NEXTera ENERGY
POINT BEACH

April 14, 2022

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U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

Point Beach Nuclear Plant, Units 1 and 2
Dockets 50-266, 50-301 and 72-005
Renewed License Nos. DPR-24 and DPR-27

2021 Annual Monitoring Report

Enclosed is the Annual Monitoring Report for PBNP Units 1 and 2, for the period January 1 through December 31, 2021.

This letter contains no new regulatory commitments and no revisions to existing regulatory commitments.

Sincerely,
NextEra Energy Point Beach, LLC

Kim Locke for Eric Schultz

Eric Schultz
Licensing Manager

Enclosure

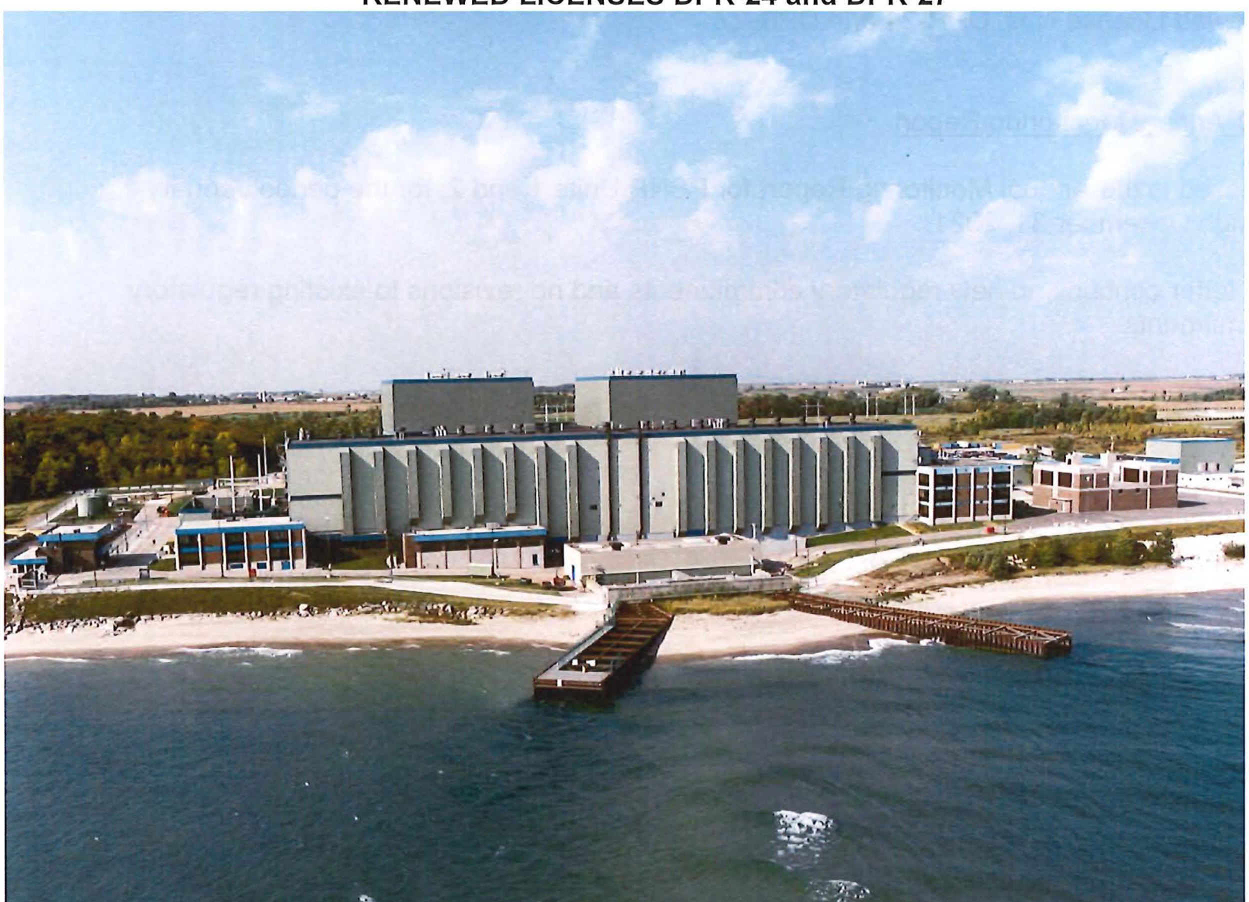
cc: Administrator, Region III, USNRC
Project Manager, Point Beach Nuclear Plant, USNRC
Resident Inspector, Point Beach Nuclear Plant, USNRC
PSCW
American Nuclear Insurers
WI Division of Public Health, Radiation Protection Section
Office of Nuclear Material Safety and Safeguards, USNRC

ENCLOSURE

ANNUAL MONITORING REPORT 2021

NEXTERA ENERGY POINT BEACH, LLC
POINT BEACH NUCLEAR PLANT

DOCKETS 50-266 (UNIT 1), 50-301 (UNIT 2), 72-005 (ISFSI)
RENEWED LICENSES DPR-24 and DPR-27



January 1, 2021 through December 31, 2021

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SUMMARY

The Annual Monitoring Report for the period from January 1, 2021, through December 31, 2021, is submitted in accordance with Point Beach Nuclear Plant (PBNP) Units 1 and 2, Technical Specification 5.6.2 and filed under Dockets 50-266 and 50-301 for Renewed Facility Operating Licenses DPR-24 and DPR-27, respectively. It also contains results of monitoring in support of the Independent Spent Fuel Storage Installation (ISFSI) Docket 72-005. The report presents the results of effluent and environmental monitoring programs, solid waste shipments, non-radioactive chemical releases, and circulating water system operation.

During 2021, the following Curies (Ci) of radioactive material were released via the liquid and atmospheric pathways:

	Liquid	Atmospheric
Tritium (Ci)	895	69.1
[1]Particulate (Ci)	0.0381	0.0000216
Noble Gas (Ci)	0.00978	0.889
C-14[2]	0.0299	10.87

[1]Atmospheric particulate includes radioiodine (I-131 - I-133).
[2]Liquid is measured, atmospheric is calculated.

For the purpose of compliance with the effluent design objectives of Appendix I to 10 CFR 50, doses from effluents are calculated for the hypothetical maximally exposed individual (MEI) for each age group and compared to the Appendix I objectives. Doses less than or equal to the Appendix I values are considered to be evidence that PBNP releases are as low as reasonably achievable (ALARA) and comply with the EPA's limits in 40CFR190. The maximum annual calculated doses in millirem (mrem) or millirad (mrad) are shown below and compared to the corresponding design objectives of 10 CFR 50, Appendix I.

LIQUID RELEASES

Dose Category	Calculated Dose	Appendix I Dose	% Appendix I
Whole body dose	0.00196 mrem	6 mrem	0.033
Organ dose	0.00214 mrem	20 mrem	0.011

ATMOSPHERIC RELEASES

Dose Category	Calculated Dose	Appendix I Dose	% Appendix I
Particulate organ dose	0.00853 mrem	30 mrem	0.0284
Noble gas beta air dose	0.0000509 mrad	40 mrad	0.00013
Noble gas gamma ray air dose	0.000127 mrad	20 mrad	0.00063
Noble gas dose to the skin	0.000177 mrem	30 mrem	0.00059
Noble gas dose to the whole body	0.000120 mrem	10 mrem	0.00120

The results show that during 2021, the doses from PBNP effluents were ≤0.033% of the Appendix I design objectives. This is less than the 2020 result of 0.036%. Therefore, operation of the PBNP radwaste treatment system continues to be ALARA.

A survey of land use with respect to the location of dairy cattle was made pursuant to Section 12.2.5 of the PBNP ODCM. As in previous years, no dairy cattle were found to be grazing at the site boundary. Therefore, the assumption that cattle graze at the site boundary used in the evaluation of doses from PBNP effluents remains conservative. Of the sixteen compass sectors around PBNP, six are over Lake Michigan. A land use census (LUC) of the remaining ten sectors over land identifies any changes in the closest garden, occupied dwelling, and dairy in each sector. The 2020 LUC results confirm the assumption that, for the purpose of calculating effluent doses, the maximally exposed person lives at the site boundary remains conservative.

The 2021 Radiological Environmental Monitoring Program (REMP) collected 724 individual samples for radiological analyses. Quarterly composites of weekly air particulate filters generated an additional 24 samples and quarterly composites of monthly lake water samples resulted in a further 12 samples. This yielded a total of 760 samples. The ambient radiation measurements in the vicinity of PBNP and the ISFSI were conducted using 148 sets of thermoluminescent dosimeters (TLDs).

Air monitoring from six different sites did not reveal any effect from Point Beach effluents.

Terrestrial monitoring consisting of soil, vegetation, and milk found no influence from PBNP. Similarly, samples from the aquatic environment, consisting of lake and well water, and fish revealed no buildup of PBNP radionuclides released in liquid effluents. Therefore, the data shows no environmental effect from plant operation.

In 2021, six dry storage units were added to the ISFSI. The total number is 56 dry storage casks: 16 ventilated, vertical storage casks (VSC-24) and 34 NUHOMS®, horizontally stacked storage modules, and 6 HOLTEC HI-STORM FW Storage Modules. The subset of the PBNP REMP samples used to evaluate the environmental impact of the PBNP ISFSI showed no environmental impact from its operation.

The environmental monitoring conducted during 2021 confirmed that the effluent control program at PBNP ensured a minimal impact on the environment.

One-hundred-sixty-one (161) samples were analyzed for tritium as part of the groundwater protection program (GWPP). These samples came from drinking water wells, monitoring wells, yard drain outfalls, yard manholes, surface water on site, the sump for the subsurface drainage system (SSD - located under the plant foundation), and four groundwater foundation integrity monitoring wells located in the facades. The results show no substantial change in tritium from previous years. No drinking water wells (depth >100 feet) have any detectable tritium that is statistically different than zero. Tritium continues to be confined to the upper soil layer where the flow is toward the lake. Groundwater samples from wells in the vicinity of the remediated, former earthen retention pond continue to show low levels of tritium. Gamma scans of groundwater samples originating within the power block found no plant related gamma emitters. Façade well samples had tritium results within the expected ranges (~200 pCi/L).

The results of GWPP monitoring indicate no significant change from previous years.

Part A
EFFLUENT MONITORING

1.0 INTRODUCTION

The PBNP effluent monitoring program is designed to comply with federal regulations for ensuring the safe operation of PBNP with respect to releases of radioactive material to the environment and its subsequent impact on the public. Pursuant to 10 CFR 50.34a, operations should be conducted to keep the levels of radioactive material in effluents to unrestricted areas as low as reasonably achievable (ALARA). In 10 CFR 50, Appendix I, the Nuclear Regulatory Commission (NRC) provides the numerical values for what it considers to be the appropriate ALARA design objectives to which the licensee's calculated effluent doses may be compared. These doses are a small fraction of the dose limits specified by 10 CFR 20.1301 and lower than the Environmental Protection Agency (EPA) limits specified in 40 CFR 190.

10 CFR 20.1302 directs PBNP to make the appropriate surveys of radioactive materials in effluents released to unrestricted and controlled areas. Liquid wastes are monitored by inline radiation monitors as well as by isotopic analyses of samples of the waste stream prior to discharge from PBNP. Airborne releases of radioactive wastes are monitored in a similar manner. The appropriate portions of the radwaste treatment systems are used as required to keep both liquid and atmospheric releases ALARA. Prior to release, results of isotopic analyses are used to adjust the release rate of discrete volumes of liquid and atmospheric wastes (from liquid waste holdup tanks and from gas decay tanks) such that the concentrations of radioactive material in the air and water beyond PBNP are below the PBNP Technical Specification concentration limits for liquid effluents and release rate limits for gaseous effluents.

Solid wastes are shipped offsite for disposal at NRC licensed facilities. The amount of radioactivity in the solid waste is determined prior to shipment in order to determine the proper shipping configuration as regulated by the Department of Transportation and the NRC.

10 CFR 72.210 grants a general license for an Independent Spent Fuel Storage Installation (ISFSI) to all nuclear power reactor sites operating under 10 CFR 50. The ISFSI annual reporting requirement pursuant to 10 CFR 72.44(d)(3) is no longer applicable (Reference: 64 FR 33178). Any release of radioactive materials from the operation of the ISFSI must comply with the limits of Part 20 and Part 50 Appendix I design objectives. The dose criteria for effluents and direct radiation specified by 10 CFR 72.104 states that during normal operations and anticipated occurrences, the annual dose equivalent to any real individual beyond the controlled area must not exceed 25 mrem to the whole body, 75 mrem to the thyroid, and 25 mrem to any other organ. The dose from naturally occurring radon and its decay products are exempt. Because the loading of the storage casks occurs within the primary auxiliary building of PBNP, the doses from effluents due to the loading process will be assessed and quantified as part of the PBNP Radiological Effluent Control Program.

2.0 RADIOACTIVE LIQUID RELEASES

The radioactive liquid release path to the environment is via the circulating water discharge. A liquid waste treatment system in conjunction with administrative controls is used to minimize the impact on the environment and maintain doses to the public ALARA from the liquid releases.

2.1 Doses From Liquid Effluent

Doses from liquid effluent are calculated using the methodology of the Offsite Dose Calculation Manual (ODCM). These calculated doses use parameters such as the amount of radioactive material released, the total volume of liquid, the total volume of dilution water, and usage factors (e.g., water and fish consumption, shoreline and swimming factors). These calculations produce a conservative estimation of the dose. For compliance with 10 CFR 50, Appendix I design objectives, the annual dose is calculated to the hypothetical maximally exposed individual (MEI). The MEI is assumed to reside at the site boundary in the highest χ/Q sector and is maximized with respect to occupancy, food consumption, and other uses of this area. As such, the MEI represents an individual with reasonable deviations from the average for the general population in the vicinity of PBNP. A comparison of the calculated doses to the 10 CFR 50, Appendix I design objectives is presented in Table 2-1. The conservatively calculated dose to the MEI is a very small fraction of the Appendix I design objective.

Table 2-1
Comparison of 2021 Liquid Effluent Calculated Doses to 10 CFR 50 Appendix I Design Objectives

Annual Limit [mrem]	Highest Total Calculated Dose [mrem]	% of Design Objective
6 (whole body)	0.00196	0.033
20 (any organ)	0.00214	0.011

2.2 2021 Circulating Water Radionuclide Release Summary

Radioactive liquid releases via the circulating water discharge are summarized by individual source and total curies released on a monthly basis, semi-annual and annual totals (Table 2-2). These releases are composed of processed waste, wastewater effluent, and blowdown from Units 1 and 2. The wastewater effluent consists of liquid from turbine hall sumps, plant well house backwashes, sewage treatment plant effluent, water treatment plant backwashes, the Unit 1 and 2 facade sumps and the subsurface drainage system sump.

2.3 2021 Isotopic Composition of Circulating Water Discharges

The isotopic composition of circulating water discharges during the current reporting period is presented in Table 2-3.

The 2021 processed waste volume (Table 2-2) decreased from 2020 (7.91E+05 gallons to 5.33E+05 gallons), which is consistent with water processing requirements during a one outage year. The total isotopic curie distribution of gamma emitters plus hard-to-detects from 2021 was 6.80E-02 Ci, which is lower than the 2020 value of 7.56E-02 Ci. The total antimony in 2021 increased to 5.58E-03 Ci in comparison to 2020 (4.08E-03 Ci). Zr-Nb increased to 6.41E-04 when compared to the 5.50E-04 Ci totaled in 2020. Tin isotopes (Sn-113/Sn-117m) totals increased to 3.49E-04 Ci in 2021 compared to the 6.72E-05 Ci in 2020. Te-123m was documented at 3.22E-03 in 2021, which is a decrease from the 7.41E-03 Ci observed in 2020. The 2021 C-14 increased to 2.99E-02 Ci from the 2020 value of 2.73E-02 Ci. No strontium isotopes were observed in the 2021 effluent. Tritium increased to 895 Ci in 2021 in comparison to the 823 Ci observed in 2020.

2.4 Beach Drain System Releases Tritium Summary

Beach drain is the term used to describe the point at which the site yard drainage system empties onto the beach of Lake Michigan. These outfalls carry yard and roof drain runoff to the beach. The plant foundation has a subsurface drainage system (SSD) around the external base of the foundation. This SSD relieves hydrostatic pressure on the foundation by draining water away from the foundation. The drainage pipes empty out onto the beach. In 2014, the SSD outfalls, designated as S-12 and S-13, were added to the beach drain sampling program. Their quarterly results are presented with the other beach drains.

The quarterly results from the monthly beach drain and SSD samples are presented in Table 2-4. The total monthly flow is calculated assuming that the flow rate at the time of sampling persists for the whole month. In 2020, no tritium was observed at the effluent LLDs. Tritium found in the beach drains is not included in the effluent totals unless it can be shown to be the result of a spill or similar event. Because the source of beach drain tritium has been determined to be recapture, including beach drain tritium in the effluent totals would be double counting (NRC RIS 2008-03, Return/re-use of previously discharged radioactive effluents).

The principle source of water for the beach drains is the yard drain system. Yard drain water sources are rain and snow melt containing recaptured tritium. During the winter natural melting is the principle source. Additionally, various roof drains connect to the yard drain system. In addition to precipitation, the roof drains also carry condensate from various building AC units. A secondary source may be groundwater in leakage. This is evidenced by flow during periods of no precipitation. Because there are no external storage tanks or piping that carries radioactive liquids, the main source of radioactivity for this system is recapture/washout of airborne tritium discharges via the yard drain system. Because of these various recapture sources, the beach drains also are sampled as part of the groundwater monitoring program. These results and other groundwater monitoring results are presented in Part D of this Annual Monitoring Report.

Table 2-2
Summary of Circulating Water Discharge
January 1, 2021 through December 31, 2021

	Jan	Feb	Mar	Apr	May	Jun	Total Jan-Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total July-Dec	Annual Total
Total Activity Released (Ci)															
Gamma Scan(+HTDs)[1]	5.65E-03	3.61E-03	4.33E-03	7.41E-03	1.42E-03	3.58E-03	2.60E-02	8.01E-03	4.37E-03	7.13E-03	7.74E-03	1.25E-02	2.24E-03	4.20E-02	6.80E-02
Gross Alpha	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tritium	2.61E+00	9.27E+01	5.31E+01	1.60E+02	1.03E+01	9.69E+01	4.15E+02	1.78E+02	5.45E+01	6.26E+01	1.08E+02	4.41E+01	3.19E+01	4.80E+02	8.95E+02
Strontium (89/90/92)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Noble Gases	0.00E+00	3.83E-04	3.08E-04	4.36E-04	0.00E+00	2.34E-04	1.36E-03	1.40E-03	2.05E-03	2.85E-04	1.82E-03	2.13E-03	7.31E-04	8.41E-03	9.78E-03
Total Vol Released (gal)															
Processed Waste	6.65E+03	3.54E+04	2.06E+04	3.20E+04	1.36E+04	2.91E+04	1.37E+05	4.67E+04	5.30E+04	4.50E+04	1.31E+05	9.62E+04	2.39E+04	3.95E+05	5.33E+05
Waste Water Effluent	3.66E+06	3.36E+06	3.73E+06	3.73E+06	3.49E+06	3.33E+06	2.13E+07	3.50E+06	3.93E+06	3.65E+06	2.85E+06	3.68E+06	3.90E+06	2.15E+07	4.28E+07
U1 SG Blowdown	6.25E+06	5.63E+06	6.23E+06	5.29E+06	2.68E+06	3.13E+06	2.92E+07	2.66E+06	3.07E+06	2.59E+06	2.77E+06	2.57E+06	2.67E+06	1.63E+07	4.55E+07
U2 SG Blowdown	2.65E+06	2.47E+06	2.68E+06	2.58E+06	2.67E+06	2.70E+06	1.58E+07	2.67E+06	2.67E+06	2.63E+06	7.89E+05	4.82E+06	3.33E+06	1.69E+07	3.27E+07
Total Gallons	1.26E+07	1.15E+07	1.27E+07	1.16E+07	8.86E+06	9.19E+06	6.64E+07	8.87E+06	9.73E+06	8.91E+06	6.53E+06	1.12E+07	9.92E+06	5.51E+07	1.22E+08
Total cc	4.75E+10	4.35E+10	4.79E+10	4.40E+10	3.35E+10	3.48E+10	2.51E+11	3.36E+10	3.68E+10	3.37E+10	2.47E+10	4.23E+10	3.76E+10	2.09E+11	4.60E+11
Dilution vol(cc)[2]	7.91E+13	7.14E+13	7.91E+13	1.03E+14	1.27E+14	1.23E+14	5.82E+14	1.27E+14	1.27E+14	1.23E+14	8.41E+13	1.19E+14	5.93E+13	6.39E+14	1.22E+15
Avg diluted discharge conc (μCi/cc)															
Gamma Scan (+HTDs)[1]	7.14E-11	5.06E-11	5.47E-11	7.20E-11	1.12E-11	2.92E-11	2.89E-10	6.32E-11	3.44E-11	5.80E-11	9.21E-11	1.05E-10	3.78E-11	3.90E-10	6.79E-10
Gross Alpha	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tritium	3.29E-08	1.30E-06	6.71E-07	1.55E-06	8.13E-08	7.89E-07	4.43E-06	1.41E-06	4.30E-07	5.10E-07	1.29E-06	3.70E-07	5.37E-07	4.54E-06	8.97E-06
Strontium (89/90/92)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Noble Gases	0.00E+00	5.37E-12	3.90E-12	4.24E-12	0.00E+00	1.91E-12	1.54E-11	1.10E-11	1.61E-11	2.32E-12	2.16E-11	1.79E-11	1.23E-11	8.13E-11	9.67E-11
Max Batch Discharge Conc (μCi/cc)															
Tritium	6.64E-06	3.17E-05	2.98E-05	3.27E-05	7.35E-06	2.75E-05		3.50E-05	3.37E-05	2.10E-05	3.65E-05	1.35E-05	2.51E-05		
Gamma Scan	3.29E-11	1.25E-10	6.09E-11	4.96E-11	9.64E-11	3.82E-11		2.85E-10	4.36E-10	2.48E-10	2.29E-09	4.48E-09	4.23E-10		

1 HTDs include Fe-55, C-14, Ni-63, and Tc-99. Does not include strontium which is totaled separately.
2 Circulating water discharge from both units.
ND: means that the radionuclide was not identified in any samples and all analyses were performed with instrumentation meeting the lower limit of detection as required by the PBNP Offsite Dose Calculation Manual.
NR: means No Release during that month

Table 2-3
Isotopic Composition of Circulating Water Discharges (Ci)
January, 2021 through December 31, 2021

Nuclide	Jan	Feb	Mar	Apr	May	Jun	Total Jan-Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total July-Dec	Annual Total
H-3	2.61E+00	9.27E+01	5.31E+01	1.60E+02	1.03E+01	9.69E+01	4.15E+02	1.78E+02	5.45E+01	6.26E+01	1.08E+02	4.41E+01	3.19E+01	4.80E+02	8.95E+02
C-14	ND	1.47E-03	1.41E-03	5.09E-03	ND	1.76E-03	9.73E-03	6.37E-03	2.41E-03	5.62E-03	2.87E-03	2.33E-03	5.96E-04	2.02E-02	2.99E-02
F-18	5.61E-03	1.77E-03	2.79E-03	2.05E-03	1.24E-03	1.63E-03	1.51E-02	1.16E-03	1.06E-03	1.06E-03	1.27E-03	1.21E-03	1.20E-03	6.96E-03	2.20E-02
Cr-51	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.43E-05	2.52E-03	ND	2.57E-03	2.57E-03
Mn-54	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.69E-05	ND	3.69E-05	3.69E-05
Fe-55	ND	ND	ND	ND	ND	ND	ND	1.38E-04	ND	ND	ND	ND	ND	1.38E-04	1.38E-04
Fe-59	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.05E-05	ND	5.05E-05	5.05E-05
Co-57	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Co-58	8.59E-06	5.47E-05	8.63E-06	3.01E-06	1.92E-05	5.97E-06	1.00E-04	6.97E-06	4.67E-06	ND	6.88E-05	1.14E-03	2.22E-05	1.24E-03	1.34E-03
Co-60	7.05E-06	5.90E-05	1.73E-05	1.66E-05	5.94E-05	3.97E-05	1.99E-04	5.02E-05	6.15E-05	4.87E-05	1.65E-04	5.50E-04	3.94E-05	9.15E-04	1.11E-03
Ni-63	2.47E-05	3.49E-05	ND	ND	9.81E-05	5.50E-05	2.13E-04	ND	1.47E-04	ND	ND	ND	ND	1.47E-04	3.59E-04
Zn-65	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Se-75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
As-76	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.03E-04	1.33E-04	ND	2.36E-04	2.36E-04
Sr-90	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sr-92	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nb-95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.04E-04	5.71E-06	4.10E-04	4.10E-04
Nb-97	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.39E-06	6.77E-06	ND	1.12E-05	1.12E-05
Zr-95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.20E-04	ND	2.20E-04	2.20E-04
Zr-97	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tc-99	ND	1.07E-05	1.17E-05	9.45E-06	2.38E-06	6.38E-06	4.06E-05	4.42E-05	5.82E-05	2.04E-05	4.94E-05	3.24E-05	5.42E-06	2.10E-04	2.51E-04
Ag-110m	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.00E-05	7.32E-05	3.28E-06	1.06E-04	1.06E-04
Sn-113	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.87E-04	5.00E-06	2.92E-04	2.92E-04
Sn-117m	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.63E-05	ND	5.63E-05	5.63E-05
Sb-122	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sb-124	ND	2.16E-05	6.16E-06	1.49E-05	ND	ND	4.27E-05	ND	6.83E-06	ND	6.49E-05	1.35E-04	2.06E-06	2.09E-04	2.51E-04
Sb-125	ND	1.28E-04	6.07E-05	1.68E-04	ND	6.88E-05	4.25E-04	2.33E-04	5.86E-04	3.62E-04	2.81E-03	8.79E-04	3.04E-05	4.91E-03	5.33E-03
I-131	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
I-132	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Te-123m	ND	6.11E-05	2.41E-05	5.91E-05	ND	1.19E-05	1.56E-04	2.02E-05	3.69E-05	2.18E-05	2.49E-04	2.41E-03	3.32E-04	3.07E-03	3.22E-03
Te-132	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cs-136	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cs-137	ND	4.88E-06	1.88E-06	ND	5.48E-06	2.68E-06	1.49E-05	ND	ND	ND	ND	ND	ND	ND	1.49E-05
Cs-138	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
La-140	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Xe-131m	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Xe-133	ND	3.83E-04	3.05E-04	4.35E-04	ND	2.33E-04	1.36E-03	1.39E-03	2.00E-03	2.85E-04	1.81E-03	2.10E-03	7.26E-04	8.32E-03	9.67E-03
Xe-133m	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Xe-135	ND	ND	3.41E-06	1.68E-06	ND	1.40E-06	6.49E-06	8.53E-06	4.58E-05	ND	7.04E-06	3.17E-05	5.29E-06	9.84E-05	1.05E-04

ND: means that the radionuclide was not identified in any samples and all analyses were performed with instrumentation meeting the lower limit of detection as required by the PBNP Offsite Dose Calculation Manual.

Table 2-4
Beach and Subsoil System Drains - Tritium Summary
January 1, 2021 through December 31, 2021

	S-1	S-3	S-7	S-8	S-9	S-10	S-12	S-13
1st Qtr								
H-3 (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Flow (gal)	2.23E+04	2.68E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2nd Qtr								
H-3 (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Flow (gal)	3.96E+05	8.78E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3rd Qtr								
H-3 (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Flow (gal)	4.23E+05	3.00E+05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.12E+05	0.00E+00
4th Qtr								
H-3 (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Flow (gal)	3.51E+05	1.00E+05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.34E+04	0.00E+00

2.6 Land Application of Sewage Sludge and Wastewater

In 1988, pursuant to 10 CFR 20.302(a), Point Beach received NRC approval for the disposal of sewage sludge, which may contain trace amounts of radionuclides, by land application on acreage within the site. Land application of sewage sludge is regulated by the Wisconsin Department of Natural Resources. Point Beach has not land applied sewage sludge for over a decade. Therefore, Point Beach has not renewed its WI DNR permit to dispose of sewage sludge in this manner.

There were no sludge or equalization basin disposals by land application during 2021. All disposals from the PBNP sewage treatment plant (STP) were done at the Manitowoc Sewage Treatment Plant. A total of 78,600 gallons in 15 shipments were sent to Manitowoc. All sludge and equalization basin discharges were analyzed to environmental LLDs, except for 2 which were analyzed to effluent LLDs and less than detectable. Naturally occurring radionuclides such as Ra-226 and K-40 were present in all samples. For the shipments in 2021 the total Ra-226 and K-40 were 43.6 µCi and 46.2 µCi, respectively. Small concentrations of H-3 (not detectable – 902 pCi/L) were found in thirteen (13) of the shipments for a total of 73.8 µCi. Based on the daily flow at the Manitowoc plant, the H-3 discharge concentration would be on the order of 0.303 pCi/L or 66,000 times lower than the EPA drinking water limit of 20,000 pCi/L.

The STP H-3 is attributable to groundwater in-leakage at the STP lift station whose volume is known to increase after a heavy rain or snow melt event. The STP is in the groundwater flow path from the retention pond area and the lake. The STP H-3 concentrations are comparable to those found in the retention pond area monitoring wells.

2.7 Carbon-14

Carbon-14 (C-14) is a naturally occurring radionuclide. Nuclear weapons testing in the 1950s and 1960s significantly increased the amount of C-14 in the atmosphere. Small amounts of C-14 also are produced by nuclear reactors, but the amounts produced are less than C-14 produced by weapons testing or that occurs naturally. Based on information from the NRC obtained at industry sponsored workshops, Point Beach began evaluating C-14 liquid discharges in 2009, prior to the issuance of Regulatory Guide 1.21 [RG 1.21], Rev 2 in June of 2009. Point Beach continues to analyze batch liquid waste discharges for C-14 and reporting the results in the Annual Monitoring Report.

The NRC requested that all nuclear plants report C-14 emissions beginning with the 2010 monitoring reports. Pursuant to NRC guidance in RG 1.21(Rev 2), evaluation of C-14 in liquid wastes is not required because the quantity released via this pathway is much less than that contributed by gaseous emissions. However, as stated above, Point Beach began C-14 analyses and reporting prior to the issuance of RG 1.21 (Rev 2). RG 1.21 states that a radionuclide is a principal effluent component if it contributes greater than 1% of the Appendix I design objective dose compared to the other radionuclides in the effluent type, or, if it is greater than 1% of the activity of all radionuclides in the effluent type. In this case, C-14 is compared to other (non-tritium or noble gases) radionuclides discharged in liquids.

For 2021, the monthly and total C-14 (2.99E-02 Ci) in liquid discharges is documented in Table 2-3. The 2021 amount of C-14 released makes up about 38.5% of the non-tritium radionuclides released in liquids (2.99E-02/7.77E-02).

The liquid C-14 dose contribution is included in the doses calculated for the hypothetically, maximally exposed individual (Table 2-1). Under the parameters and pathways used for the dose calculations, the C-14 dose contribution to the infant age group ranges from 0.0904 to 0.0906% of the dose to the whole body and the applicable organs except for bone, for which C-14 contributes 57.1% of the total dose. For the remaining age groups, the C-14 contributes roughly 95.4% of the bone dose and 7.28 – 14.3% of the dose to the whole body and to other organs specified in RG 1.109.

2.8 Abnormal Release

One abnormal liquid release occurred in 2021 when a Unit 1 hotwell containing tritium was discharged directly to circulating water on 8/2/2021. A sample had been taken prior to the discharge which identified tritium in the sample, but a permit was not generated prior to release. The sample contained 8.88E-06 µCi/cc tritium prior to dilution, and had a discharge concentration of 1.42E-08 µCi/cc. A total of 4.44E-04 Ci were discharged during this release, which was 0.000815% of the total tritium curies released in August 2021 (54.5 Ci). Based on the sample results obtained before the release, the volume discharged, and amount of time it took to perform the discharge, quantification of the release was possible and no ODCM limits were exceeded or challenged.

3.0 RADIOACTIVE AIRBORNE RELEASES

The release paths to the environment contributing to radioactive airborne release totals during this reporting period were the auxiliary building vent stack, the drumming area vent stack, the letdown gas stripper, the Unit 1 containment purge stack, and the Unit 2 containment purge stack. A gaseous radioactive effluent treatment system in conjunction with administrative controls is used to minimize the impact on the environment from the airborne releases and maintain doses to the public ALARA.

3.1 Doses from Airborne Effluent

Doses from airborne effluent are calculated for the maximum exposed individual (MEI) following the methodology contained in the PBNP ODCM. These calculated doses use parameters such as the amount of radioactive material released, the concentration at and beyond the site boundary, the average site weather conditions, and usage factors (e.g., breathing rates, food consumption). In addition to the MEI doses, the energy deposited in the air by noble gas beta particles and gamma rays is calculated and compared to the corresponding Appendix I design objectives. A comparison of the annual Appendix I design objectives for atmospheric effluents to the highest organ dose and the noble gas doses calculated using ODCM methodology is listed in Table 3-1. C-14 is not included in the Appendix I calculations because it is not an Appendix I radionuclide. The C-14 dose calculation has been required since 2010 (see Sections 3.4 through 3.6, below, for a more detailed description) and is treated separately. The comparison between airborne effluent doses with and without C-14 is shown in Table 3-4. The highest Appendix I dose is 8.53E-03 mrem for the child age group thyroid. Had C-14 been included, the child-bone dose would have been the highest at 2.25E-01 mrem. Even with the inclusion of C-14 the doses demonstrate that releases from PBNP to the atmosphere continue to be ALARA at 0.8% of the dose objective.

3.2 Radioactive Airborne Release Summary

Radioactivity released in airborne effluents for 2021 is summarized in Table 3-2. The particulate total increased to 2.16E-05 Ci in 2021 from 1.76E-05 Ci in 2020. Tritium decreased in 2021 to 69.1 Ci from 87.1 Ci in 2020. Noble gases increased to 8.89E-01 Ci from 8.85E-01 Ci in 2020 .

3.3 Isotopic Airborne Releases

The monthly isotopic airborne releases for 2021, from which the airborne doses were calculated, are presented in Table 3-3. Carbon-14 is not included in Table 3-3 because it was calculated and not measured. C-14 is discussed in the following sections.

As in previous years the outage impact of the isotopic mixture is demonstrated in the comparison of the non-outage particulate releases. During the outage in October, eight different particulates were identified in the airborne effluent. Most were released via the open hatches on the 26 and 66-foot elevation of containment. The convective flow through the open hatch during purge is unfiltered. Although the flow is into the façade, there are two circumferential gaps around the façade. It is assumed that the release into façade is transferred to the outside and therefore is treated as a release to the environment. As was stated in Section 3.2, the total particulate curies observed increased in 2021 when compared to 2020.

3.4 Carbon-14

C-14 is a naturally occurring radionuclide. Nuclear weapons testing of the 1950s and 1960s significantly increased the amount of C-14 in the atmosphere. Small amounts of C-14 also are produced by nuclear reactors as neutrons interact with the dissolved oxygen and nitrogen in the primary coolant. However, the amount produced by nuclear reactors is much less than that produced by weapons testing or that occur naturally.

The NRC has requested that nuclear plants report C-14 emissions. C-14 is a hard-to-detect radionuclide. It is not a gamma emitter and must be chemically separated from the effluent stream before it can be measured. Because nuclear plants currently are not equipped to perform this type of sampling, RG 1.21 allows for calculating C-14 discharges based on fission rates.

The Electric Power Research Institute (EPRI) developed the methodology for calculating C-14 generation and releases for the nuclear industry. The results were published as Technical Report 1021106 (December 2010), "Estimation of Carbon-14 in Nuclear Power Plant Gaseous Effluents." In addition to neutron flux, the percent oxygen and nitrogen in the VCTs is used in the C-14 calculation as both gases contribute to the generation of C-14. Pursuant to NRC guidance (Regulatory Guide 1.21, Rev 2, p. 16, June 2009), most of the C-14 emissions from nuclear plant occur in the gaseous phase.

The Point Beach C-14 generation for 2021 was calculated using the EPRI guidance and the current core parameters resulting from the power uprate. The calculated amounts were 5.41 Ci for Unit 1 and 5.46 Ci for Unit 2 yielding a total of 10.87 Ci which is lower, but statistically the same as 2016 through 2020. The 2021 calculated total 10.87 Ci is roughly 360 times higher than the 2.99E-02 Ci of C-14 determined by analyses of composites from liquid waste batch discharges, steam generator blowdown, and other waste streams.

3.5 C-14 Airborne Effluent Dose Calculation

The dose from the airborne C-14 is dependent on its chemical form. The C-14 released to the atmosphere consists of both organic and inorganic species. Both the inorganic and organic C-14 contribute to the inhalation dose. Only the inorganic $^{14}CO_2$ species contributes to the dose from the ingestion of photosynthetically incorporated C-14. The organic forms such as methane, CH_4, are not photosynthetically active. For PWRs such as PBNP most of the gaseous C-14 occurs as methane, $^{14}CH_4$, not as carbon dioxide, $^{14}CO_2$.

The amount of $^{14}CO_2$ present in the PBNP airborne effluent has not been measured. However, such measurements have been made at a comparable PWR site similar to the PBNP design. The Ginna nuclear generating station is of similar design to PBNP. It is a Westinghouse 2-loop PWR of the same vintage as PBNP and approximately the same power (prior to the PBNP power uprate).

Measurements at Ginna for 18 months in 1980 - 1981 (Kunz, "Measurement of ^{14}C Production and Discharge From the Ginna Nuclear Power Reactor," 1982) found that ten percent of the C-14 was discharged as $^{14}CO_2$. Therefore, 10% of the 10.87 Ci of the calculated C-14 for PBNP will be used in the ingestion dose calculations.

C-14 dose calculations were made using the dose factors and the methodology of Regulatory Guide 1.109. In 2018 the inhalation dose factors were updated to reflect a change in the χ/Q value in the Point Beach ODCM Rev. 20. The inhalation dose was calculated using all forms of C-14. All forms of the C-14 are used because regardless of whether the C-14 is in the form of $^{14}CO_2$ or an organic form, such as CH_4, both would be inhaled and contribute to a lung dose.

For the other existing pathways, milk, meat, and produce, the dose depends upon the amount incorporated into biomass consumed by cattle and people: forage for cattle and produce for humans. Incorporation only occurs via photosynthesis. Photosynthesis only incorporates $^{14}CO_2$ and accounts for only 10% of the total C-14 release for these pathways.

The airborne effluent C-14 dose calculations were made as described above. They were made for the MEI as explained in Section 2.1. This approach utilizes all the pathways that are applicable to a hypothetical person residing at the site boundary. Because C-14 is present as a gas, the pathways are milk, meat, and produce (vegetables, fruit, and grain) and the Regulatory Guide 1.109, Table E-5 usage factors are applied to the calculation. As such, the resulting dose will be conservative in that the produce usage factor includes grain and fruit and these pathways do not exist in the vicinity of the point for which the C-14 doses are calculated. Furthermore, because leafy vegetables are included in the produce pathway, they are not used as a separate pathway because that would result in double accounting for leafy vegetable dose contribution.

Carbon-14 is not an Appendix I radionuclide. Therefore, airborne C-14 is not summed with the other airborne radioactive effluents for comparison of airborne effluent dose to the Appendix I dose objectives. However, the C-14 doses are presented and compared to the other radionuclide doses in Table 3-4.

3.6 C-14 Measurements

No C-14 measurements were made of PBNP airborne effluents. In 2010, C-14 was measured in crops grown on fields in the owner controlled area located in the highest χ/Q sector at the site's south boundary. One field was leased for feed corn by a dairy south of the plant. That dairy is part of the REMP. In an adjacent field soybeans were grown by another farmer. These two crops were sampled in this sector and as well as in a background location about 17 miles SW of the plant. Based on the measurement error, there was no statistical difference between the results obtained on site in the highest χ/Q sector as compared to the background site some 17 miles away (2013 AMR, Table 10-3). These results demonstrated that the dose from C-14 in Point Beach airborne effluents should not measurably increase the C-14 dose compared to that received from naturally occurring C-14 in plants (1 mrem: NCRP Report 93, Ionizing Radiation Exposure of the Population of the United States, 1987, p.12).

Table 3-1
Comparison of 2021 Airborne Effluent Calculated Doses to 10 CFR 50 Appendix I Design Objectives

Category	Annual Appendix I Design Objective	January-December Calculated Dose	Percent of Appendix I Design Objective
Particulate	30 mrem/organ	0.00853 mrem	0.0284
Noble gas	40 mrad (beta air)	0.0000509 mrad	0.00013
Noble gas	20 mrad (gamma air)	0.000127 mrad	0.00063
Noble gas	30 mrem (skin)	0.000177 mrem	0.00059
Noble gas	10 mrem (whole body)	0.000120 mrem	0.00120

Table 3-2
Radioactive Airborne Effluent Release Summary
January 1, 2021 through December 31, 2021

							Total							Total	Annual
	Jan	Feb	Mar	Apr	May	Jun	Jan-Jun	Jul	Aug	Sep	Oct	Nov	Dec	July-Dec	Total
Total Noble Gas (Ci)[1]	7.19E-02	5.29E-02	5.43E-02	4.87E-02	7.81E-02	5.55E-02	3.61E-01	7.67E-02	5.70E-02	4.88E-02	1.39E-01	9.23E-02	1.14E-01	5.28E-01	8.89E-01
Total Radioiodines (Ci)[2]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	9.82E-07	ND	ND	9.82E-07	9.82E-07
Total Particulate (Ci)[3]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.07E-05	ND	ND	2.07E-05	2.07E-05
Alpha (Ci)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Strontium(Ci)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
All other beta + gamma (Ci)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.07E-05	ND	ND	2.07E-05	2.07E-05
Total Tritium (Ci)	7.17E+00	5.48E+00	5.38E+00	5.66E+00	3.95E+00	4.32E+00	3.20E+01	4.57E+00	5.30E+00	7.00E+00	9.27E+00	4.34E+00	6.65E+00	3.71E+01	6.91E+01
Max NG H'rly Rel.(Ci/sec)	5.14E-08	5.12E-08	5.12E-08	4.86E-08	1.64E-07	7.73E-08		8.51E-08	7.38E-08	5.75E-08	5.87E-08	9.82E-08	1.25E-07		

[1] Total noble gas (airborne releases) and activation gas Ar-41. It does not include the activation gas F-18 because of its short $T_{1/2}$ and because it is not an Appendix I radionuclide.
[2] Airborne radioiodines only include I-131 and I-133. Although for dose calculations iodines are grouped with particulates, for this reporting table they are separated from the particulate group.
[3] Total Particulate is the sum of alpha, strontium, and others. It does not include radioiodines or C-14. C-14 was calculated for the year and no monthly values are available.

ND: means that the radionuclide was not identified in any samples and all analyses were performed with instrumentation meeting the lower limit of detection as required by the PBNP Offsite Dose Calculation Manual.

TABLE 3-3
Isotopic Composition of Airborne Releases
January 1, 2021 through December 31, 2021

	Jan	Feb	Mar	Apr	May	Jun	Total	Jul	Aug	Sep	Oct	Nov	Dec	Total	Annual
Nuclide	(Ci)	(Ci)	(Ci)	(Ci)	(Ci)	(Ci)	Jan-Jun	(Ci)	(Ci)	(Ci)	(Ci)	(Ci)	(Ci)	July-Dec	Total
H-3	7.17E+00	5.48E+00	5.38E+00	5.66E+00	3.95E+00	4.32E+00	3.20E+01	4.57E+00	5.30E+00	7.00E+00	9.27E+00	4.34E+00	6.65E+00	3.71E+01	6.91E+01
F-18	7.33E-07	ND	ND	ND	ND	ND	7.33E-07	5.95E-05	1.91E-09	ND	ND	1.38E-06	ND	6.09E-05	6.16E-05
Ar-41	6.10E-02	4.69E-02	4.67E-02	4.20E-02	5.09E-02	3.47E-02	2.82E-01	5.49E-02	4.15E-02	4.03E-02	4.19E-02	5.56E-02	7.20E-02	3.06E-01	5.88E-01
Kr-85	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Kr-85m	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Kr-87	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Kr-88	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Xe-131m	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Xe-133	1.09E-02	6.06E-03	7.59E-03	6.74E-03	2.72E-02	2.08E-02	7.93E-02	2.18E-02	1.54E-02	8.53E-03	9.74E-02	3.66E-02	4.16E-02	2.21E-01	3.01E-01
Xe-133m	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Xe-135	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.31E-04	1.11E-04	2.42E-04	2.42E-04
Xe-135m	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Xe-138	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Na-24	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cr-51	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	9.60E-06	ND	ND	9.60E-06	9.60E-06
Mn-54	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.32E-07	ND	ND	3.32E-07	3.32E-07
Fe-59	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Co-57	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Co-58	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.05E-06	ND	ND	4.05E-06	4.05E-06
Co-60	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.53E-06	ND	ND	3.53E-06	3.53E-06
Zn-65	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nb-95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.82E-06	ND	ND	1.82E-06	1.82E-06
Zr-95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.25E-06	ND	ND	1.25E-06	1.25E-06
I-131	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	9.82E-07	ND	ND	9.82E-07	9.82E-07
I-132	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
I-133	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sb-124	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7.40E-08	ND	ND	7.40E-08	7.40E-08
Sb-125	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cs-137	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fe-55	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ni-63	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tc-99	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sr-89	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sr-90	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sn-113	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sn-117m	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Br-82	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND: means that the radionuclide was not identified in any samples and all analyses were performed with instrumentation meeting the lower limit of detection as required by the PBNP Offsite Dose Calculation Manual.

Table 3-4
Comparison of Airborne Effluent Doses (Appendix I and C-14)

2021 Appendix I (Airborne Particulate + Tritium) Dose (mrem)

	Bone	Liver	T-WB	Thyroid	Kidney	Lung	GI-LLI	Skin
Adult	1.47E-05	5.47E-03	5.47E-03	5.47E-03	5.47E-03	5.47E-03	5.47E-03	3.80E-09
Teen	1.47E-05	6.02E-03	6.02E-03	6.03E-03	6.02E-03	6.02E-03	6.02E-03	3.80E-09
Child	1.48E-05	8.51E-03	8.52E-03	8.53E-03	8.51E-03	8.52E-03	8.52E-03	3.80E-09
Infant	1.48E-05	3.69E-03	3.69E-03	3.72E-03	3.69E-03	3.69E-03	3.69E-03	3.80E-09

Ann.Limit	3.00E+01
% Ann Lim	2.84E-02

2021 Carbon-14 Dose (mrem)

	Bone	Liver	T. Body	Thyroid	Kidney	Lungs	GI-LLI	Skin
Adult	6.26E-02	1.24E-02	1.24E-02	1.24E-02	1.24E-02	1.24E-02	1.24E-02	0.00E+00
Teen	9.80E-02	1.95E-02	1.95E-02	1.95E-02	1.95E-02	1.95E-02	1.95E-02	0.00E+00
Child	2.25E-01	4.49E-02	4.49E-02	4.49E-02	4.49E-02	4.49E-02	4.49E-02	0.00E+00
Infant	1.15E-01	2.44E-02	2.44E-02	2.44E-02	2.44E-02	2.44E-02	2.44E-02	0.00E+00

2021 Total Airborne Non-Noble Gas Dose [Particulate + H-3 + C-14 (mrem)]

	Bone	Liver	T-WB	Thyroid	Kidney	Lung	GI-LLI	Skin
Adult	6.26E-02	1.79E-02	1.79E-02	1.79E-02	1.79E-02	1.79E-02	1.79E-02	3.80E-09
Teen	9.80E-02	2.55E-02	2.55E-02	2.55E-02	2.55E-02	2.55E-02	2.55E-02	3.80E-09
Child	2.25E-01	5.34E-02	5.34E-02	5.34E-02	5.34E-02	5.34E-02	5.34E-02	3.80E-09
Infant	1.15E-01	2.81E-02	2.81E-02	2.81E-02	2.81E-02	2.81E-02	2.81E-02	3.80E-09

Ann.Limit	3.00E+01
% Limit	7.51E-01

The percent of limit is calculated using the highest total dose, the Child Age Group.

4.0 RADIOACTIVE SOLID WASTE SHIPMENTS

4.1 Types, Volumes, and Activity of Shipped Solid Waste

The following types, volumes, and activity of solid waste were shipped from PBNP for offsite disposal or burial during 2021. No Types C or D wastes were shipped. No irradiated fuel was shipped offsite. The volume, activity and type of waste are listed in Table 4-1.

Table 4-1
Quantities and Types of Waste Shipped from PBNP in 2021

Type of Waste	Quantity	Activity
A. Spent resins, filter sludge, evaporator bottoms, etc.	3.5 m^3	290.000 Ci
	125.2 ft^3	
B. Dry compressible waste, contaminated equipment, etc	133.7 m^3	0.123 Ci
	4720.0 ft^3	
C. Irradiated components, control rods, etc.	0.00 m^3	N/A Ci
	ft^3	
D. Other	0.0 m^3	N/A Ci

4.2 Solid Waste Disposition

There were three solid waste shipments from PBNP during 2021. The dates and destinations are shown in Table 4-2.

Table 4-2

2021 PBNP Radioactive Waste Shipments	
Date	**Destination**
01/14/21	Erwin, TN
09/20/21	Oak Ridge, TN
10/28/21	Oak Ridge, TN

4.3 Major Nuclide Composition (by Type of Waste)

The major radionuclide content of the 2021 solid waste was determined by gamma isotopic analysis and the application of scaling factors for certain indicator radionuclides based on the measured isotopic content of representative waste stream samples. The estimated isotopic content is presented in Table 4-3. Only those radionuclides with detectable activity are listed.

Table 4-3
2021 Estimated Solid Waste Major Radionuclide Composition

Type A			Type B		
Nuclide	**Activity (mCi)**	**Percent Abundance**	**Nuclide**	**Activity (mCi)**	**Percent Abundance**
Total Activity	2.90E+05	100.00%	Total Activity	1.23E+02	100.00%
Co-60	1.41E+05	48.72%	Co-60	5.42E+01	44.07%
Ni-63	1.01E+05	34.90%	Cr-51	2.24E+01	18.18%
Fe-55	2.69E+04	9.30%	Fe-55	1.57E+01	12.77%
Co-58	9.83E+03	3.40%	Co-58	7.58E+00	6.16%
Mn-54	4.87E+03	1.68%	Nb-95	6.30E+00	5.12%
Sb-125	2.55E+03	0.88%	Ni-63	4.93E+00	4.01%
Cs-137	1.37E+03	0.47%	Zr-95	2.90E+00	2.36%
Co-57	8.53E+02	0.29%	Ag-110m	2.30E+00	1.87%
Ni-59	7.60E+02	0.26%	Sn-117m	1.84E+00	1.49%
C-14	1.36E+02	0.05%	Sb-125	1.20E+00	0.98%
Pu-241	6.54E+01	0.02%	Sb-124	7.92E-01	0.64%
Sr-90	2.68E+01	0.01%	Sn-113	7.48E-01	0.61%
Sr-89	1.00E+01	0.00%	Mn-54	7.02E-01	0.57%
Ce-144	2.82E+00	0.00%	H-3	3.47E-01	0.28%
Tc-99	2.68E+00	0.00%	Te-123m	2.35E-01	0.19%
H-3	1.69E+00	0.00%	Ce-144	1.95E-01	0.16%
Am-241	6.66E-01	0.00%	Co-57	1.87E-01	0.15%
Pu-238	6.17E-01	0.00%	Pu-241	1.59E-01	0.13%
Pu-239	3.17E-01	0.00%	Nb-94	9.42E-02	0.08%
Cm-243	2.64E-01	0.00%	Tc-99	7.24E-02	0.06%
Cm-242	1.43E-01	0.00%	Cs-137	6.97E-02	0.06%
			Ni-59	4.48E-02	0.04%
			Sr-90	6.08E-03	0.00%
			Am-241	5.95E-03	0.00%
			C-14	4.70E-03	0.00%
			Pu-238	1.64E-03	0.00%
			Pu-239	1.58E-03	0.00%
			Cm-243	9.75E-04	0.00%
			Cm-242	6.40E-04	0.00%

5.0 NONRADIOACTIVE CHEMICAL RELEASES

5.1 Scheduled Chemical Waste Releases

Scheduled chemical waste releases to the circulating water system from January 1, 2021, to June 30, 2021, included 1.42E+04 gallons of neutralized wastewater. The wastewater contained 1.4 lbs. of suspended solids and 50.5 lbs. of dissolved solids.

There were no scheduled chemical releases of neutralized wastewater to the circulating water system from July 1, 2021, to December 31, 2021.

Scheduled chemical waste releases are based on the analytical results obtained from sampling a representative number of neutralizing tanks.

5.2 Miscellaneous Chemical Waste Releases

Miscellaneous chemical waste releases from the wastewater effluent (based on effluent analyses) to the circulating water for January 1, 2021, to June 30, 2021, included 2.18E+07 gallons of clarified effluent. The wastewater contained 2.32E+03 lbs. of suspended solids.

Miscellaneous chemical waste releases from the wastewater effluent (based on effluent analyses) to the circulating water for July 1, 2021, to December 31, 2021, included 2.14E+07 gallons of clarified effluent. The wastewater contained 2.27E+03 lbs. of suspended solids.

Miscellaneous chemical waste released directly to the circulating water, based on amount of chemicals used from January 1, 2021, to June 30, 2021, included 5.73+05 lbs. of sodium bisulfite solution (2.18E+05 lbs. sodium bisulfite), 5.11E+05 lbs. of Sodium Hypochlorite Solution (6.38E+04 lbs. sodium hypochlorite), 1.49E+04 lbs. Acti-Brom 1338 (6.73E+03 lbs. sodium bromide). 2.59E+03 lbs. of biodetergent, and 4.09E+04 lbs. of silt dispersant.

Miscellaneous chemical waste released directly to the circulating water, based on amount of chemicals used from July 1, 2021, to December 31, 2021, included 7.47E+05 lbs. of sodium bisulfite solution (2.84E+05 lbs. sodium bisulfite), 7.61E+05 lbs. Sodium Hypochlorite Solution (9.51E+04 lbs. sodium hypochlorite), 2.17E+04 lbs. Acti-Brom 1338 (9.74E+03 lbs. sodium bromide), 2.63E+03 lbs. of biodetergent, and 3.64E+04 lbs. of silt dispersant.

6.0 CIRCULATING WATER SYSTEM OPERATION

The circulating water system operation during this reporting period is described in Table 6-1.

Table 6-1
Circulating Water System Operation for 2021

	UNIT	JAN	FEB	MAR	APR	MAY	JUN
Average Volume Cooling Water Discharge [million gal/day]*	1	348.5	348.5	348.5	418.6	551.5	551.5
	2	348.5	348.5	348.5	510.3	552.9	552.9
Average Cooling Water Intake Temperature [°F]	1	39	39	40	47	47	53
	2	39	40	40	46	48	53
Average Cooling Water Discharge Temperature [°F]	1	66	67	72	71	65	71
	2	71	71	72	66	65	71
Average Ambient Lake Temperature [°F]		36	35	39	43	45	50

* For days with cooling water discharge flow.

Table 6-1(continued)
Circulating Water System Operation for 2021

	UNIT	JUL	AUG	SEP	OCT***	NOV	DEC
Average Volume Cooling* Water Discharge [million gal/day]	1	551.5	551.5	551.5	569.9	551.2	443.9
	2	552.9	552.9	552.9	170.1	518.0	444.9
Average Cooling Water Intake Temperature [°F]	1	65	61	62	59	46	38
	2	65	62	63	63	47	39
Average Cooling Water Discharge Temperature [°F]	1	85	79	82	79	67	65
	2	84	80	80	73	62	63
Average Ambient Lake Temperature [°F]		63	59	60	59	46	38

* For days with cooling water discharge flow.
*** U2 outage 10/10/2021-10/31/2021

Part B
Miscellaneous Reporting Requirements

7.0 ADDITIONAL REPORTING REQUIREMENTS

7.1 Revisions to the PBNP Effluent and Environmental Programs

No revisions were made to the Offsite Dose Calculation Manual (ODCM) in 2021. The site operated under the guidance of revision 23 of the Point Beach Nuclear Plant ODCM.

7.2 Interlaboratory Comparison Program

ATI Environmental, Inc, Midwest Laboratory, the analytical laboratory contracted to perform the radioanalyses of the PBNP environmental samples, participated in several interlaboratory comparison studies including those administered by Environmental Resources Associates (ERA) during 2021. The results of these comparisons can be found in Appendix A of the attached final report for 2021, January – December 2021 from ATI Environmental Inc.

7.3 Special Circumstances

No special circumstances to report regarding operation of the explosive gas monitor for the waste gas holdup system was needed during 2021.

Part C
RADIOLOGICAL ENVIRONMENTAL MONITORING

8.0 INTRODUCTION

The objective of the PBNP Radiological Environmental Monitoring Program (REMP) is to determine whether the operation of PBNP or the ISFSI has radiologically impacted the environment. To accomplish this, the REMP collects and analyzes air, water, milk, soil, vegetation (grasses and weeds), and fish samples for radionuclides and uses thermoluminescent dosimeters (TLDs) to determine the ambient radiation background. The analyses of the various environmental media provide data on measurable levels of radiation and radioactive materials in the principal pathways of environmental exposure. These measurements also serve as a check of the efficacy of PBNP effluent controls.

The REMP fulfills the requirements of 10 CFR 20.1302, PBNP General Design Criterion (GDC) 17, GDC 64 of Appendix A to 10 CFR 50, and Sections IV.B.2 and IV.B.3 of Appendix I to 10 CFR 50 for the operation of the plant. A subset of the PBNP REMP samples, consisting of air, soil and vegetation also fulfills 10 CFR 72.44(d)(2) for operation of the ISFSI. Additionally, TLDs provide the means to measure changes in the ambient environmental radiation levels at sites near the ISFSI and at the PBNP site boundary to ensure that radiation levels from the ISFSI are maintained within the dose limits of 10 CFR 72.104. Because the ISFSI is within the PBNP site boundary, radiation doses from PBNP and the ISFSI, combined, must be used to assess compliance with 10 CFR 72.122 and 40 CFR 190. Therefore, radiological environmental monitoring for the ISFSI is provided by selected sampling sites, which are part of the PBNP REMP.

For the aquatic environment, the samples include water as well as the biological integrators, such as fish. Because of their migratory behavior, fish are wide area integrators. Grab samples of lake water provide a snapshot of radionuclide concentrations at the time the sample is taken; whereas analysis of fish yield concentrations integrated over time.

The air-grass-cow-milk exposure pathway unites the terrestrial and atmospheric environments. This pathway is important because of the many dairy farms around PBNP. Therefore, the REMP includes samples of air, general grasses, and milk from the PBNP environs. An annual land use survey is made to determine whether the assumptions on the location of dairy cattle remain conservative with respect to dose calculations for PBNP effluents. The dose calculations assume that the dairy cattle are located at the south site boundary, the highest depositional sector. In addition, soil samples are collected and analyzed in order to monitor the potential for long-term buildup of radionuclides in the vicinity of PBNP.

For the measurement of ambient environmental radiation levels that may be affected by direct radiation from PBNP or by noble gas effluents, the REMP employs a series of TLDs situated around PBNP and the ISFSI.

9.0 PROGRAM DESCRIPTION

9.1 Results Reporting Convention

The vendor used by PBNP to analyze the environmental samples is directed to report analysis results as measured by a detector, which can meet the required lower limit of detection (LLD) as specified in Table 12-1 of the ODCM for each sample. The report provided by the vendor (see Appendix 1) contains values, which can be either negative, positive or zero plus/minus the two sigma counting uncertainty, which provides the 95% confidence level for the measured value.

The LLD is an *a priori* concentration value that specifies the performance capability of the counting system used in the analyses of the REMP samples. The parameters for the *a priori* LLD are chosen such that only a five percent chance exists of falsely concluding a specific radionuclide is present when it is not present at the specified LLD. Based on detector efficiency and average background activity, the time needed to count the sample in order to achieve the desired LLD depends upon the sample size. Hence, the desired LLD may be achieved by adjusting various parameters. When a suite of radionuclides are required to be quantified in an environmental sample such as lake water, the count time used is that required to achieve the LLD for the radionuclide with the longest counting time. Therefore, in fulfilling the requirement for the most difficult to achieve radionuclide LLD, the probability of detecting the other radionuclides is increased because the counting time used is longer than that required to achieve the remaining radionuclide LLDs.

The REMP results in this report are reported as averages of the measurements made throughout the calendar year plus/minus the associated standard deviation. If all net sample concentrations are equal to or less than zero, the result is reported as "Not Detectable" (ND), indicating no detectable level of activity present in the sample. If any of the net sample concentrations indicate a positive result statistically greater than zero, all of the data reported are used to generate the reported statistics. Because of the statistical nature of radioactive decay, when the radionuclide of interest is not present in the sample, negative and positive results centered about zero will be seen. Excluding validly measured concentrations, whether negative or as small positive values below the LLD, artificially inflates the calculated average value. Therefore, all generated data are used to calculate the statistical values (i.e., average, standard deviation) presented in this report. The calculated average may be a negative number.

As mentioned above, radioactive decay is a statistical process which has an inherent uncertainty in the analytical result. No two measurements will yield exactly the same result. However, the results are considered equal if the results fall within a certain range based upon the statistical parameters involved in the process. The REMP analytical results are reported at the 95% confidence limit in which the true result may be two standard deviations above or below the reported result. This means that there is only a 5% chance of concluding that the identified radioactive atom is not there when it really is present in the sample. A false positive is an analytical result which statistically shows that the radionuclide is present in the sample when it really is not there. Typically, if the 95% confidence interval for a positive does not include zero, the radionuclide is considered to be present. For example, the result is reported as 100 ± 90. One hundred minus 90 yields a positive result and therefore may be considered to be present. However, this may be a false positive. If the radionuclide was not in the plant effluent, this result would fall into that category which 5% of the time it is falsely concluded that the radionuclide is present when in actuality it is not. This usually happens at low concentrations at or near the LLD where fluctuations in the background during the counting process skew the results to produce a positive result.

In interpreting the data, effects due to the plant must be distinguished from those due to other sources. A key interpretive aid in assessment of these effects is the design of the PBNP REMP, which is based upon the indicator-control concept. Most types of samples are collected at both indicator locations and at control locations. A plant effect would be indicated if the radiation level at an indicator location was significantly larger than that at the control location. The difference would have to be greater than could be accounted for by typical fluctuation in radiation levels arising from other sources.

9.2 Sampling Parameters

Samples are collected and analyzed at the frequency indicated in Table 9-1 from the locations described in Table 9-2 and shown in Figures 9-1, 9-2 and 9-3. (The latter two figures show sampling locations not shown in preceding figures due to space limitations. The location of the former retention pond, retired and remediated to NRC unrestricted access criteria, is indicated in Figure 9-3). The list of PBNP REMP sampling sites used to determine environmental impact around the ISFSI is found in Table 9-3. The minimum acceptable sample size is found in Table 9-4. In addition, Table 9-1 indicates the collection and analysis frequency of the ISFSI fence TLDs.

9.3 Deviations from Required Collection Frequency

Deviations from the collection frequency given in Table 9-1 are allowed because of hazardous conditions, automatic sampler malfunction, seasonal unavailability, and other legitimate reasons (Section 12.2.2.e of the ODCM). Table 9-5 lists the deviations from the scheduled sampling frequency that occurred during the reporting period.

9.4 Assistance to the State of Wisconsin

The Radiation Protection Unit of the Wisconsin Department of Health and Family Services maintains a radiological environmental monitoring program to confirm the results from the PBNP REMP. As a courtesy to the State of Wisconsin, PBNP personnel collect certain environmental samples (Table 9-6) for the State from sites that are near PBNP sampling sites, or are co-located.

9.5 Program Modifications

No procedural program modifications were made to the ODCM or REMP in 2021. In November 2021, the air instrument weather houses were upgraded to incorporate goose neck sample heads as a recommended best practice.

Table 9-1
PBNP REMP Sample Analysis and Frequency

Sample Type	Sample Codes	Analyses	Frequency
Environmental Radiation Exposure	E-01, -02, -03, -04, -05 -06, -07, -08, -09, -12 -14, -15, -16B, -17, -18, 20, -22, -23, -24, -25, -26B, -27, -28 -29, -30, 31, -32, -38, -39,-41, -42,-43, -44 -TC	TLD	Quarterly
Vegetation	E-01, -02, -03, -04, -06, -20,	Gross Beta Gamma Isotopic Analysis	2x/yr as available
Fish	E-13	Gross Beta Gamma Isotopic Analysis (Analysis of edible portions only)	Quarterly as available
Well Water	E-10	Gross Beta, H-3 Sr-89, 90, I-131 Gamma Isotopic Analysis	Quarterly
Lake Water	E-01, -05, -06	Gross Beta, Sr-89/90, H-3 I-131 Gamma Isotopic Analysis	Monthly / Quarterly composite of monthly collections Monthly Monthly
Milk	E-11, -40, -21	Sr-89, 90 I-131 Gamma Isotopic Analysis	Monthly
Air Filters	E-01, -02, -03, -04, -08, -20	Gross Beta I-131 Gamma Isotopic Analysis	Weekly (particulate) Weekly (charcoal) Quarterly (on composite particulate filters)
Soil	E-01, -02, -03, -04, -06, -20	Gross Beta Gamma Isotopic Analysis	1x/yr
Shoreline Sediment	E-01, -05, -06	Gross Beta Gamma Isotopic Analysis	1x/yr
ISFSI Ambient Radiation Exposure	North, East, South, West Fence Sections	TLD	Quarterly

Table 9-2
PBNP REMP Sampling Locations

Location Code	Location Description
E-01	Primary Meteorological Tower South of the Plant
E-02	Site Boundary Control Center - East Side of Building
E-03	Tapawingo Road, about 0.4 Miles West of Lakeshore Road
E-04	North Boundary
E-05	Two Creeks Park
E-06	Point Beach State Park - Coast Guard Station; TLD located South of the Lighthouse on Telephone pole
E-07	WPSC Substation on County V, about 0.5 Miles West of Hwy 42
E-08	G.J. Francar Property at Southeast Corner of the Intersection of Cty. B and Zander Road
E-09	Nature Conservancy
E-10	PBNP Site Well
E-11	Dairy Farm about 3.75 Miles West of Site
E-12	Discharge Flume/Pier
E-13	Pumphouse
E-14	South Boundary, about 0.2 miles East of Site Boundary Control Center
E-15	Southwest Corner of Site
E-16B	WSW, Hwy 42, a residence about 0.25 miles North of Nuclear Road
E-17	North of Mishicot, Cty. B and Assman Road, Northeast Corner of Intersection
E-18	Northwest of Two Creeks at Zander and Tannery Roads
E-20	Reference Location, 17 miles Southwest, at Holy Family Convent Property
E-21	Local Dairy Farm just South of Site on Lakeshore and Irish Roads
E-22	West Side of Hwy 42, about 0.25 miles North of Johanek Road
E-23	Greenfield Lane, about 4.5 Miles South of Site, 0.5 Miles East of Hwy 42
E-24	North Side of County Rt. V, near intersection of Saxonburg Road
E-25	South Side of County Rt. BB, about 0.5 miles West of Norman Road
E-26B	804 Tapawingo Road, about 0.4 miles East of Cty. B, North Side of Road
E-27	Intersection of Saxonburg and Nuclear Roads, Southwest Corner, about 4 Miles WSW
E-28	TLD site on western most pole between the 2nd and 3rd parking lots.
E-29	Area of North Meteorological Tower.
E-30	NE corner at Intersection of Tapawingo and Lakeshore Roads.
E-31	On utility pole North side of Tapawingo Road closest to the gate at the West property line.
E-32	On a conduit/pole located near the junction of property lines, about 500 feet east of the west gate in line with first designated treeline on Tapawingo Road and about 1200 feet south of Tapawingo Road. The location is almost under the power lines between the blue and gray transmission towers. (The conduit/pole is about 6 feet high).
E-38	Tree located at the West end of the area previously containing the Retention Pond.
E-39	Tree located at the East end of the area previously containing the Retention Pond.
E-40	Local Dairy Farm, W side of Hwy 42, about 1.8 miles north of the Nuclear Rd intersection
E-41	NW corner of Woodside and Nuclear Rds (Kewaunee County)
E-42	NW corner of Church and Division, East of Mishicot
E-43	West side of Tannery Rd south of Elmwood (7th utility pole south of Elmwood)
E-44	Utility Pole N Side of Tapawingo Rd near house at 5011
E-TC	Transportation Control; Reserved for TLDs

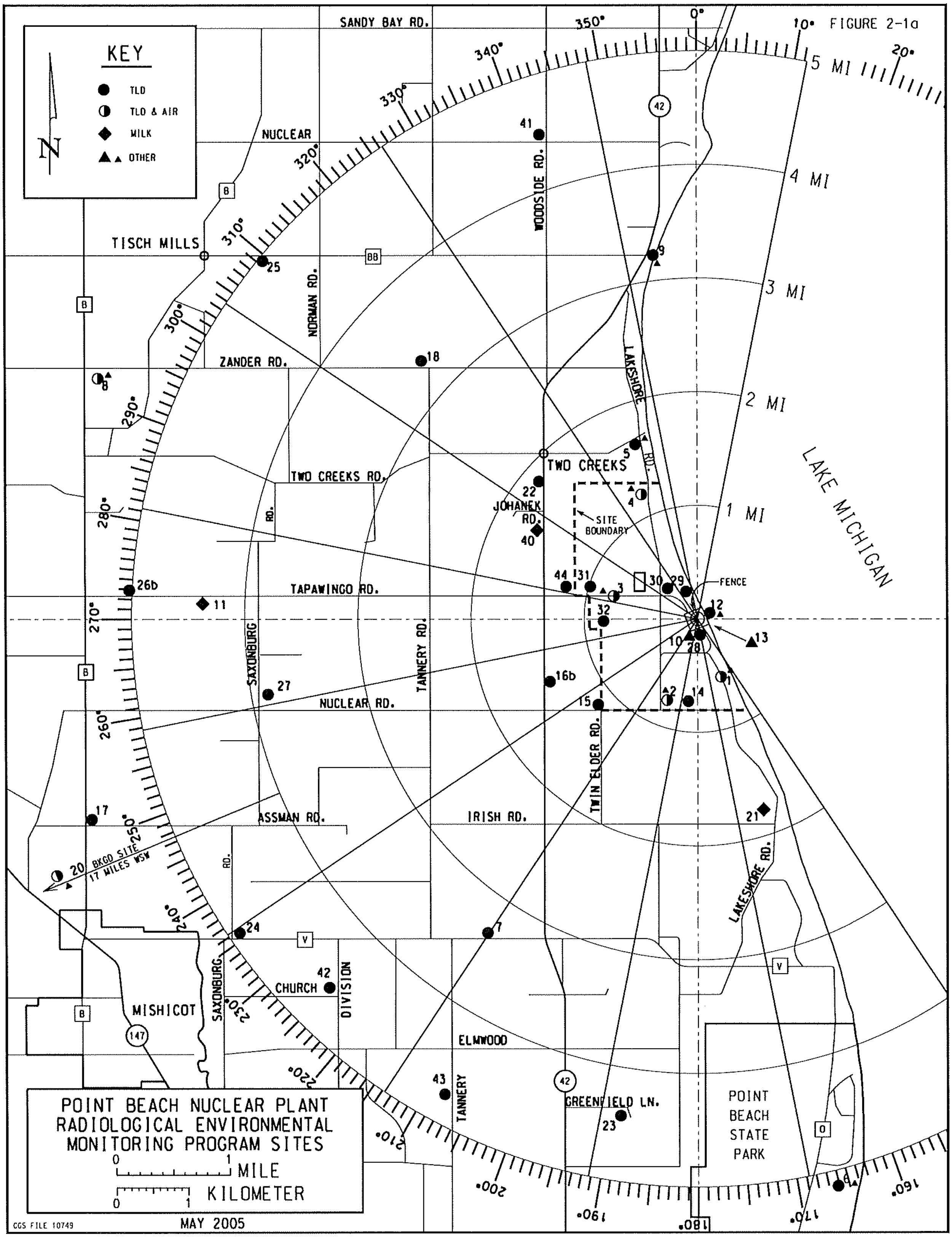


Figure 9-1
PBNP REMP Sampling Sites

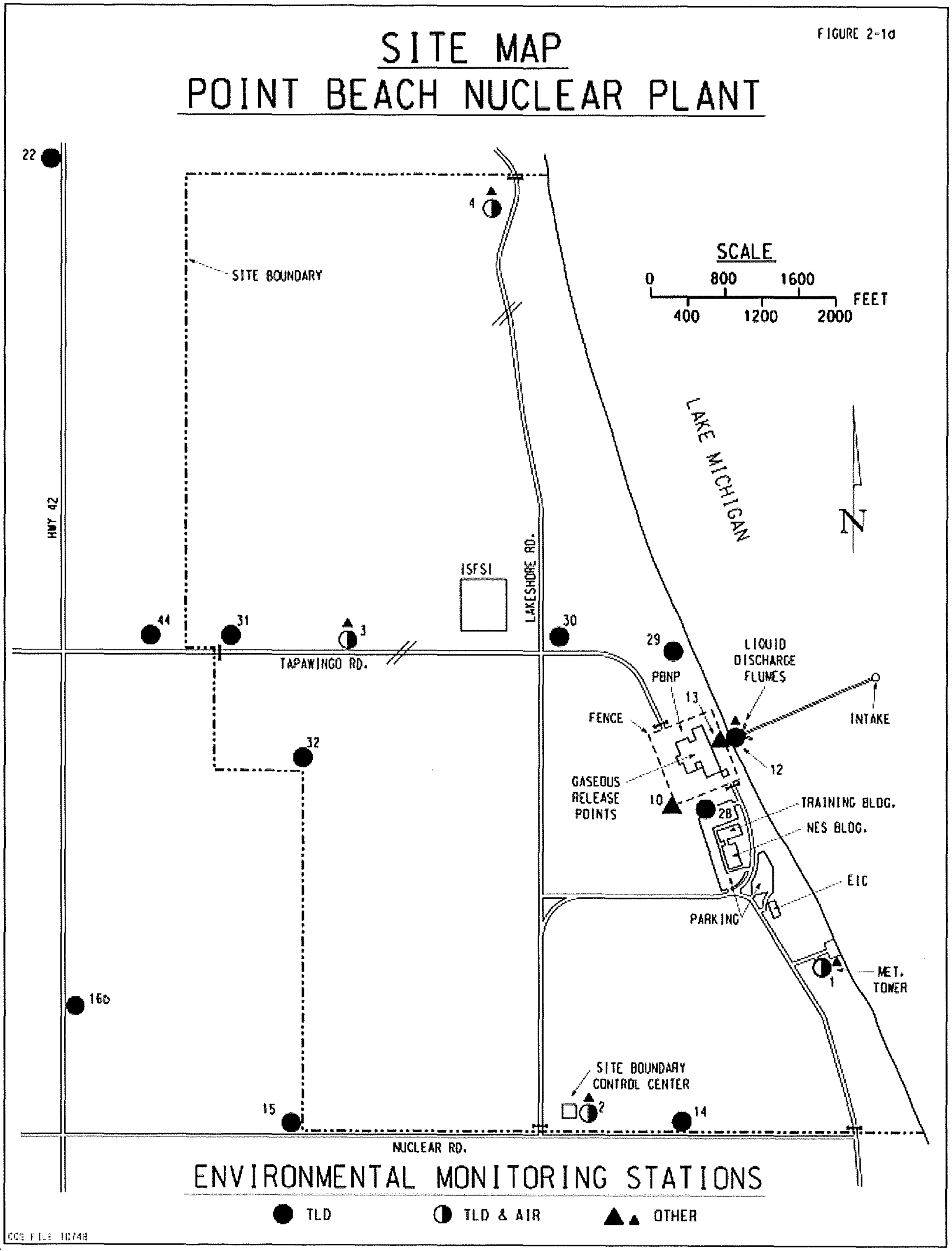


Figure 9-2
Map of REMP Sampling Sites Located Around PBNP

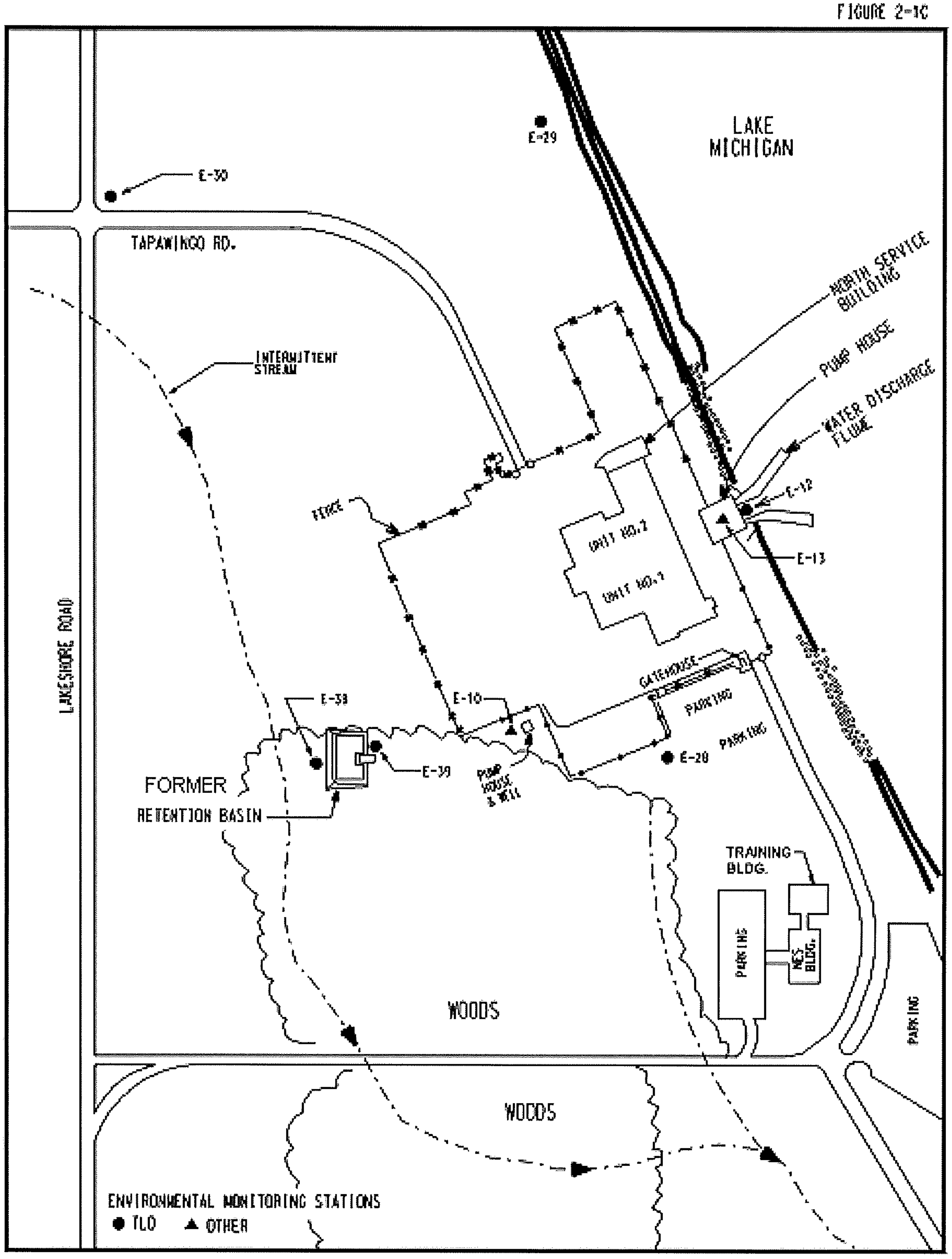


Figure 9-3
Enhanced Map Showing REMP Sampling Sites Closest to PBNP

Table 9-3
ISFSI Sampling Sites

Ambient Radiation Monitoring (TLD)	Soil, Vegetation and Airborne Monitoring
E-03	E-02
E-28	E-03
E-29	E-04
E-30	
E-31	
E-32	
E-44	

Table 9-4
Minimum Acceptable Sample Size

Sample Type	Size
Vegetation	100-1000 grams
Lake Water	8 liters
Air Filters	250 m^3 (volume of air)
Well Water	8 liters
Milk	8 liters
Fish (edible portions)	1000 grams
Soil	500-1000 grams
Shoreline Sediment	500-1000 grams

Table 9-5
Deviations from Scheduled Sampling and Frequency During 2021

Sample Type	Location	Scheduled Collection Date	Reason for not conducting REMP as required	Plans for Preventing Recurrence
LW	E-01	2/9/2021	Unable to collect water; lake frozen	Seasonal variability
LW	E-05	2/9/2021	Unable to collect water; lake frozen	Seasonal variability
LW	E-06	2/9/2021	Unable to collect water; lake frozen	Seasonal variability
AP/AI	E-03	4/29/2021	Sampler failed; no volume recorded.	Monitor equipment and replace as required.
AP/AI	E-02	8/12/2021	Power loss at the station.	Monitor equipment and replace as required.
AP/AI	E-02	8/31/2021	Power loss at the station.	Monitor equipment and replace as required.
LW	E-06	12/7/2021	Unable to collect water due to unsafe conditions.	Seasonal variability

Table 9-6

Sample Collections for State of Wisconsin

Sample Type	Location	Frequency
Lake Water	E-01	Monthly
Fish	E-13	Quarterly, As Available
Precipitation	E-04 E-08	Twice a month, As Available
Milk	E-11 E-21	Monthly
Well Water	E-10	Twice per year

9.6 Analytical Parameters

The types of analyses and their frequencies are given in Table 9-1. The LLDs for the various analyses are found in Section 10 (Table 10-1) with the summary of the REMP results. All environmental LLDs listed in Table 12-1 of the ODCM (also in Table 10-1) were achieved during 2021.

9.7 Description of Analytical Parameters in Table 9-1

9.7.1 Gamma isotopic analysis

Gamma isotopic analysis consists of a computerized scan of the gamma ray spectrum from 80 keV to 2048 keV. Specifically included in the scan are Mn-54, Fe-59, Co-58, Co-60, Zr-95, Nb-95, Ru-103, Ru-106, I-131, Ba-La-140, Cs-134, Cs-137, Ce-141, and Ce-144. However, other detected nuclear power plant produced radionuclides also are noted. The above radionuclides detected by gamma isotopic analysis are decay corrected to the time of collection. Frequently detected, but not normally reported in the Annual Monitoring Report, are the naturally occurring radionuclides Ra-226, Bi-214, Pb-212, Tl-208, Ac-228, Be-7, and K-40.

9.7.2 Gross Beta Analysis

Gross beta analysis is a non-specific analysis that consists of measuring the total beta activity of the sample. No individual radionuclides are identifiable by this method. Gross beta analysis is a quick method of screening samples for the presence of elevated activity that may require additional, immediate analyses.

9.7.3 Water Samples

Water samples include both Lake Michigan and well water. The Lake Michigan samples are collected along the shoreline at two locations north and two locations south of PBNP. The well water is sampled from the on-site PBNP well. Gross beta measurements are made on the solids remaining after evaporation of the unfiltered sample to dryness. Gamma isotopic analyses are performed using 1-liter liquid samples. Strontium is determined by chemical separation and beta counting.

9.7.4 Air Samples

Particulate air filters are allowed to decay at least 72 hours before gross beta measurements are made in order for naturally occurring radionuclides to become a negligible part of the total activity. Gross beta measurements serve as a quick check for any unexpected activity that may require immediate investigation. Quarterly composites of the particulate air filters are analyzed for long-lived radionuclides such as Cs-134 and Cs-137. Charcoal cartridges for radioiodine are counted as soon as possible so the I-131 will undergo only minimal decay prior to analyses. The weekly charcoal cartridges are screened for I-131 by counting them all at the same time to achieve a lower LLD. If a positive result is obtained, each cartridge is counted individually.

In order to ensure that the air sampling pumps are operating satisfactorily, a gross leak check is performed weekly. The pumps are changed out annually for calibration and maintenance beyond what can be accomplished in the field.

9.7.5 Vegetation

Vegetation samples consist predominantly of green, growing plant material (grasses and weeds most likely to be eaten by cattle if they were present at the sampling site). Care is taken not to include dirt associated with roots by cutting the vegetation off above the soil line.

No special vegetation samples were obtained for C-14 analyses in 2021.

9.7.6 Environmental Radiation Exposure

The 2021 environmental radiation exposure measurements were made using TLD cards. The TLD card is a small passive detector, which integrates radiation exposure. Each TLD consists of a Teflon sheet coated with a crystalline, phosphorus material (calcium sulfate containing dysprosium) which absorbs the gamma ray energy deposited in them. Each TLD is read in four distinct areas to yield four exposure values which are averaged. Prior to the third quarter of 2001, exposure data was obtained using three lithium fluoride (LiF) TLD chips sealed in black plastic. The difference in material types can impact the amount of exposure measured. An evaluation of the response difference between the two types of TLD in 2001 demonstrated that the TLD cards produced a 14% higher response than the LiF chips (2011 AMR, Table 9-7, p. 36).

The reported field exposure is the arithmetic average of the measured exposure values at each location minus the exposure transportation control TLD (exposure received while the field TLD is in storage and transit). The gamma rays may originate from PBNP produced radionuclides or from naturally occurring radionuclides. The TLDs remain at the monitoring site for roughly three months prior to analyses and the results are reported as mrem per seven days. Because the TLDs are constantly bombarded by naturally occurring gamma radiation, even during shipment to and from PBNP, the amount of exposure during transportation is measured using transportation controls with each shipment of TLDs to and from the laboratory. The doses recorded on the transportation controls are subtracted from the monitoring TLDs in order to obtain the net *in situ* dose.

9.7.7 ISFSI Ambient Radiation Exposure

The ISFSI fence TLDs are part of the 10CFR72.44 monitoring and are not considered part of the REMP. However, their results can be used indirectly to determine whether the operation of the ISFSI is having an impact on the ambient environmental radiation beyond the site boundary. Impacts are determined by comparison of fence TLD results to the results of the monitoring at PBNP site boundary and other selected locations. These results are used as part of the 40CFR190 compliance demonstration.

10.0 RESULTS

10.1 Summary of 2021 REMP Results

Radiological environmental monitoring conducted at PBNP from January 1, 2021, through December 31, 2021, consisted of analysis of air filters, milk, lake water, well water, soil, fish, shoreline sediments, and vegetation as well as TLDs. The results are summarized, averages and high values, in Table 10-1 which contain the following information:

Sample:	Type of the sample medium
Description:	Type of measurement
N:	Number of samples analyzed
LLD:	*a priori* lower limit of detection
Average:	Average value ± the standard deviation of N samples
High:	Highest measured value ± it's associated 2 sigma counting error
Units:	Units of measurement

For certain analyses, an LLD, which is lower than that required by REMP, is used because the lower value derives from the counting time required to obtain the LLDs for radionuclides that are more difficult to detect. For these analyses, both LLDs are listed with the technical specification required REMP LLD given in parentheses. The results are discussed in the narrative portion of this report (Section 11). Blank values have not been subtracted from the results presented in Table 10-1. A listing of all the individual results obtained from the contracted analytical laboratory and the laboratory's radioanalytical quality assurance results and Interlaboratory Crosscheck Program results are presented in the Appendix.

In Table 10-1 no results are reported as less than LLD (<LLD). All results are reported to Point Beach by the contracted radioanalytical laboratory "as measured" whether positive or negative (see Section 9-1). Based on these results, a radionuclide is considered detected if it meets the criterion that the measured value minus its 2σ counting error is greater than zero ($x-2\sigma > 0$). A "ND" entry in Table 10-1 means that for this radionuclide the criterion was not satisfied for any of the measurements. If one analysis fulfilled the criterion, then all of the reported results, both positive and negative, were used in calculating the average shown in Table 10-1.

The method of determining averages based on "as measured" results follows the recommendations made in NUREG-0475 (1978), "Radiological Environmental Monitoring by NRC Licensees for Routine Operations of Nuclear Facilities Task Force Report," and in Health Physics Society Committee Report HPSR-1 (1980) "Upgrading Environmental Radiation Data" released as document EPA 520/1-80-012 and in more recent documents such as ANSI N42.23-1996, "Instrument Quality Assurance for Radioassay Laboratories;" ANSI N13.30-1996, "Performance Criteria for Radiobioassay;" DE91-013607, "Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance" and NUREG-1576, "Multi-Agency Radiological Laboratory Analytical Protocols Manual."

In addition to the required radionuclides for each medium analyzed, Table 10-1 also has an additional radionuclide listed known to originate with nuclear power plants. This radionuclide is either Co-60, Ru-103, or any other radionuclide which has the lowest LLD based on the analytical parameters needed to meet the LLDs required for radionuclides specified for the medium being analyzed. The radionuclide is identified by parentheses.

During the analyses for those radionuclides specifically required to be identified, naturally occurring radionuclides such as Ra-226, Be-7 and K-40 are detected in many samples. Their concentrations are presented in Table 10-1 for a comparison to those radionuclides for which specific analyses are required by the regulations. There are no regulatory required LLDs for naturally occurring radionuclides.

Finally, Point Beach reports the results for soil analyses. There is no regulatory requirement for soil analyses in standard RETS (NUREG-0472 and NUREG-1301). Point Beach includes soil analyses in the REMP to be able to compare current results to the historical record.

Table 10-3 contains the ISFSI fence TLD results.

Table 10-1
Summary of Radiological Environmental Monitoring Results for 2021

Sample	Description	N	LLD (a)	Average ± 1 Std. Deviation (b)	High ± 2 sigma	Units
TLD	Environmental Radiation	128	1 mrem	1.21 ± 0.22	1.72 ± 0.15	mR/7days
	Control (E-20)	4	1 mrem	1.25 ± 0.19	1.42 ± 0.10	mR/7days
Air	Gross Beta	257	0.01	0.025 ± 0.009	0.055 ± 0.005	pCi/m3
	Control (E-20) Gross beta	52	0.01	0.027 ± 0.009	0.046 ± 0.004	pCi/m3
	I-131	257	0.030 (0.07)	ND	-	pCi/m3
	Control (E-20) I-131	52	0.030 (0.07)	ND	-	pCi/m3
	Cs-134	20	0.01(0.05)	ND	-	pCi/m3
	Control (E-20) Cs-134	4	0.01(0.05)	ND	-	pCi/m3
	Cs-137	20	0.01(0.06)	ND	-	pCi/m3
	Control (E-20) Cs-137	4	0.01(0.06)	ND	-	pCi/m3
	Other γ emitters (Co-60)	20	0.1	ND	-	pCi/m3
	Control (E-20) Other (Co-60)	4	0.1	ND	-	pCi/m3
	Natural Be-7	20	-	0.082 ± 0.012	0.107 ± 0.018	pCi/m3
	Control (E-20) Natural Be-7	4	-	0.087 ± 0.015	0.108 ± 0.015	pCi/m3
Milk	Sr-89	36	5	ND	-	pCi/L
	Sr-90	36	1	0.4 ± 0.2	0.9 ± 0.3	pCi/L
	I-131	36	0.5	ND	-	pCi/L
	Cs-134	36	5 (15)	ND	-	pCi/L
	Cs-137	36	5 (18)	0.0 ± 1.1	2.3 ± 2.2	pCi/L
	Ba-La-140	36	5 (15)	ND	-	pCi/L
	Other gamma emitters(Co-60)	36	15	ND	-	pCi/L
	Natural K-40	36	-	1377 ± 95	1563 ± 119	pCi/L
Well Water	Gross beta	4	4	0.9 ± 0.3	1.4 ± 1.1	pCi/L
	H-3	4	200 (3000)	ND	-	pCi/L
	Sr-89	4	5(10)	ND	-	pCi/L
	Sr-90	4	1 (2)	ND	-	pCi/L
	I-131	4	0.5 (2)	ND	-	pCi/L
	Mn-54	4	10 (15)	ND	-	pCi/L
	Fe-59	4	30	ND	-	pCi/L
	Co-58	4	10(15)	ND	-	pCi/L
	Co-60	4	10(15)	0.9 ± 0.9	2.2 ± 1.9	pCi/L
	Zn-65	4	30	ND	-	pCi/L
	Zr-Nb-95	4	15	ND	-	pCi/L
	Cs-134	4	10(15)	ND	-	pCi/L
	Cs-137	4	10(18)	ND	-	pCi/L
	Ba-La-140	4	15	ND	-	pCi/L
	Other gamma emitters(Ru-103)	4	30	ND	-	pCi/L

NS = No Sample obtained during the year

Table 10-1 (continued)
Summary of Radiological Environmental Monitoring Results for 2021

Sample	Description	N	LLD (a)	Average ± 1 Std. Deviation (b)	High ± 2 sigma	Units
Lake Water	Gross beta	32	4	1.2 ± 0.6	3.6 ± 0.7	pCi/L
	I-131	32	0.5 (2)	ND	-	pCi/L
	Mn-54	32	10 (15)	0.2 ± 0.9	2.0 ± 1.6	pCi/L
	Fe-59	32	30	-0.5 ± 1.8	3.3 ± 3.0	pCi/L
	Co-58	32	10(15)	0.2 ± 0.9	2.4 ± 1.6	pCi/L
	Co-60	32	10(15)	0.2 ± 0.8	2.2 ± 2.0	pCi/L
	Zn-65	32	30	0 ± 2.3	4.8 ± 4.6	pCi/L
	Zr-Nb-95	32	15	ND	-	pCi/L
	Cs-134	32	10 (15)	-0.5 ± 1.6	1.9 ± 1.6	pCi/L
	Cs-137	32	10 (18)	ND	-	pCi/L
	Ba-La-140	32	15	-1.5 ± 3.7	5.1 ± 1.5	pCi/L
	Other gamma (Ru-103)	32	30	ND	-	pCi/L
	Sr-89	12	5(10)	ND	-	pCi/L
	Sr-90	12	1 (2)	0.20 ± 0.13	0.39 ± 0.28	pCi/L
	H-3	12	200 (3000)	96 ± 130	1404 ± 145.4	pCi/L
Fish	Mn-54	13	0.13	0.005 ± 0.007	0.015 ± 0.010	pCi/g
	Fe-59	13	0.26	-0.009 ± 0.018	0.024 ± 0.022	pCi/g
	Co-58	13	0.13	0.001 ± 0.008	0.019 ± 0.01	pCi/g
	Co-60	13	0.13	ND	-	pCi/g
	Zn-65	13	0.26	ND	-	pCi/g
	Cs-134	13	0.13	ND	-	pCi/g
	Cs-137	13	0.15	0.009 ± 0.011	0.030 ± 0.017	pCi/g
	Other gamma (Ru-103)	13	0.5	0.000 ± 0.007	0.012 ± 0.010	pCi/g
	Natural K-40	13	-	2.22 ± 0.69	3.44 ± 0.44	pCi/g
Shoreline Sediment	Cs-134	3	0.18	ND	-	pCi/g
	Cs-137	3	0.15	0.014 ± 0.025	0.032 ± 0.015	pCi/g
	Natural Be-7	3	-	0.081 ± 0.042	0.126 ± 0.058	pCi/g
	Natural K-40	3	-	6.10 ± 2.31	8.379 ± 0.501	pCi/g
	Natural Ra-226	3	-	0.40 ± 0.05	0.461 ± 0.198	pCi/g
Soil	Cs-134	6	0.15	ND	-	pCi/g
	Cs-137	6	0.15	0.15 ± 0.15	0.429 ± 0.04	pCi/g
	Natural Be-7	6	-	0.213 ± 0.30	0.795 ± 0.32	pCi/g
	Natural K-40	6	-	16.77 ± 2.14	19.66 ± 0.97	pCi/g
	Natural Ra-226	6	-	1.08 ± 0.42	1.562 ± 0.30	pCi/g
Vegetation	I-131	12	0.06	-0.003 ± 0.008	0.011 ± 0.006	pCi/g
	Cs-134	12	0.06	ND	ND	pCi/g
	Cs-137	12	0.08	0.003 ± 0.009	0.024 ± 0.011	pCi/g
	Other gamma emitters (Co-60)	12	0.25	ND	ND	pCi/g
	Natural Be-7	12	-	3.14 ± 3.33	7.85 ± 0.39	pCi/g
	Natural K-40	12	-	5.09 ± 0.90	6.39 ± 0.52	pCi/g

(a) When two LLD values are listed, the required LLD per the PBNP REMP is enclosed in the parentheses. Whenever possible, PBNP uses the lower value to obtain greater sensitivity.
(b) "ND" indicates that the sample result is Not Detectable, i.e., sample concentrations were statistically equal to zero or <MDA.

Table 10-2
Average ISFSI Fence TLD Results for 2021

Fence Location	Average	±	Standard Deviation	Units
North	2.33	±	0.19	mR/7 days
East	3.97	±	0.29	mR/7 days
South	2.27	±	0.91	mR/7 days
West	5.89	±	2.18	mR/7 days

11.0 DISCUSSION

11.1 TLD Cards

The ambient radiation was measured in the general area of the site boundary, at an outer ring 4 to 5 miles from the plant, at special interest areas, and at one control location, roughly 17 miles southwest of the plant. The average indicator TLD is 1.21 ± 0.22 mR/7-days compared to 1.25 ± 0.19 mR/7-days at the background location. These two values are not significantly different from each other. Neither are the indicator TLD values significantly different from those observed from 2001 through 2020 for the same type of TLD (tabulated below in Table 11-1). Prior to third quarter of 2001 TLD LiF chips were used versus the current TLD cards, see Section 9.7.6 for additional information. The response difference between the two types of TLDs is evident in Table 11-1. Prior to 2001 all of the annual averages are <1 mrem/7-days. Beginning in 2001, all are >1 mrem/7-days.

Table 11-1
Average Indicator TLD Results from 1993 – 2021

Year	mR/7-days	±	St. Dev*
1993	0.82	±	0.15
1994	0.90	±	0.12
1995	0.87	±	0.13
1996	0.85	±	0.12
1997	0.87	±	0.11
1998	0.79	±	0.13
1999	0.79	±	0.21
2000	0.91	±	0.15
2001	1.06	±	0.19
2002	1.17	±	0.21
2003	1.10	±	0.20
2004	1.10	±	0.22
2005	1.04	±	0.21
2006	1.14	±	0.21
2007	1.08	±	0.20
2008	1.05	±	0.17
2009	1.08	±	0.17
2010	1.11	±	0.15
2011	1.14	±	0.25
2012	1.17	±	0.17
2013	1.14	±	0.20
2014	1.07	±	0.19
2015	1.18	±	0.20
2016	1.19	±	0.21
2017	1.11	±	0.17
2018	1.11	±	0.17
2019	1.10	±	0.20
2020	1.16	±	0.20
2021	1.21	±	0.22

*St. Dev = Standard Deviation

Table 11-2
Average ISFSI Fence TLD Results (mR/7 days)

TLD FENCE LOCATION				
YEAR	North	East	South	West
1995	1.29	1.28	1.10	1.26
1996	2.12	1.39	1.10	1.68
1997	2.05	1.28	1.00	1.66
1998	2.08	1.37	1.02	1.86
1999	2.57	1.84	1.11	3.26
2000	2.72	2.28	1.25	5.05
2001	2.78	2.54	1.36	6.08
2002	2.79	2.74	1.42	6.46
2003	2.70	2.60	1.50	6.88
2004	2.61	2.12	1.41	6.50
2005	2.54	2.05	1.44	5.63
2006	2.73	2.35	1.38	5.80
2007	2.72	2.73	1.34	5.47
2008	2.64	2.37	1.36	5.36
2009	2.36	2.35	1.20	4.63
2010	2.64	3.02	1.41	5.05
2011	2.44	2.62	1.31	4.75
2012	2.59	3.27	1.40	4.92
2013	2.57	3.66	1.15	4.28
2014	2.45	3.35	1.14	4.24
2015	2.31	3.24	1.17	4.36
2016	2.30	3.34	1.33	4.35
2017	2.21	3.84	1.30	4.25
2018	2.24	4.21	1.49	4.32
2019	2.20	4.18	1.57	4.08
2020	2.46	4.19	1.71	4.2
2021	2.33	3.97	2.27	5.89

There is no significant change in the exposure on the TLD monitoring locations around the ISFSI (Table 11-3). The results at E-03 and E-31 (W of the ISFSI) and E-32 (SW of the ISFSI) are similar to previous years (1.42, 1.26, and 1.45 respectively) and continue to be higher than E-30 (1.05) on the east side and closest to the ISFSI. E-03, about equidistant between the ISFSI and the site boundary location E-31, continues to be slightly higher than the site boundary location but the difference is not statistically different. (See Figs. 9-1 and 9-2 for locations).

Although the mR/7-day results for the three TLD locations nearest the site boundary (E-03 1.42 ± 0.44; E-31, 1.26 ± 0.28; E-32, 1.45 ± 0.28) are higher than at the background site E-20 (1.25 ± 0.19), they are comparable at the 95% confidence level, indicating a small, but not significant, increase in ambient gamma radiation at the site boundary due to the operation of the ISFSI. In 2018, a TLD monitoring location was added at location E-44 TLD, directly west of E-03 and E-31, but prior to the nearest resident. The average reading at E-44 (1.28 ± 0.45) is similar to the observed readings at E-03, E-31, and background location E-20 (1.42, 1.26, and 1.25 respectively).

Further data supporting this conclusion is the comparison of the TLD results at selected locations around the ISFSI before and after the storage of spent fuel at the ISFSI (Figure 11-1). As stated in Section 9.7.6, the TLD values increased by about 14% in the second half of 2001 when the TLD monitoring devices were changed from LiF chips in the first half of 2001 to calcium sulfate impregnated TLD cards. After that initial change, the measured radiation exposure, as measured by the TLD cards, has remained fairly constant with a slight increase with the addition of stored fuel at the ISFSI. Each year the variations in the TLD results appear to move in concert with each other and with the background site, E-20, which is 17 miles south west of the ISFSI.

Comparing the ISFSI TLD results to results from surrounding REMP indicator and background TLDs reveals minimal impact of the ISFSI on the surrounding radiation levels (Figure 11-2). An increase in the 2021 West ISFSI TLD is expected based on the placement of the new casks on the ISFSI pad. As previously discussed, the small increase is more related to the switch from the LiF chips to the calcium sulfate impregnated Teflon TLD cards as evidenced by the synchronicity with E-20, the background site.

LiF TLD chips were replaced with calcium sulfate impregnated Teflon TLD cards in the third quarter of 2001 resulting in a higher measured background values.

Figure 11-1 ISFSI AREA TLD RESULTS

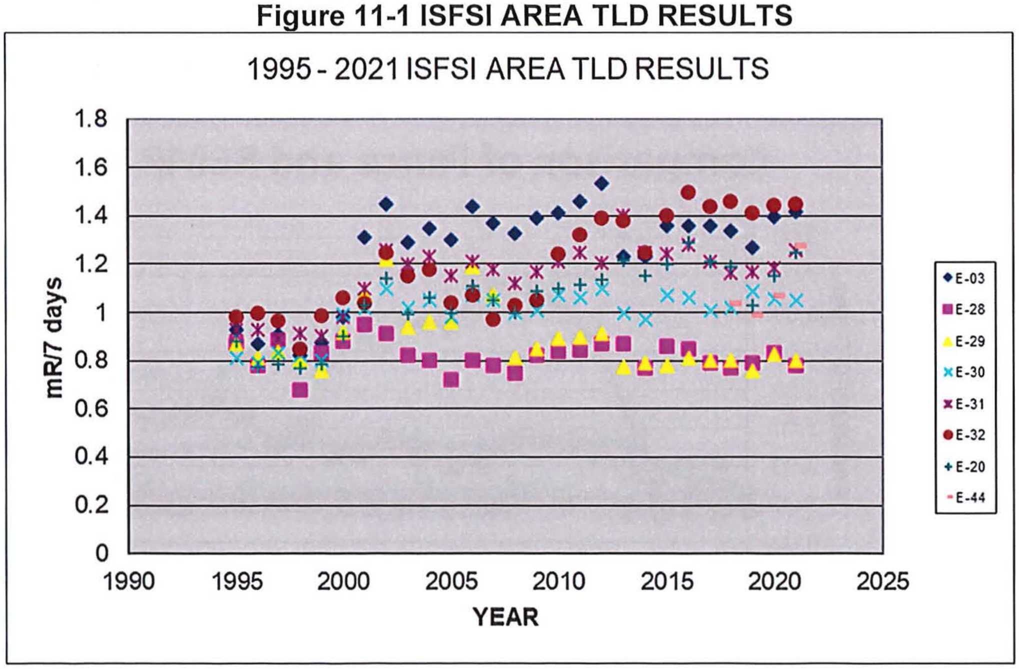


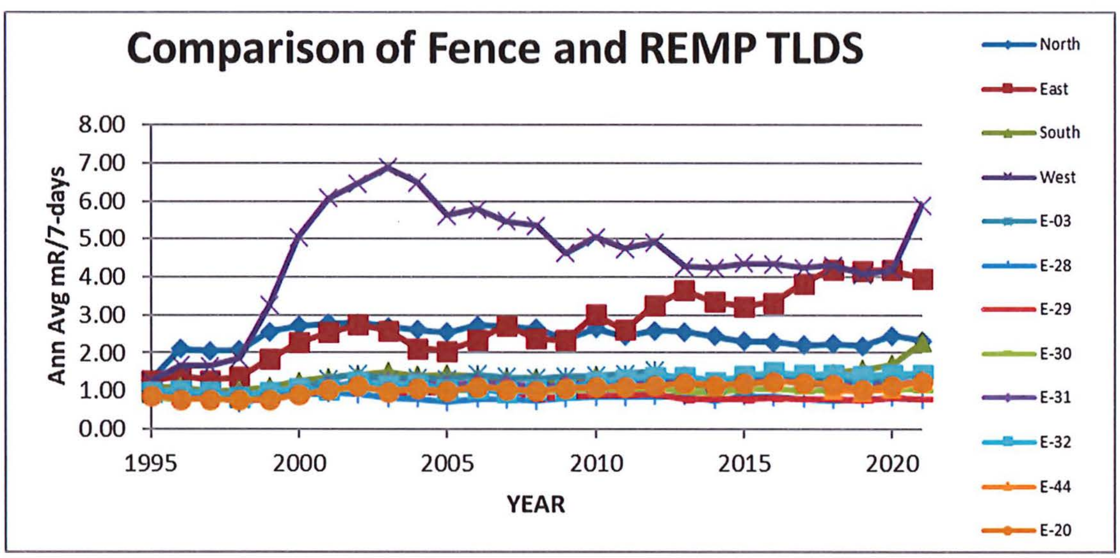
Table 11-3
Average TLD Results Surrounding the ISFSI (mR/7 days)

Sampling Site

	E-03	E-28	E-29	E-30	E-31**	E-32**	E-44****	E-20***
Pre-Operation*	0.93	0.87	0.87	0.81	0.93	0.98		0.88
1996	0.87	0.78	0.81	0.79	0.93	1.00		0.78
1997	0.91	0.89	0.84	0.84	0.89	0.97		0.79
1998	0.82	0.68	0.80	0.82	0.91	0.85		0.77
1999	0.88	0.83	0.76	0.80	0.90	0.99		0.78
2000	0.98	0.88	0.92	0.99	0.98	1.06		0.90
2001	1.31	0.95	1.07	1.02	1.10	1.04		1.03
2002	1.45	0.91	1.22	1.10	1.26	1.25		1.14
2003	1.29	0.82	0.94	1.02	1.20	1.15		0.99
2004	1.35	0.80	0.96	1.05	1.23	1.18		1.06
2005	1.30	0.72	0.96	0.98	1.15	1.04		1.00
2006	1.44	0.80	1.19	1.07	1.21	1.07		1.11
2007	1.37	0.78	1.07	1.05	1.18	0.97		1.05
2008	1.33	0.75	0.81	1.00	1.12	1.03		1.00
2009	1.39	0.82	0.85	1.01	1.17	1.05		1.09
2010	1.41	0.84	0.89	1.07	1.21	1.24		1.10
2011	1.46	0.85	0.90	1.06	1.25	1.32		1.12
2012	1.54	0.87	0.91	1.10	1.21	1.39		1.14
2013	1.23	0.87	0.77	1.00	1.40	1.38		1.22
2014	1.23	0.77	0.79	0.97	1.25	1.25		1.15
2015	1.36	0.86	0.78	1.07	1.24	1.40		1.20
2016	1.35	0.85	0.81	1.06	1.28	1.50		1.25
2017	1.36	0.79	0.80	1.01	1.21	1.44		1.21
2018	1.34	0.77	0.80	1.02	1.16	1.46	1.04	1.19
2019	1.27	0.78	0.76	1.09	1.17	1.41	0.99	1.03
2020	1.39	0.84	0.83	1.06	1.18	1.45	1.07	1.15
2021	1.42	0.78	0.8	1.05	1.26	1.45	1.28	1.25

*Pre-Operational data are the averages of the years 1992 through 3rd quarter of 1995.
**Sites E-31 and E-32 are located at the Site Boundary to the West and South-West of the ISFSI.
***E-20 is located approximately 17 miles WSW of the ISFSI.
****E-44 Added in 2018

Figure 11-2 Comparison of ISFSI Fence TLDs to Selected REMP TLDs



11.2 Milk

Naturally occurring K-40 (1377 ± 95 pCi/L) continues to be the most prevalent radionuclide measured in milk at concentrations roughly 1300 times higher than the only potential plant related radionuclide, Sr-90 (0.4 ± 0.2 pCi/L), detected in milk. The annual average Sr-90 concentrations in milk continue to be similar to previous years. No positive results for Co-60, I-131, Cs-134, Ba-La-140, or Sr-89 were obtained in 2021.

One low positive Cs-137 result was obtained in September 2021 and was below the MDC limit and therefore may be false positive. In the last four years, Cs-137 was discharged from PBNP only in March 2016 and October 2017.

The 2021 average Sr-90 concentrations have not changed much over the last few years (Figure 11-3). Over the past twenty years, the average has decreased from 1.2 ± 0.5 pCi/L in 1997 to 0.4 ± 0.2 pCi/L in 2021. The graph of the annual averages displays a logarithmic decrease over time (Figure 11-3).

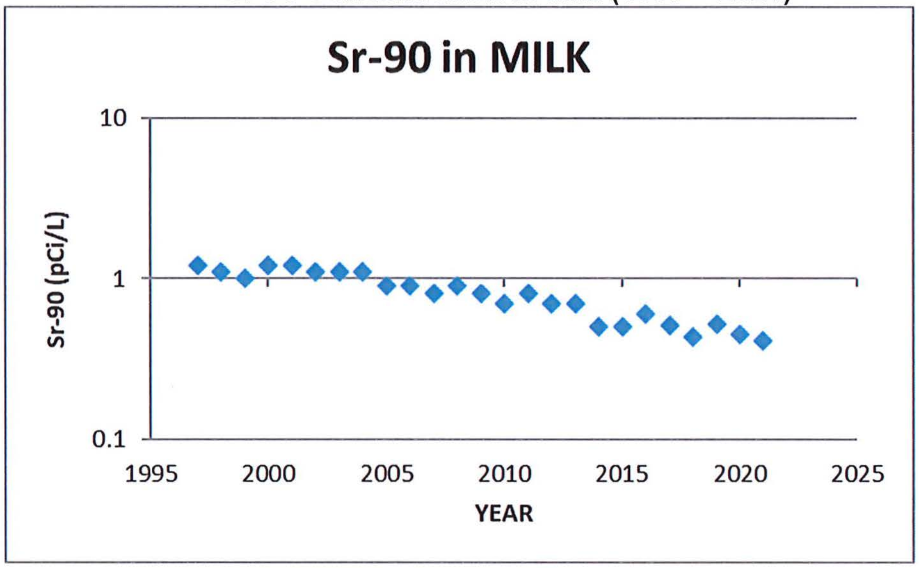
The annual averages are from the monthly Sr-90 measurements from three different dairies (Figure 9-1). The only dairy that has been in the monitoring program over the entire 1997 – 2021 timespan under consideration is located at site E-21. It is located south of the plant. The other two, E-40 and E-11, are replacements for dairies which had dropped out of the program at various times during this time interval. The replacements were chosen to maintain, to the extent possible, the former sampling sites west and north of Point Beach.

Point Beach discharged no airborne Sr-90 in 2021. Since 1997, PBNP has discharged airborne Sr-90 only in 3 years: 1999, 2.4E-08 Ci; 2004, 3.2E-08 Ci; and 2011, 1.6 E-08 Ci. It is interesting to note that nine of highest Sr-90 results occur at E-11 located about 4.4 miles west of PBNP (Fig. 9-1). If the observed Sr-90 activity were from Point Beach the highest Sr-90 concentrations would occur at E-21, the dairy south of the site boundary in the highest X/Q and D/Q meteorological sector. This dairy grows feed corn on site and in a field across the road from the site boundary in the highest D/Q sectors. Feed crops are the dominant source of food for dairy cattle. No cattle have been seen grazing neat the site boundary for many years.

The major Sr-90 input to the environment is from fallout from atmospheric weapons testing during the early 1960s with minor inputs during the 50's, 70's and later contributions from the Chernobyl accident in the late 1980s and from Fukushima in 2011. The Sr-90 in milk persists due to its 28.6 year half-life and to cycling in the biosphere. With little or no atmospheric input to the environment, the mode of entry into cattle feed must be root uptake by forage crops and transfer into the milk. Over the time period of this graph (1997 – 2021), these low discharges do not appear to impact the decreasing concentrations as they continue to decrease over time.

It is concluded that the milk data for 2021 show no radiological effects of the plant operation.

Figure 11-3
Sr-90 Concentration in Milk (1997 – 2021)



11.3 Air

The average annual gross beta concentrations (plus/minus the 2σ uncertainty) in weekly airborne particulates at the indicator and control locations were 0.025 ± 0.018 pCi/m³ and 0.027 ± 0.018 pCi/m³, respectively, and are similar to levels observed from 1993 through 2021 (Figure 11-4).

The 2021 weekly gross beta concentrations reveal higher winter values and lower summer values (Figure 11-5). This is a repeat of the patterns seen in 2006 - 2020. The slight September-October peak is similar to what was observed in 2015 (Figure 11-6). The August-October peak is observed throughout the US and believed to result from weather patterns impacting with naturally occurring airborne radionuclides. This would explain why the control and indicators are moving in concert. Therefore, a plant effect can be ruled out.

Figure 11-4 Annual Average Air Gross β (1993 – 2021)

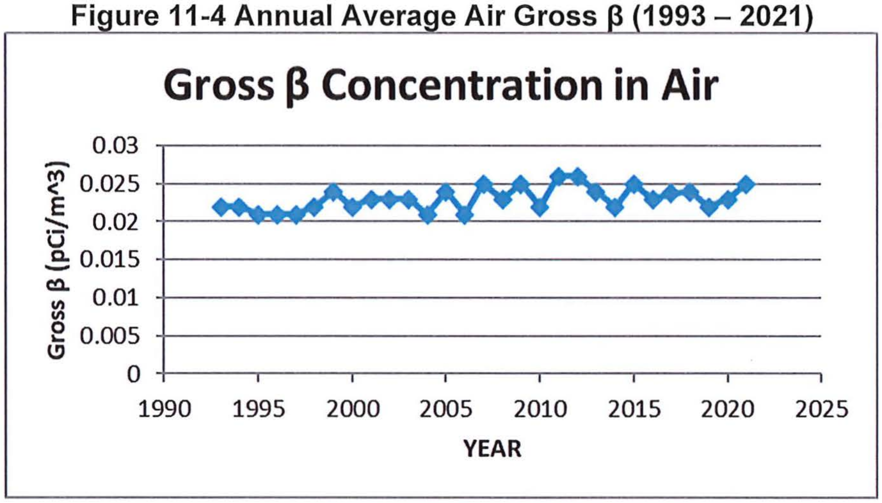


Figure 11-5 2021 Airborne Gross Beta

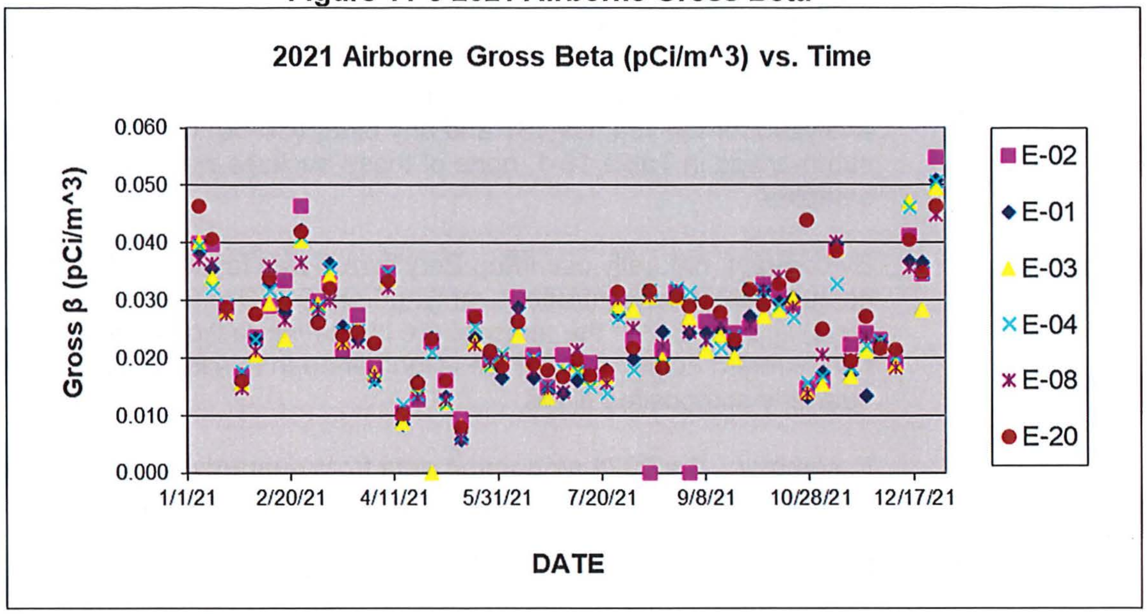
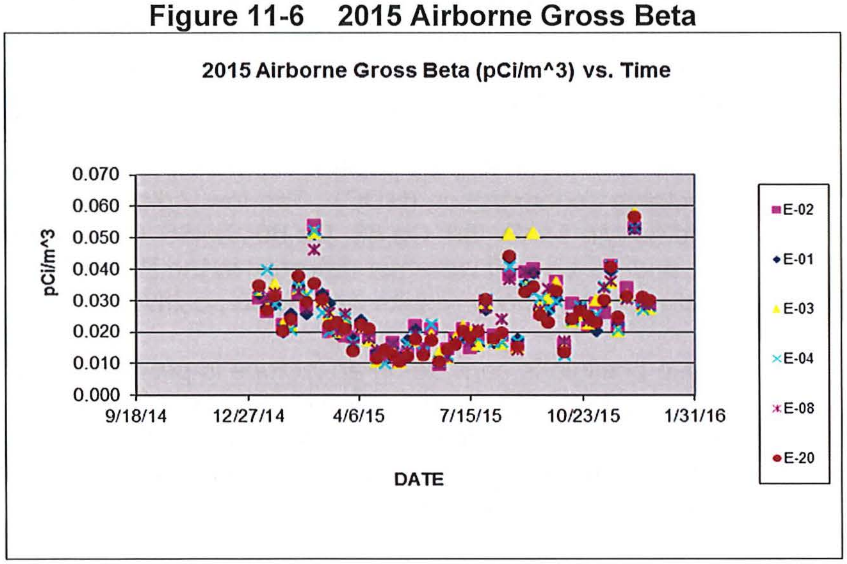


Figure 11-6 2015 Airborne Gross Beta



No I-131 was detected during 2021. In 2005, the new method of evaluating airborne I-131 was instituted. Instead of counting each charcoal cartridge separately, all six cartridges for the week are counted as one sample in a predetermined geometry to screen the samples for I-131. If any airborne radioiodine is detected, each sample cartridge is counted individually. With no detectable I-131, the reported analytical result is the minimum detectable activity (MDA) conservatively calculated using the smallest of the six sample volumes. The reported MDAs ranged from 0.004 to 0.021 pCi/m^3. Because the analysis LLD is based on counting only one cartridge, the use of six cartridges or roughly six times the sample volume with the same count time as would be needed to achieve the desired LLD for only one sample, the actual LLD is about six times lower than the programmatic value given in Table 10-1. Similarly, the actual MDA is about one-sixth of that reported, in the range of 0.001 to 0.004 pCi/m^3.

At each sampling location, the particulate filters are composited quarterly and analyzed for Cs-134, Cs-137 and any other (Co-60) detectable gamma emitters. As summarized in Table 10-1, none of those nuclides were present in the 2021 samples.

By contrast, naturally occurring Beryllium-7 was found in all of the quarterly composites at concentrations ranging from 0.063 to 0.108 pCi/m^3. Be-7 ($T_{1/2}$ = 53.3 days) is produced in the atmosphere by the interaction of cosmic rays with oxygen and nitrogen nuclei. Its half-life is long enough to allow for it to be detected in the quarterly composited filters.

In summary, the 2021 air gamma data from quarterly composites do not indicate a measurable environmental impact from the operation of PBNP.

11.4 Lake Water

For the REMP-specified gamma emitting radionuclides listed in Table 10-1, the reported concentrations continue to occur as small, negative and positive values scattered around zero, indicating no radiological impact from the operation of PBNP. Only 15 of the results were positive, of which, five are from north of the plant, sites E-33 and E-05 (see Figure 9-1).

None of the fifteen slightly positive results were greater than the minimum detectable concentration (MDC). The few indications of positive concentration were found for Mn-54, Fe-59, Co-58, Co-60, Zn-65, Cs-134, and Ba/La-140. Zn-65, Cs-134, and Ba-La-140 were not detected in the PBNP liquid effluent in 2021, concluding that those results were false positives.

A false positive is concluding an isotope is present when it isn't. False positives occur most often at the detection limit when the random fluctuations of the background result in lower than normal background activity. The result is a higher net count and hence falsely concluding an isotope is present when it isn't because the value is statistically above zero.

Fe-59 was observed in October 2021 in the lake water, but was only quantified as being released from PBNP effluents in November 2021. Mn-54 was identified in the November 2021 lake water sample which was obtained four days after Mn-54 was quantified as being released from Point Beach. Co-58 and Co-60 were observed sporadically in the lake water samples and were released throughout the year in 2021. As was stated above, all isotope values noted were less than the MDC.

Aliquots of the monthly samples are composited quarterly and analyzed for Sr-89/90 and for tritium. Small amounts of Sr-90 were detected in five of the twelve quarterly composites, one north and four south of the plant. All the results were below their statistically calculated MDCs. No Sr-90 was discharged in 2021 or in 2012 – 2015 and 2017-2019. A small amount was discharged in March of 2016. Sr-90 has a 28.6 year half-life and, like Cs-137, is a remnant of atmospheric weapons testing in the '50s and '60s. Therefore, positive Sr-90 concentrations could be indicative of fallout being recycled in Lake Michigan. However, because the concentrations are below their MDCs, they most likely are false positives and there for unlikely to be the result of past PBNP discharges.

Tritium, in addition to being produced by water-cooled reactors such as PBNP, also is a naturally occurring radionuclide. It also was produced by atmospheric weapons testing. However, due to its mobility, any tritium now found in Lake Michigan at the concentrations typically found in monitoring programs cannot be from that time period. It is the result of power plant discharges. Point Beach discharges on the order of 600 - 1000 Ci of tritium per year.

Twelve quarterly lake water composites were generated from the monthly samples. Out of the twelve quarterly composites, four had positive tritium indications, and of those four only one was greater than the MDC. The one occurrence was at E-01 the onsite meteorological tower in the 4th quarter of 2021 and had a concentration of 484 ± 101 pCi/L. The 4th quarter sample from E-01 was analyzed by month and it was shown that the October 2021 sample had a tritium result of 1404.0 ± 145.4, while November was not detectable and December was 102.9 ± 93.3 pCi/L.

Point Beach completed a batch liquid discharge approximately 8 hours prior to obtaining the lake water sample at E-01 in October. The concentration of the Point Beach discharge was 3.65E+04 pCi/L. There is potential that due to the lake current that the Point Beach discharge had an impact on the observed elevated tritium concentration in October 2021, and subsequently the 4th quarter.

In conclusion, the observed tritium concentrations were well below the limit set forth by the EPA for drinking water standards (20,000 pCi/L). As well, based on the results of the gamma scans of Lake Michigan water, there is no measurable impact on the lake from PBNP discharges.

11.5 Fish

Thirteen (13) fish were analyzed in 2021 with nine exhibiting detectable amounts of plant related activity. Of these, five were positive for Cs-137 with two Cs-137 results >MDC. The positive Cs-137 concentrations ranged from 0.012 ± 0.010 to 0.030 ± 0.017 pCi/g. Cs-137 was released in low levels during 4 months in the first half of 2021. It is likely that the Cs-137 observed is the recycling of Cs-137 that entered Lake Michigan as fallout from atmospheric weapons testing in the '50s and '60s with lesser amounts from events at Chernobyl and Fukushima.

Positive results below their MDCs were found also for Mn-54, Fe-59, Co-58, and Ru-103.

The highest radionuclide concentration in fish is naturally occurring K-40 with an average concentration of 2.22 ± 0.69 pCi/g.

Based on these results, it is concluded that there is little impact of PBNP discharges on Lake Michigan fish.

11.6 Well Water

All tritium results were not detectable for the 2021 well samples. One nuclide, Co-60, was detected in the 3rd quarter 2021 sample. The result was 2.2 ± 1.9 pCi/L and was less than the MDC of 2.5. There is no pathway for liquid effluents to have interaction with the aquifer that supplies the drinking well. The result was determined to be a false positive, based on no available pathway and no other nuclides being identified in that sample or any others throughout 2021. Therefore, there is no evidence of PBNP effluents getting into the aquifer supplying drinking water to PBNP.

11.7 Soil

Cs-137 is present in the soils throughout North America and the world resulting from the atmospheric nuclear weapons testing in the 1950s, 1960s, and 1970s and from the 1986 Chernobyl accident, and more recently, from the Fukushima event. Soil is an integrating sample media, in that it is a better indicator of long term buildup of Cs-137 as opposed to current deposition for local sources. In addition to erosion and radioactive decay, human activities can modify the soil Cs-137 concentrations.

In 2021, Cs-137 was detected in five of the six soil samples obtained in September. The concentrations ranged from not detectable to 0.429 ± 0.04 and all were >MDC. The highest value for Cs-137 was found at E-06. No airborne release of Cs-137 occurred in 2021, with the most recent release of airborne Cs-137 occurring approximately three years prior in October 2017 for a total of 0.237 µCi at a concentration of 1.96E-08 pCi/cc.

The values of Cs-137 observed are consistent with years past, therefore it seems unlikely that the observed soil Cs-137 is attributable to PBNP effluent. The most likely source is recycling of fallout from atmospheric weapons testing in the 50s and 60 as well as the Chernobyl and Fukushima events and subsequently being bound to the soil.

By comparison to naturally occurring radionuclides, Cs-137 continues to be present in soil samples at well below the levels of naturally occurring Be-7, K-40, and Ra-226 (see Table 10-1).

11.8 Shoreline Sediment

Shoreline sediment consists of sand and other sediments washed up on the Lake Michigan shore. As in soil samples, the only non-naturally occurring radionuclide found in these samples is Cs-137. Two of the three samples obtained had Cs-137 concentrations statistically different from zero with both results being >MDC.

Shoreline sediment Cs-137 concentrations continue to be about one-tenth of that found in soils (Table 10-1). This is expected because Cs-137 in the geological media is bound to fine particles, such as clay, as opposed to the sand found on the beach. Lake Michigan sediments are a known reservoir of fallout Cs-137. Wave action suspends lake sediments depositing them on the beach. The fine particles deposited on the beach eventually are winnowed from the beach leaving the heavier sand; hence the lower Cs-137 concentrations in beach samples. In contrast to Cs-137, K-40, which is actually part of the minerals making up the clay and sand, is at a concentration about several hundred times higher than the Cs-137 that is attached to particle surfaces. Therefore, it is not surprising that Cs-137 is present at concentrations 1% or less of the naturally occurring concentrations of K-40.

The most likely source of the observed Cs-137 is the cycling of fallout from atmospheric weapons tests and events such as Chernobyl and Fukushiima in the Lake Michigan environment and not current PBNP discharges. As with soil, the naturally occurring radionuclides such as K-40, and Ra-226 are found in the shoreline sediment samples. Therefore, the shoreline sediment data indicate no radiological effects from current plant operation.

11.9 Vegetation

The REMP collects general vegetation, non-cultivated plants which would be consumed by grazing cattle.

The naturally occurring radionuclides Be-7 and K-40 were found in all of the general vegetation samples (Table 10-1). The source of Be-7 is atmospheric deposition. It is continuously formed in the atmosphere by cosmic ray spallation of oxygen, carbon, and nitrogen atoms. Spallation is a process whereby a cosmic ray breaks up the target atom's nucleus producing a radionuclide of lower mass. Be-7 in the vegetation samples had an average of 3.14 ± 3.33 pCi/g. In general vegetation Be-7 concentrations were higher in the fall than in the spring and ranged from 0.25 ± 0.14 to 7.85 ± 0.39 pCi/g. The average Be-7 concentrations in the vegetation increased from May (0.39 ± 0.11 pCi/g) to September (5.89 ± 2.50). In contrast, K-40 is a primordial radionuclide which is incorporated into vegetation from the soil during the growing process. By not being dependent upon seasonal atmospheric variations and plant surface to capture deposition, the vegetation K-40 concentrations from root uptake are more uniform with a range of 3.52 ± 0.40 to 6.39 ± 0.52.

Cs-137 can be present in vegetation via both pathways. Fresh Cs-137 fallout is associated, like Be-7, with deposition on the plant surface. Old fallout from the '50s and '60s is now being incorporated into growing plants in the same manner as potassium because it is in the same chemical family as potassium. This fallout Cs-137 has been found in firewood ash at many locations in the United States that are far from any nuclear plants (S. Farber, "Cesium-137 in Wood Ash, Results of a Nationwide Survey," 5th Ann. Nat. Biofuels Conf., 10/21/1992).

In 2021, three of the twelve vegetation samples had a positive indication for Cs-137 and only one location in September had a result above the MDC. E-06 had a result of 0.024 ± 0.011 (MDC was 0.020), while the other two positive results were below the MDC and was found at E-02 in September and E-06 in May. Typically, only the vegetation collected at monitoring site E-06, in the Point Beach State Park south of PBNP, has detectable levels of Cs-137, but other slightly positive Cs-137 results have been observed at other locations. These occurrences were attributed to the above described mechanism. The only 2016 airborne Cs-137 discharged by PBNP occurred in March when there was no fresh vegetation. In 2017 the airborne Cs-137 release occurred in October after the vegetation and crops were collected, and in 2018-2021 there was no airborne Cs-137 released in plant effluents. Therefore, the Cs-137 has to be the result of uptake via roots. Therefore, it is unlikely that the Cs-137 results indicate an impact from PBNP releases.

No Cs-134 or Co-60 was detected in the 2021 vegetation samples. One positive I-131 result was detected in the vegetation sample at E-20, the control location, but was less than the MDC.

Based on the 2021 vegetation sampling results, it is concluded that there is little or no effect from PBNP effluents.

11.10 Land Use Census

In accordance with the requirements of Section 12.2.5 of the ODCM, a visual verification of animals grazing in the vicinity of the PBNP site boundary was completed in 2020. In 2020, changes to the land use surrounding the site due to the installation of solar panels at and around the site boundary were noted. These changes ensure that the use of pasturelands or grazing herds remain conservative, as there is less land near the site boundary for grazing animals and pasture use. Based on this the existing milk-sampling program continues to be acceptable. The nearest dairy (E-21) lies in the SSE sector and it is one of the Point Beach REMP milk sampling sites. Also, the highest χ/Q (1.09E-06) and D/Q (6.23E-09) values occur in these sectors. As demonstrated from the vegetation in the area, there is no measureable plant impact on the environment. Therefore, dose calculations to the maximum exposed hypothetical individual, assumed to reside at the site boundary in the S sector, continues to be conservative for the purpose of calculating doses via the grass-cow-milk and the other ingestion pathways.

The 2020 LUC revealed that three garden locations within a 5-mile radius of the site in the NNW, WNW, and W sectors required replacement. The garden locations previously identified in 2017 in these sectors were not found in 2020. New garden locations were identified in the 2020 LUC for the NNW, WNW, and W sectors. None of the changes identified in the 2020 LUC necessitate changes to the current REMP, such as the addition of new sampling locations.

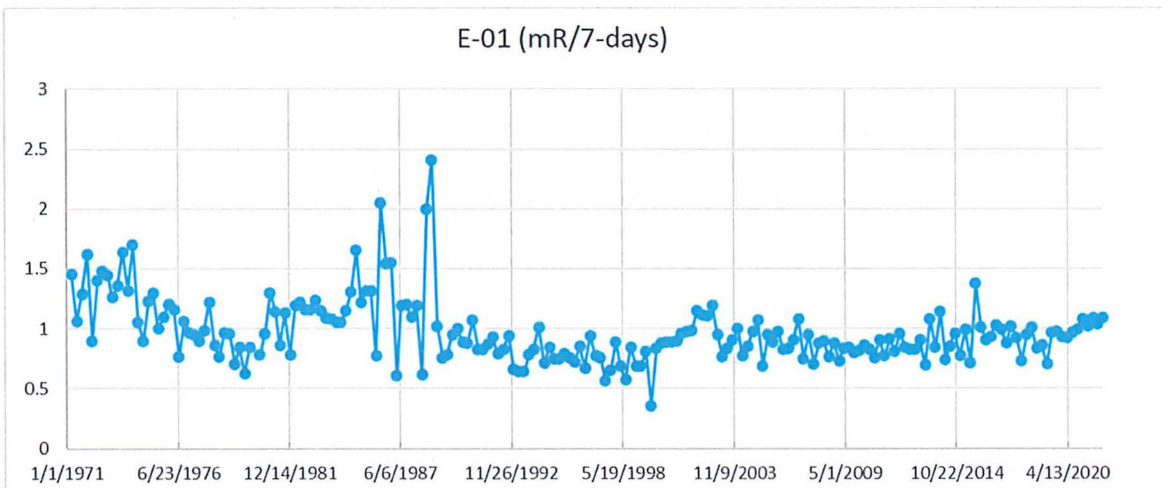
11.11 Long Term TLD Trending

To put the 2021 REMP TLD results in perspective, it is instructive to look at long term trends. The following examines the TLD results from 1971 to 2021. The ANSI standard (ANSI/HPS N13.37-2014 "Environmental Dosimetry) states that the data from early vintage dosimetry systems (c. 1970 – 1990) should not be considered comparable to current dosimetry systems in establishing a baseline for environmental TLD results. These problems are evident from the review of our early data as discussed below.

The pre-operational data, 1968 – 1970, are not included. The pre-operational ambient radiation monitoring sites were E-01 (the met tower area) through E-04 (the north boundary). They were monitored using TLDs and ionization chambers. E-04 was used as a background location until E-08 (see Figure 9-1) was added for the operational REMP in 1971. Prior to 1975, a control TLD stored in a lead pig was used for a comparison to those placed in the field. In the pre-operational data, the control TLD could be equal to or higher than the field results and both the field and control TLD results appear erratic compared to the ion-chamber results. Also, the reported TLD results do not have transportation exposures from New Mexico to Wisconsin subtracted. Therefore, only the TLD results beginning in 1971, with the transportation caveat, are used in this analysis of long-term trends.

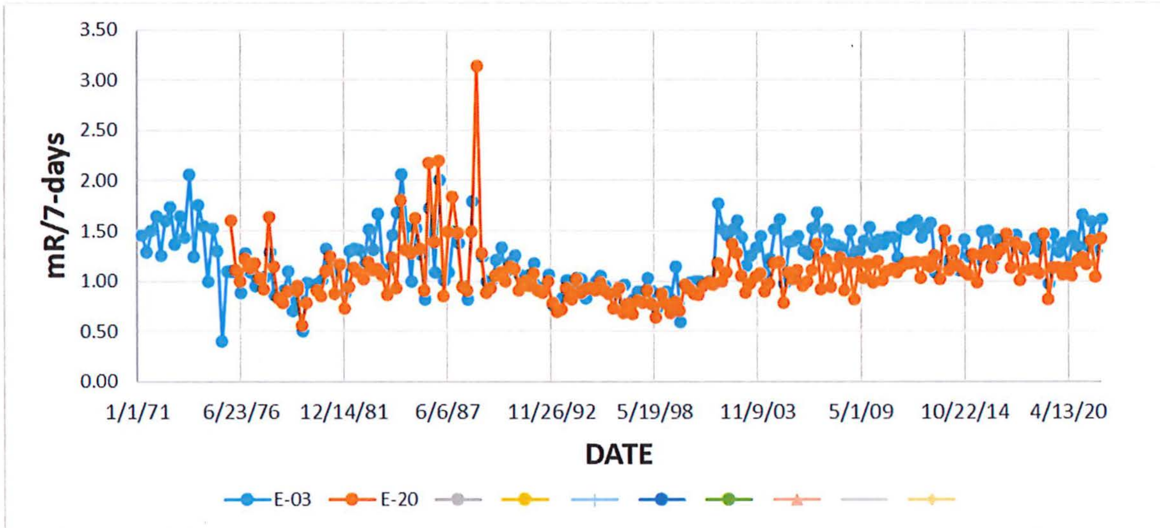
The trend at E-01(Figure 11-7) shows slowly decreasing *trend* from 1971 to 1979. This is may be an artifact. The cause is not known. As previously mentioned, no transportation controls were used until the 4th quarter of 1975 so no transport dose corrections were made prior to that quarter. There is a small increase in 1980 when the current contracted REMP lab began. A slowly decreasing exposure rate occurs from 1980 – 1992 except for the 1984 - 1988 time segments. The erratic results from 1984 – 1988 were traced to a faulty connection in the TLD reader.

Figure 11-7 E-01 Results 1971 – 2021



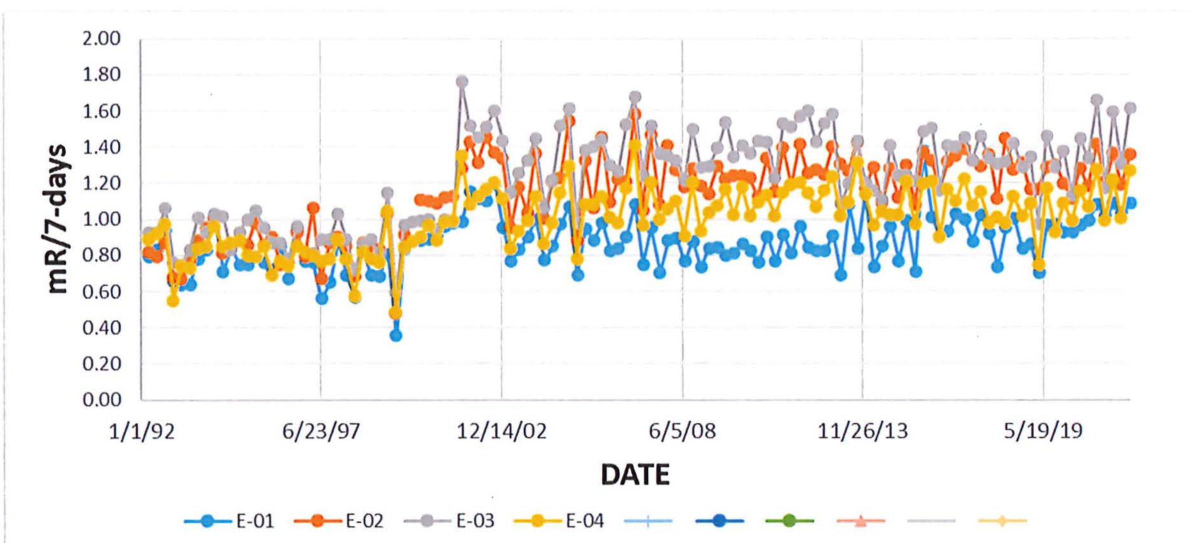
The TLD package from 1980 to 2001 consisted of three LiF chips sealed in a black plastic bag. The magnitude of the error bars indicates the degree of variability of the 1984 - 1988 results from the three chips due to a fault in the TLD reader. The results appear much the same for the E-03 and E-20 results (Figure 11-8). Note that E-20 did not begin until 1976. Again, there is an increase in both the E-20 (the background site) and E-03 (the location nearest the ISFSI) which coincides with the switch from the LiF chips to the Teflon TLD cards. Given that the first twelve casks were loaded December 1995 to September 2000 in which there were no increases in the TLD results, the increase in 2001 indicates that this change is the result of the different response of the new TLDs and not of any effluents or shine from the plant.

Figure 11-8 Comparison of E-03 and E-20 Results 1971 – 2021



Narrowing the time window for the TLD results from 1992 to the present allows for a comparison among the original four TLD locations since the introduction of the ISFSI (Figure 11-9) without the interference by the faulty TLD reader in the mid-1980s. Sites E-01 and E-02 are about 1 mile south of the ISFSI. E-03 is 1200 feet west and E-04 is 4300 feet north.

Figure 11-9 Comparison of E-01, E-02, E-03 and E-04 (1992 –2021)



The comparison shows a definite difference between E-01 and the other three locations. E-01, although approximately the same distance from the ISFSI as E-02 and further away than either E-03 or E-04, is lower than the other three sites. Therefore, distance is not the determining factor in the difference among the measured exposures. There are two factors which could cause the observed difference. The first difference is that E-02, E-03, are surrounded by ploughed fields with solar panels, and E-04 is surrounded by plowed fields whereas the area around E-01 is uncultivated. Second, E-01 is within 100 feet of the lake. Therefore, about 50% of the area contributing natural radiation to the location is a combination of sandy soil, beach sand, and lake water. Since E-01 has a combination of different natural radiation contributors (beach sand, lake water, and soil), that could explain the lower results that are observed at E-01.

The impact of the ISFSI on the ambient radiation levels at its nearest site boundary, the west boundary is shown in Figure 11-10. The ISFSI impact on ambient exposure levels was addressed briefly in Section 11.1 (see Figure 11-2).

Figure 11-10 E-03, E-31, E-44 and Background Site E-20 Results 1992 to 2021

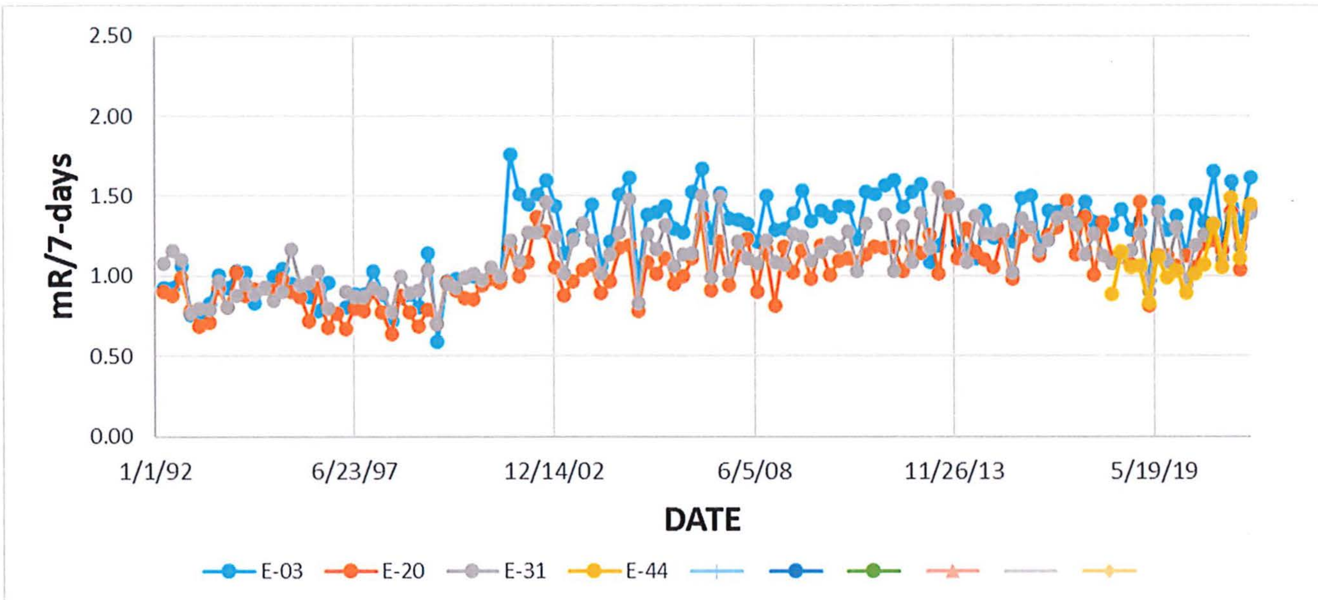


Figure 11-2 shows that beginning with the use of the Teflon TLD cards in the fourth quarter of 2000, the measured exposure levels at E-03 are 2 – 5 mR/7-days lower than the exposures at the west fence of the ISFSI. Figure 11-10 shows that although their individual 95% confidence levels overlap indicating no statistical difference, the quarterly exposures at E-03 (about 1200 feet from the ISFSI) are consistently higher than the exposure at E-31 (at the site boundary about 1400 feet west of E-03). Therefore, the lower values at E-31 compared to E-03 appear to be a real difference as the distance from the ISFSI increases at the west boundary. Because land usage and location are similar at E-03 and E-31, the cause of the previously identified response differences between E-03 and E-01 are not applicable. In 2018, a TLD monitoring location was added at location E-44, directly west of E-03 and E-31 over the site boundary. It can be seen that since 2018, E-44 shows a decreased reading when compared to E-03 and subsequently E-31. Therefore, the lower results at the site boundary location E-31 and E-44 show that the exposures from the ISFSI are dropping off and approaching the lower readings found at the background site E-20.

12.0 REMP CONCLUSION

Based on the analytical results from the 760 environmental samples (724 individual samples with an additional 24 quarterly air particulate composites and 12 quarterly lake water composites) together with 132 REMP + 16 ISFSI sets of TLDs that comprised the PBNP REMP for 2021, PBNP effluents had no discernable effect on the surrounding environs. The calculated effluent doses are below the 10 CFR 50, Appendix I dose objectives demonstrating that PBNP continues to have good controls on effluent releases. The control of effluents from PBNP continues to be acceptable pursuant to the ALARA criteria of 10 CFR 50.34a. Additionally, when the TLD results are factored in to the overall exposure, the resulting doses are lower than the ISFSI (10 CFR 72.104) and EPA (40 CFR 190) limits of 25 mrem whole body, 75 mrem thyroid, and 25 mrem any other organ.

From the long-term analysis of TLD results, there is no evidence of elevated ambient radiation levels from the operation of Point Beach and the ISFSI except for the slightly higher exposures measured at the site boundary (E-31) compared to the background reference site (E-20) [see Figure 11-10].

Part D
GROUNDWATER MONITORING

13.0 PROGRAM DESCRIPTION

PBNP monitors groundwater for tritium as part of the Groundwater Protection Program (GWPP). The GWPP supports NEI 07-07, the nuclear industry's groundwater protection initiative. The GWPP also fulfills the requirement of 10 CFR 20.1501(a) to make surveys of areas, including to subsurface in order to comply with Part 20. During 2021 the sampling program consisted of beach drains, intermittent stream and bog locations, drinking water wells, façade wells, yard electrical manholes, ground water monitoring wells, and the subsurface drainage (SSD) system sump located in the U-2 façade.

In the late 1970s, the beach drains entering Lake Michigan were found to contain tritium. The beach drains are the discharge points for yard drainage system, which carries storm water runoff, and are known to be infiltrated by groundwater as observed by discharges even when no rain has occurred. In the 1980s, the source of tritium for this pathway was postulated to be spent fuel pool leakage into the groundwater under the plant. Based on this observation, modifications were made to the pool, and the tritium concentrations decreased below the effluent LLDs. Beach drain effluents continue to be monitored and are accounted for in the monthly effluent quantification process. Because the beach drains are susceptible to groundwater in-leakage from other sources such as the area around the former retention pond which is known to contain tritium, the beach drains are monitored as part of the groundwater monitoring program. In addition to tritium, groundwater beach drain samples also are gamma scanned for the same suite of radionuclides as lake water using the lake water LLDs.

Three intermittent stream locations and the Energy Information Center (EIC) well were added to the groundwater monitoring program in the late 1990s when it was discovered that tritium diffusion from the then operable, earthen retention pond was observable in the intermittent streams which transverse the site in a NW to SE direction. A fourth stream location closer to the plant was added in 2008. These streams pass on the east and west sides of the former retention pond and empty into Lake Michigan about half a mile south of the plant near the meteorological tower. The intermittent stream samples track tritium in the surface groundwater.

The groundwater monitoring program also includes two bogs / ponds on site. One is located about 400 feet SSE of the former retention pond; the other, about 1500 feet N between Warehouses 6 and 7.

In addition to the main plant well, four other drinking water wells are monitored. The Site Boundary Control Center well, located at the plant entrance, the Warehouse 6 well, on the north side of the plant, and the EIC well, located south of the plant. In 2012, a new building (Warehouse 7) was constructed for radwaste. The well for this building was added to the GWPP. These wells do not draw water from the top 20 - 30 feet of soil which is known to contain tritium. These wells monitor the deeper (200 - 600 feet), drinking water aquifer from which the main plant well draws its water. The two soil layers are separated by a gray, very dense till layer of low permeability identified by hydrological studies.

Manholes in the plant yard and for the subsurface drainage (SSD) system under the plant are available for obtaining ground water samples. The plant yard manholes for accessing electrical conduits are susceptible to ground water in-leakage. Therefore, a number of these were sampled. The SSD system was designed to lessen hydrostatic pressure on the foundation by controlling the flow of water under the plant and around the perimeter of the foundation walls. The SSD system flows to a sump in the Unit 2 facade. The sump was sampled twelve times during 2021.

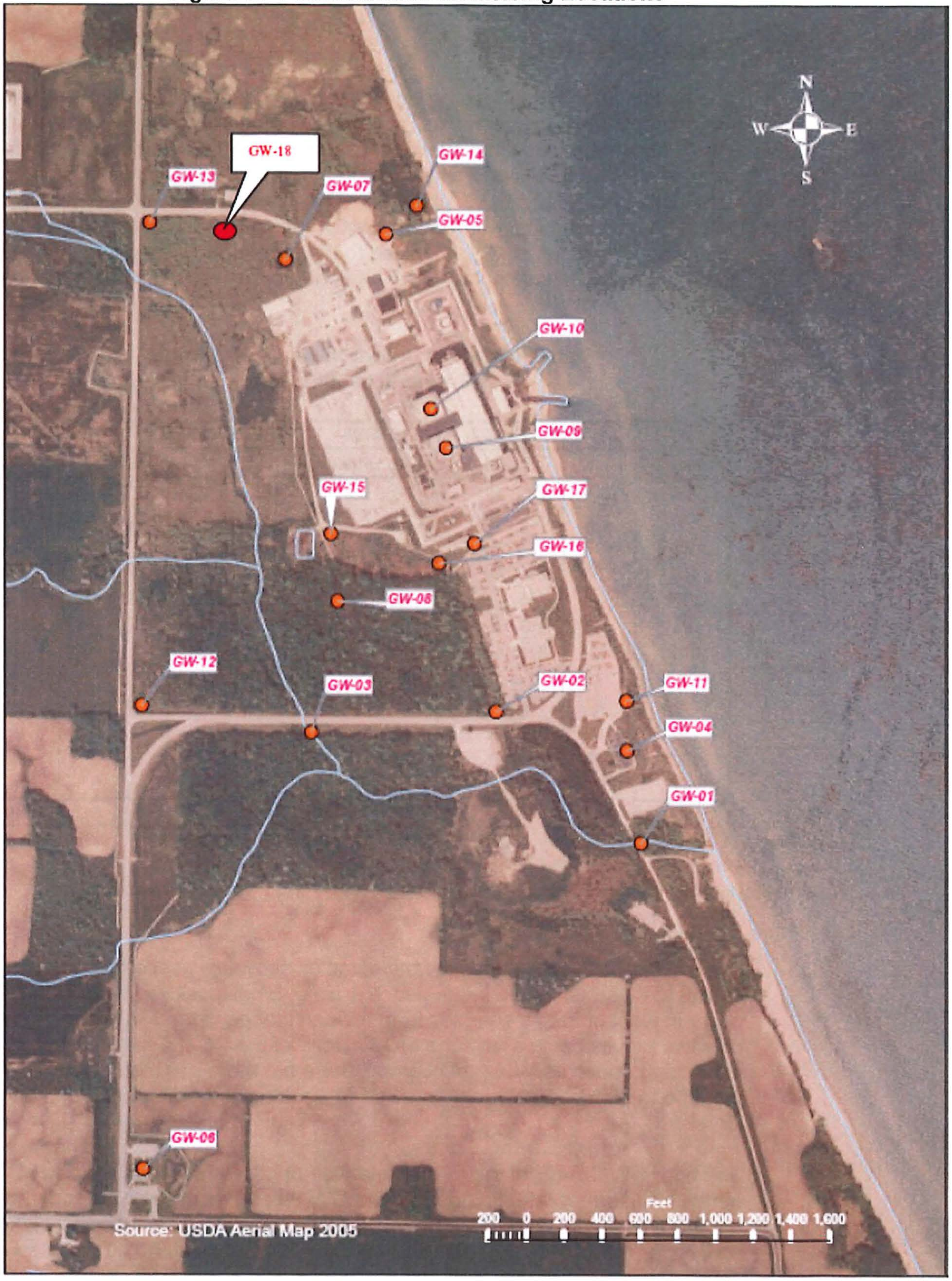
Due to flooding concerns, man-holes and clean-outs for the SSD were sealed in 2014. Therefore, only the SSD sump now is used for sampling.

In the 1990s, two wells were sunk in each unit's façade to monitor the groundwater levels and look for evidence of concrete integrity as part of the ISI IWE Containment Inspection Program. These wells are stand pipes which are sampled periodically for chemical analyses. Façade well sampling has been part of the GWPP since 2007. These wells are sampled quarterly.

In November 2019 repairs to the beach drain access and additional wave run up rip-rap was placed around the shoreline to prevent additional high lake level impacts and erosion beach. These repairs and additions allowed for better access to beach drain sampling in 2020. S-1 and S-3 locations were sampled every month during the year when flow was available, and S-12 was also more accessible throughout the year for sampling. Other beach drain locations were noted as not having flow during the sampling periods.

The groundwater sampling sites (other than the beach drains, SSDs and manholes) are shown in Figure 13.1.

Figure 13-1 Groundwater Monitoring Locations



14.0 RESULTS AND DISCUSSION

14.1 Streams and Bogs

The results from the surface groundwater monitoring associated with the former retention pond are presented in Table 14-1. For the most part, the creek results are barely above the detection level and less than the MDC. The highest averages are for the East Creek and STP which are in the groundwater flow path from the retention pond area to Lake Michigan. The West Creek is west of the former retention pond, an upstream location with respect to the groundwater flow. The tritium concentration at GW-08, close to the former retention pond, is about one-tenth of the tritium concentrations it had prior to the remediation of the retention pond.

Table 14-1 Intermittent Streams and Bogs
H-3 Concentration (pCi/l)

Month	GW-01(E-01)	GW-02	GW-03	GW-17	BOGS		MDC
	Creek Confluence	E. Creek	W. Creek	STP	GW-07	GW-08	
Jan	NS ±	NS ±	NS ±	NS ±			
Feb	NS ±	NS ±	NS ±	NS ±			
Mar	ND ±	320 ± 95	ND ±	255 ± 92			159
Apr	86 ± 80	289 ± 90	118 ± 81	186 ± 85			159
May	201 ± 86	245 ± 88	100 ± 80	120 ± 81	372 ± 94	100 ± 80	158
Jun	153 ± 83	NS ±	100 ± 80	NS ±			158
Jul	123 ± 82	310 ± 92	107 ± 81	208 ± 87			156
Aug	87 ± 78	124 ± 80	ND ±	NS ±			157
Sep	142 ± 84	186 ± 86	138 ± 84	NS ±			161
Oct	136 ± 83	185 ± 86	136 ± 83	NS ±			163
Nov	162 ± 86	252 ± 91	118 ± 84	189 ± 88			161
Dec	ND ±	122 ± 94	ND ±	301 ± 102			167
Average	116 ± 56	226 ± 75	95 ± 38	210 ± 62			

A blank indicates no sample was scheduled. Streams are sampled monthly; bogs, annually.
Values are presented as the measured value and the 95% confidence level counting error.
ND = not statistically different from zero at the 95% confidence level. NS= No sample available

The analyses of these surface water samples show low concentrations of tritium, similar to those observed in the beach drains. Small positive tritium concentrations occur in eight of the 10 samples from the confluence of the two creeks (GW-01), with only two results being above the MDC. None of the West Creek (GW-03) samples had tritium above its MDC. In contrast, there are more positive results from GW-02 (south end of the East Creek) and GW-17 (located at the north end of the East Creek).

The bog (GW-08) SE of the former retention pond is lower than the bog at GW-07 north of the former retention pond. The GW-08 bog result is down from the 3200 - 3800 pCi/l seen in 1999 before the retention pond was remediated. A gamma analysis of the GW-07 bog sample from May 2021 showed no other detectable isotopes, therefore washout from releases may have attributed to the increased tritium result at GW-07.

14.2 Beach Drains

The 2021 results for the beach drains that were sampled are presented in Table 14-2. S-1 collects yard drainage from the north part of the site yard; S-3, from the south. Drains S-8 and S-9 carry water from the lake side yard drains whereas drains S-7 and S-10 are from the turbine building roof. S-12 is a drain from the external SSD which run along the outside northern half of the foundation wall, and S-13 is the south external SSD drain. They are not connected to the internal SSD under the plant which drains to a sump in the U2 façade.

Table 14-2
2021 Beach Drain H-3 Concentration (pCi/l)

Month	S-1	S-12	S-8	S-9	S-13	S-3	MDC
Jan	435 ± 99	NF ±	NF ±	NF ±	NF ±	NS ±	166
Feb	NS ±	NF ±	NF ±	NF ±	NF ±	NS ±	
Mar	NS ±	NF ±	NF ±	NF ±	NF ±	428 ± 97	160
Apr	307 ± 93	NF ±	NF ±	NF ±	NF ±	311 ± 93	160
May	221 ± 86	NF ±	NF ±	NF ±	NF ±	325 ± 91	158
Jun	334 ± 93	NF ±	NF ±	NF ±	NF ±	331 ± 93	161
Jul	276 ± 90	NF ±	NF ±	NF ±	NF ±	426 ± 98	156
Aug	246 ± 89	NF ±	NF ±	NF ±	NF ±	410 ± 97	161
Sep	145 ± 84	246 ± 89	NF ±	NF ±	NF ±	310 ± 93	163
Oct	191 ± 87	NF ±	NF ±	NF ±	NF ±	496 ± 102	159
Nov	153 ± 84	270 ± 90	NF ±	NF ±	NF ±	270 ± 90	162
Dec	176 ± 85	NF ±	NF ±	NF ±	NF ±	275 ± 91	162
Avg =	248 ± 91	258 ± 17	±	±	±	358 ± 76	

ND = not detected and ≤MDC NS = no sample
NF = no sample due to no flow

The tritium concentrations at S-1, S-3, and S-12 are consistent with results from previous years. Results are similar to those observed at intermittent streams and in manholes around the site, and like in years prior are attributed to tritium recapture.

Gamma scans were performed on the beach drain samples at the LLD used for lake water. A few indications of small, positive concentration values below their MDCs were found for Mn-54, Cs-137, and Ba-La-140. All the positive results were below their MDCs, except for Cs-137 at S-1 in August 2021 when Cs-137 had a result of 3.4 ± 1.9 with an MDC of 2.5. This result is likely a false positive since there was no Cs-137 release that could have interacted with this beach drain sample location. This leaves tritium as the only PBNP radionuclide positively found in the beach drains.

14.3 Electrical Vaults and Other Manholes

Manholes for access to below ground electrical facilities are susceptible to groundwater in-leakage. The manholes east side of the plant, between the Turbine building and Lake Michigan have low tritium concentrations (Table 14-3). Z-065A and Z-065B are located on the west side of the pump house. Manholes, Z-066A and Z-067A through Z-066D and Z-067D are between the pump house and the turbine building and run in parallel in the NE section of the yard beginning just north of the Unit 2 truck bay and run from the Unit 2 truck bay north to the EDG building. Z-068 is located just west of the EDG building and north of Z-066/067D. Each of the two A, B, C, and D vaults is side by side.

Table 14-3
2021 East Yard Area Manhole Tritium (pCi/l)

MH	4/29/2021*	10/4/2021**
Z-065A(M-1)	318 ± 92	588 ± 106
Z-065B(M-2)	313 ± 92	985 ± 122
Z-066A	193 ± 85	351 ± 95
Z-067A	223 ± 87	280 ± 91
Z-066B	415 ± 97	310 ± 93
Z-067B	403 ± 96	305 ± 93
Z-066C	380 ± 95	317 ± 93
Z-067C	287 ± 90	276 ± 91
Z-066D	280 ± 90	264 ± 91
Z-067D	179 ± 85	262 ± 91
Z-068	320 ± 92	293 ± 92
MDC	158	159

*Other sample dates include 05/04/2021
**Other sample dates include 09/29/2021, 09/30/2021, and 10/05/2021

14.4 Façade Wells and Subsurface Drainage System

There are two methods of sampling the groundwater under the plant foundation. The first is a set of four shallow wells, two in each façade. The other is a subsurface drainage system (SSD). The façade wells were installed to monitor for groundwater conditions which may affect the integrity of the concrete and rebar of each unit's foundation. The SSD was designed to relieve hydrostatic pressure on each unit's foundation as well as the Auxiliary and Turbine buildings.

The façade wells are not located symmetrically in the two units. The Unit 1 façade wells are east of the containment in the SE (1Z-361A) and NE (1Z-361B) corners of the façade. However, in Unit 2, there is one well in the NW corner (2Z-361A) and the other rotated approximately 180° in the SW corner (2Z-361B). In each the well cap is level with the floor.

The 2021 façade well tritium results are shown in Table 14-4. The Unit 1 wells consistently have higher tritium concentrations than the U2 wells with 1Z-361A, in the SE corner of the Unit 1 façade, on average having the highest tritium concentrations.

In addition to tritium analysis, the façade wells were analyzed for gamma isotopic activity. As in lake water samples, small positive values below their calculated, minimum detectable concentrations were found for Mn-54 and Co-58, with one Ba-La-140 analysis was above the MDC of 7.7 pCi/L at 2Z-361A in 3rd quarter 2021 (9.1 ± 2.8 pCi/L). The Ba-La-140 results from the 2Z-361B third quarter façade well sample did not achieve the 15 pCi/L Lower Limit of Detection (LLD) for Ba-La-140 analysis at the offsite vendor lab. The LLD could not be achieved due to the age and size of the sample, it was obtained in August 2021 but not shipped to the lab for analysis until September 2021. All other isotope LLDs were achieved for this sample. Gamma isotopic analysis for all other isotopes in the samples and hard-to-detect isotopes for 2Z-361B were less than the minimum detectable concentrations, therefore it can be concluded that there was no groundwater monitoring program impact by not achieving the LLD for Ba-La-140.

Table 14-4
2021 Facade Well Water Tritium (pCi/l)

Month	UNIT 1		UNIT 2		MDC
	1Z-361A	1Z-361B	2Z-361A	2Z-361B	
March	219 ± 87	189 ± 85	ND ±	ND ±	161
June	258 ± 91	176 ± 87	97 ± 82	164 ± 86	160
August	175 ± 88	282 ± 94	ND ±	404 ± 99	163
October	254 ± 90	167 ± 85	ND ±	250 ± 89	163
ND = Not Detected and <MDC NS = No Sample					

To relieve hydrostatic pressure on the foundation, Point Beach has an external and an internal subsurface drainage system (SSD) to drain groundwater away from the foundation.

The internal SSD consist of perforated piping which drains groundwater by gravity to a sump located in the Unit 2 façade. A comparison of the 2017 through 2021 SSD results is presented in Table 14-5. In 2021, the tritium results were similar as to what was observed in 2019 and 2020. An increase was observed in the last July 2021 because the subsurface drainage sump pump was out of service and the samples obtained were manual grab samples at one time during the month. There were no known system leaks into the system that would cause the increased tritium. The SSD is discharged via wastewater effluent system. The tritium values then returned to expected concentrations later throughout the rest of 2021.

The SSD sump samples are scanned for gamma emitters. A few slightly positive values were found for Mn-54, Fe-59, Cs-137, and Ba-La-140, and all results were below the MDC.

Table 14-5
2017 - 2021 Unit 2 Facade SSD Sump H-3 (pCi/l)

	2017			2018			2019			2020			2021		
Date	pCi/l		2σ	pCi/l		2σ	pCi/l		2σ	pCi/l		2σ	pCi/l		2σ
Jan	1058	±	122	2634	±	168	808	±	110	3557	±	196	1185	±	127
Feb	776	±	107	2721	±	169	923	±	114	3356	±	187	1409	±	135
Mar	765	±	111	2217	±	169	924	±	116	1915	±	150	1605	±	148
Apr	1635	±	142	1107	±	122	1580	±	136	1468	±	134	1437	±	139
May	1503	±	134	389	±	98	1470	±	131	1225	±	129	1174	±	131
Jun	854	±	112	890	±	113	1784	±	146	1217	±	130	806	±	114
Jul	907	±	115	1225	±	127	1681	±	144	2136	±	157	6496	±	257
Aug	1035	±	115	1056	±	119	1703	±	143	1900	±	150	2915	±	180
Sep	737	±	105	803	±	110	1412	±	132	1621	±	141	2714	±	175
Oct	8772	±	284	1022	±	116	8932	±	291	1419	±	135	2654	±	175
Nov	7478	±	265	852	±	111	10877	±	318	1170	±	130	2672	±	175
Dec	4165	±	203	634	±	106	5886	±	240	1241	±	131	2439	±	169
Average	2474	±	2815	1296	±	781	3165	±	3444	1852	±	814	2292	±	1514

The external SSD system runs along the external foundation walls for the Unit 1 and Unit 2 facades, the Auxiliary Building, the North Service Building, and the Turbine Hall. It is not connected to the internal SSD system. During 2014, work to mitigate the possibility of external flooding events uncovered the N (S-12) and S (S-13) external SSD outfalls. Both the north and south halves of the external SSD system drain toward the beach. Several samples from SSD S-12 were obtained in 2021 and the results averaged 258 pCi/L, which is lower yet still comparable to the concentrations found in various manholes (Table 14-3) on the east side of the plant during 2021.

14.5 Potable Water and Monitoring Wells

Outside of the protected area, ten wells, in addition to the main plant well (Section 11.7), are used for monitoring tritium in groundwater: the four potable water wells, GW-04 (Energy Information Center or EIC), GW-05 (Warehouse 6), GW-18 (Warehouse 7), GW-06 (Site Boundary Control Center), and six tritium groundwater monitoring wells, GW-11 through GW-16 (Figure 13-1).

The potable water wells monitor the deep, drinking water aquifer whereas the monitoring wells penetrate less than 30 feet to monitor the top soil layer. The potable water aquifer is separated from the shallow, surface water aquifer by a thick, clay layer with very low permeability. The potable water wells had no detectable tritium, except for two results at GW-04 in June and December 2021 when the reanalysis showed a not detectable result, and one at GW-18 in October 2021 which was 116 ± 82 pCi/L and still less than MDC (Table 14-6).

GW-04 is analyzed monthly for gamma, and had three slightly positive results in separate months for Co-58, Co-60, and Zn-65 which were all less than MDC.

These are determined to be false positives as there were no other indications of nuclides (gamma or tritium) in the respective months or surrounding months. As well there were no known spills or effluent release pathways that would have interacted with this location.

Starting in late 2021 a gamma analysis was added to GW-18 for monitoring and two slightly positive, but less than MDC results for Co-60 (1.5 ± 1.4 pCi/L, MDC 1.7 pCi/L) and Ba-La-140 (2.2 ± 1.4 pCi/L, MDC 7.1 pCi/L) were obtained. There were no known spills or effluent release pathways that would have interacted with this location.

Table 14-6
2021 Potable Well Water Tritium Concentration (pCi/l)

Month	EIC WELL GW-04	EIC MDC	Warehouse 6 Well GW-05	SBCC Well GW-06	WH 7 GW-18	GW-05, 06, 18 MDC
Jan	ND	160	ND	ND	ND	160
Feb	ND	161				
Mar	ND	159				
Apr	ND	159	ND	ND	ND	159
May	ND	158				
Jun	87 ± 80	158				
Jun*	ND	171				
Jul	ND	156	ND	ND	ND	156
Aug	ND	157				
Sep	ND	161				
Oct	ND	163	ND	ND	116 ± 82	163
Nov	ND	161				
Dec	108 ± 93	167				
Dec*	ND	165				

ND= not detected

* Reanalysis of the same sample

The monitoring well results are similar to those obtained in previous years. The two monitoring wells showing higher and consistently detectable tritium (GW-15, GW-16) are in the flow path from the retention pond area to the lake (Table 14-7), however are approaching similar levels as observed at the locations nearest the lake such as GW-11 and GW-14. GW-15 duplicate samples were analyzed for gamma and no additional nuclides were detected.

Table 14-7
2021 Quarterly Monitoring Well Tritium (pCi/l)

Q	MW-01 GW-11	MW-02 GW-12	MW-06 GW-13	MW-05 GW-14	MW-04 *GW-15	MW-03 GW-16	**MDC**
1	ND ±	ND ±	ND ±	128 ± 82	115 ± 81	115 ± 81	160
2	ND ±	ND ±	ND ±	155 ± 86	139 ± 86	246 ± 94	165
3	136 ± 83	ND ±	ND ±	123 ± 82	143 ± 83	129 ± 83	162
4	ND ±	ND ±	164 ± 85	166 ± 85	164 ± 85	242 ± 89	163

ND= not statistically different from zero and <MDC. NS = no sample available

*Duplicate samples taken, highest value reported.

In summary, the results from monitoring wells GW-15 and GW-16 as well as results from the nearby surface water sample locations (GW-03, the east creek; GW-08, the bog to the SE of the former pond; and GW-17, the surface water on the SE corner of the STP) show that the area around and in the groundwater flow path from the former retention pond remain impacted by the tritium that diffused from the pond into the soil while it was in use.

15.0 GROUNDWATER SUMMARY

Groundwater monitoring indicates that low levels of tritium continue to occur in the upper soil layer but not in the deep, drinking water aquifer. These results also indicate that the low levels of tritium are restricted to a small, well defined area close to the plant. Results from precipitation analyses (2011 AMR) show that airborne tritium concentrations are higher close to the plant as compared to results at the site boundaries. The observed tritium concentrations in the yard manholes can be explained by the higher tritium in precipitation close to the plant. In addition to tritium captured by precipitation, the beach drains also receive the tritium captured in the AC condensate because the condensate drainage is connected to the yard drain system.

Tritium continues in the soil below the plant foundation as evidenced by results from the subsurface drainage system and from the façade wells.

In conclusion, the groundwater tritium concentrations observed at Point Beach are below the EPA drinking water standards prior to emptying into Lake Michigan where they will undergo further dilution. All analyses to date indicate that the drinking water contains no tritium. None of the tritium in the upper soil layer is migrating off-site toward the surrounding population. This is based on the known west-to-east groundwater flow toward Lake Michigan and the results from the two monitoring wells west of the plant (GW-12 and GW-13, Figure 13-1). Additionally, because no tritium is detected at a value statistically different than zero in either of the four potable water wells closest to the power block or from the drinking water well at the site boundary, none of the tritium observed in the upper soil layer has penetrated into the drinking water aquifer to impact either on-site or off-site personnel.

Part E
Errata/Corrections to Previous Annual Monitoring Reports

16.0 Corrections to Previous Reports

16.1 2016 Radioactive Liquid Releases

During research to answer a question related to 2016 doses as part of the June 2021 NRC inspection IP 71124.07, Radiological Environmental Monitoring Program, it was identified that the spreadsheet used to total the 2016 Liquid Dose for whole body and organ was not totaling the correct cells from January 2016. Once the spreadsheet was corrected, the total 2016 liquid whole body dose increased to 0.00459 mrem (0.00427 mrem reported) and the organ decreased to 0.00475 mrem (0.00485 mrem reported). The identified error did not cause any Appendix I doses to be exceeded and the 2016 doses still remain ALARA.

The corrected tables from the 2016 Annual Monitoring Report are included below.

SUMMARY SECTION

LIQUID RELEASES

Dose Category	Calculated Dose	Appendix I Dose	% Appendix I
Whole body dose	0.00459 mrem	6 mrem	0.077
Organ dose	0.00475 mrem	20 mrem	0.024

PART A EFFLUENT MONITORING

Table 2-1
Comparison of 2016 Liquid Effluent Calculated Doses to 10 CFR 50 Appendix I Design Objectives

Annual Limit [mrem]	Highest Total Calculated Dose [mrem]	% of Design Objective
6 (whole body)	0.00459	0.077 %
20 (any organ)	0.00475	0.024 %

16.2 2018 Radioactive Solid Waste Shipments

A review of past radwaste shipments identified a weight discrepancy in shipment 18-058. Sealand ESUU200848 was characterized using 11,820 lbs for a package weight. The actual package weight was 12,700 lbs. The sealand was characterized with the correct weight and the activity increased from 89.4 mCi to 108 mCi. The error was identified in the Type B category.

The corrected tables from the 2018 Annual Monitoring Report are included below.

Table 4-1
Quantities and Types of Waste Shipped from PBNP in 2018

A. Spent resins, filter sludge, evaporator bottoms, etc.	5.9 m^3	7.630 Ci
	207.4 ft^3	
B. Dry compressible waste, contaminated equipment, etc	208.2 m^3	0.409 Ci
	7354.2 ft^3	
C. Irradiated components, control rods, etc.	0.00 m^3	N/A Ci
	ft^3	
D. Other	0.0 m^3	N/A Ci
	0 ft^3	

Table 4-3
2018 Estimated Solid Waste Major Radionuclide Composition

TYPE A			TYPE B		
Nuclide	Activity (mCi)	Percent Abundance	Nuclide	Activity (mCi)	Percent Abundance
Total	7.63E+03	100.00%	Total	4.08E+02	100.00%
Co-60	9.43E+02	12.35%	Co-60	9.88E+01	24.40%
Co-58	2.85E+03	37.33%	Zr-95	7.70E+01	18.71%
Ni-63	2.68E+03	35.10%	Fe-55	6.39E+01	15.79%
Sb-125	4.25E+02	5.57%	Cr-51	4.46E+01	10.88%
Cs-137	1.17E+02	1.53%	Co-58	3.97E+01	9.73%
Fe-55	9.67E+01	1.27%	Nb-95	3.30E+01	7.95%
H-3	9.11E+01	1.19%	Ni-63	1.78E+01	4.37%
C-14	8.58E+01	1.12%	Sb-125	7.43E+00	1.84%
Co-57	5.98E+01	0.78%	Mn-54	4.77E+00	1.17%
Mn-54	4.92E+01	0.64%	Sn-113	4.04E+00	0.99%
Nb-95	4.36E+01	0.57%	Sb-124	3.62E+00	0.89%
Ni-59	3.80E+01	0.50%	Fe-59	2.91E+00	0.72%
Sb-124	2.46E+01	0.32%	Zn-65	2.30E+00	0.57%
Ce-144	2.36E+01	0.31%	Ni-59	1.79E+00	0.44%
Zr-95	2.32E+01	0.30%	Ag-110m	1.52E+00	0.37%
Ag-110m	2.07E+01	0.27%	Ce-144	1.36E+00	0.33%
Pu-241	2.03E+01	0.27%	Co-57	9.36E-01	0.23%
Cr-51	1.46E+01	0.19%	Sn-117m	8.25E-01	0.20%
Zn-65	1.41E+01	0.18%	Tc-99	3.64E-01	0.09%
Sn-113	8.28E+00	0.11%	Cs-137	3.36E-01	0.08%
Tc-99	3.98E+00	0.05%	H-3	2.52E-01	0.06%
Sr-90	1.36E+00	0.02%	Te-123m	2.62E-01	0.06%
Am-241	1.80E-01	0.00%	Nb-94	1.83E-01	0.05%
Pu-238	7.55E-02	0.00%	Pu-241	1.19E-01	0.03%
Pu-239	6.90E-02	0.00%	Sr-90	5.63E-02	0.01%
Cm-243	6.72E-02	0.00%	C-14	5.32E-02	0.01%
Cm-242	3.95E-02	0.00%	Am-241	1.53E-02	0.00%
			Pu-239	8.77E-03	0.00%
			Pu-238	7.99E-03	0.00%
			Cm-243	5.36E-03	0.00%
			Cm-242	2.89E-03	0.00%

APPENDIX 1

Environmental, Inc. Midwest Laboratory
Final Report for the Point Beach Nuclear Plant
and
Other Analyses
Reporting Period: January – December 2021

90 pages follow

ATI Environmental, Inc.
Midwest Laboratory
700 Landwehr Road • Northbrook, IL 60062-2310
phone (847) 564-0700 • fax (847) 564-4517

MONTHLY
PROGRESS REPORT
NextEra Energy

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

THE POINT BEACH NUCLEAR PLANT
TWO RIVERS, WISCONSIN

PREPARED AND SUBMITTED
BY
ENVIRONMENTAL INCORPORATED MIDWEST LABORATORY

Project Number: 8006

Reporting Period: January-December, 2021

Reviewed and Approved by A. Banavali, PhD. Date 2/9/22
Laboratory Manager

Distribution: S. Bartels, 1 hardcopy, 1 email

POINT BEACH NUCLEAR PLANT

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POINT BEACH NUCLEAR PLANT

1.0 INTRODUCTION

The following constitutes the current Monthly Progress Report for the Environmental Radiological Monitoring Program conducted at the Point Beach Nuclear Plant, Two Rivers, Wisconsin. Results of completed analyses are presented in the attached tables. Missing entries indicate analyses that are not completed. These results will appear in subsequent reports. Data tables reflect sample analysis results for both Technical Specification requirements and Special Interest locations and samples are randomly selected within the Program monitoring area to provide additional data for cross-comparisons.

For all gamma isotopic analyses, the spectrum is computer scanned from 80 to 2048 KeV. Specifically included are Mn-54, Fe-59, Co-58, Co-60, Zn-65, Zr-95, Nb-95, Ru-103, Ru-106, I-131, Ba-La-140, Cs-134, Cs-137, Ce-141, and Ce-144. Naturally occurring gamma-emitters, such as K-40 and Ra daughters, are frequently detected in soil and sediment samples. Specific isotopes listed are K-40, Tl-208, Pb-212, Bi-214, Ra-226 and Ac-228. The results reported under "Other Gammas" may be Co-60, Ru-103 or any other radionuclide which is indicative of other gammas for the sample type. "Other Gammas" do not include naturally occuring radionuclides.

All concentrations, except gross beta, are decay corrected.

All samples were collected within the scheduled period unless noted otherwise in the Listing of Missed Samples.

POINT BEACH NUCLEAR PLANT

2.0 LISTING OF MISSED SAMPLES

Sample Type	Location	Expected Collection Date	Reason
LW	E-01	02-09-21	Unable to collect water; lake frozen
LW	E-05	02-09-21	Unable to collect water; lake frozen
LW	E-06	02-09-21	Unable to collect water; lake frozen
AP/AI	E-03	04-29-21	Sampler failed; no volume recorded.
AP/AI	E-02	08-12-21	Power loss at the station.
AP/AI	E-02	08-31-21	Power loss at the station.
LW	E-06	12-07-21	Unable to collect water due to unsafe conditions.

3.0 Data Tables

POINT BEACH NUCLEAR PLANT

Table 1. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131.
Location: E-01, Meteorological Tower
Units: pCi/m^3
Collection: Continuous, weekly exchange.

Date Collected	Vol. (m^3)	Gross Beta	I-131	Date Collected	Vol. (m^3)	Gross Beta	I-131
Required LLD		0.010	0.030	Required LLD		0.010	0.030
01-07-21	304	0.039 ± 0.004	< 0.010	07-08-21	301	0.016 ± 0.003	< 0.013
01-13-21	260	0.035 ± 0.004	< 0.019	07-14-21	260	0.017 ± 0.004	< 0.008
01-20-21	298	0.029 ± 0.004	< 0.015	07-22-21	351	0.018 ± 0.003	< 0.011
01-27-21	302	0.016 ± 0.003	< 0.007	07-28-21	258	0.028 ± 0.004	< 0.012
02-03-21	293	0.023 ± 0.004	< 0.007				
				08-04-21	306	0.020 ± 0.003	< 0.010
02-10-21	313	0.033 ± 0.004	< 0.015	08-12-21	350	0.031 ± 0.004	< 0.004
02-17-21	303	0.028 ± 0.004	< 0.013	08-18-21	265	0.024 ± 0.004	< 0.020
02-25-21	345	0.042 ± 0.004	< 0.007	08-25-21	305	0.031 ± 0.004	< 0.010
03-05-21	344	0.026 ± 0.003	< 0.017	08-31-21	265	0.024 ± 0.004	< 0.014
03-11-21	259	0.036 ± 0.004	< 0.015	09-08-21	353	0.024 ± 0.003	< 0.011
03-17-21	258	0.025 ± 0.004	< 0.013	09-15-21	310	0.025 ± 0.003	< 0.009
03-24-21	309	0.023 ± 0.003	< 0.007	09-22-21	309	0.022 ± 0.003	< 0.007
04-01-21	346	0.016 ± 0.003	< 0.011	09-29-21	303	0.027 ± 0.004	< 0.007
1st Quarter Mean ± s.d.		0.029 ± 0.008	< 0.012	3rd Quarter Mean ± s.d.		0.024 ± 0.005	< 0.011
04-08-21	300	0.033 ± 0.004	< 0.015	10-06-21	305	0.032 ± 0.004	< 0.005
04-15-21	303	0.009 ± 0.003	< 0.015	10-13-21	308	0.030 ± 0.004	< 0.009
04-22-21	301	0.016 ± 0.003	< 0.009	10-20-21	306	0.030 ± 0.004	< 0.010
04-29-21	306	0.024 ± 0.003	< 0.008	10-27-21	314	0.013 ± 0.003	< 0.010
				11-03-21	306	0.017 ± 0.003	< 0.011
05-06-21	302	0.013 ± 0.003	< 0.007				
05-13-21	305	0.006 ± 0.003	< 0.007	11-10-21	298	0.040 ± 0.004	< 0.014
05-20-21	303	0.023 ± 0.004	< 0.008	11-17-21	305	0.017 ± 0.003	< 0.009
05-27-21	305	0.021 ± 0.003	< 0.009	11-24-21	302	0.014 ± 0.003	< 0.009
06-02-21	261	0.017 ± 0.003	< 0.018	12-01-21	333	0.023 ± 0.003	< 0.006
06-10-21	343	0.029 ± 0.003	< 0.013	12-08-21	309	0.021 ± 0.003	< 0.013
06-17-21	303	0.017 ± 0.003	< 0.007	12-15-21	305	0.037 ± 0.004	< 0.009
06-24-21	297	0.014 ± 0.003	< 0.008	12-21-21	267	0.037 ± 0.004	< 0.012
07-01-21	296	0.014 ± 0.003	< 0.018	12-28-21	303	0.051 ± 0.005	< 0.007
2nd Quarter Mean ± s.d.		0.018 ± 0.008	< 0.011	4th Quarter Mean ± s.d.		0.028 ± 0.011	< 0.010
				Cumulative Average		0.025 ± 0.009	< 0.011

POINT BEACH NUCLEAR PLANT

Table 1. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131.
Location: E-02, Site Boundary Control Center
Units: pCi/m^3
Collection: Continuous, weekly exchange.

Date Collected	Vol. (m^3)	Gross Beta	I-131
Required LLD		0.010	0.030
01-07-21	303	0.040 ± 0.004	< 0.010
01-13-21	260	0.040 ± 0.005	< 0.019
01-20-21	308	0.029 ± 0.004	< 0.015
01-27-21	308	0.017 ± 0.003	< 0.006
02-03-21	297	0.024 ± 0.004	< 0.007
02-10-21	313	0.029 ± 0.004	< 0.015
02-17-21	294	0.034 ± 0.004	< 0.014
02-25-21	345	0.047 ± 0.004	< 0.007
03-05-21	344	0.030 ± 0.003	< 0.017
03-11-21	263	0.033 ± 0.004	< 0.015
03-17-21	263	0.021 ± 0.003	< 0.013
03-24-21	304	0.028 ± 0.004	< 0.007
04-01-21	346	0.018 ± 0.003	< 0.011
1st Quarter Mean ± s.d.		0.030 ± 0.009	< 0.012
04-08-21	300	0.035 ± 0.004	< 0.015
04-15-21	301	0.011 ± 0.003	< 0.015
04-22-21	302	0.013 ± 0.003	< 0.009
04-29-21	304	0.023 ± 0.003	< 0.008
05-06-21	302	0.016 ± 0.003	< 0.007
05-13-21	304	0.009 ± 0.003	< 0.007
05-20-21	302	0.027 ± 0.004	< 0.008
05-27-21	302	0.020 ± 0.003	< 0.009
06-02-21	263	0.019 ± 0.004	< 0.018
06-10-21	340	0.031 ± 0.004	< 0.013
06-17-21	297	0.021 ± 0.004	< 0.008
06-24-21	302	0.015 ± 0.003	< 0.007
07-01-21	298	0.021 ± 0.003	< 0.017
2nd Quarter Mean ± s.d.		0.020 ± 0.008	< 0.011
07-08-21	301	0.019 ± 0.003	< 0.013
07-14-21	262	0.019 ± 0.004	< 0.008
07-22-21	382	0.017 ± 0.003	< 0.010
07-28-21	258	0.031 ± 0.004	< 0.012
08-04-21	309	0.023 ± 0.003	< 0.010
08-12-21		NS[b]	
08-18-21	251	0.021 ± 0.004	< 0.021
08-25-21	315	0.031 ± 0.004	< 0.010
08-31-21		NS[b]	
09-08-21	349	0.026 ± 0.003	< 0.012
09-15-21	327	0.026 ± 0.003	< 0.009
09-22-21	324	0.024 ± 0.003	< 0.007
09-29-21	294	0.025 ± 0.004	< 0.008
3rd Quarter Mean ± s.d.		0.024 ± 0.005	< 0.011
10-06-21	320	0.033 ± 0.004	< 0.005
10-13-21	303	0.031 ± 0.004	< 0.010
10-20-21	323	0.029 ± 0.004	< 0.010
10-27-21	314	0.015 ± 0.003	< 0.010
11-03-21	324	0.016 ± 0.003	< 0.010
11-10-21	301	0.039 ± 0.004	< 0.014
11-17-21	302	0.022 ± 0.003	< 0.009
11-24-21	303	0.024 ± 0.004	< 0.009
12-01-21	323	0.023 ± 0.004	< 0.007
12-08-21	309	0.019 ± 0.003	< 0.013
12-15-21	304	0.041 ± 0.004	< 0.009
12-21-21	271	0.035 ± 0.004	< 0.011
12-28-21	308	0.055 ± 0.005	< 0.007
4th Quarter Mean ± s.d.		0.029 ± 0.011	< 0.010
Cumulative Average		0.026 ± 0.009	< 0.011

[b] No sample; see table 2.0 .Listing of Missed Samples.

Table 1. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131.
Location: E-03, West Boundary
Units: pCi/m^3
Collection: Continuous, weekly exchange.

Date Collected	Vol. (m^3)	Gross Beta	I-131	Date Collected	Vol. (m^3)	Gross Beta	I-131
Required LLD		0.010	0.030	Required LLD		0.010	0.030
01-07-21	314	0.040 ± 0.004	< 0.009	07-08-21	300	0.019 ± 0.003	< 0.013
01-13-21	256	0.034 ± 0.004	< 0.019	07-14-21	269	0.016 ± 0.003	< 0.007
01-20-21	311	0.028 ± 0.004	< 0.015	07-22-21	294	0.017 ± 0.003	< 0.014
01-27-21	308	0.016 ± 0.003	< 0.006	07-28-21	261	0.029 ± 0.004	< 0.012
02-03-21	296	0.020 ± 0.003	< 0.007				
				08-04-21	300	0.028 ± 0.004	< 0.010
02-10-21	308	0.029 ± 0.004	< 0.015	08-12-21	345	0.031 ± 0.004	< 0.004
02-17-21	303	0.023 ± 0.003	< 0.013	08-18-21	265	0.020 ± 0.004	< 0.019
02-25-21	345	0.040 ± 0.004	< 0.007	08-25-21	305	0.031 ± 0.004	< 0.010
03-05-21	344	0.029 ± 0.003	< 0.017	08-31-21	265	0.027 ± 0.004	< 0.014
03-11-21	258	0.034 ± 0.004	< 0.015	09-08-21	376	0.021 ± 0.003	< 0.011
03-17-21	262	0.023 ± 0.003	< 0.013	09-15-21	304	0.024 ± 0.003	< 0.009
03-24-21	304	0.025 ± 0.003	< 0.007	09-22-21	304	0.020 ± 0.003	< 0.007
04-01-21	347	0.017 ± 0.003	< 0.011	09-29-21	293	0.032 ± 0.004	< 0.008
1st Quarter Mean ± s.d.		0.028 ± 0.008	< 0.012	3rd Quarter Mean ± s.d.		0.024 ± 0.006	< 0.011
04-08-21	303	0.034 ± 0.004	< 0.014	10-06-21	282	0.027 ± 0.004	< 0.006
04-15-21	306	0.009 ± 0.003	< 0.015	10-13-21	300	0.028 ± 0.004	< 0.010
04-22-21	302	0.015 ± 0.003	< 0.009	10-20-21	304	0.030 ± 0.004	< 0.010
04-29-21		NS[b]		10-27-21	313	0.014 ± 0.003	< 0.010
				11-03-21	370	0.015 ± 0.003	< 0.009
05-06-21	305	0.012 ± 0.003	< 0.007				
05-13-21	309	0.008 ± 0.003	< 0.007	11-10-21	307	0.039 ± 0.004	< 0.014
05-20-21	301	0.023 ± 0.004	< 0.008	11-17-21	310	0.017 ± 0.003	< 0.009
05-27-21	300	0.019 ± 0.003	< 0.010	11-24-21	296	0.021 ± 0.004	< 0.009
06-02-21	261	0.020 ± 0.004	< 0.018	12-01-21	319	0.022 ± 0.003	< 0.007
06-10-21	339	0.024 ± 0.003	< 0.013	12-08-21	315	0.019 ± 0.003	< 0.013
06-17-21	310	0.019 ± 0.003	< 0.007	12-15-21	263	0.047 ± 0.005	< 0.011
06-24-21	307	0.013 ± 0.003	< 0.007	12-21-21	276	0.028 ± 0.004	< 0.011
07-01-21	299	0.018 ± 0.003	< 0.017	12-28-21	312	0.050 ± 0.005	< 0.007
2nd Quarter Mean ± s.d.		0.018 ± 0.007	< 0.011	4th Quarter Mean ± s.d.		0.028 ± 0.011	< 0.010
				Cumulative Average		0.024 ± 0.009	< 0.011

[b] No sample; see table 2.0 .Listing of Missed Samples.

POINT BEACH NUCLEAR PLANT

Table 1. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131.
Location: E-04, North Boundary
Units: pCi/m^3
Collection: Continuous, weekly exchange.

Date Collected	Vol. (m^3)	Gross Beta	I-131
Required LLD		0.010	0.030
01-07-21	313	0.040 ± 0.004	< 0.010
01-13-21	259	0.032 ± 0.004	< 0.019
01-20-21	304	0.029 ± 0.004	< 0.015
01-27-21	307	0.018 ± 0.003	< 0.006
02-03-21	297	0.023 ± 0.004	< 0.007
02-10-21	313	0.032 ± 0.004	< 0.015
02-17-21	303	0.030 ± 0.004	< 0.013
02-25-21	333	0.041 ± 0.004	< 0.007
03-05-21	344	0.029 ± 0.003	< 0.017
03-11-21	266	0.036 ± 0.004	< 0.014
03-17-21	261	0.025 ± 0.004	< 0.013
03-24-21	307	0.025 ± 0.003	< 0.007
04-01-21	345	0.016 ± 0.003	< 0.011
1st Quarter Mean ± s.d.		0.029 ± 0.008	< 0.012
04-08-21	304	0.035 ± 0.004	< 0.014
04-15-21	299	0.012 ± 0.003	< 0.015
04-22-21	301	0.014 ± 0.003	< 0.009
04-29-21	301	0.021 ± 0.003	< 0.008
05-06-21	301	0.012 ± 0.003	< 0.007
05-13-21	314	0.006 ± 0.003	< 0.007
05-20-21	308	0.025 ± 0.004	< 0.008
05-27-21	313	0.019 ± 0.003	< 0.009
06-02-21	261	0.021 ± 0.004	< 0.018
06-10-21	335	0.026 ± 0.003	< 0.013
06-17-21	297	0.020 ± 0.004	< 0.008
06-24-21	297	0.015 ± 0.003	< 0.008
07-01-21	300	0.018 ± 0.003	< 0.017
2nd Quarter Mean ± s.d.		0.019 ± 0.007	< 0.011

Date Collected	Vol. (m^3)	Gross Beta	I-131
Required LLD		0.010	0.030
07-08-21	303	0.018 ± 0.003	< 0.013
07-14-21	257	0.015 ± 0.003	< 0.008
07-22-21	351	0.014 ± 0.003	< 0.011
07-28-21	258	0.027 ± 0.004	< 0.012
08-04-21	304	0.018 ± 0.003	< 0.010
08-12-21	342	0.032 ± 0.004	< 0.004
08-18-21	269	0.019 ± 0.003	< 0.019
08-25-21	309	0.032 ± 0.004	< 0.010
08-31-21	267	0.031 ± 0.004	< 0.014
09-08-21	353	0.023 ± 0.003	< 0.011
09-15-21	309	0.022 ± 0.003	< 0.009
09-22-21	302	0.024 ± 0.003	< 0.007
09-29-21	304	0.032 ± 0.004	< 0.007
3rd Quarter Mean ± s.d.		0.024 ± 0.007	< 0.011
10-06-21	304	0.032 ± 0.004	< 0.005
10-13-21	304	0.029 ± 0.004	< 0.010
10-20-21	309	0.027 ± 0.004	< 0.010
10-27-21	313	0.016 ± 0.003	< 0.010
11-03-21	308	0.017 ± 0.003	< 0.011
11-10-21	305	0.033 ± 0.004	< 0.014
11-17-21	307	0.018 ± 0.003	< 0.009
11-24-21	297	0.022 ± 0.004	< 0.009
12-01-21	318	0.023 ± 0.004	< 0.007
12-08-21	310	0.020 ± 0.003	< 0.013
12-15-21	301	0.046 ± 0.004	< 0.010
12-21-21	271	0.035 ± 0.004	< 0.011
12-28-21	316	0.051 ± 0.005	< 0.007
4th Quarter Mean ± s.d.		0.028 ± 0.011	< 0.010
Cumulative Average		0.025 ± 0.009	< 0.011

Table 1. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131.
Location: E-08, G.J. Francar Residence
Units: pCi/m^3
Collection: Continuous, weekly exchange.

Date Collected	Vol. (m^3)	Gross Beta	I-131
Required LLD		0.010	0.030
01-07-21	316	0.037 ± 0.004	< 0.009
01-13-21	256	0.036 ± 0.005	< 0.019
01-20-21	285	0.028 ± 0.004	< 0.016
01-27-21	316	0.015 ± 0.003	< 0.006
02-03-21	297	0.021 ± 0.003	< 0.007
02-10-21	313	0.036 ± 0.004	< 0.015
02-17-21	302	0.027 ± 0.004	< 0.013
02-25-21	339	0.037 ± 0.004	< 0.007
03-05-21	336	0.029 ± 0.003	< 0.017
03-11-21	258	0.030 ± 0.004	< 0.015
03-17-21	257	0.022 ± 0.004	< 0.013
03-24-21	304	0.023 ± 0.003	< 0.007
04-01-21	347	0.017 ± 0.003	< 0.011
1st Quarter Mean ± s.d.		0.027 ± 0.008	< 0.012
04-08-21	304	0.032 ± 0.004	< 0.014
04-15-21	306	0.010 ± 0.003	< 0.015
04-22-21	308	0.013 ± 0.003	< 0.009
04-29-21	302	0.023 ± 0.003	< 0.008
05-06-21	298	0.013 ± 0.003	< 0.007
05-13-21	304	0.006 ± 0.003	< 0.007
05-20-21	297	0.022 ± 0.004	< 0.009
05-27-21	305	0.020 ± 0.003	< 0.009
06-02-21	268	0.020 ± 0.004	< 0.018
06-10-21	350	0.028 ± 0.003	< 0.013
06-17-21	319	0.018 ± 0.003	< 0.007
06-24-21	303	0.015 ± 0.003	< 0.007
07-01-21	296	0.014 ± 0.003	< 0.017
2nd Quarter Mean ± s.d.		0.018 ± 0.007	< 0.011

Date Collected	Vol. (m^3)	Gross Beta	I-131
Required LLD		0.010	0.030
07-08-21	308	0.021 ± 0.003	< 0.013
07-14-21	260	0.017 ± 0.004	< 0.008
07-22-21	361	0.016 ± 0.003	< 0.011
07-28-21	254	0.030 ± 0.004	< 0.012
08-04-21	298	0.025 ± 0.004	< 0.010
08-12-21	352	0.031 ± 0.004	< 0.004
08-18-21	260	0.022 ± 0.004	< 0.020
08-25-21	301	0.032 ± 0.004	< 0.010
08-31-21	263	0.025 ± 0.004	< 0.014
09-08-21	353	0.023 ± 0.003	< 0.011
09-15-21	302	0.026 ± 0.004	< 0.009
09-22-21	304	0.023 ± 0.003	< 0.007
09-29-21	299	0.026 ± 0.004	< 0.007
3rd Quarter Mean ± s.d.		0.024 ± 0.005	< 0.011
10-06-21	303	0.032 ± 0.004	< 0.005
10-13-21	311	0.034 ± 0.004	< 0.009
10-20-21	310	0.029 ± 0.004	< 0.010
10-27-21	318	0.014 ± 0.003	< 0.010
11-03-21	312	0.021 ± 0.003	< 0.011
11-10-21	306	0.040 ± 0.004	< 0.014
11-17-21	301	0.020 ± 0.003	< 0.009
11-24-21	298	0.024 ± 0.004	< 0.009
12-01-21	326	0.022 ± 0.003	< 0.007
12-08-21	314	0.018 ± 0.003	< 0.013
12-15-21	305	0.036 ± 0.004	< 0.009
12-21-21	277	0.035 ± 0.004	< 0.011
12-28-21	304	0.045 ± 0.004	< 0.007
4th Quarter Mean ± s.d.		0.028 ± 0.009	< 0.010
Cumulative Average		0.025 ± 0.008	< 0.011
Indicator Locations Annual Mean ± s.d.		**0.025 ± 0.009**	**< 0.011**

POINT BEACH NUCLEAR PLANT

Table 1. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131.
Location: E-20, Silver Lake
Units: pCi/m^3
Collection: Continuous, weekly exchange.

Date Collected	Vol. (m^3)	Gross Beta	I-131
Required LLD		0.010	0.030
01-07-21	309	0.046 ± 0.004	< 0.010
01-13-21	260	0.041 ± 0.005	< 0.019
01-20-21	308	0.029 ± 0.004	< 0.015
01-27-21	302	0.016 ± 0.003	< 0.007
02-03-21	302	0.028 ± 0.004	< 0.007
02-10-21	313	0.034 ± 0.004	< 0.015
02-17-21	303	0.030 ± 0.004	< 0.013
02-25-21	345	0.042 ± 0.004	< 0.007
03-05-21	344	0.026 ± 0.003	< 0.017
03-11-21	262	0.032 ± 0.004	< 0.015
03-17-21	264	0.024 ± 0.004	< 0.012
03-24-21	308	0.025 ± 0.003	< 0.007
04-01-21	343	0.023 ± 0.003	< 0.011
1st Quarter Mean ± s.d.		0.030 ± 0.009	< 0.012
04-08-21	307	0.034 ± 0.004	< 0.014
04-15-21	307	0.010 ± 0.003	< 0.015
04-22-21	302	0.016 ± 0.003	< 0.009
04-29-21	306	0.023 ± 0.003	< 0.008
05-06-21	303	0.016 ± 0.003	< 0.007
05-13-21	313	0.008 ± 0.003	< 0.007
05-20-21	301	0.027 ± 0.004	< 0.008
05-27-21	305	0.021 ± 0.003	< 0.009
06-02-21	267	0.019 ± 0.004	< 0.018
06-10-21	337	0.026 ± 0.003	< 0.013
06-17-21	301	0.019 ± 0.003	< 0.007
06-24-21	303	0.018 ± 0.003	< 0.007
07-01-21	302	0.017 ± 0.003	< 0.017
2nd Quarter Mean ± s.d.		0.020 ± 0.007	< 0.011

Date Collected	Vol. (m^3)	Gross Beta	I-131
Required LLD		0.010	0.030
07-08-21	297	0.020 ± 0.003	< 0.014
07-14-21	260	0.017 ± 0.004	< 0.008
07-22-21	363	0.018 ± 0.003	< 0.011
07-28-21	257	0.032 ± 0.004	< 0.012
08-04-21	316	0.022 ± 0.003	< 0.010
08-12-21	347	0.032 ± 0.004	< 0.004
08-18-21	264	0.018 ± 0.003	< 0.020
08-25-21	305	0.031 ± 0.004	< 0.010
08-31-21	260	0.029 ± 0.004	< 0.014
09-08-21	355	0.030 ± 0.003	< 0.011
09-15-21	309	0.028 ± 0.004	< 0.009
09-22-21	301	0.023 ± 0.003	< 0.007
09-29-21	302	0.032 ± 0.004	< 0.007
3rd Quarter Mean ± s.d.		0.025 ± 0.006	< 0.011
10-06-21	302	0.029 ± 0.004	< 0.005
10-13-21	307	0.033 ± 0.004	< 0.009
10-20-21	308	0.034 ± 0.004	< 0.010
10-27-21	323	0.044 ± 0.004	< 0.009
11-03-21	310	0.025 ± 0.004	< 0.011
11-10-21	306	0.039 ± 0.004	< 0.014
11-18-21	334	0.020 ± 0.003	< 0.008
11-24-21	264	0.027 ± 0.004	< 0.010
12-01-21	328	0.022 ± 0.003	< 0.007
12-08-21	313	0.021 ± 0.003	< 0.013
12-15-21	299	0.041 ± 0.004	< 0.010
12-21-21	261	0.035 ± 0.004	< 0.012
12-28-21	306	0.046 ± 0.004	< 0.007
4th Quarter Mean ± s.d.		0.032 ± 0.009	< 0.010
Cumulative Average		0.027 ± 0.009	< 0.011
Control Annual Mean ± s.d.		0.027 ± 0.009	< 0.011

POINT BEACH NUCLEAR PLANT

Table 2. Gamma emitters in quarterly composites of air particulate filters

Units: pCi/m^3

Location	Lab Code	Be-7	Be-7	Cs-134	Cs-134	Cs-137	Cs-137	(Other) Co-60	(Other) (Co-60)	Volume
	Req. LLD	-	MDC	0.01	MDC	0.01	MDC	(0.10)	MDC	m^3
					1st Quarter					
E-01	EAP- 1041	0.074 ± 0.017	-	0.0001 ± 0.0005	< 0.0008	-0.0006 ± 0.0006	< 0.0006	0.0002 ± 0.0006	< 0.0007	3932
E-02	- 1042	0.082 ± 0.012	-	0.0002 ± 0.0005	< 0.0008	0.0004 ± 0.0005	< 0.0008	-0.0004 ± 0.0005	< 0.0004	3947
E-03	- 1043	0.077 ± 0.014	-	-0.0002 ± 0.0004	< 0.0008	-0.0002 ± 0.0004	< 0.0004	-0.0001 ± 0.0004	< 0.0003	3955
E-04	- 1044	0.082 ± 0.015	-	-0.0004 ± 0.0005	< 0.0008	0.0002 ± 0.0004	< 0.0006	-0.0002 ± 0.0004	< 0.0005	3953
E-08	- 1045	0.070 ± 0.015	-	-0.0005 ± 0.0006	< 0.0011	0.0004 ± 0.0005	< 0.0008	0.0001 ± 0.0005	< 0.0004	3926
E-20	- 1046	0.076 ± 0.015	-	-0.0003 ± 0.0006	< 0.0010	-0.0002 ± 0.0006	< 0.0006	0.0003 ± 0.0007	< 0.0008	3962
					2nd Quarter					
E-01	EAP- 2168	0.085 ± 0.012	-	0.0000 ± 0.0004	< 0.0008	0.0001 ± 0.0005	< 0.0006	0.0000 ± 0.0005	< 0.0005	3922
E-02	- 2169	0.087 ± 0.019	-	-0.0008 ± 0.0006	< 0.0009	0.0001 ± 0.0006	< 0.0010	-0.0003 ± 0.0006	< 0.0004	3919
E-03	- 2170	0.089 ± 0.014	-	-0.0004 ± 0.0005	< 0.0010	-0.0001 ± 0.0005	< 0.0009	-0.0004 ± 0.0006	< 0.0006	3642
E-04	- 2171	0.074 ± 0.021	-	-0.0004 ± 0.0006	< 0.0011	-0.0002 ± 0.0005	< 0.0006	-0.0002 ± 0.0006	< 0.0007	3931
E-08	- 2172	0.091 ± 0.014	-	0.0001 ± 0.0004	< 0.0009	0.0002 ± 0.0005	< 0.0008	0.0004 ± 0.0004	< 0.0006	3958
E-20	- 2173	0.108 ± 0.015	-	-0.0001 ± 0.0005	< 0.0009	0.0000 ± 0.0005	< 0.0007	-0.0001 ± 0.0003	< 0.0004	3953
					3rd Quarter					
E-01	EAP- 3395	0.107 ± 0.018	-	0.0000 ± 0.0005	< 0.0010	-0.0002 ± 0.0005	< 0.0005	-0.0001 ± 0.0006	< 0.0006	3936
E-02	- 3396	0.090 ± 0.019	-	-0.0011 ± 0.0007	< 0.0012	-0.0001 ± 0.0006	< 0.0008	0.0003 ± 0.0007	< 0.0009	3372
E-03	- 3397	0.101 ± 0.017	-	-0.0003 ± 0.0005	< 0.0010	0.0003 ± 0.0006	< 0.0010	0.0004 ± 0.0005	< 0.0005	3880
E-04	- 3398	0.093 ± 0.018	-	-0.0004 ± 0.0005	< 0.0009	0.0000 ± 0.0006	< 0.0010	0.0002 ± 0.0005	< 0.0007	3927
E-08	- 3399	0.091 ± 0.016	-	-0.0002 ± 0.0005	< 0.0009	-0.0002 ± 0.0005	< 0.0005	-0.0001 ± 0.0006	< 0.0008	3916
E-20	- 3400	0.083 ± 0.017	-	-0.0006 ± 0.0005	< 0.0008	0.0004 ± 0.0006	< 0.0007	0.0004 ± 0.0007	< 0.0008	3935
					4th Quarter					
E-01	EAP- 4366	0.076 ± 0.017	-	-0.0021 ± 0.0007	< 0.0011	0.0001 ± 0.0006	< 0.0008	0.0002 ± 0.0006	< 0.0007	3961
E-02	- 4367	0.072 ± 0.024	-	-0.0024 ± 0.0007	< 0.0013	-0.0003 ± 0.0008	< 0.0013	-0.0003 ± 0.0010	< 0.0014	4005
E-03	- 4368	0.063 ± 0.016	-	-0.0006 ± 0.0005	< 0.0009	0.0004 ± 0.0005	< 0.0008	0.0001 ± 0.0006	< 0.0006	3965
E-04	- 4369	0.066 ± 0.019	-	0.0002 ± 0.0006	< 0.0011	0.0000 ± 0.0006	< 0.0009	-0.0003 ± 0.0005	< 0.0005	3963
E-08	- 4370	0.070 ± 0.016	-	-0.0001 ± 0.0004	< 0.0008	0.0002 ± 0.0005	< 0.0009	0.0003 ± 0.0004	< 0.0005	3985
E-20	- 4371	0.080 ± 0.013	-	0.0002 ± 0.0004	< 0.0010	0.0000 ± 0.0005	< 0.0006	-0.0004 ± 0.0005	< 0.0004	3960
Annual Mean±s.d.		**0.083 ± 0.012**		**-0.0004 ± 0.0007**	**< 0.0009**	**0.0000 ± 0.0003**	**< 0.0008**	**0.0000 ± 0.0003**	**< 0.0006**	

POINT BEACH NUCLEAR PLANT

Table 3. Radioactivity in milk samples

Collection: Monthly

Sample Description and Concentration (pCi/L)

E-11 Lambert Dairy Farm

Collection Date	01-13-21	MDC	02-10-21	MDC	03-10-21	MDC	Required LLD
Lab Code	EMI- 82		EMI- 351		EMI- 597		
Sr-89	-0.7 ± 0.9	< 0.9	-0.4 ± 0.7	< 0.8	0.3 ± 0.9	< 0.9	5.0
Sr-90	0.8 ± 0.4	< 0.7	0.5 ± 0.3	< 0.6	0.5 ± 0.4	< 0.7	1.0
I-131	0.05 ± 0.15	< 0.28	-0.02 ± 0.10	< 0.19	0.14 ± 0.17	< 0.29	0.5
K-40	1361 ± 111	-	1322 ± 118	-	1353 ± 114	-	
Cs-134	-2.6 ± 2.0	< 3.6	-0.4 ± 2.5	< 4.4	-2.1 ± 2.3	< 4.2	5.0
Cs-137	0.4 ± 2.3	< 4.2	-0.6 ± 2.6	< 3.4	-1.6 ± 2.7	< 3.9	5.0
Ba-La-140	0.6 ± 2.0	< 3.7	-2.0 ± 2.5	< 2.7	0.5 ± 2.3	< 4.2	5.0
Other (Co-60)	0.7 ± 2.4	< 3.4	0.9 ± 2.0	< 2.9	0.1 ± 2.4	< 3.0	15.0

Collection Date	04-14-21	MDC	05-12-21	MDC	06-09-21	MDC	Required LLD
Lab Code	EMI- 1004		EMI- 1397		EMI- 1705		
Sr-89	0.3 ± 0.5	< 0.5	0.1 ± 0.7	< 0.8	0.2 ± 0.7	< 0.7	5.0
Sr-90	0.4 ± 0.3	< 0.5	0.4 ± 0.3	< 0.5	0.4 ± 0.3	< 0.5	1.0
I-131	0.04 ± 0.19	< 0.37	0.01 ± 0.18	< 0.37	-0.07 ± 0.21	< 0.47	0.5
K-40	1360 ± 104	-	1306 ± 95	-	1316 ± 89	-	
Cs-134	-1.4 ± 1.8	< 3.1	-1.0 ± 1.6	< 3.0	-1.4 ± 1.8	< 3.6	5.0
Cs-137	0.3 ± 2.3	< 4.6	0.0 ± 1.9	< 3.5	-0.1 ± 2.0	< 3.3	5.0
Ba-La-140	-1.8 ± 6.2	< 2.2	-2.1 ± 1.7	< 3.0	1.5 ± 1.6	< 2.7	5.0
Other (Co-60)	-0.5 ± 2.2	< 2.3	1.2 ± 1.8	< 3.2	0.8 ± 1.7	< 2.9	15.0

Table 3. Radioactivity in milk samples

Collection: Monthly

Sample Description and Concentration (pCi/L)

E-11 Lambert Dairy Farm

Collection Date	07-14-21	MDC	08-11-21	MDC	09-08-21	MDC	Required LLD
Lab Code	EMI- 2183		EMI- 2556		EMI- 2883		
Sr-89	-0.1 ± 0.7	< 0.8	0.3 ± 0.7	< 0.7	0.0 ± 0.6	< 0.7	5.0
Sr-90	0.4 ± 0.3	< 0.5	0.5 ± 0.3	< 0.5	0.5 ± 0.3	< 0.5	1.0
I-131	0.00 ± 0.12	< 0.21	0.11 ± 0.20	< 0.38	0.13 ± 0.15	< 0.27	0.5
K-40	1224 ± 94	-	1137 ± 93	-	1563 ± 119	-	
Cs-134	0.5 ± 1.8	< 3.0	-0.2 ± 1.9	< 3.3	0.4 ± 2.6	< 5.0	5.0
Cs-137	-0.6 ± 2.0	< 2.7	1.7 ± 1.9	< 3.6	-1.4 ± 2.5	< 2.8	5.0
Ba-La-140	-0.2 ± 1.8	< 1.8	-0.3 ± 1.7	< 3.0	-5.2 ± 9.2	< 2.3	5.0
Other (Co-60)	-0.4 ± 2.0	< 3.0	-0.2 ± 1.7	< 2.7	-1.5 ± 2.5	< 2.5	15.0

Collection Date	10-13-21	MDC	11-10-21	MDC	12-08-21	MDC	Required LLD
Lab Code	EMI- 3320		EMI- 3790		EMI- 4006		
Sr-89	0.1 ± 0.6	< 0.7	0.4 ± 0.7	< 0.8	-0.2 ± 0.7	< 0.7	5.0
Sr-90	0.4 ± 0.3	< 0.5	0.4 ± 0.3	< 0.6	0.9 ± 0.3	< 0.5	1.0
I-131	0.03 ± 0.21	< 0.43	-0.01 ± 0.15	< 0.27	-0.03 ± 0.17	< 0.31	0.5
K-40	1229 ± 95	-	1413 ± 106	-	1524 ± 123	-	
Cs-134	1.0 ± 1.6	< 2.9	0.4 ± 1.9	< 3.4	0.9 ± 2.3	< 4.7	5.0
Cs-137	0.3 ± 2.0	< 3.1	-1.8 ± 2.3	< 3.4	1.4 ± 2.6	< 4.4	5.0
Ba-La-140	0.6 ± 1.4	< 4.9	-1.4 ± 1.8	< 1.5	-0.9 ± 2.0	< 2.6	5.0
Other (Co-60)	1.2 ± 1.9	< 3.4	-1.2 ± 2.1	< 2.9	0.2 ± 2.8	< 2.4	15.0

Table 3. Radioactivity in milk samples

Collection: Monthly

Sample Description and Concentration (pCi/L)

E-21 Strutz Dairy Farm

Collection Date	01-13-21	MDC	02-10-21	MDC	03-10-21	MDC	Required LLD
Lab Code	EMI- 83		EMI- 352		EMI- 598		
Sr-89	0.3 ± 0.6	< 0.7	0.0 ± 0.5	< 0.7	0.4 ± 0.6	< 0.7	5.0
Sr-90	0.4 ± 0.3	< 0.6	0.1 ± 0.2	< 0.5	0.4 ± 0.3	< 0.7	1.0
I-131	-0.08 ± 0.21	< 0.45	0.02 ± 0.11	< 0.19	-0.10 ± 0.19	< 0.39	0.5
K-40	1373 ± 111	-	1473 ± 108	-	1326 ± 109	-	
Cs-134	-1.0 ± 2.0	< 3.4	-0.6 ± 2.1	< 4.2	-1.2 ± 2.1	< 3.5	5.0
Cs-137	-0.4 ± 2.2	< 3.3	0.5 ± 2.5	< 4.6	0.1 ± 1.9	< 3.2	5.0
Ba-La-140	-0.3 ± 1.9	< 4.2	0.6 ± 2.2	< 3.0	0.2 ± 1.6	< 4.3	5.0
Other (Co-60)	-1.6 ± 2.4	< 2.9	0.3 ± 2.4	< 3.7	-0.5 ± 2.1	< 2.1	15.0

Collection Date	04-14-21	MDC	05-12-21	MDC	06-09-21	MDC	Required LLD
Lab Code	EMI- 1005		EMI- 1398		EMI- 1706		
Sr-89	0.4 ± 0.5	< 0.6	-0.4 ± 0.9	< 0.7	0.3 ± 0.7	< 0.9	5.0
Sr-90	0.2 ± 0.3	< 0.6	0.5 ± 0.4	< 0.7	0.3 ± 0.3	< 0.5	1.0
I-131	0.03 ± 0.14	< 0.25	-0.06 ± 0.13	< 0.24	0.04 ± 0.22	< 0.47	0.5
K-40	1364 ± 107	-	1428 ± 92	-	1290 ± 96	-	
Cs-134	-1.6 ± 1.8	< 3.3	-0.9 ± 1.5	< 2.9	-4.8 ± 2.2	< 3.6	5.0
Cs-137	-2.0 ± 2.5	< 3.3	0.2 ± 1.7	< 3.7	-2.2 ± 2.1	< 2.3	5.0
Ba-La-140	-0.9 ± 1.5	< 1.5	-0.4 ± 1.4	< 2.8	1.5 ± 1.7	< 3.3	5.0
Other (Co-60)	-2.2 ± 2.0	< 1.6	1.3 ± 1.6	< 2.1	0.1 ± 2.3	< 3.5	15.0

POINT BEACH NUCLEAR PLANT

Table 3. Radioactivity in milk samples

Collection: Monthly

Sample Description and Concentration (pCi/L)

E-21 Strutz Dairy Farm

Collection Date	07-14-21	MDC	08-11-21	MDC	09-08-21	MDC	Required LLD
Lab Code	EMI- 2184		EMI- 2557		EMI- 2884		
Sr-89	-0.1 ± 0.8	< 0.8	0.2 ± 0.7	< 0.8	-0.6 ± 0.7	< 0.7	5.0
Sr-90	0.5 ± 0.3	< 0.6	0.4 ± 0.3	< 0.5	0.5 ± 0.3	< 0.6	1.0
I-131	0.00 ± 0.15	< 0.29	0.06 ± 0.22	< 0.47	0.05 ± 0.20	< 0.40	0.5
K-40	1471 ± 100	-	1382 ± 106	-	1330 ± 112	-	
Cs-134	0.9 ± 1.7	< 2.9	0.6 ± 1.9	< 3.8	0.9 ± 2.2	< 3.4	5.0
Cs-137	0.7 ± 1.8	< 3.5	-1.7 ± 2.1	< 3.3	0.9 ± 2.3	< 4.1	5.0
Ba-La-140	0.2 ± 1.2	< 1.2	0.7 ± 2.1	< 2.7	0.3 ± 2.2	< 3.7	5.0
Other (Co-60)	0.4 ± 1.9	< 2.9	-0.2 ± 2.5	< 1.7	-1.0 ± 2.6	< 3.4	15.0

Collection Date	10-13-21	MDC	11-10-21	MDC	12-08-21	MDC	Required LLD
Lab Code	EMI- 3321		EMI- 3791		EMI- 4007		
Sr-89	-0.2 ± 0.6	< 0.7	-0.2 ± 0.7	< 0.8	0.0 ± 0.7	< 0.9	5.0
Sr-90	0.4 ± 0.3	< 0.5	0.5 ± 0.3	< 0.6	0.3 ± 0.3	< 0.6	1.0
I-131	0.08 ± 0.23	< 0.43	0.03 ± 0.18	< 0.32	-0.02 ± 0.16	< 0.29	0.5
K-40	1360 ± 106	-	1267 ± 108	-	1295 ± 112	-	
Cs-134	-0.1 ± 1.7	< 3.2	-1.4 ± 2.0	< 3.7	-1.7 ± 1.8	< 3.1	5.0
Cs-137	-0.6 ± 1.9	< 2.6	0.8 ± 2.2	< 3.2	-0.2 ± 2.4	< 3.0	5.0
Ba-La-140	-0.7 ± 2.0	< 3.2	-0.8 ± 2.3	< 3.3	-1.3 ± 2.0	< 2.9	5.0
Other (Co-60)	0.0 ± 2.2	< 3.3	1.0 ± 2.0	< 4.1	-0.3 ± 2.2	< 3.5	15.0

Table 3. Radioactivity in milk samples

Collection: Monthly

Sample Description and Concentration (pCi/L)

E-40 Barta

Collection Date	01-13-21	MDC	02-10-21	MDC	03-10-21	MDC	Required LLD
Lab Code	EMI- 84		EMI- 353		EMI- 599		
Sr-89	0.2 ± 0.5	< 0.6	-0.3 ± 0.6	< 0.6	0.1 ± 0.6	< 0.6	5.0
Sr-90	0.3 ± 0.3	< 0.5	0.5 ± 0.3	< 0.5	0.5 ± 0.3	< 0.5	1.0
I-131	-0.20 ± 0.19	< 0.42	-0.05 ± 0.10	< 0.19	-0.53 ± 0.14	< 0.27	0.5
K-40	1450 ± 114	-	1458 ± 110	-	1437 ± 125	-	
Cs-134	0.7 ± 2.0	< 3.5	-0.1 ± 2.1	< 3.5	-3.3 ± 2.5	< 4.7	5.0
Cs-137	-1.2 ± 2.3	< 3.3	1.5 ± 2.1	< 4.0	0.3 ± 2.4	< 3.2	5.0
Ba-La-140	-1.4 ± 1.9	< 4.2	0.9 ± 1.9	< 4.6	-1.5 ± 2.1	< 4.6	5.0
Other (Co-60)	-0.9 ± 2.2	< 3.3	0.3 ± 2.4	< 3.8	0.3 ± 2.9	< 3.6	15.0

Collection Date	04-14-21	MDC	05-12-21	MDC	06-09-21	MDC	Required LLD
Lab Code	EMI- 1006		EMI- 1399		EMI- 1707		
Sr-89	0.3 ± 0.5	< 0.5	-0.2 ± 0.5	< 0.7	-0.4 ± 0.7	< 0.7	5.0
Sr-90	0.4 ± 0.3	< 0.5	0.2 ± 0.2	< 0.4	0.5 ± 0.3	< 0.5	1.0
I-131	-0.10 ± 0.18	< 0.38	0.00 ± 0.13	< 0.24	0.06 ± 0.14	< 0.24	0.5
K-40	1356 ± 110	-	1499 ± 98	-	1445 ± 81	-	
Cs-134	0.1 ± 1.8	< 3.1	0.7 ± 1.8	< 3.7	-1.1 ± 1.4	< 2.8	5.0
Cs-137	0.6 ± 2.2	< 3.5	0.4 ± 2.1	< 3.5	0.3 ± 1.6	< 2.8	5.0
Ba-La-140	0.3 ± 1.7	< 1.3	-0.9 ± 6.3	< 4.6	0.6 ± 1.3	< 3.8	5.0
Other (Co-60)	0.5 ± 2.0	< 2.8	1.8 ± 2.0	< 3.1	-0.8 ± 1.5	< 1.6	15.0

Table 3. Radioactivity in milk samples

Collection: Monthly

Sample Description and Concentration (pCi/L)

E-40 Barta

Collection Date	07-14-21	MDC	08-11-21	MDC	09-08-21	MDC	Required LLD
Lab Code	EMI- 2185		EMI- 2558		EMI- 2885		
Sr-89	-0.3 ± 0.6	< 0.7	0.5 ± 0.6	< 0.7	0.4 ± 0.5	< 0.6	5.0
Sr-90	0.5 ± 0.3	< 0.5	0.2 ± 0.3	< 0.5	0.1 ± 0.3	< 0.5	1.0
I-131	0.09 ± 0.16	< 0.30	-0.05 ± 0.13	< 0.24	0.12 ± 0.18	< 0.31	0.5
K-40	1440 ± 112	-	1299 ± 105	-	1429 ± 116	-	
Cs-134	-0.6 ± 2.0	< 3.1	-0.4 ± 1.8	< 3.6	0.5 ± 2.1	< 3.7	5.0
Cs-137	0.3 ± 2.3	< 4.0	0.3 ± 2.4	< 2.9	2.3 ± 2.2	< 3.6	5.0
Ba-La-140	1.0 ± 2.0	< 2.9	-0.1 ± 1.6	< 1.7	-1.3 ± 2.1	< 3.4	5.0
Other (Co-60)	0.4 ± 2.1	< 3.4	-1.4 ± 2.2	< 1.9	0.2 ± 2.5	< 4.0	15.0

Collection Date	10-13-21	MDC	11-10-21	MDC	12-08-21	MDC	Required LLD
Lab Code	EMI- 3322		EMI- 3792		EMI- 4008		
Sr-89	-0.2 ± 0.5	< 0.6	0.3 ± 0.7	< 0.7	-0.7 ± 0.8	< 0.8	5.0
Sr-90	0.3 ± 0.3	< 0.5	0.2 ± 0.3	< 0.6	0.6 ± 0.4	< 0.6	1.0
I-131	-0.06 ± 0.21	< 0.43	0.11 ± 0.18	< 0.32	0.00 ± 0.19	< 0.35	0.5
K-40	1469 ± 107	-	1543 ± 118	-	1298 ± 114	-	
Cs-134	-1.0 ± 1.9	< 3.3	-1.5 ± 2.3	< 4.6	-1.7 ± 2.0	< 3.7	5.0
Cs-137	0.8 ± 1.8	< 3.3	0.8 ± 2.6	< 4.9	-0.2 ± 2.5	< 3.4	5.0
Ba-La-140	0.7 ± 1.2	< 2.0	-2.0 ± 2.6	< 3.1	0.8 ± 1.8	< 2.5	5.0
Other (Co-60)	1.2 ± 2.0	< 2.8	-0.6 ± 2.7	< 2.6	2.3 ± 2.3	< 3.7	15.0

Sr-89 Annual Mean + s.d.	**0.0 ± 0.3**
Sr-90 Annual Mean + s.d.	**0.4 ± 0.2**
I-131 Annual Mean + s.d.	**-0.01 ± 0.12**
K-40 Annual Mean + s.d.	**1377 ± 95**
Cs-134 Annual Mean + s.d.	**-0.7 ± 1.3**
Cs-137 Annual Mean + s.d.	**0.0 ± 1.1**
Ba-La Annual Mean + s.d.	**-0.4 ± 1.3**
Co-60 Annual Mean + s.d.	**0.1 ± 1.0**

Table 4. Radioactivity in Well Water Samples, E-10
Collection: Quarterly
Units: pCi/L

	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Req. LLD	
Collection Date	01-21-21	04-16-21	07-21-21	10-14-21		
Lab Code	EWW- 179	EWW- 1063	EWW- 2332	EWW- 3319		
Gross Beta	0.9 ± 1.1	0.7 ± 1.0	0.8 ± 1.1	1.4 ± 1.1	4.0	**0.9 ± 0.3**
H-3	-32 ± 72	-18 ± 74	61 ± 79	81 ± 81	500	**22.8 ± 56.2**
Sr-89	0.2 ± 0.4	-0.2 ± 0.4	0.3 ± 0.3	0.1 ± 0.4	5.0	**0.1 ± 0.2**
Sr-90	0.0 ± 0.2	0.0 ± 0.2	-0.2 ± 0.2	-0.1 ± 0.2	1.0	**-0.1 ± 0.1**
I-131	-0.11 ± 0.21	-0.05 ± 0.20	0.18 ± 0.21	-0.15 ± 0.18	0.5	**-0.03 ± 0.15**
Mn-54	-0.8 ± 3.1	0.7 ± 2.6	-1.3 ± 1.8	-0.6 ± 1.4	10	**-0.5 ± 0.8**
Fe-59	-1.5 ± 1.4	3.4 ± 4.4	0.9 ± 3.5	0.2 ± 2.4	30	**0.8 ± 2.0**
Co-58	1.3 ± 2.3	-0.8 ± 2.2	-1.9 ± 1.8	0.0 ± 1.5	10	**-0.3 ± 1.4**
Co-60	0.7 ± 3.2	0.9 ± 2.9	2.2 ± 1.9	-0.1 ± 1.7	10	**0.9 ± 0.9**
Zn-65	-14.5 ± 7.2	-4.5 ± 6.3	-4.1 ± 4.0	-2.1 ± 3.1	30	**-6.3 ± 5.6**
Zr-Nb-95	-0.9 ± 3.2	-1.6 ± 2.5	-0.3 ± 1.7	-0.1 ± 1.6	15	**-0.7 ± 0.7**
Cs-134	-4.3 ± 3.2	-0.6 ± 2.2	-0.2 ± 2.0	-0.1 ± 1.5	10	**-1.3 ± 2.0**
Cs-137	-3.1 ± 3.0	-4.2 ± 2.5	-1.7 ± 2.0	1.7 ± 1.7	10	**-1.8 ± 2.5**
Ba-La-140	-1.0 ± 3.3	-0.8 ± 2.6	-0.8 ± 2.1	0.1 ± 4.7	15	**-0.6 ± 0.5**
Other (Ru-103)	-0.9 ± 2.7	1.8 ± 2.5	0.5 ± 1.9	-0.7 ± 1.5	30	**0.2 ± 1.2**

MDC Data

Collection Date	01-21-21	04-16-21	07-21-21	10-14-21		
Lab Code	EWW- 179	EWW- 1063	EWW- 2332	EWW- 3319		
Gross Beta	< 2.0	< 1.9	< 2.0	< 1.9	4.0	**< 2.0**
H-3	< 160	< 159	< 156	< 159	500	**< 158.2**
Sr-89	< 0.6	< 0.5	< 0.4	< 0.6	5.0	**< 0.5**
Sr-90	< 0.5	< 0.5	< 0.5	< 0.5	1.0	**< 0.5**
I-131	< 0.39	< 0.41	< 0.37	< 0.33	0.5	**< 0.37**
Mn-54	< 5.6	< 4.4	< 2.2	< 1.5	10	**< 3.4**
Fe-59	< 5.3	< 7.0	< 6.9	< 5.1	30	**< 6.1**
Co-58	< 3.5	< 3.7	< 2.3	< 2.4	10	**< 3.0**
Co-60	< 4.7	< 2.2	< 2.5	< 2.7	10	**< 3.0**
Zn-65	< 10.6	< 7.1	< 2.9	< 4.0	30	**< 6.1**
Zr-Nb-95	< 4.2	< 3.1	< 4.6	< 2.6	15	**< 3.6**
Cs-134	< 5.8	< 4.3	< 3.9	< 2.7	10	**< 4.2**
Cs-137	< 3.8	< 2.9	< 2.8	< 3.4	10	**< 3.2**
Ba-La-140	< 2.9	< 1.8	< 3.4	< 3.6	15	**< 2.9**
Other (Ru-103)	< 5.6	< 5.0	< 3.9	< 2.1	30	**< 4.1**

Table 5. Lake water, analyses for gross beta, iodine-131 and gamma emitting isotopes.
Location: E-01 (Meteorological Tower)
Collection: Monthly composites Units: pCi/L

		MDC		MDC		MDC		MDC	
Lab Code	ELW- 77		NS[a]		ELW- 600		ELW- 1012		
Date Collected	01-12-21		02-09-21		03-10-21		04-14-21		Req. LLD
Gross beta	1.6 ± 0.6	< 0.9	-		1.7 ± 0.6	< 0.9	1.1 ± 0.6	< 0.9	4.0
I-131	-0.02 ± 0.12	< 0.22	-		0.12 ± 0.14	< 0.24	-0.13 ± 0.13	< 0.24	0.5
Be-7	33.6 ± 18.6	< 41.1	-		0.8 ± 19.5	< 26.6	-3.1 ± 19.2	< 43.3	
Mn-54	0.4 ± 1.6	< 1.9	-		-0.6 ± 2.1	< 2.5	-1.4 ± 1.9	< 3.0	10
Fe-59	-2.3 ± 4.4	< 4.5	-		0.2 ± 4.5	< 9.2	-1.0 ± 3.6	< 6.7	30
Co-58	2.2 ± 2.1	< 4.4	-		0.6 ± 1.9	< 3.8	-1.9 ± 1.6	< 2.7	10
Co-60	0.2 ± 2.3	< 2.4	-		1.0 ± 1.9	< 3.1	-0.1 ± 2.0	< 2.0	10
Zn-65	-8.6 ± 5.4	< 10.8	-		4.8 ± 4.6	< 5.7	1.2 ± 4.4	< 6.6	30
Zr-Nb-95	0.1 ± 2.7	< 4.5	-		-0.6 ± 2.0	< 3.9	-0.5 ± 1.6	< 2.7	15
Cs-134	-6.4 ± 2.9	< 3.7	-		0.3 ± 2.0	< 4.0	-0.5 ± 2.3	< 4.7	10
Cs-137	-2.6 ± 2.6	< 2.7	-		-1.4 ± 2.1	< 2.3	1.8 ± 2.2	< 3.9	10
Ba-La-140	-5.0 ± 2.6	< 11.9	-		-0.7 ± 2.0	< 7.1	-3.2 ± 2.2	< 8.3	15
Other (Ru-103)	-3.3 ± 2.2	< 3.4	-		-2.5 ± 2.3	< 6.2	1.3 ± 2.1	< 5.2	30

		MDC		MDC		MDC		MDC	
Lab Code	ELW- 1405		ELW- 1708		ELW- 2177		ELW- 2545		
Date Collected	05-12-21		06-08-21		07-13-21		08-11-21		Req. LLD
Gross beta	1.0 ± 0.5	< 0.9	0.7 ± 0.5	< 0.9	1.1 ± 0.5	< 0.8	1.4 ± 0.6	< 0.9	4.0
I-131	-0.19 ± 0.13	< 0.26	0.03 ± 0.14	< 0.24	-0.07 ± 0.14	< 0.26	-0.12 ± 0.15	< 0.29	0.5
Be-7	7.7 ± 10.8	< 24.3	-5.7 ± 11.5	< 30.9	-4.5 ± 14.0	< 29.3	2.5 ± 17.9	< 28.9	
Mn-54	2.0 ± 1.3	< 2.7	-0.7 ± 1.6	< 1.7	0.7 ± 1.4	< 2.8	-0.4 ± 1.9	< 3.0	10
Fe-59	0.1 ± 2.4	< 5.8	-2.4 ± 2.9	< 4.8	-2.7 ± 2.9	< 4.5	2.5 ± 3.6	< 9.0	30
Co-58	0.6 ± 1.1	< 3.0	-0.9 ± 1.6	< 1.8	1.1 ± 1.5	< 2.0	-0.9 ± 1.7	< 3.7	10
Co-60	-0.6 ± 1.4	< 1.2	-0.5 ± 1.7	< 2.6	-1.3 ± 1.8	< 1.9	1.1 ± 2.3	< 2.8	10
Zn-65	1.1 ± 2.5	< 4.8	0.9 ± 2.8	< 5.3	-1.2 ± 3.4	< 5.8	2.6 ± 3.6	< 6.1	30
Zr-Nb-95	0.9 ± 1.1	< 3.8	-2.9 ± 1.4	< 2.5	0.9 ± 1.8	< 4.3	-1.8 ± 1.7	< 3.3	15
Cs-134	-1.0 ± 1.2	< 2.4	0.6 ± 1.4	< 2.9	0.8 ± 1.6	< 3.0	1.2 ± 1.7	< 3.5	10
Cs-137	-0.3 ± 1.3	< 2.2	-0.5 ± 1.8	< 2.4	0.8 ± 1.9	< 2.7	0.6 ± 1.9	< 2.9	10
Ba-La-140	1.2 ± 1.4	< 5.1	0.9 ± 1.5	< 5.3	-2.1 ± 2.0	< 3.1	-5.7 ± 2.3	< 2.7	15
Other (Ru-103)	1.0 ± 1.2	< 3.1	-1.2 ± 1.4	< 3.4	-0.4 ± 1.6	< 3.8	-0.2 ± 1.9	< 4.6	30

		MDC		MDC		MDC		MDC	
Lab Code	ELW- 2886		ELW- 3328		ELW- 3793		ELW- 4013		
Date Collected	09-07-21		10-12-21		11-10-21		12-07-21		Req. LLD
Gross beta	0.5 ± 0.5	< 0.9	1.1 ± 0.5	< 0.9	1.3 ± 0.6	< 0.9	0.7 ± 0.6	< 1.0	4.0
I-131	-0.05 ± 0.14	< 0.27	-0.10 ± 0.15	< 0.29	0.12 ± 0.17	< 0.30	-0.03 ± 0.21	< 0.43	0.5
Be-7	-18.8 ± 11.9	< 24.1	-17.4 ± 13.0	< 33.9	2.4 ± 5.3	< 16.8	19.7 ± 14.0	< 33.2	
Mn-54	1.4 ± 1.6	< 2.7	-1.8 ± 1.7	< 1.5	0.8 ± 0.6	< 1.3	0.9 ± 1.7	< 2.8	10
Fe-59	-2.1 ± 2.9	< 5.3	3.3 ± 3.0	< 7.1	0.6 ± 1.0	< 3.6	-1.3 ± 2.8	< 3.6	30
Co-58	1.8 ± 1.3	< 2.3	0.7 ± 1.6	< 2.8	0.8 ± 0.6	< 1.7	0.7 ± 1.4	< 2.0	10
Co-60	-0.1 ± 1.5	< 1.5	1.3 ± 1.8	< 2.3	0.0 ± 0.7	< 1.3	-1.0 ± 1.8	< 2.7	10
Zn-65	-0.3 ± 2.6	< 3.8	2.2 ± 3.5	< 7.8	0.4 ± 1.2	< 2.6	-1.6 ± 3.1	< 3.5	30
Zr-Nb-95	0.8 ± 1.5	< 2.8	-6.1 ± 2.2	< 3.3	0.2 ± 0.7	< 2.3	-0.7 ± 1.9	< 4.2	15
Cs-134	0.9 ± 1.6	< 2.7	1.9 ± 1.6	< 3.0	-1.0 ± 0.7	< 1.2	-0.8 ± 1.8	< 3.3	10
Cs-137	-1.5 ± 1.7	< 2.3	-0.1 ± 2.0	< 3.5	0.9 ± 0.8	< 1.4	-1.0 ± 1.8	< 2.4	10
Ba-La-140	-0.9 ± 1.4	< 3.8	-4.1 ± 1.9	< 6.4	-4.1 ± 0.7	< 7.7	0.7 ± 1.2	< 1.7	15
Other (Ru-103)	-0.8 ± 1.4	< 2.5	0.0 ± 1.6	< 3.3	0.1 ± 0.6	< 2.6	-0.4 ± 1.6	< 3.5	30

[a] "NS" = No sample; see Table 2.0, Listing of Missed Samples.

Table 5. Lake water, analyses for gross beta, iodine-131 and gamma emitting isotopes.
Location: E-05 (Two Creeks Park)
Collection: Monthly composites Units: pCi/L

		MDC		MDC		MDC		MDC	
Lab Code	ELW- 78		NS[a]		ELW- 601		ELW- 1013		
Date Collected	01-12-21		02-09-21		03-10-21		04-14-21		Req. LLD
Gross beta	1.1 ± 0.5	< 0.9	-		3.6 ± 0.7	< 0.9	1.3 ± 0.6	< 0.9	4.0
I-131	0.11 ± 0.13	< 0.23	-		0.06 ± 0.13	< 0.24	-0.05 ± 0.12	< 0.23	0.5
Be-7	18.9 ± 20.0	< 47.6	-		8.5 ± 16.4	< 41.3	32.0 ± 17.2	< 36.3	
Mn-54	1.3 ± 2.1	< 1.8	-		1.2 ± 1.7	< 3.2	-1.8 ± 2.1	< 2.4	10
Fe-59	0.5 ± 4.2	< 5.6	-		-1.3 ± 3.4	< 3.7	-5.1 ± 4.1	< 3.9	30
Co-58	-0.2 ± 2.1	< 2.8	-		-0.9 ± 2.2	< 3.3	0.3 ± 1.7	< 2.4	10
Co-60	-0.8 ± 1.9	< 2.5	-		1.5 ± 2.1	< 3.0	-1.1 ± 2.4	< 2.1	10
Zn-65	-4.7 ± 5.3	< 4.4	-		-1.6 ± 4.2	< 5.6	-2.9 ± 4.7	< 5.6	30
Zr-Nb-95	-1.8 ± 2.3	< 3.3	-		-3.0 ± 2.1	< 3.2	-2.2 ± 2.2	< 5.0	15
Cs-134	-1.5 ± 2.4	< 3.9	-		-4.9 ± 2.3	< 3.5	-4.3 ± 2.5	< 4.1	10
Cs-137	-0.9 ± 2.7	< 2.5	-		0.6 ± 2.3	< 3.8	1.8 ± 2.4	< 3.9	10
Ba-La-140	-19.1 ± 7.4	< 13.8	-		0.6 ± 2.2	< 13.0	-0.3 ± 2.2	< 7.8	15
Other (Ru-103)	-1.3 ± 2.2	< 2.7	-		-2.9 ± 2.1	< 3.2	-0.2 ± 2.3	< 4.5	30

Lab Code	ELW- 1406		ELW- 1709		ELW- 2178		ELW- 2546		
Date Collected	05-12-21		06-08-21		07-13-21		08-11-21		Req. LLD
Gross beta	0.8 ± 0.5	< 0.9	0.5 ± 0.5	< 0.8	1.8 ± 0.6	< 0.9	0.9 ± 0.5	< 0.9	4.0
I-131	-0.06 ± 0.14	< 0.26	0.02 ± 0.23	< 0.48	-0.07 ± 0.12	< 0.23	-0.15 ± 0.15	< 0.28	0.5
Be-7	-4.4 ± 11.6	< 33.2	-5.3 ± 16.0	< 28.1	-4.7 ± 18.1	< 34.1	9.4 ± 17.3	< 31.2	
Mn-54	-0.1 ± 1.2	< 1.9	1.4 ± 1.4	< 2.7	0.2 ± 1.8	< 3.2	1.2 ± 1.8	< 3.5	10
Fe-59	1.2 ± 2.5	< 3.6	2.9 ± 3.0	< 3.9	-3.8 ± 3.6	< 3.0	2.3 ± 3.6	< 4.7	30
Co-58	-1.2 ± 1.3	< 1.5	2.4 ± 1.6	< 3.6	-0.5 ± 1.7	< 2.9	1.6 ± 1.5	< 3.3	10
Co-60	0.8 ± 1.8	< 2.5	-0.1 ± 1.8	< 2.5	-0.5 ± 1.7	< 1.6	-0.6 ± 1.7	< 2.3	10
Zn-65	1.5 ± 3.0	< 5.1	-1.5 ± 3.3	< 3.3	4.1 ± 3.5	< 4.8	1.2 ± 4.2	< 3.5	30
Zr-Nb-95	-1.3 ± 1.5	< 2.6	-0.8 ± 1.8	< 4.1	0.7 ± 1.9	< 4.8	-1.7 ± 1.4	< 2.2	15
Cs-134	-0.5 ± 1.3	< 2.5	-0.1 ± 1.9	< 3.9	-0.9 ± 1.8	< 3.8	0.8 ± 2.0	< 3.7	10
Cs-137	-0.2 ± 1.7	< 2.6	0.3 ± 1.9	< 2.7	0.4 ± 2.2	< 3.9	-2.8 ± 2.3	< 1.7	10
Ba-La-140	5.1 ± 1.5	< 6.2	-1.8 ± 1.8	< 6.7	0.6 ± 2.0	< 5.8	-2.3 ± 1.9	< 4.8	15
Other (Ru-103)	1.0 ± 1.5	< 4.0	0.5 ± 2.0	< 5.5	-0.1 ± 2.3	< 4.5	-1.3 ± 2.1	< 3.8	30

Lab Code	ELW- 2887		ELW- 3329		ELW- 3794		ELW- 4014		
Date Collected	09-07-21		10-12-21		11-10-21		12-07-21		Req. LLD
Gross beta	0.9 ± 0.5	< 0.9	1.4 ± 0.6	< 0.9	0.9 ± 0.5	< 0.9	1.5 ± 0.6	< 0.9	4.0
I-131	0.12 ± 0.15	< 0.25	-0.02 ± 0.16	< 0.30	0.02 ± 0.14	< 0.25	0.04 ± 0.16	< 0.29	0.5
Be-7	4.5 ± 11.4	< 24.8	9.4 ± 12.3	< 36.0	-3.0 ± 8.1	< 23.3	25.1 ± 16.3	< 37.0	
Mn-54	0.8 ± 1.4	< 2.4	-0.3 ± 1.4	< 2.1	-0.2 ± 0.8	< 1.5	-0.6 ± 2.0	< 2.8	10
Fe-59	-1.0 ± 2.5	< 4.3	-3.0 ± 2.6	< 4.4	0.1 ± 1.6	< 3.5	-2.9 ± 3.4	< 5.7	30
Co-58	1.0 ± 1.4	< 2.4	1.0 ± 1.4	< 2.4	-0.6 ± 0.8	< 1.8	0.0 ± 1.8	< 3.8	10
Co-60	0.3 ± 1.7	< 2.6	1.2 ± 1.6	< 2.5	0.5 ± 0.8	< 1.6	-1.3 ± 2.2	< 1.9	10
Zn-65	0.3 ± 2.7	< 3.9	3.8 ± 2.8	< 5.2	-0.6 ± 1.8	< 3.4	-1.0 ± 3.9	< 3.8	30
Zr-Nb-95	0.3 ± 1.5	< 3.8	0.2 ± 1.5	< 4.9	0.0 ± 0.8	< 2.6	0.0 ± 1.7	< 4.1	15
Cs-134	0.1 ± 1.4	< 2.4	-0.7 ± 1.5	< 2.8	-0.5 ± 0.8	< 1.8	0.9 ± 1.8	< 3.8	10
Cs-137	1.4 ± 1.5	< 2.8	0.7 ± 1.6	< 3.1	0.2 ± 1.0	< 1.5	0.7 ± 1.9	< 3.9	10
Ba-La-140	0.2 ± 1.6	< 6.5	0.3 ± 1.7	< 9.3	-4.9 ± 0.9	< 6.5	-2.9 ± 2.2	< 2.1	15
Other (Ru-103)	-0.4 ± 1.4	< 4.0	-0.4 ± 1.3	< 3.5	-1.3 ± 1.0	< 3.5	-2.8 ± 1.9	< 3.7	30

[a] "NS" = No sample; see Table 2.0, Listing of Missed Samples.

Table 5. Lake water, analyses for gross beta, iodine-131 and gamma emitting isotopes.
Location: E-06 (Coast Guard Station)
Collection: Monthly composites Units: pCi/L

		MDC		MDC		MDC		MDC	
Lab Code	ELW- 79		NS[a]		ELW- 602		ELW- 1014		
Date Collected	01-12-21		02-09-21		03-10-21		04-14-21		Req. LLD
Gross beta	1.1 ± 0.6	< 0.9	-		2.0 ± 0.6	< 0.9	1.4 ± 0.6	< 0.9	4.0
I-131	0.12 ± 0.21	< 0.42	-		-0.01 ± 0.12	< 0.21	0.18 ± 0.19	< 0.36	0.5
Be-7	-1.7 ± 11.7	< 18.5	-		-3.5 ± 10.9	< 24.9	2.3 ± 13.9	< 44.0	
Mn-54	1.0 ± 1.3	< 3.0	-		1.0 ± 1.6	< 2.8	2.0 ± 1.6	< 2.2	10
Fe-59	0.2 ± 2.3	< 5.8	-		-1.0 ± 3.1	< 4.4	1.2 ± 3.1	< 5.8	30
Co-58	0.1 ± 1.3	< 2.7	-		-0.3 ± 1.5	< 2.8	-0.3 ± 1.7	< 2.4	10
Co-60	-0.9 ± 1.4	< 1.9	-		0.4 ± 1.6	< 2.4	0.7 ± 1.6	< 2.4	10
Zn-65	-0.8 ± 2.5	< 3.3	-		-2.8 ± 3.6	< 4.5	-1.8 ± 3.4	< 4.2	30
Zr-Nb-95	0.7 ± 1.6	< 4.4	-		-1.6 ± 1.9	< 3.2	-0.1 ± 1.7	< 5.3	15
Cs-134	-1.9 ± 1.5	< 2.6	-		-0.8 ± 1.7	< 3.2	0.6 ± 1.8	< 3.1	10
Cs-137	-0.6 ± 1.5	< 2.1	-		-0.3 ± 1.8	< 2.6	1.2 ± 1.9	< 4.1	10
Ba-La-140	0.2 ± 1.3	< 6.0	-		-0.6 ± 1.9	< 7.2	-10.1 ± 2.0	< 3.7	15
Other (Ru-103)	-0.4 ± 1.3	< 3.2	-		-0.5 ± 1.5	< 3.9	-1.7 ± 1.5	< 2.7	30
Lab Code	ELW- 1407		ELW- 1710		ELW- 2179		ELW- 2547		
Date Collected	05-12-21		06-08-21		07-13-21		08-11-21		Req. LLD
Gross beta	1.4 ± 0.6	< 0.9	1.1 ± 0.6	< 0.9	1.2 ± 0.6	< 1.0	0.8 ± 0.5	< 0.9	4.0
I-131	-0.04 ± 0.20	< 0.42	-0.03 ± 0.12	< 0.23	0.10 ± 0.12	< 0.21	-0.05 ± 0.18	< 0.32	0.5
Be-7	2.5 ± 16.4	< 35.7	5.6 ± 18.2	< 37.2	-12.3 ± 15.4	< 28.3	9.0 ± 12.4	< 32.4	
Mn-54	-0.3 ± 1.8	< 3.3	-0.6 ± 1.6	< 2.7	-0.3 ± 1.4	< 2.0	0.1 ± 1.6	< 1.5	10
Fe-59	-2.0 ± 2.9	< 4.9	-2.1 ± 3.2	< 4.9	-0.3 ± 3.0	< 3.2	-2.9 ± 2.6	< 3.2	30
Co-58	-0.2 ± 1.5	< 1.8	1.0 ± 1.6	< 4.1	-0.7 ± 1.5	< 2.5	0.2 ± 1.7	< 2.6	10
Co-60	1.1 ± 1.7	< 2.2	1.6 ± 1.6	< 2.0	0.3 ± 1.5	< 2.1	2.2 ± 2.0	< 3.1	10
Zn-65	3.1 ± 3.3	< 3.9	2.1 ± 3.6	< 5.1	0.2 ± 3.0	< 3.4	-1.5 ± 2.8	< 3.8	30
Zr-Nb-95	-1.7 ± 1.9	< 4.5	-0.5 ± 1.9	< 3.0	-0.8 ± 1.5	< 3.2	-3.3 ± 1.8	< 1.9	15
Cs-134	-1.4 ± 2.0	< 3.1	0.6 ± 1.9	< 3.8	0.2 ± 1.5	< 3.1	-0.3 ± 1.7	< 2.8	10
Cs-137	-0.3 ± 2.1	< 2.1	0.3 ± 1.9	< 1.6	0.2 ± 1.8	< 2.0	-0.3 ± 1.9	< 2.7	10
Ba-La-140	-3.3 ± 2.2	< 7.8	-3.8 ± 1.9	< 7.4	-1.0 ± 2.0	< 5.5	1.8 ± 1.9	< 5.1	15
Other (Ru-103)	-1.3 ± 1.9	< 3.1	-1.2 ± 1.9	< 4.0	-0.1 ± 1.7	< 3.5	0.3 ± 1.4	< 4.0	30
Lab Code	ELW- 2888		ELW- 3330		ELW- 3796		NS[a]		
Date Collected	09-07-21		10-12-21		11-10-21		12-07-21		Req. LLD
Gross beta	0.7 ± 0.5	< 0.9	1.5 ± 0.6	< 0.9	0.8 ± 0.5	< 0.8	-		4.0
I-131	0.12 ± 0.19	< 0.36	0.04 ± 0.15	< 0.27	0.01 ± 0.14	< 0.25	-		0.5
Be-7	-3.0 ± 16.2	< 28.5	12.4 ± 13.3	< 28.7	-17.6 ± 19.6	< 30.3	-		
Mn-54	-1.7 ± 1.7	< 2.0	-0.3 ± 1.4	< 1.5	1.5 ± 2.0	< 3.8	-		10
Fe-59	0.9 ± 3.1	< 5.5	1.6 ± 2.9	< 5.7	-0.9 ± 3.2	< 8.2	-		30
Co-58	-0.7 ± 1.6	< 2.7	-0.3 ± 1.6	< 2.2	1.6 ± 1.9	< 4.3	-		10
Co-60	0.6 ± 1.7	< 2.1	-1.0 ± 1.7	< 2.1	1.7 ± 2.2	< 2.4	-		10
Zn-65	1.9 ± 3.2	< 4.6	-0.1 ± 2.8	< 6.5	-1.5 ± 4.9	< 6.0	-		30
Zr-Nb-95	-0.4 ± 1.9	< 2.7	0.4 ± 2.9	< 5.3	-0.6 ± 1.9	< 5.1	-		15
Cs-134	0.4 ± 1.6	< 3.5	-1.4 ± 1.5	< 2.8	-2.4 ± 1.9	< 4.0	-		10
Cs-137	0.6 ± 2.0	< 3.7	-0.8 ± 2.2	< 2.5	-0.9 ± 2.2	< 2.8	-		10
Ba-La-140	-0.2 ± 1.7	< 5.6	1.5 ± 1.8	< 12.2	0.2 ± 2.2	< 9.9	-		15
Other (Ru-103)	-1.1 ± 1.9	< 3.8	-0.8 ± 1.6	< 3.5	0.2 ± 2.1	< 4.0	-		30

[a] "NS" = No sample; see Table 2.0, Listing of Missed Samples.

Annual					
Annual					
All locations	Mean ± s.d.		Mean ± s.d.		Mean ± s.d.
Gross Beta	1.2 ± 0.6				
I-131	0.00 ± 0.09	Co-58	0.2 ± 0.9	Cs-134	-0.5 ± 1.6
Be-7	2.4 ± 11.1	Co-60	0.2 ± 0.8	Cs-137	0.0 ± 0.9
Mn-54	0.2 ± 0.9	Zn-65	0.0 ± 2.3	Ba-La-140	-1.5 ± 3.7
Fe-59	-0.5 ± 1.8	Zr-Nb-95	-0.6 ± 1.4	Ru-103	-0.5 ± 1.0

Table 6. Lake water, analyses for tritium, strontium-89 and strontium-90.
Collection: Quarterly composites of weekly grab samples
Units: pCi/L

Location	E-01 (Meteorological Tower)							
Period	1st Qtr.	MDC	2nd Qtr.	MDC	3rd Qtr.	MDC	4th Qtr.	MDC
Lab Code	ELW- 647		ELW- 1735		ELW- 2952		ELW- 4237	
H-3	45 ± 76	< 158	73 ± 79	< 161	59 ± 81	< 162	484 ± 101 [a]	< 157
Sr-89	0.53 ± 0.66	< 0.77	-0.21 ± 0.48	< 0.56	-0.05 ± 0.48	< 0.62	-0.11 ± 0.63	< 0.73
Sr-90	-0.02 ± 0.28	< 0.61	0.39 ± 0.28	< 0.51	0.13 ± 0.25	< 0.50	0.29 ± 0.28	< 0.54

[a] Monthly tritium analyses in App. F

Location	E-05 (Two Creeks Park)							
Period	1st Qtr.		2nd Qtr.		3rd Qtr.		4th Qtr.	
Lab Code	ELW- 648		ELW- 1736		ELW- 2953		ELW- 4238	
H-3	67 ± 77	< 158	114 ± 81	< 161	50 ± 81	< 162	52 ± 79	< 157
Sr-89	-0.17 ± 0.54	< 0.74	0.21 ± 0.46	< 0.61	-0.41 ± 0.51	< 0.66	-0.04 ± 0.63	< 0.79
Sr-90	0.14 ± 0.26	< 0.52	-0.01 ± 0.26	< 0.56	0.29 ± 0.28	< 0.52	0.18 ± 0.28	< 0.56

Location	E-06 (Coast Guard Station)							
Period	1st Qtr.		2nd Qtr.		3rd Qtr.		4th Qtr.	
Lab Code	ELW- 649		ELW- 1737		ELW- 2954		ELW- 4239	
H-3	-36 ± 71	< 158	3 ± 75	< 161	117 ± 85	< 162	125 ± 83	< 158
Sr-89	-0.01 ± 0.54	< 0.62	0.12 ± 0.47	< 0.51	-0.06 ± 0.46	< 0.56	0.18 ± 0.89	< 1.01
Sr-90	0.27 ± 0.26	< 0.50	0.34 ± 0.27	< 0.49	0.20 ± 0.25	< 0.48	0.20 ± 0.27	< 0.54

Tritium Annual Mean ± s.d.	**96 ± 130**
Sr-89 Annual Mean ± s.d.	**0.00 ± 0.24**
Sr-90 Annual Mean ± s.d.	**0.20 ± 0.13**

POINT BEACH NUCLEAR PLANT

Table 7. Fish, analyses for gamma emitting isotopes.
Location: E-13
Collection: Quarterly Units: pCi/g wet

	Sample Description and Concentration	MDC		MDC		MDC	Req. LLD
Collection Date	01-20-21		01-10-21		02-05-21		
Lab Code	EF- 477		EF- 478		EF- 479		
Type	Brown trout		Burbot		Burbot		
K-40	2.20 ± 0.33	-	1.92 ± 0.294	-	0.95 ± 0.22	-	
Mn-54	0.003 ± 0.008	< 0.017	-0.003 ± 0.008	< 0.018	-0.001 ± 0.007	< 0.012	0.13
Fe-59	0.023 ± 0.015	< 0.081	-0.031 ± 0.018	< 0.058	-0.022 ± 0.013	< 0.024	0.26
Co-58	0.006 ± 0.007	< 0.023	0.004 ± 0.009	< 0.032	-0.004 ± 0.007	< 0.017	0.13
Co-60	-0.007 ± 0.009	< 0.013	0.000 ± 0.009	< 0.013	-0.003 ± 0.008	< 0.011	0.13
Zn-65	0.011 ± 0.019	< 0.043	-0.069 ± 0.024	< 0.039	-0.018 ± 0.014	< 0.022	0.26
Cs-134	-0.011 ± 0.008	< 0.015	-0.025 ± 0.011	< 0.020	-0.028 ± 0.009	< 0.013	0.13
Cs-137	0.012 ± 0.010	< 0.018	0.026 ± 0.013	< 0.019	-0.006 ± 0.008	< 0.007	0.15
Other (Ru-103)	0.006 ± 0.007	< 0.053	-0.012 ± 0.008	< 0.051	0.003 ± 0.006	< 0.034	0.5
Collection Date	06-01-21		05-12-21		05-02-21		
Lab Code	EF- 1702		EF- 1703		EF- 1704		
Type	Lake Trout		Burbot		Salmon		
K-40	2.38 ± 0.38	-	1.81 ± 1.81	-	1.46 ± 0.29	-	
Mn-54	0.012 ± 0.009	< 0.016	0.015 ± 0.010	< 0.021	0.007 ± 0.009	< 0.020	0.13
Fe-59	0.024 ± 0.022	< 0.054	-0.013 ± 0.017	< 0.065	-0.013 ± 0.018	< 0.030	0.26
Co-58	-0.001 ± 0.008	< 0.015	-0.008 ± 0.011	< 0.033	0.015 ± 0.008	< 0.025	0.13
Co-60	0.001 ± 0.012	< 0.013	-0.002 ± 0.009	< 0.014	0.006 ± 0.008	< 0.010	0.13
Zn-65	0.007 ± 0.020	< 0.033	0.011 ± 0.023	< 0.042	-0.008 ± 0.023	< 0.036	0.26
Cs-134	-0.001 ± 0.010	< 0.020	0.001 ± 0.009	< 0.021	-0.011 ± 0.008	< 0.017	0.13
Cs-137	0.005 ± 0.012	< 0.018	0.010 ± 0.013	< 0.022	0.000 ± 0.010	< 0.012	0.15
Other (Ru-103)	0.012 ± 0.010	< 0.035	0.005 ± 0.009	< 0.057	0.000 ± 0.009	< 0.039	0.5

Table 7. Fish, analyses for gamma emitting isotopes.
Location: E-13
Collection: Quarterly Units: pCi/g wet

	Sample Description and Concentration (pCi/g wet)	MDC		MDC		MDC	Req. LLD
Collection Date	08-31-21		07-21-21		08-22-21		
Lab Code	EF- 2777		EF- 2778		EF- 2779		
Type	Lake Trout		Chinook Salmon		Salmon		
K-40	3.44 ± 0.44	-	2.28 ± 0.35	-	2.03 ± 2.03		
Mn-54	0.000 ± 0.008	< 0.012	-0.007 ± 0.008	< 0.013	-0.004 ± 0.011	< 0.013	0.13
Fe-59	0.001 ± 0.016	< 0.048	-0.025 ± 0.017	< 0.087	0.007 ± 0.019	< 0.057	0.26
Co-58	0.001 ± 0.008	< 0.018	-0.004 ± 0.008	< 0.029	-0.004 ± 0.010	< 0.024	0.13
Co-60	-0.003 ± 0.010	< 0.014	0.000 ± 0.009	< 0.010	-0.005 ± 0.011	< 0.011	0.13
Zn-65	0.008 ± 0.018	< 0.032	-0.009 ± 0.018	< 0.025	-0.007 ± 0.023	< 0.026	0.26
Cs-134	-0.003 ± 0.008	< 0.015	-0.002 ± 0.008	< 0.016	0.001 ± 0.009	< 0.019	0.13
Cs-137	0.016 ± 0.011	< 0.020	0.002 ± 0.010	< 0.014	0.004 ± 0.012	< 0.017	0.15
Other (Ru-103)	-0.002 ± 0.008	< 0.027	-0.002 ± 0.011	< 0.056	-0.004 ± 0.009	< 0.029	0.5
Collection Date	08-22-21		08-28-21				
Lab Code	EF- 2780		EF- 2781				
Type	Burbot		Burbot				
K-40	2.53 ± 0.37	-	1.88 ± 0.34	-			
Mn-54	0.012 ± 0.008	< 0.013	0.013 ± 0.008	< 0.015			0.13
Fe-59	-0.016 ± 0.019	< 0.076	-0.013 ± 0.016	< 0.052			0.26
Co-58	0.005 ± 0.009	< 0.020	-0.007 ± 0.009	< 0.019			0.13
Co-60	0.005 ± 0.010	< 0.015	0.000 ± 0.009	< 0.012			0.13
Zn-65	-0.011 ± 0.019	< 0.024	0.002 ± 0.018	< 0.028			0.26
Cs-134	-0.002 ± 0.010	< 0.017	-0.001 ± 0.008	< 0.016			0.13
Cs-137	0.019 ± 0.012	< 0.022	0.030 ± 0.017	< 0.019			0.15
Other (Ru-103)	0.007 ± 0.008	< 0.033	0.003 ± 0.006	< 0.025			0.5

Table 7. Fish, analyses for gross beta and gamma emitting isotopes.
Location: E-13
Collection: Quarterly Units: pCi/g wet

	Sample Description and Concentration (pCi/g wet)	MDC		MDC		MDC	Req. LLD
Collection Date	10-22-21		11-26-21				
Lab Code	EF- 3928		EF- 3929				
Type	Salmon		Lake Trout				
K-40	3.34 ± 0.40	-	2.68 ± 0.35	-			
Mn-54	0.007 ± 0.010	< 0.020	0.006 ± 0.007	< 0.011			0.13
Fe-59	-0.017 ± 0.021	< 0.084	-0.020 ± 0.014	< 0.029			0.26
Co-58	0.019 ± 0.010	< 0.036	-0.002 ± 0.007	< 0.014			0.13
Co-60	-0.004 ± 0.012	< 0.015	0.002 ± 0.009	< 0.015			0.13
Zn-65	-0.032 ± 0.028	< 0.041	-0.007 ± 0.019	< 0.016			0.26
Cs-134	-0.010 ± 0.009	< 0.020	0.006 ± 0.008	< 0.015			0.13
Cs-137	-0.005 ± 0.011	< 0.015	0.008 ± 0.009	< 0.014			0.15
Other (Ru-103)	-0.012 ± 0.010	< 0.073	0.000 ± 0.006	< 0.024			0.5

	Annual
Mn-54	**0.005 ± 0.007**
Fe-59	**-0.009 ± 0.018**
Co-58	**0.001 ± 0.008**
Co-60	**-0.001 ± 0.004**
Zn-65	**-0.009 ± 0.022**
Cs-134	**-0.007 ± 0.010**
Cs-137	**0.009 ± 0.011**
Other (Ru-103)	**0.000 ± 0.007**

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Table 8. Radioactivity in shoreline sediment samples

Collection: Annual

Sample Description and Concentration (pCi/g dry)

		MDC		MDC		MDC	
Collection Date	10/19/2021		10/19/2021		10/19/2021		
Lab Code	ESS- 3453		ESS- 3455		ESS- 3456		LLD
Location	E-01		E-05		E-06		
Be-7	0.126 ± 0.058	< 0.186	0.044 ± 0.076	< 0.204	0.073 ± 0.075	< 0.256	
K-40	3.763 ± 0.335	-	6.169 ± 0.454	-	8.379 ± 0.501	-	-
Cs-134	-0.004 ± 0.007	< 0.010	-0.004 ± 0.009	< 0.019	-0.003 ± 0.008	< 0.015	0.15
Cs-137	0.032 ± 0.015	< 0.013	-0.015 ± 0.011	< 0.014	0.024 ± 0.010	< 0.017	0.15
Tl-208	0.057 ± 0.015	-	0.059 ± 0.028	-	0.043 ± 0.017	-	-
Pb-212	0.141 ± 0.021	-	0.102 ± 0.023	-	0.124 ± 0.022	-	-
Bi-214	0.206 ± 0.030	-	0.182 ± 0.038	-	0.177 ± 0.034	-	-
Ra-226	0.461 ± 0.198	-	0.363 ± 0.182	-	0.385 ± 0.215	-	-
Ac-228	0.131 ± 0.054	-	0.171 ± 0.087	-	0.192 ± 0.062	-	-

	Annual Mean ±s.d.
Be-7	0.081 ± 0.042
K-40	6.10 ± 2.31
Cs-134	0.00 ± 0.00
Cs-137	0.014 ± 0.025
Tl-208	0.05 ± 0.01
Pb-212	0.12 ± 0.02
Bi-214	0.19 ± 0.02
Ra-226	0.40 ± 0.05
Ac-228	0.16 ± 0.03

Table 9. Radioactivity in soil samples

Collection: Annual

Sample Description and Concentration (pCi/g dry)

		MDC		MDC		MDC	
Collection Date	9/23/2021		9/23/2021		9/23/2021		Req.
Lab Code	ESO- 3080		ESO- 3081		ESO- 3082		LLD
Location	E-01		E-02		E-03		
Be-7	0.029 ± 0.09	< 0.22	0.096 ± 0.14	< 0.37	0.103 ± 0.11	< 0.26	
K-40	17.03 ± 0.79	-	15.87 ± 0.93	-	19.66 ± 0.97	-	-
Cs-134	-0.005 ± 0.01	< 0.02	0.001 ± 0.01	< 0.03	0.001 ± 0.01	< 0.02	0.15
Cs-137	0.162 ± 0.03	< 0.03	0.042 ± 0.02	< 0.03	0.100 ± 0.10	< 0.03	0.15
Tl-208	0.187 ± 0.03	-	0.153 ± 0.04	-	0.203 ± 0.04	-	-
Pb-212	0.527 ± 0.04	-	0.364 ± 0.05	-	0.517 ± 0.05	-	-
Bi-214	0.447 ± 0.05	-	0.323 ± 0.06	-	0.443 ± 0.06	-	-
Ra-226	1.562 ± 0.30	-	1.371 ± 0.42	-	1.445 ± 0.53	-	-
Ac-228	0.563 ± 0.08	-	0.405 ± 0.11	-	0.647 ± 0.12	-	-
Collection Date	9/23/2021		9/21/2021		9/23/2021		
Lab Code	ESO- 3083		ESO- 3084		ESO- 3086		
Location	E-04		E-06		E-20		
Be-7	0.008 ± 0.10	< 0.32	0.795 ± 0.32	< 0.28	0.246 ± 0.13	< 0.30	
K-40	18.13 ± 0.97	-	13.35 ± 0.74	-	16.55 ± 0.91	-	-
Cs-134	0.000 ± 0.01	< 0.02	0.000 ± 0.01	< 0.02	-0.020 ± 0.01	< 0.03	0.15
Cs-137	0.122 ± 0.03	< 0.03	0.429 ± 0.04	< 0.03	0.025 ± 0.02	< 0.03	0.15
Tl-208	0.147 ± 0.04	-	0.063 ± 0.03	-	0.206 ± 0.04	-	-
Pb-212	0.412 ± 0.04	-	0.139 ± 0.03	-	0.444 ± 0.05	-	-
Bi-214	0.289 ± 0.06	-	0.127 ± 0.04	-	0.458 ± 0.06	-	-
Ra-226	0.716 ± 0.35	-	0.579 ± 0.22	-	0.829 ± 0.35	-	-
Ac-228	0.555 ± 0.11	-	0.227 ± 0.11	-	0.479 ± 0.11	-	-
					Annual		
					Mean ± s.d.		
Be-7					**0.213 ± 0.30**		
K-40					**16.77 ± 2.14**		-
Cs-134					**-0.004 ± 0.01**		0.15
Cs-137					**0.15 ± 0.15**		0.15
Tl-208					**0.16 ± 0.05**		-
Pb-212					**0.40 ± 0.14**		-
Bi-214					**0.35 ± 0.13**		-
Ra-226					**1.08 ± 0.42**		-
Ac-228					**0.48 ± 0.15**		-

Table 10. Radioactivity in vegetation samples
Collection: Bi-annual

Sample Description and Concentration (pCi/g wet)

		MDC		MDC		MDC	
Location	E-01		E-02		E-03		
Collection Date	05-26-21		05-26-21		05-26-21		
Lab Code	EG- 1542		EG- 1543		EG- 1544		Req. LLD
Be-7	0.25 ± 0.14	-	0.40 ± 0.12	-	0.48 ± 0.21	-	-
K-40	5.76 ± 0.46	-	4.76 ± 0.41	-	6.39 ± 0.52	-	-
I-131	-0.006 ± 0.012	< 0.027	-0.003 ± 0.007	< 0.031	-0.010 ± 0.009	< 0.019	0.060
Cs-134	0.001 ± 0.008	< 0.017	-0.003 ± 0.007	< 0.013	-0.003 ± 0.008	< 0.015	0.060
Cs-137	0.003 ± 0.010	< 0.020	-0.002 ± 0.009	< 0.011	-0.007 ± 0.009	< 0.009	0.080
Other (Co-60)	-0.003 ± 0.010	< 0.013	0.005 ± 0.007	< 0.009	0.000 ± 0.009	< 0.011	0.060
Location	E-04		E-06		E-20		
Collection Date	05-26-21		05-26-21		05-26-21		
Lab Code	EG- 1545		EG- 1546		EG- 1547		Req. LLD
Be-7	0.35 ± 0.13	-	0.55 ± 0.17	-	0.29 ± 0.11	-	-
K-40	5.17 ± 0.41	-	3.92 ± 0.39	-	5.26 ± 0.37	-	-
I-131	-0.001 ± 0.009	< 0.020	0.008 ± 0.007	< 0.016	0.011 ± 0.006	< 0.025	0.060
Cs-134	-0.006 ± 0.008	< 0.015	-0.009 ± 0.009	< 0.015	0.000 ± 0.007	< 0.012	0.060
Cs-137	-0.010 ± 0.008	< 0.009	0.013 ± 0.010	< 0.015	0.004 ± 0.007	< 0.015	0.080
Other (Co-60)	-0.004 ± 0.008	< 0.009	0.002 ± 0.008	< 0.006	-0.008 ± 0.008	< 0.008	0.060

Table 10. Radioactivity in vegetation samples
Collection: Bi-annual

Sample Description and Concentration (pCi/g wet)

		MDC		MDC		MDC	
Location	E-01		E-02		E-03		
Collection Date	09-21-21		09-21-21		09-21-21		
Lab Code	EG- 3074		EG- 3075		EG- 3076		Req. LLD
Be-7	7.85 ± 0.39	-	4.48 ± 0.29	-	7.69 ± 0.36	-	-
K-40	3.52 ± 0.40	-	5.41 ± 0.44	-	5.85 ± 0.44	-	-
I-131	-0.015 ± 0.009	< 0.030	-0.001 ± 0.008	< 0.023	0.002 ± 0.008	< 0.031	0.060
Cs-134	-0.002 ± 0.009	< 0.017	-0.005 ± 0.008	< 0.014	0.004 ± 0.008	< 0.015	0.060
Cs-137	-0.003 ± 0.010	< 0.018	0.013 ± 0.009	< 0.016	0.001 ± 0.009	< 0.012	0.080
Other (Co-60)	-0.011 ± 0.010	< 0.008	0.005 ± 0.008	< 0.013	-0.008 ± 0.010	< 0.016	0.060
Location	E-04		E-06		E-20		
Collection Date	09-21-21		09-21-21		09-21-21		
Lab Code	EG- 3077		EG- 3078		EG- 3079		Req. LLD
Be-7	7.14 ± 0.36	-	6.73 ± 0.37	-	1.44 ± 0.19	-	-
K-40	4.92 ± 0.40	-	4.04 ± 0.39	-	6.08 ± 0.42	-	-
I-131	-0.004 ± 0.007	< 0.021	0.001 ± 0.012	< 0.039	-0.015 ± 0.007	< 0.023	0.060
Cs-134	-0.006 ± 0.007	< 0.012	0.006 ± 0.009	< 0.017	-0.002 ± 0.006	< 0.012	0.060
Cs-137	0.000 ± 0.009	< 0.013	0.024 ± 0.011	< 0.020	-0.003 ± 0.007	< 0.011	0.080
Other (Co-60)	-0.002 ± 0.008	< 0.010	-0.003 ± 0.008	< 0.009	0.001 ± 0.008	< 0.010	0.060

Be-7 Annual Mean ± s.d.	**3.14 ± 3.33**
K-40 Annual Mean ± s.d.	**5.09 ± 0.90**
I-131 Annual Mean ± s.d.	**-0.003 ± 0.008**
Cs-134 Annual Mean ± s.d.	**-0.002 ± 0.004**
Cs-137 Annual Mean ± s.d.	**0.003 ± 0.009**
Co-60 Annual Mean ± s.d.	**-0.002 ± 0.005**

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Table 11. Ambient Gamma Radiation [a]
LLD/7days: < 1mR/TLD

1st. Quarter, 2021

Date Annealed:	12-03-20	Days in the field	88
Date Placed:	01-08-21	Days from Annealing	
Date Removed:	04-06-21 [b]	to Readout:	133
Date Read:	04-15-21		

Location	Days in Field	Total mR	Net mR	mR/Stnd Qtr (91 days)	Net mR per 7 days
Indicator					
E-1	88	20.6 ± 1.3	12.8 ± 1.5	13.2 ± 1.6	1.02 ± 0.12
E-2	88	23.0 ± 1.6	15.1 ± 1.7	15.6 ± 1.7	1.20 ± 0.13
E-3	88	22.6 ± 1.7	14.8 ± 1.7	15.3 ± 1.8	1.17 ± 0.14
E-4	88	20.4 ± 1.3	12.5 ± 1.4	12.9 ± 1.4	0.99 ± 0.11
E-5	88	22.3 ± 0.8	14.4 ± 0.9	14.9 ± 0.9	1.15 ± 0.07
E-6	88	19.9 ± 0.6	12.0 ± 0.7	12.4 ± 0.7	0.95 ± 0.06
E-7	88	20.2 ± 0.8	12.3 ± 0.9	12.7 ± 0.9	0.98 ± 0.07
E-8	88	20.6 ± 1.4	12.7 ± 1.5	13.2 ± 1.5	1.01 ± 0.12
E-9	88	23.9 ± 0.4	16.1 ± 0.6	16.6 ± 0.6	1.28 ± 0.04
E-12	88	16.7 ± 0.6	8.8 ± 0.7	9.1 ± 0.7	0.70 ± 0.06
E-14	88	21.9 ± 0.7	14.0 ± 0.8	14.5 ± 0.8	1.12 ± 0.06
E-15	88	22.9 ± 0.5	15.1 ± 0.6	15.6 ± 0.7	1.20 ± 0.05
E-16B	88	22.8 ± 0.7	15.0 ± 0.8	15.5 ± 0.8	1.19 ± 0.08
E-17	88	22.7 ± 0.9	14.9 ± 1.0	15.4 ± 1.0	1.18 ± 0.08
E-18	88	23.9 ± 0.9	16.0 ± 1.0	16.6 ± 1.0	1.27 ± 0.08
E-22	88	21.7 ± 1.2	13.8 ± 1.3	14.3 ± 1.3	1.10 ± 0.10
E-23	88	22.3 ± 0.4	14.5 ± 0.6	15.0 ± 0.6	1.15 ± 0.05
E-24	88	22.7 ± 1.1	14.8 ± 1.2	15.3 ± 1.3	1.18 ± 0.10
E-25	88	21.1 ± 0.6	13.3 ± 0.7	13.7 ± 0.7	1.06 ± 0.06
E-26B	88	23.2 ± 0.7	15.3 ± 0.8	15.8 ± 0.8	1.22 ± 0.06
E-27	88	22.9 ± 0.3	15.0 ± 0.5	15.5 ± 0.6	1.20 ± 0.04
E-28	89	17.5 ± 0.5	9.6 ± 0.7	9.9 ± 0.7	0.76 ± 0.05
E-29	88	18.2 ± 0.8	10.3 ± 0.9	10.7 ± 1.0	0.82 ± 0.07
E-30	88	20.1 ± 1.1	12.3 ± 1.2	12.7 ± 1.2	0.98 ± 0.10
E-31	88	21.8 ± 0.7	13.9 ± 0.8	14.4 ± 0.8	1.11 ± 0.06
E-32	89	25.1 ± 1.0	17.2 ± 1.1	17.6 ± 1.1	1.35 ± 0.08
E-38	88	21.9 ± 1.1	14.0 ± 1.2	14.5 ± 1.2	1.12 ± 0.09
E-39	88	21.5 ± 0.6	13.6 ± 0.7	14.1 ± 0.7	1.08 ± 0.06
E-41	88	20.7 ± 0.5	12.8 ± 0.7	13.3 ± 0.7	1.02 ± 0.05
E-42	88	23.6 ± 0.9	15.7 ± 1.0	16.2 ± 1.0	1.25 ± 0.08
E-43	88	22.0 ± 1.3	14.1 ± 1.3	14.6 ± 1.4	1.12 ± 0.10
E-44	88	21.2 ± 1.0	13.3 ± 1.1	13.8 ± 1.1	1.06 ± 0.08
Control					
E-20	90	22.8 ± 1.3	14.9 ± 1.3	15.1 ± 1.3	1.16 ± 0.10
Mean±s.d.		21.7 ± 1.8	13.8 ± 1.8	14.2 ± 1.9	1.10 ± 0.15

In-Transit Exposure	Date Annealed	Date Read	ITC-1	ITC-2
	12-03-20	01-13-21	7.0 ± 0.5	7.1 ± 0.3
	03-04-21	04-15-21	7.5 ± 0.3	7.4 ± 0.4

[a] The $CaSO_4$:Dy dosimeter cards provide four separate readout areas. Values listed represent the mean and standard deviation of the average of the four readings.
[b] Some TLDs removed on 4/7 or 4/8, as indicated.

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Table 11. Ambient Gamma Radiation [a]
LLD/7days: < 1mR/TLD

2nd Quarter, 2021

Date Annealed:	03-04-21	Days in the field	86
Date Placed:	04-06-21 [c]	Days from Annealing	
Date Removed:	07-01-21	to Readout:	127
Date Read:	07-09-21		

Location	Days in Field	Total mR	Net mR	mR/Stnd Qtr (91 days)	Net mR per 7 days
Indicator					
E-1	86	18.8 ± 0.3	13.4 ± 0.7	14.1 ± 0.7	1.09 ± 0.06
E-2	86	22.1 ± 1.4	16.7 ± 1.5	17.7 ± 1.6	1.36 ± 0.12
E-3	86	25.0 ± 1.5	19.6 ± 1.6	20.7 ± 1.7	1.59 ± 0.13
E-4	86	20.3 ± 0.7	14.9 ± 1.0	15.8 ± 1.0	1.21 ± 0.08
E-5	86	21.5 ± 0.5	16.0 ± 0.8	17.0 ± 0.8	1.31 ± 0.07
E-6	86	19.3 ± 1.1	13.9 ± 1.2	14.7 ± 1.3	1.13 ± 0.10
E-7	86	18.8 ± 0.6	13.4 ± 0.9	14.2 ± 0.9	1.09 ± 0.07
E-8	86	19.4 ± 0.6	14.0 ± 0.8	14.8 ± 0.9	1.14 ± 0.07
E-9	86	23.3 ± 0.7	17.8 ± 0.9	18.9 ± 1.0	1.45 ± 0.08
E-12	86	17.1 ± 1.3	11.7 ± 1.5	12.4 ± 1.6	0.95 ± 0.12
E-14	86	24.7 ± 0.4	19.3 ± 0.7	20.5 ± 0.8	1.57 ± 0.06
E-15	86	22.8 ± 1.4	17.3 ± 1.5	18.4 ± 1.6	1.41 ± 0.12
E-16B	86	21.9 ± 0.8	16.5 ± 1.0	17.5 ± 1.1	1.35 ± 0.08
E-17	86	22.2 ± 0.9	16.8 ± 1.0	17.8 ± 1.1	1.37 ± 0.09
E-18	86	25.8 ± 1.9	20.4 ± 2.0	21.6 ± 2.1	1.66 ± 0.16
E-22	86	21.0 ± 0.5	15.6 ± 0.8	16.5 ± 0.9	1.27 ± 0.07
E-23	86	23.4 ± 0.6	17.9 ± 0.8	19.0 ± 0.9	1.46 ± 0.07
E-24	86	22.6 ± 1.0	17.2 ± 1.2	18.1 ± 1.3	1.40 ± 0.10
E-25	86	23.8 ± 0.5	18.4 ± 0.8	19.5 ± 0.8	1.50 ± 0.06
E-26B	86	20.3 ± 0.6	14.9 ± 0.8	15.8 ± 0.9	1.22 ± 0.07
E-27	86	24.1 ± 0.7	18.7 ± 1.0	19.7 ± 1.0	1.52 ± 0.08
E-28	85	16.6 ± 0.6	11.2 ± 0.9	12.0 ± 0.9	0.92 ± 0.07
E-29	86	16.5 ± 0.2	11.1 ± 0.6	11.7 ± 0.7	0.90 ± 0.05
E-30	86	19.1 ± 0.8	13.7 ± 1.0	14.5 ± 1.1	1.11 ± 0.08
E-31	86	22.2 ± 1.5	16.8 ± 1.6	17.8 ± 1.7	1.37 ± 0.13
E-32	85	25.5 ± 0.9	20.0 ± 1.1	21.5 ± 1.2	1.65 ± 0.09
E-38	86	22.9 ± 0.7	17.5 ± 0.9	18.5 ± 1.0	1.42 ± 0.07
E-39	86	23.4 ± 0.7	17.9 ± 0.9	19.0 ± 1.0	1.46 ± 0.08
E-41	86	21.2 ± 0.6	15.8 ± 0.9	16.7 ± 0.9	1.28 ± 0.07
E-42	86	24.0 ± 1.4	18.5 ± 1.5	19.6 ± 1.6	1.51 ± 0.12
E-43	86	24.7 ± 1.0	19.2 ± 1.1	20.4 ± 1.2	1.57 ± 0.09
E-44	86	23.7 ± 0.4	18.3 ± 0.7	19.4 ± 0.8	1.49 ± 0.06
Control					
E-20	84	22.2 ± 0.9	16.8 ± 1.1	18.2 ± 1.2	1.40 ± 0.09
Mean±s.d.		21.8 ± 2.5	16.4 ± 2.5	17.4 ± 2.7	1.34 ± 0.21

In-Transit Exposure	Date Annealed	Date Read	ITC-1	ITC-2
	03-04-21	04-15-21	5.9 ± 0.3	5.7 ± 0.4
	06-03-21	07-09-21	5.0 ± 0.3	5.1 ± 0.2

[a] The $CaSO_4$:Dy dosimeter cards provide four separate readout areas. Values listed represent the mean and standard deviation of the average of the four readings.
[c] Some samples placed on 4/7 or 4/8 as indicated

POINT BEACH NUCLEAR PLANT

Table 11. Ambient Gamma Radiation [a]
LLD/7days: < 1mR/TLD

3rd Quarter, 2021

Date Annealed:	06-03-21	Days in the field	94
Date Placed:	07-01-21	Days from Annealing	
Date Removed:	10-03-21	to Readout:	126
Date Read:	10-07-21		

Location	Days in Field	Total mR	Net mR	mR/Stnd Qtr (91 days)	Net mR per 7 days
Indicator					
E-1	94	18.9 ± 1.2	13.9 ± 1.3	13.4 ± 1.3	1.03 ± 0.10
E-2	94	21.0 ± 1.3	16.0 ± 1.4	15.4 ± 1.4	1.19 ± 0.10
E-3	94	22.5 ± 1.6	17.5 ± 1.7	16.9 ± 1.6	1.30 ± 0.12
E-4	94	18.6 ± 1.2	13.5 ± 1.3	13.1 ± 1.2	1.01 ± 0.09
E-5	94	20.9 ± 0.5	15.8 ± 0.7	15.3 ± 0.7	1.18 ± 0.05
E-6	94	19.0 ± 0.7	13.9 ± 0.9	13.5 ± 0.8	1.04 ± 0.06
E-7	94	18.3 ± 1.0	13.3 ± 1.1	12.9 ± 1.1	0.99 ± 0.08
E-8	94	18.2 ± 0.9	13.2 ± 1.1	12.7 ± 1.0	0.98 ± 0.08
E-9	94	22.3 ± 0.6	17.3 ± 0.8	16.7 ± 0.7	1.29 ± 0.06
E-12	94	14.0 ± 0.4	9.0 ± 0.6	8.7 ± 0.6	0.67 ± 0.05
E-14	94	20.0 ± 0.6	14.9 ± 0.8	14.5 ± 0.8	1.11 ± 0.06
E-15	94	21.7 ± 0.8	16.7 ± 0.9	16.2 ± 0.9	1.24 ± 0.07
E-16B	94	20.2 ± 0.3	15.2 ± 0.6	14.7 ± 0.6	1.13 ± 0.04
E-17	94	17.5 ± 0.6	12.5 ± 0.8	12.1 ± 0.8	0.93 ± 0.06
E-18	94	23.3 ± 1.0	18.3 ± 1.1	17.7 ± 1.0	1.36 ± 0.08
E-22	94	19.8 ± 0.9	14.8 ± 1.0	14.3 ± 1.0	1.10 ± 0.07
E-23	94	21.9 ± 0.6	16.9 ± 0.7	16.3 ± 0.7	1.26 ± 0.06
E-24	94	19.2 ± 0.8	14.1 ± 1.0	13.7 ± 0.9	1.05 ± 0.07
E-25	94	19.5 ± 0.7	14.5 ± 0.9	14.0 ± 0.9	1.08 ± 0.07
E-26B	94	18.5 ± 0.6	13.5 ± 0.8	13.1 ± 0.8	1.00 ± 0.06
E-27	94	21.5 ± 0.6	16.5 ± 0.8	16.0 ± 0.7	1.23 ± 0.06
E-28	94	14.6 ± 0.5	9.6 ± 0.7	9.2 ± 0.7	0.71 ± 0.05
E-29	94	15.5 ± 0.9	10.5 ± 1.1	10.1 ± 1.0	0.78 ± 0.08
E-30	94	18.1 ± 0.9	13.1 ± 1.0	12.7 ± 1.0	0.97 ± 0.08
E-31	94	21.0 ± 0.5	15.9 ± 0.7	15.4 ± 0.7	1.19 ± 0.05
E-32	94	24.2 ± 1.0	19.2 ± 1.1	18.6 ± 1.0	1.43 ± 0.08
E-38	94	21.5 ± 1.8	16.5 ± 1.9	15.9 ± 1.8	1.23 ± 0.14
E-39	94	20.9 ± 1.6	15.9 ± 1.6	15.4 ± 1.6	1.18 ± 0.12
E-41	94	19.8 ± 0.9	14.8 ± 1.0	14.3 ± 1.0	1.10 ± 0.08
E-42	94	22.1 ± 0.7	17.0 ± 0.9	16.5 ± 0.9	1.27 ± 0.07
E-43	94	21.3 ± 1.3	16.3 ± 1.4	15.8 ± 1.4	1.21 ± 0.11
E-44	94	19.9 ± 1.0	14.9 ± 1.1	14.4 ± 1.1	1.11 ± 0.09
Control					
E-20	94	19.0 ± 1.0	14.0 ± 1.1	13.5 ± 1.1	1.04 ± 0.08
Mean±s.d.		19.8 ± 2.3	14.8 ± 2.3	14.3 ± 2.2	1.10 ± 0.18

In-Transit Exposure	Date Annealed	Date Read	ITC-1	ITC-2
	06-03-21	07-09-21	5.0 ± 0.3	5.1 ± 0.2
	09-07-21	10-07-21	4.7 ± 0.2	5.3 ± 0.3

[a] The $CaSO_4$:Dy dosimeter cards provide four separate readout areas. Values listed represent the mean and standard deviation of the average of the four readings.

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Table 11. Ambient Gamma Radiation[a]
LLD/7days: < 1mR/TLD

4th Quarter, 2021

Date Annealed:	09-07-21	Days in the field	93
Date Placed:	10-03-21	Days from Annealing	
Date Removed:	01-04-22	to Readout:	122
Date Read:	01-07-22		

Location	Days in Field	Total mR	Net mR	mR/Stnd Qtr (91 days)	Net mR per 7 days
Indicator					
E-1	93	20.1 ± 0.3	14.4 ± 0.7	14.1 ± 0.6	1.09 ± 0.05
E-2	93	23.7 ± 0.8	18.0 ± 1.0	17.6 ± 1.0	1.36 ± 0.07
E-3	93	27.1 ± 1.2	21.4 ± 1.4	21.0 ± 1.3	1.61 ± 0.10
E-4	93	22.5 ± 0.8	16.9 ± 1.0	16.5 ± 1.0	1.27 ± 0.08
E-5	93	23.7 ± 0.3	18.0 ± 0.7	17.6 ± 0.7	1.35 ± 0.05
E-6	93	20.3 ± 1.2	14.6 ± 1.3	14.3 ± 1.3	1.10 ± 0.10
E-7	93	18.7 ± 0.7	13.1 ± 0.9	12.8 ± 0.9	0.98 ± 0.07
E-8	93	21.4 ± 1.0	15.7 ± 1.1	15.4 ± 1.1	1.18 ± 0.08
E-9	93	25.3 ± 0.7	19.6 ± 0.9	19.2 ± 0.9	1.47 ± 0.07
E-12	93	18.4 ± 1.5	12.7 ± 1.6	12.4 ± 1.5	0.96 ± 0.12
E-14	93	22.7 ± 1.6	17.1 ± 1.7	16.7 ± 1.7	1.28 ± 0.13
E-15	93	22.1 ± 1.4	16.4 ± 1.5	16.1 ± 1.5	1.23 ± 0.11
E-16B	93	24.6 ± 1.9	18.9 ± 2.0	18.5 ± 1.9	1.42 ± 0.15
E-17	93	23.7 ± 1.0	18.0 ± 1.1	17.7 ± 1.1	1.36 ± 0.08
E-18	93	28.5 ± 1.9	22.8 ± 2.0	22.3 ± 1.9	1.72 ± 0.15
E-22	93	23.2 ± 0.7	17.6 ± 0.9	17.2 ± 0.9	1.32 ± 0.07
E-23	93	25.4 ± 0.5	19.7 ± 0.8	19.3 ± 0.7	1.48 ± 0.06
E-24	93	24.2 ± 1.0	18.5 ± 1.2	18.1 ± 1.2	1.39 ± 0.09
E-25	93	25.7 ± 0.5	20.1 ± 0.8	19.6 ± 0.7	1.51 ± 0.06
E-26B	93	19.9 ± 0.4	14.2 ± 0.7	13.9 ± 0.7	1.07 ± 0.05
E-27	93	25.3 ± 0.8	19.6 ± 1.0	19.2 ± 1.0	1.48 ± 0.08
E-28	93	15.5 ± 0.8	9.8 ± 1.0	9.6 ± 1.0	0.74 ± 0.07
E-29	93	15.2 ± 0.2	9.5 ± 0.6	9.3 ± 0.6	0.71 ± 0.05
E-30	93	20.9 ± 0.9	15.2 ± 1.1	14.9 ± 1.1	1.15 ± 0.08
E-31	93	24.2 ± 1.3	18.5 ± 1.5	18.1 ± 1.4	1.39 ± 0.11
E-32	93	23.8 ± 0.8	18.2 ± 1.0	17.8 ± 1.0	1.37 ± 0.07
E-38	93	24.3 ± 0.6	18.6 ± 0.8	18.2 ± 0.8	1.40 ± 0.06
E-39	93	25.2 ± 0.9	19.5 ± 1.1	19.1 ± 1.1	1.47 ± 0.08
E-41	93	22.5 ± 0.7	16.8 ± 0.9	16.5 ± 0.9	1.27 ± 0.07
E-42	93	26.1 ± 1.3	20.5 ± 1.5	20.0 ± 1.4	1.54 ± 0.11
E-43	93	26.8 ± 1.0	21.1 ± 1.1	20.7 ± 1.1	1.59 ± 0.08
E-44	93	24.9 ± 0.5	19.2 ± 0.8	18.8 ± 0.7	1.45 ± 0.06
Control					
E-20	93	24.6 ± 1.1	18.9 ± 1.3	18.5 ± 1.3	1.42 ± 0.10
Mean±s.d.		23.0 ± 3.1	17.4 ± 3.1	17.0 ± 3.0	1.31 ± 0.24

In-Transit Exposure	Date Annealed	Date Read	ITC-1	ITC-2
	09-07-21	10-07-21	4.7 ± 0.2	5.3 ± 0.3
	12-06-21	01-07-22	6.3 ± 0.4	6.5 ± 0.3

[a] The $CaSO_4$:Dy dosimeter cards provide four separate readout areas. Values listed represent the mean and standard deviation of the average of the four readings.

	Total mR	Net mR	mR/Stnd Qtr	Net mR per 7 days
Annual Indicator Mean±s.d.	21.6 ± 2.7	15.6 ± 2.8	15.7 ± 2.9	1.2 ± 0.2
Annual Control Mean±s.d.	22.1 ± 2.3	16.1 ± 2.2	16.3 ± 2.4	1.3 ± 0.2
Annual Indicator/Control Mean±s.d.	21.6 ± 2.7	15.6 ± 2.8	15.7 ± 2.9	1.2 ± 0.2

Table 12. Groundwater Tritium Monitoring Program
(Monthly Collections)
Units = pCi/L

Intermittent Streams

Sample ID GW-01 / GW-02

Collection Date	Lab Code	Tritium	MDC	Collection Date	Lab Code	Tritium	MDC
01-21-21		NS[a]		01-21-21		NS[a]	
02-17-21		NS[a]		02-17-21		NS[a]	
03-25-21	EWW- 778	11 ± 79	< 159	03-25-21	EWW- 779	320 ± 95	< 159
04-23-21	EWW- 1198	86 ± 80	< 159	04-23-21	EWW- 1199	289 ± 90	< 159
05-19-21	EWW- 1484	201 ± 86	< 158	05-19-21	EWW- 1485	245 ± 88	< 158
06-18-21	EWW- 1904	153 ± 83	< 158	06-18-21		NF[b]	
07-21-21	EWW- 2327	123 ± 82	< 156	07-21-21	EWW- 2328	310 ± 92	< 156
08-19-21	EWW- 2641	87 ± 78	< 157	08-19-21	EWW- 2643	124 ± 80	< 157
09-16-21	EWW- 2988	142 ± 84	< 161	09-16-21	EWW- 2990	186 ± 86	< 161
10-19-21	EWW- 3461	136 ± 83	< 163	10-19-21	EWW- 3462	185 ± 86	< 163
11-18-21	EWW- 3901	162 ± 86	< 161	11-18-21	EWW- 3903	252 ± 91	< 161
12-16-21	EWW- 4090	59 ± 91	< 167	12-16-21	EWW- 4091	122 ± 94	< 167
Mean ± s.d.		116 ± 56		Mean ± s.d.		226 ± 75	

Sample ID GW-03 / GW-17

Collection Date	Lab Code	Tritium	MDC	Collection Date	Lab Code	Tritium	MDC
01-21-21		NS[a]		01-21-21		NS[a]	
02-17-21		NS[a]		02-17-21		NS[a]	
03-25-21	EWW- 780	38 ± 81	< 159	03-25-21	EWW- 782	255 ± 92	< 159
04-23-21	EWW- 1200	118 ± 81	< 159	04-23-21	EWW- 1202	186 ± 85	< 159
05-19-21	EWW- 1487	100 ± 80	< 158	05-19-21	EWW- 1491	120 ± 81	< 158
06-18-21	EWW- 1905	100 ± 80	< 158	06-18-21		NF[b]	
07-21-21	EWW- 2329	107 ± 81	< 156	07-21-21	EWW- 2331	208 ± 87	< 156
08-19-21	EWW- 2644	50 ± 76	< 157	08-19-21		NF[b]	
09-16-21	EWW- 2991	138 ± 84	< 161	09-16-21		NF[b]	
10-19-21	EWW- 3463	136 ± 83	< 163	10-19-21		NF[b]	
11-18-21	EWW- 3904	118 ± 84	< 161	11-18-21	EWW- 3906	189 ± 88	< 161
12-16-21	EWW- 4092	41 ± 90	< 167	12-16-21	EWW- 4094	301 ± 102	< 167
Mean ± s.d.		95 ± 38		Mean ± s.d.		210 ± 62	

Wells

Sample ID GW-04 (EIC Well)

Collection Date	Lab Code	Tritium	MDC	
01-21-21	EWW- 180	-43 ± 71	< 160	
02-17-21	EWW- 400	-44 ± 72	< 161	
03-25-21	EWW- 781	-45 ± 76	< 159	
04-23-21	EWW- 1201	25 ± 76	< 159	
05-19-21	EWW- 1488	-13 ± 73	< 158	
06-17-21	EWW- 1906	87 ± 80	< 158	c
07-21-21	EWW- 2330	61 ± 79	< 156	
08-19-21	EWW- 2645	-5 ± 73	< 157	
09-16-21	EWW- 2992	-6 ± 75	< 161	
10-20-21	EWW- 3464	65 ± 79	< 163	
11-18-21	EWW- 3905	58 ± 81	< 161	
12-16-21	EWW- 4093	108 ± 93	< 167	d
Mean ± s.d.		21 ± 54		

[a] "NS" = No sample; creeks frozen.
[b] "NF" = No flow.
[c] Recount = -11 ± 89 pCi/L, MDC <171
[d] Recount = 40 ± 102 pCi/L, MDC < 165

Table 12. Groundwater Tritium Monitoring Program
(Monthly Collections)
Units = pCi/L

Beach Drains

Sample ID	S-1				S-3		
Collection Date	Lab Code	Tritium	MDC	Collection Date	Lab Code	Tritium	MDC
01-06-21	ESW- 63	435 ± 99	< 166	01-06-21		NF[a]	
02-04-21		NF[a]		02-04-21		NF[a]	
03-01-21		NF[a]		03-01-21	ESW- 472	428 ± 97	< 160
04-07-21	ESW- 922	307 ± 93	< 160	04-07-21	ESW- 924	311 ± 93	< 160
05-05-21	ESW- 1332	221 ± 86	< 158	05-05-21	ESW- 1334	325 ± 91	< 158
06-02-21	ESW- 1659	334 ± 93	< 161	06-02-21	ESW- 1660	331 ± 93	< 161
07-08-21	ESW- 2180	276 ± 90	< 156	07-08-21	ESW- 2182	426 ± 98	< 156
08-04-21	EWW- 2484	246 ± 89	< 161	08-04-21	ESW- 2485	410 ± 97	< 161
08-31-21	EWW- 2769	145 ± 84	< 163	08-31-21	ESW- 2770	310 ± 93	< 163
10-05-21	EWW- 3260	191 ± 87	< 159	10-05-21	ESW- 3261	496 ± 102	< 159
11-02-21	EWW- 3673	153 ± 84	< 162	11-02-21	ESW- 3674	270 ± 90	< 162
12-02-21	EWW- 3968	176 ± 85	< 162	12-02-21	EWW- 3969	275 ± 91	< 162
Mean ± s.d.		248 ± 91		Mean ± s.d.		358 ± 76	

Sample ID	S-7				S-8		
Collection Date	Lab Code	Tritium	MDC	Collection Date	Lab Code	Tritium	MDC
01-06-21		NF[a]		01-06-21		NF[a]	
02-04-21		NF[a]		02-04-21		NF[a]	
03-01-21		NF[a]		03-01-21		NF[a]	
04-07-21		NF[a]		04-07-21		NF[a]	
05-05-21		NF[a]		05-05-21		NF[a]	
06-02-21		NF[a]		06-02-21		NF[a]	
07-08-21		NF[a]		07-08-21		NF[a]	
08-04-21		NF[a]		08-04-21		NF[a]	
08-31-21		NF[a]		08-31-21		NF[a]	
11-02-21		NF[a]		11-02-21		NF[a]	
12-02-21		NF[a]		12-02-21		NF[a]	
Mean ± s.d.				Mean ± s.d.			

Sample ID	S-9				S-10		
Collection Date	Lab Code	Tritium	MDC	Collection Date	Lab Code	Tritium	MDC
01-06-21		NF[a]		01-06-21		NF[a]	
02-04-21		NF[a]		02-04-21		NF[a]	
03-01-21		NF[a]		03-01-21		NF[a]	
04-07-21		NF[a]		04-07-21		NF[a]	
05-05-21		NF[a]		05-05-21		NF[a]	
06-02-21		NF[a]		06-02-21		NF[a]	
07-08-21		NF[a]		07-08-21		NF[a]	
08-04-21		NF[a]		08-04-21		NF[a]	
08-31-21		NF[a]		08-31-21		NF[a]	
10-05-21		NF[a]		10-05-21		NF[a]	
11-02-21		NF[a]		11-02-21		NF[a]	
12-02-21		NF[a]		12-02-21		NF[a]	
Mean ± s.d.				Mean ± s.d.			

[a] "NF" = No flow.

Table 12. Groundwater Tritium Monitoring Program
(Monthly Collections)
Units = pCi/L

Beach Drains (cont.)

Sample ID	S-12			S-13			
Collection Date	Lab Code	Tritium	MDC	Collection Date	Lab Code	Tritium	MDC
01-06-21		NF[a]		01-06-21		NF[a]	
02-04-21		NF[a]		02-04-21		NF[a]	
03-01-21		NF[a]		03-01-21		NF[a]	
04-07-21		NF[a]		04-07-21		NF[a]	
05-05-21		NF[a]		05-05-21		NF[a]	
06-02-21		NF[a]		06-02-21		NF[a]	
07-08-21		NF[a]		07-08-21		NF[a]	
08-04-21		NF[a]		08-04-21		NF[a]	
08-31-21	EWW- 2772	246 ± 89	< 163	08-31-21		NF[a]	
10-05-21		NF[a]		10-05-21		NF[a]	
11-02-21	EWW- 3675	270 ± 90	< 162	11-02-21		NF[a]	
12-02-21		NF[a]		12-02-21		NF[a]	
Mean ± s.d.		258 ± 17		Mean ± s.d.			

U2 Façade Subsurface Drain Sump

Sample ID	U2 Façade Subsurface Drain Sump		
Collection Date	Lab Code	Tritium	MDC
01-31-21	EW- 471	1185 ± 127	< 161
02-28-21	EW- 685	1409 ± 135	< 162
03-31-21	EW- 1251	1605 ± 148	< 160
04-30-21	EW- 1413	1437 ± 139	< 158
05-31-21	EW- 2025	1174 ± 131	< 161
06-30-21	EW- 2325	806 ± 114	< 157
07-31-21	EW- 2573	6496 ± 257	< 164
08-31-21	EW- 3072	2915 ± 180	< 161
09-30-21	EW- 3256	2714 ± 175	< 159
10-31-21	EW- 3898	2654 ± 175	< 162
11-30-21	EW- 4132	2672 ± 175	< 157
12-31-21	EW- 4389	2439 ± 169	163
Mean ± s.d.		2292 ± 1514	

[a] "NF" = No flow.

POINT BEACH NUCLEAR PLANT

Beach Drains

Units: = pCi/L — Gamma isotopic analysis

Location	S-1		S-3		S-7		S-8	
Collection Date	01-06-21		01-06-21		01-06-21		01-06-21	
Lab Code	EW- 63	MDC	NF[a]	MDC	NF[a]	MDC	NF[a]	MDC
Be-7	7.6 ± 20.3	< 43.2	-		-		-	
Mn-54	0.4 ± 2.0	< 3.3	-		-		-	
Fe-59	-0.2 ± 3.5	< 5.7	-		-		-	
Co-58	-2.6 ± 2.0	< 2.4	-		-		-	
Co-60	-0.4 ± 2.1	< 3.4	-		-		-	
Zn-65	-1.2 ± 4.4	< 7.8	-		-		-	
Zr-Nb-95	1.5 ± 1.9	< 4.0	-		-		-	
Cs-134	0.6 ± 2.2	< 3.8	-		-		-	
Cs-137	2.3 ± 2.5	< 4.4	-		-		-	
Ba-La-140	0.7 ± 1.8	< 4.9	-		-		-	

Location	S-9		S-10		S-12		S-13	
Collection Date	01-06-21		01-06-21		01-06-21		01-06-21	
Lab Code	NF[a]	MDC	NF[a]	MDC	NF[a]	MDC	NF[a]	MDC
Be-7	-		-		-		-	
Mn-54	-		-		-		-	
Fe-59	-		-		-		-	
Co-58	-		-		-		-	
Co-60	-		-		-		-	
Zn-65	-		-		-		-	
Zr-Nb-95	-		-		-		-	
Cs-134	-		-		-		-	
Cs-137	-		-		-		-	
Ba-La-140	-		-		-		-	

Location	S-1		S-3		S-7		S-8	
Collection Date	02-04-21		02-04-21		02-04-21		02-04-21	
Lab Code	NF[a]	MDC	NF[a]	MDC	NF[a]	MDC	NF[a]	MDC
Be-7	-		-		-		-	
Mn-54	-		-		-		-	
Fe-59	-		-		-		-	
Co-58	-		-		-		-	
Co-60	-		-		-		-	
Zn-65	-		-		-		-	
Zr-Nb-95	-		-		-		-	
Cs-134	-		-		-		-	
Cs-137	-		-		-		-	
Ba-La-140	-		-		-		-	

[a] "NF" = No flow.

Beach Drains (cont.)

Units: = pCi\L — Gamma isotopic analysis

Location	S-9		S-10		S-12		S-13	
Collection Date	02-04-21		02-04-21		02-04-21		02-04-21	
Lab Code	NF[a]	MDC	NF[a]	MDC	NF[a]	MDC	NF[a]	MDC
Be-7	-		-		-		-	
Mn-54	-		-		-		-	
Fe-59	-		-		-		-	
Co-58	-		-		-		-	
Co-60	-		-		-		-	
Zn-65	-		-		-		-	
Zr-Nb-95	-		-		-		-	
Cs-134	-		-		-		-	
Cs-137	-		-		-		-	
Ba-La-140	-		-		-		-	

Location	S-1		S-3		S-7		S-8	
Collection Date	03-01-21		03-01-21		03-01-21		03-01-21	
Lab Code	NF[a]	MDC	EW- 472	MDC	NF[a]	MDC	NF[a]	MDC
Be-7	-		17.6 ± 19.2	< 37.7	-		-	
Mn-54	-		-1.3 ± 1.9	< 2.1	-		-	
Fe-59	-		-0.6 ± 3.8	< 4.0	-		-	
Co-58	-		-0.2 ± 1.8	< 2.7	-		-	
Co-60	-		0.2 ± 2.3	< 2.4	-		-	
Zn-65	-		1.3 ± 3.3	< 3.7	-		-	
Zr-Nb-95	-		0.3 ± 2.0	< 2.7	-		-	
Cs-134	-		0.3 ± 2.1	< 3.7	-		-	
Cs-137	-		0.5 ± 2.6	< 4.7	-		-	
Ba-La-140	-		2.0 ± 2.6	< 6.1	-		-	

Location	S-9		S-10		S-12		S-13	
Collection Date	03-01-21		03-01-21		03-01-21		03-01-21	
Lab Code	NF[a]	MDC	NF[a]	MDC	NF[a]	MDC	NF[a]	MDC
Be-7	-		-		-		-	
Mn-54	-		-		-		-	
Fe-59	-		-		-		-	
Co-58	-		-		-		-	
Co-60	-		-		-		-	
Zn-65	-		-		-		-	
Zr-Nb-95	-		-		-		-	
Cs-134	-		-		-		-	
Cs-137	-		-		-		-	
Ba-La-140	-		-		-		-	

[a] "NF" = No flow.

Beach Drains (cont.)

Units: = pCi\L

Gamma isotopic analysis

Location	S-1		S-3		S-7		S-8	
Collection Date	04-07-21		04-07-21		04-07-21		04-07-21	
Lab Code	EW- 922	MDC	EW- 924	MDC	NF[a]	MDC	NF[a]	MDC
Be-7	-1.9 ± 13.6	< 41.6	-23.6 ± 21.0	< 38.5	-		-	
Mn-54	0.1 ± 1.6	< 2.1	0.0 ± 2.3	< 4.4	-		-	
Fe-59	1.1 ± 2.8	< 4.8	0.4 ± 4.0	< 4.9	-		-	
Co-58	-0.1 ± 1.3	< 2.4	-0.2 ± 2.0	< 2.8	-		-	
Co-60	-0.8 ± 1.8	< 1.8	0.6 ± 1.9	< 2.2	-		-	
Zn-65	0.9 ± 2.6	< 4.1	1.4 ± 4.8	< 6.7	-		-	
Zr-Nb-95	-1.0 ± 1.8	< 3.7	-2.3 ± 2.4	< 3.1	-		-	
Cs-134	-0.1 ± 1.6	< 3.1	0.5 ± 2.1	< 3.8	-		-	
Cs-137	0.9 ± 1.7	< 3.3	-0.9 ± 2.4	< 2.9	-		-	
Ba-La-140	1.8 ± 1.6	< 3.1	-0.4 ± 1.9	< 4.5	-		-	

Location	S-9		S-10		S-12		S-13	
Collection Date	04-07-21		04-07-21		04-07-21		04-07-21	
Lab Code	NF[a]	MDC	NF[a]	MDC	NF[a]	MDC	NF[a]	MDC
Be-7	-		-		-		-	
Mn-54	-		-		-		-	
Fe-59	-		-		-		-	
Co-58	-		-		-		-	
Co-60	-		-		-		-	
Zn-65	-		-		-		-	
Zr-Nb-95	-		-		-		-	
Cs-134	-		-		-		-	
Cs-137	-		-		-		-	
Ba-La-140	-		-		-		-	

Location	S-1		S-3		S-7		S-8	
Collection Date	05-05-21		05-05-21		05-05-21		05-05-21	
Lab Code	EW- 1332	MDC	EW- 1334	MDC	NF[a]	MDC	NF[a]	MDC
Be-7	-0.7 ± 4.8	< 13.0	-2.2 ± 7.2	< 20.9	-		-	
Mn-54	-0.6 ± 0.6	< 1.3	-1.2 ± 0.7	< 1.1	-		-	
Fe-59	-2.1 ± 1.1	< 2.8	-1.0 ± 1.4	< 1.9	-		-	
Co-58	0.5 ± 0.6	< 1.3	0.1 ± 0.7	< 1.8	-		-	
Co-60	0.2 ± 0.7	< 1.2	-1.2 ± 0.7	< 0.9	-		-	
Zn-65	-1.4 ± 1.1	< 1.8	0.6 ± 1.6	< 2.4	-		-	
Zr-Nb-95	-0.1 ± 0.6	< 1.6	0.1 ± 0.8	< 2.4	-		-	
Cs-134	0.0 ± 0.6	< 1.2	-0.7 ± 0.7	< 1.6	-		-	
Cs-137	0.9 ± 0.7	< 1.4	0.0 ± 0.9	< 1.8	-		-	
Ba-La-140	0.9 ± 0.7	< 5.4	-0.5 ± 0.8	< 6.2	-		-	

[a] "NF" = No flow.

POINT BEACH NUCLEAR PLANT

Beach Drains (cont.)

Units: = pCi\L

Gamma isotopic analysis

Location	S-9		S-10		S-12		S-13	
Collection Date	05-05-21		05-05-21		05-05-21		05-05-21	
Lab Code	NF[a]	MDC	NF[a]	MDC	NF[a]	MDC	NF[a]	MDC
Be-7	-		-		-		-	
Mn-54	-		-		-		-	
Fe-59	-		-		-		-	
Co-58	-		-		-		-	
Co-60	-		-		-		-	
Zn-65	-		-		-		-	
Zr-Nb-95	-		-		-		-	
Cs-134	-		-		-		-	
Cs-137	-		-		-		-	
Ba-La-140	-		-		-		-	

Location	S-1		S-3		S-7		S-8	
Collection Date	06-02-21		06-02-21		06-02-21		06-02-21	
Lab Code	EW- 1659	MDC	EW- 1660	MDC	NF[a]	MDC	NF[a]	MDC
Be-7	-27.3 ± 24.8	< 48.7	13.7 ± 21.3	< 53.2	-		-	
Mn-54	-0.4 ± 2.6	< 3.8	-1.3 ± 2.5	< 3.6	-		-	
Fe-59	2.4 ± 4.5	< 5.1	-2.0 ± 5.2	< 8.9	-		-	
Co-58	-0.4 ± 2.4	< 3.9	0.9 ± 2.5	< 2.2	-		-	
Co-60	-0.7 ± 2.3	< 3.6	-0.4 ± 2.6	< 3.6	-		-	
Zn-65	-0.6 ± 5.1	< 6.4	1.7 ± 5.1	< 7.7	-		-	
Zr-Nb-95	-3.4 ± 2.6	< 3.1	-0.1 ± 2.7	< 5.2	-		-	
Cs-134	-0.6 ± 2.8	< 4.5	0.5 ± 2.6	< 5.2	-		-	
Cs-137	-0.6 ± 2.9	< 4.1	-0.5 ± 3.2	< 5.2	-		-	
Ba-La-140	-3.7 ± 2.4	< 4.6	0.5 ± 3.0	< 2.7	-		-	

Location	S-9		S-10		S-12		S-13	
Collection Date	06-02-21		06-02-21		06-02-21		06-02-21	
Lab Code	NF[a]	MDC	NF[a]	MDC	NF[a]	MDC	NF[a]	MDC
Be-7	-		-		-		-	
Mn-54	-		-		-		-	
Fe-59	-		-		-		-	
Co-58	-		-		-		-	
Co-60	-		-		-		-	
Zn-65	-		-		-		-	
Zr-Nb-95	-		-		-		-	
Cs-134	-		-		-		-	
Cs-137	-		-		-		-	
Ba-La-140	-		-		-		-	

[a] "NF" = No flow.

POINT BEACH NUCLEAR PLANT

Beach Drains (cont.)

Units: = pCi\L | Gamma isotopic analysis

Location	S-1		S-3		S-7		S-8	
Collection Date	07-08-21		07-08-21		07-08-21		07-08-21	
Lab Code	EW- 2180	MDC	EW- 2181	MDC	NF[a]	MDC	NF[a]	MDC
Be-7	-3.8 ± 15.9	< 32.9	-1.1 ± 10.7	< 24.8	-		-	
Mn-54	0.3 ± 1.4	< 2.0	-0.7 ± 1.3	< 1.6	-		-	
Fe-59	-0.3 ± 2.5	< 2.6	-1.2 ± 2.3	< 2.4	-		-	
Co-58	-0.6 ± 1.4	< 2.3	-1.5 ± 1.1	< 1.1	-		-	
Co-60	-1.4 ± 1.4	< 1.6	0.5 ± 1.3	< 1.8	-		-	
Zn-65	-2.3 ± 3.6	< 4.0	-2.2 ± 2.5	< 3.8	-		-	
Zr-Nb-95	-0.8 ± 1.7	< 2.6	-0.6 ± 1.2	< 2.2	-		-	
Cs-134	-0.8 ± 1.7	< 3.4	-0.1 ± 1.5	< 2.6	-		-	
Cs-137	-0.8 ± 1.8	< 1.8	1.1 ± 1.4	< 2.9	-		-	
Ba-La-140	-2.5 ± 1.8	< 6.2	-1.9 ± 1.4	< 2.7	-		-	

Location	S-9		S-10		S-12		S-13	
Collection Date	07-08-21		07-08-21		07-08-21		07-08-21	
Lab Code	NF[a]	MDC	NF[a]	MDC	NF[a]	MDC	NF[a]	MDC
Be-7	-		-		-		-	
Mn-54	-		-		-		-	
Fe-59	-		-		-		-	
Co-58	-		-		-		-	
Co-60	-		-		-		-	
Zn-65	-		-		-		-	
Zr-Nb-95	-		-		-		-	
Cs-134	-		-		-		-	
Cs-137	-		-		-		-	
Ba-La-140	-		-		-		-	

Location	S-1		S-3		S-7		S-8	
Collection Date	08-04-21	MDC	08-04-21	MDC	08-04-21	MDC	08-04-21	MDC
Lab Code	EW- 2484		EW- 2485		NF[a]		NF[a]	
Be-7	11.6 ± 13.8	< 25.4	-9.7 ± 9.7	< 23.7	-		-	
Mn-54	0.2 ± 1.3	< 2.2	0.6 ± 1.0	< 1.5	-		-	
Fe-59	-3.5 ± 2.9	< 5.2	-0.9 ± 1.7	< 2.2	-		-	
Co-58	-0.6 ± 1.3	< 2.5	0.7 ± 1.3	< 2.2	-		-	
Co-60	0.7 ± 1.5	< 1.8	-0.4 ± 1.2	< 1.5	-		-	
Zn-65	1.3 ± 2.6	< 4.5	-2.7 ± 2.5	< 4.6	-		-	
Zr-Nb-95	-1.5 ± 1.4	< 2.8	-1.3 ± 1.4	< 2.5	-		-	
Cs-134	1.4 ± 1.4	< 3.0	0.4 ± 1.2	< 2.4	-		-	
Cs-137	3.4 ± 1.9	< 2.5	0.8 ± 1.6	< 3.3	-		-	
Ba-La-140	-4.7 ± 1.5	< 3.2	0.3 ± 1.6	< 3.0	-		-	

[a] "NF" = No flow.

POINT BEACH NUCLEAR PLANT

Beach Drains (cont.)

Units: = pCi\L

Gamma isotopic analysis

Location	S-9		S-10		S-12		S-13	
Collection Date	08-04-21		08-04-21		08-04-21		08-04-21	
Lab Code	NF[a]	MDC	NF[a]	MDC	NF[a]	MDC	NF[a]	MDC
Be-7	-		-		-		-	
Mn-54	-		-		-		-	
Fe-59	-		-		-		-	
Co-58	-		-		-		-	
Co-60	-		-		-		-	
Zn-65	-		-		-		-	
Zr-Nb-95	-		-		-		-	
Cs-134	-		-		-		-	
Cs-137	-		-		-		-	
Ba-La-140	-		-		-		-	

Location	S-1		S-3		S-7		S-8	
Collection Date	08-31-21		08-31-21		08-31-21		08-31-21	
Lab Code	EW- 2769	MDC	EW- 2770	MDC	NF[a]	MDC	NF[a]	MDC
Be-7	6.0 ± 16.5	< 35.8	-3.0 ± 14.6	< 28.8	-		-	
Mn-54	-0.6 ± 2.2	< 2.3	0.2 ± 2.1	< 2.6	-		-	
Fe-59	2.2 ± 3.5	< 6.0	1.8 ± 3.5	< 6.6	-		-	
Co-58	-0.1 ± 1.9	< 2.8	-1.5 ± 1.6	< 2.0	-		-	
Co-60	-2.7 ± 2.1	< 2.4	2.1 ± 2.3	< 3.5	-		-	
Zn-65	0.1 ± 4.1	< 5.3	2.4 ± 3.7	< 6.7	-		-	
Zr-Nb-95	-3.8 ± 2.3	< 4.2	-4.6 ± 2.3	< 2.8	-		-	
Cs-134	-0.9 ± 1.9	< 3.5	1.8 ± 2.2	< 4.1	-		-	
Cs-137	-1.1 ± 2.1	< 3.2	0.2 ± 2.1	< 3.3	-		-	
Ba-La-140	1.1 ± 2.2	< 2.3	0.4 ± 2.4	< 5.5	-		-	

Location	S-9		S-10		S-12		S-13	
Collection Date	08-31-21		08-31-21		08-31-21		08-31-21	
Lab Code	NF[a]	MDC	NF[a]	MDC	EW- 2772	MDC	NF[a]	MDC
Be-7	-		-		0.2 ± 22.1	< 37.6	-	
Mn-54	-		-		1.5 ± 2.7	< 4.4	-	
Fe-59	-		-		-0.2 ± 5.2	< 10.0	-	
Co-58	-		-		-3.0 ± 2.3	< 2.3	-	
Co-60	-		-		-2.3 ± 2.8	< 2.5	-	
Zn-65	-		-		-7.8 ± 6.6	< 8.9	-	
Zr-Nb-95	-		-		0.0 ± 3.0	< 4.9	-	
Cs-134	-		-		-1.5 ± 2.5	< 4.9	-	
Cs-137	-		-		2.7 ± 2.8	< 5.5	-	
Ba-La-140	-		-		-1.1 ± 3.4	< 5.6	-	

[a] "NF" = No flow.

POINT BEACH NUCLEAR PLANT

Beach Drains (cont.)

Units: = pCi\L — Gamma isotopic analysis

Location	S-1		S-3		S-7		S-8	
Collection Date	10-05-21		10-05-21		10-05-21		10-05-21	
Lab Code	EW- 3260	MDC	EW- 3261	MDC	NF[a]	MDC	NF[a]	MDC
Be-7	-0.6 ± 9.6	< 20.6	7.5 ± 8.0	< 16.2	-		-	
Mn-54	0.1 ± 1.2	< 1.4	-0.4 ± 0.9	< 1.2	-		-	
Fe-59	-0.7 ± 2.0	< 4.9	-0.1 ± 1.8	< 4.0	-		-	
Co-58	0.1 ± 1.0	< 1.4	-0.5 ± 1.0	< 1.8	-		-	
Co-60	0.9 ± 1.1	< 1.8	-0.4 ± 1.0	< 1.6	-		-	
Zn-65	0.6 ± 2.2	< 3.2	-0.1 ± 1.8	< 2.9	-		-	
Zr-Nb-95	0.8 ± 1.2	< 3.0	-0.8 ± 1.0	< 2.2	-		-	
Cs-134	-0.2 ± 1.2	< 2.2	-0.5 ± 1.0	< 1.9	-		-	
Cs-137	0.9 ± 1.3	< 2.5	-0.6 ± 1.1	< 1.2	-		-	
Ba-La-140	-0.9 ± 1.4	< 6.9	-0.3 ± 1.3	< 8.2	-		-	

Location	S-9		S-10		S-12		S-13	
Collection Date	10-05-21		10-05-21		10-05-21		10-05-21	
Lab Code	NF[a]	MDC	NF[a]	MDC	NF[a]	MDC	NF[a]	MDC
Be-7	-		-		-		-	
Mn-54	-		-		-		-	
Fe-59	-		-		-		-	
Co-58	-		-		-		-	
Co-60	-		-		-		-	
Zn-65	-		-		-		-	
Zr-Nb-95	-		-		-		-	
Cs-134	-		-		-		-	
Cs-137	-		-		-		-	
Ba-La-140	-		-		-		-	

Location	S-1	MDC	S-3	MDC	S-7	MDC	S-8	MDC
Collection Date	11-02-21		11-02-21		11-02-21		11-02-21	
Lab Code	EW- 3673		EW- 3674		NF[a]		NF[a]	
Be-7	-4.4 ± 7.0	< 15.6	-3.8 ± 4.8	< 14.3	-		-	
Mn-54	-0.2 ± 0.7	< 1.3	0.9 ± 0.5	< 1.1	-		-	
Fe-59	-0.4 ± 1.4	< 2.1	-1.7 ± 1.1	< 3.3	-		-	
Co-58	0.0 ± 0.7	< 1.2	-0.2 ± 0.6	< 1.1	-		-	
Co-60	0.0 ± 0.7	< 1.4	-0.7 ± 0.7	< 0.9	-		-	
Zn-65	-2.0 ± 1.5	< 2.3	0.1 ± 1.1	< 2.3	-		-	
Zr-Nb-95	-2.4 ± 0.8	< 2.7	-1.2 ± 0.6	< 2.0	-		-	
Cs-134	-0.7 ± 0.7	< 1.6	0.0 ± 0.6	< 1.1	-		-	
Cs-137	-0.8 ± 0.8	< 1.0	0.5 ± 0.7	< 1.4	-		-	
Ba-La-140	0.5 ± 0.8	< 11.6	-3.9 ± 2.0	< 11.7	-		-	

[a] "NF" = No flow.

POINT BEACH NUCLEAR PLANT

Beach Drains (cont.)

Units: = pCi\L

Gamma isotopic analysis

Location	S-9		S-10		S-12		S-13	
Collection Date	11-02-21		11-02-21		11-02-21		11-02-21	
Lab Code	NF[a]	MDC	NF[a]	MDC		MDC	NF[a]	MDC
Be-7	-		-		5.0 ± 8.0	< 24.2	-	
Mn-54	-		-		-0.5 ± 0.9	< 1.7	-	
Fe-59	-		-		1.5 ± 1.6	< 6.0	-	
Co-58	-		-		-0.2 ± 0.8	< 1.9	-	
Co-60	-		-		0.2 ± 0.9	< 1.4	-	
Zn-65	-		-		-1.8 ± 1.9	< 3.4	-	
Zr-Nb-95	-		-		-0.7 ± 0.8	< 3.6	-	
Cs-134	-		-		-0.1 ± 0.9	< 1.7	-	
Cs-137	-		-		-0.2 ± 0.9	< 1.7	-	
Ba-La-140	-		-		-7.4 ± 1.0	< 9.5	-	

Location	S-1		S-3		S-7		S-8	
Collection Date	12-02-21		12-02-21		12-02-21		12-02-21	
Lab Code	EW- 3968	MDC	EW- 3969	MDC	NF[a]	MDC	NF[a]	MDC
Be-7	12.7 ± 22.0	< 43.4	13.7 ± 21.1	< 42.4	-		-	
Mn-54	2.1 ± 2.4	< 3.8	1.3 ± 2.0	< 3.4	-		-	
Fe-59	1.6 ± 3.7	< 7.3	-1.5 ± 4.2	< 7.7	-		-	
Co-58	0.8 ± 2.0	< 4.0	-1.4 ± 2.0	< 2.5	-		-	
Co-60	-1.7 ± 2.6	< 1.9	0.2 ± 3.0	< 4.3	-		-	
Zn-65	-1.7 ± 5.3	< 4.9	3.1 ± 4.3	< 7.6	-		-	
Zr-Nb-95	0.8 ± 2.4	< 4.7	0.4 ± 2.5	< 4.8	-		-	
Cs-134	-0.6 ± 2.5	< 4.5	-1.0 ± 2.3	< 4.3	-		-	
Cs-137	-0.2 ± 2.4	< 3.3	0.3 ± 2.6	< 4.1	-		-	
Ba-La-140	-0.4 ± 2.4	< 3.1	0.7 ± 2.4	< 3.3	-		-	

Location	S-9		S-10		S-12		S-13	
Collection Date	12-02-21		12-02-21		12-02-21		12-02-21	
Lab Code	NF[a]	MDC	NF[a]	MDC	NF[a]	MDC	NF[a]	MDC
Be-7	-		-		-		-	
Mn-54	-		-		-		-	
Fe-59	-		-		-		-	
Co-58	-		-		-		-	
Co-60	-		-		-		-	
Zn-65	-		-		-		-	
Zr-Nb-95	-		-		-		-	
Cs-134	-		-		-		-	
Cs-137	-		-		-		-	
Ba-La-140	-		-		-		-	

[a] "NF" = No flow.

Table 12. Groundwater Tritium Monitoring Program
(Quarterly Collections)
Units = pCi/L

Quarterly Wells

Sample ID	GW-05 (WH 6 Well)				GW-06 (SBCC Well)		
Collection Date	Lab Code	Tritium	MDC	Collection Date	Lab Code	Tritium	MDC
01-21-21	EWW- 181	-7 ± 74	< 160	01-21-21	EWW- 182	22 ± 75	< 160
04-16-21	EWW- 1064	16 ± 76	< 159	04-16-21	EWW- 1065	-11 ± 74	< 159
07-27-21	EWW- 2333	24 ± 76	< 156	07-21-21	EWW- 2334	51 ± 78	< 156
10-12-21	EWW- 3439	-43 ± 73	< 163	10-12-21	EWW- 3440	1 ± 76	< 163
Mean ± s.d.		-3 ± 30		Mean ± s.d.		16 ± 27	

Sample ID	GW-11 (MW-1)				GW-12 (MW-2)		
Collection Date	Lab Code	Tritium	MDC	Collection Date	Lab Code	Tritium	MDC
01-14-21	EWW- 215	52 ± 77	< 160	01-14-21	EWW- 216	-32 ± 72	< 160
05-14-21	EWW- 1560	76 ± 82	< 165	05-14-21	EWW- 1561	-63 ± 74	< 165
07-22-21	EWW- 2476	136 ± 83	< 162	07-22-21	EWW- 2477	-2 ± 75	< 162
10-17-21	EWW- 3499	1 ± 76	< 163	10-17-21	EWW- 3500	47 ± 78	< 163
Mean ± s.d.		66 ± 56		Mean ± s.d.		-13 ± 47	

Sample ID	GW-13 (MW-6)				GW-14A (MW-05A)		
Collection Date	Lab Code	Tritium	MDC	Collection Date	Lab Code	Tritium	MDC
01-14-21	EWW- 217	43 ± 77	< 160	01-14-21	EWW- 218	128 ± 82	< 160
05-14-21	EWW- 1562	34 ± 80	< 165	05-14-21	EWW- 1563	155 ± 86	< 165
07-22-21	EWW- 2478	19 ± 76	< 162	07-22-21	EWW- 2479	123 ± 82	< 162
10-17-21	EWW- 3501	164 ± 85	< 163	10-17-21	EWW- 3502	166 ± 85	< 163
Mean ± s.d.		65 ± 67		Mean ± s.d.		143 ± 21	

Sample ID	GW-15A (MW-4)				GW-15B (MW-4)		
Collection Date	Lab Code	Tritium	MDC	Collection Date	Lab Code	Tritium	MDC
01-14-21	EWW- 219	115 ± 81	< 160	01-14-21	EWW- 220	97 ± 80	< 160
05-14-21	EWW- 1564	104 ± 84	< 165	05-14-21	EWW- 1565	139 ± 86	< 165
07-22-21	EWW- 2480	40 ± 77	< 162	07-22-21	EWW- 2481	143 ± 83	< 162
10-17-21	EWW- 3503	164 ± 85	< 163	10-17-21	EWW- 3504	127 ± 83	< 163
Mean ± s.d.		106 ± 51		Mean ± s.d.		126 ± 21	

Sample ID	GW-16A (MW-3)		
Collection Date	Lab Code	Tritium	MDC
01-14-21	EWW- 221	115 ± 81	< 160
05-14-21	EWW- 1566	246 ± 91	< 165
07-22-21	EWW- 2482	129 ± 83	< 162
10-17-21	EWW- 3505	242 ± 89	< 163
Mean ± s.d.		183 ± 70	

Table 12. Groundwater Tritium Monitoring Program
(Quarterly Collections)
Units = pCi/L

Quarterly Wells (cont.)

Sample ID: GW-18 (WH 7 Well)

Collection Date	Lab Code	Tritium	MDC
01-21-21	EWW- 183	6 ± 74	< 160
04-16-21	EWW- 1066	-34 ± 73	< 159
07-21-21	EWW- 2335	-16 ± 74	< 156
10-12-21	EWW- 3441	116 ± 82	< 163
Mean ± s.d.		18 ± 67	

Façade Wells

Sample ID: GW-09 1Z-361A

Collection Date	Lab Code	Tritium	MDC
03-16-21	EWW- 687	219 ± 87	< 161
06-04-21	EWW- 1907	258 ± 91	< 160
08-07-21	EWW- 2773	175 ± 88	< 163
10-16-21	EWW- 3457	254 ± 90	< 163
Mean ± s.d.		227 ± 39	

Sample ID: GW-09 1Z-361B

Collection Date	Lab Code	Tritium	MDC
03-16-21	EWW- 688	189 ± 85	< 161
06-04-21	EWW- 1908	176 ± 87	< 160
08-07-21	EWW- 2774	282 ± 94	< 163
10-16-21	EWW- 3458	167 ± 85	< 163
Mean ± s.d.		203 ± 53	

Sample ID: GW-10 2Z-361A

Collection Date	Lab Code	Tritium	MDC
03-16-21	EWW- 689	32 ± 77	< 161
06-04-21	EWW- 1910	97 ± 82	< 160
08-07-21	EWW- 2775	43 ± 81	< 163
10-16-21	EWW- 3459	-44 ± 73	< 163
Mean ± s.d.		32 ± 58	

Sample ID: GW-10 2Z-361B

Collection Date	Lab Code	Tritium	MDC
03-16-21	EWW- 690	34 ± 77	< 161
06-04-21	EWW- 1911	164 ± 86	< 160
08-07-21	EWW- 2776	404 ± 99	< 163
10-16-21	EWW- 3460	250 ± 89	< 163
Mean ± s.d.		213 ± 155	

(Annual Collections)
Units = pCi/L

Bogs

Sample ID: GW-07 (North Bog)

Collection Date	Lab Code	Tritium	MDC
05-19-21	[a] EWW- 1489	372 ± 94	< 158

Sample ID: GW-08 EIC Bog

Collection Date	Lab Code	Tritium	MDC
05-19-21	EWW- 1490	100 ± 80	< 158

[a] Gamma scan in App. E

Table 12. Groundwater Tritium Monitoring Program

Units = pCi/L

Manholes

Sample ID	MH Z-065A				MH Z-065B		
Collection Date	Lab Code	Tritium	MDC (pCi/L)	Collection Date	Lab Code	Tritium	MDC (pCi/L)
04-29-21	EW- 1420	318 ± 92	< 158	04-29-21	EW- 1421	313 ± 92	< 158
09-29-21	EW- 3262	588 ± 106	< 159	09-30-21	EW- 3263	985 ± 122	< 159
Mean ± s.d.		453 ± 191		Mean ± s.d.		649 ± 475	

Sample ID	MH Z-065C				MH Z-065D		
Collection Date	Lab Code	Tritium	MDC (pCi/L)	Collection Date	Lab Code	Tritium	MDC (pCi/L)
Mean ± s.d.				Mean ± s.d.			

Sample ID	MH Z-066A				MH Z-066B		
Collection Date	Lab Code	Tritium	MDC (pCi/L)	Collection Date	Lab Code	Tritium	MDC (pCi/L)
04-29-21	EW- 1422	193 ± 85	< 158	05-04-21	EW- 1424	415 ± 97	< 158
10-05-21	EW- 3264	351 ± 95	< 159	10-04-21	EW- 3265	310 ± 93	< 159
Mean ± s.d.		272 ± 112		Mean ± s.d.		362 ± 74	

Sample ID	MH Z-066C				MH Z-066D		
Collection Date	Lab Code	Tritium	MDC (pCi/L)	Collection Date	Lab Code	Tritium	MDC (pCi/L)
05-04-21	EW- 1425	380 ± 95	< 153	05-04-21	EW- 1426	280 ± 90	< 158
10-04-21	EW- 3266	317 ± 93	< 159	10-05-21	EW- 3267	264 ± 91	< 159
Mean ± s.d.		348 ± 44		Mean ± s.d.		272 ± 11	

Sample ID	MH Z-067A				MH Z-067B		
Collection Date	Lab Code	Tritium	MDC (pCi/L)	Collection Date	Lab Code	Tritium	MDC (pCi/L)
04-29-21	EW- 1427	223 ± 87	< 158	05-04-21	EW- 1428	403 ± 96	< 158
10-05-21	EW- 3268	280 ± 91	< 159	10-04-21	EW- 3269	305 ± 93	< 159
Mean ± s.d.		251 ± 41		Mean ± s.d.		354 ± 69	

Manholes (cont.)

Sample ID	MH Z-067C				MH Z-067D		
Collection Date	Lab Code	Tritium	MDC (pCi/L)	Collection Date	Lab Code	Tritium	MDC (pCi/L)
05-04-21	EW- 1429	287 ± 90	< 158	05-04-21	EW- 1430	179 ± 85	< 158
10-04-21	EW- 3270	276 ± 91	< 159	10-05-21	EW- 3271	262 ± 91	< 159
Mean ± s.d.		281 ± 8		Mean ± s.d.		220 ± 59	

Sample ID	MH Z-068				MH-1		
Collection Date	Lab Code	Tritium	MDC (pCi/L)	Collection Date	Lab Code	Tritium	MDC (pCi/L)
05-04-21	EW- 1431	320 ± 92	< 158				
10-05-21	EW- 3497	293 ± 92	< 163				
Mean ± s.d.		306 ± 19		Mean ± s.d.			

Sample ID	MH-4				MH-6		
Collection Date	Lab Code	Tritium	MDC (pCi/L)	Collection Date	Lab Code	Tritium	MDC (pCi/L)
Mean ± s.d.				Mean ± s.d.			

Sample ID	MH-7				MH-8		
Collection Date	Lab Code	Tritium	MDC (pCi/L)	Collection Date	Lab Code	Tritium	MDC (pCi/L)
Mean ± s.d.				Mean ± s.d.			

Sample ID	MH-16				MH-2		
Collection Date	Lab Code	Tritium	MDC (pCi/L)	Collection Date	Lab Code	Tritium	MDC (pCi/L)
Mean ± s.d.				Mean ± s.d.			

Sample ID	MH-5A				MH-9		
Collection Date	Lab Code	Tritium	MDC (pCi/L)	Collection Date	Lab Code	Tritium	MDC (pCi/L)
Mean ± s.d.				Mean ± s.d.			

ATI Environmental, Inc.
Midwest Laboratory
700 Landwehr Road • Northbrook, IL 60062-2310
phone (847) 564-0700 • fax (847) 564-4517

APPENDIX A

INTERLABORATORY AND INTRALABORATORY COMPARISON PROGRAM RESULTS

NOTE: Appendix A is updated four times a year. The complete appendix is included in March, June, September and December monthly progress reports only.

October, 2020 through September, 2021

Appendix A

Interlaboratory/ Intralaboratory Comparison Program Results

Environmental, Inc., Midwest Laboratory has participated in interlaboratory comparison (crosscheck) programs since the formulation of its quality control program in December 1971. These programs are operated by agencies which supply environmental type samples containing concentrations of radionuclides known to the issuing agency but not to participant laboratories. The purpose of such a program is to provide an independent check on a laboratory's analytical procedures and to alert it of any possible problems.

Participant laboratories measure the concentration of specified radionuclides and report them to the issuing agency. Several months later, the agency reports the known values to the participant laboratories and specifies control limits. Results consistently higher or lower than the known values or outside the control limits indicate a need to check the instruments or procedures used.

Results in Table A-1 were obtained through participation in the RAD PT Study Proficiency Testing Program administered by Environmental Resource Associates, serving as a replacement for studies conducted previously by the U.S. EPA Environmental Monitoring Systems Laboratory, Las Vegas, Nevada.

Results in Table A-2 were obtained through participation in the New York Department of Health Environmental Laboratory Approval Program (ELAP) PT.

Table A-3 lists results for thermoluminescent dosimeters (TLDs), via irradiation and evaluation by the University of Wisconsin-Madison Radiation Calibration Laboratory at the University of Wisconsin Medical Radiation Research Center.

Table A-4 lists results of the analyses on intralaboratory "spiked" samples for the past twelve months. All samples are prepared using NIST traceable sources. Data for previous years available upon request.

Table A-5 lists results of the analyses on intralaboratory "blank" samples for the past twelve months. Data for previous years available upon request.

Table A-6 lists analytical results from the intralaboratory "duplicate" program for the past twelve months. Acceptance is based on each result being within 25% of the mean of the two results or the two sigma uncertainties of each result overlap.

The results in Table A-7 were obtained through participation in the Mixed Analyte Performance Evaluation Program.

Results in Table A-8 were obtained through participation in the MRAD PT Study Proficiency Testing Program administered by Environmental Resource Associates, serving as a replacement for studies conducted previously by the Environmental Measurement Laboratory Quality Assessment Program (EML).

Attachment A lists the laboratory acceptance criteria for various analyses.

Out-of-limit results are explained directly below the result.

Attachment A

ACCEPTANCE CRITERIA FOR INTRALABORATORY "SPIKED" SAMPLES

Analysis	Ratio of lab result to known value.
Gamma Emitters	0.8 to 1.2
Strontium-89, Strontium-90	0.8 to 1.2
Potassium-40	0.8 to 1.2
Gross alpha	0.5 to 1.5
Gross beta	0.8 to 1.2
Tritium	0.8 to 1.2
Radium-226, Radium-228	0.7 to 1.3
Plutonium	0.8 to 1.2
Iodine-129, Iodine-131	0.8 to 1.2
Nickel-63, Technetium-99, Uranium-238	0.7 to 1.3
Iron-55	0.8 to 1.2
Other Analyses	0.8 to 1.2

TABLE A-1. Interlaboratory Comparison Crosscheck program, Environmental Resource Associates (ERA)[a].

RAD study

Lab Code	Date	Analysis	Concentration (pCi/L) Laboratory Result	ERA Result	Control Limits	Acceptance
RAD-124 Study						
ERW-94	1/11/2021	Ba-133	24.1 ± 3.5	23.8	18.4 - 27.4	Pass
ERW-94	1/11/2021	Cs-134	46.1 ± 3.1	42.8	34.2 - 47.1	Pass
ERW-94	1/11/2021	Cs-137	154 ± 6.0	148	133 - 165	Pass
ERW-94	1/11/2021	Co-60	39.4 ± 3.2	34.6	30.8 - 40.8	Pass
ERW-94	1/11/2021	Zn-65	66.2 ± 6.3	61.6	54.6 - 75.0	Pass
ERDW-96	1/11/2021	Gr. Alpha	58.4 ± 2.6	63.3	33.2 - 78.5	Pass
ERDW-96	1/11/2021	Gr. Beta	38.1 ± 1.3	39.8	26.4 - 47.3	Pass
ERDW-98	1/11/2021	Ra-226	16.3 ± 0.5	15.5	11.5 - 17.8	Pass
ERDW-98	1/11/2021	Ra-228	12.3 ± 1.2	12.9	8.54 - 15.8	Pass
ERDW-98	1/11/2021	Uranium	33.2 ± 1.8	30.1	24.4 - 33.4	Pass
ERW-100	1/11/2021	H-3	2,100 ± 160	2,120	1,750 - 2,350	Pass
RAD-126 Study						
ERDW-2194	7/12/2021	Ba-133	44.1 ± 4.0	45.5	37.2 - 50.6	Pass
ERDW-2194	7/12/2021	Cs-134	85.2 ± 3.9	87.5	71.8 - 96.2	Pass
ERDW-2194	7/12/2021	Cs-137	218 ± 8	208	187 - 230	Pass
ERDW-2194	7/12/2021	Co-60	91.7 ± 4.0	87.1	78.4 - 98.1	Pass
ERDW-2194	7/12/2021	Zn-65	114 ± 9	102	91.8 - 122.0	Pass
ERDW-2196	7/12/2021	Gr. Alpha	61.5 ± 2.9	49.1	25.6 - 61.7	Pass
ERDW-2196	7/12/2021	Gr. Beta	31.7 ± 1.3	31.5	20.3 - 39.2	Pass
ERDW-2200	7/12/2021	Ra-226	16.5 ± 0.5	13.4	10.0 - 15.4	Fail[b]
ERDW-2200	7/12/2021	Ra-228	8.7 ± 1.0	7.6	4.81 - 9.7	Pass
ERDW-2200	7/12/2021	Uranium	71.7 ± 2.3	62.3	50.9 - 68.5	Fail[c]
ERDW-2202	7/12/2021	H-3	11,300 ± 300	10,400	9,050 - 11,400	Pass
ERDW-2198	7/12/2021	I-131	22.3 ± 1.1	20.8	17.2 - 25.0	Pass

[a] Results obtained by Environmental, Inc., Midwest Laboratory as a participant in the crosscheck program for proficiency testing in drinking water conducted by Environmental Resource Associates (ERA).

[b] The radium-226 result did not meet ERA acceptance criteria.

[c] The uranium result did not meet ERA acceptance criteria.

TABLE A-2. Interlaboratory Comparison Crosscheck program, New York Department of Health (ELAP)[a].

Lab Code	Date	Concentration (pCi/L) Analysis	Laboratory Result	Assigned Value	Acceptance Limits	Acceptance
			Shipment 437R			
NYW-3307	9/15/2020	H-3	11,500 ± 465	11,208	9760 - 12,300	Pass
NYW-3331	9/15/2020	Gross Alpha	43.7 ± 2.5	64.9	34.0 - 80.4	Pass
NYW-3331	9/15/2020	Gross Beta	11.1 ± 1.1	8.85	3.62 - 17.4	Pass
NYW-3335	9/15/2020	I-131	14.1 ± 1.4	12.6	10.3 - 16.0	Pass
NYW-3333	9/15/2020	Ra-226	2.24 ± 0.27	2.63	2.06 - 3.44	Pass
NYW-3333	9/15/2020	Ra-228	4.91 ± 1.12	5.41	3.27 - 7.18	Pass
NYW-3333	9/15/2020	Uranium	42.8 ± 1.94	37.1	30.1 - 41.0	Fail[b]
NYW-3337	9/15/2020	Co-60	46.4 ± 3.8	42.3	38.1 - 49.2	Pass
NYW-3337	9/15/2020	Zn-65	133 ± 9	116	104 - 138	Pass
NYW-3337	9/15/2020	Ba-133	49.5 ± 4.1	46.4	38.0 - 51.6	Pass
NYW-3337	9/15/2020	Cs-134	32.5 ± 3.1	33.0	26.0 - 36.3	Pass
NYW-3337	9/15/2020	Cs-137	147 ± 7	134	121 - 150	Pass

[a] Results obtained by Environmental, Inc., Midwest Laboratory as a participant in the crosscheck program for proficiency testing in drinking water conducted by the New York Department of Health Laboratory Approval Program(NY ELAP).

[b] Lab passed all ERA and MAPEP studies for uranium in 2020.(See tables A-1, A-7 and A-8) Uncertainty overlapped upper acceptance limit.

TABLE A-3. Thermoluminescent Dosimetry, (TLD, $CaSO_4$: Dy Cards).[a]

Lab Code	Irradiation Date	Description	Delivered Dose (mrem)	Reported[b] Dose (mrem)	Performance[c] Quotient (P)	
Environmental, Inc.		Group 1				
2020-1	10/28/2020	Spike 1	172.0	180.0	0.05	
2020-1	10/28/2020	Spike 2	172.0	174.5	0.01	
2020-1	10/28/2020	Spike 3	172.0	174.3	0.01	
2020-1	10/28/2020	Spike 4	172.0	174.0	0.01	
2020-1	10/28/2020	Spike 5	172.0	167.1	-0.03	
2020-1	10/28/2020	Spike 6	172.0	161.9	-0.06	
2020-1	10/28/2020	Spike 7	172.0	167.9	-0.02	
2020-1	10/28/2020	Spike 8	172.0	171.0	-0.01	
2020-1	10/28/2020	Spike 9	172.0	170.7	-0.01	
2020-1	10/28/2020	Spike 10	172.0	170.1	-0.01	
2020-1	10/28/2020	Spike 11	172.0	173.8	0.01	
2020-1	10/28/2020	Spike 12	172.0	178.3	0.04	
2020-1	10/28/2020	Spike 13	172.0	178.2	0.04	
2020-1	10/28/2020	Spike 14	172.0	171.9	0.00	
2020-1	10/28/2020	Spike 15	172.0	190.4	0.11	
2020-1	10/28/2020	Spike 16	172.0	170.9	-0.01	
2020-1	10/28/2020	Spike 17	172.0	183.3	0.07	
2020-1	10/28/2020	Spike 18	172.0	170.6	-0.01	
2020-1	10/28/2020	Spike 19	172.0	164.9	-0.04	
2020-1	10/28/2020	Spike 20	172.0	175.7	0.02	
Mean (Spike 1-20)				173.5	0.01	Pass[d]
Standard Deviation (Spike 1-20)				6.5	0.04	Pass[d]

a TLD's were irradiated by the University of Wisconsin-Madison Radiation Calibration Laboratory following ANSI N13.37 protocol from a known air kerma rate. TLD's were read and the results were submitted by Environmental Inc. to the University of Wisconsin-Madison Radiation Calibration Laboratory for comparison to the delivered dose.

b Reported dose was converted from exposure (R) to Air Kerma (cGy) using a conversion of 0.876. Conversion from air kerma to ambient dose equivalent for Cs-137 at the reference dose point $H^*(10)K_a = 1.20$. mrem/cGy = 1000.

c Performance Quotient (P) is calculated as ((reported dose - conventionally true value) ÷ conventionally true value) where the conventionally true value is the delivered dose.

d Acceptance is achieved when neither the absolute value of the mean of the P values, nor the standard deviation of the P values exceed 0.15.

TABLE A-3. Thermoluminescent Dosimetry, (TLD, $CaSO_4$: Dy Cards).[a]

				mrem		
Lab Code	Irradiation Date	Description	Delivered Dose	Reported[b] Dose	Performance[c] Quotient (P)	
Environmental, Inc.		Group 2				
2020-2	10/28/2020	Spike 21	114.0	117.3	0.03	
2020-2	10/28/2020	Spike 22	114.0	103.3	-0.09	
2020-2	10/28/2020	Spike 23	114.0	106.2	-0.07	
2020-2	10/28/2020	Spike 24	114.0	110.1	-0.03	
2020-2	10/28/2020	Spike 25	114.0	114.9	0.01	
2020-2	10/28/2020	Spike 26	114.0	115.5	0.01	
2020-2	10/28/2020	Spike 27	114.0	110.4	-0.03	
2020-2	10/28/2020	Spike 28	114.0	111.7	-0.02	
2020-2	10/28/2020	Spike 29	114.0	111.3	-0.02	
2020-2	10/28/2020	Spike 30	114.0	113.1	-0.01	
2020-2	10/28/2020	Spike 31	114.0	116.4	0.02	
2020-2	10/28/2020	Spike 32	114.0	111.8	-0.02	
2020-2	10/28/2020	Spike 33	114.0	112.6	-0.01	
2020-2	10/28/2020	Spike 34	114.0	105.7	-0.07	
2020-2	10/28/2020	Spike 35	114.0	104.5	-0.08	
2020-2	10/28/2020	Spike 36	114.0	103.6	-0.09	
2020-2	10/28/2020	Spike 37	114.0	104.4	-0.08	
2020-2	10/28/2020	Spike 38	114.0	104.5	-0.08	
2020-2	10/28/2020	Spike 39	114.0	106.4	-0.07	
2020-2	10/28/2020	Spike 40	114.0	107.7	-0.06	
Mean (Spike 21-40)				109.6	-0.04	Pass[d]
Standard Deviation (Spike 21-40)				4.6	0.04	Pass[d]

a TLD's were irradiated by the University of Wisconsin-Madison Radiation Calibration Laboratory following ANSI N13.37 protocol from a known air kerma rate. TLD's were read and the results were submitted by Environmental Inc. to the University of Wisconsin-Madison Radiation Calibration Laboratory for comparison to the delivered dose.

b Reported dose was converted from exposure (R) to Air Kerma (cGy) using a conversion of 0.876. Conversion from air kerma to ambient dose equivalent for Cs-137 at the reference dose point $H^*(10)K_a = 1.20$. mrem/cGy = 1000.

c Performance Quotient (P) is calculated as ((reported dose - conventionally true value) ÷ conventionally true value) where the conventionally true value is the delivered dose.

d Acceptance is achieved when neither the absolute value of the mean of the P values, nor the standard deviation of the P values exceed 0.15.

TABLE A-4. Intralaboratory "Spiked" Samples

Lab Code[b]	Date	Analysis	Concentration[a] Laboratory results 2s, n=1[c]	Known Activity	Control Limits[d]	Acceptance	Ratio Lab/Known
SPW-3482	10/2/2020	H-3	1,984 ± 154	2,110	1,688 - 2,532	Pass	0.94
SPW-3624	10/9/2020	H-3	1,924 ± 152	2,110	1,688 - 2,532	Pass	0.91
SPW-3794	10/16/2020	H-3	2,109 ± 156	2,110	1,688 - 2,532	Pass	1.00
SPW-3836	10/20/2020	Sr-90	16.8 ± 1.1	17.9	14.3 - 21.5	Pass	0.94
SPW-4043	10/23/2020	H-3	1893 ± 149	2,110	1,688 - 2,532	Pass	0.90
SPW-4179	10/28/2020	Ra-228	15.4 ± 2.4	12.1	8.5 - 15.7	Pass	1.27
SPW-4422	10/30/2020	Ra-226	12.3 ± 0.3	12.3	8.6 - 16.0	Pass	1.00
SPW-4234	11/11/2020	H-3	2,008 ± 154	2,110	1,688 - 2,532	Pass	0.95
SPW-4634	11/23/2020	Ra-226	11.4 ± 0.3	12.3	8.6 - 16.0	Pass	0.93
SPW-4509	12/4/2020	H-3	1,873 ± 149	2,110	1,688 - 2,532	Pass	0.89
SPW-4625	12/18/2020	H-3	1,940 ± 152	2,110	1,688 - 2,532	Pass	0.92
SPW-4741	12/18/2020	Ra-226	12.5 ± 0.4	12.3	8.6 - 16.0	Pass	1.02
SPW-55	1/8/2021	H-3	1,889 ± 150	2,110	1,688 - 2,532	Pass	0.90
SPDW-62	1/11/2021	Gr. Alpha	34.3 ± 1.7	64.9	34.0 - 80.4	Pass	0.53
SPDW-62	1/11/2021	Gr. Beta	9.2 ± 0.8	8.9	3.6 - 17.4	Pass	1.04
SPW-131	1/19/2021	Sr-90	18.0 ± 1.1	17.9	14.3 - 21.5	Pass	1.00
SPW-133	1/19/2021	H-3	1,842 ± 150	2,110	1,688 - 2,532	Pass	0.87
SPW-188	1/18/2021	Ra-228	14.2 ± 1.7	14.9	10.4 - 19.3	Pass	0.96
SPW-236	1/26/2021	Ra-228	12.2 ± 1.9	15.3	10.7 - 19.9	Pass	0.80
SPW-305	2/5/2021	H-3	1,785 ± 147	2,110	1,688 - 2,532	Pass	0.85
SPW-372	2/12/2021	H-3	1,742 ± 145	2,110	1,688 - 2,532	Pass	0.83
SPW-526	3/5/2021	H-3	1,899 ± 150	2,110	1,688 - 2,532	Pass	0.90
SPW-692	3/19/2021	H-3	1,953 ± 151	2,110	1,688 - 2,532	Pass	0.93
SPW-694	1/4/2021	Ra-226	9.7 ± 0.4	12.3	8.6 - 16.0	Pass	0.79
SPW-800	3/30/2021	Ra-228	15.8 ± 2.0	15.3	10.7 - 19.9	Pass	1.03
SPW-802	3/31/2021	H-3	1,878 ± 150	2,110	1,688 - 2,532	Pass	0.89
SPW-810	3/19/2021	Ra-226	11.4 ± 0.3	12.3	8.6 - 16.0	Pass	0.93
SPDW-30103	3/31/2021	Ra-226	13.5 ± 0.4	12.3	8.6 - 16.0	Pass	1.10
SPW-812	4/1/2021	H-3	2,005 ± 155	2,110	1,688 - 2,532	Pass	0.95
SPW-919	4/7/2021	H-3	1,877 ± 149	2,110	1,688 - 2,532	Pass	0.89
SPW-944	4/9/2021	Gr. Alpha	56.7 ± 2.5	58.4	29.2 - 87.6	Pass	0.97
SPW-944	4/9/2021	Gr. Beta	35.1 ± 1.3	38.1	30.5 - 45.7	Pass	0.92
SPW-1048	4/15/2021	H-3	1,915 ± 152	2,110	1,688 - 2,532	Pass	0.91
SPW-1250	4/30/2021	H-3	2,015 ± 154	2,110	1,688 - 2,532	Pass	0.95
SPW-1373	5/11/2021	Gr. Alpha	63.5 ± 2.9	58.4	29.2 - 87.6	Pass	1.09
SPW-1373	5/11/2021	Gr. Beta	38.5 ± 1.3	38.1	30.5 - 45.7	Pass	1.01
SPW-1377	5/11/2021	Sr-90	17.4 ± 1.2	17.9	14.3 - 21.5	Pass	0.97
SPDW-30108	5/28/2021	H-3	2,222 ± 161	2,110	1,688 - 2,532	Pass	1.05
SPDW-30125	5/13/2021	Ra-226	10.9 ± 0.3	12.3	8.6 - 16.0	Pass	0.89

[a] Liquid sample results are reported in pCi/Liter, air filters (pCi/m3), charcoal (pCi/charcoal canister), and solid samples (pCi/kg).
[b] Laboratory codes : W & SPW (Water), MI (milk), AP (air filter), SO (soil), VE (vegetation), CH (charcoal canister), F (fish), U (urine).
[c] Results are based on single determinations.
[d] Acceptance criteria are listed in Attachment A of this report.

TABLE A-4. Intralaboratory "Spiked" Samples

Lab Code[b]	Date	Analysis	Concentration[a] Laboratory results 2s, n=1[c]	Known Activity	Control Limits[d]	Acceptance	Ratio Lab/Known
SPDW-30118	6/4/2021	H-3	2,230 ± 163	2,110	1,688 - 2,532	Pass	1.06
SPMI-1672	6/8/2021	Sr-90	14.2 ± 0.9	13.6	10.9 - 16.3	Pass	1.04
SPDW-30160	6/11/2021	Ra-226	11.4 ± 0.3	12.3	8.6 - 16.0	Pass	0.93
SPDW-30129	6/15/2021	H-3	2,238 ± 162	2,110	1,688 - 2,532	Pass	1.06
SPDW-30134	6/18/2021	Gr. Alpha	17.9 ± 1.4	23.5	11.8 - 35.3	Pass	0.76
SPDW-30134	6/18/2021	Gr. Beta	60.9 ± 1.6	67.6	54.1 - 81.1	Pass	0.90
SPDW-30148	6/25/2021	Ra-228	15.1 ± 2.9	15.3	10.7 - 19.9	Pass	0.98
SPDW-30206	7/8/2021	Ra-226	12.7 ± 0.4	12.3	8.6 - 16.0	Pass	1.03
SPDW-3001	7/29/2021	Ra-226	11.6 ± 0.3	12.3	8.6 - 16.0	Pass	0.95
SPDW-30224	8/2/2021	Gr. Alpha	38.6 ± 2.1	49.1	24.6 - 73.7	Pass	0.79
SPDW-30224	8/2/2021	Gr. Beta	27.8 ± 1.2	31.5	25.2 - 37.8	Pass	0.88
SPDW-30226	8/13/2021	H-3	2,074 ± 157	2,110	1,688 - 2,532	Pass	0.98
SPDW-30231	8/18/2021	Ra-228	14.5 ± 2.2	15.3	10.7 - 19.9	Pass	0.95
SPW-2783	9/3/2021	Sr-90	18.9 ± 1.2	17.1	13.7 - 20.5	Pass	1.10
SPDW-2785	9/3/2021	H-3	2,135 ± 158	2,110	1,688 - 2,532	Pass	1.01
SPDW-2891	9/10/2021	H-3	2,159 ± 160	2,110	1,688 - 2,532	Pass	1.02
SPDW-3115	9/17/2021	Ra-226	11.3 ± 0.3	12.3	8.6 - 16.0	Pass	0.92
SPDW-3036	9/23/2021	Ra-228	18.0 ± 2.6	15.3	10.7 - 19.9	Pass	1.17
SPDW-3223	9/28/2021	Ra-228	16.6 ± 2.5	15.3	10.7 - 19.9	Pass	1.08
SPDW-3288	9/29/2021	U-234	29.2 ± 1.6	23.0	16.1 - 29.9	Pass	1.27
SPDW-3288	9/29/2021	U-238	28.2 ± 1.6	23.2	16.3 - 30.2	Pass	1.21

[a] Liquid sample results are reported in pCi/Liter, air filters (pCi/m3), charcoal (pCi/charcoal canister), and solid samples (pCi/kg).
[b] Laboratory codes : W & SPW (Water), MI (milk), AP (air filter), SO (soil), VE (vegetation), CH (charcoal canister), F (fish), U (urine).
[c] Results are based on single determinations.
[d] Acceptance criteria are listed in Attachment A of this report.

TABLE A-5. Intralaboratory "Blank" Samples

Lab Code[b]	Sample Type	Date	Analysis[c]	Concentration[a] Laboratory results (4.66σ) LLD	Activity[d]	Acceptance Criteria (4.66 σ)
SPW-3481	Water	10/2/2020	H-3	154	63 ± 80	200
SPW-3623	Water	10/9/2020	H-3	156	57 ± 81	200
SPW-3793	Water	10/16/2020	H-3	157	3 ± 73	200
SPW-3835	Water	10/20/2020	Sr-89	0.55	-0.10 ± 0.43	5
SPW-3835	Water	10/20/2020	Sr-90	0.59	0.09 ± 0.28	1
SPW-4042	Water	10/23/2020	H-3	155	-6 ± 72	200
SPW-4178	Water	10/28/2020	Ra-228	1.04	0.33 ± 0.52	2
SPW-4421	Water	10/30/2020	Ra-226	0.03	0.07 ± 0.03	2
SPW-4233	Water	11/11/2020	H-3	155	78 ± 79	200
SPW-4356	Water	11/20/2020	H-3	157	52 ± 76	200
SPW-4633	Water	11/23/2020	Ra-226	0.05	0.04 ± 0.11	2
SPW-4508	Water	12/4/2020	H-3	159	-68 ± 69	200
SPW-4624	Water	12/18/2020	H-3	160	8 ± 77	200
SPW-4740	Water	12/18/2020	Ra-226	0.04	0.02 ± 0.03	2
SPW-54	Water	1/8/2021	H-3	153	24 ± 77	200
SPDW-61	Water	1/11/2021	Gr. Alpha	0.56	-0.32 ± 0.37	2
SPDW-61	Water	1/11/2021	Gr. Beta	0.73	-0.11 ± 0.49	4
SPW-130	Water	1/19/2021	Sr-89	0.66	-0.12 ± 0.49	5
SPW-130	Water	1/19/2021	Sr-90	0.68	-0.02 ± 0.31	1
SPW-132	Water	1/19/2021	H-3	165	38 ± 79	200
SPW-4923	Water	1/26/2021	I-131	0.28	0.26 ± 0.16	1
SPW-187	Water	1/18/2021	Ra-228	1.44	0.81 ± 0.76	2
SPW-235	Water	1/26/2021	Ra-228	1.54	0.94 ± 0.82	2
SPW-254	Water	2/2/2021	I-131	0.29	-0.06 ± 0.13	1
SPW-304	Water	2/5/2021	H-3	159	6 ± 74	200
SPW-372	Water	2/12/2021	H-3	154	-37 ± 70	200
SPW-525	Water	3/5/2021	H-3	160	97 ± 80	200
SPW-691	Water	3/19/2021	H-3	158	-38 ± 71	200
SPW-693	Water	1/4/2021	Ra-226	0.03	-0.01 ± 0.01	2
SPW-799	Water	3/30/2021	Ra-228	1.03	0.06 ± 0.48	2
SPW-809	Water	3/19/2021	Ra-226	0.04	0.01 ± 0.03	2
SPDW-30102	Water	3/31/2021	Ra-226	0.03	0.00 ± 0.03	2
SPW-811	Water	4/1/2021	H-3	158	-29 ± 77	200
SPW-918	Water	4/7/2021	H-3	156	93 ± 79	200
SPW-943	Water	4/9/2021	Gr. Alpha	0.39	-0.08 ± 0.27	2
SPW-943	Water	4/9/2021	Gr. Beta	0.73	0.04 ± 0.51	4
SPW-1047	Water	4/15/2021	H-3	160	-51 ± 74	200
SPW-1249	Water	4/30/2021	H-3	158	109 ± 81	200

[a] Liquid sample results are reported in pCi/Liter, air filters (pCi/m^3), charcoal (pCi/charcoal canister), and solid samples (pCi/g).

[b] Laboratory codes : W & SPW (Water), MI (milk), AP (air filter), SO (soil), VE (vegetation), CH (charcoal canister), F (fish), U (urine).

[c] I-131(G); iodine-131 as analyzed by gamma spectroscopy.

[d] Activity reported is a net activity result.

TABLE A-5. Intralaboratory "Blank" Samples

Lab Code[b]	Sample Type	Date	Analysis[c]	Concentration[a] Laboratory results (4.66σ) LLD	Activity[d]	Acceptance Criteria (4.66 σ)
SPW-1372	Water	5/11/2021	Gr. Alpha	0.35	0.27 ± 0.27	2
SPW-1372	Water	5/11/2021	Gr. Beta	0.68	0.27 ± 0.49	4
SPW-1376	Water	5/11/2021	Sr-89	0.52	0.23 ± 0.39	5
SPW-1376	Water	5/11/2021	Sr-90	0.51	-0.06 ± 0.23	1
SPDW-30124	Water	5/13/2021	Ra-226	0.03	-0.02 ± 0.03	2
SPDW-30104	Water	5/26/2021	Ra-228	1.30	-0.04 ± 0.60	2
SPDW-30107	Water	5/28/2021	H-3	157	33 ± 76	200
SPDW-30117	Water	6/4/2021	H-3	165	67 ± 81	200
SPMI-1671	Milk	6/8/2021	Sr-89	0.46	0.23 ± 0.42	5
SPMI-1671	Milk	6/8/2021	Sr-90	0.45	0.23 ± 0.24	1
SPDW-30159	Water	6/11/2021	Ra-226	0.04	-0.02 ± 0.04	2
SPDW-30128	Water	6/15/2021	H-3	161	17 ± 76	200
SPDW-30133	Water	6/17/2021	I-131	0.20	0.06 ± 0.12	1
SPDW-30134	Water	6/18/2021	Gr. Alpha	0.46	-0.11 ± 0.32	2
SPDW-30134	Water	6/18/2021	Gr. Beta	0.70	-0.10 ± 0.49	4
SPDW-30147	Water	6/25/2021	Ra-228	1.76	-0.15 ± 0.80	2
SPDW-30205	Water	7/8/2021	Ra-226	0.03	0.02 ± 0.03	2
SPDW-3000	Water	7/29/2021	Ra-226	0.03	0.03 ± 0.03	2
SPDW-30223	Water	8/2/2021	Gr. Alpha	0.46	-0.13 ± 0.31	2
SPDW-30223	Water	8/2/2021	Gr. Beta	0.70	0.16 ± 0.49	4
SPDW-30225	Water	8/13/2021	H-3	161	-2 ± 75	200
SPDW-30230	Water	8/18/2021	Ra-228	1.02	0.47 ± 0.53	2
SPW-2782	Water	9/3/2021	Sr-89	0.60	-0.16 ± 0.48	5
SPW-2782	Water	9/3/2021	Sr-90	0.63	0.20 ± 0.32	1
SPDW-2784	Water	9/3/2021	H-3	157	-50 ± 69	200
SPDW-2890	Water	9/10/2021	H-3	163	-59 ± 72	200
SPDW-2981	Water	9/17/2021	H-3	162	11 ± 78	200
SPDW-3114	Water	9/17/2021	Ra-226	0.03	0.04 ± 0.03	2
SPDW-3035	Water	9/23/2021	Ra-228	1.15	0.10 ± 0.55	2
SPDW-3222	Water	9/28/2021	Ra-228	1.37	-0.30 ± 0.60	2
SPDW-3287	Water	9/29/2021	U-234	0.22	0.19 ± 0.23	1
SPDW-3287	Water	9/29/2021	U-238	0.38	-0.05 ± 0.21	1

[a] Liquid sample results are reported in pCi/Liter, air filters (pCi/m^3), charcoal (pCi/charcoal canister), and solid samples (pCi/g).

[b] Laboratory codes : W & SPW (Water), MI (milk), AP (air filter), SO (soil), VE (vegetation), CH (charcoal canister), F (fish), U (urine).

[c] I-131(G); iodine-131 as analyzed by gamma spectroscopy.

[d] Activity reported is a net activity result.

TABLE A-6. Intralaboratory "Duplicate" Samples

			Concentration[a]			
Lab Code[b]	Date	Analysis	First Result	Second Result	Averaged Result	Acceptance
SW-3515,3516	10/1/2020	H-3	154 ± 86	111 ± 84	133 ± 60	Pass
DW-20141,20142	10/1/2020	Ra-226	1.34 ± 0.16	1.39 ± 0.16	1.37 ± 0.11	Pass
DW-20141,20142	10/1/2020	Ra-228	1.74 ± 0.62	2.09 ± 0.64	1.92 ± 0.45	Pass
SW-3536,3537	10/5/2020	H-3	376 ± 97	378 ± 97	377 ± 68	Pass
WW-3727,3728	10/8/2020	H-3	152 ± 82	190 ± 84	171 ± 59	Pass
VE-3748,3749	10/12/2020	K-40	3.07 ± 0.25	2.88 ± 0.26	2.98 ± 0.18	Pass
VE-3769,3770	10/12/2020	Be-7	0.80 ± 0.31	0.51 ± 0.15	0.66 ± 0.17	Pass
VE-3769,3770	10/12/2020	K-40	5.69 ± 0.61	5.79 ± 0.39	5.74 ± 0.36	Pass
WW-4092,4093	10/13/2020	H-3	6,484 ± 252	6,275 ± 248	6,380 ± 177	Pass
WW-3838,3839	10/14/2020	H-3	313 ± 90	263 ± 88	288 ± 63	Pass
WW-4394,4395	11/3/2020	H-3	161 ± 83	199 ± 85	180 ± 60	Pass
WW-4587,4588	11/4/2020	H-3	6,468 ± 252	6,638 ± 255	6,553 ± 179	Pass
WW-4524,4525	11/5/2020	H-3	160 ± 86	131 ± 84	145 ± 60	Pass
VE-4415,4416	11/24/2020	Be-7	0.28 ± 0.08	0.22 ± 0.07	0.25 ± 0.05	Pass
VE-4415,4416	11/24/2020	K-40	2.25 ± 0.21	2.20 ± 0.19	2.23 ± 0.14	Pass
AP-4845,4846	12/31/2020	Be-7	0.07 ± 0.01	0.06 ± 0.02	0.06 ± 0.01	Pass
WW-4566,4567	12/8/2020	Gr. Beta	2.79 ± 1.13	3.52 ± 1.26	3.15 ± 0.84	Pass
WW-4654,4655	12/14/2020	H-3	3,250 ± 188	3,250 ± 188	3,250 ± 133	Pass
S-4608,4609	12/9/2020	K-40	20.8 ± 1.0	22.1 ± 3.0	21.4 ± 1.6	Pass
AP-4803,4804	12/29/2020	Be-7	0.072 ± 0.009	0.080 ± 0.009	0.076 ± 0.006	Pass
SWU-4717,4718	12/29/2020	Gr. Beta	0.88 ± 0.53	1.43 ± 0.57	1.15 ± 0.39	Pass
AP-4824,4825	12/30/2020	Be-7	0.075 0.009	0.080 ± 0.009	0.078 ± 0.006	Pass
AP-4908,4909	12/30/2020	Be-7	0.066 0.011	0.056 ± 0.010	0.061 ± 0.007	Pass
AP-4845,4846	12/31/2020	Be-7	0.052 0.014	0.058 ± 0.012	0.055 ± 0.009	Pass
S-20,21	1/5/2021	K-40	23.3 ± 0.6	22.6 ± 1.6	23.0 ± 0.9	Pass
XW-295,296	1/13/2021	H-3	245 ± 87	288 ± 89	267 ± 62	Pass
S-143,144	1/14/2021	K-40	7.47 ± 0.76	8.38 ± 0.22	7.93 ± 0.40	Pass
S-360,361	2/10/2021	K-40	9.23 ± 0.54	9.00 ± 0.68	9.12 ± 0.43	Pass
S-406,407	2/15/2021	K-40	2.92 ± 0.28	2.94 ± 0.94	2.93 ± 0.49	Pass
W-469,470	2/22/2021	Ra-226	0.75 ± 0.21	0.87 ± 0.22	0.81 ± 0.15	Pass
W-448,449	2/25/2021	Gr. Alpha	3.52 ± 1.84	3.72 ± 1.87	3.62 ± 1.31	Pass
W-448,449	2/25/2021	Gr. Beta	8.71 ± 1.36	8.91 ± 1.40	8.81 ± 0.98	Pass
W-448,449	2/25/2021	Ra-226	1.87 ± 0.25	1.82 ± 0.28	1.85 ± 0.19	Pass
W-448,449	2/25/2021	Ra-228	2.65 ± 1.26	2.53 ± 1.35	2.59 ± 0.92	Pass
P-511,512	3/2/2021	H-3	198 ± 85	202 ± 86	200 ± 60	Pass
WW-630,631	3/10/2021	H-3	144 ± 82	148 ± 82	146 ± 58	Pass
WW-743,744	3/16/2021	H-3	183 ± 85	167 ± 84	175 ± 60	Pass
S-785,786	3/25/2021	Pb-214	0.59 ± 0.08	0.34 ± 0.05	0.47 ± 0.05	Pass
S-785,786	3/25/2021	Ac-228	0.61 ± 0.12	0.58 ± 0.13	0.60 ± 0.09	Pass

TABLE A-6. Intralaboratory "Duplicate" Samples

			Concentration[a]			
Lab Code[b]	Date	Analysis	First Result	Second Result	Averaged Result	Acceptance
AP-1052,1053	3/30/2021	Be-7	0.081 ± 0.010	0.075 ± 0.011	0.078 ± 0.007	Pass
AP-966,967	3/30/2021	Be-7	0.080 ± 0.010	0.085 ± 0.009	0.083 ± 0.007	Pass
SWU-835,836	3/30/2021	Gr. Beta	1.22 ± 0.56	1.27 ± 0.55	1.24 ± 0.39	Pass
AP-1204,1205	3/30/2021	Be-7	0.187 ± 0.102	0.160 ± 0.088	0.173 ± 0.067	Pass
AP-1029,1030	4/2/2021	Be-7	0.067 ± 0.012	0.079 ± 0.012	0.073 ± 0.009	Pass
SW-922,923	4/7/2021	H-3	440 ± 99	307 ± 93	373 ± 68	Pass
WW-987,988	4/12/2021	H-3	190 ± 87	284 ± 92	237 ± 63	Pass
F-1246,1247	4/22/2021	K-40	3.26 ± 0.66	2.83 ± 0.46	3.04 ± 0.40	Pass
SWT-1311,1312	4/27/2021	Gr. Beta	1.05 ± 0.52	1.16 ± 0.55	1.10 ± 0.38	Pass
WW-1401,1402	5/5/2021	Gr. Alpha	1.10 ± 1.00	2.50 ± 1.20	1.80 ± 0.78	Pass
WW-1401,1402	5/5/2021	K-40	126 ± 15	105 ± 30	115 ± 17	Pass
DW-30071.,30072	5/6/2021	Ra-226	0.98 ± 0.15	0.67 ± 0.13	0.83 ± 0.10	Pass
DW-30071.,30072	5/6/2021	Ra-228	0.83 ± 0.51	1.21 ± 0.54	1.02 ± 0.37	Pass
DW-30078,30079	5/10/2021	Gr. Alpha	4.90 ± 0.92	5.92 ± 0.99	5.41 ± 0.68	Pass
AP-051120A,B	5/11/2021	Gr. Beta	0.006 ± 0.002	0.005 ± 0.002	0.005 ± 0.002	Pass
DW-30083,30084	5/11/2021	Ra-226	0.34 ± 0.13	0.19 ± 0.20	0.27 ± 0.12	Pass
DW-30083,30084	5/11/2021	Ra-228	0.98 ± 0.60	0.15 ± 0.56	0.57 ± 0.41	Pass
S-1506,1507	5/18/2021	K-40	10.1 ± 0.8	14.9 ± 1.2	12.5 ± 0.7	Pass
DW-30092,30093	5/20/2021	Gr. Alpha	2.86 ± 0.85	2.40 ± 0.90	2.63 ± 0.62	Pass
DW-30095,30096	5/21/2021	Ra-226	1.18 ± 0.16	0.73 ± 0.15	0.96 ± 0.11	Pass
DW-30095,30096	5/21/2021	Ra-228	1.44 ± 0.63	0.61 ± 0.59	1.03 ± 0.43	Pass
AP-052521A,B	5/25/2021	Gr. Beta	0.021 ± 0.003	0.022 ± 0.003	0.021 ± 0.002	Pass
S-1589,1590	5/28/2021	Pb-214	1.16 ± 0.08	1.06 ± 0.09	1.11 ± 0.06	Pass
S-1589,1590	5/28/2021	Ac-228	1.17 ± 0.18	1.08 ± 0.14	1.13 ± 0.11	Pass
AP-060121A,B	6/1/2021	Gr. Beta	0.015 ± 0.003	0.013 ± 0.003	0.014 ± 0.002	Pass
DW-30113,30114	6/1/2021	Ra-226	2.00 ± 0.34	2.64 ± 0.26	2.32 ± 0.21	Pass
DW-30113,30114	6/1/2021	Ra-228	2.50 ± 0.78	3.13 ± 0.82	2.82 ± 0.57	Pass
PS-1631,1632	6/2/2021	K-40	21.1 ± 0.8	20.4 ± 0.8	20.7 ± 0.6	Pass
DW-30119,30120	6/3/2021	Gr. Alpha	1.18 ± 0.75	0.66 ± 0.64	0.92 ± 0.49	Pass
WW-1908,1909	6/4/2021	H-3	150 ± 85	176 ± 87	163 ± 61	Pass
VE-1717,1718	6/7/2021	Be-7	0.50 ± 0.19	0.38 ± 0.14	0.44 ± 0.12	Pass
VE-1717,1718	6/7/2021	K-40	5.26 ± 0.47	5.45 ± 0.44	5.35 ± 0.32	Pass
AP-060821A,B	6/8/2021	Gr. Beta	0.030 ± 0.004	0.028 ± 0.004	0.029 ± 0.003	Pass
AP-1822,1823	6/10/2021	Be-7	0.23 ± 0.12	0.22 ± 0.12	0.22 ± 0.08	Pass
CF-1844,1845	6/14/2021	K-40	8.37 ± 0.44	8.33 ± 0.35	8.35 ± 0.28	Pass
AP-061521A,B	6/15/2021	Gr. Beta	0.020 ± 0.004	0.017 ± 0.003	0.019 ± 0.002	Pass
DW-30131,30132	6/17/2021	Ra-226	0.41 ± 0.21	0.34 ± 0.23	0.38 ± 0.16	Pass
DW-30131,30132	6/17/2021	Ra-228	0.42 ± 0.85	0.52 ± 0.74	0.47 ± 0.56	Pass
DW-30138,30139	6/17/2021	Gr. Alpha	1.59 ± 0.84	2.21 ± 0.95	1.90 ± 0.63	Pass

TABLE A-6. Intralaboratory "Duplicate" Samples

			Concentration[a]			
Lab Code[b]	Date	Analysis	First Result	Second Result	Averaged Result	Acceptance
S-1929,1930	6/22/2021	K-40	19.4 ± 1.0	19.2 ± 1.1	19.3 ± 0.7	Pass
AP-062221A,B	6/22/2021	Gr. Beta	0.014 ± 0.003	0.012 ± 0.028	0.013 ± 0.014	Pass
DW-30150,30151	6/28/2021	Ra-226	0.53 ± 0.15	0.55 ± 0.19	0.54 ± 0.12	Pass
DW-30150,30151	6/28/2021	Ra-228	0.76 ± 0.54	0.52 ± 0.52	0.64 ± 0.37	Pass
AP-2160,2161	6/28/2021	Be-7	0.11 ± 0.01	0.11 ± 0.01	0.11 ± 0.01	Pass
DW-30150,30151	6/28/2021	Ra-226	0.53 ± 0.15	0.55 ± 0.19	0.54 ± 0.12	Pass
DW-30150,30151	6/28/2021	Ra-228	0.76 ± 0.54	0.52 ± 0.52	0.64 ± 0.37	Pass
AP-2218,2119	6/29/2021	Be-7	0.11 ± 0.01	0.12 ± 0.01	0.11 ± 0.01	Pass
AP-2235,2236	6/30/2021	Be-7	0.10 ± 0.01	0.11 ± 0.01	0.10 ± 0.01	Pass
CF-2139,2140	7/12/2021	Be-7	0.49 ± 0.12	0.65 ± 0.20	0.57 ± 0.12	Pass
CF-2139,2140	7/12/2021	K-40	8.25 ± 0.41	7.94 ± 0.46	8.10 ± 0.31	Pass
VE-2214,2215	7/12/2021	K-40	3.26 ± 0.11	3.41 ± 0.25	3.34 ± 0.14	Pass
DW-30169,30170	7/12/2021	Gr. Alpha	2.61 ± 0.87	2.09 ± 0.84	2.35 ± 0.60	Pass
DW-30169,30170	7/12/2021	Gr. Beta	2.09 ± 0.67	2.52 ± 0.60	2.31 ± 0.45	Pass
DW-30169,30170	7/12/2021	Ra-226	0.84 ± 0.24	0.82 ± 0.20	0.83 ± 0.16	Pass
DW-30169,30170	7/12/2021	Ra-228	0.80 ± 0.54	0.84 ± 0.50	0.82 ± 0.37	Pass
AP-71320,71321	7/13/2021	Gr. Beta	0.015 ± 0.003	0.010 ± 0.003	0.013 ± 0.002	Pass
XW-2424,2425	7/16/2021	H-3	193 ± 86	104 ± 81	149 ± 59	Pass
DW-30183,30184	7/19/2021	Ra-226	1.37 ± 0.18	1.21 ± 0.27	1.29 ± 0.16	Pass
DW-30183,30185	7/19/2021	Ra-228	1.51 ± 0.69	1.52 ± 0.68	1.52 ± 0.48	Pass
AP-71920,71921	7/19/2021	Gr. Beta	0.021 ± 0.004	0.020 ± 0.003	0.021 ± 0.002	Pass
S-2277,2278	7/20/2021	K-40	13.6 ± 0.9	12.3 ± 0.9	12.9 ± 0.6	Pass
DW-30191,30192	7/20/2021	Gr. Alpha	3.88 ± 0.94	3.66 ± 94.00	3.77 ± 47.00	Pass
SG-2382,2383	7/23/2021	Pb-214	1.88 ± 0.21	1.94 ± 0.21	1.91 ± 0.15	Pass
SG-2382,2383	7/23/2021	Ac-228	1.69 ± 0.28	1.96 ± 0.33	1.83 ± 0.22	Pass
DW-30207,30208	7/26/2021	Gr. Alpha	5.47 ± 1.29	5.20 ± 1.24	5.34 ± 0.89	Pass
DW-30207,30208	7/26/2021	Gr. Beta	5.89 ± 0.77	6.11 ± 0.73	6.00 ± 0.53	Pass
DW-30210,30211	7/28/2021	Ra-226	0.48 ± 0.13	0.62 ± 0.11	0.55 ± 0.09	Pass
DW-30210,30211	7/28/2021	Ra-228	0.45 ± 0.53	0.73 ± 0.65	0.59 ± 0.42	Pass
S-2509,2510	8/1/2021	K-40	14.2 ± 0.5	13.7 ± 1.0	14.0 ± 0.6	Pass
S-2509,2510	8/1/2021	Be-7	7.27 ± 0.29	7.97 ± 0.69	7.62 ± 0.37	Pass
DW-30221,30222	8/6/2021	Gr. Alpha	2.19 ± 1.55	2.08 ± 1.54	2.14 ± 1.09	Pass
DW-30221,30222	8/6/2021	Gr. Beta	1.19 ± 1.04	2.76 ± 1.08	1.98 ± 0.75	Pass
DW-30221,30222	8/6/2021	Ra-226	2.00 ± 0.22	1.58 ± 0.26	1.79 ± 0.17	Pass
DW-30221,30222	8/6/2021	Ra-228	1.69 ± 0.56	1.75 ± 0.54	1.72 ± 0.39	Pass
VE-2551,2552	8/11/2021	K-40	2.68 ± 0.20	2.61 ± 0.27	2.64 ± 0.17	Pass
VE-2551,2552	8/11/2021	Be-7	0.16 ± 0.08	0.18 ± 0.08	0.17 ± 0.05	Pass
AP-2578,2579	8/12/2021	Be-7	0.18 ± 0.09	0.20 ± 0.11	0.19 ± 0.07	Pass
AP-082421A,B	8/24/2021	Gr. Beta	0.032 ± 0.004	0.028 ± 0.004	0.030 ± 0.003	Pass
AP-083121A,B	8/24/2021	Gr. Beta	0.027 ± 0.004	0.029 ± 0.004	0.028 ± 0.003	Pass
VE-2684,2685	8/25/2021	K-40	2.15 ± 0.26	1.92 ± 0.27	2.03 ± 0.19	Pass
VE-2684,2685	8/25/2021	Be-7	0.20 ± 0.10	0.26 ± 0.11	0.23 ± 0.07	Pass
VE-2728,2729	8/25/2021	K-40	2.34 ± 0.41	2.27 ± 0.40	2.31 ± 0.29	Pass

TABLE A-6. Intralaboratory "Duplicate" Samples

			Concentration[a]			
Lab Code[b]	Date	Analysis	First Result	Second Result	Averaged Result	Acceptance
DW-30238,30239	8/25/2021	Gr. Alpha	3.94 ± 0.91	2.43 ± 0.86	3.185 ± 0.63	Pass
DW-30238,30239	8/25/2021	Ra-226	2.57 ± 0.24	1.83 ± 0.24	2.20 ± 0.17	Pass
DW-30238,30239	8/25/2021	Ra-228	2.86 ± 0.83	2.52 ± 0.66	2.69 ± 0.53	Pass
SW-2641,2642	8/31/2021	H-3	289 ± 92	310 ± 93	300 ± 65	Pass
VE-2858,2859	9/2/2021	K-40	8.36 ± 0.41	8.02 ± 0.47	8.19 ± 0.31	Pass
SG-2934,2935	9/13/2021	Pb-214	2.72 ± 0.22	2.54 ± 0.27	2.63 ± 0.17	Pass
SG-2934,2935	9/13/2021	Ac-228	3.16 ± 0.39	3.22 ± 0.58	3.19 ± 0.35	Pass
DW-30249,30250	9/17/2021	Ra-226	0.70 ± 0.18	1.00 ± 0.17	0.85 ± 0.12	Pass
S-3042,3043	9/22/2021	K-40	7.55 ± 0.80	7.57 ± 0.81	7.56 ± 0.57	Pass
DW-30249,30250	9/17/2021	Ra-226	0.70 ± 0.18	1.00 ± 0.17	0.85 ± 0.12	Pass
S-3042,3043	9/22/2021	K-40	7.55 ± 0.80	7.57 ± 0.81	7.56 ± 0.57	Pass

Note: Duplicate analyses are performed on every twentieth sample received. Results are not listed for those analyses with activities that measure below the LLD.

[a] Results are reported in units of pCi/L, except for air filters (pCi/Filter or pCi/m3), food products, vegetation, soil and sediment (pCi/g).

[b] AP (Air Particulate), AV (Aquatic Vegetation), BS (Bottom Sediment), CF (Cattle Feed), CH (Charcoal Canister), DW (Drinking Water), E (Egg), F (Fish), G (Grass), LW (Lake Water), MI (Milk), P (Precipitation), PM (Powdered Milk), S (Solid), SG (Sludge), SO (Soil), SS (Shoreline Sediment), SW (Surface Water), SWT (Surface Water Treated), SWU (Surface Water Untreated), VE (Vegetation), W (Water), WW (Well Water).

TABLE A-7. Department of Energy's Mixed Analyte Performance Evaluation Program (MAPEP).

			Concentration[a]			
Lab Code [b]	Reference Date	Analysis	Laboratory result	Known Activity	Control Limits [c]	Acceptance
MAAP-3181	8/1/2020	Gross Alpha	0.45 ± 0.06	0.528	0.158 - 0.898	Pass
MAAP-3181	8/1/2020	Gross Beta	0.97 ± 0.04	0.915	0.458 - 1.373	Pass
MADW-3101	8/1/2020	Gross Alpha	0.57 ± 0.04	0.62	0.19 - 1.05	Pass
MADW-3101	8/1/2020	Gross Beta	0.75 ± 0.04	0.83	0.42 - 1.25	Pass
MASO-3179	8/1/2020	Cs-134	599 ± 7	710	497 - 923	Pass
MASO-3179	8/1/2020	Cs-137	3.33 ± 4.81	0	NA [c]	Pass
MASO-3179	8/1/2020	Co-57	1145 ± 8	1100	770 - 1430	Pass
MASO-3179	8/1/2020	Co-60	965 ± 9	1000	700 - 1300	Pass
MASO-3179	8/1/2020	Mn-54	651 ± 11	610	427 - 793	Pass
MASO-3179	8/1/2020	Zn-65	524 ± 14	470	329 - 611	Pass
MASO-3179	8/1/2020	K-40	684 ± 58	622	435 - 809	Pass
MAW-3175	8/1/2020	Cs-134	13.9 ± 0.3	15.2	10.6 - 19.8	Pass
MAW-3175	8/1/2020	Cs-137	15.4 ± 0.4	14.3	10.0 - 18.6	Pass
MAW-3175	8/1/2020	Co-57	0.10 ± 0.16	0	NA [c]	Pass
MAW-3175	8/1/2020	Co-60	12.5 ± 0.3	12.2	8.5 - 15.9	Pass
MAW-3175	8/1/2020	Mn-54	0.07 ± 0.17	0	NA [c]	Pass
MAW-3175	8/1/2020	Zn-65	18.3 ± 0.6	16.9	11.8 - 22.0	Pass
MAW-3175	8/1/2020	K-40	1.06 ± 1.65	0	NA [c]	Pass
MAAP-3177	8/1/2020	Cs-134	1.28 ± 0.05	1.83	1.28 - 2.38	Fail [d]
MAAP-3177	8/1/2020	Cs-137	0.981 ± 0.068	0.996	0.697 - 1.295	Pass
MAAP-3177	8/1/2020	Co-57	0.020 ± 0.027	0	NA [c]	Pass
MAAP-3177	8/1/2020	Co-60	1.57 ± 0.06	1.73	1.21 - 2.25	Pass
MAAP-3177	8/1/2020	Mn-54	0.751 ± 0.077	1.400	0.98 - 1.82	Fail [e]
MAAP-3177	8/1/2020	Zn-65	2.07 ± 0.15	2.00	1.40 - 2.60	Pass
MAVE-3185	8/1/2020	Cs-134	4.73 ± 0.10	4.94	3.46 - 6.42	Pass
MAVE-3185	8/1/2020	Cs-137	0.03 ± 0.06	0	NA [c]	Pass
MAVE-3185	8/1/2020	Co-57	7.83 ± 0.12	6.67	4.67 - 8.67	Pass
MAVE-3185	8/1/2020	Co-60	4.41 ± 0.10	4.13	2.89 - 5.37	Pass
MAVE-3185	8/1/2020	Mn-54	6.52 ± 0.18	5.84	4.09 - 7.59	Pass
MAVE-3185	8/1/2020	Zn-65	7.26 ± 0.19	6.38	4.47 - 8.29	Pass
MAAP-594	2/1/2021	Gross Alpha	1.30 ± 0.08	1.77	0.53 - 3.01	Pass
MAAP-594	2/1/2021	Gross Beta	0.81 ± 0.04	0.649	0.325 - 0.974	Pass
MADW-571	2/1/2021	Gross Alpha	0.73 ± 0.06	0.87	0.26 - 1.48	Pass
MADW-572	2/1/2021	Gross Beta	2.38 ± 0.06	2.50	1.25 - 3.75	Pass

TABLE A-7. Department of Energy's Mixed Analyte Performance Evaluation Program (MAPEP).

			Concentration[a]			
Lab Code [b]	Reference Date	Analysis	Laboratory result	Known Activity	Control Limits [c]	Acceptance
MASO-591	2/1/2021	Cs-134	-2.57 ± 2.21	0	NA [c]	Pass
MASO-591	2/1/2021	Cs-137	1700 ± 20	1550	1085 - 2015	Pass
MASO-591	2/1/2021	Co-57	977 ± 7	920	644 - 1196	Pass
MASO-591	2/1/2021	Co-60	1360 ± 10	1370	959 - 1781	Pass
MASO-591	2/1/2021	Mn-54	0.91 ± 2.85	0	NA [c]	Pass
MASO-591	2/1/2021	Zn-65	687 - 17	604	423 - 785	Pass
MASO-591	2/1/2021	K-40	682 ± 53	618	433 - 803	Pass
MAW-569	2/1/2021	Cs-134	10.5 ± 0.3	11.5	8.1 - 15.0	Pass
MAW-569	2/1/2021	Cs-137	8.53 ± 0.32	7.9	5.5 - 10.3	Pass
MAW-569	2/1/2021	Co-57	12.2 ± 0.3	11.4	8.0 - 14.8	Pass
MAW-569	2/1/2021	Co-60	0.03 ± 0.05	0	NA [c]	Pass
MAW-569	2/1/2021	Mn-54	16.5 ± 0.4	15.5	10.9 - 20.2	Pass
MAW-569	2/1/2021	Zn-65	11.5 ± 0.5	10.5	7.40 - 13.7	Pass
MAW-569	2/1/2021	K-40	9.93 ± 1.42	0	NA [c]	Fail [f]
MAAP-592	2/1/2021	Cs-134	1.54 ± 0.06	2.14	1.50 - 2.78	Pass
MAAP-592	2/1/2021	Cs-137	-0.011 ± 0.020	0	NA [c]	Pass
MAAP-592	2/1/2021	Co-57	0.636 ± 0.042	0.69	0.480 - 0.892	Pass
MAAP-592	2/1/2021	Co-60	-0.64 ± 0.02	0	NA [c]	Fail [g]
MAAP-592	2/1/2021	Mn-54	0.312 ± 0.058	0.312	0.218 - 0.406	Pass
MAAP-592	2/1/2021	Zn-65	0.41 ± 0.07	0.352	0.246 - 0.458	Pass
MAVE-588	2/1/2021	Cs-134	3.73 ± 0.09	3.60	2.50 - 4.70	Pass
MAVE-588	2/1/2021	Cs-137	5.69 ± 0.10	4.69	3.28 - 6.10	Pass
MAVE-588	2/1/2021	Co-57	6.23 ± 0.07	5.05	3.54 - 6.57	Pass
MAVE-588	2/1/2021	Co-60	3.29 ± 0.06	2.99	2.09 - 3.89	Pass
MAVE-588	2/1/2021	Mn-54	6.17 ± 0.16	5.25	3.68 - 6.83	Pass
MAVE-588	2/1/2021	Zn-65	-0.04 ± 0.08	0	NA [c]	Pass

[a] Results are reported in units of Bq/kg (soil), Bq/L (water) or Bq/total sample (filters, vegetation).

[b] Laboratory codes as follows: MAW (water), MADW (water), MAAP (air filter), MASO (soil) and MAVE (vegetation).

[c] MAPEP results are presented as the known values and expected laboratory precision (1 sigma, 1 determination) and control limits as defined by the MAPEP. A known value of "zero" indicates an analysis was included in the testing series as a "false positive". MAPEP does not provide control limits.

[d] Analysis was run in duplicate. Results were (1.18 Bq/sample and 1.37 Bq/sample). The submitted result was the mean of the two results (1.28 ± 0.05 Bq/sample).

[e] A data transcription error resulted in an erroneous reported value. The actual result (1.36 ± 0.08 Bq/L) passes.

[f] The sample spectrum was reanalyzed utilizing the minimum data point background width method. The result was 1.59 ± 1.77 Bq/L which satisfies MAPEP criteria for a false positive test.

[g] A decimal was misplaced in one of two cobalt-60 results while calculating a mean result causing MAPEP to fail the result as a statistically significant negative value at 3 standard deviations. The correct mean result (-0.0004 ± 0.0186) is not a statistically significant negative value and would not have failed.

TABLE A-8. Interlaboratory Comparison Crosscheck Program, Environmental Resource Associates (ERA)[a].

MRAD-30 Study

			Concentration [a]			
Lab Code [b]	Date	Analysis	Laboratory Result	ERA Value [c]	Control Limits [d]	Acceptance
ERAP-722	3/22/2021	Cs-134	898	1030	668 - 1260	Pass
ERAP-722	3/22/2021	Cs-137	181	163	134 - 214	Pass
ERAP-722	3/22/2021	Co-60	1270	1220	1040 - 1550	Pass
ERAP-722	3/22/2021	Mn-54	< 4.3	< 50.0	0.00 - 50.0	Pass
ERAP-722	3/22/2021	Zn-65	908	771	632 - 1180	Pass
ERAP-722	3/22/2021	Sr-90	184	189	120 - 257	Pass
ERAP-724	3/22/2021	Gross Alpha	88.4	96.1	50.2 - 158	Pass
ERAP-724	3/22/2021	Gross Beta	74.1	62.6	38.0 - 94.6	Pass

[a] Results obtained by Environmental, Inc., Midwest Laboratory (EIML) as a participant in the crosscheck program for proficiency testing administered by Environmental Resource Associates, serving as a replacement for studies conducted previously by the Environmental Measurements Laboratory Quality Assessment Program (EML).

[b] Laboratory code ERAP (air filter). Results are reported in units of (pCi/Filter).

[c] The ERA Assigned values for the air filter standards are equal to 100% of the parameter present in the standard as determined by the gravimetric and/or volumetric measurements made during standard preparation as applicable.

[d] The acceptance limits are established per the guidelines contained in the Department of Energy (DOE) report EML-564, Analysis of Environmental Measurements Laboratory (EML) Quality Assessment Program (QAP) Data Determination of Operational Criteria and Control Limits for Performance Evaluation Purposes or ERA's SOP for the generation of Performance Acceptance Limits.

APPENDIX B

DATA REPORTING CONVENTIONS

Data Reporting Conventions

1.0. All activities, except gross alpha and gross beta, are decay corrected to collection time or the end of the collection period.

2.0. Single Measurements

Each single measurement is reported as follows: $x \pm s$

where: x = value of the measurement;

$s = 2\sigma$ counting uncertainty (corresponding to the 95% confidence level).

In cases where the activity is less than the lower limit of detection L, it is reported as: $< L$, where L = the lower limit of detection based on 4.66σ uncertainty for a background sample.

3.0. Duplicate analyses

If duplicate analyses are reported, the convention is as follows. :

3.1 Individual results: For two analysis results; $x_1 \pm s_1$ and $x_2 \pm s_2$

Reported result: $x \pm s$; where $x = (1/2)(x_1 + x_2)$ and $s = (1/2)\sqrt{s_1^2 + s_2^2}$

3.2. Individual results: $< L_1$, $< L_2$ — Reported result: $< L$, where L = lower of L_1 and L_2

3.3. Individual results: $x \pm s$, $< L$ — Reported result: $x \pm s$ if $x \geq L$; $< L$ otherwise.

4.0. Computation of Averages and Standard Deviations

4.1 Averages and standard deviations listed in the tables are computed from all of the individual measurements over the period averaged; for example, an annual standard deviation would not be the average of quarterly standard deviations. The average $\bar{x}$ and standard deviation "s" of a set of n numbers $x_1, x_2 \ldots x_n$ are defined as follows:

$$\bar{x} = \frac{1}{n} \sum x \qquad s = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}}$$

4.2 Values below the highest lower limit of detection are not included in the average.

4.3 If all values in the averaging group are less than the highest LLD, the highest LLD is reported.

4.4 If all but one of the values are less than the highest LLD, the single value x and associated two sigma error is reported.

4.5 In rounding off, the following rules are followed:

4.5.1. If the number following those to be retained is less than 5, the number is dropped, and the retained numbers are kept unchanged. As an example, 11.443 is rounded off to 11.44.

4.5.2. If the number following those to be retained is equal to or greater than 5, the number is dropped and the last retained number is raised by 1. As an example, 11.445 is rounded off to 11.45.

APPENDIX C

Sampling Program and Locations

POINT BEACH NUCLEAR PLANT

Sample Type	No.	Locations Codes (and Type)[a]	Collection Type (and Frequency)[b]	Analysis (and Frequency)[b]
Airborne Filters	6	E-1-4, 8, 20	Weekly	GB, GS, on QC for each location
Airborne Iodine	6	E-1-4, 8, 20	Weekly	I-131
Ambient Radiation (TLD's)	22	E-1-9, 12, 14-18, 20, 22-32, 34-36, 38,39	Quarterly	Ambient Gamma
Lake Water	5	E-1, 5, 6, 33	Monthly	GB, GS, I-131 on MC H-3, Sr-89-90 on QC
Well Water	1	E-10	Quarterly	GB, GS, H-3, Sr-89-90, I-131
Vegetation	8	E-1-4, 6, 20	2x / year as available	GS
Shoreline Silt	5	E-1, 5, 6	Annual	GS
Soil	8	E-1-4, 6, 20	Annual	GS
Milk	3	E-11, 40, 21	Monthly	GS, I-131, Sr-89-90
Fish	1	E-13	2x / year as available	GS (in edible portions)

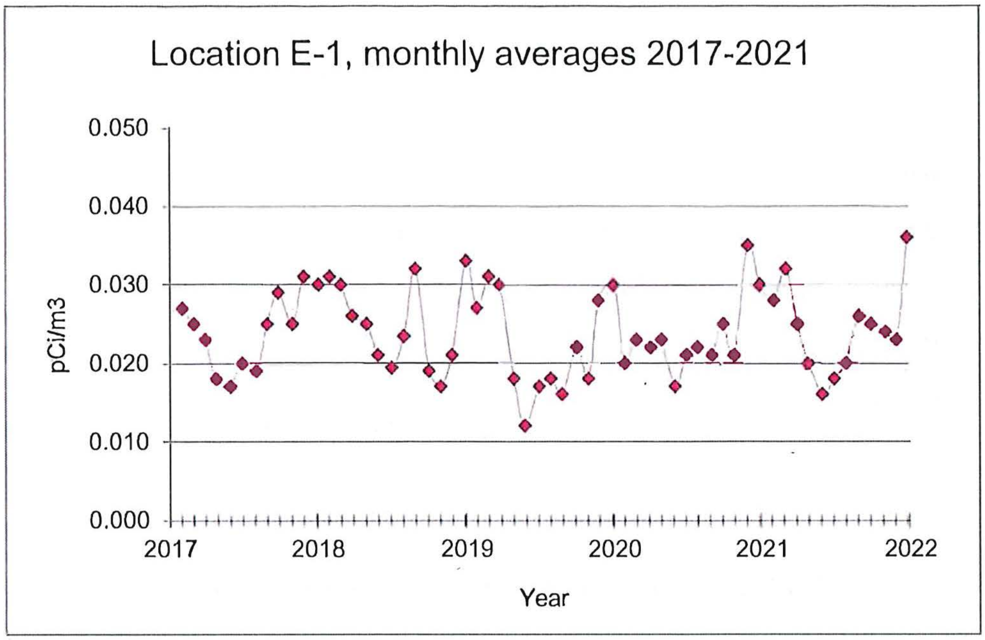
[a] Locations codes are defined in Table 2. Control Stations are indicated by (C). All other stations are indicators.

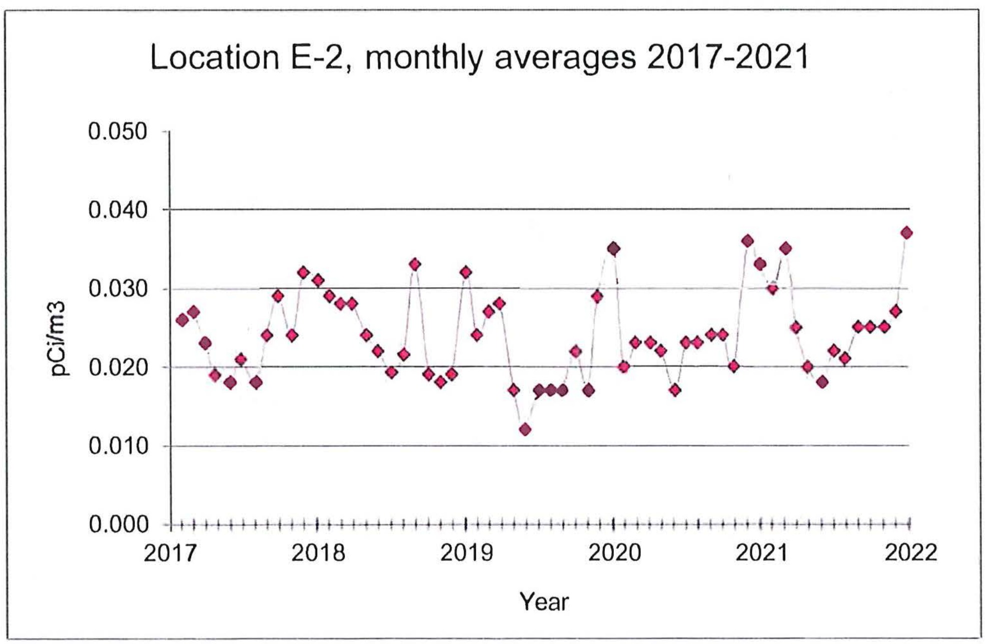
[b] Analysis type is coded as follows: GB = gross beta, GA = gross alpha, GS = gamma spectroscopy, H-3 = tritium, Sr-89 = strontium-89, Sr-90 = strontium-90, I-131 = iodine-131. Analysis frequency is coded as follows: MC = monthly composite, QC = quarterly composite.

APPENDIX D

Graphs of Data Trends

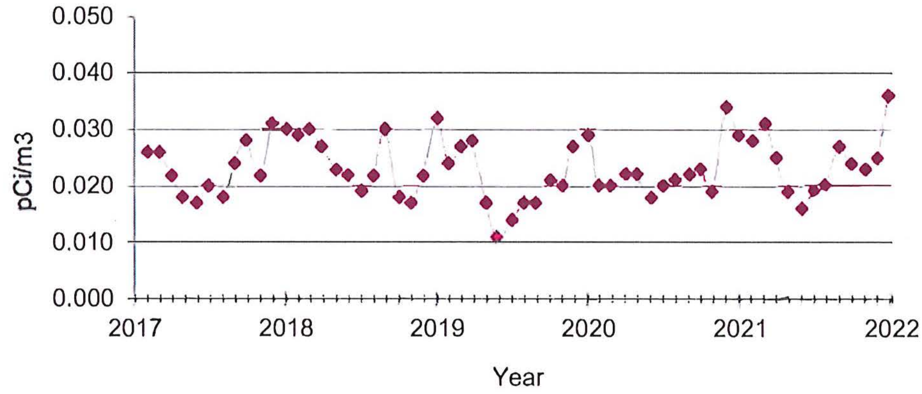
Air Particulates - Gross Beta



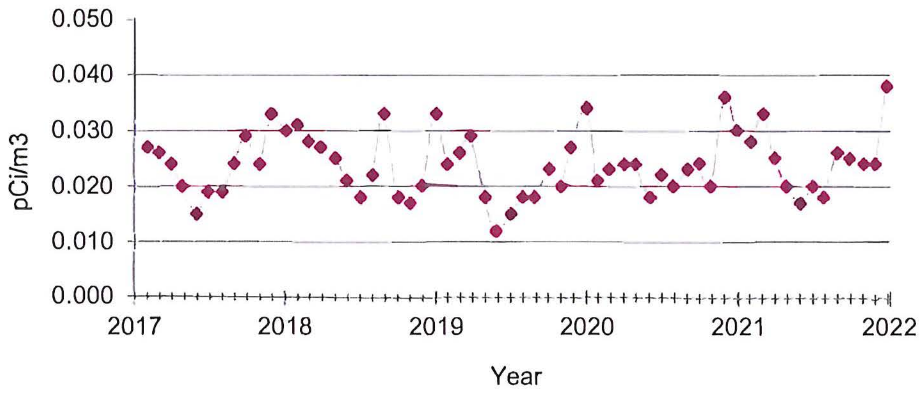


Air Particulates - Gross Beta

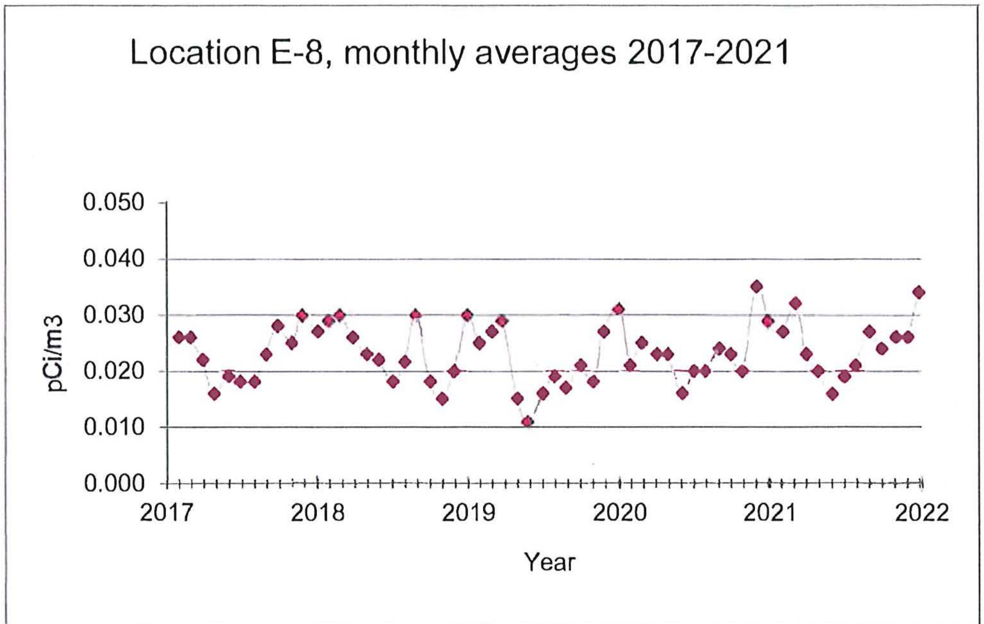
Location E-3, monthly averages 2017-2021

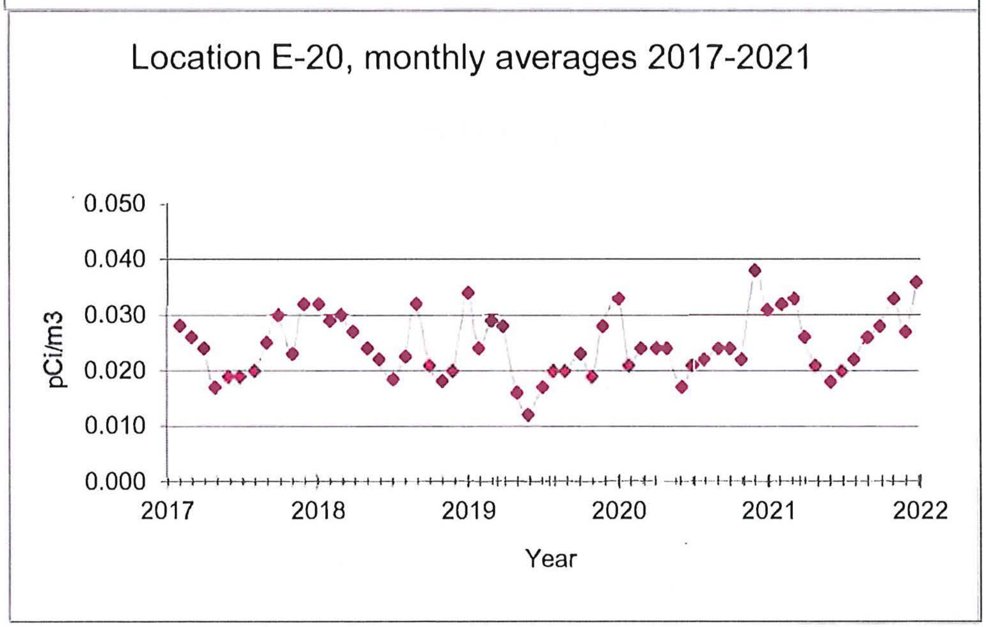


Location E-4, monthly averages 2017-2021



Air Particulates - Gross Beta





APPENDIX E

Supplemental Analyses

POINT BEACH NUCLEAR PLANT

Facade Wells

Units: = pCi\L

Gamma isotopic analysis

Location	GW-09 1Z-361A		GW-09 1Z-361B		GW-10 2Z-361A		GW-10 2Z-361B	
Collection Date	03-16-21		03-16-21		03-16-21		03-16-21	
Lab Code	EWW- 687	MDC	EWW- 688	MDC	EWW- 689	MDC	EWW- 690	MDC
Be-7	36.3 ± 11.9	< 28.4	14.7 ± 13.1	< 29.2	29.0 ± 17.4	< 33.1	5.9 ± 10.7	< 24.1
Mn-54	-0.1 ± 1.3	< 2.4	0.2 ± 1.3	< 2.6	2.3 ± 2.0	< 4.0	0.5 ± 1.3	< 2.8
Fe-59	-1.8 ± 2.3	< 4.5	-0.7 ± 2.6	< 3.3	-4.1 ± 3.6	< 7.1	1.5 ± 2.3	< 5.4
Co-58	0.0 ± 1.3	< 2.3	-0.3 ± 1.3	< 2.1	-0.9 ± 1.7	< 2.9	0.4 ± 1.2	< 2.7
Co-60	-0.9 ± 1.5	< 1.9	-0.3 ± 1.3	< 3.1	0.0 ± 2.1	< 3.7	0.8 ± 1.4	< 2.1
Zn-65	1.9 ± 2.4	< 4.8	0.2 ± 2.8	< 4.0	-6.8 ± 4.0	< 6.3	-1.4 ± 2.8	< 4.7
Zr-Nb-95	-2.8 ± 1.4	< 2.8	0.8 ± 1.5	< 3.5	0.3 ± 1.8	< 4.3	-1.6 ± 1.5	< 3.4
Cs-134	-0.1 ± 1.4	< 2.3	-1.2 ± 1.4	< 2.8	0.6 ± 1.8	< 3.6	0.9 ± 1.4	< 2.5
Cs-137	-0.5 ± 1.5	< 2.8	0.4 ± 1.6	< 2.7	1.3 ± 1.9	< 3.5	1.0 ± 1.6	< 2.9
Ba-La-140	-1.4 ± 1.4	< 3.4	0.6 ± 1.6	< 4.5	-0.9 ± 2.1	< 3.4	-1.0 ± 1.5	< 3.6

Location	GW-09 1Z-361A		GW-09 1Z-361B		GW-10 2Z-361A		GW-10 2Z-361B	
Collection Date	06-04-21		06-04-21		06-04-21		06-04-21	
Lab Code	EWW- 1907	MDC	EWW- 1908	MDC	EWW- 1910	MDC	EWW- 1911	MDC
Be-7	3.1 ± 14.1	< 28.8	-7.5 ± 13.4	< 31.2	6.6 ± 11.0	< 28.1	5.2 ± 10.5	< 30.3
Mn-54	0.0 ± 1.5	< 1.6	1.1 ± 1.4	< 2.2	-0.2 ± 1.4	< 1.7	-1.0 ± 1.2	< 2.0
Fe-59	-2.9 ± 2.8	< 3.9	-1.6 ± 2.9	< 5.6	-1.0 ± 2.3	< 5.6	0.7 ± 2.2	< 5.6
Co-58	-0.5 ± 1.4	< 3.2	-1.1 ± 1.4	< 1.7	0.1 ± 1.4	< 2.8	-0.7 ± 1.3	< 3.2
Co-60	-0.6 ± 1.7	< 3.4	0.7 ± 1.4	< 2.5	-1.0 ± 1.5	< 2.5	-0.6 ± 1.4	< 2.8
Zn-65	2.0 ± 3.1	< 6.0	0.8 ± 3.0	< 5.7	2.1 ± 2.8	< 5.8	1.8 ± 2.2	< 3.7
Zr-Nb-95	-3.9 ± 1.5	< 5.0	-1.1 ± 1.4	< 4.0	-6.6 ± 1.5	< 4.2	-2.3 ± 1.4	< 3.5
Cs-134	0.4 ± 1.5	< 3.1	-2.1 ± 1.5	< 3.1	0.5 ± 1.4	< 2.6	0.2 ± 1.3	< 2.6
Cs-137	0.8 ± 1.7	< 3.3	0.5 ± 1.6	< 2.9	0.5 ± 1.6	< 2.8	0.7 ± 1.5	< 2.8
Ba-La-140	-2.2 ± 1.6	< 7.0	-3.1 ± 1.7	< 8.9	-4.9 ± 1.6	< 7.7	-8.4 ± 1.5	< 5.2

	GW-09 1Z-361A		GW-09 1Z-361B		GW-10 2Z-361A		GW-10 2Z-361B	
Collection Date	08-07-21		08-07-21		08-08-21		08-08-21	
Lab Code	EWW- 2773	MDC	EWW- 2774	MDC	EWW- 2775	MDC	EWW- 2776	MDC
Be-7	-12.2 ± 9.8	< 18.1	-3.9 ± 7.5	< 18.3	-22.6 ± 22.2	< 44.7	25.5 ± 13.5	< 30.1
Mn-54	1.0 ± 1.0	< 2.0	0.1 ± 0.9	< 1.6	0.7 ± 2.8	< 4.7	0.6 ± 1.4	< 2.5
Fe-59	2.0 ± 2.0	< 6.4	-3.6 ± 1.6	< 4.7	1.0 ± 4.6	< 13.3	-2.0 ± 2.6	< 7.0
Co-58	-0.4 ± 1.0	< 2.4	0.5 ± 0.9	< 2.2	1.1 ± 2.8	< 6.9	0.4 ± 1.3	< 3.2
Co-60	0.1 ± 1.1	< 1.3	0.6 ± 0.9	< 1.7	-0.6 ± 2.7	< 4.8	1.4 ± 1.5	< 3.0
Zn-65	-1.1 ± 2.1	< 3.3	0.5 ± 1.9	< 3.7	4.3 ± 4.4	< 9.6	-1.1 ± 2.8	< 4.1
Zr-Nb-95	-1.8 ± 1.1	< 4.3	-1.6 ± 1.0	< 3.8	-2.6 ± 2.9	< 9.5	-2.7 ± 1.5	< 5.7
Cs-134	-0.3 ± 1.0	< 2.2	0.1 ± 1.0	< 1.8	-0.1 ± 2.8	< 5.1	-0.3 ± 1.5	< 3.1
Cs-137	0.8 ± 1.1	< 2.4	0.0 ± 1.1	< 1.8	-0.5 ± 2.9	< 4.8	0.9 ± 1.6	< 3.0
Ba-La-140	-14.3 ± 1.2	< 7.5	0.8 ± 1.0	< 11.1	9.1 ± 2.8	< 7.7	-8.2 ± 1.6	< 15.7 [a]

[a] LLD not reached due to late arrival and small sample size.

POINT BEACH NUCLEAR PLANT

Location	GW-09 1Z-361A		GW-09 1Z-361B		GW-10 2Z-361A		GW-10 2Z-361B	
Collection Date	10-16-21		10-16-21		10-16-21		10-16-21	
Lab Code	EWW- 3457	MDC	EWW- 3458	MDC	EWW- 3459	MDC	EWW- 3460	MDC
Be-7	-3.9 ± 14.3	< 22.2	-3.9 ± 10.5	< 14.8	-14.4 ± 9.9	< 17.7	-16.8 ± 13.8	< 27.7
Mn-54	-0.9 ± 1.4	< 2.3	0.0 ± 1.4	< 2.6	1.2 ± 1.3	< 2.7	0.1 ± 1.4	< 2.8
Fe-59	-0.5 ± 2.8	< 3.1	-0.1 ± 2.2	< 5.2	-1.0 ± 2.4	< 3.6	-2.0 ± 3.0	< 6.3
Co-58	1.8 ± 1.4	< 3.2	0.2 ± 1.3	< 2.5	0.0 ± 1.3	< 2.8	-0.1 ± 1.4	< 3.2
Co-60	1.1 ± 1.6	< 3.1	1.0 ± 1.5	< 3.1	-0.4 ± 1.4	< 2.0	-0.2 ± 1.4	< 2.5
Zn-65	-1.3 ± 3.4	< 4.8	1.4 ± 2.6	< 4.4	0.5 ± 2.6	< 3.9	-1.2 ± 3.4	< 4.9
Zr-Nb-95	-0.3 ± 1.6	< 2.9	-1.5 ± 1.5	< 2.6	-0.3 ± 1.4	< 3.5	-3.6 ± 1.5	< 4.3
Cs-134	-0.6 ± 1.6	< 3.1	-0.8 ± 1.4	< 2.6	-0.6 ± 1.4	< 2.6	-2.0 ± 1.5	< 3.1
Cs-137	-0.8 ± 1.7	< 2.6	1.5 ± 1.5	< 2.8	0.5 ± 1.5	< 2.9	-0.1 ± 1.6	< 2.5
Ba-La-140	-3.0 ± 1.8	< 2.7	1.7 ± 4.2	< 2.7	-0.3 ± 1.5	< 4.6	-4.1 ± 1.8	< 4.0

POINT BEACH NUCLEAR PLANT

Supplemental Analyses

Units: = pCi/L

Gamma isotopic analysis

Location	GW-04		U2FSSDS		GW-15A,B	
Collection Date	01-21-21		01-31-21		01-28-21	
Lab Code	EW- 180	MDC	EW- 471	MDC	EW- 222	MDC
Be-7	7.5 ± 18.3	< 41.4	0.6 ± 10.8	< 34.7	-5.0 ± 12.9	< 32.3
Mn-54	0.0 ± 2.0	< 3.7	0.1 ± 1.3	< 2.4	0.5 ± 1.6	< 3.3
Fe-59	-1.1 ± 3.8	< 6.3	-1.6 ± 2.3	< 7.2	-0.6 ± 2.6	< 4.0
Co-58	1.1 ± 1.7	< 2.1	-0.4 ± 1.4	< 4.3	-0.3 ± 1.4	< 3.0
Co-60	0.8 ± 2.0	< 2.9	0.2 ± 1.5	< 2.0	0.3 ± 1.7	< 3.3
Zn-65	-5.6 ± 4.5	< 5.9	0.3 ± 2.6	< 4.2	0.9 ± 3.1	< 6.4
Zr-Nb-95	-5.7 ± 2.4	< 5.4	-1.8 ± 1.5	< 3.0	-2.5 ± 1.7	< 4.5
Cs-134	-0.8 ± 2.1	< 3.7	-0.8 ± 1.3	< 2.4	-0.1 ± 1.5	< 2.9
Cs-137	0.1 ± 2.0	< 2.5	-0.9 ± 1.5	< 2.3	1.5 ± 1.8	< 3.2
Ba-La-140	-3.0 ± 2.0	< 3.9	-1.2 ± 1.5	< 12.4	-1.6 ± 1.8	< 6.8

Location	U2FSSDS		GW-04		GW-04	
Collection Date	02-28-21		02-17-21		03-25-21	
Lab Code	EW- 685	MDC	EW- 400	MDC	EW- 781	MDC
Be-7	1.7 ± 10.7	< 29.4	-6.8 ± 18.4	< 20.8	-8.0 ± 19.6	< 28.8
Mn-54	1.0 ± 1.3	< 2.3	0.7 ± 1.7	< 3.0	-0.9 ± 2.2	< 2.9
Fe-59	-0.7 ± 2.2	< 4.4	1.3 ± 3.7	< 3.6	-2.4 ± 4.5	< 6.2
Co-58	0.2 ± 1.2	< 2.9	-0.4 ± 1.8	< 2.1	0.3 ± 1.9	< 2.3
Co-60	0.7 ± 1.3	< 2.5	0.1 ± 2.0	< 2.4	0.9 ± 2.3	< 2.4
Zn-65	-0.6 ± 2.6	< 4.8	-2.1 ± 4.0	< 2.9	3.2 ± 4.5	< 5.2
Zr-Nb-95	-0.4 ± 1.5	< 4.1	0.2 ± 2.2	< 4.5	-3.7 ± 2.7	< 2.2
Cs-134	-0.3 ± 1.3	< 2.5	-1.6 ± 2.0	< 3.9	-5.5 ± 2.6	< 3.9
Cs-137	-0.6 ± 1.5	< 2.1	-0.4 ± 2.4	< 4.5	-0.8 ± 2.1	< 2.2
Ba-La-140	0.3 ± 1.4	< 7.0	-1.4 ± 2.3	< 3.4	1.8 ± 2.5	< 5.1

Location	U2FSSDS		GW-04		U2FSSDS	
Collection Date	03-31-21	MDC	04-23-21	MDC	04-30-21	MDC
Lab Code	EWW- 1251		EWW- 1201		EWW- 1413	
Be-7	9.7 ± 12.0	< 31.3	13.3 ± 10.7	< 35.6	-0.6 ± 10.1	< 25.5
Mn-54	2.4 ± 1.3	< 3.1	0.1 ± 1.4	< 2.0	-0.6 ± 1.3	< 2.6
Fe-59	4.5 ± 2.6	< 8.1	-3.3 ± 1.8	< 2.6	-2.0 ± 2.2	< 3.7
Co-58	0.9 ± 1.2	< 2.4	-0.1 ± 1.2	< 1.5	0.0 ± 1.2	< 2.5
Co-60	0.4 ± 1.3	< 2.4	-0.3 ± 1.3	< 2.2	-0.5 ± 1.3	< 2.5
Zn-65	-3.0 ± 2.9	< 4.2	2.5 ± 2.4	< 4.2	-1.6 ± 2.5	< 4.1
Zr-Nb-95	-3.3 ± 2.3	< 4.5	1.0 ± 1.3	< 3.7	-0.4 ± 1.3	< 3.7
Cs-134	0.2 ± 1.4	< 2.9	0.2 ± 1.2	< 2.6	-0.7 ± 1.3	< 2.5
Cs-137	0.8 ± 1.5	< 2.7	-0.1 ± 1.4	< 2.0	0.1 ± 1.5	< 2.6
Ba-La-140	-1.2 ± 1.6	< 13.2	-1.8 ± 1.5	< 8.5	-1.1 ± 1.5	< 4.9

POINT BEACH NUCLEAR PLANT

Supplemental Analyses

Units: = pCi\L

Gamma isotopic analysis

Location	GW-15A,B		GW-04		U2FSSDS	
Collection Date	05-14-21		05-19-21		05-31-21	
Lab Code	EW- 1567	MDC	EW- 1488	MDC	EW- 2025	MDC
Be-7	-5.5 ± 14.9	< 29.5	-2.5 ± 15.0	< 36.3	4.2 ± 10.7	< 38.4
Mn-54	-0.7 ± 1.6	< 3.6	-0.9 ± 1.7	< 2.4	0.6 ± 1.3	< 2.7
Fe-59	-5.2 ± 3.1	< 4.5	-2.4 ± 2.8	< 3.8	3.4 ± 2.5	< 8.7
Co-58	1.0 ± 1.5	< 2.8	0.5 ± 1.7	< 2.5	0.4 ± 1.3	< 3.0
Co-60	-0.3 ± 1.6	< 2.1	0.3 ± 1.9	< 2.5	-0.9 ± 1.4	< 2.1
Zn-65	-0.1 ± 3.5	< 6.2	-0.5 ± 2.8	< 3.6	0.5 ± 2.6	< 4.6
Zr-Nb-95	0.1 ± 1.5	< 3.7	0.4 ± 1.7	< 4.6	-5.2 ± 1.5	< 5.9
Cs-134	1.2 ± 1.6	< 3.2	-0.6 ± 1.8	< 3.4	0.8 ± 1.4	< 2.6
Cs-137	-0.2 ± 1.8	< 2.2	-0.5 ± 1.9	< 3.2	0.1 ± 1.6	< 2.8
Ba-La-140	-5.4 ± 1.8	< 3.8	-7.0 ± 6.4	< 2.5	-19.4 ± 1.5	< 9.1

Location	GW-07 (North Bog)		GW-04		U2FSSDS	
Collection Date	05-19-21		06-17-21		06-30-21	
Lab Code	EW- 1489	MDC	EW- 1906	MDC	EW- 2325	MDC
Be-7	4.9 ± 4.6	< 23.1	-5.5 ± 11.1	< 22.6	-10.1 ± 13.6	< 33.5
Mn-54	-0.1 ± 0.5	< 0.9	0.7 ± 1.4	< 2.4	0.3 ± 1.4	< 3.2
Fe-59	-0.6 ± 0.9	< 3.5	-0.3 ± 2.6	< 5.9	2.3 ± 2.7	< 8.2
Co-58	0.2 ± 0.5	< 1.4	-0.6 ± 1.2	< 1.3	-1.4 ± 1.4	< 1.7
Co-60	-0.3 ± 0.5	< 0.6	0.3 ± 1.0	< 2.0	0.6 ± 1.5	< 2.4
Zn-65	0.1 ± 1.0	< 2.3	0.1 ± 2.6	< 4.9	-0.7 ± 3.2	< 6.3
Zr-Nb-95	-0.7 ± 0.6	< 2.3	-1.7 ± 1.5	< 3.2	0.1 ± 1.5	< 4.8
Cs-134	-0.2 ± 0.6	< 1.0	0.7 ± 1.3	< 2.5	0.9 ± 1.5	< 3.0
Cs-137	0.0 ± 0.6	< 1.2	1.2 ± 1.3	< 2.7	-0.3 ± 1.7	< 2.7
Ba-La-140	-2.2 ± 0.6	< 14.7	-1.6 ± 4.3	< 4.8	2.6 ± 1.6	< 13.5

Location	GW-04		GW-15A,B		U2FSSDS	
Collection Date	07-21-21		07-22-21		07-31-21	
Lab Code	EW- 2330	MDC	EW- 2483	MDC	EW- 2573 [a]	MDC
Be-7	-9.9 ± 10.9	< 27.4	-5.2 ± 12.4	< 27.9	-4.0 ± 9.9	< 19.3
Mn-54	-1.1 ± 1.3	< 1.4	0.3 ± 1.6	< 3.8	0.8 ± 1.3	< 2.3
Fe-59	-1.2 ± 2.7	< 2.8	-2.3 ± 2.8	< 6.9	-0.1 ± 2.3	< 5.2
Co-58	0.4 ± 1.3	< 2.6	-0.5 ± 1.5	< 2.7	0.1 ± 1.3	< 2.6
Co-60	-0.8 ± 1.1	< 1.3	-0.6 ± 1.6	< 3.3	0.7 ± 1.3	< 2.7
Zn-65	1.3 ± 2.2	< 3.0	-4.0 ± 2.9	< 4.8	-2.4 ± 2.3	< 3.6
Zr-Nb-95	-1.4 ± 1.4	< 2.0	-3.4 ± 1.7	< 4.1	0.1 ± 1.3	< 3.5
Cs-134	-0.6 ± 1.5	< 2.7	1.1 ± 1.5	< 2.9	-0.4 ± 1.4	< 2.6
Cs-137	-1.2 ± 1.6	< 2.7	-0.6 ± 1.7	< 2.4	-1.0 ± 1.4	< 2.6
Ba-La-140	-2.5 ± 2.0	< 5.4	0.2 ± 1.8	< 11.4	-1.8 ± 1.4	< 7.9

[a] HTD analyses in app. F

POINT BEACH NUCLEAR PLANT

Supplemental Analyses

Units: = pCi\L

Gamma isotopic analysis

Location	U2FSSDS		GW-04		U2FSSDS	
Collection Date	08-31-21		08-19-21		09-30-21	
Lab Code	EW- 3072	MDC	EW- 2645	MDC	EW- 3256	MDC
Be-7	3.8 ± 9.9	< 27.4	-5.8 ± 10.7	< 18.5	-8.7 ± 10.1	< 18.4
Mn-54	1.3 ± 1.3	< 3.0	-1.3 ± 1.2	< 1.6	-0.5 ± 1.3	< 2.1
Fe-59	-3.7 ± 2.4	< 4.6	-1.7 ± 2.5	< 4.3	-0.1 ± 2.3	< 5.4
Co-58	0.7 ± 1.2	< 3.0	0.7 ± 1.2	< 1.9	0.0 ± 1.3	< 2.8
Co-60	-1.1 ± 1.4	< 2.7	-0.1 ± 1.1	< 1.7	0.4 ± 1.3	< 2.7
Zn-65	-0.9 ± 2.7	< 5.7	0.1 ± 2.3	< 3.9	0.8 ± 2.4	< 4.4
Zr-Nb-95	-2.4 ± 1.4	< 4.7	0.1 ± 1.3	< 2.0	0.9 ± 1.4	< 2.7
Cs-134	0.0 ± 1.4	< 2.5	-0.1 ± 1.2	< 2.3	-1.1 ± 1.3	< 2.5
Cs-137	0.4 ± 1.5	< 2.5	0.7 ± 1.5	< 3.0	-0.8 ± 1.5	< 2.3
Ba-La-140	-0.7 ± 1.4	< 8.3	-0.3 ± 1.4	< 2.2	-2.3 ± 1.5	< 2.9

Location	GW-04		GW-18		GW-04	
Collection Date	09-16-21		10-12-21		10-19-21	
Lab Code	EW- 2992	MDC	EW- 3441	MDC	EW- 3464	MDC
Be-7	-2.4 ± 4.5	< 7.5	6.3 ± 17.6	< 24.5	7.6 ± 13.2	< 36.2
Mn-54	0.1 ± 0.6	< 1.0	-0.1 ± 1.9	< 2.8	-0.3 ± 1.8	< 3.4
Fe-59	-0.5 ± 1.0	< 2.0	-3.5 ± 3.3	< 4.6	-0.2 ± 3.1	< 5.4
Co-58	0.4 ± 0.6	< 1.2	0.4 ± 2.0	< 5.1	-0.8 ± 1.5	< 2.6
Co-60	-0.1 ± 0.6	< 0.9	1.5 ± 1.4	< 1.7	1.9 ± 1.6	< 2.7
Zn-65	-0.4 ± 1.1	< 2.3	1.8 ± 4.0	< 4.4	1.3 ± 2.5	< 5.8
Zr-Nb-95	-0.2 ± 0.6	< 1.5	-3.2 ± 1.9	< 5.0	-1.8 ± 1.6	< 3.3
Cs-134	-0.3 ± 0.6	< 1.1	-1.9 ± 2.0	< 4.0	0.1 ± 1.5	< 2.9
Cs-137	0.4 ± 0.7	< 1.2	1.1 ± 2.1	< 3.9	-1.4 ± 2.0	< 2.1
Ba-La-140	0.3 ± 0.6	< 2.6	2.2 ± 1.4	< 7.1	-3.5 ± 1.6	< 7.1

Location	GW-15A,B		U2FSSDS		GW-04	
Collection Date	10-17-21		10-31-21		11-18-21	
Lab Code	EW- 3506	MDC	EW- 3898	MDC	EW- 3905	MDC
Be-7	-3.3 ± 13.8	< 24.3	-0.7 ± 11.0	< 33.0	6.8 ± 14.1	< 34.3
Mn-54	0.0 ± 1.4	< 2.5	2.0 ± 1.4	< 2.8	-0.4 ± 1.3	< 1.7
Fe-59	0.1 ± 2.9	< 4.1	-0.9 ± 2.4	< 5.8	-1.8 ± 2.3	< 5.6
Co-58	0.1 ± 1.4	< 3.1	0.2 ± 1.4	< 3.7	2.4 ± 1.4	< 2.6
Co-60	-0.7 ± 1.4	< 2.1	0.0 ± 1.4	< 2.1	-0.4 ± 1.5	< 2.0
Zn-65	-2.9 ± 3.1	< 4.1	-1.6 ± 2.6	< 5.4	0.8 ± 3.3	< 6.2
Zr-Nb-95	-0.1 ± 1.4	< 2.6	-0.7 ± 1.5	< 4.3	-0.9 ± 1.7	< 2.8
Cs-134	0.2 ± 1.5	< 3.0	-0.8 ± 1.4	< 2.6	0.2 ± 1.5	< 2.9
Cs-137	-0.5 ± 1.6	< 2.1	-0.6 ± 1.5	< 2.1	-0.2 ± 1.7	< 2.5
Ba-La-140	-2.2 ± 1.6	< 3.5	-1.8 ± 1.7	< 9.2	1.4 ± 2.0	< 9.1

POINT BEACH NUCLEAR PLANT

Supplemental Analyses

Units: = pCi\L

Gamma isotopic analysis

Location	U2FSSDS		GW-04		U2FSSDS	
Collection Date	11-30-21		12-16-21		12-31-21	
Lab Code	EW- 4132	MDC	EW- 4093	MDC	EW- 4389	MDC
Be-7	-9.6 ± 9.8	< 30.6	-6.0 ± 19.1	< 39.2	2.5 ± 10.4	< 28.3
Mn-54	0.3 ± 1.2	< 2.4	1.6 ± 1.8	< 2.9	-0.8 ± 1.3	< 2.2
Fe-59	0.6 ± 2.2	< 7.7	-0.7 ± 3.7	< 4.8	-1.1 ± 2.3	< 6.0
Co-58	0.8 ± 1.2	< 3.6	0.9 ± 1.9	< 2.9	-1.3 ± 1.3	< 2.1
Co-60	0.2 ± 1.3	< 2.3	0.5 ± 1.8	< 2.3	-0.8 ± 1.2	< 2.3
Zn-65	-3.5 ± 2.3	< 4.3	-0.5 ± 4.0	< 3.1	-2.4 ± 2.7	< 4.4
Zr-Nb-95	-1.9 ± 1.4	< 5.4	-0.1 ± 1.7	< 3.5	-1.5 ± 2.1	< 3.7
Cs-134	-0.8 ± 1.3	< 2.4	0.6 ± 2.0	< 3.8	-1.1 ± 1.3	< 2.5
Cs-137	-0.1 ± 1.4	< 2.2	1.7 ± 2.0	< 4.0	1.8 ± 1.5	< 2.9
Ba-La-140	-0.2 ± 1.4	< 11.9	-0.2 ± 2.5	< 7.2	0.5 ± 4.3	< 6.5

APPENDIX F

Special Analyses

POINT BEACH NUCLEAR PLANT

Additional Analyses

Location	U2FSSDS	MDC
Collection Date	07-31-21	
Lab Code	EW- 2573	
Fe-55	-65.4 ± 337.6	< 562.2
Ni-63	23.90 ± 42.2	< 68.8
Sr-89	-2.51 ± 3.9	< 4.50
Sr-90	1.26 ± 1.4	< 2.66
Tc-99	0.0 ± 6.7	< 10.98

Location: E-01 (Meteorological Tower)		MDC	pCi/L
Collection Date	10-12-21		
Lab Code	ELW- 3328		
H-3	1404.0 ± 145.4	< 169	

Location: E-01 (Meteorological Tower)		MDC	pCi/L
Collection Date	11-10-21		
Lab Code	ELW- 3793		
H-3	65.8 ± 145.4	< 168	

Location: E-01 (Meteorological Tower)		MDC	pCi/L
Collection Date	12-07-21		
Lab Code	ELW- 4013		
H-3	102.9 ± 93.3	< 167	

ATI Environmental, Inc.
Midwest Laboratory
700 Landwehr Road • Northbrook, IL 60062-2310
phone (847) 564-0700 • fax (847) 564-4517

Amended Report*

Jerri Walters
Radiation Protection Mgr.
Point Beach Nuclear Plant
NextEraEnergy
6610 Nuclear Road
Two Rivers, WI 54241

LABORATORY REPORT NO.: 8006-100-1422-A
SAMPLES RECEIVED: 04-09-21
PURCHASE ORDER NO.:

Below are the results of the readout of supplemental TLDs deployed during the first quarter, 2021.

Period:	1st Quarter, 2021
Date Annealed:	12/03/20
Date Placed:	01/08/21
Date Removed:(SGSF-N/S/E/W, ISFSI-N/S/E/W)	04/06/21
Date Removed:(Control)	04/08/21
Date Read:	04/14/21
Days in the Field:(SGSF-N/S/E/W, ISFSI-N/S/E/W)	88
Days in the Field:(Control)	90
Days from Annealing to Readout:	132
In-transit exposure:	7.56 ± 0.51

Location	Total mR	Net mR	Net mR Std Qtr	Net mR per 7 days
SGSF-North	19.4 ± 1.0	11.9 ± 1.1	12.3 ± 1.2	0.94 ± 0.09
SGSF-East	20.6 ± 1.0	13.0 ± 1.1	13.5 ± 1.1	1.04 ± 0.09
SGSF-South	20.3 ± 0.5	12.7 ± 0.7	13.1 ± 0.7	1.01 ± 0.05
SGSF-West	20.4 ± 1.4	12.8 ± 1.5	13.3 ± 1.6	1.02 ± 0.12
ISFSI-North	37.3 ± 0.7	29.8 ± 0.8	30.8 ± 0.9	2.37 ± 0.07
ISFSI-East	57.4 ± 1.3	49.8 ± 1.4	51.5 ± 1.4	3.96 ± 0.11
ISFSI-South	25.2 ± 0.9	17.7 ± 1.0	18.3 ± 1.0	1.41 ± 0.08
ISFSI-West	54.0 ± 2.0	46.4 ± 2.1	48.0 ± 2.2	3.69 ± 0.17
Control	25.2 ± 0.9	17.6 ± 1.1	17.8 ± 1.1	1.37 ± 0.08

* The report approved 5/11/21 had incorrect quarterly and weekly values for SGSF and ISFSI locations due to erroneous removal dates.

Forrest G. Shaw III 5/19/21
Quality Assurance

APPROVED Ashok Banavali 5/19/21
Ashok Banavali, Ph.D.
Laboratory Manager

ATI Environmental, Inc.
Midwest Laboratory
700 Landwehr Road • Northbrook, IL 60062-2310
phone (847) 564-0700 • fax (847) 564-4517

Darren Peterson
Radiation Protection Mgr.
Point Beach Nuclear Plant
NextEraEnergy
6610 Nuclear Road
Two Rivers, WI 54241

LABORATORY REPORT NO.: 8006-100-1427
SAMPLES RECEIVED: 07-06-21
PURCHASE ORDER NO.:

Below are the results of the readout of supplemental TLDs deployed during the second quarter, 2021.

Period:	2nd Quarter, 2021
Date Annealed:	03/04/21
Date Placed:(SGSF-N/S/E/W, ISFSI-N/S/E/W)	04/06/21
Date Placed:(Control)	04/08/21
Date Removed:	07/01/21
Date Read:	07/09/21
Days in the Field:(SGSF-N/S/E/W, ISFSI-N/S/E/W)	86
Days in the Field:(Control)	84
Days from Annealing to Readout:	127
In-transit exposure:	6.98 ± 0.42

Location	Total mR	Net mR	Net mR Std Qtr	Net mR per 7 days
SGSF-North	18.3 ± 0.8	11.4 ± 0.9	12.0 ± 0.9	0.93 ± 0.07
SGSF-East	19.0 ± 0.4	12.0 ± 0.6	12.7 ± 0.6	0.98 ± 0.05
SGSF-South	19.5 ± 0.9	12.5 ± 1.0	13.2 ± 1.1	1.02 ± 0.08
SGSF-West	19.3 ± 0.9	12.3 ± 1.0	13.0 ± 1.1	1.00 ± 0.08
ISFSI-North	32.3 ± 2.0	25.3 ± 2.0	26.8 ± 2.1	2.06 ± 0.16
ISFSI-East	54.1 ± 1.5	47.1 ± 1.5	49.8 ± 1.6	3.83 ± 0.13
ISFSI-South	26.6 ± 1.4	19.6 ± 1.5	20.8 ± 1.5	1.60 ± 0.12
ISFSI-West	60.5 ± 2.4	53.5 ± 2.4	56.7 ± 2.6	4.36 ± 0.20
Control	23.6 ± 1.3	16.6 ± 1.4	18.0 ± 1.5	1.39 ± 0.11

7/27/21
Forrest G. Shaw III
Quality Assurance

APPROVED 7/28/21
Ashok Banavali, Ph.D.
Laboratory Manager

ATI Environmental, Inc.
Midwest Laboratory
700 Landwehr Road • Northbrook, IL 60062-2310
phone (847) 564-0700 • fax (847) 564-4517

Jerri Walters
Radiation Protection Mgr.
Point Beach Nuclear Plant
NextEraEnergy
6610 Nuclear Road
Two Rivers, WI 54241

LABORATORY REPORT NO.: 8006-100-1440
SAMPLES RECEIVED: 10-05-21
PURCHASE ORDER NO.:

Below are the results of the readout of supplemental TLDs deployed during the third quarter, 2021.

Period:	3rd Quarter, 2021
Date Annealed:	06/03/21
Date Placed:	07/01/21
Date Removed:	10/03/21
Date Read:	10/07/21
Days in the Field:	94
Days from Annealing to Readout:	126
In-transit exposure:	5.10 ± 0.36

Location	Total mR	Net mR	Net mR Std Qtr	Net mR per 7 days
SGSF-North	17.3 ± 0.8	12.2 ± 0.9	11.8 ± 0.9	0.91 ± 0.07
SGSF-East	17.3 ± 0.7	12.2 ± 0.8	11.8 ± 0.8	0.91 ± 0.06
SGSF-South	18.4 ± 0.6	13.3 ± 0.7	12.9 ± 0.6	0.99 ± 0.05
SGSF-West	17.6 ± 0.6	12.5 ± 0.7	12.1 ± 0.7	0.93 ± 0.05
ISFSI-North	38.6 ± 2.8	33.5 ± 2.8	32.4 ± 2.7	2.50 ± 0.21
ISFSI-East	54.9 ± 1.5	49.8 ± 1.6	48.2 ± 1.5	3.71 ± 0.12
ISFSI-South	42.5 ± 1.5	37.4 ± 1.6	36.2 ± 1.5	2.78 ± 0.12
ISFSI-West	104.5 ± 5.5	99.4 ± 5.5	96.2 ± 5.4	7.40 ± 0.41
Control	22.6 ± 1.0	17.5 ± 1.1	16.9 ± 1.1	1.30 ± 0.08

Forrest G. Shaw III 10/25/21
Quality Assurance

APPROVED Ashok Banavali 10/25/21
Ashok Banavali, Ph.D.
Laboratory Manager

ATI Environmental, Inc.
Midwest Laboratory
700 Landwehr Road • Northbrook, IL 60062-2310
phone (847) 564-0700 • fax (847) 564-4517

Darren Peterson
Radiation Protection Mgr.
Point Beach Nuclear Plant
NextEraEnergy
6610 Nuclear Road
Two Rivers, WI 54241

LABORATORY REPORT NO.: 8006-100-1454
SAMPLES RECEIVED: 01-06-22
PURCHASE ORDER NO.:

Below are the results of the readout of supplemental TLDs deployed during the fourth quarter, 2021.

Period:	4th Quarter, 2021
Date Annealed:	09/07/21
Date Placed:	10/03/21
Date Removed:	01/03/22
Date Read:	01/07/22
Days in the Field:	92
Days from Annealing to Readout:	122
In-transit exposure:	5.63 ± 0.39

Location	Total mR	Net mR	Net mR Std Qtr	Net mR per 7 days
SGSF-North	19.4 ± 0.9	13.8 ± 1.0	13.7 ± 1.0	1.05 ± 0.08
SGSF-East	19.7 ± 0.4	14.1 ± 0.6	14.0 ± 0.6	1.07 ± 0.04
SGSF-South	20.3 ± 1.1	14.7 ± 1.2	14.6 ± 1.2	1.12 ± 0.09
SGSF-West	20.2 ± 1.0	14.6 ± 1.1	14.4 ± 1.1	1.11 ± 0.08
ISFSI-North	37.1 ± 2.3	31.5 ± 2.4	31.2 ± 2.4	2.40 ± 0.18
ISFSI-East	63.2 ± 1.9	57.6 ± 1.9	57.0 ± 1.9	4.38 ± 0.15
ISFSI-South	48.7 ± 2.0	43.1 ± 2.1	42.6 ± 2.0	3.28 ± 0.16
ISFSI-West	111.9 ± 3.4	106.3 ± 3.4	105.1 ± 3.4	8.09 ± 0.26
Control	24.6 ± 1.5	19.0 ± 1.6	18.8 ± 1.6	1.44 ± 0.12

Forrest G. Shaw III 1/28/22
Quality Assurance

APPROVED Ashok Banavali 1/28/22
Ashok Banavali, Ph.D.
Laboratory Manager