Environmental Monitoring Report

For 2021

Pilgrim and Seabrook

Nuclear Power Stations

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EXECUTIVE SUMMARY

The Massachusetts Department of Public Health (MDPH) Bureau of Environmental Health's (MDPH/BEH) 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 2021 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 2021 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/BEH 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/BEH or provided by the utilities that operate the nuclear power plants, are analyzed for radiation by the MDPH/BEH Massachusetts Environmental Radiation Laboratory (MERL). Environmental media analyzed in 2021 include: air, surface water, milk, fish, shellfish, sediment, vegetation and food crops. In addition to the samples analyzed for radiation by MERL, MDPH/BEH has a network of stationary monitors surrounding Pilgrim that measures gamma radiation in real-time. This network is monitored online by MDPH/BEH staff. The C-l0 Research & Education Foundation, Inc., a non-profit organization under contract to MDPH/BEH, conducts direct radiation monitoring in Massachusetts communities within the Seabrook EPZ and provides summary reports to MDPH/BEH.

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 2021 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/BEH 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/BEH 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 2021 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.

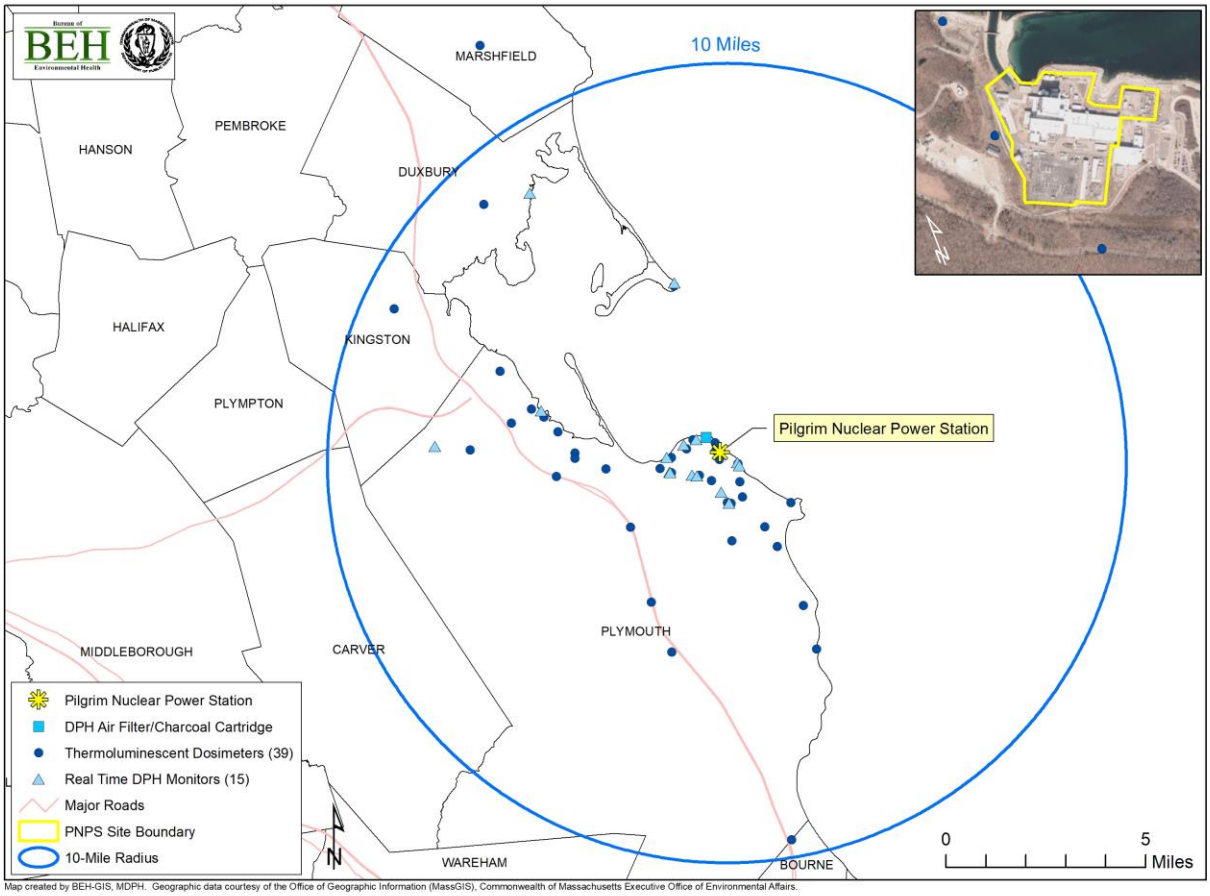

Figure 1. The MDPH/BEH Radiation -monitoring network at Pilgrim

In 2021, MDPH/BEH'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 mixed grasses/wild vegetation. Figure 1 shows locations of the air monitors for Pilgrim. Sample locations for water, fish, shellfish, sediment, food crops, and mixed grasses/wild vegetation are shown in Figure 2.

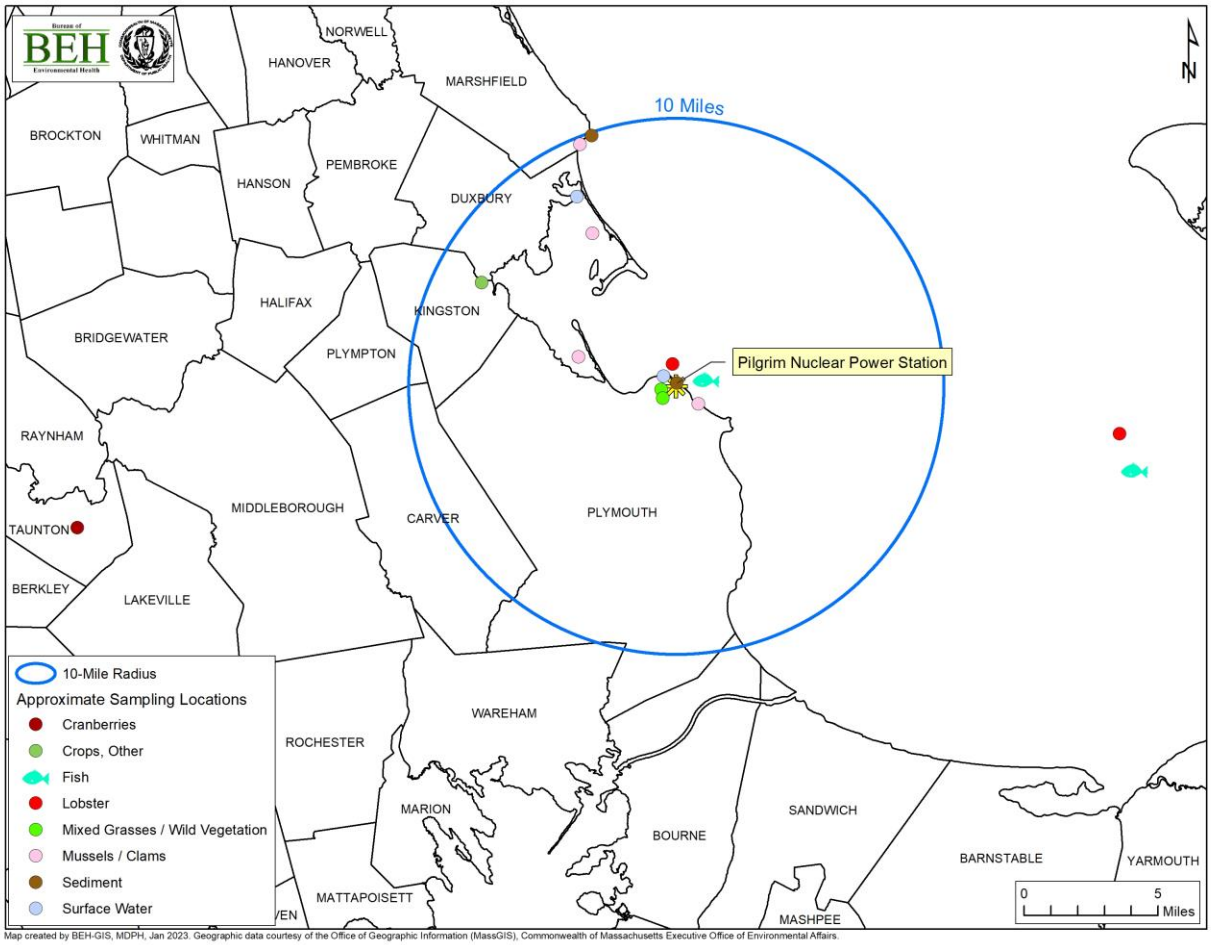

Figure 2. Pilgrim 10-mile radius and sampling locations

Air/Direct Radiation

MDPH/BEH'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/BEH maintains a network of 15 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/BEH completely replaced the older system with new monitors and servers and installed an internet-based communication system.

MDPH/BEH 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/BEH 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/BEH 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 2021 Holtec also provided MERL with split samples of background fish and lobster from Cape Cod Bay.

In 2021, 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/BEH because they fall within 10 miles of the plant. MERL analyzes the split samples for gamma-emitting radionuclides.

Sediment

In 2021 Holtec collected sediment samples from Green Harbor in Marshfield, Duxbury and the Pilgrim discharge canal; MERL analyzed the split samples.

Crops

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

In 2021 MDPH collected samples of strawberries, tomatoes, and zucchini during the growing season, from a farm in Kingston.

Mixed Grasses/Wild Vegetation

In 2021 MERL analyzed two split samples of mixed grasses/wild vegetation, collected by Holtec from the beach area at Pilgrim.

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).

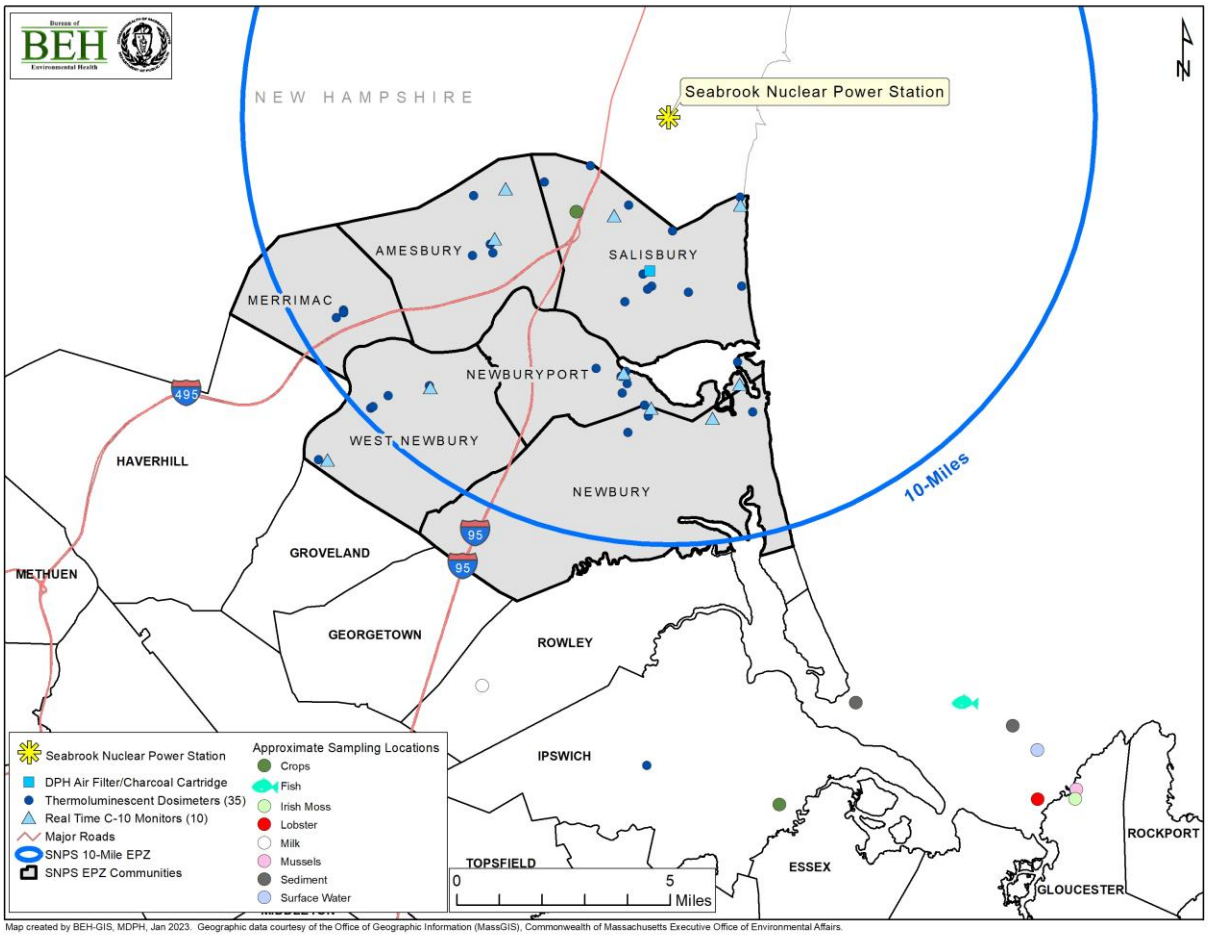

Figure 3. Seabrook EPZ and sampling locations within Massachusetts

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/BEH 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/BEH 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/BEH 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/BEH 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/BEH. 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/BEH 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 2021 MDPH collected cucumber, sugar snap peas, and zucchini, from a farm located within the Seabrook EPZ in Salisbury, and also collected cucumber, sugar snap peas, and tomatoes from a farm in Ipswich, which is outside the Seabrook EPZ.

3. 2021 ENVIRONMENTAL MONITORING RESULTS

Results of environmental monitoring conducted by MDPH/BEH 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 and consistent with levels detected in background samples.. Naturally occurring Potassium-40 was detected in all samples of environmental media analyzed for Potassium-40, except for the first quarter composite air sample. Naturally occurring Beryllium-7 was detected in: 1) all quarterly composite air samples; 2) clams from Duxbury; 3) mussels from the Pilgrim discharge canal; 4) strawberries; 5) mixed grass; and 6) 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 0.003 – 0.020 and 0.031 – 0.161 pico curies (pCi)/m^3, respectively. These levels are consistent with those measured at the background location in Boston, of 0.004 – 0.012 and 0.029 – 0.080 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 12.3 to 161 mRoentgen/quarter (i.e., 0.006 – 0.074 mRoentgen/hour) with an average of 17.0 mRoentgen/quarter (0.007 mRoentgen/hour). This value is compared to an average value of 18.2 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 161 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 19.5 mRoentgen/quarter for the same period. Excluding the quarterly value of 161 mRoentgen/quarter, the next highest value was 32.3 mRoentgen/quarter, measured at the onsite TLD.

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 except for the first quarterly composite air sample. 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 (0.003 – 0.056 pCi/m^3) and gross beta (0.027 – 0.485 pCi/m^3) radiation. The maximum levels are greater than levels measured at the background location in Boston, where gross alpha ranged from 0.004 – 0.012 pCi/m^3 and gross beta ranged from 0.029 – 0.080 pCi/m^3. The elevated levels measured within the Seabrook EPZ are due to low sample collection volumes for three samples, resulting in falsely high readings. Excluding the low volume samples, levels of gross alpha and beta within the Seabrook EPZ ranged from 0.003 – 0.015 pCi/m3, and 0.027 – 0.086 pCi/m3, respectively, consistent with background levels. No gamma radionuclides of concern were detected in quarterly composite air samples.

In 2021, 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 11.2 to 21.6 mRoentgen/quarter (0.005 – 0.010 mRoentgen/hour) with an average exposure of 17.3 mRoentgen/quarter (0.008 mRoentgen/hour), compared to an average of 18.2 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 2021 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 2021 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	01/05/2021	<0.0166	-	-	-	-	-	-	-	0.0086	0.0493
Air	Pilgrim Station	01/13/2021	<0.0136	-	-	-	-	-	-	-	0.0064	0.0478
Air	Pilgrim Station	01/21/2021	<0.0238	-	-	-	-	-	-	-	0.0155	0.0971
Air	Pilgrim Station	01/29/2021	<0.0228	-	-	-	-	-	-	-	0.0053	0.0446
Air	Pilgrim Station	02/02/2021	<0.0324	-	-	-	-	-	-	-	0.0088	0.0600
Air	Pilgrim Station	02/08/2021	<0.0397	-	-	-	-	-	-	-	0.0151	0.0924
Air	Pilgrim Station Quarterly Composite	2/15/2021	-	0.129	<0.028	<0.001	<0.005	<0.001	<0.002	<0.001	-	-
Air	Pilgrim Station	02/17/2021	<0.0108	-	-	-	-	-	-	-	0.0060	0.0604
Air	Pilgrim Station	02/25/2021	<0.0157	-	-	-	-	-	-	-	0.0081	0.0639
Air	Pilgrim Station	03/03/2021	<0.0184	-	-	-	-	-	-	-	0.0090	0.0653
Air	Pilgrim Station	03/11/2021	<0.0150	-	-	-	-	-	-	-	0.0085	0.0620
Air	Pilgrim Station	03/16/2021	<0.0611*	-	-	-	-	-	-	-	0.0201	0.1610
Air	Pilgrim Station	03/24/2021	<0.0569	-	-	-	-	-	-	-	0.0095	0.0860
Air	Pilgrim Station	03/31/2021	<0.0155	-	-	-	-	-	-	-	0.0052	0.0454
Air	Pilgrim Station	04/06/2021	<0.0150	-	-	-	-	-	-	-	0.0055	0.0454
Air	Pilgrim Station	04/14/2021	<0.0149	-	-	-	-	-	-	-	0.0033	0.0307
Air	Pilgrim Station	04/21/2021	<0.0128	-	-	-	-	-	-	-	0.0045	0.0314
Air	Pilgrim Station	04/28/2021	<0.0204	-	-	-	-	-	-	-	0.0090	0.0666
Air	Pilgrim Station	05/05/2021	<0.0138	-	-	-	-	-	-	-	0.0065	0.0537
Air	Pilgrim Station	05/12/2021	<0.0153	-	-	-	-	-	-	-	0.0045	0.0365
Air	Pilgrim Station Quarterly Composite	5/15/2021	-	0.143	0.128	<0.001	<0.005	<0.001	<0.002	<0.001	-	-
Air	Pilgrim Station	05/19/2021	<0.0179	-	-	-	-	-	-	-	0.0058	0.0615
Air	Pilgrim Station	05/26/2021	<0.0130	-	-	-	-	-	-	-	0.0044	0.0481
Air	Pilgrim Station	06/02/2021	<0.0131	-	-	-	-	-	-	-	0.0051	0.0425
Air	Pilgrim Station	06/10/2021	<0.0150	-	-	-	-	-	-	-	0.0050	0.0572
Air	Pilgrim Station	06/16/2021	<0.0174								0.0047	0.0476
Air	Pilgrim Station	06/23/2021	<0.0198	-	-	-	-	-	-	-	0.0045	0.0610
Air	Pilgrim Station	06/29/2021	<0.0178	-	-	-	-	-	-	-	0.0038	0.0533
Air	Pilgrim Station	07/07/2021	<0.0140	-	-	-	-	-	-	-	0.0065	0.0364
Air	Pilgrim Station	07/14/2021	<0.0125	-	-	-	-	-	-	-	0.0070	0.0390
Air	Pilgrim Station	07/21/2021	<0.0184	-	-	-	-	-	-	-	0.0096	0.0629

-" = 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	07/27/2021	<0.0190	-	-	-	-	-	-	-	0.0102	0.0628
Air	Pilgrim Station	08/04/2021	<0.0157	-	-	-	-	-	-	-	0.0079	0.0497
Air	Pilgrim Station	08/10/2021	<0.0189	-	-	-	-	-	-	-	0.0106	0.0752
Air	Pilgrim Station	08/18/2021	<0.0132	-	-	-	-	-	-	-	0.0066	0.0572
Air	Pilgrim Station Quarterly Composite	08/15/2021	-	0.132	0.155	<0.001	<0.011	<0.001	<0.002	<0.001	-	-
Air	Pilgrim Station	08/18/2021	<0.0132	-	-	-	-	-	-	-	0.0066	0.0572
Air	Pilgrim Station	08/25/2021	<0.0175	-	-	-	-	-	-	-	0.0081	0.0475
Air	Pilgrim Station	08/31/2021	<0.0214	-	-	-	-	-	-	-	0.0106	0.0829
Air	Pilgrim Station	09/08/2021	<0.0147	-	-	-	-	-	-	-	0.0068	0.0542
Air	Pilgrim Station	09/15/2021	<0.0165	-	-	-	-	-	-	-	0.0089	0.0787
Air	Pilgrim Station	09/22/2021	<0.0276	-	-	-	-	-	-	-	0.0074	0.0611
Air	Pilgrim Station	09/29/2021	<0.0134	-	-	-	-	-	-	-	0.0055	0.0645
Air	Pilgrim Station	10/06/2021	<0.0172	-	-	-	-	-	-	-	0.0078	0.0510
Air	Pilgrim Station	10/13/2021	<0.0179	-	-	-	-	-	-	-	0.0060	0.0477
Air	Pilgrim Station	10/20/2021	<0.0197	-	-	-	-	-	-	-	0.0090	0.0708
Air	Pilgrim Station	10/27/2021	<0.0174	-	-	-	-	-	-	-	0.0114	0.0789
Air	Pilgrim Station	11/03/2021	<0.0172	-	-	-	-	-	-	-	0.0094	0.0612
		11/10/2021	<0.0262	-	-	-	-	-	-	-	0.0122	0.0778
Air	Pilgrim Station Quarterly Composite	11/15/2021	-	0.090	0.159	<0.001	<0.006	<0.001	<0.002	<0.001	-	-
Air	Pilgrim Station	11/17/2021	<0.0174	-	-	-	-	-	-	-	0.0119	0.0684
Air	Pilgrim Station	11/23/2021	<0.0204	-	-	-	-	-	-	-	0.0144	0.0739
Air	Pilgrim Station	12/01/2021	<0.0148	-	-	-	-	-	-	-	0.0108	0.0689
Air	Pilgrim Station	12/09/2021	<0.0213	-	-	-	-	-	-	-	0.0095	0.0738
Air	Pilgrim Station	12/14/2021	<0.0275	-	-	-	-	-	-	-	0.0167	0.1020
Air	Pilgrim Station	12/22/2021	<0.0259	-	-	-	-	-	-	-	0.0093	0.0685
Air	Pilgrim Station	12/29/2021	<0.0178	-	-	-	-	-	-	-	0.0117	0.0845
Air	Background	01/04/2021	<0.0237	-	-	-	-	-	-	-	0.0092	0.0629
Air	Background	01/11/2021	<0.0164	-	-	-	-	-	-	-	0.0072	0.0502
Air	Background	01/19/2021	<0.0134	-	-	-	-	-	-	-	0.0091	0.0713
Air	Background	01/25/2021	<0.0193	-	-	-	-	-	-	-	0.0083	0.0563
Air	Background	02/03/2021	<0.0098	-	-	-	-	-	-	-	0.0042	0.0349
Air	Background	02/09/2021	<0.0154	-	-	-	-	-	-	-	0.0101	0.0632

-" = 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	02/15/2021	-	0.135	0.088	<0.001	<0.004	<0.001	<0.002	<0.0006	-	-
Air	Background	02/16/2021	<0.0169	-	-	-	-	-	-	-	0.0079	0.0700
Air	Background	02/22/2021	<0.0200	-	-	-	-	-	-	-	0.0086	0.0685
Air	Background	03/03/2021	<0.0100	-	-	-	-	-	-	-	0.0075	0.0573
Air	Background	03/10/2021	<0.0168	-	-	-	-	-	-	-	0.0086	0.0583
Air	Background	03/16/2021	<0.0195	-	-	-	-	-	-	-	0.0087	0.0621
Air	Background	03/23/2021	<0.0141	-	-	-	-	-	-	-	0.0071	0.0604
Air	Background	03/30/2021	<0.0160	-	-	-	-	-	-	-	0.0052	0.0487
Air	Background	04/07/2021	<0.0141	-	-	-	-	-	-	-	0.0069	0.0450
Air	Background	04/12/2021	<0.0233	-	-	-	-	-	-	-	0.0059	0.0415
Air	Background	04/20/2021	<0.0134	-	-	-	-	-	-	-	0.0046	0.0287
Air	Background	04/27/2021	<0.0127	-	-	-	-	-	-	-	0.0065	0.0506
Air	Background	05/04/2021	<0.0132	-	-	-	-	-	-	-	0.0062	0.0468
Air	Background	05/12/2021	<0.0159	-	-	-	-	-	-	-	0.0051	0.0306
Air	Background Quarterly Composite	5/15/2021	-	0.117	0.094	<0.001	<0.003	<0.001	<0.001	<0.0005	-	-
Air	Background	05/18/2021	<0.0156	-	-	-	-	-	-	-	0.0085	0.0565
Air	Background	05/25/2021	<0.0147	-	-	-	-	-	-	-	0.0069	0.0494
Air	Background	06/01/2021	<0.0148	-	-	-	-	-	-	-	0.0070	0.0379
Air	Background	06/08/2021	<0.0166	-	-	-	-	-	-	-	0.0063	0.0647
Air	Background	06/16/2021	<0.0131	-	-	-	-	-	-	-	0.0050	0.0462
Air	Background	06/22/2021	<0.0162	-	-	-	-	-	-	-	0.0056	0.0535
Air	Background	06/29/2021	<0.0162	-	-	-	-	-	-	-	0.0062	0.0473
Air	Background	07/06/2021	<0.0122	-	-	-	-	-	-	-	0.0054	0.0358
Air	Background	07/13/2021	<0.0170	-	-	-	-	-	-	-	0.0068	0.0485
Air	Background	07/20/2021	<0.0156	-	-	-	-	-	-	-	0.0059	0.0440
Air	Background	07/27/2021	<0.0144	-	-	-	-	-	-	-	0.0081	0.0437
Air	Background	08/03/2021	<0.0177	-	-	-	-	-	-	-	0.0075	0.0587
Air	Background			-	-	-	-	-	-	-	0.0084	0.0607
Air	Background Quarterly Composite	08/15/2021	-	0.113	<0.016	<0.001	<0.004	<0.001	<0.001	<0.0006	-	-
Air	Background	08/17/2021	<0.0139	-	-	-	-	-	-	-	0.0086	0.0572
Air	Background	08/24/2021	<0.0175	-	-	-	-	-	-	-	0.0071	0.0487

-" = 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	08/31/2021	<0.0169	-	-	-	-	-	-	-	0.0099	0.0762
Air	Background	09/07/2021	<0.0184	-	-	-	-	-	-	-	0.0084	0.0541
Air	Background	09/14/2021	<0.0138	-	-	-	-	-	-	-	0.0083	0.0753
Air	Background	09/21/2021	<0.0148	-	-	-	-	-	-	-	0.0075	0.0723
Air	Background	09/29/2021	<0.0142	-	-	-	-	-	-	-	0.0062	0.0606
Air	Background	10/06/2021	<0.0163	-	-	-	-	-	-	-	0.0092	0.0521
Air	Background	10/12/2021	<0.0190	-	-	-	-	-	-	-	0.0095	0.0546
Air	Background	10/19/2021	<0.0167	-	-	-	-	-	-	-	0.0123	0.0637
Air	Background	10/26/2021	<0.0160	-	-	-	-	-	-	-	0.0120	0.0800
Air	Background	11/02/2021	<0.0172	-	-	-	-	-	-	-	0.0088	0.0516
Air	Background	11/09/2021	<0.0132	-	-	-	-	-	-	-	0.0089	0.0657
Air	Background Quarterly Composite	11/15/2021	-	0.082	0.156	<0.001	<0.006	<0.001	<0.002	<0.0005	-	-
Air	Background	11/16/2021	<0.0158	-	-	-	-	-	-	-	0.0107	0.0743
Air	Background	11/23/2021	<0.0162	-	-	-	-	-	-	-	0.0084	0.0620
Air	Background	11/30/2021	<0.0157	-	-	-	-	-	-	-	0.0093	0.0572
Air	Background	12/07/2021	<0.0160	-	-	-	-	-	-	-	0.0086	0.0613
Air	Background	12/16/2021	<0.0190	-	-	-	-	-	-	-	0.0059	0.0565
Air	Background	12/21/2021	<0.0207	-	-	-	-	-	-	-	0.0084	0.0725
Air	Background	12/28/2021	<0.0189	-	-	-	-	-	-	-	0.0072	0.0698

-" = 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 2021 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	01/15/2021	304	<2.7	<7.6	<2.7	<5.5	NR	<2.6	<300
Surface water	Discharge Canal	02/15/2021	287	<3.7	<18.8	<2.7	<7.6	NR	<3.1	<300
Surface water	Discharge Canal	03/15/2021	382	<3.2	<13.5	<2.8	<7.3	NR	<3.0	<300
Surface water	Discharge Canal	04/15/2021	1590	<3.3	<12.0	<3.1	<6.8	NR	<2.9	<300
Surface water	Discharge Canal	05/15/2021	701	<2.5	<7.9	<2.7	<5.9	NR	<2.5	<300
Surface water	Discharge Canal	06/15/2021	1560	<3.2	<8.6	<2.8	<7.2	NR	<3.0	<300
Surface water	Discharge Canal	07/15/2021	1480	<3.1	<8.3	<2.8	<6.8	<19.0	<2.9	<300
Surface water	Discharge Canal	08/15/2021	270	<2.9	<10.8	<3.0	<6.3	NR	<2.8	<300
Surface water	Discharge Canal	09/15/2021	698	<2.6	<8.9	<2.7	<6.0	NR	<2.7	<300
Surface water	Discharge Canal	10/15/2021	1030	<3.9	NR	<3.5	<8.4	NR	<3.6	<300
Surface water	Discharge Canal	11/15/2021	860	<3.0	<13.0	<2.8	<6.5	NR	<2.7	<300
Surface water	Discharge Canal	12/15/2021	909	<2.8	<9.9	<2.6	<6.6	NR	<2.6	<300
Surface water	Powder Point Bridge[1]	01/15/2021	299	<3.2	<10.3	<2.9	<6.4	NR	<2.9	<300
Surface water	Powder Point Bridge[1]	02/15/2021	298	<2.6	<15.2	<2.8	<6.5	NR	<2.5	<300
Surface water	Powder Point Bridge[1]	03/15/2021	1490	<3.3	<13.1	<3.0	<7.1	NR	<3.0	<300
Surface water	Powder Point Bridge[1]	04/15/2021	356	<2.8	<10.5	<2.8	<5.4	NR	<2.6	<300
Surface water	Powder Point Bridge[1]	05/15/2021	1510	<3.0	<9.8	<2.8	<7.0	NR	<3.0	<300
Surface water	Powder Point Bridge[1]	06/15/2021	700	<2.6	<8.1	<2.7	<5.8	NR	<2.8	<300
Surface water	Powder Point Bridge[1]	07/15/2021	675	<2.6	<6.4	<2.7	<5.3	<13.5	<2.8	<300
Surface water	Powder Point Bridge[1]	08/15/2021	256	<2.5	<9.2	<2.6	<6.1	NR	<2.7	<300
Surface water	Powder Point Bridge[1]	09/15/2021	718	<2.7	<8.2	<2.8	<5.9	NR	<2.6	<300
Surface water	Powder Point Bridge[1]	10/15/2021	954	<3.0	<19.6	<2.9	<6.8	NR	<2.7	<300
Surface water	Powder Point Bridge[1]	11/15/2021	1040	<3.7	<16.9	<3.2	<7.9	NR	<3.6	<300
Surface water	Powder Point Bridge[1]	12/15/2021	1230	<3.8	<14.5	<3.5	<8.2	NR	<3.7	<300

[1]Sample considered "background" for the purpose of NRC regulations, but considered "indicator" by MDPH because it falls within 10-mile 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 4. Pilgrim Nuclear Power Station 2021 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)
Atlantic Menhaden	Cape Cod Bay (background)	11/16/2021	<882	10300	<38.1	NR	<34.9	<88.6	<30.8
Flounder	Cape Cod Bay (background)	11/09/2021	<936	12700	<34.7	<269	<29.8	<82.1	<30.7
Lobster	Cape Cod Bay (background)	07/24/2021	<39.3	2250	<4.0	<11.2	<4.5	<9.1	<4.2
Lobster	PNPS Discharge Canal	07/24/2021	<46.4	4420	<5.1	<13.1	<4.8	<11.1	<4.7
Mytilus[1]	Green Harbor, Marshfield[2]	04/30/2021	<71	1700	<5.3	<21.5	<4.8	<12.0	<4.5
Mytilus[1]	Green Harbor, Marshfield[2]	11/08/2021	<162	2640	<7.2	<49.0	<5.7	<16.0	<5.3
Mytilus[1]	Pilgrim Discharge Canal	06/08/2021	<48	1510	<4.8	<11.3	<4.9	<11.0	<4.7
Mytilus[1]	Pilgrim Discharge Canal	11/10/2021	<138	2390	<6.6	<41.0	<6.3	<15.6	<5.2
Softshell Clams	Duxbury[2]	04/30/2021	81.9	1830	<3.8	<16.8	<4.1	<10.3	<3.9
Softshell Clams	Duxbury[2]	12/03/2021	177	3120	<7.2	<35.3	<6.9	<15.7	<7.1
Softshell Clams	Plymouth Harbor	04/29/2021	<72	1570	<4.6	<18.9	<4.7	<11.5	<4.5
Softshell Clams	Plymouth Harbor	11/04/2021	<152	2500	<6.0	<48.8	<5.0	<13.8	<4.8
Sediment	Green Harbor, Marshfield[2]	04/30/2021	-	138000	-	-	<237	-	NR
Sediment	Green Harbor, Marshfield[2]	11/08/2021	-	15100	-	-	<23.5	-	<22.4
Sediment	PNPS Discharge Canal	06/08/2021	-	8980	-	-	<17.1	-	<17.0
Sediment	PNPS Discharge Canal	11/10/2021	-	14100	-	-	<19.0	-	<17.8
Cranberries	E. Taunton (background)	10/04/2021	453	12000	<38.0	<77.6	<42.7	<78.3	<41.0
Strawberries	Cretinon's Farm, Kingston	06/10/2021	16.0	1530	<4.5	<9.4	<4.68	<10.1	<4.2
Tomatoes	Cretinon's Farm, Kingston	08/10/2021	<25.7	3320	<3.3	<6.5	<3.16	<7.1	<3.3
Zucchini	Cretinon's Farm, Kingston	07/07/2021	<37.3	3550	<4.1	<6.2	<4.73	<10.0	<4.7
Mixed Grasses	Pilgrim Beach[3]	10/20/2021	3290	2440	<14.4	<28.8	<15.7	<33.2	<14.9
Mixed Grasses	Pilgrim Beach[4]	10/20/2021	6700	8440	<25.8	<58.1	<28.9	<59.1	<28.4

[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
[3]Sample collected near doghouse
[4]Sample collected near TLD 21

-" = 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 2021 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	01/05/2021	<0.0384	-	-	-	-	-	-	-	0.0113	0.0673
Air	Salisbury Fire Station	01/12/2021	<0.0258								0.0085	0.0516
Air	Salisbury Fire Station	01/19/2021	<0.0205								0.0100	0.0647
Air	Salisbury Fire Station	01/26/2021	<0.0344								0.0080	0.0503
Air	Salisbury Fire Station	02/02/2021	<0.0237								0.0066	0.0390
Air	Salisbury Fire Station	02/11/2021	<0.0172								0.0076	0.0504
Air	Salisbury Fire Station Quarterly Composite	02/15/2021	-	0.097	<0.018	<0.001	<0.004	<0.001	<0.002	<0.001	-	-
Air	Salisbury Fire Station	02/16/2021	<0.0287	-	-	-	-	-	-	-	0.0130	0.0807
Air	Salisbury Fire Station	02/23/2021	<0.0186	-	-	-	-	-	-	-	0.0084	0.0858
Air	Salisbury Fire Station	03/03/2021	<0.0355	-	-	-	-	-	-	-	0.0076	0.0587
Air	Salisbury Fire Station	03/09/2021	<0.0202	-	-	-	-	-	-	-	0.0063	0.0680
Air	Salisbury Fire Station	03/15/2021	<0.0273	-	-	-	-	-	-	-	0.0091	0.0708
Air	Salisbury Fire Station	03/23/2021	<0.0176	-	-	-	-	-	-	-	0.0080	0.0559
Air	Salisbury Fire Station	03/30/2021	<0.0218	-	-	-	-	-	-	-	0.0079	0.0545
Air	Salisbury Fire Station	04/05/2021	<0.0223	-	-	-	-	-	-	-	0.0075	0.0690
Air	Salisbury Fire Station	04/13/2021	<0.0329	-	-	-	-	-	-	-	0.0038	0.0265
Air	Salisbury Fire Station	04/23/2021	<0.2330	-	-	-	-	-	-	-	0.0564[a]	0.4850[a]
Air	Salisbury Fire Station	04/28/2021	<0.0198	-	-	-	-	-	-	-	0.0058	0.0368
Air	Salisbury Fire Station	05/12/2021	<0.0105	-	-	-	-	-	-	-	0.0034	0.0334
Air	Salisbury Fire Station Quarterly Composite	05/15/2021	-	0.137	0.355	<0.001	<0.006	<0.001	<0.002	<0.001	-	-
Air	Salisbury Fire Station	05/18/2021	<0.0218	-	-	-	-	-	-	-	0.0079	0.0651
Air	Salisbury Fire Station	05/26/2021	<0.0164	-	-	-	-	-	-	-	0.0063	0.0557
Air	Salisbury Fire Station	06/01/2021	<0.0163	-	-	-	-	-	-	-	0.0049	0.0675
Air	Salisbury Fire Station	06/09/2021	<0.0125	-	-	-	-	-	-	-	0.0040	0.0658
Air	Salisbury Fire Station	06/15/2021	<0.0193	-	-	-	-	-	-	-	0.0050	0.0493
Air	Salisbury Fire Station	06/24/2021	<0.0147	-	-	-	-	-	-	-	0.0033	0.0477
Air	Salisbury Fire Station	06/29/2021	<0.0184	-	-	-	-	-	-	-	0.0068	0.0723
Air	Salisbury Fire Station	07/8/2021	<0.1030[b]	-	-	-	-	-	-	-	0.0232[b]	0.1550[b]
Air	Salisbury Fire Station	07/16/2021	<0.0211	-	-	-	-	-	-	-	0.0056	0.0464
Air	Salisbury Fire Station	07/22/2021	<0.0320	-	-	-	-	-	-	-	0.0075	0.0643
Air	Salisbury Fire Station	07/27/2021	<0.0466	-	-	-	-	-	-	-	0.0104	0.0768

-" = 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	08/4/2021	<0.0730	-	-	-	-	-	-	-	0.0229[b]	0.1310[b]
Air	Salisbury Fire Station Quarterly Composite	08/15/2021	-	0.131	0.244	<0.001	<0.016	<0.001	<0.003	<0.001	-	-
Air	Salisbury Fire Station	08/18/2021	<0.0186	-	-	-	-	-	-	-	0.0073	0.0515
Air	Salisbury Fire Station	08/26/2021	<0.0191	-	-	-	-	-	-	-	0.0066	0.0528
Air	Salisbury Fire Station	08/31/2021	<0.0318	-	-	-	-	-	-	-	0.0071	0.0796
Air	Salisbury Fire Station	09/07/2021	<0.0155	-	-	-	-	-	-	-	0.0057	0.0597
Air	Salisbury Fire Station	09/15/2021	<0.0162	-	-	-	-	-	-	-	0.0052	0.0713
Air	Salisbury Fire Station	09/21/2021	<0.0200[b]	-	-	-	-	-	-	-	0.0097	0.0729
Air	Salisbury Fire Station	09/29/2021	<0.0145	-	-	-	-	-	-	-	0.0053	0.0650
Air	Salisbury Fire Station	10/04/2021	<0.0259	-	-	-	-	-	-	-	0.0082	0.0556
Air	Salisbury Fire Station	10/13/2021	<0.0157	-	-	-	-	-	-	-	0.0038	0.0398
Air	Salisbury Fire Station	10/22/2021	<0.0337	-	-	-	-	-	-	-	0.0059	0.0647
Air	Salisbury Fire Station	10/27/2021	<0.0254	-	-	-	-	-	-	-	0.0079	0.0602
Air	Salisbury Fire Station	11/01/2021	<0.0269								0.0064	0.0641
Air	Salisbury Fire Station	11/10/2021	<0.0198	-	-	-	-	-	-	-	0.0052	0.0604
Air	Salisbury Fire Station Quarterly Composite	11/15/2021	-	0.111	0.122	<0.001	<0.008	<0.001	<0.002	<0.001	-	-
Air	Salisbury Fire Station	11/15/2021	<0.0289	-	-	-	-	-	-	-	0.0077	0.0726
Air	Salisbury Fire Station	11/24/2021	<0.0231	-	-	-	-	-	-	-	0.0053	0.0468
Air	Salisbury Fire Station	12/01/2021	<0.0192	-	-	-	-	-	-	-	0.0091	0.0640
Air	Salisbury Fire Station	12/08/2021	<0.0344	-	-	-	-	-	-	-	0.0110	0.0811
Air	Salisbury Fire Station	12/13/2021	<0.0366	-	-	-	-	-	-	-	0.0147	0.0861
Air	Salisbury Fire Station	12/22/2021	<0.0234	-	-	-	-	-	-	-	0.0069	0.0672
Air	Salisbury Fire Station	12/29/2021	[c]	-	-	-	-	-	-	-	0.0060	0.0593
Air	Background	01/04/2021	<0.0237	-	-	-	-	-	-	-	0.0092	0.0629
Air	Background	01/11/2021	<0.0164	-	-	-	-	-	-	-	0.0072	0.0502
Air	Background	01/19/2021	<0.0134	-	-	-	-	-	-	-	0.0091	0.0713
Air	Background	01/25/2021	<0.0193	-	-	-	-	-	-	-	0.0083	0.0563
Air	Background	02/03/2021	<0.0098	-	-	-	-	-	-	-	0.0042	0.0349
Air	Background	02/09/2021	<0.0154	-	-	-	-	-	-	-	0.0101	0.0632
Air	Background Quarterly Composite	02/15/2021	-	0.135	0.088	<0.001	<0.004	<0.001	<0.002	<0.0006	-	-
Air	Background	02/16/2021	<0.0169	-	-	-	-	-	-	-	0.0079	0.0700

-" = 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	02/22/2021	<0.0200	-	-	-	-	-	-	-	0.0086	0.0685
Air	Background	03/03/2021	<0.0100	-	-	-	-	-	-	-	0.0075	0.0573
Air	Background	03/10/2021	<0.0168	-	-	-	-	-	-	-	0.0086	0.0583
Air	Background	03/16/2021	<0.0195	-	-	-	-	-	-	-	0.0087	0.0621
Air	Background	03/23/2021	<0.0141	-	-	-	-	-	-	-	0.0071	0.0604
Air	Background	03/30/2021	<0.0160	-	-	-	-	-	-	-	0.0052	0.0487
Air	Background	04/07/2021	<0.0141	-	-	-	-	-	-	-	0.0069	0.0450
Air	Background	04/12/2021	<0.0233	-	-	-	-	-	-	-	0.0059	0.0415
Air	Background	04/20/2021	<0.0134	-	-	-	-	-	-	-	0.0046	0.0287
Air	Background	04/27/2021	<0.0127	-	-	-	-	-	-	-	0.0065	0.0506
Air	Background	05/04/2021	<0.0132	-	-	-	-	-	-	-	0.0062	0.0468
Air	Background	05/12/2021	<0.0159	-	-	-	-	-	-	-	0.0051	0.0306
Air	Background Quarterly Composite	5/15/2021	-	0.117	0.094	<0.001	<0.003	<0.001	<0.001	<0.0005	-	-
Air	Background	05/18/2021	<0.0156	-	-	-	-	-	-	-	0.0085	0.0565
Air	Background	05/25/2021	<0.0147	-	-	-	-	-	-	-	0.0069	0.0494
Air	Background	06/01/2021	<0.0148	-	-	-	-	-	-	-	0.0070	0.0379
Air	Background	06/08/2021	<0.0166	-	-	-	-	-	-	-	0.0063	0.0647
Air	Background	06/16/2021	<0.0131	-	-	-	-	-	-	-	0.0050	0.0462
Air	Background	06/22/2021	<0.0162	-	-	-	-	-	-	-	0.0056	0.0535
Air	Background	06/29/2021	<0.0162	-	-	-	-	-	-	-	0.0062	0.0473
Air	Background	07/06/2021	<0.0122	-	-	-	-	-	-	-	0.0054	0.0358
Air	Background	07/13/2021	<0.0170	-	-	-	-	-	-	-	0.0068	0.0485
Air	Background	07/20/2021	<0.0156	-	-	-	-	-	-	-	0.0059	0.0440
Air	Background	07/27/2021	<0.0144	-	-	-	-	-	-	-	0.0081	0.0437
Air	Background	08/03/2021	<0.0177	-	-	-	-	-	-	-	0.0075	0.0587
Air	Background	08/10/2021	<0.0193	-	-	-	-	-	-	-	0.0084	0.0607
Air	Background Quarterly Composite	08/15/2021	-	0.113	<0.016	<0.001	<0.004	<0.001	<0.001	<0.0006	-	-
Air	Background	08/17/2021	<0.0139	-	-	-	-	-	-	-	0.0086	0.0572
Air	Background	08/24/2021	<0.0175	-	-	-	-	-	-	-	0.0071	0.0487
Air	Background	08/31/2021	<0.0169	-	-	-	-	-	-	-	0.0099	0.0762
Air	Background	09/07/2021	<0.0184	-	-	-	-	-	-	-	0.0084	0.0541
Air	Background	09/14/2021	<0.0138	-	-	-	-	-	-	-	0.0083	0.0753

-" = 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	09/21/2021	<0.0148	-	-	-	-	-	-	-	0.0075	0.0723
Air	Background	09/29/2021	<0.0142	-	-	-	-	-	-	-	0.0062	0.0606
Air	Background	10/06/2021	<0.0163	-	-	-	-	-	-	-	0.0092	0.0521
Air	Background	10/12/2021	<0.0190	-	-	-	-	-	-	-	0.0095	0.0546
Air	Background	10/19/2021	<0.0167	-	-	-	-	-	-	-	0.0123	0.0637
Air	Background	10/26/2021	<0.0160	-	-	-	-	-	-	-	0.0120	0.0800
Air	Background	11/02/2021	<0.0172	-	-	-	-	-	-	-	0.0088	0.0516
Air	Background	11/09/2021	<0.0132	-	-	-	-	-	-	-	0.0089	0.0657
Air	Background Quarterly Composite	11/15/2021	-	0.082	0.156	<0.001	<0.006	<0.001	<0.002	<0.0005	-	-
Air	Background	11/16/2021	<0.0158	-	-	-	-	-	-	-	0.0107	0.0743
Air	Background	11/23/2021	<0.0162	-	-	-	-	-	-	-	0.0084	0.0620
Air	Background	11/30/2021	<0.0157	-	-	-	-	-	-	-	0.0093	0.0572
Air	Background	12/07/2021	<0.0160	-	-	-	-	-	-	-	0.0086	0.0613
Air	Background	12/16/2021	<0.0190	-	-	-	-	-	-	-	0.0059	0.0565
Air	Background	12/21/2021	<0.0207	-	-	-	-	-	-	-	0.0084	0.0725
Air	Background	12/28/2021	<0.0189	-	-	-	-	-	-	-	0.0072	0.0698

[a] Low volume sample due to equipment failure
[b] Low volume sample due to power interruption
[c] Sample not collected

-" = 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 2021 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]	01/11/2021	278	<2.5	<6.7	<2.6	<5.5	<16.1	-	<2.6	-	<300
Surface water	Ipswich bay[1]	02/10/2021	341	<3.1	<7.1	<2.7	<6.4	<19.5	-	<3.1	-	<300
Surface water	Ipswich bay[1]	03/18/2021	365	<3.3	<14.4	<2.9	<7.2	NR	-	<3.1	-	<300
Surface water	Ipswich bay[1]	04/21/2021	305	<2.4	<6.9	<2.7	<6.0	<23.6	-	<2.5	-	<300
Surface water	Ipswich bay[1]	05/11/2021	1480	<3.2	<12.6	<2.8	<7.3	NR	-	<3.0	-	<300
Surface water	Ipswich bay[1]	06/14/2021	1490	<3.3	<10.6	<3.1	<7.2	NR	-	<3.0	-	<300
Surface water	Ipswich bay[1]	07/14/2021	1280	<3.3	<10.7	<3.0	<7.0	NR	-	<3.1	-	<300
Surface water	Ipswich bay[1]	08/09/2021	634	<3.0	<14.8	<2.9	<6.2	NR	-	<2.8	-	<300
Surface water	Ipswich bay[1]	09/15/2021	308	<2.7	<9.5	<2.7	<6.1	NR	-	<2.7	-	<300
Surface water	Ipswich bay[1]	10/12/2021	304	<2.7	<7.6	<2.8	<5.7	<25.3	-	<2.7	-	<300
Surface water	Ipswich bay[1]	11/17/2021	963	<2.9	<16.4	<2.6	<6.6	NR	-	<2.6	-	<300
Surface water	Ipswich bay[1]	12/09/2021	1120	<3.7	<16.7	<3.7	<8.6	NR	-	<3.6	-	<300
Milk	Rowley	01/12/2021	1470	-	-	-	-	<3.8	<2.8	<3.1	<12.0	-
Milk	Rowley	02/16/2021	1450	-	-	-	-	<3.5	<2.7	<3.0	<11.0	-
Milk	Rowley	03/23/2021	1790	-	-	-	-	<2.4	<2.5	<2.9	<9.5	-
Milk	Rowley	04/06/2021	1410	-	-	-	-	<3.4	<2.7	<3.2	<11.1	-
Milk	Rowley	05/04/2021	1520	-	-	-	-	<3.6	<2.7	<3.1	<11.2	-
Milk	Rowley	06/09/2021	1420	-	-	-	-	<4.5	<2.4	<2.8	<13.3	-
Milk	Rowley	6/29/2021[a]	1770	-	-	-	-	<2.4	<2.3	<2.8	<9.1	-
Milk	Rowley	08/04/2021	2630	-	-	-	-	<3.4	<2.7	<3.0	<10.9	-
Milk	Rowley	09/07/2021	2620	-	-	-	-	<3.5	<2.8	<3.2	<11.2	-
Milk	Rowley	10/04/2021	1780	-	-	-	-	<2.7	<2.5	<3.0	<10.9	-
Milk	Rowley	11/10/2021	1510	-	-	-	-	NR	<2.7	<2.7	NR	-
Milk	Rowley	12/01/2021	2090	-	-	-	-	NR	<3.5	<3.7	NR	-

[1]Background sample

[a] July sample, collected early due to holiday and staffing

-" = 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 2021 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)
Cod	Ipswich Bay	02/08/2021	<1020	13500	<36.2	<310	<25.4	<79.7	<27.2	-
Longhorn Sculpin	Ipswich Bay	05/11/2021	<716	3520	<46.4	<193	<37.5	<98.7	<39.9	-
Window Pane Flounder	Ipswich Bay	11/11/2021	<1170	12600	<46.0	<350	<38.4	<111	<38.9	
Winter Flounder	Ipswich Bay	08/25/2021	<232	8140	<26.8	<50.8	<27.2	<56.0	<28.1	
Lobster	Ipswich Bay	05/23/2021	<116	4610	<5.9	<36.7	<5.2	<14.7	<4.9	-
Lobster	Ipswich Bay	11/15/2021	<224	4620	<8.9	<73.4	<8.3	<21.6	<8.0	-
Modiolus[2]	Ipswich Bay	05/11/2021	<72.2	1820	<4.2	<20.4	<4.1	<10.1	<3.8	-
Modiolus[2]	Ipswich Bay	11/17/2021	<1.1	2820	<3.1	<0.1	<6.0	<5.7	<6.3	-
Mytilus[2]	Ipswich Bay	05/23/2021	66	1520	<4.1	<10.0	<4.6	<8.8	<4.4	-
Mytilus[2]	Ipswich Bay	11/15/2021	<85.0	1080	<4.9	<25.3	<4.1	<10.5	<4.0	-
Sediment	Ipswich Bay - subtidal	05/11/2021	-	8790	-	-	<22.1	-	<22.0	-
Sediment	Ipswich Bay - subtidal	11/17/2021	-	17600	-	-	<30.1	-	<32.9	-
Sediment	Plum Island - beach	05/11/2021	-	24500	-	-	<18.7	-	<17.0	-
Sediment	Plum Island - beach	11/15/2021	-	20300	-	-	<29.3	-	<28.9	-
Irish Moss[3]	Ipswich Bay	5/11/2021	245	7800	<8.2	<23.2	<8.1	<20.2	NR	<8.2
Cucumber	Bartlett Farm, Salisbury[4]	08/18/2021	<40.6	3190	<4.8	<9.0	<4.8	<10.7	<4.7	-
Cucumber	Russell Orchards, Ipswich	08/18/2021	<31.4	2160	<4.2	<8.1	<4.4	<9.7	<4.2	-
Sugar Snap Peas	Bartlett Farm, Salisbury[4]	06/24/2021	<42.5	4230	<4.7	<9.8	<4.6	<10.2	<4.6	-
Sugar Snap Peas	Russell Orchards, Ipswich	06/24/2021	<42.3	2590	<4.4	<10.2	<4.5	<9.7	<4.4	-
Tomatoes	Russell Orchards, Ipswich	07/07/2021	<29.6	2290	<3.5	<7.5	<3.7	<7.7	<3.8	-
Zucchini	Bartlett Farm, Salisbury[4]	07/07/2021	<32.1	385	<4.0	<8.5	<3.8	<8.4	<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.