background, the MERL protocol calls for additional testing at an outside laboratory for alpha emitters, such as transuranic (high atomic number) elements, and beta emitters, such as Strontium-90. MERL maintains its standard of excellence in analytical capability through participation with several federal agencies in inter-laboratory quality assurance measures.

Analysis methods by media are summarized below:

AIR

Air filters are collected weekly and analyzed for gross alpha and gross beta radioactivity using a gas proportion counter. Gross alpha and beta analysis is a screening-level tool that does not identify individual radionuclides; therefore, air filters are also analyzed quarterly for gamma emitting radionuclides using gamma spectroscopy. Results are compared to results from a background monitor located in Boston.

Air cartridges are analyzed weekly for iodine-131 using gamma spectroscopy.

Direct gamma radiation in air is measured with thermoluminescent dosimeters (TLDs) and analyzed using gamma spectroscopy.

WATER

Surface water samples are tested for total alpha and beta radioactivity with a gas proportional counter, and for gamma-emitting radionuclides with a gamma spectrometer. Water samples are also tested for tritium with a liquid scintillation counter.

MILK

Milk is a good indicator media for radioactive elements, particularly iodine-131, which can be detected in milk soon after cows graze on contaminated pastures or feed. Hence, cow's milk is tested for gamma radionuclides, including iodine-131, using gamma spectroscopy.

SEAFOOD, SEDIMENT, VEGETATION, AND FOOD CROPS

Seafood, sediment, vegetation and food crops were chosen to represent various stages of the food chain where radionuclides may be identified. Mollusks (such as clams and mussels) filter-feed sediment and sand where heavy and sediment-bound radionuclides may accumulate; lobsters eat clams, mussels and small fish; and radionuclides biomagnify from smaller to larger surface-dwelling fish.

Analyses of vegetation and crop samples aim to identify radionuclides that may settle on surfaces or be absorbed through the roots. Samples are tested for gamma-emitting radionuclides using a gamma spectrometer.

IRISH MOSS

Irish moss (i.e., Chondrus) is a type of seaweed that readily absorbs iodine and is thus a good reference indicator of iodine-131 in the environment.

QUALITY ASSURANCE

Laboratory sample detection levels are affected by sample size, time between collection and analysis, and equipment processing and counting time. Where detection levels fall outside our analytic sensitivity guidelines they are noted in the tables as “NR” (Result is not reported for quality control reason).

2. ENVIRONMENTAL MONITORING AND SAMPLING

This section summarizes the environmental samples collected and analyzed in 2022 for the Pilgrim and Seabrook nuclear power stations.

A. PILGRIM NUCLEAR POWER STATION

The Pilgrim Nuclear Power Station (Pilgrim) is located in Plymouth, MA. There are five Massachusetts communities within a 10-mile radius of Pilgrim: Carver, Duxbury, Kingston, Marshfield, and Plymouth, all shown below in Figure 1.

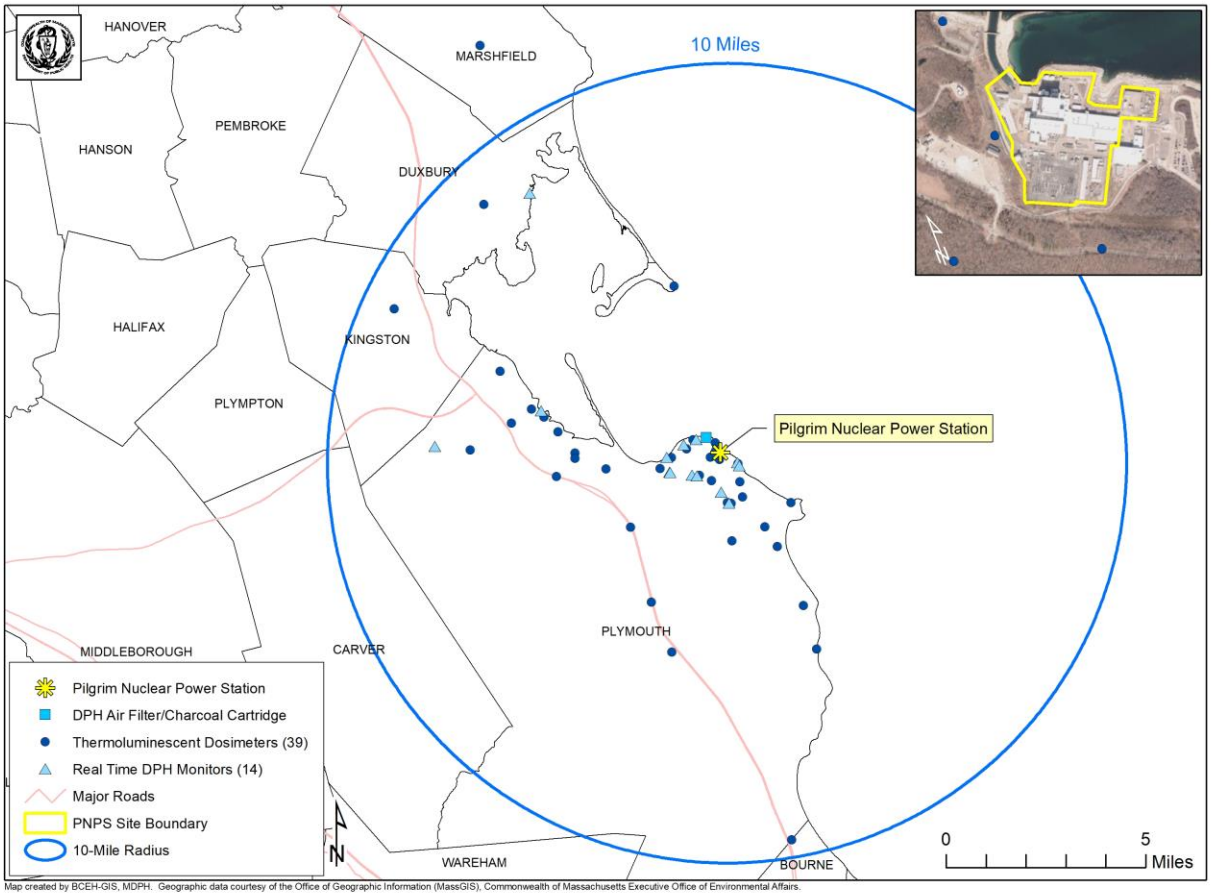

Figure 1. The MDPH/BCEH Radiation -monitoring network at Pilgrim

In 2022, MDPH/BCEH's radiation monitoring conducted in the areas surrounding Pilgrim included a combination of independent direct monitoring of airborne radiation; air and cranberry sampling; and analysis of split samples provided by the current owner of the Pilgrim site (Holtec). Holtec provided samples of water, fish, shellfish, sediment, food crops, and Irish moss. Figure 1 shows locations of the air monitors for Pilgrim. Sample locations for water, fish, shellfish, sediment, food crops, and Irish moss are shown in Figure 2.

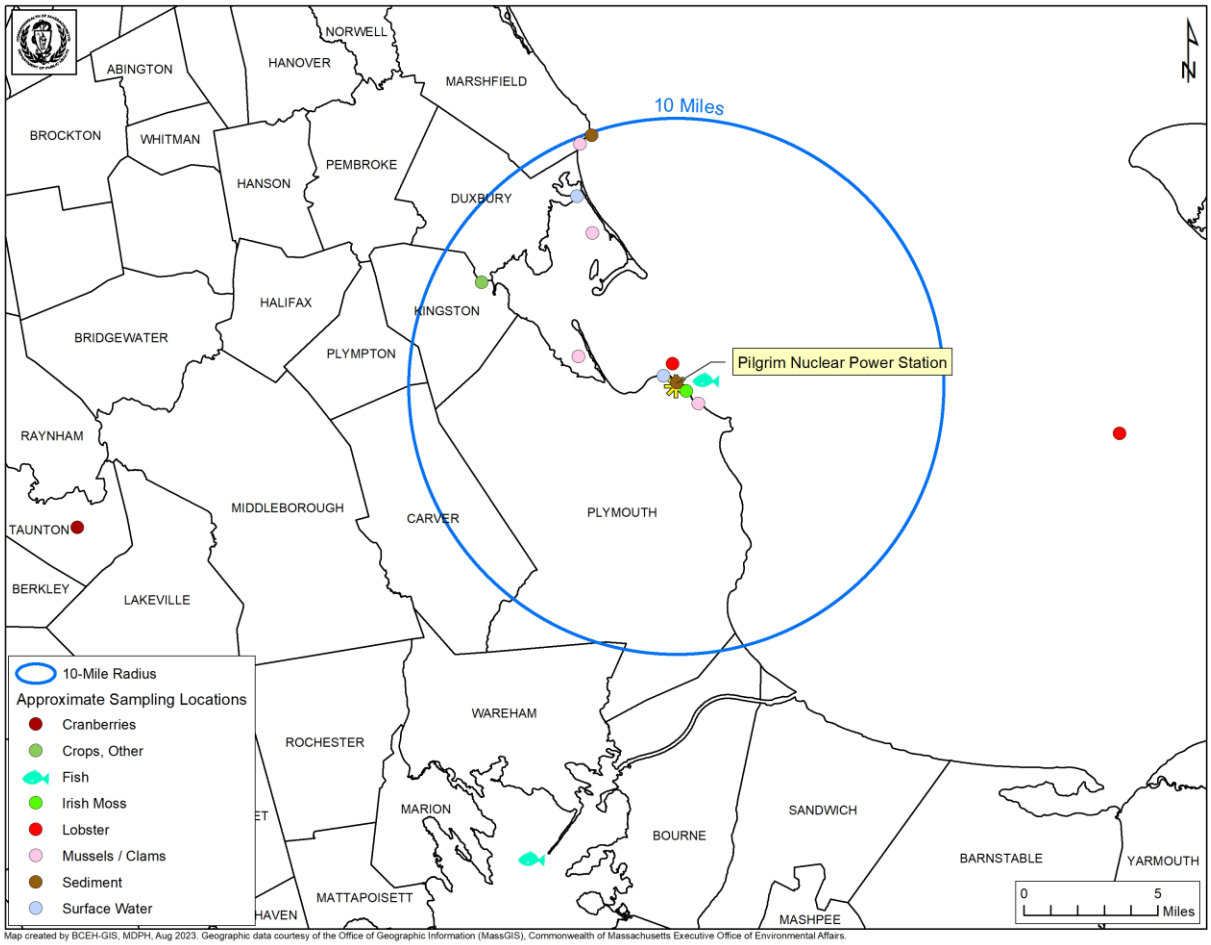

Figure 2. Pilgrim 10-mile radius and sampling locations

Air/Direct Radiation

MDPH/BCEH's direct radiation monitoring at Pilgrim is comprised of three systems operating on real-time, weekly, and quarterly bases. The redundant systems are designed to independently monitor the land areas surrounding Pilgrim and to verify the utility's radiation monitoring.

MDPH/BCEH currently maintains a network of 14 stationary radiation monitoring stations that detects gamma radiation in real-time and transmits data to a computer which is remotely accessed by staff. Emergency alerts are sent to MDPH and Massachusetts Emergency Management Agency (MEMA) officials if radiation is detected at levels greater than three times the typical background level. In 2016, MDPH/BCEH completely replaced the older system with new monitors and servers and installed an internet-based communication system.

MDPH/BCEH analyzes samples collected from an air particulate filter and a charcoal air cartridge located just outside the Pilgrim utility's fence. Filters are analyzed for gross beta and gross alpha radioactivity and cartridges are analyzed for iodine-131. A filter composite sample is also analyzed quarterly for additional gamma-emitting radionuclides. The same analyses are done for an air particulate filter and charcoal cartridge collected from a background location in Boston.

MDPH/BCEH also has a network of 39 TLDs placed throughout the Pilgrim 10-mile radius and surrounding communities, which measure total gamma radiation in milliroentgen (mR). The majority of the TLDs are located in the inner region of the 10-mile radius, and three are near the plant border. These TLDs are collected and analyzed quarterly, and the results are compared to those of a background location in Boston.

Surface Water

Holtec collects seawater on a weekly basis from the Pilgrim discharge canal and the Powder Point Bridge in Duxbury and provides split samples of monthly composites to MDPH/BCEH for analysis of gamma-emitting radionuclides. MERL also analyzes monthly composites of weekly surface water samples from both locations for tritium.

Fish and Shellfish

Holtec provides annual split samples of fish and lobster collected from the Pilgrim discharge canal to MERL for analysis. In 2022 Holtec also provided MERL with split samples of background fish and lobster from Buzzards Bay.

In 2022, Holtec collected Mytilus (i.e., blue or common mussels) from Green Harbor in Marshfield and the Pilgrim discharge canal; and collected soft shell clams from Duxbury Bay and Plymouth Harbor. Duxbury Bay, Green Harbor, and Plymouth Harbor are reported to be background locations by Holtec for federal reporting requirements but are considered to be “indicator” locations by MDPH/BCEH because they fall within 10 miles of the plant. MERL analyzed the split samples for gamma-emitting radionuclides.

Sediment

In 2022 Holtec collected sediment samples from Green Harbor in Marshfield and the Pilgrim discharge canal; MERL analyzed the split samples.

Irish moss

In 2022, Holtec collected samples of Irish moss from the Pilgrim discharge canal; split samples were analyzed by MERL.

Crops

MDPH/BCEH collects and analyzes background cranberry samples from a bog in East Taunton annually.

In 2022 MDPH collected samples of strawberries, tomatoes, and zucchini during the growing season, from a farm in Kingston.

B. SEABROOK NUCLEAR POWER STATION

The Seabrook Nuclear Power Station (Seabrook) is located in Seabrook, New Hampshire, approximately two miles north of the Massachusetts border. Six Massachusetts communities are included within 10 miles of Seabrook: Amesbury, Merrimac, Newbury, Newburyport, Salisbury, and West Newbury as shown in Figure 3. Because the Seabrook plant is still operating, areas within the 10-mile radius are referred to as an Emergency Planning Zone (EPZ).

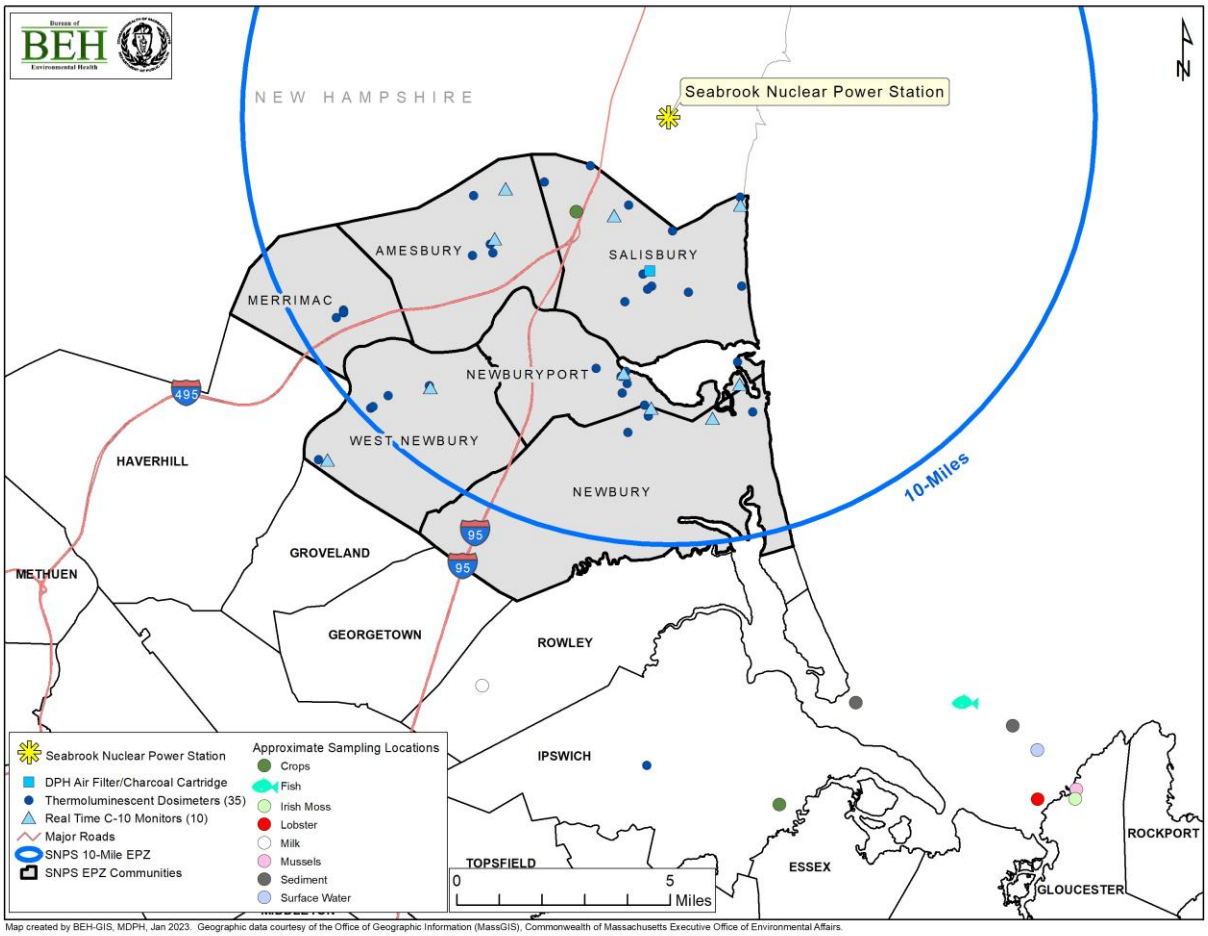

Figure 3. Seabrook EPZ and sampling locations within Massachusetts

Radiation monitoring conducted within and outside the Seabrook EPZ includes the following environmental media: air, surface water, fish, shellfish, sediment, Irish moss, crops, and milk. MDPH/BCEH receives split samples from Nextera, the utility that owns Seabrook, for all media except milk and air. Sampling locations and activities within Massachusetts are described below. Sampling locations are shown in Figure 3.

Air/Direct Radiation

MDPH/BCEH collects air particulate filters and charcoal cartridges weekly at the Salisbury Fire Station. Filters are analyzed for gross beta and alpha radioactivity, and cartridges for iodine-131. Additionally, a filter composite is analyzed quarterly for gamma-emitting radionuclides. The same analyses are done for air particulate filters and charcoal cartridges collected at the background location in Boston.

MDPH/BCEH measures total ambient gamma radiation using a network of 34 TLDs placed at locations throughout the Seabrook EPZ in Massachusetts. These are collected and analyzed quarterly and results are compared to those of a background location in Boston.

MDPH/BCEH contracts with the C-l0 Research & Education Foundation, Inc. to conduct radiation monitoring in Massachusetts communities located in the Seabrook EPZ. The C-10 system consists of a network of 10 real-time radiation sensors and weather probes located in Massachusetts within a 10-mile radius of Seabrook station. Beta, gamma, and weather data are collected and uploaded every 15 minutes to a secure web-based central repository. C-10 compiles and graphs the data monthly and sends reports to MDPH/BCEH. The 10 Massachusetts monitoring sites within the Seabrook 10-mile EPZ are located at private homes, schools, and businesses. MDPH and MEMA officials receive text alerts from C-10 if levels are greater than three times the typical background readings.

Surface Water

Seawater samples are typically collected monthly by Nextera from a background location in Ipswich Bay. MERL analyzes split samples for gamma-emitting radionuclides. MERL also analyzes surface water samples for tritium.

Milk

MDPH/BCEH collects samples of cow's milk monthly from a farm located in Rowley and MERL analyzes the samples for gamma-emitting radionuclides, including iodine-131.

Fish and Shellfish

Nextera semi-annually collects samples of fish and shellfish, including lobster, Modiolus (i.e, Atlantic ribbed mussels) and Mytilus (i.e., blue or common mussels), from Ipswich Bay, which is considered a background location; MERL analyzes the split samples for gamma-emitting radionuclides.

Sediment

Nextera semi-annually collects sediment samples from Ipswich Bay and the tidal flats on Plum Island, both background locations; MERL analyzes the split samples for gamma-emitting radionuclides.

Irish moss

As noted earlier, Irish moss readily absorbs iodine and is a sentinel indicator of environmental iodine-131. Nextera collects samples of Irish moss semiannually from a background location in Ipswich Bay, and split samples are analyzed by MERL for gamma-emitting radionuclides.

Crops

In 2022 MDPH collected strawberries, tomatoes, and zucchini, from a farm located within the Seabrook EPZ in Salisbury; and also collected strawberries, tomatoes, and zucchini from a farm in Ipswich, which is outside the Seabrook EPZ.

3. 2022 ENVIRONMENTAL MONITORING RESULTS

Results of environmental monitoring conducted by MDPH/BCEH in the Massachusetts communities in the vicinity of the Pilgrim and Seabrook nuclear power stations are discussed below and presented in Tables 2-7. The tables are organized by nuclear power station and by sample media.

A. PILGRIM NUCLEAR POWER STATION

Sampling results for Pilgrim are provided in Tables 2, 3 and 4. Only two radionuclides – Beryllium-7 and Potassium-40, both of which are naturally occurring, were detected in samples collected either within or outside the former EPZ (i.e., the 10-mile radius from Pilgrim). Levels detected within the former EPZ are generally consistent with levels detected in background samples. Naturally occurring Potassium-40 was detected in all samples of environmental media analyzed for Potassium-40. Naturally occurring Beryllium-7 was detected in: 1) all quarterly composite air samples; 2) Irish Moss; and 3) cranberries. Except for the cranberries, all samples in which Beryllium-7 was detected were collected within 10-miles of Pilgrim; the cranberries were collected in Taunton, which is more than 10 miles from Pilgrim. For both Potassium-40 and Beryllium-7, levels detected in all samples collected in the vicinity of Pilgrim (including the cranberries) are generally consistent with levels detected in background samples.

In addition to naturally occurring Beryllium-7 and Potassium-40, which were detected at levels consistent with background levels, air filter and cartridge analyses indicated low levels of gross alpha and gross beta radiation. Levels of gross alpha and beta radiation measured ranged from 0.0001 – 0.012 and 0.010 – 0.081 pico curies (pCi)/m^3, respectively. These levels are consistent with those measured at the background location in Boston, of 0.002 – 0.008 and 0.014 – 0.098 pCi/m^3, respectively. No gamma-emitting radionuclides of concern were detected in quarterly composite air samples.

Real-time monitoring did not detect radiation greater than typical background levels of approximately 0.007 - 0.009 mRoentgen/hour with the exception of brief increases up to approximately 0.02 mRoentgen/hour. Brief increases are expected due to rainfall washout from naturally occurring radionuclides such as airborne radon daughters and cosmic radiation events. No alerts at three times background were recorded.

TLD total gamma exposure results ranged from 10.8 to 149 mRoentgen/quarter (i.e., 0.005 – 0.068 mRoentgen/hour) with an average of 16.7 mRoentgen/quarter (0.008 mRoentgen/hour). This value is compared to an average value of 17.9 mRoentgen/quarter measured at a background location in Boston and corresponds to an average gamma exposure of 1.2 mRoentgen/quarter below background. The maximum quarterly value of 149 mRoentgen/quarter was measured at an onsite TLD monitor located inside the PNPS property, near the dry fuel storage pad, and covers a period when spent fuel was being moved to the storage pad. Because the TLD monitor is onsite, gamma levels measured at the monitor do not represent potential exposure to the general public. At a nearby TLD monitor located on Rocky Hill Rd (approximately 400 meters southeast of the onsite TLD), the total gamma exposure was 15.7 mRoentgen/quarter for the same period. Excluding the quarterly value of 149 mRoentgen/quarter, the next highest value was 27.9 mRoentgen/quarter.

B. SEABROOK NUCLEAR POWER STATION

Seabrook sampling results are provided in Tables 5, 6 and 7. As with Pilgrim, the only radionuclides detected either within or outside the Seabrook EPZ were Potassium-40 and Beryllium-7.

Naturally occurring Potassium-40 was detected in all samples of environmental media from both within and outside the Seabrook EPZ. Naturally occurring Beryllium-7 was detected in Irish moss (i.e., chondrus) and mytilus mussels collected in May, from the background sampling location in Ipswich Bay, and in the composite air samples collected at the Salisbury Fire Station for all 4 quarters. As with Pilgrim, levels of Potassium-40 and Beryllium-7 detected within the Seabrook EPZ are consistent with background levels.

In addition to naturally occurring Beryllium-7 and Potassium-40, detected at levels consistent with background, analyses of air filter and cartridge samples found low levels of gross alpha (0.001 – 0.012 pCi/m^3) and gross beta (0.014 – 0.086 pCi/m^3) radiation. These levels are comparable to levels measured at the background location in Boston, where gross alpha ranged from 0.002 – 0.008 pCi/m^3 and gross beta ranged from 0.014 – 0.098 pCi/m^3. No gamma radionuclides of concern were detected in quarterly composite air samples.

In 2022, real-time monitoring for the Seabrook EPZ did not show gamma radiation levels above typical background levels at most stations (approximately 0.010 mRoentgen/hour) with the exception of brief increases (typically up to approximately 0.02 mRoentgen/hour). Brief increases are expected due to rainfall washout from naturally occurring radionuclides such as airborne radon daughters and cosmic radiation events. Beta readings ranged from approximately 35 to 55 counts per minute with the exception of brief increases similar to the gamma results. These beta levels are comparable to levels from previous years, and also to levels from the background location in Somerville, MA.

TLD results for total gamma exposure ranged from 10.8 to 21.2 mRoentgen/quarter (0.005 – 0.010 mRoentgen/hour) with an average exposure of 17.4 mRoentgen/quarter (0.008 mRoentgen/hour), compared to an average of 18.3 mRoentgen/quarter at the background location in Boston. The result for the TLDs near Seabrook is an average gamma exposure level of 0.9 mRoentgen/quarter below background.

C. SUMMARY

Radiation monitoring results in 2022 for Massachusetts have been either non-detect or naturally occurring (i.e., Potassium-40, Beryllium-7). No detectible radionuclides were at levels of health concern or were indicative of an unintentional release of radiation at Pilgrim or Seabrook.

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D. RESULTS TABLES

Table 2. Pilgrim Nuclear Power Station 2022 Environmental Monitoring Data - Air Samples

Sample Type	Location	Date	I-131* (pCi/m³)	Be-7* (pCi/m³)	K-40* (pCi/m³)	Mn-54* (pCi/m³)	Fe-59* (pCi/m³)	Co-60* (pCi/m³)	Zn-65* (pCi/m³)	Cs-137* (pCi/m³)	Gross Alpha (pCi/m³)	Gross Beta (pCi/m³)
Air	Pilgrim Station	01/05/2022	<0.0259	-	-	-	-	-	-	-	0.0118	0.0808
Air	Pilgrim Station	01/12/2022	<0.0351	-	-	-	-	-	-	-	0.0108	0.0784
Air	Pilgrim Station	01/19/2022	<0.0347	-	-	-	-	-	-	-	0.0105	0.0800
Air	Pilgrim Station	01/26/2022	<0.0397	-	-	-	-	-	-	-	0.0092	0.0683
Air	Pilgrim Station	02/02/2022	<0.0176	-	-	-	-	-	-	-	0.0102	0.0727
Air	Pilgrim Station	02/10/2022	<0.0157	-	-	-	-	-	-	-	0.0074	0.0496
Air	Pilgrim Station Quarterly Composite	2/15/2022	-	0.125	0.165	<0.001	<0.004	<0.001	<0.002	<0.001	-	-
Air	Pilgrim Station	02/16/2022	<0.0210	-	-	-	-	-	-	-	0.0086	0.0677
Air	Pilgrim Station	02/24/2022	<0.0431	-	-	-	-	-	-	-	0.0069	0.0537
Air	Pilgrim Station	03/03/2022	<0.0267	-	-	-	-	-	-	-	0.0069	0.0681
Air	Pilgrim Station	03/10/2022	<0.0240	-	-	-	-	-	-	-	0.0057	0.0607
Air	Pilgrim Station	03/17/2022	<0.0164	-	-	-	-	-	-	-	0.0064	0.0689
Air	Pilgrim Station	03/24/2022	<0.0158	-	-	-	-	-	-	-	0.0047	0.0555
Air	Pilgrim Station	03/30/2022	<0.0211	-	-	-	-	-	-	-	0.0049	0.0446
Air	Pilgrim Station	04/07/2022	<0.0149	-	-	-	-	-	-	-	0.0041	0.0479
Air	Pilgrim Station	04/13/2022	<0.0257	-	-	-	-	-	-	-	0.0044	0.0445
Air	Pilgrim Station	04/20/2022	<0.0181	-	-	-	-	-	-	-	0.0030	0.0455
Air	Pilgrim Station	04/27/2022	<0.0162	-	-	-	-	-	-	-	0.0040	0.0458
Air	Pilgrim Station	05/04/2022	<0.0183	-	-	-	-	-	-	-	0.0025	0.0384
Air	Pilgrim Station	05/12/2022	<0.0135	-	-	-	-	-	-	-	0.0034	0.0438
Air	Pilgrim Station Quarterly Composite	5/15/2022	-	0.105	0.161	<0.001	<0.004	<0.001	<0.002	<0.001	-	-
Air	Pilgrim Station	05/18/2022	<0.0170	-	-	-	-	-	-	-	0.0018	0.0353
Air	Pilgrim Station	05/25/2022	<0.0157	-	-	-	-	-	-	-	0.0041	0.0476
Air	Pilgrim Station	06/01/2022	<0.0278	-	-	-	-	-	-	-	0.0030	0.0398
Air	Pilgrim Station	06/08/2022	<0.0136	-	-	-	-	-	-	-	0.0026	0.0393
Air	Pilgrim Station	06/15/2022	<0.0164	-	-	-	-	-	-	-	0.0018	0.0468
Air	Pilgrim Station	06/22/2022	<0.0175	-	-	-	-	-	-	-	0.0023	0.0417
Air	Pilgrim Station	06/30/2022	<0.0128	-	-	-	-	-	-	-	0.0014	0.0425
Air	Pilgrim Station	07/06/2022	<0.0171	-	-	-	-	-	-	-	0.0052	0.0486
Air	Pilgrim Station	07/13/2022	<0.0146	-	-	-	-	-	-	-	0.0044	0.0358
Air	Pilgrim Station	07/20/2022	<0.0146	-	-	-	-	-	-	-	0.0048	0.0588

-" = Not analyzed

* I-131 = iodine 131; Ba-140 = Barium 140; Be-7 = Beryllium 7; Co-60 = Cobalt 60; Cs-134 = Cesium 134; Cs-137=Cesium 137; Fe-59=Iron 59; H-3* = Tritium; K-40 = Potassium-40; Mn-54=Manganese-54; Zn-65=Zinc 65

"<" = value is less than the listed MDA (Minimum Detectable Activity) value

"NR"= result not reported for quality control reasons.

Sample Type	Location	Date	I-131* (pCi/m³)	Be-7* (pCi/m³)	K-40* (pCi/m³)	Mn-54* (pCi/m³)	Fe-59* (pCi/m³)	Co-60* (pCi/m³)	Zn-65* (pCi/m³)	Cs-137* (pCi/m³)	Gross Alpha (pCi/m³)	Gross Beta (pCi/m³)
Air	Pilgrim Station	07/27/2022	<0.0151	-	-	-	-	-	-	-	0.0076	0.0689
Air	Pilgrim Station	08/04/2022	<0.0119	-	-	-	-	-	-	-	0.0058	0.0602
Air	Pilgrim Station	08/11/2022	<0.0146	-	-	-	-	-	-	-	0.0048	0.0506
Air	Pilgrim Station Quarterly Composite	08/15/2022	-	0.115	0.338	<0.001	<0.027	<0.001	<0.003	<0.001	-	-
Air	Pilgrim Station	08/18/2022	<0.0131	-	-	-	-	-	-	-	0.0033	0.0396
Air	Pilgrim Station	08/24/2022	<0.0168	-	-	-	-	-	-	-	0.0051	0.0678
Air	Pilgrim Station	08/31/2022	<0.0133	-	-	-	-	-	-	-	0.0055	0.0663
Air	Pilgrim Station	09/07/2022	<0.0143	-	-	-	-	-	-	-	0.0028	0.0425
Air	Pilgrim Station	09/15/2022	<0.0134	-	-	-	-	-	-	-	0.0036	0.0536
Air	Pilgrim Station	09/21/2022	<0.0161	-	-	-	-	-	-	-	0.0026	0.0553
Air	Pilgrim Station	09/29/2022	<0.0137	-	-	-	-	-	-	-	0.0015	0.0490
Air	Pilgrim Station	10/06/2022	<0.0209	-	-	-	-	-	-	-	0.0011	0.0097
Air	Pilgrim Station	10/12/2022	<0.0169	-	-	-	-	-	-	-	0.0037	0.0260
Air	Pilgrim Station	10/19/2022	<0.0136	-	-	-	-	-	-	-	0.0044	0.0286
Air	Pilgrim Station	10/26/2022	<0.0256	-	-	-	-	-	-	-	0.0029	0.0200
Air	Pilgrim Station	11/02/2022	<0.0170	-	-	-	-	-	-	-	0.0013	0.0136
Air	Pilgrim Station	11/09/2022	<0.0129	-	-	-	-	-	-	-	0.0028	0.0247
Air	Pilgrim Station Quarterly Composite	11/15/2022	-	0.088	0.151	<0.001	<0.006	<0.001	<0.001	<0.001	-	-
Air	Pilgrim Station	11/18/2022	<0.0150	-	-	-	-	-	-	-	0.0024	0.0149
Air	Pilgrim Station	11/23/2022	<0.0326	-	-	-	-	-	-	-	0.0047	0.0336
Air	Pilgrim Station	11/30/2022	<0.0141	-	-	-	-	-	-	-	0.0021	0.0261
Air	Pilgrim Station	12/07/2022	<0.0156	-	-	-	-	-	-	-	0.0020	0.0223
Air	Pilgrim Station	12/14/2022	<0.0161	-	-	-	-	-	-	-	0.0016	0.0190
Air	Pilgrim Station	12/21/2022	<0.0283	-	-	-	-	-	-	-	0.0001	0.0171
Air	Pilgrim Station	12/28/2022	<0.0315	-	-	-	-	-	-	-	0.0038	0.0311
Air	Background	01/04/2022	<0.0160	-	-	-	-	-	-	-	0.0080	0.0673
Air	Background	01/12/2022	<0.0304	-	-	-	-	-	-	-	0.0068	0.0636
Air	Background	01/19/2022	<0.0248	-	-	-	-	-	-	-	0.0064	0.0706
Air	Background	01/26/2022	<0.0177	-	-	-	-	-	-	-	0.0069	0.0676
Air	Background	02/02/2022	<0.0195	-	-	-	-	-	-	-	0.0077	0.0674
Air	Background	02/09/2022	<0.0148	-	-	-	-	-	-	-	0.0060	0.0514

-" = Not analyzed

* I-131 = iodine 131; Ba-140 = Barium 140; Be-7 = Beryllium 7; Co-60 = Cobalt 60; Cs-134 = Cesium 134; Cs-137=Cesium 137; Fe-59=Iron 59; H-3* = Tritium; K-40 = Potassium-40; Mn-54=Manganese-54; Zn-65=Zinc 65

"<" = value is less than the listed MDA (Minimum Detectable Activity) value

"NR"= result not reported for quality control reasons.

Sample Type	Location	Date	I-131* (pCi/m³)	Be-7* (pCi/m³)	K-40* (pCi/m³)	Mn-54* (pCi/m³)	Fe-59* (pCi/m³)	Co-60* (pCi/m³)	Zn-65* (pCi/m³)	Cs-137* (pCi/m³)	Gross Alpha (pCi/m³)	Gross Beta (pCi/m³)
Air	Background Quarterly Composite	02/15/2022	-	0.105	0.153	<0.001	<0.004	<0.001	<0.001	<0.001	-	-
Air	Background	02/16/2022	<0.0163	-	-	-	-	-	-	-	0.0082	0.0671
Air	Background	02/23/2022	<0.0150	-	-	-	-	-	-	-	0.0058	0.0462
Air	Background	03/02/2022	<0.0157	-	-	-	-	-	-	-	0.0074	0.0670
Air	Background	03/10/2022	<0.0183	-	-	-	-	-	-	-	0.0048	0.0610
Air	Background	03/15/2022	<0.0210	-	-	-	-	-	-	-	0.0082	0.0786
Air	Background	03/23/2022	<0.0159	-	-	-	-	-	-	-	0.0051	0.0649
Air	Background	03/28/2022	<0.0220	-	-	-	-	-	-	-	0.0079	0.0484
Air	Background	04/05/2022	<0.0168	-	-	-	-	-	-	-	0.0056	0.0406
Air	Background	04/12/2022	<0.0220	-	-	-	-	-	-	-	0.0044	0.0496
Air	Background	04/19/2022	<0.0167	-	-	-	-	-	-	-	0.0042	0.0509
Air	Background	04/26/2022	<0.0192	-	-	-	-	-	-	-	0.0043	0.0525
Air	Background	05/03/2022	<0.0162	-	-	-	-	-	-	-	0.0047	0.0475
Air	Background	05/10/2022	<0.0193	-	-	-	-	-	-	-	0.0039	0.0503
Air	Background Quarterly Composite	5/15/2022	-	0.096	0.091	<0.001	<0.004	<0.001	<0.002	<0.001	-	-
Air	Background	05/17/2022	<0.0169	-	-	-	-	-	-	-	0.0033	0.0396
Air	Background	05/24/2022	<0.0170	-	-	-	-	-	-	-	0.0043	0.0508
Air	Background	05/31/2022	<0.0307	-	-	-	-	-	-	-	0.0022	0.0398
Air	Background	06/07/2022	<0.0178	-	-	-	-	-	-	-	0.0021	0.0337
Air	Background	06/14/2022	<0.0189	-	-	-	-	-	-	-	0.0026	0.0425
Air	Background	06/21/2022	<0.0169	-	-	-	-	-	-	-	0.0026	0.0428
Air	Background	06/28/2022	<0.0157	-	-	-	-	-	-	-	0.0026	0.0528
Air	Background	07/05/2022	<0.0189	-	-	-	-	-	-	-	0.0071	0.0494
Air	Background	07/12/2022	<0.0179	-	-	-	-	-	-	-	0.0029	0.0379
Air	Background	07/19/2022	<0.0169	-	-	-	-	-	-	-	0.0043	0.0550
Air	Background	07/26/2022	<0.0166	-	-	-	-	-	-	-	0.0064	0.0739
Air	Background	08/02/2022	<0.0187	-	-	-	-	-	-	-	0.0042	0.0538
Air	Background	08/09/2022	<0.0176	-	-	-	-	-	-	-	0.0046	0.0652
Air	Background Quarterly Composite	08/15/2022	-	0.131	0.184	<0.001	<0.007	<0.001	<0.002	<0.001	-	-
Air	Background	08/16/2022	<0.0518	-	-	-	-	-	-	-	0.0072	0.0983
Air	Background	08/24/2022	<0.0152	-	-	-	-	-	-	-	0.0060	0.0582

-" = Not analyzed

* I-131 = iodine 131; Ba-140 = Barium 140; Be-7 = Beryllium 7; Co-60 = Cobalt 60; Cs-134 = Cesium 134; Cs-137=Cesium 137; Fe-59=Iron 59; H-3* = Tritium; K-40 = Potassium-40; Mn-54=Manganese-54; Zn-65=Zinc 65

"<" = value is less than the listed MDA (Minimum Detectable Activity) value

"NR"= result not reported for quality control reasons.

Sample Type	Location	Date	I-131* (pCi/m³)	Be-7* (pCi/m³)	K-40* (pCi/m³)	Mn-54* (pCi/m³)	Fe-59* (pCi/m³)	Co-60* (pCi/m³)	Zn-65* (pCi/m³)	Cs-137* (pCi/m³)	Gross Alpha (pCi/m³)	Gross Beta (pCi/m³)
Air	Background	08/30/2022	<0.0211	-	-	-	-	-	-	-	0.0049	0.0838
Air	Background	09/07/2022	<0.0136	-	-	-	-	-	-	-	0.0034	0.0455
Air	Background	09/13/2022	<0.0217	-	-	-	-	-	-	-	0.0037	0.0680
Air	Background	09/20/2022	<0.0177	-	-	-	-	-	-	-	0.0030	0.0626
Air	Background	09/27/2022	<0.0213	-	-	-	-	-	-	-	0.0037	0.0532
Air	Background	10/04/2022	<0.0236	-	-	-	-	-	-	-	0.0019	0.0142
Air	Background	10/11/2022	<0.0273	-	-	-	-	-	-	-	0.0041	0.0200
Air	Background	10/18/2022	<0.0160	-	-	-	-	-	-	-	0.0075	0.0360
Air	Background	10/25/2022	<0.0296	-	-	-	-	-	-	-	0.0038	0.0251
Air	Background	11/01/2022	<0.0564	-	-	-	-	-	-	-	0.0001	0.0296
Air	Background	11/08/2022	<0.0172	-	-	-	-	-	-	-	0.0040	0.0290
Air	Background Quarterly Composite	11/15/2022	-	0.082	0.195	<0.001	<0.007	<0.001	<0.002	<0.001	-	-
Air	Background	11/15/2022	<0.0161	-	-	-	-	-	-	-	0.0045	0.0209
Air	Background	11/22/2022	<0.0172	-	-	-	-	-	-	-	0.0068	0.0264
Air	Background	11/29/2022	<0.0168	-	-	-	-	-	-	-	0.0075	0.0350
Air	Background	12/06/2022	<0.0163	-	-	-	-	-	-	-	0.0036	0.0247
Air	Background	12/14/2022	<0.0147	-	-	-	-	-	-	-	0.0048	0.0253
Air	Background	12/21/2022	<0.0341	-	-	-	-	-	-	-	0.0045	0.0210
Air	Background	12/28/2022	<0.0288	-	-	-	-	-	-	-	0.0069	0.0371

-" = Not analyzed

* I-131 = iodine 131; Ba-140 = Barium 140; Be-7 = Beryllium 7; Co-60 = Cobalt 60; Cs-134 = Cesium 134; Cs-137=Cesium 137; Fe-59=Iron 59; H-3* = Tritium; K-40 = Potassium-40; Mn-54=Manganese-54; Zn-65=Zinc 65

"<" = value is less than the listed MDA (Minimum Detectable Activity) value

"NR"= result not reported for quality control reasons.

Table 3. Pilgrim Nuclear Power Station 2022 Environmental Monitoring Data – Liquid Matrices

Sample Type	Location	Date	K-40* (pCi/L)	Mn-54* (pCi/L)	Fe-59* (pCi/L)	Co-60* (pCi/L)	Zn-65* (pCi/L)	I-131* (pCi/L)	Cs-137* (pCi/L)	H-3* (pCi/L)
Surface water	Discharge Canal	01/15/2022	981	<2.8	<9.3	<2.6	<6.1	NR	<2.6	<300
Surface water	Discharge Canal	02/15/2022	941	<2.7	<6.0	<2.6	<5.5	<11.2	<2.6	<300
Surface water	Discharge Canal	03/15/2022	976	<2.7	<5.9	<2.5	<5.3	<6.0	<2.5	<300
Surface water	Discharge Canal	04/15/2022	747	<2.8	<6.2	<3.1	<6.5	<5.4	<3.0	<300
Surface water	Discharge Canal	05/15/2022	976	<2.7	<5.6	<2.5	<5.6	<8.4	<2.5	<300
Surface water	Discharge Canal	06/15/2022	821	<2.9	<6.2	<3.0	<5.9	<4.9	<3.0	<300
Surface water	Discharge Canal	07/15/2022	1080	<2.6	<6.4	<3.0	<6.2	<6.5	<3.2	<300
Surface water	Discharge Canal	08/15/2022	984	NR	<19.7	NR	NR	<26.2	NR	<300
Surface water	Discharge Canal	09/15/2022	990	<2.7	<5.6	<2.4	<5.4	<6.2	<2.5	<300
Surface water	Discharge Canal	10/15/2022	974	<2.9	<9.6	<2.4	<6.0	<77.7	<2.5	<300
Surface water	Discharge Canal	11/15/2022	944	<2.7	<9.3	<2.5	<6.0	NR	<2.7	<300
Surface water	Discharge Canal	12/15/2022	979	<2.6	<6.5	<2.6	<5.8	<12.0	<2.6	<300
Surface water	Powder Point Bridge[1]	01/15/2022	745	<3.1	<9.3	<3.0	<6.9	NR	<3.2	<300
Surface water	Powder Point Bridge[1]	02/15/2022	675	<2.9	<7.1	<3.1	<6.4	<11.6	<3.2	<300
Surface water	Powder Point Bridge[1]	03/15/2022	923	<2.6	<5.9	<2.7	<5.6	<10.3	<2.4	<300
Surface water	Powder Point Bridge[1]	04/15/2022	922	<2.6	<5.5	<2.5	<5.6	<5.0	<2.6	<300
Surface water	Powder Point Bridge[1]	05/15/2022	721	<3.1	<7.1	<3.2	<6.3	<8.6	<3.3	<300
Surface water	Powder Point Bridge[1]	06/15/2022	945	<2.5	<5.2	<2.3	<5.6	<5.0	<2.5	<300
Surface water	Powder Point Bridge[1]	07/15/2022	825	<2.9	<6.6	<3.1	<6.0	<8.6	<3.3	<300
Surface water	Powder Point Bridge[1]	08/15/2022	725	<3.1	<6.2	<3.1	<5.6	<5.8	<3.0	<300
Surface water	Powder Point Bridge[1]	09/15/2022	1420	<3.5	<7.8	<3.5	<7.4	<8.2	<3.8	<300
Surface water	Powder Point Bridge[1]	10/15/2022	1010	<2.6	<10.1	<2.4	<5.9	NR	<2.5	<300
Surface water	Powder Point Bridge[1]	11/15/2022	924	<3.0	<10.7	<2.7	<6.1	NR	<2.5	<300
Surface water	Powder Point Bridge[1]	12/15/2022	1200	<3.3	<7.9	<3.5	<6.8	<13.8	<3.7	<300

[1]Sample considered "background" for the purpose of NRC regulations, but considered "indicator" by MDPH because it falls within 10-miles of the PNPS plant.

-" = Not analyzed

* I-131 = iodine 131; Ba-140 = Barium 140; Be-7 = Beryllium 7; Co-60 = Cobalt 60; Cs-134 = Cesium 134; Cs-137=Cesium 137; Fe-59=Iron 59; H-3* = Tritium; K-40 = Potassium-40; Mn-54=Manganese-54; Zn-65=Zinc 65

"<" = value is less than the listed MDA (Minimum Detectable Activity) value

"NR"= result not reported for quality control reasons.

Table 4. Pilgrim Nuclear Power Station 2022 Environmental Monitoring Data – Solid matrices

Sample	Location	Date	Be-7* (pCi/kg)	K-40* (pCi/kg)	Mn-54* (pCi/kg)	Fe-59* (pCi/kg)	Co-60* (pCi/kg)	Zn-65* (pCi/kg)	Cs-137* (pCi/kg)	I-131* (pCi/kg)
Atlantic Menhaden	Buzzards Bay (background)	10/9/2022	<115	2450	<5.2	<42.5	<4.1	<12.0	<3.8	-
Striped Bass	Buzzards Bay (background)	10/9/2022	<230	6740	<8.5	<70.7	<7.4	<20.2	<7.4	-
Striped Bass	PNPS Discharge Canal	10/15/2022	<541	1220	<22.5	<167	<18.4	<52.2	<18.1	-
Tautog	Buzzards Bay (background)	10/22/2022	<105	4880	<4.7	<38.7	<5.1	<13.1	<4.3	-
Lobster	Cape Cod Bay (background)	8/26/2022	<82.2	4300	<5.6	<22.9	<5.7	<13.1	<5.4	-
Lobster	PNPS Discharge Canal	8/26/2022	<46.9	1610	<3.5	<16.1	<3.4	<9.2	<3.1	-
Mytilus[1]	Green Harbor, Marshfield[2]	05/17/2022	<118	3000	<5.5	<37.0	<5.2	<14.4	<5.2	-
Mytilus[1]	PNPS Discharge Canal	10/10/2022	<158	2540	<6.3	<43.5	<5.4	<14.3	<5.4	-
Softshell Clams	Duxbury[2]	05/17/2022	<87.1	854	<4.4	<25.8	<3.7	<10.4	<3.6	-
Softshell Clams	Plymouth Harbor	05/18/2022	<95.6	1030	<5.2	<30.4	<4.3	<12.2	<4.1	-
Irish Moss	PNPS Discharge Canal	11/23/2022	**237**	7270	<5.2	<12.5	<5.2	<12.6	<5.2	<8.9
Sediment	Green Harbor, Marshfield[2]	05/17/2022	-	17100	-	-	<32.9	-	<30.8	-
Sediment	PNPS Discharge Canal	10/15/2022	-	10100	-	-	<15.3	-	<15.0	-
Sediment	PNPS Discharge Canal	11/22/2022	-	16900	-	-	<15.0	-	<15.3	-
Cranberries	E. Taunton (background)	9/29/2022	45.0	2160	<36.8	<7.5	<3.8	<7.2	<4.2	-
Strawberries	Cretinon's Farm, Kingston	6/15/2022	<35.5	2220	<3.8	<8.1	<4.5	<8.3	<4.1	-
Tomatoes	Cretinon's Farm, Kingston	8/18/2022	<24.7	1200	<2.6	<6.3	<3.3	<6.5	<3.0	-
Zucchini	Cretinon's Farm, Kingston	7/27/2022	<35.7	3480	<4.2	<8.9	<4.6	<9.2	<4.2	-

[1]Blue, or common mussel

[2]Sample considered "background" for the purpose of NRC regulations, but considered "indicator" by MDPH because it falls within 10-miles of the plant

-" = Not analyzed

* I-131 = iodine 131; Ba-140 = Barium 140; Be-7 = Beryllium 7; Co-60 = Cobalt 60; Cs-134 = Cesium 134; Cs-137=Cesium 137; Fe-59=Iron 59; H-3* = Tritium; K-40 = Potassium-40; Mn-54=Manganese-54; Zn-65=Zinc 65

"<" = value is less than the listed MDA (Minimum Detectable Activity) value

"NR"= result not reported for quality control reasons.

Table 5. Seabrook Nuclear Power Station 2022 Environmental Monitoring Data - Air Samples

Sample Type	Location	Date	I-131* (pCi/m³)	Be-7* (pCi/m³)	K-40* (pCi/m³)	Mn-54* (pCi/m³)	Fe-59* (pCi/m³)	Co-60* (pCi/m³)	Zn-65* (pCi/m³)	Cs-137* (pCi/m³)	Gross Alpha (pCi/m³)	Gross Beta (pCi/m³)
Air	Salisbury Fire Station	01/05/2022	<0.0186	-	-	-	-	-	-	-	0.0072	0.0764
Air	Salisbury Fire Station	01/14/2022	<0.0360	-	-	-	-	-	-	-	0.0050	0.0659
Air	Salisbury Fire Station	01/19/2022	<0.0424	-	-	-	-	-	-	-	0.0082	0.0852
Air	Salisbury Fire Station	01/25/2022	<0.0387	-	-	-	-	-	-	-	0.0075	0.0759
Air	Salisbury Fire Station	02/03/2022	<0.0303	-	-	-	-	-	-	-	0.0055	0.0656
Air	Salisbury Fire Station	02/09/2022	<0.0410	-	-	-	-	-	-	-	0.0066	0.0567
Air	Salisbury Fire Station Quarterly Composite	02/15/2022	-	0.117	0.096	<0.001	<0.005	<0.001	<0.002	<0.001	-	-
Air	Salisbury Fire Station	02/16/2022	<0.0339	-	-	-	-	-	-	-	0.0067	0.0709
Air	Salisbury Fire Station	02/23/2022	<0.0318	-	-	-	-	-	-	-	0.0071	0.0569
Air	Salisbury Fire Station	03/02/2022	<0.0316	-	-	-	-	-	-	-	0.0075	0.0715
Air	Salisbury Fire Station	03/16/2022	<0.0093	-	-	-	-	-	-	-	0.0041	0.0456
Air	Salisbury Fire Station	03/24/2022	<0.0143	-	-	-	-	-	-	-	0.0034	0.0520
Air	Salisbury Fire Station	04/01/2022	<0.0158	-	-	-	-	-	-	-	0.0025	0.0362
Air	Salisbury Fire Station	04/06/2022	<0.0285	-	-	-	-	-	-	-	0.0033	0.0579
Air	Salisbury Fire Station	04/15/2022	<0.0266	-	-	-	-	-	-	-	0.0022	0.0342
Air	Salisbury Fire Station	04/20/2022	<0.0302	-	-	-	-	-	-	-	0.0019	0.0554
Air	Salisbury Fire Station	05/06/2022	<0.0103	-	-	-	-	-	-	-	0.0020	0.0297
Air	Salisbury Fire Station	05/11/2022	<0.0220	-	-	-	-	-	-	-	0.0039	0.0648
Air	Salisbury Fire Station Quarterly Composite	05/15/2022	-	0.109	0.204	<0.001	<0.004	<0.001	<0.002	<0.001	-	-
Air	Salisbury Fire Station	05/17/2022	<0.0181	-	-	-	-	-	-	-	0.0021	0.0319
Air	Salisbury Fire Station	05/23/2022	<0.0212	-	-	-	-	-	-	-	0.0027	0.0447
Air	Salisbury Fire Station	06/01/2022	<0.0215	-	-	-	-	-	-	-	0.0022	0.0357
Air	Salisbury Fire Station	06/08/2022	<0.0238	-	-	-	-	-	-	-	0.0017	0.0398
Air	Salisbury Fire Station	06/15/2022	<0.0232	-	-	-	-	-	-	-	0.0019	0.0481
Air	Salisbury Fire Station	06/21/2022	<0.0353								0.0026	0.0387
Air	Salisbury Fire Station	06/29/2022	<0.0259	-	-	-	-	-	-	-	0.0020	0.0406
Air	Salisbury Fire Station	07/08/2022	<0.0237	-	-	-	-	-	-	-	0.0055	0.0394
Air	Salisbury Fire Station	07/15/2022	<0.0222	-	-	-	-	-	-	-	0.0036	0.0397
Air	Salisbury Fire Station	07/20/2022	<0.0269	-	-	-	-	-	-	-	0.0065	0.0705
Air	Salisbury Fire Station	07/28/2022	<0.0242	-	-	-	-	-	-	-	0.0038	0.0352
Air	Salisbury Fire Station	08/01/2022	<0.0375	-	-	-	-	-	-	-	0.0066	0.0729

-" = Not analyzed

* I-131 = iodine 131; Ba-140 = Barium 140; Be-7 = Beryllium 7; Co-60 = Cobalt 60; Cs-134 = Cesium 134; Cs-137=Cesium 137; Fe-59=Iron 59; H-3* = Tritium; K-40 = Potassium-40; Mn-54=Manganese-54; Zn-65=Zinc 65

"<" = value is less than the listed MDA (Minimum Detectable Activity) value

"NR"= result not reported for quality control reasons.

Sample Type	Location	Date	I-131* (pCi/m³)	Be-7* (pCi/m³)	K-40* (pCi/m³)	Mn-54* (pCi/m³)	Fe-59* (pCi/m³)	Co-60* (pCi/m³)	Zn-65* (pCi/m³)	Cs-137* (pCi/m³)	Gross Alpha (pCi/m³)	Gross Beta (pCi/m³)
Air	Salisbury Fire Station	08/10/2022	<0.0130	-	-	-	-	-	-	-	0.0041	0.0499
Air	Salisbury Fire Station Quarterly Composite	08/15/2022	-	0.096	0.170	<0.001	<0.006	<0.001	<0.002	<0.001	-	-
Air	Salisbury Fire Station	08/19/2022	<0.0119	-	-	-	-	-	-	-	0.0029	0.0433
Air	Salisbury Fire Station	08/23/2022	<0.0476	-	-	-	-	-	-	-	0.0063	0.0734
Air	Salisbury Fire Station	08/31/2022	<0.0143	-	-	-	-	-	-	-	0.0055	0.0672
Air	Salisbury Fire Station	09/08/2022	<0.0300	-	-	-	-	-	-	-	0.0029	0.0359
Air	Salisbury Fire Station	09/13/2022	<0.0252	-	-	-	-	-	-	-	0.0069	0.0862
Air	Salisbury Fire Station	09/21/2022	<0.0317								0.0026	0.0491
Air	Salisbury Fire Station	09/30/2022	<0.0476	-	-	-	-	-	-	-	0.0022	0.0505
Air	Salisbury Fire Station	10/07/2022	<0.0529	-	-	-	-	-	-	-	0.0031	0.0181
Air	Salisbury Fire Station	10/14/2022	<0.0251	-	-	-	-	-	-	-	0.0118	0.0382
Air	Salisbury Fire Station	10/20/2022	<0.0178	-	-	-	-	-	-	-	0.0031	0.0270
Air	Salisbury Fire Station	10/25/2022	<0.0478	-	-	-	-	-	-	-	0.0073	0.0386
Air	Salisbury Fire Station	11/03/2022	<0.0193	-	-	-	-	-	-	-	0.0033	0.0184
Air	Salisbury Fire Station	11/10/2022	<0.0301	-	-	-	-	-	-	-	0.0040	0.0239
Air	Salisbury Fire Station Quarterly Composite	11/15/2022	-	0.114	0.208	<0.001	<0.008	<0.001	<0.002	<0.001	-	-
Air	Salisbury Fire Station	11/18/2022	<0.0226	-	-	-	-	-	-	-	0.0022	0.0143
Air	Salisbury Fire Station	11/21/2022	<0.1750[a]	-	-	-	-	-	-	-	0.0024	0.0345
Air	Salisbury Fire Station	12/01/2022	<0.0121	-	-	-	-	-	-	-	0.0066	0.0274
Air	Salisbury Fire Station	12/09/2022	<0.2180	-	-	-	-	-	-	-	0.0029	0.0215
Air	Salisbury Fire Station	12/13/2022	<0.1170	-	-	-	-	-	-	-	0.0056	0.0327
Air	Salisbury Fire Station	12/22/2022	<0.1010	-	-	-	-	-	-	-	0.0012	0.0184
Air	Salisbury Fire Station	12/30/2022	<0.0424	-	-	-	-	-	-	-	0.0039	0.0369
Air	Background	01/04/2022	<0.0160	-	-	-	-	-	-	-	0.0080	0.0673
Air	Background	01/12/2022	<0.0304	-	-	-	-	-	-	-	0.0068	0.0636
Air	Background	01/19/2022	<0.0248	-	-	-	-	-	-	-	0.0064	0.0706
Air	Background	01/26/2022	<0.0177	-	-	-	-	-	-	-	0.0069	0.0676
Air	Background	02/02/2022	<0.0195	-	-	-	-	-	-	-	0.0077	0.0674
Air	Background	02/09/2022	<0.0148	-	-	-	-	-	-	-	0.0060	0.0514
Air	Background Quarterly Composite	02/15/2022	-	0.105	0.153	<0.001	<0.004	<0.001	<0.001	<0.001	-	-
Air	Background	02/16/2022	<0.0163	-	-	-	-	-	-	-	0.0082	0.0671

-" = Not analyzed

* I-131 = iodine 131; Ba-140 = Barium 140; Be-7 = Beryllium 7; Co-60 = Cobalt 60; Cs-134 = Cesium 134; Cs-137=Cesium 137; Fe-59=Iron 59; H-3* = Tritium; K-40 = Potassium-40; Mn-54=Manganese-54; Zn-65=Zinc 65

"<" = value is less than the listed MDA (Minimum Detectable Activity) value

"NR"= result not reported for quality control reasons.

Sample Type	Location	Date	I-131* (pCi/m³)	Be-7* (pCi/m³)	K-40* (pCi/m³)	Mn-54* (pCi/m³)	Fe-59* (pCi/m³)	Co-60* (pCi/m³)	Zn-65* (pCi/m³)	Cs-137* (pCi/m³)	Gross Alpha (pCi/m³)	Gross Beta (pCi/m³)
Air	Background	02/23/2022	<0.0150	-	-	-	-	-	-	-	0.0058	0.0462
Air	Background	03/02/2022	<0.0157	-	-	-	-	-	-	-	0.0074	0.0670
Air	Background	03/10/2022	<0.0183	-	-	-	-	-	-	-	0.0048	0.0610
Air	Background	03/15/2022	<0.0210	-	-	-	-	-	-	-	0.0082	0.0786
Air	Background	03/23/2022	<0.0159	-	-	-	-	-	-	-	0.0051	0.0649
Air	Background	03/28/2022	<0.0220	-	-	-	-	-	-	-	0.0079	0.0484
Air	Background	04/05/2022	<0.0168	-	-	-	-	-	-	-	0.0056	0.0406
Air	Background	04/12/2022	<0.0220	-	-	-	-	-	-	-	0.0044	0.0496
Air	Background	04/19/2022	<0.0167	-	-	-	-	-	-	-	0.0042	0.0509
Air	Background	04/26/2022	<0.0192	-	-	-	-	-	-	-	0.0043	0.0525
Air	Background	05/03/2022	<0.0162	-	-	-	-	-	-	-	0.0047	0.0475
Air	Background	05/10/2022	<0.0193	-	-	-	-	-	-	-	0.0039	0.0503
Air	Background Quarterly Composite	5/15/2022	-	0.096	0.091	<0.001	<0.004	<0.001	<0.002	<0.001	-	-
Air	Background	05/17/2022	<0.0169	-	-	-	-	-	-	-	0.0033	0.0396
Air	Background	05/24/2022	<0.0170	-	-	-	-	-	-	-	0.0043	0.0508
Air	Background	05/31/2022	<0.0307	-	-	-	-	-	-	-	0.0022	0.0398
Air	Background	06/07/2022	<0.0178	-	-	-	-	-	-	-	0.0021	0.0337
Air	Background	06/14/2022	<0.0189	-	-	-	-	-	-	-	0.0026	0.0425
Air	Background	06/21/2022	<0.0169	-	-	-	-	-	-	-	0.0026	0.0428
Air	Background	06/28/2022	<0.0157	-	-	-	-	-	-	-	0.0026	0.0528
Air	Background	07/05/2022	<0.0189	-	-	-	-	-	-	-	0.0071	0.0494
Air	Background	07/12/2022	<0.0179	-	-	-	-	-	-	-	0.0029	0.0379
Air	Background	07/19/2022	<0.0169	-	-	-	-	-	-	-	0.0043	0.0550
Air	Background	07/26/2022	<0.0166	-	-	-	-	-	-	-	0.0064	0.0739
Air	Background	08/02/2022	<0.0187	-	-	-	-	-	-	-	0.0042	0.0538
Air	Background	08/09/2022	<0.0176	-	-	-	-	-	-	-	0.0046	0.0652
Air	Background Quarterly Composite	08/15/2022	-	0.131	0.184	<0.001	<0.007	<0.001	<0.002	<0.001	-	-
Air	Background	08/16/2022	<0.0518	-	-	-	-	-	-	-	0.0072	0.0983
Air	Background	08/24/2022	<0.0152	-	-	-	-	-	-	-	0.0060	0.0582
Air	Background	08/30/2022	<0.0211	-	-	-	-	-	-	-	0.0049	0.0838
Air	Background	09/07/2022	<0.0136	-	-	-	-	-	-	-	0.0034	0.0455
Air	Background	09/13/2022	<0.0217	-	-	-	-	-	-	-	0.0037	0.0680

-" = Not analyzed

* I-131 = iodine 131; Ba-140 = Barium 140; Be-7 = Beryllium 7; Co-60 = Cobalt 60; Cs-134 = Cesium 134; Cs-137=Cesium 137; Fe-59=Iron 59; H-3* = Tritium; K-40 = Potassium-40; Mn-54=Manganese-54; Zn-65=Zinc 65

"<" = value is less than the listed MDA (Minimum Detectable Activity) value

"NR"= result not reported for quality control reasons.

Sample Type	Location	Date	I-131* (pCi/m³)	Be-7* (pCi/m³)	K-40* (pCi/m³)	Mn-54* (pCi/m³)	Fe-59* (pCi/m³)	Co-60* (pCi/m³)	Zn-65* (pCi/m³)	Cs-137* (pCi/m³)	Gross Alpha (pCi/m³)	Gross Beta (pCi/m³)
Air	Background	09/20/2022	<0.0177	-	-	-	-	-	-	-	0.0030	0.0626
Air	Background	09/27/2022	<0.0213	-	-	-	-	-	-	-	0.0037	0.0532
Air	Background	10/04/2022	<0.0236	-	-	-	-	-	-	-	0.0019	0.0142
Air	Background	10/11/2022	<0.0273	-	-	-	-	-	-	-	0.0041	0.0200
Air	Background	10/18/2022	<0.0160	-	-	-	-	-	-	-	0.0075	0.0360
Air	Background	10/25/2022	<0.0296	-	-	-	-	-	-	-	0.0038	0.0251
Air	Background	11/01/2022	<0.0564	-	-	-	-	-	-	-	0.0001	0.0296
Air	Background	11/08/2022	<0.0172	-	-	-	-	-	-	-	0.0040	0.0290
Air	Background Quarterly Composite	11/15/2022	-	0.082	0.195	<0.001	<0.007	<0.001	<0.002	<0.001	-	-
Air	Background	11/15/2022	<0.0161	-	-	-	-	-	-	-	0.0045	0.0209
Air	Background	11/22/2022	<0.0172	-	-	-	-	-	-	-	0.0068	0.0264
Air	Background	11/29/2022	<0.0168	-	-	-	-	-	-	-	0.0075	0.0350
Air	Background	12/06/2022	<0.0163	-	-	-	-	-	-	-	0.0036	0.0247
Air	Background	12/14/2022	<0.0147	-	-	-	-	-	-	-	0.0048	0.0253
Air	Background	12/21/2022	<0.0341	-	-	-	-	-	-	-	0.0045	0.0210
Air	Background	12/28/2022	<0.0288	-	-	-	-	-	-	-	0.0069	0.0371

[a] Low volume sample due to power interruption

-" = Not analyzed

* I-131 = iodine 131; Ba-140 = Barium 140; Be-7 = Beryllium 7; Co-60 = Cobalt 60; Cs-134 = Cesium 134; Cs-137=Cesium 137; Fe-59=Iron 59; H-3* = Tritium; K-40 = Potassium-40; Mn-54=Manganese-54; Zn-65=Zinc 65

"<" = value is less than the listed MDA (Minimum Detectable Activity) value

"NR"= result not reported for quality control reasons.

Table 6. Seabrook Nuclear Power Station 2022 Environmental Monitoring Data – Liquid Matrices

Sample Type	Location	Date	K-40* (pCi/L)	Mn-54* (pCi/L)	Fe-59* (pCi/L)	Co-60* (pCi/L)	Zn-65* (pCi/L)	I-131* (pCi/L)	Cs-134* (pCi/L)	Cs-137* (pCi/L)	Ba-140* (pCi/L)	H-3* (pCi/L)
Surface water	Ipswich bay[1]	01/11/2022	959	<2.9	<12.6	<2.7	<6.4	NR	-	<2.6	-	<300
Surface water	Ipswich bay[1]	02/17/2022	1010	<2.8	<8.5	<2.5	<6.0	NR	-	<2.5	-	<300
Surface water	Ipswich bay[1]	03/14/2022	644	<2.7	<6.0	<2.8	<6.1	<5.8	-	<3.1	-	<300
Surface water	Ipswich bay[1]	04/12/2022	1140	<3.5	<7.6	<3.4	<7.4	<10.3	-	<3.7	-	<300
Surface water	Ipswich bay[1]	05/19/2022	794	<3.0	<7.8	<2.9	<6.8	<25.4	-	<3.0	-	<300
Surface water	Ipswich bay[1]	06/14/2022	1130	<2.9	<8.4	<2.9	<6.4	<28.1	-	<3.2	-	<300
Surface water	Ipswich bay[1]	07/14/2022	949	<2.5	<7.2	<2.6	<5.4	NR	-	<2.5	-	<300
Surface water	Ipswich bay[1]	08/09/2022	972	<2.6	<7.3	<2.4	<5.7	<28.3	-	<2.5	-	<300
Surface water	Ipswich bay[1]	09/12/2022	977	<2.7	<7.3	<2.3	<5.9	<3.8	-	<2.5	-	<300
Surface water	Ipswich bay[1]	10/10/2022	954	<2.8	<13.4	<2.8	<6.3	NR	-	<2.4	-	<300
Surface water	Ipswich bay[1]	11/15/2022	1030	<3.6	<15.9	<3.5	<7.3	NR	-	<3.4	-	<300
Surface water	Ipswich bay[1]	12/21/2022	950	<2.7	<6.7	<2.3	<6.3	NR	-	<2.4	-	<300
Milk	Rowley	01/19/2022	2500	-	-	-	-	<5.5	<3.1	<3.7	<17.4	-
Milk	Rowley	02/23/2022	898	-	-	-	-	NR	<2.8	<3.2	<30.5	-
Milk	Rowley	03/24/2022	2150	-	-	-	-	<3.0	<2.4	<2.7	<9.7	-
Milk	Rowley	04/20/2022	926	-	-	-	-	<3.1	<2.4	<2.7	<10.0	-
Milk	Rowley	05/17/2022	1820	-	-	-	-	<3.1	<2.7	<3.3	<11.5	-
Milk	Rowley	06/29/2022	1040	-	-	-	-	<4.9	<2.3	<2.6	<12.7	-
Milk	Rowley	07/20/2022	906	-	-	-	-	<2.8	<2.2	<2.5	<9.1	-
Milk	Rowley	08/19/2022	869	-	-	-	-	<4.2	<2.3	<2.6	<11.9	-
Milk	Rowley	09/13/2022	1800	-	-	-	-	<3.0	<2.7	<3.3	<11.5	-
Milk	Rowley	10/20/2022	883	-	-	-	-	<2.7	<2.3	<2.4	<8.6	-
Milk	Rowley	11/18/2022	903	-	-	-	-	<4.0	<2.3	<2.6	<11.7	-
Milk	Rowley	12/15/2022	1710	-	-	-	-	NR	<2.8	<3.2	NR	-

[1]Background sample

-" = Not analyzed

* I-131 = iodine 131; Ba-140 = Barium 140; Be-7 = Beryllium 7; Co-60 = Cobalt 60; Cs-134 = Cesium 134; Cs-137=Cesium 137; Fe-59=Iron 59; H-3* = Tritium; K-40 = Potassium-40; Mn-54=Manganese-54; Zn-65=Zinc 65

"<" = value is less than the listed MDA (Minimum Detectable Activity) value

"NR"= result not reported for quality control reasons.

Table 7. Seabrook Nuclear Power Station 2022 Environmental Monitoring Data –Solid Matrices

Sample	Location[1]	Date	Be-7* (pCi/kg)	K-40* (pCi/kg)	Mn-54* (pCi/kg)	Fe-59* (pCi/kg)	Co-60* (pCi/kg)	Zn-65* (pCi/kg)	Cs-137* (pCi/kg)	I-131* (pCi/kg)
Flounder	Ipswich Bay	05/19/2022	<453	7810	<32.1	<102	<30.2	<65.8	<32.7	-
Haddock	Ipswich Bay	08/11/2022	<93.8	2680	<4.5	<34.1	<4.0	<11.4	<3.7	-
Haddock	Ipswich Bay	11/16/2022	<77.0	3470	<5.5	<27.2	<5.2	<13.3	<4.5	
Lobster	Ipswich Bay	05/26/2022	<43.7	1970	<4.1	<13.0	<4.1	<10.0	<3.6	-
Lobster	Ipswich Bay	11/16/2022	<115	1950	<5.1	<37.1	<5.0	<12.3	<4.4	-
Modiolus[2]	Ipswich Bay	05/19/2022	<56	864	<5.0	<14.6	<4.7	<11.1	<4.3	-
Modiolus[2]	Ipswich Bay	11/15/2022	<72.6	1920	<3.7	<19.1	<3.6	<8.7	<3.5	-
Mytilus[2]	Ipswich Bay	05/09/2022	78.3	2340	<3.8	<14.5	<4.1	<8.5	<3.7	-
Mytilus[2]	Ipswich Bay	11/14/2022	<63.4	637	<3.6	<18.2	<3.4	<8.2	<3.1	-
Irish Moss[3]	Ipswich Bay	05/19/2022	125	6300	<6.9	<18.6	<6.6	<16.7	<6.5	<35.5
Irish Moss[3]	Ipswich Bay	11/15/2022	409	2580	<3.8	<10.2	<3.8	<8.7	<3.5	<26.3
Sediment	Ipswich Bay - subtidal	05/19/2022	-	17600	-	-	<31.7	-	<34.3	-
Sediment	Ipswich Bay - subtidal	11/16/2022	-	<1000	-	-	<27.9	-	<30.0	-
Sediment	Plum Island - beach	05/09/2022	-	15800	-	-	<16.3	-	<15.7	-
Sediment	Plum Island - beach	11/14/2022	-	25200	-	-	<22.1	-	<22.6	-
Strawberries	Bartlett Farm, Salisbury[4]	06/08/2022	<22.6	777	<2.8	<5.3	<2.6	<5.9	<2.4	-
Strawberries	Russell Orchards, Ipswich	06/08/2022	<32.9	2540	<3.8	<7.0	<4.1	<8.1	<4.1	-
Tomatoes	Bartlett Farm, Salisbury[4]	08/10/2022	<21.9	2600	<2.7	<5.7	<2.6	<3.2	<2.5	
Tomatoes	Russell Orchards, Ipswich	08/10/2022	<24.8	1120	<2.8	<6.0	<2.7	<6.8	<2.8	-
Zucchini	Bartlett Farm, Salisbury[4]	07/18/2022	<33.1	3080	<3.8	<8.3	<5.4	<9.2	<4.3	
Zucchini	Russell Orchards, Ipswich	07/20/2022	<27.3	2650	<3.3	<6.8	<3.6	<8.0	<3.7	

[1]All samples are background, except for produce samples from Bartlett Farm in Salisbury

[2]Mytilus (i.e., blue or common mussel) samples collected on Plum Island; Modiolus (i.e., Atlantic ribbed mussel) samples collected offshore.

[3]Sample not dried prior to analysis

[4]Indicator sample

-" = Not analyzed

* I-131 = iodine 131; Ba-140 = Barium 140; Be-7 = Beryllium 7; Co-60 = Cobalt 60; Cs-134 = Cesium 134; Cs-137=Cesium 137; Fe-59=Iron 59; H-3* = Tritium; K-40 = Potassium-40; Mn-54=Manganese-54; Zn-65=Zinc 65

"<" = value is less than the listed MDA (Minimum Detectable Activity) value

"NR"= result not reported for quality control reasons.