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April 28, 2022
L-22-104

10CFR50.36(a)

ATTN: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT:
Perry Nuclear Power Plant
Docket No. 50-440
Annual Radiological Environmental Operating Report

Enclosed is the Annual Radiological Environmental Operating Report for the Perry Nuclear Power Plant (PNPP) for the period of January 1, 2021 through December 31, 2021. This document partially satisfies the requirements of the PNPP Technical Specifications (TS), the PNPP Offsite Dose Calculation Manual (ODCM), and the Environmental Protection Plan contained in Appendix B of the PNPP Operating License.

There are no regulatory commitments contained in this letter. If there are any questions or if additional information is required, please contact Mr. Eli Crosby, Chemistry Manager at (440) 280-5032.

Sincerely,

A handwritten signature in black ink, appearing to read "Rod L. Penfield", written over a white background.

Rod Penfield

Enclosures:

A PNPP 2021 Annual Radiological Environmental Operating Report

cc: NRC Project Manager
NRC Resident Inspector
NRC Region III

Enclosure A

L-22-104

PNPP 2021 Annual Radiological Environmental Operating Report



Annual Radiological Environmental Operating Report 2021

Document Number: L-22-104

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1.0 LIST OF ACRONYMS AND DEFINITIONS

1. Airborne Activity Sampling: Continuous sampling of air through the collection of particulates and radionuclides on filter media. Periodic soil samples are collected for gamma isotopic analysis to provide information on deposition to the soil from airborne releases.
2. AIP: Air, Iodine and Particulate
3. ARERR: Annual Radioactive Effluent Release Report
4. AREOR: Annual Radioactive Environmental Operating Report
5. BLV: Broad Leaf Vegetation
6. BWR: Boiling Water Reactor
7. Composite Sample: A series of single collected portions (aliquots) analyzed as one sample. The aliquots making up the sample are collected at time intervals that are very short compared to the composite period.
8. Control: A sampling station in a location not likely to be affected by plant effluents due to its distance and/or direction from the Columbia Generating Station.
9. Curie (Ci): A measure of radioactivity; equal to $3.7E+10$ disintegrations per second, or $2.22E+12$ disintegrations per minute.
10. Direct Radiation Monitoring: The measurement of radiation dose at various distances from the plant is assessed using Thermoluminescent dosimeters, Optical Stimulated Luminance dosimeters and pressurized ionization chambers.
11. DW: Drinking Water
12. Grab Sample: A single discrete sample drawn at one point in time.
13. Indicator: A sampling location that is likely to be affected by plant effluents due to its proximity and/or direction from the plant.
14. Ingestion Pathway: The ingestion pathway includes milk, fish, drinking water and garden produce. Also sampled (under special circumstances) are other media such as vegetation and animal products such as eggs and meat when additional information about particular radionuclides is needed.
15. Lower Limit of Detection (LLD): The smallest concentration of radioactive material in a sample that will yield a net count (above system background) that will be detected with 95% probability with a 5% probability of a false conclusion that a blank observation represents "real" signal.
16. MDA: Minimum Detectable Activity

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17. Mean: The average, i.e., the sum of results divided by the number of results.
18. NA: Not Applicable
19. NIST: National Institute of Standards and Technology.
20. NRC: Nuclear Regulatory Commission
21. ODCM: Offsite Dose Calculation Manual
22. pCi: is equal to one trillionth of a curie
23. pCi/L: picocuries / Liter
24. PNPP: Perry Nuclear Power Plant
25. PWR: Pressurized Water Reactor
26. REMP: Radiological Environmental Monitoring Program
27. SW: Surface Water
28. TLD: Thermoluminescent Dosimeter
29. TS: Technical Specification

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2.0 EXECUTIVE SUMMARY

The Annual Radiological Environmental Operating Report (AREOR) details the results of Radiological Environmental Monitoring Program (REMP) conducted at the Perry Nuclear Power Plant (PNPP) from January 01 through December 31, 2021. This report meets all of the requirements in PNPP Offsite Dose Calculation Manual (ODCM) and the Environmental Protection Plan (EPP). Report topics include radiological environmental monitoring and the land use census. The results of the environmental and effluent programs indicate that the operations of the PNPP did not result in any adverse environmental impact.

2.1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

The Radiological Environmental Monitoring Program (REMP) was established in 1981 to monitor the radiological conditions in the environment around PNPP. The operational REMP was initiated in 1986 and has continued through this reporting period. The REMP is conducted in accordance with the PNPP ODCM. This program includes collection and analysis of environmental samples and evaluation of results at indicator as well as control locations. Indicator samples are collected at locations determined to be most influenced by operation of the PNPP. Control samples are collected at locations beyond the measurable influence of the PNPP for data comparison.

2.2 PRE-OCCUPATIONAL REMP

The REMP was established at PNPP six years before the plant became operational. Between 1981 and 1986 environmental monitoring involved collection and analysis of environmental samples. This pre-operational program was designed to provide data on background radiation levels and radioactivity normally present in the area in order to establish a baseline for data comparison prior to operation of the plant. PNPP has continued to monitor the environment during plant operation by collecting and analyzing samples of air, milk, fish, vegetation, water, and sediment, as well as by measuring radiation directly.

The contribution of radionuclides to the environment resulting from PNPP operation is assessed by comparing results from the environmental monitoring program with pre-operational data, operational data from previous years, and control location data. The results for each sample type are compared to historical data to determine whether trends or changes in concentrations are observable.

2.3 OPERATIONAL REMP

Results of air samples collected to monitor the radioactivity in the atmosphere revealed normal background radionuclide concentrations. Terrestrial monitoring included the analysis of vegetation due to the unavailability of milk samples; the results of which indicated concentrations of radioactivity similar to those found in previous years. Analyses of vegetation

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samples detected only natural radioactivity similar to that observed in previous years and indicated no radioactivity attributable to operation of the PNPP.

Aquatic monitoring included the collection and analyses of water, fish, and shoreline sediments. The analytical results of these samples showed normal background radionuclide concentrations.

Direct radiation measurements showed no significant changes from previous years. The indicator locations averaged 15.6 mrem/quarter and control locations averaged 15.1 mrem/quarter. Radiation dose in the area of PNPP were similar to the radiation dose measured at locations greater than ten miles away from PNPP.

Results from indicator samples collected during this reporting period were compared to control sample results and pre-operational data. Based on the results, it can be concluded that the operation of the PNPP resulted in no significant increase in the radionuclide concentrations observed in the surrounding environment. The results of the REMP indicate adequate control of radioactivity released from PNPP. These results also demonstrate that PNPP complies with federal regulations.

2.4 LAND USE CENSUS

In order to estimate radiation dose attributable to operation of the PNPP, the potential pathways through which public exposure can occur must be known. To identify these pathways, an Annual Land Use Census is performed as part of the REMP. During the census, PNPP personnel travel public roads within a five-mile radius of the plant to locate key radiological exposure pathways. These key pathways include the nearest resident, garden, in each of the ten meteorological land sectors that surround the plant. The information obtained from the census is entered into a computer program used to assess hypothetical dose to members of the public. The predominant land use within the census area continues to be rural and/or agricultural.

3.0 INTRODUCTION

The REMP was established at PNPP for several reasons. First, it verifies the adequacy of plant design and operation to control radioactive materials and limit effluent releases. Second, it assesses the radiological impact, if any, that the plant has had on the surrounding environment. Third, it ensures compliance with regulatory guidelines. The REMP is conducted in accordance with Appendix B of the PNPP Operating License, Technical Specifications, the ODCM, Nuclear Regulatory Commission (NRC) Regulatory Guide 4.1, NUREG 1301/1302 [6,7], and the 1979 NRC Branch Technical Position [17].

A variety of samples are collected as part of the PNPP REMP. The selection of sample types, locations, and collection frequency are based on many variables. Potential pathways for the transfer of radionuclides through the environment to humans, sample availability, local meteorology, population characteristics, land use, and NRC requirements are all factors and diagramed in Figure 1.

To ensure that the REMP data is significant and valuable, detailed sampling methods and procedures are followed to ensure that samples are collected in the same manner and from the same locations each time. All samples are packaged on site and then shipped to an independent vendor laboratory for analysis. The vendor laboratory analyzes the samples and reports results to the PNPP Chemistry Unit staff, the Lake County General Health District, and the State of Ohio Department of Health. Additionally, the Lake County General Health District obtains monthly “split” samples of milk (when available), water, and vegetation to perform an independent verification of PNPP’s REMP.

The Radiological Environmental Monitoring Program (REMP) provides data on measurable levels of radiation and radioactive materials in the site environment. This program also evaluates the relationship between quantities of radioactive materials released from the plant and resultant doses to individuals from principal pathways of exposure. In this capacity, REMP provides a check on the effluent release program and dispersion modeling to ensure that concentrations in the environment radioactive effluents conform to the “As Low as Is Reasonably Achievable” (ALARA) design objectives of 10 CFR 50, Appendix I. REMP is designed to conform to the NRC Regulatory Guide 4.1, NUREG 1301/1302 [6,7], and the 1979 NRC Branch Technical Position [17].

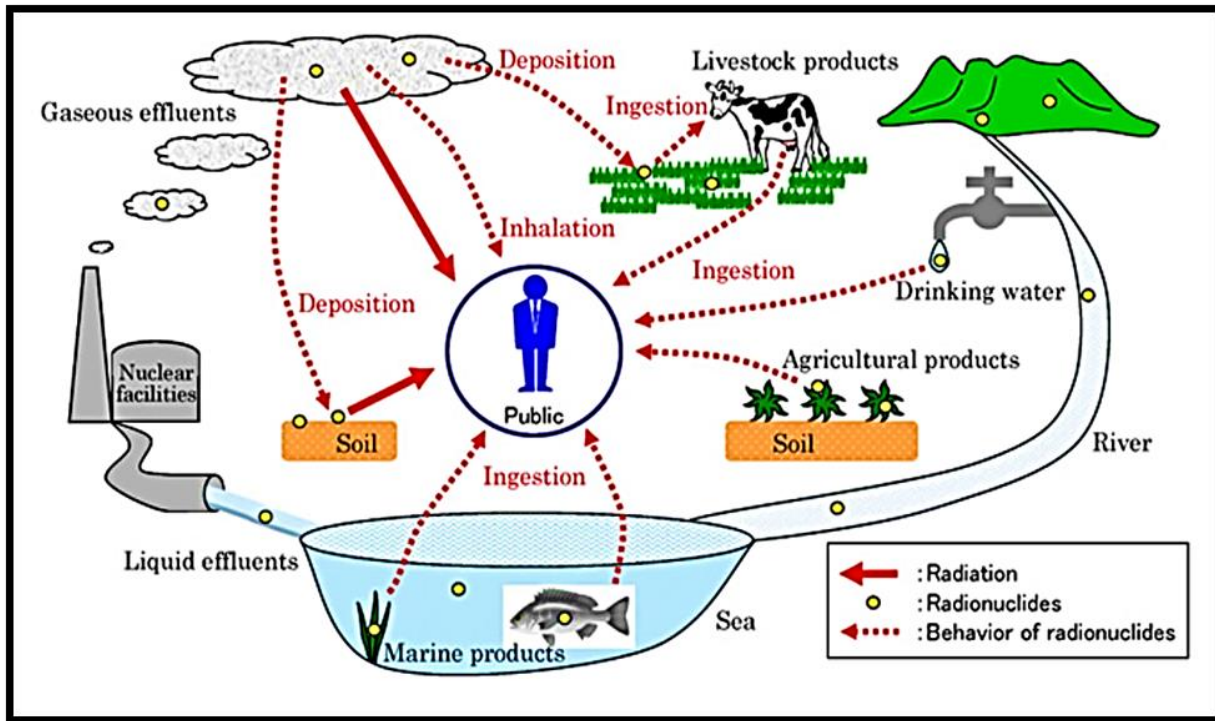


Figure 1, Potential exposure pathways to Members of the Public due to Plant Operations (1)

Quality assurance aspects of the sampling program and TLD data collection are conducted in accordance with Regulatory Guide 4.15 [13] and Regulatory Guide 4.13 [21]. REMP also adheres to the requirements of the State of Ohio, PNPP Technical Specifications, and the Offsite Dose Calculation Manual (ODCM). These governing documents dictate the environmental sampling, sample analysis protocols, data reporting, and quality assurance requirements for the environmental monitoring program.

The Annual Radioactive Environmental Operating Report provides summaries of the environmental data from exposure pathways, interpretations of the data, and analyses of trends of the results. Routinely monitored pathways include ingestion, inhalation, and direct radiation. Routes of exposure are based on site specific information such as meteorology, receptor locations, and water usage around the plant.

4.0 SAMPLE LOCATIONS

REMP samples are collected at numerous locations, both on site and up to 16.2 miles away from the plant. Sampling locations are divided into two general categories: indicator and control. Indicator locations are relatively close to the plant and monitor for any environmental impact due to plant operations. Control locations are those that are unaffected by plant operation; they are a greater distance from the plant and in the least prevalent wind directions. Data obtained from the indicator locations are compared with data from the control locations. This comparison allows naturally-occurring background radiation to be considered when evaluating any radiological impact PNPP may have had on the environment. Table 1, Figure 2, Figure 3, and Figure 4 identify the PNPP REMP sampling locations. Many REMP samples are collected in addition to those required by the PNPP ODCM. The ODCM requirements for each sample type are discussed in more detail later in the report.

Table 1: REMP Sampling Locations

Location #	Description	Miles	Direction	Media (1)
1	Chapel Road	3.4	ENE	TLD, AIP
2	Kanda Garden	1.9	ENE	Broadleaf Vegetation
3	Meteorological Tower	1.0	SE	TLD, AIP
4	Site Boundary	0.7	S	TLD, AIP
5	Quincy Substation	0.6	SW	TLD, AIP
6	Concord Service Center	11.0	SSW	TLD, AIP
7	Site Boundary	0.6	NE	TLD, AIP
8	Site Boundary	0.8	E	TLD
9	Site Boundary	0.7	ESE	TLD
10	Site Boundary	0.8	SSE	TLD
11	Parmly Rd. at Center Rd.	0.6	SSW	TLD
12	Site Boundary	0.6	WSW	TLD
13	Madison-on-the-Lake	4.7	ENE	TLD
14	Hubbard Rd.	4.9	E	TLD
15	Eagle St. Substation	5.1	ESE	TLD
16	Eubank Garden	0.9	S	Broadleaf Vegetation
20	Rainbow Farms	1.9	E	Broadleaf Vegetation
21	Hardy Rd. – Painesville Township Park	5.1	WSW	TLD
23	High St. Substation	7.9	WSW	TLD
24	St. Clair Ave. at Mentor Substation	15.1	SW	TLD
25	Offshore - PNPP discharge	0.6	NNW	Fish
29	River Rd.at Turney Rd.	4.3	SSE	TLD
30	Lane Rd.	4.8	SSW	TLD
31	Wood Rd. at River Rd.	4.8	SE	TLD
32	Offshore – Mentor-on-the-Lake	15.8	WSW	Fish
33	River Rd. at Blair Rd.	4.5	S	TLD
34	PNPP Intake	0.2	NW	Surface Water
35	Site Boundary	0.6	E	TLD, AIP
36	Lake County Water Plant	3.9	WSW	TLD, Drinking Water
37	Gerlica Farm	1.5	ENE	Broadleaf Vegetation
39	Painesville Purification Plant	8.3	W	Drinking Water
53	3715 Parmly Rd.	0.5	WSW	TLD
54	Hale Rd. School	4.6	SW	TLD
55	Center Rd. behind soccer field	2.5	S	TLD
56	Madison High School	4.0	ESE	TLD
57	Perry High School	1.7	S	TLD
58	Antioch Rd.	0.8	ENE	TLD
59	Lake Shoreline at Green Rd.	4.0	ENE	Surface Water
60	Lake Shoreline at Perry Park	1.0	WSW	Surface Water
64	Northwest Drain Mouth	0.4	WNW	Sediment
66	Lake Shore, Metropolitan Park	1.4	NE	Sediment
70	H&H Farm Stand	16.2	SSW	Broadleaf Vegetation

(1) AIP = Air, Iodine and Particulate

TLD = Thermoluminescent Dosimeter

5.0 MAPS OF COLLECTION SITES

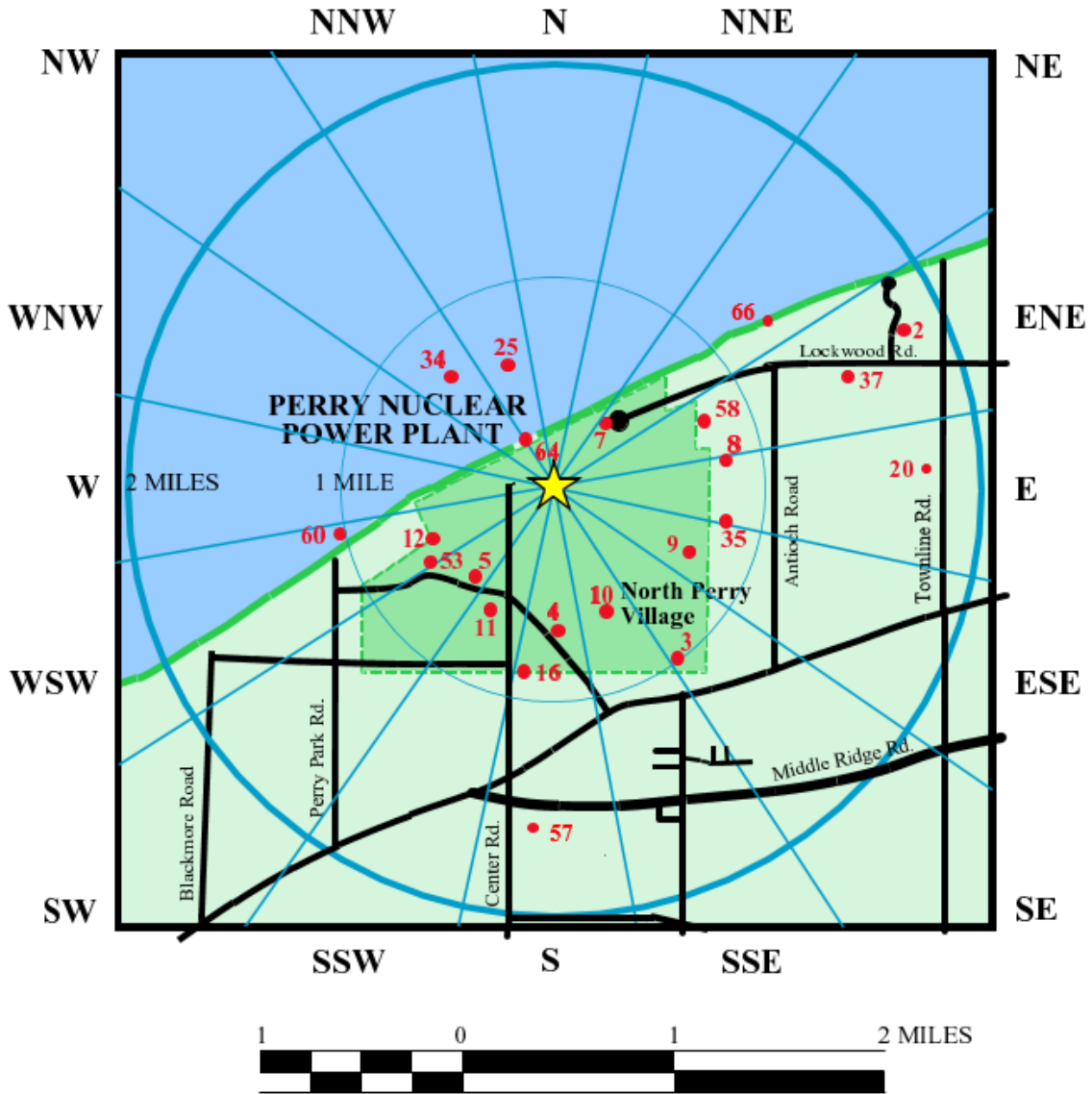


Figure 2, REMP Sample Locations within Two Miles of the Plant Site

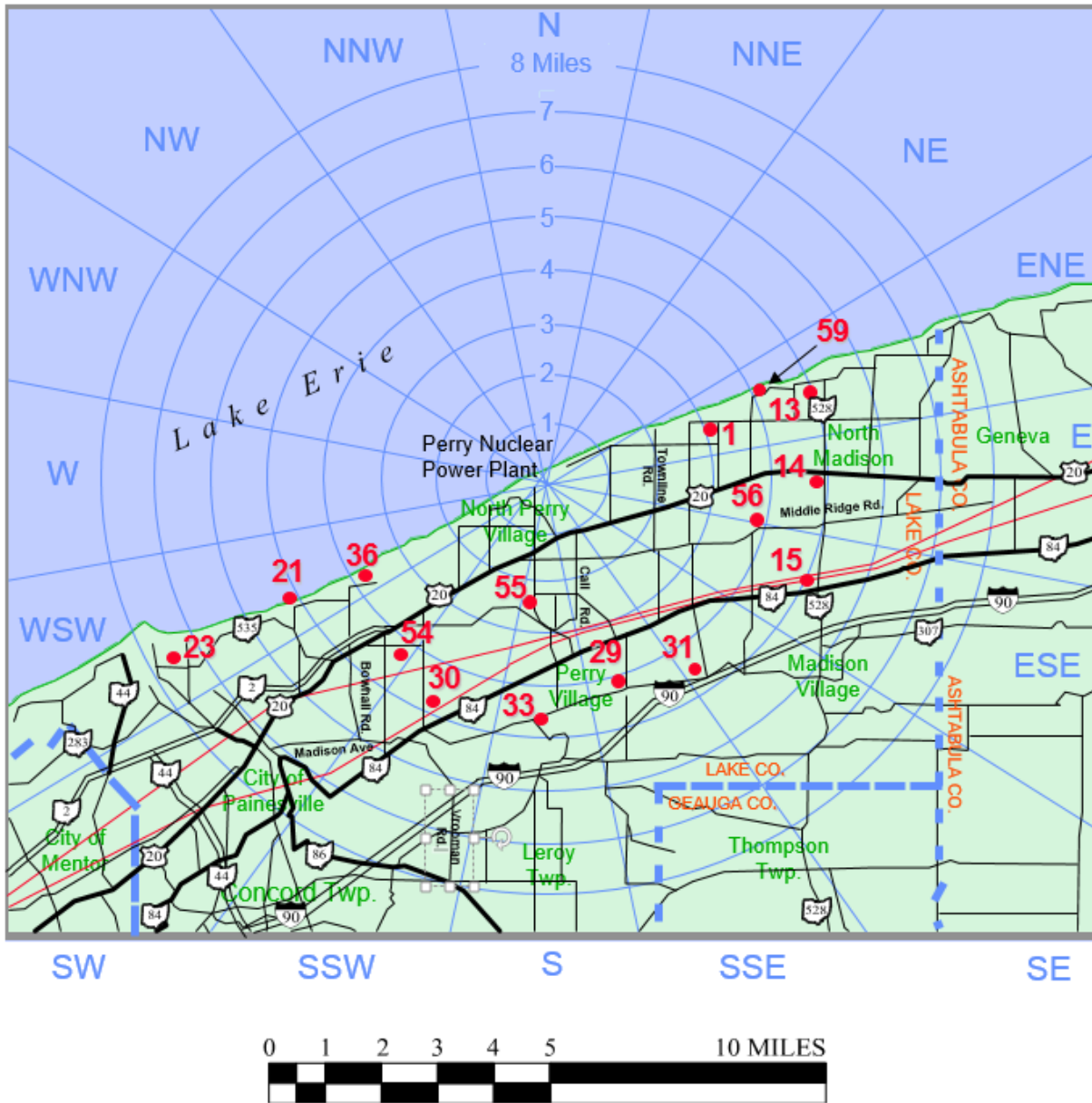


Figure 3, REMP Sampling Locations between Two and Eight Miles from the Plant Site



Figure 4, REMP Sampling Locations Greater Than Eight Miles from the Plant Site

6.0 SAMPLING ANALYSIS

When environmental samples are analyzed for radioactivity, several types of measurements are performed to provide information about the types of radiation and radionuclides present. The major analyses that are performed are discussed below.

Gross beta activity measures the total amount of beta-emitting radioactivity present in a sample and acts as a tool to identify samples that may require further analysis. Beta radiation may be released by many different radionuclides. Since beta-decay results in a continuous energy spectrum rather than the discrete energy levels, or "peaks", associated with gamma radiation, identification of specific beta-emitting nuclides is more difficult. Therefore, gross beta activity only indicates whether the sample contains normal or abnormal amounts of beta-emitting radioactivity; it does not specifically identify the radionuclides present.

Gamma spectral analysis provides more specific information than does the analysis for gross beta activity. Gamma spectral analysis identifies each radionuclide and the amount of radioactivity present in the sample that is emitting gamma radiation. Each radionuclide has a very specific "fingerprint" that allows for accurate identification and quantification.

Iodine activity analysis measures the amount of radioactive iodine present in a sample. Some media (e.g., air sample charcoal cartridges) are analyzed directly by gamma spectral analysis. With other media (e.g., milk when available), the radioiodines are extracted by chemical separation before being analyzed by gamma spectral analysis.

Tritium activity analysis measures the amount of the radionuclide tritium (H-3) present in a sample. Tritium is an isotope of hydrogen that emits low-energy beta particles. Tritium occurs naturally from interactions with atmospheric cosmic rays and is also man-made from the nuclear fission process.

Gamma doses received by Thermoluminescent Dosimeters (TLD) while in the field are determined by a special laboratory procedure. Thermoluminescence is a process by which ionizing radiation interacts with the sensitive phosphor material in the TLD. Energy is trapped in the TLD material and can be stored for months or years. This capability provides a method to measure the dose received over long periods of time. The amount of energy that was stored in the TLD as a result of interaction with radiation is released by a controlled heating process and measured in a calibrated reading system. As the TLD is heated, the phosphor releases the stored energy as light. The amount of light is directly proportional to the amount of radiation to which the TLD was exposed.

Table 2 provides a list of the analyses performed on environmental samples collected for the PNPP REMP.

The required REMP detection limits for samples is determined by sample media and the radionuclide that is being analyzed. The NRC has established LLDs for REMP sample analysis. These LLDs are listed in the PNPP ODCM. The vendor laboratory for REMP sample analysis has complied with these LLDs.

Table 2: REMP Sample Analyses

Type	Sample	Frequency	Analysis
Atmospheric Monitoring	Airborne Particulates	Weekly & Quarterly	Gross Beta Activity & Gamma Spectral Analysis
	Airborne Radioiodine	Weekly	Iodine-131
Terrestrial Monitoring	Milk	Monthly & Semi-Monthly when animals are on pasture	Gamma Spectral Analysis & Iodine-131
	Broadleaf Vegetation	Monthly during growing season	Gamma Spectral Analysis & Iodine-131
Aquatic Monitoring	Water	Monthly	Gross Beta Activity & Gamma Spectral Analysis
		Quarterly	Tritium Activity
	Fish	Semi-Annually	Gamma Spectral Analysis
	Sediment	Semi-annually	Gamma Spectral Analysis
Direct Radiation Monitoring	TLD	Quarterly & Annually	Gamma Dose

6.1 **SAMPLING PROGRAM**

The contribution of radionuclides to the environment resulting from PNPP operation is assessed by comparing results from the environmental monitoring program with pre-operational data (i.e., data from before 1986), operational data from previous years, and control location data. The results for each sample type are discussed below and compared to historical data to determine if there are any observable trends. All results are expressed as concentrations. Refer to Appendix B, 2021 REMP Data Summary Reports for a detailed listing of these results. The NRC requires special reporting whenever sample analysis results exceed set limits. No values exceeded those limits.

6.2 **SAMPLING CHANGES**

There were no changes to the REMP program during this reporting period.

7.0 ATMOSPHERIC MONITORING

7.1 AIR

Air sampling is conducted to detect any increase in the concentration of airborne radionuclides. The PNPP REMP maintains an additional two air sampling locations above the five locations (four indicators and one control) required by the ODCM. Six of these locations are within four miles of the plant site; the seventh is used as a control location and is eleven miles from PNPP. Air sampling pumps draw continuous samples at a rate of approximately two cubic feet per minute. The air is drawn through glass fiber filters to collect particulate material and a charcoal cartridge to adsorb iodine. The samples are collected on a weekly basis, 52 weeks a year, from each of the seven air sampling stations.

Air samples are analyzed weekly for gross beta activity and radioiodine activity. The air samples are also analyzed by gamma spectral analysis quarterly. A total of 363 air particulate and 363 air radioiodine samples were collected and analyzed.

Gross beta activity was detected in 363 of the 363 air samples. The average gross beta activity for indicator locations was 0.029 pCi/m³ and the controls was 0.028 pCi/m³. Historically, the concentration of gross beta in air has been essentially identical at indicator and control locations. Figure 5 reflects the average gross beta activity for 2021 and previous years. All radioiodine samples were less than the lower limit of detection for iodine-131.

With the exception of naturally-occurring beryllium-7, no radionuclides above the LLD values were identified in the quarterly gamma spectral analysis.

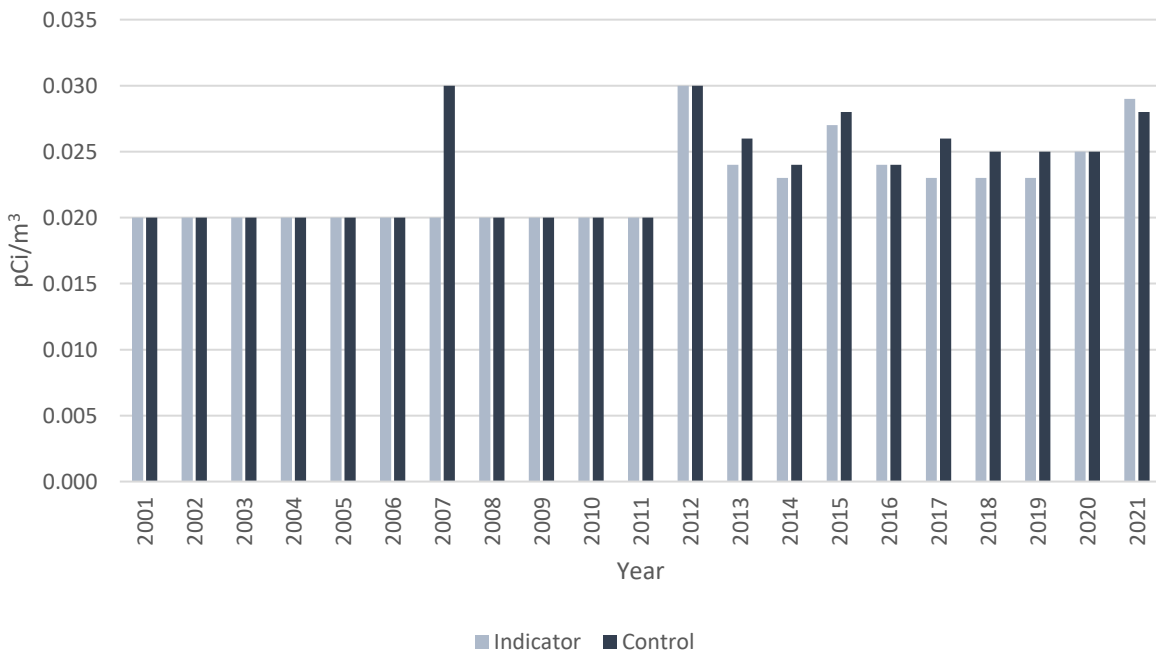


Figure 5: Air Particulate: Analysis for Gross Beta, Average Mean for All Indicator vs. Control

Table 3: Air Particulate and Radioiodine Comparison of Current Year and Historic Data

Pre-Operational (pCi/m ³)	2021 Sample Result Average (pCi/m ³)
0.23	0.28

Air particulate and radioiodine results from this monitoring period, 2021, were similar compared to preoperational data as shown in Table 3 and Figure 5. There were no significant changes in baseline.

8.0 TERRESTRIAL MONITORING

Collecting and analyzing samples of milk (when available) and broadleaf vegetation provides data to assess the build-up of radionuclides that may be ingested by humans. The historical data from soil and vegetation samples provides information on atmospheric radionuclide deposition.

8.1 MILK

Since the milk sampling locations do not meet the requirements of the ODCM (no milk-producing animals are located within the required distance), broadleaf vegetation sampling (discussed below) is performed by PNPP. Milk was collected from the available locations to augment vegetation sampling until Spring 2018.

8.2 BROADLEAF VEGETATION

Because there is not a milking animal within 5 km of the plant, PNPP sampled broadleaf vegetation as required by the ODCM. These samples are collected monthly during the growing season from four gardens in the vicinity of PNPP and one control location 16.2 miles SSW from PNPP.

Seventy-one (71) samples were collected and analyzed by gamma spectral analysis. Four vegetation types were grown and collected: collard greens, turnip greens, kale, and swiss chard. Beryllium-7 and potassium-40, both naturally-occurring radionuclides, were found in the samples. No other radionuclides were detected.

9.0 AQUATIC MONITORING

Radionuclides may be present in Lake Erie from many sources other than the PNPP. These sources include atmospheric deposition, run-off, soil erosion, and releases of radioactivity in liquid effluents from hospitals, universities, or other industrial facilities. These sources provide two forms of potential radiation exposure: external and internal. External exposure can occur from contact with water or shoreline sediments, while internal exposure can occur from either direct ingestion of radionuclides or the transfer of radionuclides through the aquatic food chain. Direct exposure can occur through ingestion by drinking the water, while the transfer via the aquatic food chain occurs from the eventual consumption of aquatic organisms, such as fish. PNPP samples water, shoreline sediments, and fish to monitor these pathways.

9.1 WATER

Water is sampled from five locations along Lake Erie in the vicinity of the PNPP as required by the PNPP ODCM when available and weather permits. Fifty-eight (58) monthly composite samples were collected and analyzed for gross beta activity and gamma spectral analysis. Monthly composite samples are analyzed for gamma emitters. Aliquots from the monthly composites are combined to form quarterly composites which is then analyzed for tritium.

Gross beta activity was detected in 43 of the 58 samples collected. The indicator annual average gross beta activity was 1.4 pCi/L and the control average gross beta activity was 1.1 pCi/L. Refer to Figure 6 for the annual average gross beta activity for both indicator and control locations. No gamma activity was detected in any of the 58 samples collected. The 20 quarterly composite samples had 9 samples where tritium activity was detected. Any positive result less than 500 pCi/L is considered as background activity and not due to plant operations. The highest tritium activity was 252 pCi/L.

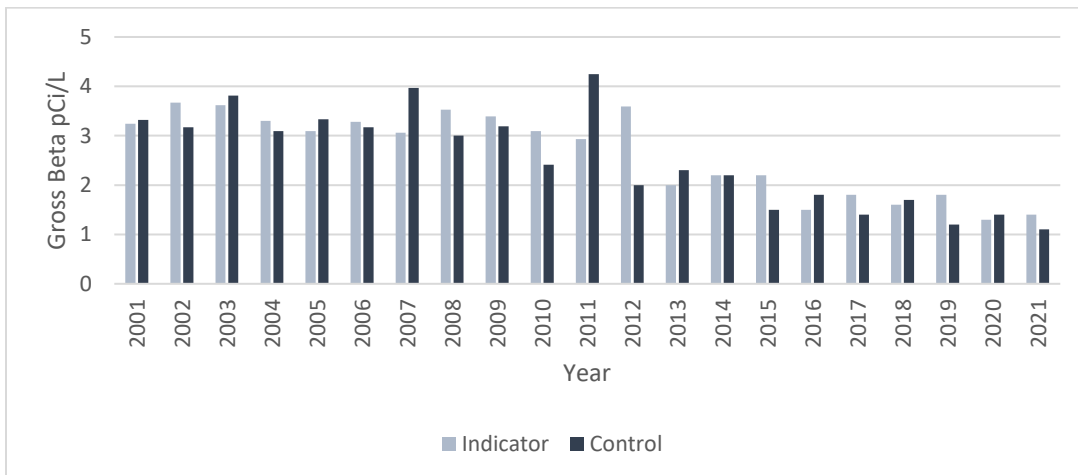


Figure 6: Annual Average Gross Beta Activity in Water

9.2 **SEDIMENT**

Sampling shoreline sediments provides an indication of the accumulation of particulate radionuclides which may lead to an external radiation source to fishermen and swimmers from shoreline exposure. Sediment was sampled from two locations.

A total of four sediment samples were collected in May and October of 2021 and were analyzed by gamma spectroscopy. The only radionuclide detected was naturally-occurring potassium-40.

9.3 **FISH**

Fish are analyzed primarily to quantify the radionuclide intake by humans and secondarily to serve as indicators of radioactivity in the aquatic ecosystem. Fish are collected from two locations annually during the fishing season as required by the ODCM. Important sport or commercial species are targeted, and only the fillets are sent to the laboratory for analysis.

Twenty (20) fish samples were collected and analyzed: 12 indicator and 8 control samples. The species were; walleye, white perch, smallmouth bass, golden redhorse sucker, white sucker, freshwater drum, channel catfish, white bass, gizzard shad, and carp. Only naturally-occurring potassium-40 was detected in these samples.

10.0 **DIRECT RADIATION MONITORING**

10.1 **THERMOLUMINESCENT DOSIMETER (TLD)**

Environmental radiation is measured directly at 27 locations around the PNPP site and at two control locations. The locations are positioned in two rings around the plant as well as at the site boundary. The inner ring is within a one-mile radius of the plant site; the outer ring is four to five miles from the plant. The control locations are over ten miles from the plant in the two least prevalent wind directions. Each location has three TLDs, two of which are changed quarterly, and one that is changed annually.

A total of 279 TLDs were collected and analyzed. This includes 248 collected on a quarterly basis and 31 collected annually. Annual TLDs are not required per the ODCM and are used for supplemental data only.

The annual average dose for all indicator locations was 58.2 mrem and 56.9 mrem for the control locations.

The average quarterly dose for the indicator locations was 15.6 mrem, and 15.1 mrem for the control locations. Refer to Figure 7 for the average quarterly TLD dose rates for both indicator and control locations.

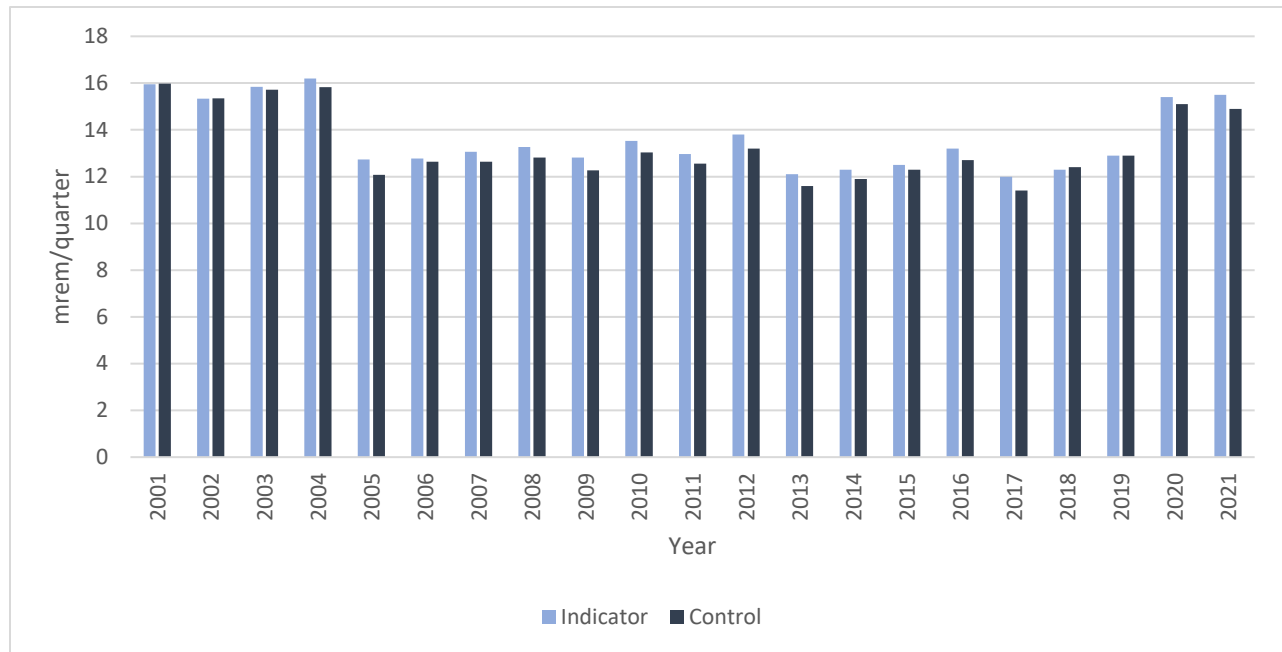


Figure 7: Average Quarterly TLD Dose

11.0 CONCLUSION

There are no discernable trends or increase in radiological parameters when comparing current monitoring results to pre-operational studies. Non-routine analyses were not required during this reporting period. There is no detectable radiological effect on the surrounding environment due to operation of the Perry Nuclear Power Plant.

12.0 INTER-LABORATORY CROSS-CHECK COMPARISON PROGRAM

The purpose of the Inter-laboratory Cross-Check Comparison Program is to provide an independent check on the vendor laboratory's analytical procedures. Samples with a known concentration of specific radionuclides are provided to the vendor laboratory. The vendor laboratory measures and reports the concentration of specified radionuclides. The known values are then compared to the vendor results. Results consistently outside established acceptance criteria indicate a need to check instruments or procedures. Regulatory Guide 4.15 [13] specifically requires that contractor laboratories that performed environmental measurement participate in the EPA's Environmental Radioactivity Laboratory Inter-Comparison Studies Program, or an equivalent program.

The EPA's program is no longer funded or offered. The reason that the EPA program was referenced in the regulatory guide is that the EPA standards were traceable to National Bureau of Standards (now known as National Institute of Standards and Technology). In

response, the vendor lab incorporated a program offered by Environmental Resource Associates (ERA), which covered the same analyses in the same matrix at the same frequency as the EPA program. ERA has received NIST accreditation as an equivalent program. In addition to comparison cross checks performed with ERA, the vendor laboratory routinely monitors the quality of their analyses by analyzing "spiked" samples (samples with a specific quantity of radioactive material present in them) and participating in the Department of Energy's Mixed Analyte Performance Evaluation Program (MAPEP).

See Attachment 1, for the vendor Inter-Laboratory Cross-Check Comparison Program Results.

13.0 LAND USE CENSUS EXPOSURE PATHWAY

In order to estimate radiation dose attributable to operation of the PNPP, the potential pathways through which public exposure can occur must be known. To identify these pathways, an Annual Land Use Census is performed as part of the REMP. During the census, PNPP personnel travel public roads within a five-mile radius of the plant to locate key radiological exposure pathways. These key pathways include the nearest resident and nearest garden in each of the ten meteorological land sectors that surround the plant. The information obtained from the census is entered into a computer program used to assess hypothetical dose to members of the public. The predominant land use within the census area continues to be rural and/or agricultural.

13.1 Introduction

Each year a Land Use Census is conducted to identify the locations of the nearest available milking animal, garden (of greater than 500 square feet), and residence in each of the meteorological sectors that is over land. Information gathered during the Land Use Census is used for off-site dose assessment and to update sampling locations for the REMP. The census is conducted by traveling all roads within a five-mile radius of the plant site and recording and mapping the locations of the nearest resident, available milk animal, and vegetable garden. The Land Use Census was conducted in August 2021. The census identified the garden, and residence locations identified in Table 4 and Table 5 that are depicted in Figure 8. Note that the W, WNW, NW, NNW, N, and NNE sectors extend over Lake Erie and are not included in the survey. No location with an available milking animal was identified.

13.2 Discussion and Results

In general, the predominant land use within the census area continues to be rural/ agricultural. In recent years, however, it has been noted that tracts of land once used for farming are now being developed as mini-industrial parks and residential housing. This is reflected in the loss of available milking animals within a five-kilometer radius of PNPP to support the REMP.

There were no changes to the REMP sampling locations compared to the 2020 Land Use Census. Refer to Figure 2, Figure 3, and Figure 4 for the REMP sampling locations.

Table 4 identifies the nearest residences, by sector, to the PNPP. There were no changes from the 2020 Land Use Census. Refer to Figure 8 for map locator numbers.

Table 4: Nearest Residence, By Sector

Sector	Location Address	Miles from PNPP	Map Locator Number
NE	2348 W. Hemlock	0.9	11
ENE	2452 Antioch	1.1	12
E	2634 Antioch	1.1	3
ESE	2836 Antioch	1.1	4
SE	4671 North Ridge	1.3	15
SSE	4225 Red Mill Valley	1.1	16
S	3121 Center Rd.	0.9	7
SSW	3300 Ohio St.	2.3	17
SW	3021 Perry Park	1.3	13
WSW	3460 Parmly	1.0	14

Table 5 lists the nearest gardens by sector to the PNPP consisting of at least 500 square feet. Refer to Figure 8 for map locator numbers.

Table 5: Nearest Garden, By Sector

Sector	Location Address	Miles from PNPP	Map Locator Number
NE	4384 Lockwood	0.7	1
ENE	4602 Lockwood	1.1	2
E	2626 Antioch	1.0	3
ESE	2836 Antioch	1.1	4
SE	4495 North Ridge	1.3	5
SSE	3119 Parmly	0.9	6
S	3121 Center	0.9	7
SSW	3850 Clark	0.9	8
SW	2997 Perry Park	1.2	9
WSW	3460 Parmly	1.0	10

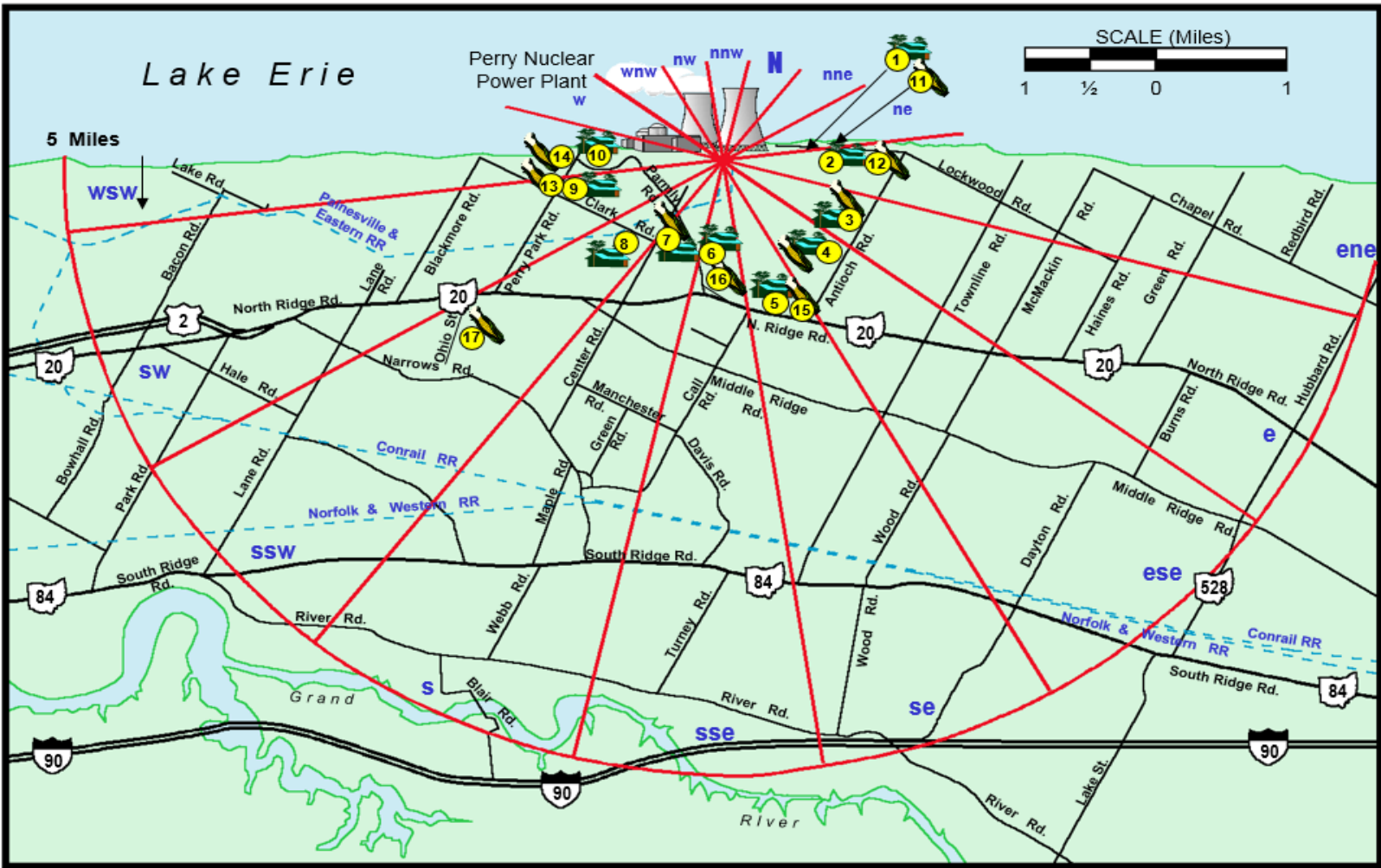


Figure 8: Land Use Census Map

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14.0 ANNUAL ENVIRONMENTAL OPERATING REPORT

The NRC issued Amendment No. 178 to Facility Operating License No. NPF-58 on October 19, 2017. This amendment revises the PNPP “Environmental Protection Plan (Non-radiological)” (EPP) to clarify and enhance wording to remove duplicative or outdated program information, and to relieve the burden of submitting unnecessary or duplicative information to the NRC.

As a result of the above Amendment issued in October 2017, redundant program information is no longer required to be compiled and included in this report. This includes the sections: Clam/Mussel Monitoring, Herbicide Applications, and Special Reports which included National Pollutant Discharge Elimination System Permit exceedances, and the EPP from previous years.

15.0 ODCM NON-COMPLIANCES

There were no ODCM non-compliances for 2021.

15.1 INTROUCTION

Sampling and analysis are performed for media types addressed in the Offsite Dose Calculation Manual. Sampling and analysis challenges may be experienced due to a multitude of reasons including environmental factors, loss of TLDs, contamination of samples, *etc.* To aid classification of sampling and analysis challenges experienced in 2021, the following three terms are used to describe the issues: Sample Anomalies (SA), Sample Deviation (SD), and Unavailable Samples (US).

Media that experienced downtime (*i.e.*, air samplers or water samplers) during a surveillance period are classified a “Sample Deviation”. “Sample Anomalies” are defined as errors that were introduce to a sample once it arrived in the laboratory or errors that prevents the sample from being analyzed as it normally would or may have altered the outcome of the analysis (*i.e.*, cross contamination, human error).

“Sample Unavailability” is defined as sample collection evolution with no available sample (*i.e.*, food crop, TLD).

15.2 SAMPLING CHALLENGES

15.2.1 Sample Unavailability

In February of 2021 shoreline water sampling (#59 and #60) was not performed due to the shoreline being frozen and/or the presence of unsafe conditions to obtain the sample. This is normal for this time of year, and sampling resumed when conditions changed.

15.2.2 Sample Deviations

On 2/3/2021 Parmly (#4) air sampler was found running with no flow on the keypad screen indicating a turbine failure. Flow was checked and read 0.0 cfm. The pump was inspected, and charcoal vanes were replaced. The turbine was replaced, and the pump and turbine were calibrated satisfactorily. The ODCM allows for equipment malfunction therefore it is not a missed sample.

On 2/24/2021 Quincy (#5) air sampler was found running with no flow on the keypad screen indicating a turbine failure. Flow was checked and read 0.0 cfm. The pump was inspected, and charcoal vanes were replaced. The turbine was replaced, and the pump and turbine were calibrated satisfactorily. The sample had enough run time and volume to meet sample LLDs, so it was not a missed sample.

Table 6: Sample Deviation Summary

Sample Classification	Sample Type	Analysis	Location	Collection Date	Reason	Plans for preventing reoccurrence
US	Shoreline	Surface Water	Green Rd (#59)	February 2021	Lake Frozen	NA
US	Shoreline	Surface Water	Perry Park (#60)	February 2021	Lake Frozen	NA
SD	Air	N/A	Parmly (#4)	2/3/2021	No Flow on Keypad	Pump Internals Replaced, Turbine Replaced. Both Calibrated
SD	Air	N/A	Quincy (#5)	2/24/2021	No Flow on Keypad	Pump Internals Replaced, Turbine Replaced. Both Calibrated

15.3 Corrections to Previous Reports

There were no corrections to previously submitted reports.

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Attachment 1, Inter-Laboratory Cross Check Comparison Program Results



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.

January, 2020 through December, 2020

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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)			Acceptance
			Laboratory Result	ERA Result	Control Limits	
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	Analysis	Concentration (pCi/L)			Acceptance
			Laboratory Result	Assigned Value	Acceptance Limits	
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, CaSO₄: Dy Cards).^a

Lab Code	Irradiation Date	Description	mrem			
			Delivered Dose	Reported ^b Dose	Performance ^c Quotient (P)	
<u>Environmental, Inc.</u>		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 $H^*(10)K_0 = 1.20$. 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, CaSO₄: Dy Cards).^a

Lab Code	Irradiation Date	Description	mrem		Performance ^c Quotient (P)	
			Delivered Dose	Reported ^b Dose		
<u>Environmental, Inc.</u>		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 0.878. Conversion from air kerma to ambient dose equivalent for Cs-137 at the reference dose point $H^*(10)K_{cs} = 1.20$. 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			Acceptance	Ratio Lab/Known
			Laboratory results 2s, n=1 ^c	Known Activity	Control Limits ^d		
SPW-3482	10/2/2020	H-3	1,984 ± 154	2,110	1,888 - 2,532	Pass	0.94
SPW-3624	10/9/2020	H-3	1,924 ± 152	2,110	1,888 - 2,532	Pass	0.91
SPW-3794	10/16/2020	H-3	2,109 ± 156	2,110	1,888 - 2,532	Pass	1.00
SPW-3838	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	1,888 - 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-228	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	1,888 - 2,532	Pass	0.95
SPW-4634	11/23/2020	Ra-228	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	1,888 - 2,532	Pass	0.89
SPW-4625	12/18/2020	H-3	1,940 ± 152	2,110	1,888 - 2,532	Pass	0.92
SPW-4741	12/18/2020	Ra-228	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	1,888 - 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	1,888 - 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	1,888 - 2,532	Pass	0.85
SPW-372	2/12/2021	H-3	1,742 ± 145	2,110	1,888 - 2,532	Pass	0.83
SPW-526	3/5/2021	H-3	1,899 ± 150	2,110	1,888 - 2,532	Pass	0.90
SPW-692	3/19/2021	H-3	1,953 ± 151	2,110	1,888 - 2,532	Pass	0.93
SPW-694	1/4/2021	Ra-228	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	1,888 - 2,532	Pass	0.89
SPW-810	3/19/2021	Ra-228	11.4 ± 0.3	12.3	8.6 - 16.0	Pass	0.93
SPDW-30103	3/31/2021	Ra-228	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	1,888 - 2,532	Pass	0.95
SPW-919	4/7/2021	H-3	1,877 ± 149	2,110	1,888 - 2,532	Pass	0.89
SPW-944	4/9/2021	Gr. Alpha	58.7 ± 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	1,888 - 2,532	Pass	0.91
SPW-1250	4/30/2021	H-3	2,015 ± 154	2,110	1,888 - 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 ± 181	2,110	1,888 - 2,532	Pass	1.05
SPDW-30125	5/13/2021	Ra-228	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			Acceptance	Ratio Lab/known
			Laboratory results 2s, n=1 ^c	Known Activity	Control Limits ^d		
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-228	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-228	12.7 ± 0.4	12.3	8.6 - 16.0	Pass	1.03
SPDW-3001	7/29/2021	Ra-228	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-228	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		Acceptance Criteria (4.66 σ)
				Laboratory results (4.66σ)		
				LLD	Activity ^d	
SPW-3481	Water	10/2/2020	H-3	154	63 ± 80	200
SPW-3823	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-228	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-4833	Water	11/23/2020	Ra-228	0.05	0.04 ± 0.11	2
SPW-4508	Water	12/4/2020	H-3	159	-68 ± 69	200
SPW-4824	Water	12/18/2020	H-3	160	8 ± 77	200
SPW-4740	Water	12/18/2020	Ra-228	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-228	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-228	0.04	0.01 ± 0.03	2
SPDW-30102	Water	3/31/2021	Ra-228	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/m³), 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		Acceptance Criteria (4.66 σ)
				Laboratory results (4.66 σ)		
				LLD	Activity ^d	
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-228	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	185	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-228	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-228	0.03	0.02 ± 0.03	2
SPDW-3000	Water	7/29/2021	Ra-228	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-228	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/m³), 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

Lab Code ^b	Date	Analysis	Concentration ^a		Averaged Result	Acceptance
			First Result	Second Result		
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	5.89 ± 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-4568,4567	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	0.058 ± 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

Lab Code ^b	Date	Analysis	Concentration ^a		Averaged Result	Acceptance
			First Result	Second Result		
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-835,838	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	0.087 ± 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-228	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-228	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-228	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-228	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-228	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

Lab Code ^b	Date	Analysis	Concentration ^a		Averaged Result	Acceptance
			First Result	Second Result		
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-228	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-228	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-30189,30170	7/12/2021	Gr. Alpha	2.61 ± 0.87	2.09 ± 0.84	2.35 ± 0.60	Pass
DW-30189,30170	7/12/2021	Gr. Beta	2.09 ± 0.67	2.52 ± 0.60	2.31 ± 0.45	Pass
DW-30189,30170	7/12/2021	Ra-228	0.84 ± 0.24	0.82 ± 0.20	0.83 ± 0.16	Pass
DW-30189,30170	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-228	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-228	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-228	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

Lab Code ^b	Date	Analysis	Concentration ^a		Averaged Result	Acceptance
			First Result	Second Result		
DW-30238,30239	8/25/2021	Gr. Alpha	3.94 ± 0.91	2.43 ± 0.88	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).

Lab Code ^b	Reference Date	Analysis	Laboratory result	Concentration ^a		Acceptance
				Known Activity	Control Limits ^c	
MAAP-3181	8/1/2020	Gross Alpha	0.45 ± 0.08	0.528	0.158 - 0.898	Pass
MAAP-3181	8/1/2020	Gross Beta	0.87 ± 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	985 ± 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 ± 0.18	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 ± 0.088	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 ± 0.08	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).

Lab Code ^b	Reference Date	Analysis	Laboratory result	Concentration ^a		Acceptance
				Known Activity	Control Limits ^c	
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-589	2/1/2021	Cs-134	10.5 ± 0.3	11.5	8.1 - 15.0	Pass
MAW-589	2/1/2021	Cs-137	8.53 ± 0.32	7.9	5.5 - 10.3	Pass
MAW-589	2/1/2021	Co-57	12.2 ± 0.3	11.4	8.0 - 14.8	Pass
MAW-589	2/1/2021	Co-60	0.03 ± 0.05	0	NA ^c	Pass
MAW-589	2/1/2021	Mn-54	16.5 ± 0.4	15.5	10.9 - 20.2	Pass
MAW-589	2/1/2021	Zn-65	11.5 ± 0.5	10.5	7.40 - 13.7	Pass
MAW-589	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 ± 0.08	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

Lab Code ^b	Date	Analysis	Concentration ^a		Control Limits ^d	Acceptance
			Laboratory Result	ERA Value ^c		
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	98.1	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-584, 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.

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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 = 2σ 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 $x_1, x_2 \dots x_n$ 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.

Attachment 2, REMP Data Summary Reports

Pathway Sampled (Units)	Type, Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Locations Mean ¹¹ Detected/Collected Range ¹	Indicator Mean ¹¹ Detected/Collected Range ¹	Location with Highest Annual Mean		Control Mean ¹¹ Detected/Collected Range	Number of Non-routine Reported Measurements
					Location # Distance Direction	Mean ¹¹ Detected/Collected Range		
Air pCi/m ³	Be-7 28	N/A	0.081 28/28 0.055 - 0.142	0.085 24/24 0.055 - 0.142	1 3.4 ENE	0.099 4/4 0.071 - 0.142	0.075 4/4 0.062 - 0.085	0
Air pCi/m ³	Co-58 28	N/A	< LLD 0/28 —	< LLD 0/24 —	—	—	< LLD 0/4 —	0
Air pCi/m ³	Co-60 28	N/A	< LLD 0/28 —	< LLD 0/24 —	—	—	< LLD 0/4 —	0
Air pCi/m ³	Cs-134 28	0.005	< LLD 0/28 —	< LLD 0/24 —	—	—	< LLD 0/4 —	0
Air pCi/m ³	Cs-137 28	0.045	< LLD 0/28 —	< LLD 0/24 —	—	—	< LLD 0/4 —	0
Air pCi/m ³	Gross Beta 363	0.0075	0.029 363/363 0.006 - 0.082	0.029 311/311 0.008 - 0.077	1 3.4 ENE	0.032 52/52 0.014 - 0.077	0.028 52/52 0.006 - 0.082	0

¹ Mean and range are based on detectable measurements only.

Pathway Sampled (Units)	Type, Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Locations Mean ¹¹ Detected/Collected Range ¹	Indicator Mean ¹¹ Detected/Collected Range ¹	Location with Highest Annual Mean		Control Mean ¹¹ Detected/Collected Range	Number of Non-routine Reported Measurements
					Location # Distance Direction	Mean ¹¹ Detected/Collected Range		
Air pCi/m ³	I-131 363	0.050	< LLD 0/363 —	< LLD 0/311 —	—	—	<LLD 0/52 —	0
Broadleaf Vegetation pCi/kg wet	Be-7 71	N/A	370.0 46/71 129 – 1104	374.3 42/57 129 - 1104	2 1.9 ENE	396.3 10/11 225 - 1104	355.2 12/14 204 - 801	0
Broadleaf Vegetation pCi/kg wet	K-40 71	N/A	5318.7 71/71 3056 – 9269	5188.5 57/57 3056 - 8091	20 1.9 E	5848.8 14/14 4004 - 9269	5848.8 14/14 4004 - 9269	0
Broadleaf Vegetation pCi/kg wet	Co-58 71	N/A	< LLD 0/71 —	<LLD 0/57 —	—	—	< LLD 0/14 —	0
Broadleaf Vegetation pCi/kg wet	Co-60 71	N/A	< LLD 0/71 —	<LLD 0/57 —	—	—	< LLD 0/14 —	0
Broadleaf Vegetation pCi/kg wet	I-131 71	45	< LLD 0/71 —	<LLD 0/57 —	—	—	< LLD 0/14 —	0
Broadleaf Vegetation pCi/kg wet	Cs-134 71	45	< LLD 0/71 —	<LLD 0/57 —	—	—	< LLD 0/14 —	0

¹ Mean and range are based on detectable measurements only.

Pathway Sampled (Units)	Type, Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Locations Mean ¹¹ Detected/Collected Range ¹	Indicator Mean ¹¹ Detected/Collected Range ¹	Location with Highest Annual Mean		Control Mean ¹¹ Detected/Collected Range	Number of Non-routine Reported Measurements
					Location # Distance Direction	Mean ¹¹ Detected/Collected Range		
Broadleaf Vegetation pCi/kg wet	Cs-137 71	60	< LLD 0/71 —	<LLD 0/57 —	—	—	< LLD 0/14 —	0
Fish pCi/kg wet	K-40 20	N/A	1193.6 20/20 644 – 2060	1244.9 12/12 706 – 2060	25 0.6 NNW	1244.9 12/12 706 – 2060	116.5 8/8 644- 1651	0
Fish pCi/kg wet	Mn-54 20	94	< LLD 0/20 —	< LLD 0/12 —	—	—	< LLD 0/8 —	0
Fish pCi/kg wet	Fe-59 20	195	< LLD 0/20 —	< LLD 0/12 —	—	—	< LLD 0/8 —	0
Fish pCi/kg wet	Co-58 20	97	< LLD 0/20 —	< LLD 0/12 —	—	—	< LLD 0/8 —	0
Fish pCi/kg wet	Co-60 20	97	< LLD 0/20 —	< LLD 0/12 —	—	—	< LLD 0/8 —	0
Fish pCi/kg wet	Zn-65 20	195	< LLD 0/20 —	< LLD 0/12 —	—	—	< LLD 0/8 —	0

¹ Mean and range are based on detectable measurements only.

Pathway Sampled (Units)	Type, Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Locations Mean ¹¹ Detected/Collected Range ¹	Indicator Mean ¹¹ Detected/Collected Range ¹	Location with Highest Annual Mean		Control Mean ¹¹ Detected/Collected Range	Number of Non-routine Reported Measurements
					Location # Distance Direction	Mean ¹¹ Detected/Collected Range		
Fish pCi/kg wet	Cs-134 20	97	< LLD 0/20 —	< LLD 0/12 —	—	—	< LLD 0/8 —	0
Fish pCi/kg wet	Cs-137 20	112	< LLD 0/20 —	< LLD 0/12 —	—	—	< LLD 0/8 —	0
Sediment pCi/kg wet	K-40 4	N/A	10608.5 4/4 10002 – 11362	10608.5 4/4 10002 – 11362	66 1.4 NE	10698.0 2/2 10034 - 11362	N/A N/A N/A	0
Sediment pCi/kg wet	Co-58 4	50	< LLD 0/4 —	< LLD 0/4 —	—	—	N/A N/A N/A	0
Sediment pCi/kg wet	Co-60 4	40	< LLD 0/4 —	< LLD 0/4 —	—	—	N/A N/A N/A	0
Sediment pCi/kg wet	Cs-134 4	112	< LLD 0/4 —	< LLD 0/4 —	—	—	N/A N/A N/A	0
Sediment pCi/kg wet	Cs-137 4	135	< LLD 0/4 —	< LLD 0/4 —	—	—	N/A N/A N/A	0

¹ Mean and range are based on detectable measurements only.

Pathway Sampled (Units)	Type, Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Locations Mean ¹¹ Detected/Collected Range ¹	Indicator Mean ¹¹ Detected/Collected Range ¹	Location with Highest Annual Mean		Control Mean ¹¹ Detected/Collected Range	Number of Non-routine Reported Measurements
					Location # Distance Direction	Mean ¹¹ Detected/Collected Range		
TLD (E) mR/91 days	Direct 116	1.0	15.1 116/116 9.1 – 21.2	15.2 108/108 11.1 – 21.2	33 4.5 S	20.2 4/4 19.5 – 21.2	14.7 8/8 12.8 – 17.8	0
TLD (Q) mR/91 days	Direct 116	1.0	15.6 116/116 11.6 – 22.5	15.6 108/108 11.6 – 22.5	36 3.9 WSW	19.8 4/4 16.7 – 22.5	15.1 8/8 14.2 – 16.3	0
TLD mR/365 days	Direct 29	1.0	58.1 29/29 25.5 – 79.9	58.2 27/27 25.5 – 79.9	29 4.3 SSE	79.9 1/1 79.9 – 79.9	56.9 2/2 54.0 – 59.8	0
Water pCi/L	Gross Beta 58	3	1.3 43/58 0.9 – 2.3	1.3 39/46 0.9 – 2.3	60 1.0 WSW	1.4 9/11 1.1 – 1.8	1.1 4/12 1.0 – 1.2	0
Water pCi/L	H-3 20	1500	203.8 9/20 161.6 – 252.5	202.4 7/16 161.6 – 252.2	34 0.2 NW	247.6 1/4 247.6 – 247.6	139.1 2/4 185.3 – 232.1	0
Water pCi/L	Mn-54 58	11	< LLD 0/58 —	< LLD 0/46 —	—	—	< LLD 0/12 —	0
Water pCi/L	Fe-59 58	22	< LLD 0/58 —	< LLD 0/46 —	—	—	< LLD 0/12 —	0

¹ Mean and range are based on detectable measurements only.

Pathway Sampled (Units)	Type, Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Locations Mean ¹¹ Detected/Collected Range ¹	Indicator Mean ¹¹ Detected/Collected Range ¹	Location with Highest Annual Mean		Control Mean ¹¹ Detected/Collected Range	Number of Non-routine Reported Measurements
					Location # Distance Direction	Mean ¹¹ Detected/Collected Range		
Water pCi/L	Co-58 58	11	< LLD 0/58 —	< LLD 0/46 —	—	—	< LLD 0/12 —	0
Water pCi/L	Co-60 58	11	< LLD 0/58 —	< LLD 0/46 —	—	—	< LLD 0/12 —	0
Water pCi/L	Zn-65 58	22	< LLD 0/58 —	< LLD 0/46 —	—	—	< LLD 0/12 —	0
Water pCi/L	Zr-95 58	22	< LLD 0/58 —	< LLD 0/46 —	—	—	< LLD 0/12 —	0
Water pCi/L	Nb-95 58	11	< LLD 0/58 —	< LLD 0/46 —	—	—	< LLD 0/12 —	0
Water pCi/L	Cs-134 58	11	< LLD 0/58 —	< LLD 0/46 —	—	—	< LLD 0/12 —	0
Water pCi/L	Cs-137 58	13	< LLD 0/58 —	< LLD 0/46 —	—	—	< LLD 0/12 —	0

¹ Mean and range are based on detectable measurements only.

Pathway Sampled (Units)	Type, Total Number of Analyses Performed	Lower Limit of Detection (LLD)	All Locations Mean ¹¹ Detected/Collected Range ¹	Indicator Mean ¹¹ Detected/Collected Range ¹	Location with Highest Annual Mean		Control Mean ¹¹ Detected/Collected Range	Number of Non-routine Reported Measurements
					Location # Distance Direction	Mean ¹¹ Detected/Collected Range		
Water pCi/L	Ba-140 58	45	< LLD 0/58 —	< LLD 0/46 —	—	—	< LLD 0/12 —	0
Water pCi/L	La-140 58	11	< LLD 0/58 —	< LLD 0/46 —	—	—	< LLD 0/12 —	0

¹ Mean and range are based on detectable measurements only.

Attachment 3, 2021 REMP Detailed Data Report



MONTHLY PROGRESS REPORT
to
FIRST ENERGY CORPORATION

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM (REMP)
FOR THE
PERRY NUCLEAR POWER PLANT

Reporting Period: January-December, 2021

Prepared and Submitted by
ENVIRONMENTAL, INC.,
MIDWEST LABORATORY

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PERRY NUCLEAR POWER PLANT

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PERRY NUCLEAR POWER PLANT

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PERRY NUCLEAR POWER PLANT

1.0 INTRODUCTION

The following constitutes the current 2021 report for the Radiological Environmental Monitoring Program conducted at the Perry Nuclear Power Plant in Perry, Ohio. Results of completed analyses are presented in the attached tables.

The data obtained in the program were within ranges previously encountered and to be expected in the environmental media sampled.

All concentrations, except gross beta, are decay corrected to the time of collection. Airborne iodine is decay corrected to the midpoint of the collection period.

All samples were collected within the scheduled period, unless noted otherwise in Table 2.0, Listing of Missed Samples.

2.0 LISTING OF MISSED SAMPLES

Sample Type	Location	Expected Collection Date	Reason
AP/AI	PE-004	02-03-21	Pump failure; sample not sent due to low volume.
LW	PE-059	02-23-21	Unable to collect water; lake frozen.
LW	PE-060	02-23-21	Unable to collect water; lake frozen.

3.0 DATA TABLES

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Table 1. Direct Radiation (TLDs), Quarterly Exposure.
Units: mR/91 days

	<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>
Date Placed	01-05-21	04-06-21	07-08-21	10-15-21
Date Removed	04-06-21	07-08-21	10-15-21	01-06-22
E-1	14.2 ± 0.7	14.0 ± 1.7	14.7 ± 1.0	15.2 ± 1.9
E-3	12.2 ± 0.7	11.1 ± 1.4	12.1 ± 0.8	11.7 ± 1.5
E-4	14.0 ± 0.7	14.2 ± 1.5	14.3 ± 0.7	14.5 ± 1.6
E-5	13.1 ± 0.6	14.8 ± 1.4	13.4 ± 0.8	11.7 ± 1.9
E-6	14.3 ± 0.8	14.2 ± 1.5	14.3 ± 0.9	15.7 ± 1.6
E-7	13.7 ± 0.6	13.5 ± 1.4	14.6 ± 0.8	13.3 ± 1.5
E-8	13.3 ± 0.6	13.7 ± 1.3	14.0 ± 0.6	14.4 ± 1.4
E-9	12.5 ± 0.5	12.2 ± 1.3	13.6 ± 0.8	13.2 ± 1.5
E-10	14.1 ± 0.7	12.9 ± 1.4	14.9 ± 0.8	16.4 ± 1.7
E-11	13.8 ± 0.8	13.9 ± 1.3	15.0 ± 1.0	14.4 ± 1.4
E-12	13.1 ± 0.7	14.3 ± 1.8	14.6 ± 0.8	14.9 ± 1.9
E-13	13.7 ± 0.8	14.2 ± 1.6	14.6 ± 1.1	13.4 ± 1.6
E-14	14.8 ± 0.5	14.6 ± 1.3	14.2 ± 0.9	14.8 ± 1.5
E-15	13.2 ± 0.6	13.4 ± 1.5	13.6 ± 0.8	14.3 ± 1.6
E-21	15.7 ± 1.7	16.0 ± 1.3	17.8 ± 0.8	16.4 ± 1.4
E-23	16.5 ± 0.7	16.0 ± 1.3	17.6 ± 0.7	16.9 ± 1.4
E-24	14.8 ± 0.7	12.8 ± 1.3	15.0 ± 0.8	13.5 ± 1.4
E-29	18.0 ± 1.0	18.1 ± 1.4	19.5 ± 1.1	18.8 ± 1.5
E-30	16.3 ± 0.6	16.4 ± 1.4	17.3 ± 0.8	17.0 ± 1.5
E-31	17.2 ± 0.6	17.3 ± 1.3	19.1 ± 1.1	18.0 ± 1.4
E-33	20.0 ± 1.1	19.5 ± 1.4	21.2 ± 1.1	20.0 ± 1.5
E-35	14.1 ± 0.7	12.7 ± 1.4	14.7 ± 0.7	12.9 ± 1.5
E-36	18.0 ± 0.8	17.2 ± 1.4	19.6 ± 0.9	17.2 ± 1.4
E-53	15.7 ± 0.6	14.6 ± 1.3	16.5 ± 0.6	14.6 ± 1.5
E-54	15.3 ± 0.5	14.3 ± 1.3	16.1 ± 0.6	14.9 ± 1.7
E-55	14.9 ± 1.3	15.6 ± 1.4	16.8 ± 1.5	15.6 ± 1.6
E-56	14.8 ± 0.8	14.9 ± 1.4	15.6 ± 0.8	15.0 ± 1.5
E-57	16.0 ± 0.7	14.8 ± 1.6	17.0 ± 0.9	15.8 ± 1.7
E-58	12.5 ± 0.8	12.8 ± 1.4	13.1 ± 0.9	13.9 ± 1.5
Mean ± s.d.	14.8 ± 1.8	14.6 ± 1.8	15.7 ± 2.2	15.1 ± 1.9
E-Control 1	9.4 ± 0.5	9.9 ± 1.3	9.5 ± 0.8	10.0 ± 1.5
E-Control 2	9.6 ± 0.7	9.1 ± 1.3	9.5 ± 0.7	9.6 ± 1.4

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Table 1. Direct Radiation (TLDs), Quarterly Exposure.
Units: mR/91 days

	<u>1st Qtr.</u>	<u>2nd Qtr.</u>	<u>3rd Qtr.</u>	<u>4th Qtr.</u>
Date Placed	01-05-21	04-06-21	07-08-21	12-15-21
Date Removed	04-06-21	07-08-21	10-15-21	01-06-22
Q-1	14.1 ± 1.0	12.8 ± 1.3	14.8 ± 1.1	14.7 ± 1.5
Q-3	12.4 ± 0.6	12.2 ± 0.9	12.3 ± 0.6	14.7 ± 1.0
Q-4	14.3 ± 0.5	13.7 ± 0.7	15.2 ± 0.5	16.1 ± 1.0
Q-5	13.4 ± 0.7	12.1 ± 0.8	13.7 ± 0.6	14.2 ± 1.2
Q-6	14.6 ± 0.5	14.3 ± 0.7	15.1 ± 0.5	16.3 ± 0.9
Q-7	14.4 ± 0.6	13.8 ± 0.6	14.7 ± 0.4	16.3 ± 0.8
Q-8	13.8 ± 0.5	13.7 ± 0.6	14.2 ± 0.6	14.0 ± 0.8
Q-9	13.1 ± 0.7	12.7 ± 0.6	13.6 ± 0.6	13.6 ± 0.8
Q-10	13.8 ± 0.5	12.9 ± 0.7	14.2 ± 0.7	15.3 ± 0.8
Q-11	15.9 ± 0.8	14.1 ± 0.7	16.4 ± 0.5	16.2 ± 0.8
Q-12	14.2 ± 0.5	14.9 ± 0.6	15.0 ± 0.5	17.6 ± 0.8
Q-13	13.7 ± 0.6	14.6 ± 1.0	15.0 ± 0.5	16.8 ± 1.1
Q-14	15.4 ± 0.5	13.7 ± 0.7	16.0 ± 0.5	15.5 ± 0.9
Q-15	12.0 ± 0.5	13.9 ± 0.9	12.8 ± 0.9	15.6 ± 1.3
Q-21	15.6 ± 0.8	16.8 ± 1.1	17.7 ± 1.0	19.6 ± 1.4
Q-23	16.0 ± 1.2	16.8 ± 1.0	18.6 ± 1.4	17.2 ± 1.3
Q-24	14.6 ± 1.4	14.2 ± 0.7	15.0 ± 1.2	16.3 ± 0.9
Q-29	17.0 ± 0.6	18.8 ± 1.0	18.3 ± 0.9	21.5 ± 1.3
Q-30	16.3 ± 0.7	16.6 ± 0.9	16.8 ± 0.6	19.1 ± 1.5
Q-31	18.2 ± 0.7	17.9 ± 0.8	19.0 ± 0.8	20.2 ± 1.0
Q-33	19.4 ± 0.6	18.6 ± 1.1	20.4 ± 0.8	20.7 ± 1.2
Q-35	16.2 ± 0.5	13.3 ± 0.7	16.5 ± 0.5	15.5 ± 0.9
Q-36	21.1 ± 0.9	16.7 ± 0.6	22.5 ± 0.8	18.7 ± 0.7
Q-53	15.2 ± 0.6	15.0 ± 0.8	16.1 ± 0.6	17.0 ± 1.0
Q-54	14.6 ± 0.6	15.2 ± 0.6	15.3 ± 0.6	15.5 ± 0.9
Q-55	15.2 ± 0.8	15.3 ± 0.6	16.0 ± 0.8	17.7 ± 0.8
Q-56	14.8 ± 0.6	14.0 ± 0.8	15.5 ± 0.7	15.9 ± 0.7
Q-57	15.7 ± 1.1	15.2 ± 0.9	16.5 ± 0.8	18.0 ± 1.1
Q-58	11.6 ± 0.8	12.1 ± 0.6	13.2 ± 0.7	13.4 ± 0.8
Mean ± s.d.	15.1 ± 2.0	14.7 ± 1.9	15.9 ± 2.3	16.7 ± 2.1
Q-Control 1	9.5 ± 0.5	10.2 ± 1.1	9.7 ± 0.7	9.0 ± 0.7
Q-Control 2	9.5 ± 0.5	9.0 ± 0.6	9.5 ± 0.5	9.3 ± 0.7

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Table 1. Direct Radiation (TLDs), Annual Exposure.
Units: mR/365 days

	2021
Date Placed	01-05-21
Date Removed	01-06-22
A-1	25.5 ± 2.7
A-3	49.4 ± 2.7
A-4	52.1 ± 3.7
A-5	49.4 ± 2.3
A-6	59.8 ± 2.1
A-7	52.3 ± 2.5
A-8	55.6 ± 2.4
A-9	52.3 ± 1.8
A-10	55.9 ± 2.0
A-11	59.9 ± 2.3
A-12	58.8 ± 2.4
A-13	59.7 ± 3.2
A-14	52.8 ± 3.6
A-15	51.4 ± 3.4
A-21	68.2 ± 4.1
A-23	63.5 ± 2.3
A-24	54.0 ± 3.7
A-29	79.9 ± 3.9
A-30	66.7 ± 3.0
A-31	72.9 ± 3.3
A-33	78.1 ± 3.9
A-35	56.3 ± 2.7
A-36	65.0 ± 3.9
A-53	56.5 ± 3.3
A-54	63.5 ± 4.6
A-55	59.0 ± 5.4
A-56	56.1 ± 3.7
A-57	57.3 ± 3.3
A-58	53.7 ± 2.3
Mean ± s.d.	58.1 ± 10.1
A-Control 1	34.7 ± 2.0
A-Control 2	34.4 ± 1.7

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Table 2. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131.

Location: P-1

Units: pCi/m³

Collection: Continuous, weekly exchange.

Date Collected	Volume (m ³)	Gross Beta	I-131	Date Collected	Volume (m ³)	Gross Beta	I-131
Required LLD		<u>0.0075</u>	<u>0.050</u>			<u>0.0075</u>	<u>0.050</u>
01-06-21	579	0.026 ± 0.003	< 0.011	07-07-21	532	0.026 ± 0.003	< 0.005
01-13-21	568	0.035 ± 0.003	< 0.004	07-14-21	536	0.022 ± 0.003	< 0.009
01-20-21	554	0.030 ± 0.003	< 0.012	07-21-21	524	0.027 ± 0.003	< 0.005
01-28-21	646	0.017 ± 0.003	< 0.006	07-28-21	541	0.025 ± 0.003	< 0.012
02-03-21	515	0.014 ± 0.003	< 0.008				
				08-04-21	520	0.020 ± 0.003	< 0.006
02-10-21	587	0.036 ± 0.003	< 0.004	08-11-21	456	0.038 ± 0.004	< 0.008
02-17-21	612	0.030 ± 0.003	< 0.007	08-18-21	482	0.023 ± 0.003	< 0.009
02-24-21	586	0.053 ± 0.004	< 0.010	08-25-21	469	0.043 ± 0.004	< 0.006
03-03-21	584	0.023 ± 0.003	< 0.006	09-01-21	474	0.037 ± 0.004	< 0.015
03-10-21	559	0.041 ± 0.003	< 0.013	09-08-21	457	0.027 ± 0.004	< 0.009
03-17-21	552	0.042 ± 0.003	< 0.004	09-15-21	537	0.027 ± 0.003	< 0.007
03-25-21	543	0.043 ± 0.003	< 0.007	09-22-21	539	0.030 ± 0.003	< 0.009
03-31-21	429	0.036 ± 0.004	< 0.007	09-29-21	495	0.026 ± 0.003	< 0.013
<hr/>				<hr/>			
1Q 2021	Mean ± s.d.	0.033 ± 0.011	< 0.013	3Q 2021	Mean ± s.d.	0.029 ± 0.007	< 0.015
04-07-21	459	0.060 ± 0.004	< 0.007	10-06-21	504	0.026 ± 0.003	< 0.016
04-14-21	423	0.044 ± 0.004	< 0.008	10-13-21	493	0.023 ± 0.003	< 0.014
04-21-21	424	0.028 ± 0.003	< 0.010	10-20-21	502	0.035 ± 0.004	< 0.011
04-28-21	356	0.069 ± 0.005	< 0.010	10-27-21	499	0.025 ± 0.003	< 0.009
				11-03-21	496	0.016 ± 0.003	< 0.007
05-05-21	516	0.037 ± 0.003	< 0.011				
05-12-21	489	0.015 ± 0.003	< 0.008	11-10-21	497	0.038 ± 0.004	< 0.007
05-19-21	560	0.037 ± 0.003	< 0.014	11-17-21	471	0.023 ± 0.003	< 0.008
05-26-21	372	0.077 ± 0.006	< 0.009	11-24-21	543	0.024 ± 0.003	< 0.010
06-02-21	401	0.040 ± 0.004	< 0.010	12-01-21	500	0.022 ± 0.003	< 0.014
06-09-21	571	0.027 ± 0.003	< 0.014	12-08-21	473	0.028 ± 0.004	< 0.011
06-16-21	572	0.019 ± 0.003	< 0.005	12-15-21	569	0.037 ± 0.003	< 0.010
06-23-21	547	0.020 ± 0.003	< 0.011	12-22-21	538	0.031 ± 0.003	< 0.011
06-30-21	551	0.023 ± 0.003	< 0.008	12-29-21	529	0.047 ± 0.004	< 0.009
<hr/>				<hr/>			
2Q 2021	Mean ± s.d.	0.038 ± 0.020	< 0.014	4Q 2021	Mean ± s.d.	0.029 ± 0.008	< 0.016
						Cumulative Average	0.032

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Table 2: Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131.

Location: P-3

Units: pCi/m³

Collection: Continuous, weekly exchange.

Date Collected	Volume (m ³)	Gross Beta	I-131	Date Collected	Volume (m ³)	Gross Beta	I-131
Required LLD		<u>0.0075</u>	<u>0.050</u>			<u>0.0075</u>	<u>0.050</u>
01-06-21	570	0.028 ± 0.003	< 0.011	07-07-21	524	0.023 ± 0.003	< 0.005
01-13-21	565	0.035 ± 0.003	< 0.004	07-14-21	562	0.020 ± 0.002	< 0.009
01-20-21	541	0.032 ± 0.003	< 0.012	07-21-21	520	0.026 ± 0.003	< 0.005
01-28-21	638	0.019 ± 0.003	< 0.006	07-28-21	554	0.026 ± 0.003	< 0.012
02-03-21	521	0.015 ± 0.003	< 0.008				
				08-04-21	548	0.021 ± 0.003	< 0.006
02-10-21	555	0.040 ± 0.004	< 0.004	08-11-21	547	0.032 ± 0.003	< 0.007
02-17-21	597	0.029 ± 0.003	< 0.007	08-18-21	533	0.021 ± 0.003	< 0.009
02-24-21	577	0.049 ± 0.004	< 0.010	08-25-21	561	0.036 ± 0.003	< 0.005
03-03-21	574	0.023 ± 0.003	< 0.006	09-01-21	547	0.031 ± 0.003	< 0.013
03-10-21	589	0.031 ± 0.003	< 0.012	09-08-21	535	0.030 ± 0.003	< 0.008
03-17-21	612	0.026 ± 0.003	< 0.004	09-15-21	601	0.028 ± 0.003	< 0.006
03-25-21	708	0.022 ± 0.002	< 0.006	09-22-21	566	0.028 ± 0.003	< 0.009
03-31-21	539	0.019 ± 0.003	< 0.005	09-29-21	574	0.022 ± 0.003	< 0.011
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1Q 2021	Mean ± s.d.	0.028 ± 0.009	< 0.012	3Q 2021	Mean ± s.d.	0.026 ± 0.005	< 0.013
04-07-21	624	0.029 ± 0.003	< 0.005	10-06-21	597	0.022 ± 0.003	< 0.013
04-14-21	622	0.022 ± 0.002	< 0.005	10-13-21	603	0.021 ± 0.003	< 0.011
04-21-21	515	0.012 ± 0.002	< 0.008	10-20-21	569	0.032 ± 0.003	< 0.010
04-28-21	536	0.026 ± 0.003	< 0.007	10-27-21	571	0.024 ± 0.003	< 0.008
				11-03-21	577	0.017 ± 0.003	< 0.006
05-05-21	533	0.020 ± 0.003	< 0.011				
05-12-21	539	0.008 ± 0.002	< 0.007	11-10-21	592	0.039 ± 0.003	< 0.006
05-19-21	561	0.023 ± 0.003	< 0.014	11-17-21	574	0.022 ± 0.003	< 0.006
05-26-21	553	0.034 ± 0.003	< 0.006	11-24-21	592	0.021 ± 0.003	< 0.009
06-02-21	523	0.018 ± 0.003	< 0.008	12-01-21	562	0.021 ± 0.003	< 0.012
06-09-21	560	0.031 ± 0.003	< 0.014	12-08-21	586	0.031 ± 0.003	< 0.009
06-16-21	555	0.021 ± 0.003	< 0.005	12-15-21	599	0.036 ± 0.003	< 0.010
06-23-21	551	0.021 ± 0.003	< 0.011	12-22-21	566	0.028 ± 0.003	< 0.010
06-30-21	546	0.024 ± 0.003	< 0.008	12-29-21	580	0.040 ± 0.003	< 0.008
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2Q 2021	Mean ± s.d.	0.022 ± 0.007	< 0.014	4Q 2021	Mean ± s.d.	0.027 ± 0.008	< 0.013
						Cumulative Average	0.026

PNPP

Table 2. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131.

Location: P-4

Units: pCi/m³

Collection: Continuous, weekly exchange.

Date Collected	Volume (m ³)	Gross Beta	I-131	Date Collected	Volume (m ³)	Gross Beta	I-131
<u>Required LLD</u>		<u>0.0075</u>	<u>0.050</u>			<u>0.0075</u>	<u>0.050</u>
01-06-21	568	0.027 ± 0.003	< 0.011	07-07-21	522	0.038 ± 0.004	< 0.005
01-13-21	570	0.031 ± 0.003	< 0.004	07-14-21	550	0.032 ± 0.003	< 0.009
01-20-21	556	0.034 ± 0.003	< 0.012	07-21-21	514	0.045 ± 0.003	< 0.005
01-28-21	647	0.013 ± 0.002	< 0.006	07-28-21	541	0.041 ± 0.004	< 0.012
02-03-21		NS ^a		08-04-21	536	0.033 ± 0.003	< 0.006
02-10-21	707	0.030 ± 0.003	< 0.003	08-11-21	521	0.052 ± 0.004	< 0.007
02-17-21	707	0.018 ± 0.002	< 0.006	08-18-21	528	0.028 ± 0.003	< 0.009
02-24-21	669	0.038 ± 0.003	< 0.009	08-25-21	522	0.059 ± 0.004	< 0.006
03-03-21	654	0.020 ± 0.003	< 0.005	09-01-21	530	0.053 ± 0.004	< 0.013
03-10-21	645	0.026 ± 0.003	< 0.011	09-08-21	471	0.049 ± 0.004	< 0.009
03-17-21	534	0.029 ± 0.003	< 0.004	09-15-21	656	0.024 ± 0.003	< 0.006
03-25-21	558	0.030 ± 0.003	< 0.007	09-22-21	686	0.026 ± 0.003	< 0.007
03-31-21	406	0.019 ± 0.003	< 0.007	09-29-21	659	0.019 ± 0.003	< 0.010
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1Q 2021	Mean ± s.d.	0.026 ± 0.007	< 0.012	3Q 2021	Mean ± s.d.	0.038 ± 0.013	< 0.013
04-07-21	415	0.044 ± 0.004	< 0.007	10-06-21	687	0.018 ± 0.002	< 0.011
04-14-21	426	0.032 ± 0.003	< 0.007	10-13-21	641	0.017 ± 0.003	< 0.010
04-21-21	476	0.019 ± 0.003	< 0.009	10-20-21	614	0.026 ± 0.003	< 0.009
04-28-21	474	0.034 ± 0.003	< 0.007	10-27-21	654	0.020 ± 0.003	< 0.007
				11-03-21	651	0.012 ± 0.002	< 0.005
05-05-21	512	0.024 ± 0.003	< 0.011	11-10-21	671	0.021 ± 0.003	< 0.005
05-12-21	503	0.011 ± 0.003	< 0.008	11-17-21	622	0.016 ± 0.002	< 0.006
05-19-21	537	0.030 ± 0.003	< 0.014	11-24-21	643	0.015 ± 0.002	< 0.009
05-26-21	517	0.040 ± 0.004	< 0.007	12-01-21	630	0.015 ± 0.003	< 0.011
06-02-21	505	0.019 ± 0.003	< 0.008				
06-09-21	536	0.032 ± 0.003	< 0.014	12-08-21	647	0.018 ± 0.003	< 0.008
06-16-21	474	0.014 ± 0.003	< 0.006	12-15-21	640	0.026 ± 0.003	< 0.009
06-23-21	409	0.027 ± 0.004	< 0.014	12-22-21	593	0.021 ± 0.003	< 0.010
06-30-21	553	0.038 ± 0.003	< 0.008	12-29-21	621	0.033 ± 0.003	< 0.008
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2Q 2021	Mean ± s.d.	0.028 ± 0.010	< 0.014	4Q 2021	Mean ± s.d.	0.020 ± 0.006	< 0.011
						Cumulative Average	0.029

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

PNPP

Table 2. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131.

Location: P-5

Units: pCi/m³

Collection: Continuous, weekly exchange.

Date Collected	Volume (m ³)	Gross Beta	I-131	Date Collected	Volume (m ³)	Gross Beta	I-131
Required LLD		<u>0.0075</u>	<u>0.050</u>			<u>0.0075</u>	<u>0.050</u>
01-06-21	614	0.027 ± 0.003	< 0.010	07-07-21	442	0.029 ± 0.004	< 0.006
01-13-21	574	0.036 ± 0.003	< 0.004	07-14-21	560	0.025 ± 0.003	< 0.009
01-20-21	579	0.031 ± 0.003	< 0.012	07-21-21	544	0.028 ± 0.003	< 0.005
01-28-21	659	0.015 ± 0.002	< 0.006	07-28-21	566	0.034 ± 0.003	< 0.011
02-03-21	524	0.016 ± 0.003	< 0.008				
				08-04-21	550	0.029 ± 0.003	< 0.006
02-10-21	571	0.043 ± 0.004	< 0.004	08-11-21	537	0.046 ± 0.004	< 0.007
02-17-21	611	0.032 ± 0.003	< 0.007	08-18-21	548	0.026 ± 0.003	< 0.008
02-24-21	301	0.058 ± 0.006	< 0.019 ^a	08-25-21	535	0.051 ± 0.004	< 0.005
03-03-21	656	0.019 ± 0.002	< 0.005	09-01-21	550	0.048 ± 0.004	< 0.013
03-10-21	668	0.025 ± 0.003	< 0.010	09-08-21	495	0.041 ± 0.004	< 0.009
03-17-21	555	0.026 ± 0.003	< 0.004	09-15-21	562	0.023 ± 0.003	< 0.007
03-25-21	603	0.026 ± 0.003	< 0.007	09-22-21	546	0.028 ± 0.003	< 0.009
03-31-21	439	0.019 ± 0.003	< 0.006	09-29-21	508	0.024 ± 0.003	< 0.013
1Q 2021 Mean ± s.d. 0.029 ± 0.012 < 0.019				3Q 2021 Mean ± s.d. 0.033 ± 0.010 < 0.013			
04-07-21	456	0.038 ± 0.004	< 0.007	10-06-21	524	0.019 ± 0.003	< 0.015
04-14-21	447	0.026 ± 0.003	< 0.007	10-13-21	507	0.018 ± 0.003	< 0.013
04-21-21	557	0.016 ± 0.002	< 0.008	10-20-21	489	0.028 ± 0.003	< 0.012
04-28-21	539	0.032 ± 0.003	< 0.007	10-27-21	450	0.021 ± 0.004	< 0.010
				11-03-21	462	0.015 ± 0.003	< 0.007
05-05-21	537	0.022 ± 0.003	< 0.011				
05-12-21	517	0.011 ± 0.002	< 0.008	11-10-21	514	0.032 ± 0.003	< 0.006
05-19-21	517	0.033 ± 0.004	< 0.015	11-17-21	441	0.022 ± 0.003	< 0.008
05-26-21	511	0.038 ± 0.004	< 0.007	11-24-21	469	0.023 ± 0.003	< 0.012
06-02-21	467	0.024 ± 0.003	< 0.009	12-01-21	309	0.020 ± 0.005	< 0.022
06-09-21	544	0.033 ± 0.003	< 0.014	12-08-21	537	0.026 ± 0.003	< 0.010
06-16-21	469	0.025 ± 0.004	< 0.006	12-15-21	628	0.034 ± 0.003	< 0.009
06-23-21	467	0.028 ± 0.004	< 0.013	12-22-21	587	0.030 ± 0.003	< 0.010
06-30-21	460	0.032 ± 0.004	< 0.010	12-29-21	543	0.047 ± 0.004	< 0.009
2Q 2021 Mean ± s.d. 0.028 ± 0.008 < 0.015				4Q 2020 Mean ± s.d. 0.026 ± 0.009 < 0.022			
Cumulative Average						0.029	

^a Lower volume due to a pump malfunction.

PNPP

Table 2. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131.

Location: P-6
 Units: pCi/m³
 Collection: Continuous, weekly exchange.

Date Collected	Volume (m ³)	Gross Beta	I-131	Date Collected	Volume (m ³)	Gross Beta	I-131
<u>Required LLD</u>		<u>0.0075</u>	<u>0.050</u>			<u>0.0075</u>	<u>0.050</u>
01-06-21	511	0.033 ± 0.003	< 0.012	07-07-21	533	0.021 ± 0.003	< 0.005
01-13-21	505	0.044 ± 0.004	< 0.005	07-14-21	546	0.017 ± 0.002	< 0.009
01-20-21	465	0.038 ± 0.004	< 0.014	07-21-21	524	0.026 ± 0.003	< 0.005
01-28-21	612	0.027 ± 0.003	< 0.006	07-28-21	542	0.026 ± 0.003	< 0.012
02-03-21	473	0.023 ± 0.003	< 0.008				
				08-04-21	547	0.019 ± 0.003	< 0.006
02-10-21	528	0.062 ± 0.004	< 0.005	08-11-21	520	0.032 ± 0.003	< 0.007
02-17-21	544	0.049 ± 0.004	< 0.008	08-18-21	550	0.017 ± 0.003	< 0.008
02-24-21	528	0.082 ± 0.005	< 0.011	08-25-21	527	0.035 ± 0.003	< 0.005
03-03-21	532	0.040 ± 0.004	< 0.006	09-01-21	533	0.035 ± 0.003	< 0.013
03-10-21	540	0.052 ± 0.004	< 0.013	09-08-21	529	0.025 ± 0.003	< 0.008
03-17-21	582	0.025 ± 0.003	< 0.004	09-15-21	576	0.029 ± 0.003	< 0.007
03-25-21	654	0.023 ± 0.002	< 0.006	09-22-21	572	0.030 ± 0.003	< 0.009
03-31-21	511	0.018 ± 0.003	< 0.006	09-29-21	572	0.024 ± 0.003	< 0.011
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1Q 2021	Mean ± s.d.	0.040 ± 0.018	< 0.014	3Q 2021	Mean ± s.d.	0.026 ± 0.006	< 0.013
04-07-21	574	0.029 ± 0.003	< 0.005	10-06-21	602	0.022 ± 0.003	< 0.013
04-14-21	594	0.023 ± 0.002	< 0.005	10-13-21	586	0.020 ± 0.003	< 0.011
04-21-21	572	0.012 ± 0.002	< 0.007	10-20-21	591	0.028 ± 0.003	< 0.010
04-28-21	568	0.023 ± 0.003	< 0.006	10-27-21	571	0.022 ± 0.003	< 0.008
				11-03-21	585	0.016 ± 0.003	< 0.006
05-05-21	585	0.018 ± 0.002	< 0.010				
05-12-21	578	0.006 ± 0.002	< 0.007	11-10-21	608	0.035 ± 0.003	< 0.005
05-19-21	583	0.022 ± 0.003	< 0.013	11-17-21	586	0.021 ± 0.003	< 0.006
05-26-21	577	0.029 ± 0.003	< 0.006	11-24-21	718	0.020 ± 0.002	< 0.008
06-02-21	578	0.011 ± 0.003	< 0.007	12-01-21	497	0.017 ± 0.003	< 0.014
06-09-21	573	0.025 ± 0.003	< 0.014	12-08-21	625	0.026 ± 0.003	< 0.009
06-16-21	551	0.018 ± 0.003	< 0.005	12-15-21	596	0.034 ± 0.003	< 0.010
06-23-21	543	0.017 ± 0.003	< 0.011	12-22-21	586	0.029 ± 0.003	< 0.010
06-30-21	534	0.024 ± 0.003	< 0.009	12-29-21	570	0.049 ± 0.004	< 0.008
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2Q 2021	Mean ± s.d.	0.020 ± 0.007	< 0.014	4Q 2021	Mean ± s.d.	0.026 ± 0.009	< 0.014
						Cumulative Average	0.028

PNPP

Table 2. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131.

Location: P-7

Units: pCi/m³

Collection: Continuous, weekly exchange.

Date Collected	Volume (m ³)	Gross Beta	I-131	Date Collected	Volume (m ³)	Gross Beta	I-131
<u>Required LLD</u>		<u>0.0075</u>	<u>0.050</u>			<u>0.0075</u>	<u>0.050</u>
01-06-21	572	0.030 ± 0.003	< 0.011	07-07-21	565	0.028 ± 0.003	< 0.005
01-13-21	545	0.035 ± 0.003	< 0.004	07-14-21	573	0.024 ± 0.003	< 0.009
01-20-21	544	0.033 ± 0.003	< 0.012	07-21-21	563	0.027 ± 0.003	< 0.005
01-28-21	625	0.019 ± 0.003	< 0.006	07-28-21	580	0.031 ± 0.003	< 0.011
02-03-21	507	0.017 ± 0.003	< 0.008				
				08-04-21	581	0.025 ± 0.003	< 0.005
02-10-21	566	0.041 ± 0.004	< 0.004	08-11-21	570	0.039 ± 0.003	< 0.007
02-17-21	597	0.029 ± 0.003	< 0.007	08-18-21	594	0.021 ± 0.003	< 0.008
02-24-21	571	0.058 ± 0.004	< 0.010	08-25-21	574	0.045 ± 0.004	< 0.005
03-03-21	577	0.025 ± 0.003	< 0.006	09-01-21	588	0.044 ± 0.003	< 0.012
03-10-21	563	0.030 ± 0.003	< 0.012	09-08-21	555	0.034 ± 0.003	< 0.008
03-17-21	561	0.027 ± 0.003	< 0.004	09-15-21	625	0.029 ± 0.003	< 0.006
03-25-21	599	0.023 ± 0.003	< 0.007	09-22-21	493	0.036 ± 0.004	< 0.010
03-31-21	413	0.020 ± 0.003	< 0.007	09-29-21	427	0.029 ± 0.004	< 0.015
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1Q 2021	Mean ± s.d.	0.030 ± 0.011	< 0.012	3Q 2021	Mean ± s.d.	0.032 ± 0.007	< 0.015
04-07-21	459	0.034 ± 0.003	< 0.007	10-06-21	463	0.031 ± 0.004	< 0.017
04-14-21	452	0.025 ± 0.003	< 0.007	10-13-21	596	0.024 ± 0.003	< 0.011
04-21-21	542	0.015 ± 0.002	< 0.008	10-20-21	587	0.036 ± 0.003	< 0.010
04-28-21	514	0.031 ± 0.003	< 0.007	10-27-21	615	0.026 ± 0.003	< 0.007
				11-03-21	613	0.018 ± 0.003	< 0.006
05-05-21	538	0.025 ± 0.003	< 0.011				
05-12-21	545	0.009 ± 0.002	< 0.007	11-10-21	681	0.032 ± 0.003	< 0.005
05-19-21	535	0.032 ± 0.003	< 0.014	11-17-21	662	0.025 ± 0.003	< 0.006
05-26-21	511	0.036 ± 0.004	< 0.007	11-24-21	697	0.026 ± 0.003	< 0.008
06-02-21	521	0.024 ± 0.003	< 0.008	12-01-21	683	0.023 ± 0.003	< 0.010
06-09-21	478	0.038 ± 0.004	< 0.016	12-08-21	710	0.026 ± 0.003	< 0.008
06-16-21	563	0.024 ± 0.003	< 0.005	12-15-21	540	0.036 ± 0.003	< 0.011
06-23-21	560	0.023 ± 0.003	< 0.010	12-22-21	541	0.029 ± 0.003	< 0.011
06-30-21	586	0.028 ± 0.003	< 0.008	12-29-21	548	0.047 ± 0.004	< 0.009
<hr/>				<hr/>			
2Q 2021	Mean ± s.d.	0.026 ± 0.008	< 0.016	4Q 2021	Mean ± s.d.	0.029 ± 0.007	< 0.017
Cumulative Average						0.029	

PNPP

Table 2. Airborne particulates and charcoal canisters, analyses for gross beta and iodine-131.

Location: P-35

Units: pCi/m³

Collection: Continuous, weekly exchange.

Date Collected	Volume (m ³)	Gross Beta	I-131	Date Collected	Volume (m ³)	Gross Beta	I-131
Required LLD		<u>0.0075</u>	<u>0.050</u>			<u>0.0075</u>	<u>0.050</u>
01-06-21	501	0.032 ± 0.003	< 0.012	07-07-21	576	0.023 ± 0.003	< 0.008
01-13-21	490	0.038 ± 0.004	< 0.017	07-14-21	596	0.022 ± 0.002	< 0.011
01-20-21	489	0.033 ± 0.004	< 0.012	07-21-21	575	0.024 ± 0.003	< 0.006
01-28-21	551	0.019 ± 0.003	< 0.012	07-28-21	596	0.023 ± 0.003	< 0.007
02-03-21	421	0.016 ± 0.003	< 0.018				
				08-04-21	619	0.018 ± 0.003	< 0.008
02-10-21	451	0.052 ± 0.004	< 0.013	08-11-21	588	0.036 ± 0.003	< 0.009
02-17-21	640	0.027 ± 0.003	< 0.012	08-18-21	596	0.021 ± 0.003	< 0.010
02-24-21	614	0.051 ± 0.004	< 0.026	08-25-21	581	0.041 ± 0.003	< 0.012
03-03-21	623	0.022 ± 0.003	< 0.006	09-01-21	597	0.034 ± 0.003	< 0.012
03-10-21	600	0.031 ± 0.003	< 0.008	09-08-21	578	0.027 ± 0.003	< 0.014
03-17-21	569	0.028 ± 0.003	< 0.009	09-15-21	530	0.025 ± 0.003	< 0.015
03-25-21	619	0.025 ± 0.003	< 0.004	09-22-21	542	0.029 ± 0.003	< 0.013
03-31-21	480	0.016 ± 0.003	< 0.020	09-29-21	526	0.020 ± 0.003	< 0.008
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1Q 2021	Mean ± s.d.	0.030 ± 0.012	< 0.026	3Q 2021	Mean ± s.d.	0.026 ± 0.007	< 0.015
04-07-21	539	0.031 ± 0.003	< 0.010	10-06-21	552	0.020 ± 0.003	< 0.014
04-14-21	538	0.024 ± 0.003	< 0.007	10-13-21	541	0.019 ± 0.003	< 0.014
04-21-21	525	0.013 ± 0.002	< 0.012	10-20-21	528	0.032 ± 0.003	< 0.012
04-28-21	527	0.027 ± 0.003	< 0.009	10-27-21	531	0.020 ± 0.003	< 0.019
				11-03-21	530	0.017 ± 0.003	< 0.014
05-05-21	536	0.020 ± 0.003	< 0.010				
05-12-21	545	0.010 ± 0.002	< 0.005	11-10-21	552	0.033 ± 0.003	< 0.011
05-19-21	538	0.027 ± 0.003	< 0.010	11-17-21	536	0.018 ± 0.003	< 0.014
05-26-21	288	0.056 ± 0.006	< 0.014	11-24-21	541	0.062 ± 0.004	< 0.016
06-02-21	514	0.018 ± 0.003	< 0.016	12-01-21	526	0.024 ± 0.003	< 0.014
06-09-21	526	0.030 ± 0.003	< 0.014	12-08-21	533	0.025 ± 0.003	< 0.015
06-16-21	490	0.020 ± 0.003	< 0.014	12-15-21	515	0.034 ± 0.003	< 0.011
06-23-21	472	0.022 ± 0.003	< 0.010	12-22-21	483	0.032 ± 0.003	< 0.027
06-30-21	610	0.024 ± 0.003	< 0.006	12-29-21	532	0.042 ± 0.003	< 0.009
<hr/>				<hr/>			
2Q 2021	Mean ± s.d.	0.025 ± 0.011	< 0.016	4Q 2021	Mean ± s.d.	0.029 ± 0.013	< 0.027
Cumulative Average						0.028	

PNPP

Table 3. Airborne particulates, analyses for gamma-emitting isotopes.
Collection: Quarterly Composite
Units: pCi/m³

PE-1					
Location					
Quarter	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Req. LLD
Lab Code	PEAP - 1056	PEAP - 2241	PEAP - 3407	PEAP - 4373	
Vol. (m ³)	7314	6241	6562	6614	
Be-7	0.102 ± 0.010	0.142 ± 0.012	0.082 ± 0.011	0.071 ± 0.010	-
Co-58	< 0.0004	< 0.0004	< 0.0005	< 0.0005	-
Co-60	< 0.0003	< 0.0003	< 0.0005	< 0.0003	-
Cs-134	< 0.0004	< 0.0005	< 0.0006	< 0.0004	0.005
Cs-137	< 0.0004	< 0.0004	< 0.0003	< 0.0005	0.045

PE-3					
Location					
Quarter	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Req. LLD
Lab Code	PEAP - 1057	PEAP - 2242	PEAP - 3408	PEAP - 4374	
Vol. (m ³)	7586	7218	7172	7568	
Be-7	0.081 ± 0.009	0.091 ± 0.013	0.076 ± 0.011	0.072 ± 0.010	-
Co-58	< 0.0003	< 0.0006	< 0.0003	< 0.0003	-
Co-60	< 0.0002	< 0.0004	< 0.0002	< 0.0003	-
Cs-134	< 0.0004	< 0.0005	< 0.0005	< 0.0005	0.005
Cs-137	< 0.0004	< 0.0003	< 0.0004	< 0.0004	0.045

PE-4					
Location					
Quarter	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Req. LLD
Lab Code	PEAP - 1058	PEAP - 2243	PEAP - 3409	PEAP - 4375	
Vol. (m ³)	7221	6337	7236	8314	
Be-7	0.066 ± 0.009	0.116 ± 0.012	0.101 ± 0.012	0.055 ± 0.008	-
Co-58	< 0.0005	< 0.0005	< 0.0005	< 0.0003	-
Co-60	< 0.0004	< 0.0003	< 0.0003	< 0.0001	-
Cs-134	< 0.0005	< 0.0005	< 0.0005	< 0.0003	0.005
Cs-137	< 0.0004	< 0.0006	< 0.0004	< 0.0003	0.045

PE-5					
Location					
Quarter	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Req. LLD
Lab Code	PEAP - 1059	PEAP - 2244	PEAP - 3410	PEAP - 4376	
Vol. (m ³)	7354	6488	6943	6460	
Be-7	0.069 ± 0.008	0.114 ± 0.013	0.093 ± 0.012	0.066 ± 0.012	-
Co-58	< 0.0003	< 0.0007	< 0.0004	< 0.0005	-
Co-60	< 0.0003	< 0.0002	< 0.0006	< 0.0004	-
Cs-134	< 0.0004	< 0.0005	< 0.0006	< 0.0005	0.005
Cs-137	< 0.0003	< 0.0004	< 0.0003	< 0.0004	0.045

PNPP

Table 3. Airborne particulates, analyses for gamma-emitting isotopes.
Collection: Quarterly Composite
Units: pCi/m³

PE-6					
Location					
Quarter	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Req. LLD
Lab Code	PEAP - 1060	PEAP - 2245	PEAP - 3411	PEAP - 4376	
Vol. (m ³)	6985	7410	7071	7721	
Be-7	0.085 ± 0.013	0.078 ± 0.010	0.075 ± 0.011	0.062 ± 0.009	-
Co-58	< 0.0006	< 0.0003	< 0.0005	< 0.0006	-
Co-60	< 0.0003	< 0.0004	< 0.0005	< 0.0003	-
Cs-134	< 0.0005	< 0.0005	< 0.0005	< 0.0004	0.005
Cs-137	< 0.0004	< 0.0005	< 0.0004	< 0.0005	0.045

PE-7					
Location					
Quarter	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Req. LLD
Lab Code	PEAP - 1061	PEAP - 2246	PEAP - 3413	PEAP - 4378	
Vol. (m ³)	7240	6804	7288	7936	
Be-7	0.072 ± 0.011	0.115 ± 0.013	0.081 ± 0.011	0.074 ± 0.009	-
Co-58	< 0.0005	< 0.0005	< 0.0004	< 0.0004	-
Co-60	< 0.0004	< 0.0004	< 0.0005	< 0.0005	-
Cs-134	< 0.0005	< 0.0005	< 0.0005	< 0.0004	0.005
Cs-137	< 0.0003	< 0.0006	< 0.0003	< 0.0003	0.045

PE-35					
Location					
Quarter	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Req. LLD
Lab Code	PEAP - 1062	PEAP - 2247	PEAP - 3414	PEAP - 4379	
Vol. (m ³)	7048	6648	7500	6900	
Be-7	0.072 ± 0.010	0.093 ± 0.012	0.079 ± 0.011	0.062 ± 0.011	-
Co-58	< 0.0006	< 0.0005	< 0.0006	< 0.0005	-
Co-60	< 0.0003	< 0.0005	< 0.0002	< 0.0002	-
Cs-134	< 0.0006	< 0.0006	< 0.0005	< 0.0006	0.005
Cs-137	< 0.0004	< 0.0004	< 0.0002	< 0.0003	0.045

Table 4. Lake water, analyses for gross beta and gamma emitting isotopes.

PNPP

	Location: P-34				Collection: Monthly composites	Units: pCi/L
Lab Code	PELW- 255	PELW- 462	PELW- 959	PELW- 1257		
Start Date	12-30-20	01-25-21	02-23-21	03-30-21	Req. LLD	
End Date	01-25-21	02-23-21	03-30-21	04-28-21		
Gross beta	1.9 ± 0.6	0.9 ± 0.5	0.9 ± 0.5	< 0.9	3.0	
Mn-54	< 3.2	< 2.8	< 2.3	< 1.2	11	
Fe-59	< 4.4	< 2.7	< 4.4	< 2.3	22	
Co-58	< 2.2	< 2.3	< 1.9	< 1.8	11	
Co-60	< 2.5	< 2.6	< 1.7	< 1.3	11	
Zn-65	< 3.4	< 6.7	< 5.3	< 1.3	22	
Zr-95	< 4.8	< 4.9	< 4.7	< 3.0	22	
Nb-95	< 3.4	< 5.8	< 3.4	< 2.6	11	
Cs-134	< 3.8	< 4.2	< 3.1	< 1.4	11	
Cs-137	< 3.9	< 4.0	< 2.7	< 1.1	13	
Ba-140	< 13.7	< 16.2	< 16.9	< 26.7	45	
La-140	< 3.5	< 4.9	< 5.2	< 7.4	11	
Lab Code	PELW- 1581	PELW- 1931	PELW- 2427	PELW- 2832		
Start Date	04-28-21	05-25-21	06-28-21	07-26-21	Req. LLD	
End Date	05-25-21	06-28-21	07-26-21	08-25-21		
Gross beta	< 0.9	1.6 ± 0.6	1.4 ± 0.5	1.7 ± 0.6	3.0	
Mn-54	< 1.7	< 4.1	< 3.0	< 2.1	11	
Fe-59	< 5.4	< 7.3	< 6.4	< 6.4	22	
Co-58	< 1.5	< 4.4	< 3.2	< 3.1	11	
Co-60	< 2.3	< 1.8	< 1.9	< 2.9	11	
Zn-65	< 5.3	< 4.7	< 1.9	< 2.4	22	
Zr-95	< 3.3	< 6.0	< 5.6	< 6.0	22	
Nb-95	< 2.7	< 4.0	< 3.6	< 3.0	11	
Cs-134	< 2.5	< 4.0	< 3.1	< 3.0	11	
Cs-137	< 2.3	< 3.8	< 3.0	< 2.4	13	
Ba-140	< 13.3	< 19.5	< 15.8	< 29.3	45	
La-140	< 3.7	< 1.8	< 4.6	< 5.4	11	
Lab Code	PELW- 3217	PELW- 3693	PELW- 3982	PELW- 4277		
Start Date	08-25-21	09-28-21	10-28-21	11-30-21	Req. LLD	
End Date	09-28-21	10-28-21	11-30-21	12-28-21		
Gross beta	1.2 ± 0.6	1.8 ± 0.6	1.2 ± 0.6	1.4 ± 0.6	3.0	
Mn-54	< 1.8	< 1.8	< 1.3	< 2.1	11	
Fe-59	< 4.0	< 6.4	< 4.9	< 4.0	22	
Co-58	< 2.2	< 2.1	< 3.0	< 2.6	11	
Co-60	< 1.3	< 1.5	< 2.1	< 3.3	11	
Zn-65	< 2.4	< 3.2	< 2.8	< 4.2	22	
Zr-95	< 3.8	< 4.2	< 5.7	< 4.7	22	
Nb-95	< 2.9	< 3.1	< 3.1	< 5.9	11	
Cs-134	< 2.5	< 1.9	< 2.4	< 4.2	11	
Cs-137	< 2.3	< 1.6	< 2.8	< 1.8	13	
Ba-140	< 13.3	< 25.4	< 37.1	< 33.6	45	
La-140	< 3.7	< 10.6	< 10.1	< 5.6	11	

Table 4. Lake water, analyses for gross beta and gamma emitting isotopes.

PNPP

Location: P-36	Collection: Monthly composites				Units: pCi/L
Lab Code	PELW- 256	PELW- 463	PELW- 960	PELW- 1258	
Start Date	12-30-20	01-25-21	02-23-21	03-30-21	Req. LLD
End Date	01-25-21	02-23-21	03-30-21	04-28-21	
Gross beta	2.3 ± 0.6	7.3 ± 1.0 ^a	1.4 ± 0.6	< 0.9	3.0
Mn-54	< 1.9	< 3.8	< 2.3	< 1.6	11
Fe-59	< 3.2	< 7.0	< 6.3	< 3.4	22
Co-58	< 2.3	< 2.2	< 1.4	< 1.5	11
Co-60	< 2.2	< 1.7	< 2.7	< 1.2	11
Zn-65	< 2.8	< 2.4	< 5.1	< 2.8	22
Zr-95	< 7.1	< 6.1	< 4.4	< 2.8	22
Nb-95	< 2.4	< 3.4	< 4.5	< 2.4	11
Cs-134	< 3.9	< 4.0	< 3.6	< 1.5	11
Cs-137	< 2.5	< 3.9	< 3.7	< 1.6	13
Ba-140	< 15.1	< 18.2	< 24.4	< 23.1	45
La-140	< 7.3	< 5.7	< 5.4	< 4.6	11
Lab Code	PELW- 1582	PELW- 1932	PELW- 2428	PELW- 2833	
Start Date	04-28-21	05-25-21	06-28-21	08-25-21	Req. LLD
End Date	05-25-21	06-28-21	07-26-21	08-25-21	
Gross beta	1.1 ± 0.5	2.2 ± 0.6	0.9 ± 0.5	1.2 ± 0.5	3.0
Mn-54	< 3.2	< 2.6	< 2.6	< 3.8	11
Fe-59	< 3.6	< 4.5	< 4.8	< 9.8	22
Co-58	< 2.5	< 1.2	< 2.0	< 4.2	11
Co-60	< 1.9	< 1.4	< 2.1	< 2.3	11
Zn-65	< 5.4	< 3.6	< 3.8	< 4.3	22
Zr-95	< 4.7	< 4.2	< 5.2	< 5.0	22
Nb-95	< 3.4	< 3.0	< 2.6	< 4.6	11
Cs-134	< 3.2	< 2.2	< 2.8	< 4.9	11
Cs-137	< 1.9	< 3.3	< 3.7	< 4.0	13
Ba-140	< 17.2	< 14.8	< 16.9	< 31.1	45
La-140	< 5.6	< 2.9	< 4.7	< 3.4	11
Lab Code	PELW- 3218	PELW- 3694	PELW- 3983	PELW- 4278	
Start Date	08-25-21	09-28-21	10-28-21	11-30-21	Req. LLD
End Date	09-28-21	10-28-21	11-30-21	12-28-21	
Gross beta	1.0 ± 0.5	< 0.9	1.1 ± 0.6	1.1 ± 0.5	3.0
Mn-54	< 2.3	< 2.5	< 1.3	< 2.4	11
Fe-59	< 4.6	< 6.1	< 4.3	< 2.6	22
Co-58	< 2.3	< 2.7	< 1.6	< 3.8	11
Co-60	< 1.6	< 1.5	< 1.1	< 2.1	11
Zn-65	< 4.5	< 5.0	< 2.3	< 5.7	22
Zr-95	< 3.9	< 5.3	< 3.0	< 4.6	22
Nb-95	< 3.8	< 4.6	< 2.2	< 4.6	11
Cs-134	< 2.5	< 2.7	< 1.1	< 3.5	11
Cs-137	< 3.4	< 2.9	< 1.1	< 2.5	13
Ba-140	< 15.3	< 38.9	< 24.9	< 33.1	45
La-140	< 3.4	< 7.3	< 6.2	< 7.9	11

^a Recount = 6.3 ± 0.9 pCi/L, reanalysis = 1.1 ± 0.5 pCi/L

Table 4. Lake water, analyses for gross beta and gamma emitting isotopes.

PNPP

Location: P-39

Collection: Monthly composites

Units: pCi/L

Lab Code	PELW- 257	PELW- 464	PELW- 961	PELW- 1259	Req. LLD
Start Date	12-30-20	01-25-21	02-23-21	03-30-21	
End Date	01-25-21	02-23-21	03-30-21	04-28-21	
Gross beta	< 0.8	< 0.9	1.1 ± 0.5	< 0.8	3.0
Mn-54	< 2.7	< 3.3	< 1.9	< 1.3	11
Fe-59	< 2.6	< 4.6	< 2.2	< 3.4	22
Co-58	< 2.1	< 2.2	< 2.8	< 1.7	11
Co-60	< 2.3	< 2.8	< 1.6	< 0.9	11
Zn-65	< 4.6	< 6.6	< 2.1	< 2.7	22
Zr-95	< 3.2	< 5.1	< 4.4	< 3.1	22
Nb-95	< 2.1	< 2.7	< 1.9	< 2.1	11
Cs-134	< 3.4	< 2.5	< 2.3	< 1.3	11
Cs-137	< 2.8	< 3.2	< 1.9	< 1.3	13
Ba-140	< 19.7	< 11.5	< 19.0	< 27.6	45
La-140	< 4.7	< 3.8	< 2.8	< 5.6	11
Lab Code	PELW- 1583	PELW- 1933	PELW- 2429	PELW- 2834	Req. LLD
Start Date	04-28-21	05-25-21	06-28-21	07-26-21	
End Date	05-25-21	06-28-21	07-26-21	08-25-21	
Gross beta	< 0.9	< 0.8	1.0 ± 0.5	< 0.9	3.0
Mn-54	< 2.0	< 2.2	< 2.8	< 2.7	11
Fe-59	< 3.7	< 3.0	< 5.8	< 7.6	22
Co-58	< 2.3	< 2.0	< 3.7	< 2.2	11
Co-60	< 1.7	< 1.7	< 1.7	< 2.4	11
Zn-65	< 3.6	< 3.6	< 7.0	< 2.7	22
Zr-95	< 4.2	< 3.1	< 4.4	< 5.7	22
Nb-95	< 3.8	< 2.8	< 5.1	< 2.1	11
Cs-134	< 3.0	< 2.1	< 3.6	< 3.2	11
Cs-137	< 4.3	< 2.4	< 3.2	< 2.7	13
Ba-140	< 20.7	< 10.8	< 26.9	< 19.7	45
La-140	< 5.6	< 2.8	< 3.7	< 6.3	11
Lab Code	PELW- 3219	PELW- 3695	PELW- 3984	PELW- 4279	Req. LLD
Start Date	08-25-21	09-28-21	10-28-21	11-30-21	
End Date	09-28-21	10-28-21	11-30-21	12-28-21	
Gross beta	1.1 ± 0.5	< 0.9	< 0.9	1.2 ± 0.6	3.0
Mn-54	< 3.0	< 3.3	< 1.4	< 3.3	11
Fe-59	< 3.9	< 4.9	< 3.5	< 3.3	22
Co-58	< 2.5	< 3.3	< 1.2	< 3.1	11
Co-60	< 2.8	< 3.0	< 1.2	< 2.0	11
Zn-65	< 4.1	< 5.9	< 2.8	< 3.4	22
Zr-95	< 6.6	< 3.9	< 2.5	< 5.0	22
Nb-95	< 4.1	< 7.0	< 1.8	< 3.0	11
Cs-134	< 2.8	< 3.5	< 1.5	< 3.6	11
Cs-137	< 4.0	< 2.7	< 1.6	< 3.6	13
Ba-140	< 37.1	< 41.7	< 28.6	< 35.0	45
La-140	< 6.2	< 8.0	< 5.2	< 3.7	11

Table 4. Lake water, analyses for gross beta and gamma emitting isotopes.

PNPP

Location: P-59

Collection: Monthly composites

Units: pCi/L

Lab Code	PELW- 258	PELW- 465	PELW- 962	PELW- 1260	Req. LLD
Start Date	12-30-20	02-23-21	02-23-21	03-30-21	
End Date	01-25-21	NS ^a	03-30-21	04-28-21	
Gross beta	1.6 ± 0.6	-	1.0 ± 0.5	0.9 ± 0.5	3.0
Mn-54	< 2.8	-	< 2.5	< 1.1	11
Fe-59	< 5.7	-	< 5.7	< 2.1	22
Co-58	< 3.5	-	< 2.3	< 1.3	11
Co-60	< 2.4	-	< 1.7	< 0.8	11
Zn-65	< 4.8	-	< 4.6	< 2.4	22
Zr-95	< 4.8	-	< 3.9	< 1.7	22
Nb-95	< 3.8	-	< 3.5	< 1.7	11
Cs-134	< 4.5	-	< 2.0	< 1.1	11
Cs-137	< 4.0	-	< 2.9	< 1.1	13
Ba-140	< 16.4	-	< 20.8	< 14.1	45
La-140	< 4.1	-	< 3.2	< 2.4	11
Lab Code	PELW- 1584	PELW- 1934	PELW- 2430	PELW- 2835	Req. LLD
Start Date	04-28-21	05-25-21	06-28-21	07-26-21	
End Date	05-25-21	06-28-21	07-26-21	08-25-21	
Gross beta	< 0.8	1.1 ± 0.6	1.7 ± 0.6	1.2 ± 0.5	3.0
Mn-54	< 1.8	< 3.2	< 1.2	< 2.1	11
Fe-59	< 4.8	< 6.0	< 4.7	< 4.2	22
Co-58	< 2.3	< 3.4	< 1.4	< 2.0	11
Co-60	< 2.6	< 2.3	< 2.1	< 1.7	11
Zn-65	< 3.8	< 4.3	< 4.2	< 4.3	22
Zr-95	< 4.1	< 4.3	< 5.0	< 2.8	22
Nb-95	< 2.4	< 4.0	< 3.7	< 3.5	11
Cs-134	< 2.5	< 3.7	< 2.9	< 3.0	11
Cs-137	< 2.6	< 3.9	< 3.4	< 3.3	13
Ba-140	< 15.6	< 20.9	< 22.1	< 26.3	45
La-140	< 2.8	< 3.2	< 3.1	< 4.9	11
Lab Code	PELW- 3220	PELW- 3696	PELW- 3985	PELW- 4280	Req. LLD
Start Date	08-25-21	09-28-21	10-28-21	11-30-21	
End Date	09-28-21	10-28-21	11-30-21	12-28-21	
Gross beta	0.9 ± 0.5	1.0 ± 0.5	1.5 ± 0.6	2.0 ± 0.6	3.0
Mn-54	< 1.6	< 2.7	< 0.9	< 2.7	11
Fe-59	< 4.3	< 3.9	< 2.4	< 5.7	22
Co-58	< 2.0	< 2.0	< 1.5	< 3.3	11
Co-60	< 1.9	< 3.6	< 0.8	< 2.1	11
Zn-65	< 4.2	< 5.8	< 2.7	< 3.5	22
Zr-95	< 5.7	< 6.1	< 2.6	< 4.7	22
Nb-95	< 3.3	< 4.6	< 2.7	< 3.0	11
Cs-134	< 2.6	< 3.0	< 1.5	< 3.5	11
Cs-137	< 2.5	< 3.1	< 1.4	< 2.3	13
Ba-140	< 32.5	< 36.6	< 32.0	< 29.6	45
La-140	< 4.7	< 9.4	< 5.7	< 5.5	11

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

Table 4. Lake water, analyses for gross beta and gamma emitting isotopes.

PNPP

Location: P-60	Collection: Monthly composites				Units: pCi/L
Lab Code	PELW- 259	PELW- 466	PELW- 963	PELW- 1261	
Start Date	12-30-20	02-23-21	02-23-21	03-30-21	Req. LLD
End Date	01-25-21	NS ^a	03-30-21	04-28-21	
Gross beta	1.5 ± 0.6	-	1.1 ± 0.6	< 0.9	3.0
Mn-54	< 3.3	-	< 1.3	< 0.6	11
Fe-59	< 5.3	-	< 3.1	< 3.0	22
Co-58	< 1.9	-	< 2.2	< 1.1	11
Co-60	< 1.8	-	< 2.5	< 0.8	11
Zn-65	< 8.5	-	< 3.9	< 2.1	22
Zr-95	< 5.4	-	< 5.0	< 2.5	22
Nb-95	< 3.8	-	< 3.9	< 2.1	11
Cs-134	< 3.6	-	< 2.1	< 1.1	11
Cs-137	< 3.9	-	< 3.5	< 1.0	13
Ba-140	< 14.4	-	< 20.6	< 20.1	45
La-140	< 7.9	-	< 2.0	< 6.0	11
Lab Code	PELW- 1585	PELW- 1935	PELW- 2431	PELW- 2836	
Start Date	04-28-21	05-25-21	06-28-21	07-26-21	Req. LLD
End Date	05-25-21	06-28-21	07-26-21	08-25-21	
Gross beta	1.3 ± 0.6	1.2 ± 0.6	1.7 ± 0.6	1.6 ± 0.6	3.0
Mn-54	< 2.8	< 2.7	< 2.9	< 2.6	11
Fe-59	< 5.6	< 4.4	< 5.4	< 7.3	22
Co-58	< 3.4	< 3.2	< 3.0	< 1.6	11
Co-60	< 2.3	< 1.8	< 2.4	< 2.0	11
Zn-65	< 2.9	< 3.7	< 4.3	< 2.7	22
Zr-95	< 5.3	< 6.0	< 6.5	< 7.1	22
Nb-95	< 4.4	< 3.4	< 5.4	< 2.6	11
Cs-134	< 3.4	< 3.1	< 3.7	< 2.6	11
Cs-137	< 3.4	< 3.2	< 1.8	< 2.3	13
Ba-140	< 18.2	< 25.6	< 26.8	< 22.5	45
La-140	< 5.3	< 6.0	< 6.7	< 5.6	11
Lab Code	PELW- 3221	PELW- 3697	PELW- 3986	PELW- 4281	
Start Date	08-25-21	09-28-21	10-28-21	11-30-21	Req. LLD
End Date	09-28-21	10-28-21	11-30-21	12-28-21	
Gross beta	1.2 ± 0.6	3.1 ± 0.7 ^b	1.8 ± 0.6	1.5 ± 0.6	3.0
Mn-54	< 1.6	< 2.9	< 1.2	< 3.1	11
Fe-59	< 5.5	< 10.0	< 3.7	< 6.7	22
Co-58	< 2.4	< 2.9	< 1.4	< 2.7	11
Co-60	< 2.1	< 2.1	< 0.9	< 2.7	11
Zn-65	< 3.8	< 5.5	< 2.8	< 6.0	22
Zr-95	< 3.6	< 6.7	< 2.4	< 6.4	22
Nb-95	< 4.1	< 2.9	< 2.3	< 3.3	11
Cs-134	< 2.6	< 3.3	< 1.2	< 3.4	11
Cs-137	< 2.6	< 1.8	< 1.1	< 1.8	13
Ba-140	< 37.5	< 37.1	< 25.2	< 44.7	45
La-140	< 9.7	< 10.7	< 10.0	< 9.0	11

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

^b Recount = 0.8 ± 0.5, LLD < 0.9 pCi/L

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Table 4. Lake Water, analysis for tritium.
 Collection: Quarterly composites of monthly collections.
 Units: pCi/L

Required limit of detection: 1500 pCi/L

Location P-34				
Period	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
Lab Code	PELW- 982	PELW- 1943	PELW- 3224	PELW- 4286
H-3	< 160	< 158	< 159	247.6 ± 87
Location P-36				
Period	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
Lab Code	PELW- 983	PELW- 1944	PELW- 3225	PELW- 4287
H-3	< 160	< 158	< 159	220.0 ± 86
Location P-39				
Period	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
Lab Code	PELW- 984	PELW- 1945	PELW- 3226	PELW- 4289
H-3	< 160	232.1 ± 87	< 159	185.3 ± 84
Location P-59				
Period	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
Lab Code	PELW- 985	PELW- 1946	PELW- 3227	PELW- 4290
H-3	< 160	161.6 ± 84	177.3 ± 86	252.2 ± 88
Location P-60				
Period	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
Lab Code	PELW- 986	PELW- 1947	PELW- 3228	PELW- 4291
H-3	< 160	< 158	184.1 ± 87	173.8 ± 83

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Table 7. Food Products, analyses for gamma emitting isotopes.

Collection: Monthly

Units: pCi/kg wet

Location: P-2

Lab Code	PEVE- 2209	PEVE- 2210	PEVE- 2211	PEVE- 2223	Req. LLD
Date Collected	07-12-21	07-12-21	07-12-21	07-12-21	
Sample Type	Swiss Chard	Collard Greens	Kale	Turnip Greens	
Be-7	296 ± 107	460 ± 135	225 ± 62	1104 ± 171	-
K-40	3810 ± 309	3480 ± 297	4008 ± 155	4157 ± 336	-
Co-58	< 10	< 12	< 7	< 13	-
Co-60	< 9	< 11	< 5	< 10	-
I-131	< 39	< 44	< 19	< 27	45
Cs-134	< 10	< 12	< 6	< 10	45
Cs-137	< 14	< 11	< 6	< 12	60

Lab Code	PEVE- 2845	PEVE- 2846	PEVE- 2847	PEVE- 2962	Req. LLD
Date Collected	09-02-21	09-02-21	09-02-21	09-14-21	
Sample Type	Collard Greens	Kale	Swiss Chard	Collard Greens	
Be-7	282 ± 134	< 153	345 ± 136	445 ± 136	-
K-40	3358 ± 288	6325 ± 375	5586 ± 432	4614 ± 386	-
Co-58	< 8	< 10	< 14	< 7	-
Co-60	< 10	< 6	< 11	< 12	-
I-131	< 34	< 44	< 24	< 22	45
Cs-134	< 10	< 11	< 12	< 12	45
Cs-137	< 13	< 11	< 10	< 10	60

Lab Code	PEVE- 2963	PEVE- 3229	Req. LLD
Date Collected	09-14-21	10-05-21	
Sample Type	Kale	Turnip Greens	
Be-7	333 ± 133	250 ± 105	-
K-40	6066 ± 448	5167 ± 333	-
Co-58	< 7	< 9	-
Co-60	< 8	< 9	-
I-131	< 28	< 17	45
Cs-134	< 16	< 11	45
Cs-137	< 20	< 7	60

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Table 7. Food Products, analyses for gamma emitting isotopes.

Collection: Monthly

Units: pCi/kg wet

Location: P-16

Lab Code	PEVE- 2212	PEVE- 2213	PEVE- 2214	PEVE- 2224	Req. LLD
Date Collected	07-12-21	07-12-21	07-12-21	07-12-21	
Sample Type	Swiss Chard	Collard Greens	Kale	Turnip Greens	
Be-7	305 ± 48	171 ± 79	< 96	381 ± 109	-
K-40	3354 ± 141	4067 ± 257	3407 ± 249	3684 ± 310	-
Co-58	< 5	< 9	< 7	< 10	-
Co-60	< 5	< 8	< 6	< 9	-
I-131	< 19	< 19	< 19	< 40	45
Cs-134	< 4	< 10	< 8	< 10	45
Cs-137	< 5	< 9	< 6	< 9	60

Lab Code	PEVE- 2848	PEVE- 2849	PEVE- 2850	PEVE- 2851	Req. LLD
Date Collected	09-02-21	09-02-21	09-02-21	09-02-21	
Sample Type	Turnip Greens	Collard Greens	Kale	Swiss Chard	
Be-7	478 ± 157	340 ± 92	< 131	357 ± 134	-
K-40	6751 ± 424	4568 ± 240	5968 ± 364	6690 ± 432	-
Co-58	< 13	< 6	< 9	< 14	-
Co-60	< 7	< 5	< 10	< 7	-
I-131	< 33	< 26	< 40	< 29	45
Cs-134	< 13	< 8	< 13	< 12	45
Cs-137	< 11	< 8	< 11	< 10	60

Lab Code	PEVE- 2964	PEVE- 2965	PEVE- 2967	PEVE- 2968	Req. LLD
Date Collected	09-14-21	09-14-21	09-14-21	09-14-21	
Sample Type	Swiss Chard	Kale	Turnip Greens	Collard Greens	
Be-7	< 125	150 ± 71	312 ± 116	< 141	-
K-40	7163 ± 431	4654 ± 308	6541 ± 439	4620 ± 409	-
Co-58	< 10	< 9	< 12	< 15	-
Co-60	< 9	< 6	< 13	< 10	-
I-131	< 12	< 12	< 21	< 27	45
Cs-134	< 12	< 9	< 13	< 15	45
Cs-137	< 11	< 9	< 16	< 11	60

Lab Code	PEVE- 3230	PEVE- 3231	PEVE- 3232	PEVE- 3233	Req. LLD
Date Collected	10-05-21	10-05-21	10-05-21	10-05-21	
Sample Type	Swiss Chard	Kale	Turnip Greens	Collard Greens	
Be-7	339 ± 113	195 ± 95	565 ± 149	< 134	-
K-40	6215 ± 391	4320 ± 310	4935 ± 405	3641 ± 338	-
Co-58	< 13	< 5	< 11	< 12	-
Co-60	< 11	< 8	< 14	< 10	-
I-131	< 15	< 21	< 21	< 18	45
Cs-134	< 10	< 9	< 13	< 10	45
Cs-137	< 10	< 7	< 9	< 8	60

Company: Energy Harbor

Plant: Perry Nuclear Power Plant

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Table 7. Food Products, analyses for gamma emitting isotopes.

Collection: Monthly

Units: pCi/kg wet

Location: P-20

Lab Code	PEVE- 2216	PEVE- 2217	PEVE- 2225	PEVE- 2852	Req. LLD
Date Collected	07-12-21	07-12-21	07-12-21	09-02-21	
Sample Type	Collard Greens	Kale	Turnip Greens	Turnip Greens	
Be-7	183 ± 52	207 ± 62	824 ± 77	305 ± 96	-
K-40	3056 ± 131	4007 ± 142	3903 ± 151	7566 ± 424	-
Co-58	< 7	< 4	< 5	< 12	-
Co-60	< 3	< 6	< 6	< 10	-
I-131	< 24	< 21	< 14	< 29	45
Cs-134	< 5	< 5	< 5	< 11	45
Cs-137	< 6	< 6	< 5	< 11	60
Lab Code	PEVE- 2853	PEVE- 2854	PEVE- 2855	PEVE- 2969	Req. LLD
Date Collected	09-02-21	09-02-21	09-02-21	09-14-21	
Sample Type	Collard Greens	Kale	Swiss Chard	Collard Greens	
Be-7	< 98	< 132	< 175	< 95	-
K-40	6518 ± 399	6667 ± 409	6306 ± 444	5377 ± 355	-
Co-58	< 13	< 11	< 9	< 10	-
Co-60	< 13	< 8	< 14	< 10	-
I-131	< 24	< 43	< 33	< 15	45
Cs-134	< 10	< 11	< 15	< 9	45
Cs-137	< 9	< 9	< 16	< 8	60
Lab Code	PEVE- 2970	PEVE- 2971	PEVE- 2972	PEVE- 3234	Req. LLD
Date Collected	09-14-21	09-14-21	09-14-21	10-05-21	
Sample Type	Kale	Swiss Chard	Turnip Greens	Collard Greens	
Be-7	< 178	312 ± 125	< 142	< 123	-
K-40	6559 ± 531	8091 ± 454	6072 ± 425	3914 ± 323	-
Co-58	< 14	< 14	< 11	< 12	-
Co-60	< 15	< 9	< 14	< 11	-
I-131	< 37	< 16	< 25	< 17	45
Cs-134	< 17	< 13	< 13	< 14	45
Cs-137	< 14	< 14	< 15	< 12	60
Lab Code	PEVE- 3235	PEVE- 3236	PEVE- 3237		Req. LLD
Date Collected	10-05-21	10-05-21	10-05-21		
Sample Type	Kale	Swiss Chard	Turnip Greens		
Be-7	305 ± 128	283 ± 137	488 ± 193		-
K-40	5383 ± 400	5849 ± 370	5138 ± 368		-
Co-58	< 16	< 9	< 9		-
Co-60	< 14	< 11	< 8		-
I-131	< 38	< 16	< 21		45
Cs-134	< 14	< 9	< 12		45
Cs-137	< 15	< 9	< 13		60

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Table 7. Food Products, analyses for gamma emitting isotopes.

Collection: Monthly						Units: pCi/kg wet
Location: P-37						
Lab Code	PEVE- 2218	PEVE- 2219	PEVE- 2220	PEVE- 2226		
Date Collected	07-12-21	07-12-21	07-12-21	07-12-21		Req. LLD
Sample Type	Swiss Chard	Collard Greens	Kale	Turnip Greens		
Be-7	276 ± 87	129 ± 39	191 ± 91	564 ± 114		-
K-40	5829 ± 207	3515 ± 114	5812 ± 294	3450 ± 275		-
Co-58	< 7	< 4	< 7	< 6		-
Co-60	< 6	< 5	< 9	< 9		-
I-131	< 16	< 10	< 27	< 19		45
Cs-134	< 7	< 4	< 9	< 8		45
Cs-137	< 8	< 4	< 10	< 10		60
Lab Code	PEVE- 2856	PEVE- 2857	PEVE- 2858	PEVE- 2973		
Date Collected	09-02-21	09-02-21	09-02-21	09-14-21		Req. LLD
Sample Type	Turnip Greens	Collard Greens	Swiss Chard	Collard Greens		
Be-7	340 ± 141	< 164	< 155	286 ± 155		-
K-40	7588 ± 431	6299 ± 435	8017 ± 465	3732 ± 415		-
Co-58	< 10	< 13	< 16	< 9		-
Co-60	< 13	< 15	< 11	< 13		-
I-131	< 38	< 29	< 36	< 34		45
Cs-134	< 14	< 14	< 14	< 17		45
Cs-137	< 13	< 12	< 10	< 11		60
Lab Code	PEVE- 2974	PEVE- 2975	PEVE- 2976	PEVE- 3239		
Date Collected	09-14-21	09-14-21	09-14-21	10-05-21		Req. LLD
Sample Type	Turnip Greens	Swiss Chard	Kale	Collard Greens		
Be-7	542 ± 239	369 ± 140	263 ± 121	< 199		-
K-40	8029 ± 540	5861 ± 443	5046 ± 366	3511 ± 396		-
Co-58	< 14	< 12	< 12	< 11		-
Co-60	< 8	< 12	< 8	< 13		-
I-131	< 30	< 22	< 21	< 29		45
Cs-134	< 18	< 12	< 10	< 15		45
Cs-137	< 18	< 14	< 11	< 18		60
Lab Code	PEVE- 3240	PEVE- 3241	PEVE- 3242			
Date Collected	10-05-21	10-05-21	10-05-21			Req. LLD
Sample Type	Turnip Greens	Swiss Chard	Kale			
Be-7	584 ± 260	741 ± 218	297 ± 101			-
K-40	4867 ± 508	5836 ± 459	3681 ± 310			-
Co-58	< 19	< 19	< 9			-
Co-60	< 10	< 10	< 7			-
I-131	< 42	< 33	< 20			45
Cs-134	< 20	< 17	< 11			45
Cs-137	< 17	< 12	< 12			60

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Table 7. Food Products, analyses for gamma emitting isotopes.

Collection:					Units: pCi/kg wet
Location:					
<hr/>					
Lab Code	PEVE- 2221	PEVE- 2222	PEVE- 2227	PEVE- 2860	
Date Collected	07-12-21	07-12-21	07-12-21	09-02-21	Req. LLD
Sample Type	Collard Greens	Kale	Turnip Greens	Turnip Greens	
Be-7	449 ± 173	< 152	801 ± 117	389 ± 130	-
K-40	5140 ± 390	4004 ± 371	4803 ± 280	5910 ± 359	-
Co-58	< 9	< 10	< 8	< 6	-
Co-60	< 11	< 12	< 9	< 7	-
I-131	< 59 ^a	< 42	< 22	< 19	45
Cs-134	< 15	< 15	< 8	< 10	45
Cs-137	< 15	< 15	< 9	< 8	60
Lab Code	PEVE- 2861	PEVE- 2862	PEVE- 2863	PEVE- 2977	
Date Collected	09-02-21	09-02-21	09-02-21	09-14-21	Req. LLD
Sample Type	Collard Greens	Kale	Swiss Chard	Turnip Greens	
Be-7	229 ± 70	328 ± 78	328 ± 130	204 ± 88	-
K-40	5739 ± 239	5604 ± 302	8625 ± 495	5376 ± 348	-
Co-58	< 5	< 9	< 7	< 9	-
Co-60	< 8	< 6	< 13	< 7	-
I-131	< 14	< 19	< 37	< 20	45
Cs-134	< 7	< 9	< 13	< 9	45
Cs-137	< 5	< 8	< 11	< 9	60
Lab Code	PEVE- 2978	PEVE- 2979	PEVE- 2980	PEVE- 3243	
Date Collected	09-14-21	09-14-21	09-14-21	10-05-21	Req. LLD
Sample Type	Collard Greens	Swiss Chard	Kale	Turnip Greens	
Be-7	268 ± 136	508 ± 153	212 ± 104	337 ± 139	-
K-40	5863 ± 368	9269 ± 493	5926 ± 366	4124 ± 317	-
Co-58	< 10	< 12	< 8	< 9	-
Co-60	< 9	< 10	< 7	< 8	-
I-131	< 31	< 23	< 15	< 25	45
Cs-134	< 11	< 13	< 10	< 12	45
Cs-137	< 12	< 13	< 8	< 10	60
Lab Code	PEVE- 3244	PEVE- 3245	PEVE- 3246		
Date Collected	10-05-21	10-05-21	10-05-21		Req. LLD
Sample Type	Collard Greens	Swiss Chard	Kale		
Be-7	248 ± 136	298 ± 156	< 146		-
K-40	4837 ± 362	6519 ± 501	4268 ± 387		-
Co-58	< 5	< 15	< 10		-
Co-60	< 7	< 12	< 13		-
I-131	< 26	< 20	< 37		45
Cs-134	< 13	< 15	< 15		45
Cs-137	< 11	< 15	< 8		60

^a Sample counting accidentally cut short.

Table 9. Fish, analyses for gamma emitting isotopes.

Collection: Semiannually

Units: pCi/kg wet

Location						P-25
Lab Code	PEF- 1833	PEF- 1834	PEF- 1835	PEF- 1836		Req. LLD
Date Collected	06-07-21	06-07-21	06-07-21	06-07-21		
Sample Type	White Perch	Smallmouth Bass	Golden Redhorse Sucker	White Sucker		
K-40	986 ± 247	1935 ± 405	950 ± 243	1419 ± 396		-
Mn-54	< 14	< 20	< 15	< 24		94
Fe-59	< 39	< 89	< 34	< 54		195
Co-58	< 17	< 26	< 21	< 19		97
Co-60	< 10	< 15	< 7	< 11		97
Zn-65	< 27	< 52	< 28	< 24		195
Cs-134	< 13	< 22	< 16	< 21		97
Cs-137	< 13	< 21	< 9	< 19		112

Location						P-25
Lab Code	PEF- 1936	PEF- 1937				Req. LLD
Date Collected	06-07-21	06-07-21				
Sample Type	Walleye	Freshwater Drum				
K-40	2060 ± 348	925 ± 231				-
Mn-54	< 17	< 17				94
Fe-59	< 36	< 48				195
Co-58	< 13	< 16				97
Co-60	< 11	< 18				97
Zn-65	< 50	< 35				195
Cs-134	< 20	< 16				97
Cs-137	< 19	< 13				112

Location						P-25
Lab Code	PEF- 3016	PEF- 3017	PEF- 3018	PEF- 3019		Req. LLD
Date Collected	09-17-21	09-17-21	09-17-21	09-17-21		
Sample Type	Channel Catfish	Walleye	Freshwater Drum	Smallmouth Bass		
K-40	1063 ± 260	1470 ± 294	1414 ± 255	706 ± 279		-
Mn-54	< 13	< 18	< 19	< 14		94
Fe-59	< 26	< 75	< 59	< 42		195
Co-58	< 19	< 30	< 30	< 20		97
Co-60	< 17	< 13	< 17	< 13		97
Zn-65	< 22	< 31	< 36	< 26		195
Cs-134	< 15	< 22	< 22	< 19		97
Cs-137	< 18	< 18	< 20	< 19		112

Location						P-25
Lab Code	PEF- 3021	PEF- 3022				Req. LLD
Date Collected	09-17-21	09-17-21				
Sample Type	White Bass	Golden Redhorse				
K-40	799 ± 333	1212 ± 220				-
Mn-54	< 22	< 9				94
Fe-59	< 59	< 39				195
Co-58	< 31	< 11				97
Co-60	< 23	< 15				97
Zn-65	< 55	< 30				195
Cs-134	< 21	< 13				97
Cs-137	< 21	< 12				112

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Table 9. Fish, analyses for gamma emitting isotopes.

Collection: Semiannually

Units: pCi/kg wet

Location		P-32				
Lab Code	PEF- 1837	PEF- 1838	PEF- 1839	PEF- 1840	Req. LLD	
Date Collected	06-07-21	06-07-21	06-07-21	06-07-21		
Sample Type	Walleye	Golden Redhorse Sucker	White Perch	Freshwater Drum		
K-40	1256 ± 328	1623 ± 328	644 ± 187	927 ± 296	-	
Mn-54	< 17	< 20	< 15	< 11	94	
Fe-59	< 64	< 78	< 36	< 69	195	
Co-58	< 26	< 20	< 15	< 21	97	
Co-60	< 19	< 14	< 7	< 18	97	
Zn-65	< 27	< 62	< 28	< 48	195	
Cs-134	< 18	< 23	< 14	< 20	97	
Cs-137	< 17	< 22	< 11	< 19	112	

Location		P-32				
Lab Code	PEF- 3023	PEF- 3024	PEF- 3025	PEF- 3026	Req. LLD	
Date Collected	09-17-21	09-17-21	09-17-21	09-17-21		
Sample Type	Walleye	Channel Catfish	Gizzard Shad	Carp		
K-40	1171 ± 318	647 ± 263	1651 ± 366	1013 ± 381	-	
Mn-54	< 18	< 12	< 18	< 19	94	
Fe-59	< 81	< 62	< 72	< 63	195	
Co-58	< 31	< 19	< 13	< 37	97	
Co-60	< 12	< 9	< 19	< 17	97	
Zn-65	< 41	< 35	< 46	< 79	195	
Cs-134	< 17	< 19	< 20	< 27	97	
Cs-137	< 15	< 14	< 19	< 21	112	

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Table 11. Sediments, analyses for gamma emitting isotopes.

Collection: Semiannually

Units: pCi/kg dry

Location	P-64		
Lab Code	PEBS- 1586	PEBS- 3247	
Date Collected	05-11-21	10-05-21	Req. LLD
K-40	11036 ± 566	10002 ± 674	-
Co-58	< 24.0	< 17.9	50
Co-60	< 15.0	< 14.9	40
Cs-134	< 17.3	< 18.9	112
Cs-137	< 22.5	< 19.0	135

Location	P-66		
Lab Code	PEBS- 1587	PEBS- 3248	
Date Collected	05-11-21	10-05-21	Req. LLD
K-40	11362 ± 561	10034 ± 668	-
Co-58	< 26.1	< 32.4	50
Co-60	< 16.3	< 18.3	40
Cs-134	< 18.7	< 23.9	112
Cs-137	< 15.4	< 22.6	135