PSEG Nuclear LLC
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PSEG
Nuclear LLC

Technical Specification Section 6.9.1.7(Salem)
Technical Specification Section 6.9.1.6 (Hope Creek)

LR-N22-0040

April 28, 2022

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington DC 20555-001

Salem Nuclear Generating Station, Unit Nos. 1 and 2
Renewed Facility Operating License Nos. DPR-70 and DPR-75
NRC Docket NOS. 50-272 and 50-311

Hope Creek Generating Station
Renewed Facility Operating License No. NPF-57
Docket No. 50-354

Subject: 2021 Annual Radiological Environmental Operating Report

As required with Section 6.9.1.7 of Appendix A to Renewed Facility Operating License Nos. DPR-70 (Unit 1) and DPR-75 (Unit 2) for SGS, and Section 6.9.1.6 of Appendix A to Renewed Facility Operating License NPF-57 for HCGS, PSEG Nuclear hereby transmits one (1) copy of the combined 2021 Annual Radiological Environmental Operating Report (Enclosure). This report summarizes the results of the radiological environmental surveillance program for 2021 in the vicinity of the Salem and Hope Creek Generating Stations. The result of this program for 2021 was specifically compared to the result of the pre-operational program.

There are no regulatory commitments contained in this letter.

If you have any questions or comments on this transmittal, please contact Mr. Rick Heathwaite at (856) 279-1239 (cell), or Rick.Heathwaite@PSEG.com.

Sincerely,

Richard DeSanctis
Plant Manager
Salem Generating Stations

Steven Poorman
Plant Manager
Hope Creek Generating Station

Enclosure: 2021 Annual Radiological Environmental Operating Report for Salem and Hope Creek Generating Stations

cc: Administrator - Region I - USNRC
Project Manager - USNRC
Salem Senior Resident Inspector - USNRC
Hope Creek Senior Resident Inspector - USNRC
NRC Inspector - Region I - USNRC
Chief - NJ Bureau of Nuclear Engineering (NJBNE)
Corporate Commitment Tracking Coordinator - w/o attachment
Salem/Hope Creek Commitment Tracking Coordinator - w/o attachment

LR-N22-0040

Enclosure

PSEG Nuclear LLC

Salem and Hope Creek Generating Stations

2021 Annual Radiological Environmental Operating Report

PSEG Nuclear LLC

Salem and Hope Creek Generating Stations

Annual Radiological Environmental Operating Report

2021

Document Number: SGS-AREOR-70 / HCGS-AREOR-44

Unit 1	Unit 2	Unit 1
Docket No. 50-272	Docket No. 50-311	Docket No. 50-354
Operating License No. DPR-070	Operating License No. DPR-075	Operating License No. NPF-057

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AREOR (REMP) Review and Approval Confirmation in SAP (I.A.W. AD-AA-1006 SIGNATURE AUTHORITY)

SAP 80130945

Opr

0021	Stephen Gattuso, Salem Chemistry Manager	Date: 04/22/2022
0022	Scott Kozink, Hope Creek Chemistry Manager	Date: 04/18/2022
0023	William Gropp, Salem Radiation Protection Manager	Date: 04/21/2022
0024	Mariaz Davis, Hope Creek Radiation Protection Manager	Date: 04/19/2022
0025	William Muffley, Salem Senior Director of Operations	Date: 04/19/2022
0026	James Priest, Hope Creek Senior Director of Operations	Date: 04/15/2022
0027	Richard DeSanctis, Salem Plant Manager	Date: 04/18/2022
0028	Steven Poorman, Hope Creek Plant Manager	Date: 04/19/2022

Report Prepared By: _____

Rick M. Heathwaite (REMP/REC Program Manager)

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ATTACHMENTS

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. APT: Air Particulate
3. AIO: Air Iodine Sample
4. Analyte: The substance being identified and measured in a chemical analysis
5. ARERR: Annual Radioactive Effluent Release Report
6. AREOR: Annual Radioactive Environmental Operating Report
7. BLV: Broad Leaf Vegetation
8. BNE: Bureau of Nuclear Engineering: A New Jersey state agency regulating, as applicable, the nuclear industry within the Department of Environmental Protection.
9. BWR: Boiling Water Reactor
10. CARR: Corrective/Preventive Action Request and Report (GEL CAP)
11. 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.
12. Control (C): 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.
13. Curie (Ci): A measure of radioactivity; equal to 3.7×10^{10} disintegrations per second, or 2.22×10^{12} disintegrations per minute.
14. 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.
15. DOE: Department of Energy
16. DQO: Data Quality Objective
17. DW: Drinking Water
18. ECH: Crab sample
19. ERA: Environmental Resource Associates
20. ESF: Fish sample
21. ESS: Sediment sample

22. EZA: Eckert & Ziegler Analytics, Inc.
23. FPL: Broad Leafy Vegetation sample
24. FPV: Vegetables sample
25. GAM: Game sample
26. GEL: General Engineering Laboratories; Duplicate sample analysis vendor
27. Gr-A: Gross alpha
28. Gr-B: Gross beta
29. Grab Sample: A single discrete sample drawn at one point in time.
30. H-3: Hope Creek Generating Station
31. HCGS: Hope Creek Generating Station
32. IDM: Immersion Dose Monitor sample (direct radiation measurement made with field TLD)
33. Indicator: A sampling location that is likely to be affected by plant effluents due to its proximity and/or direction from the plant.
34. 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.
35. ISFSI: Independent Spent Fuel Storage Installation
36. Kg: Kilogram
37. L: Liter
38. LIMS: Laboratory Information Management System
39. 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.
40. LTS: Laboratory Testing Services
41. m^3: Cubic meter
42. MAPEP: Mixed Analyte Performance Evaluation Program
43. MDA: Minimum Detectable Activity
44. MDC: Minimum Detectable Concentration
45. Mean: The average, i.e., the sum of results divided by the number of results.
46. Microcurie: 3.7×10^4 disintegrations per second, or 2.22×10^6 disintegrations per minute.

47. mL: Milliliter
48. MLK: Milk sample
49. MWe: Megawatts Electric
50. N: Not Acceptable
51. NA: Not Applicable
52. NCR: Nonconformance Report (TBE CAP)
53. NDA: No Detectable Activity
54. NEI: Nuclear Energy Institute
55. NIST: National Institute of Standards and Technology.
56. NPDES: National Pollutant Discharge Elimination System.
57. NRC: Nuclear Regulatory Commission
58. ODCM: Offsite Dose Calculation Manual Common REMP
59. pCi/L: picocuries per Liter
60. Protected Area: An area encompassed by physical barriers and to which access is controlled.
61. PSEG: Public Service Enterprise Group
62. PWR: Pressurized Water Reactor
63. PWR/PWT: Potable Water sample (Raw/Treated)
64. REMP: Radiological Environmental Monitoring Program
65. Restricted Area: An area, access to which is limited by the licensee for the purpose of protecting individuals against undue risks from exposure to radiation and radioactive materials.
66. RGPP: Radiological Groundwater Protection Program
67. RL: Reporting Level
68. SA: Salem
69. SCFM: Standard Cubic Feet Per Minute
70. SLC: Selected Licensee Commitment
71. SD: Sample Deviation
72. SGS: Salem Generating Station
73. SOL: Soil Sample
74. Std Quarter: Standard Quarter = 91 days
75. SWA: Surface Water
76. TBE: Teledyne Brown Engineering; Primary sample analysis vendor
77. TLD: Thermoluminescent Dosimeter
78. TRM: Technical Requirement Manual

79. TS: Technical Specification
80. uCi: Microcuries (one-millionth of a Curie)
81. USEPA: United States Environmental Protection Agency
82. VGT: Fodder Crop sample
83. WWA: Ground (well) Water sample

2.0 EXECUTIVE SUMMARY

Salem and Hope Creek Generating Stations Radiological Environmental Monitoring Program (REMP) was established prior to the station becoming operational to provide information on background radiation present in the area. The goal of SGS/HCGS REMP is to evaluate the impact of the station on the environment. Environmental samples from different media are monitored as part of the program in accordance with specifications detailed in the Offsite Dose Calculation Manual Common REMP (ODCM). The program compares data from indicator locations near the plant, to control locations farther away from the site to assess operation impacts.

The Annual Radioactive Environmental Operating Report (AREOR) provides data obtained through analyses of environmental samples collected at Salem and Hope Creek Generating Station for the reporting period of January 1st through December 31st, 2021. During that time period 1662 analyses were performed on 1306 samples and there was no instance of radioactivity from plant effluents observed in the environment that exceeded any Reporting Levels identified in Salem and Hope Creek Common ODCM Table 3.12-2 [23]. Also, in assessing all the data gathered for this report and comparing these results with preoperational data, it was concluded that the operation of Salem and Hope Creek Generating Stations had no significant radiological impact on the health and safety of the public or on the environment.

2.1 Summary Of Conclusions:

There was no instance of a plant related radionuclide above baseline detected during this sampling period. Radionuclides identified are summarized in Table 1, 2021 Radiological Environmental Monitoring Program Summary of Results. Natural occurring radionuclides come from minerals and raw materials and exists at exposure levels that are not of concern for radiation protection. These elements are present in the Earth's crust and atmosphere and exists in detectable quantities throughout the world. It is common to detect natural occurring radionuclides in many of the samples collected for REMP. Some examples of naturally occurring radionuclides that are frequently seen in samples are potassium-40, beryllium-7, actinium-228 (present as a decay product of radium-228), and radium-226. Additionally, some relatively long-lived anthropogenic radioisotopes, such as strontium-90 and cesium-137, are also seen in some REMP samples; these radionuclides exist in measurable quantities throughout the world as a result of fallout from historic atmospheric nuclear weapons testing. Neither cesium-137 nor strontium-90 were detected in any of the indicator or control locations. Detailed information on the exposure of the U.S. population to ionizing radiation can be found in NCRP Report No. 160 [5].

Table 1, 2021 Radiological Environmental Monitoring Program Summary of Results

Media	Radionuclide identified but within historical levels	Naturally Occurring	Dose Impact from Radionuclide identified > 1 mRem	N/A[1]
Direct Radiation	☒	☐	☐	☐
Airborne Radioiodine and Particulates	☐	☒	☐	☐
Surface Water	☐	☒	☐	☐
Groundwater - REMP	☐	☒	☐	☐
Drinking Water	☐	☒	☐	☐
Shoreline Sediment	☐	☒	☐	☐
Milk	☐	☒	☐	☐
Fish and invertebrates	☐	☒	☐	☐
Food Products	☐	☒	☐	☐
Soil	☐	☐	☐	☒
Grass or Leafy Vegetation	☐	☒	☐	☐
Aquatic Vegetation	☐	☐	☐	☒
Other aquatic (Crustacean, mollusks, etc.)	☐	☒	☐	☐

3.0 INTRODUCTION

The Radiological Environmental Monitoring Program (REMP) provides data on measurable levels of radiation and radioactive materials in the site environs. 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 radioactive concentrations in the environment 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 Nuclear Regulatory Commission (NRC) Regulatory Guide 4.1 [18], NUREG 1301/1302 [6][7], and the 1979 NRC Branch Technical Position [17].

[1] Media is not analyzed in accordance with implemented regulatory program at this facility.

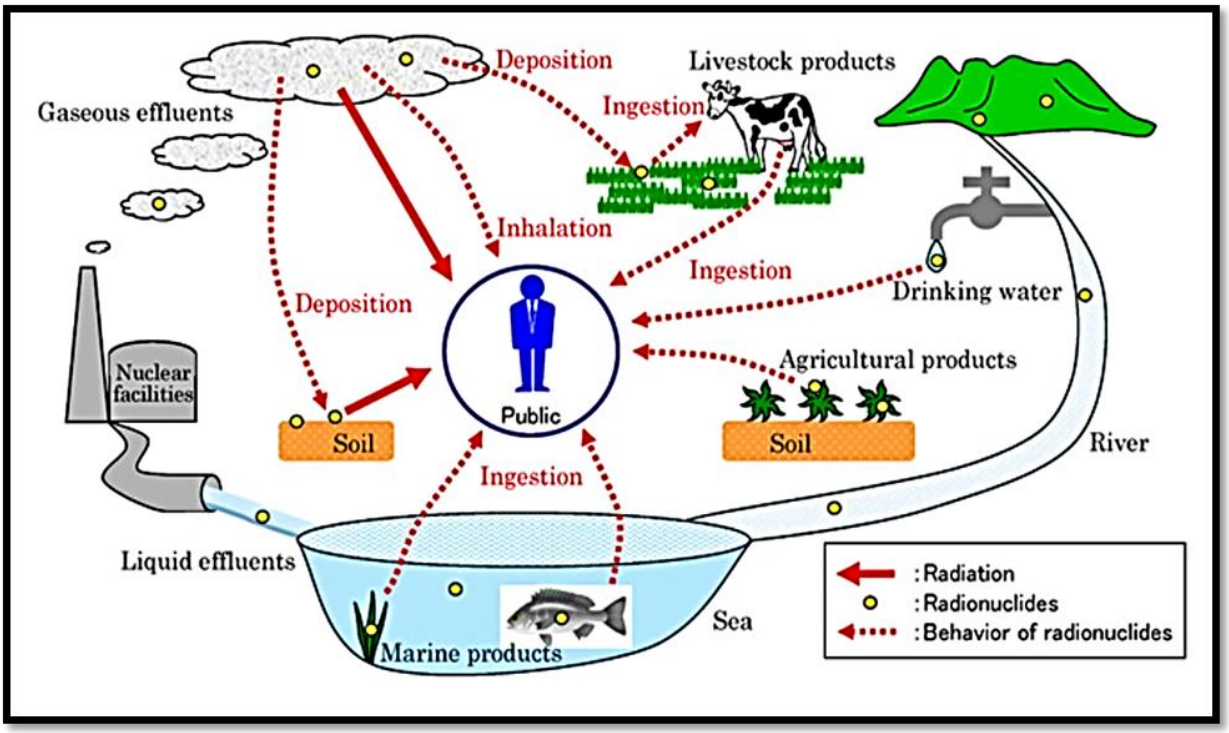

Figure 1, Potential exposure pathways to Members of the Public due to Plant Operations (1)

Quality assurance aspects of the sampling program and TLD data collection are conducted in accordance with Regulatory Guides 4.15 [13] and Regulatory Guides 4.13 [22]. REMP also adheres to the requirements of New Jersey, SGS/HCGS Technical Specifications, and the Offsite Dose Calculation Manual Common REMP (ODCM). These governing documents dictate the environmental sampling, sample analysis protocols, data reporting and quality assurance requirements for the environmental monitoring program.

The REMP is based on NRC guidance as reflected in the Site ODCM and establishes sample media, sampling locations, sampling frequency and analytical sensitivity requirements. It also identifies indicator and control locations established for comparison purposes to distinguish plant related radioactivity from naturally occurring or other radioactivity from man-made sources. The environmental monitoring program also verifies the projected and anticipated radionuclide concentrations in the environment and evaluates exposures associated with releases of radionuclides from the Site as described by the ODCM.

This program satisfies the requirements of Section IV.B.2 of Appendix I to 10 CFR 50 and provides surveillance of all appropriate critical exposure pathways to man.

To demonstrate compliance with the requirements, samples of air particulates, air iodine, milk, surface water, ground (well) water, potable (drinking) water, vegetables, fodder crops, fish, crabs, oysters, game, and sediment were collected and analyzed. External radiation dose measurements were also made in the vicinity of the Site using passive dosimeters. These environmental media were analyzed for one or more of the following: gamma emitting isotopes, tritium (H-3), iodine-131 (I-131), gross alpha, gross beta, direct and immersion dose. Measurements made in the vicinity of the Site were compared to background or control measurements and the preoperational REMP study performed before SGS Unit 1 became operational. The results of these analyses were used to assess the impact on the health and safety of the public or on the environment of Site operations, thereby demonstrating compliance with the applicable Technical Specifications, ODCM Common REMP, and Federal regulations.

The detection capabilities for environmental samples, required by the Site ODCM, were achieved for the Reporting Period. Any exceptions to the program are noted in the Report and the associated PSEG Nuclear corrective action identifier was included in parenthesis.

4.0 SITE DESCRIPTION AND SAMPLE LOCATIONS

The Site is located in Lower Alloway's Creek Township, Salem County, New Jersey. SGS consists of two operating pressurized water nuclear power reactors. SGS Unit 1 has an approximate net electrical rating of 1,180 megawatts electric (MWe) and SGS Unit 2 has an approximate net electrical rating of 1,178 MWe. The licensed core thermal power rating for both Units is 3,459 megawatts thermal (MWth). HCGS consists of an operating boiling water nuclear power reactor, which has an approximate net electrical rating of 1,212 MWe. The licensed core thermal power rating is 3,902 MWth.

The Site is located on a man-made peninsula on the east bank of the Delaware River called Artificial Island. The peninsula was created by the deposition of hydraulic fill from dredging operations. The surrounding environment is characterized mainly by the Delaware River Estuary, extensive tidal marshlands, and low-lying meadowlands. These land types make up a vast majority of the land area within five miles of the Site, with most of the remaining land used for agriculture.

Since 1968, a Radiological Environmental Monitoring Program (REMP) has been conducted at the Site. Starting in December 1972, a more extensive radiological monitoring program was initiated in preparation for the operation of SGS Unit 1. The operational REMP was initiated in December 1976 when SGS Unit 1 achieved criticality.

SGS/HCGS sampling media are selected based on site specific information such as meteorology, receptor locations, and water usage around the plant. Sampling and analysis frequencies are documented in the Offsite Dose Calculation Manual and site procedures. Required sampling, analysis frequencies and location of sample collected are captured in the following tables and figures:

- Table 2, Radiological Environmental Sampling Program – Exposure Pathway – Direct Radiation
- Table 3, Radiological Environmental Sampling Program – Exposure Pathway - Airborne
- Table 4, Radiological Environmental Sampling Program – Exposure Pathway - Waterborne
- Table 5, Radiological Environmental Sampling Program – Exposure Pathway - Ingestion
- Table 6, Radiological Environmental Sampling Program – Exposure Pathway - Terrestrial
- Table 7, Radiological Environmental Monitoring Program Sampling Locations
- Figure 2, REMP Sample Locations (On-Site Sampling Locations To 1 Mile)
- Figure 3, REMP Sample Locations (Off-Site Sampling Locations 1 to 10 Miles)
- Figure 4, REMP Sample Locations (Off-Site Sampling Locations Greater Than 10 Miles)

5.0 RADIOLOGICAL ENVIRONMENTAL SAMPLING PROGRAM REQUIREMENTS

Table 2, Radiological Environmental Sampling Program – Exposure Pathway – Direct Radiation

1. DIRECT RADIATION a. Dosimeters (IDM)	Fifty-seven routine monitoring locations with two or more dosimeters placed as follows: An inner ring of locations, one in each of the land based meteorological sectors in the general area of the SITE BOUNDARY; and An outer ring of locations, one in each of the land based meteorological sector in the 5 to 11 km (3.1 - 6.8 miles) range from the site; and The balance of the locations placed in areas of special interest such as population centers, nearby residences, and schools and in one or two areas to serve as control locations.	Quarterly	Gamma dose / quarterly

Table 3, Radiological Environmental Sampling Program – Exposure Pathway - Airborne

Exposure Pathway	Number of Representative Samples and Sample Locations	Sampling Collection/ Frequency	Type and Frequency of Analyses
2. ATMOSPHERIC a. Air Particulate (APT) b. Air Iodine (AIO)	3 samples close to the Site Boundary: 05X1, 06S1, 15S2. One duplicate sample from close to the site boundary: 05S2. 3 samples from different land based sectors: 01F1, 02F6, 05D1. One sample from the vicinity of a community having a highest annual average ground level D/Q: 16E1. One sample from a control location; for example 15 - 30 km distant (9.3 - 18.6 miles) and in the least prevalent wind direction: 14G1	Continuous sampler operation with sample collection weekly or more frequently if required by dust loading Continuous sampler operation with sample collection weekly or more frequently if required by dust loading	Gross Beta / weekly Gamma isotopic analysis / quarterly composite* Iodine-131 / weekly

Table 4, Radiological Environmental Sampling Program – Exposure Pathway - Waterborne

Exposure Pathway	Number of Representative Samples and Sample Locations	Sampling Collection/ Frequency	Type and Frequency of Analyses
Surface Water (SWA)	One sample upstream: 01F2. One sample downstream: 07E1. One sample outfall: 11A1. One sample cross-stream (mouth of Appoquinimink River): 12B1. And an additional location in the Chesapeake & Delaware Canal: 16F1.	Semi-Monthly	Gamma scan / monthly Tritium / monthly**
Potable Water (Drinking Water) (PWR, PWT)	Although no potable water samples are required as liquid effluents discharged from SGS/HCGS do not directly affect this pathway and it is not required by SGS/HCGS ODCM, one raw and one treated water sample from a public water supply (City of Salem Water and Sewer Department) are collected: 02F3 as management audit samples.	Monthly (composited weekly)	Gross alpha / monthly Gross beta / monthly Tritium / monthly Gamma scan / monthly Iodine-131 / monthly
Well Water (Ground) (WWA)	Although wells in the vicinity of SGS/HCGS are not directly affected by plant operations so sampling is not required by SGS/HCGS ODCM, samples of 03E1 farm's well are collected as management audit samples.	Monthly	Gamma scan / monthly Gross alpha / monthly Gross beta / monthly Tritium / monthly
Sediment (ESS)	One sample from downstream area: 07E1. One sample from cross-stream area and control location: 12B1. One sample from outfall area: 11A1. One sample from upstream, the C & D Canal: 16F1. One sample from shoreline area: 05A1. One sample from Cooling Tower Blowdown discharge: 15A1. One sample south storm drain discharge line: 15A2.	Semi-Annually	Gamma scan / on collection

Table 5, Radiological Environmental Sampling Program – Exposure Pathway - Ingestion

Exposure Pathway	Number of Representative Samples and Sample Locations	Sampling Collection/ Frequency	Type and Frequency of Analyses
Milk (MLK)	Samples from milking animals in 3 locations within 5 km distance (3.1 miles) having the highest dose potential. If there are none, then 1 sample from milking animals in each of 3 areas between 5 - 8 km distant (3.1 - 5.0 miles) where doses are calculated to be greater than 1 mrem per yr: 13E3. 1 Sample from milking animals at a control location 15 30 km distant (9.3 - 18.6 miles): 03G1. NOTE: *Milk animals are not prevalent in the vicinity of the plant. Only one farm met the requiem for milk. In lieu of samples, broad-leaf vegetation sampling is being conducted*.	Semi-monthly (when animals are on pasture) Monthly (when animals are not on pasture)	Gamma scan / semi-monthly Iodine-131 / semi-monthly Gamma scan / monthly Iodine-131 / monthly
Edible Fish (ESF)	One sample of each commercially and recreationally important species in vicinity of plant discharge area: 11A1. One sample of same species in area not influenced by plant discharge: 12B1, and an additional location downstream: 07E1.	Semi-Annually	Gamma scan (flesh) / on collection
Blue Crabs (ECH)	One sample of each commercially and recreationally important species in vicinity of plant discharge area 11A1. One sample of same species in area not influenced by plant discharge 12B1.	Semi-Annually	Gamma scan (flesh) /on collection

Table 5, Radiological Environmental Sampling Program – Exposure Pathway – Ingestion (Continued)

Exposure Pathway	Number of Representative Samples and Sample Locations	Sampling Collection/ Frequency	Type and Frequency of Analyses
Vegetables (FPL, FPV)	Although the Delaware River at the location of SGS/HCGS is a brackish water source and is not used for irrigation of food products and so sampling is not required by SGS/HCGS ODCM, samples of vegetables are collected as management audit samples from various locations during harvest. In addition, broad leaf vegetation is collected from various offsite locations as well as being planted & collected onsite (01S3, 06S1, 15S2, 16S1, 10D1). This is in lieu of having a milk farm within 5 km (3.1 miles) of the Site(1).	Monthly (during growing season)	Gamma scan / on collection
Fodder Crops (VGT)	Although not required by SGS/HCGS ODCM, samples of crops normally used as cattle feed (silage) were collected from milk farms as management audit samples: 14F4, 02G3, 13E3.	Annually (at harvest)	Gamma scan / on collection
Game (GAM)	Although not required by SGS/HCGS ODCM, game samples were collected as management audit samples from three indicator locations: 03E1,13E3, 05C1.	Annually	Gamma scan / on collection

Table 6, Radiological Environmental Sampling Program – Exposure Pathway - Terrestrial

Exposure Pathway	Number of Representative Samples and Sample Locations	Sampling Collection/ Frequency	Type and Frequency of Analyses
Soil (SOL)	Although not required by SGS/HCGS ODCM, samples of soil are collected as management audit samples.	Every 3 years (2013-2016-2019)	Gamma scan / on Collection

6.0 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SAMPLING LOCATIONS

Site # Nomenclature

First 2 digits represent each of the sixteen angular sectors of 22.5 degrees centered about the reactor site. Sector one is divided evenly by the north axis and other sectors are numbered in a clockwise direction, e.g. 1=N, 2=NNE, 3=NE, 4=ENE, 5=E, 6=ESE, 7=SE, 8=SSE, 9=S, 10=SSW, 11=SW, 12=WSW, 13=W, 14=WNW,15=NW, and 16=NNW.

The next digit is a letter which represents the radial distance from the reference point: S=On-site location, X=Site Boundary (SB), A=SB-1 miles off-site, B=1-2 miles off-site, C=2-3 miles off-site, D=3-4 miles off-site, E=4-5 miles off-site, F=5-10 miles off-site, G=10-20 miles off-site and H=>20 miles off-site, Q=Special Interest.

The last number is the station numerical designation within the sector and zone; e.g. 1,2,3,…etc

For example, the Site # 03E1 would indicate a sample in sector number 3, centered at 45 degrees (north east) with respect to the midpoint between Salem 1 and 2 containments at a radial distance of 4 to 5 miles offsite, (therefore, radial distance E). The number 1 indicates that this is sampling station number 1 in that particular sector.

Definitions

SB	Site Boundary	A	Alternate Location	MLK	Milk
IR	Intermediate Ring	D	Duplicate	WWA	Well Water (Ground)
OR	Outer Ring	APT	Air Particulate	PWR,PWT	Potable Water (Raw,Treated
C	Control	AIO	Air Iodine	FPL,FPV	Vegetables
MA	Management Audit	ECH	Hard Shell Blue Crab	VGT	Fodder Crops
I	Indicator	ESF	Edible Fish	SOL	Soil
IDM	Dosimeters (TLD)	ESS	Sediment	SWA	Surface Water
SI	Special Interest	GAM	Game	S	On-Site

Table 7, Radiological Environmental Monitoring Program Sampling Locations

Specific information about the individual sampling locations are given in Tables 2, 3, 4, and 5. Figures 2, 3, and 4 show the locations of sampling locations with respect to the Site.

All sample types are not required to be collected at all possible sites every year.

Site #	Measurement Type	Sector	Location Description	IDM (SB/IR/OR/C/SI/S)	Airborne	Waterborne	Ingestion	MA
01Q1	I	N	0.58 mi. N side of road near ISFSI pad.	SI				
01S3	I	N	0.58 mi. N side of road near ISFSI pad					FPL
02S2a	I	NNE	0.41 mi. lamp pole 65 near HC switch yard	S				
01X2	I	N	0.60 mi 382 feet from TLD 01Q1	SB				
02X4	I	NNE	0.59 mi.; in the equipment laydown area	SB				
03X1	I	NE	0.58 mi.; behind refrigeration building	SB				
04X1	I, D	ENE	0.60 mi.; site access road near intersection to TB-02	SB				
05X1	I	E	0.86 mi.; site access road	SB	AIO, APT			
05X2	I,D	E	0.86 mi.; site access road, duplicate sample		AIO, APT			
06X2	I	ESE	0.23mi.; area around helicopter pad	SB				
07S1	I	SE	0.12 mi.; station personnel gate	S				
06S1	I	ESE	0.19 mi.; station personnel gate		AIO, APT	FPL		SOL
08S1	I	SSE	0.14 mi.; fuel oil storage	S				

Table 7, Radiological Environmental Monitoring Program Sampling Locations

Specific information about the individual sampling locations are given in Tables 2, 3, 4, and 5. Figures 2, 3, and 4 show the locations of sampling locations with respect to the Site.

All sample types are not required to be collected at all possible sites every year.

Site #	Measurement Type	Sector	Location Description	IDM (SB/IR/OR/C/SI/S)	Airborne	Waterborne	Ingestion	MA
08S2	I	SSE	0.17 mi.; fuel oil storage	S				
10S1	I	SSW	0.11 mi.; circulating water building	S				
11S1	I	SW	0.12 mi.; circulating water building	S				
12S1	I	WSW	0.09 mi.; outside security fence	S				
14S2	I	WNW	0.12 mi.; outside security fence	S				
15S1	I	NW	0.57 mi.; near river and HCGS barge slip	S				
15S2	I	NW	0.59 mi.; near river and HCGS barge slip	S	AIO, APT		FPL	
15S3	I	NW	0.17 mi.; outside security fence	S				
16S1	I	NNW	0.57 mi.; on road near fuel oil storage tank	S			FPL	
16Q2	SI	NNW	0.60 mi.; near security firing range	SI				
16X3	SI	NNW	0.88 mi.; consolidated spoils facility	S				
05A1	I	E	0.89 mi., near shoreline			ESS		
11A1	I, D	SW	0.22 mi.; SGS outfall area			ESS,SWA	ECH,ESF	

Table 7, Radiological Environmental Monitoring Program Sampling Locations

Specific information about the individual sampling locations are given in Tables 2, 3, 4, and 5. Figures 2, 3, and 4 show the locations of sampling locations with respect to the Site.

All sample types are not required to be collected at all possible sites every year.

Site #	Measurement Type	Sector	Location Description	IDM (SB/IR/OR/C/SI/S)	Airborne	Waterborne	Ingestion	MA
11A1A	A	SE	0.15 mi.; Located in the plant barge slip area			SWA		
15A1	I	NW	0.69 mi.; HCGS outfall area			ESS		
15A2	I	NW	0.66 mi.; South Storm Drain outfall			ESS		
12B1	C	WSW	1.8 mi.; West bank of Delaware River			ESS,SWA	ECH,ESF	
12B1A	A	NW	3.7 mi.; Tip of Augustine Beach Boat Ramp			SWA		
04D2	I	ENE	3.9 mi.; Alloway Creek Neck Road	IR				
05D1	I	E	3.5 mi.; local farm along SGS/HCGS access road.	IR	AIO, APT			
10D1	I	SSW	3.9 mi.; Taylor's Bridge Spur, DE	IR			FPL	SOL
14D1	I	WNW	3.3 mi.; Bay View, DE	IR				
15D1	I	NW	3.7 mi ; Route 9, Augustine Beach, DE	IR				
02E1	I	NNE	4.4 mi.; local farm, NJ	IR				
03E1	I	NE	4.1 mi; local farm, NJ	IR				WWA,GAM
07E1	I	SE	4.4 mi.; River Bank 1 mi. W of Mad Horse Creek			ESS,SWA	ESF	

Table 7, Radiological Environmental Monitoring Program Sampling Locations

Specific information about the individual sampling locations are given in Tables 2, 3, 4, and 5. Figures 2, 3, and 4 show the locations of sampling locations with respect to the Site.

All sample types are not required to be collected at all possible sites every year.

Site #	Measurement Type	Sector	Location Description	IDM (SB/IR/OR/C/SI/S)	Airborne	Waterborne	Ingestion	MA
07E1A	A	SE	9.2 mi.; Located at the end of Bayside Road, NJ			SWA		
11E2	I	SW	5.0 mi.; Route 9, DE	IR				
12E1	I	WSW	4.4 mi.; Thomas Landing, DE	IR				
13E1	I	W	4.1 mi.; Diehl House Lab, DE	IR				
13E3	I	W	5.0 mi.; local farm, DE				MLK	VGT,SOL,GAM
16E1	I	NNW	4.1 mi.; Port Penn, DE	IR	AIO, APT			SOL
01F1	I	N	5.7 mi.; Fort Elfsborg, NJ	OR	AIO, APT			
01F2	I	N	7.1 mi.; midpoint of Delaware River			SWA		
02F2	I	NNE	8.5 mi.; Salem Substation, Salem NJ	OR				
02F3	I	NNE	8.0 mi.; City of Salem, NJ Water and Sewage Dep					PWR, PWT
02F5	I	NNE	7.3 mi.; Salem High School, Salem, NJ	OR, SI				
02F6	I	NNE	7.3 mi.; PSE&G Training Center, Salem NJ	OR	AIO, APT			
02F9	I, D	NNE	7.5 mi.; Local Farm , Tilbury Rd, Salem, NJ					FPV, SOL

Table 7, Radiological Environmental Monitoring Program Sampling Locations

Specific information about the individual sampling locations are given in Tables 2, 3, 4, and 5. Figures 2, 3, and 4 show the locations of sampling locations with respect to the Site.

All sample types are not required to be collected at all possible sites every year.

Site #	Measurement Type	Sector	Location Description	IDM (SB/IR/OR/C/SI/S)	Airborne	Waterborne	Ingestion	MA
03F2	I	NE	5.1 mi.; Hancocks Bridge, NJ Munc Bldg	OR				
03F3	I	NE	8.6 mi.; Quinton Township Elem. School NJ	OR, SI				
03F8	I	NE	9.3 mi.; Circle M Orchard, NJ					FPV
04F2	I	ENE	6.0 mi.; Mays Lane, Harmersville, NJ	OR				
05F1	I	E	6.4 mi.; Canton, NJ	OR				SOL
06F1	I	ESE	6.4 mi.; Stow Neck Road, NJ	OR				
07F2	I	SE	9.3 mi.; Bayside, NJ	OR				
09F1	I, D	S	5.3 mi.; off Route #9, DE	OR				FPV
09F2	I	S	5.2 mi.; Collins Beach Boat Ramp	OR				
10F2	I	SSW	5.7 mi.; Route #9, DE	OR				
11F1	I	SW	6.0 mi.; Taylor’s Bridge, DE	OR				
12F1	I	WSW	9.4 mi.; Townsend Elementary School, DE	OR				
13F2	I	W	6.5 mi ; Odessa, DE	OR				

Table 7, Radiological Environmental Monitoring Program Sampling Locations

Specific information about the individual sampling locations are given in Tables 2, 3, 4, and 5. Figures 2, 3, and 4 show the locations of sampling locations with respect to the Site.

All sample types are not required to be collected at all possible sites every year.

Site #	Measurement Type	Sector	Location Description	IDM (SB/IR/OR/C/SI/S)	Airborne	Waterborne	Ingestion	MA
13F3	I	W	9.3 mi.; Redding Middle School, Middletown, DE	OR, SI				
13F4	I	W	9.8 mi.; Middletown, DE	OR, SI				
14F2	I	WNW	6.7 mi.; Route 13 and Boyds Corner Rd, DE	OR				
14F4	I, D	WNW	8.0 mi.; local farm, DE				MLK	SOL, VGT, FPV
15F3	I	NW	5.4 mi., Port Penn Rd. at Pole Bridge Rd., DE	OR				
15F4	I, D	NW	7.0 mi.; local farm; Port Penn Road; DE					FPV
16F1	I	NNW	6.9 mi.; C&D Canal, DE			ESS, SWA		
16F1A	A	NNW	6.5 mi.; Located at the C&D Canal Tip, DE			SWA		
16F2	I	NNW	8.1 mi.; Delaware City Public School, DE	OR, SI				
01G1	I, D	NNE	10.9 mi.; Route 49, South Broadway, NJ				FPL	FPV
01G3	I	N	19 mi.; N. Church Street Wilmington, DE	C				
02G2	I, D	NNE	13.5 mi.; Local Farm; Pointers Auburn Road (Route 540), Salem, NJ					FPV

Table 7, Radiological Environmental Monitoring Program Sampling Locations

Specific information about the individual sampling locations are given in Tables 2, 3, 4, and 5. Figures 2, 3, and 4 show the locations of sampling locations with respect to the Site.

All sample types are not required to be collected at all possible sites every year.

Site #	Measurement Type	Sector	Location Description	IDM (SB/IR/OR/C/SI/S)	Airborne	Waterborne	Ingestion	MA
02G3	C	NNE	11.8 mi.; Local Milk Farm, NJ				MLK	VGT, SOL
03G1	I	NE	16.5 mi.; local farm, NJ	C				SOL
10G1	I	SSW	11.6 mi.; Smyrna, DE	C				
14G1	C	WNW	13.4 mi.; Route 286, Bethel Church Road, DE	C	AIO,APT			
16G1	I	NNW	15.1 mi.; Wilmington Airport, DE	C				
03H1	I	NE	33.1 mi.; National Park, NJ	C				
03H5	C, D	NE	25 mi.; Farm Market, Route 77, NJ				FPL	FPV

TABLE 7 NOTATIONS:

Vegetable samples are not always collected in consecutive years from the same farmer due to crop rotation.

7.0 MAPS OF COLLECTION SITES

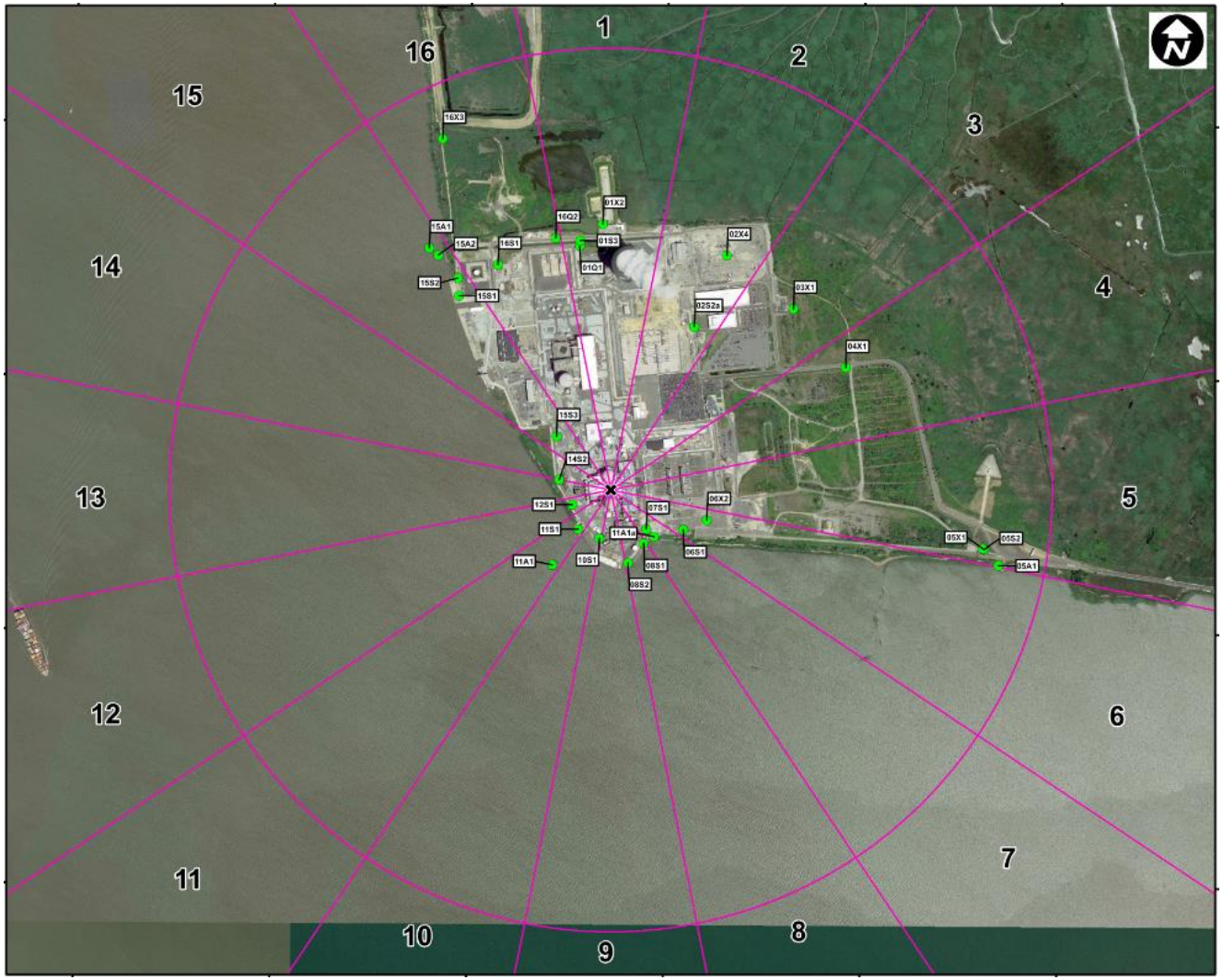

Figure 2, REMP Sample Locations (On-Site Sampling Locations To 1 Mile)

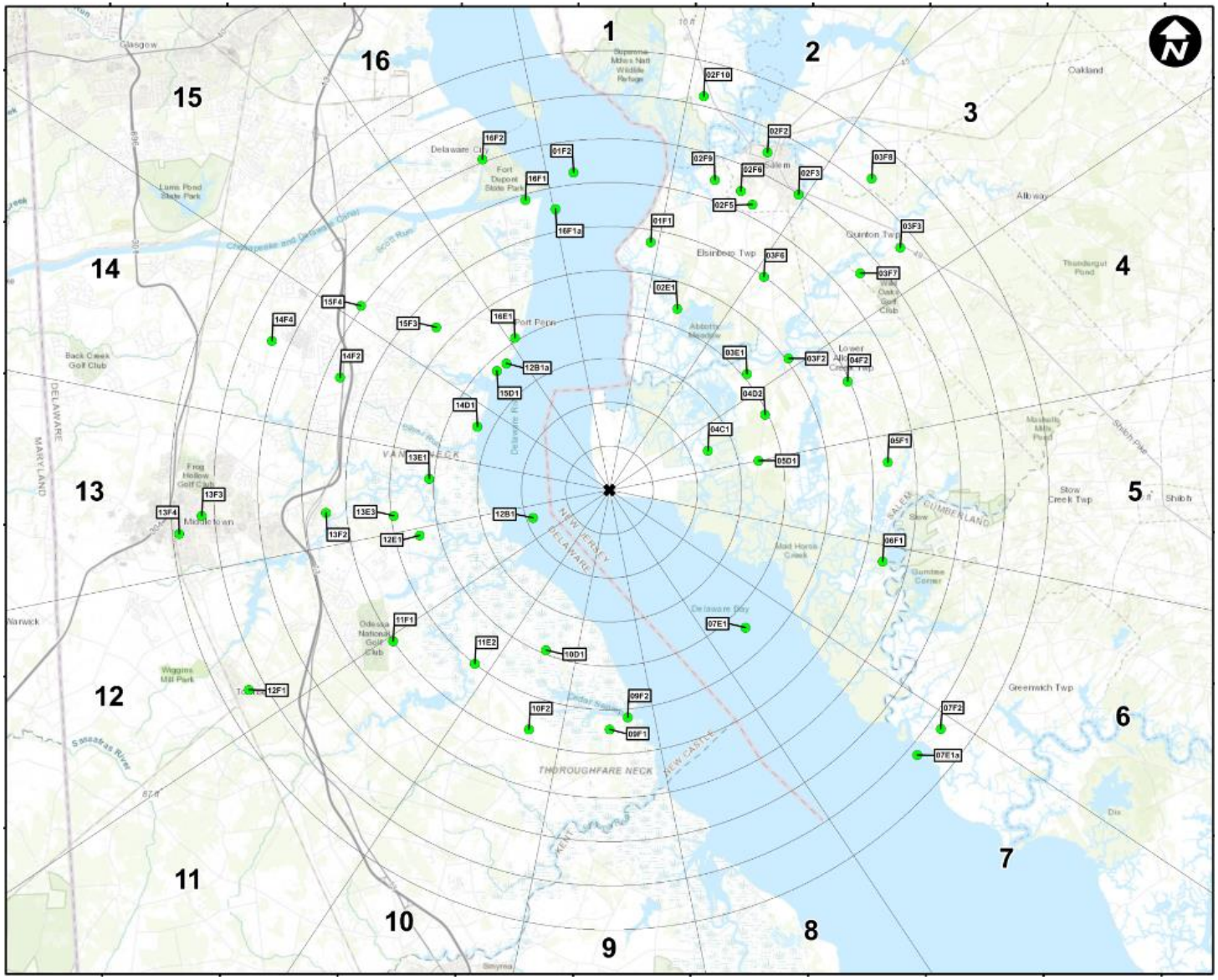

Figure 3, REMP Sample Locations (Off-Site Sampling Locations 1 to 10 Miles)

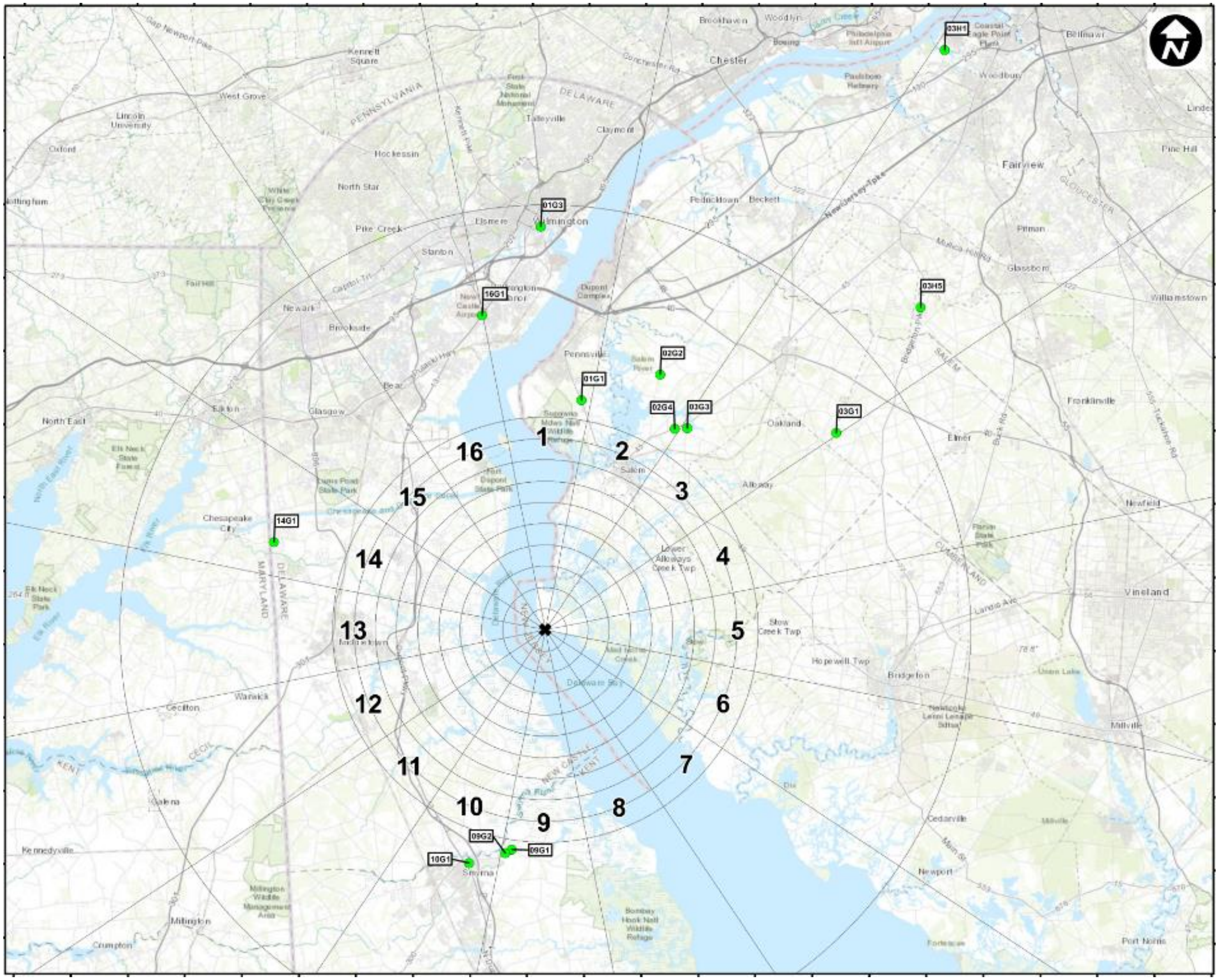

Figure 4, REMP Sample Locations (Off-Site Sampling Locations Greater Than 10 Miles)

8.0 REPORTING LEVELS FOR RADIOACTIVITY CONCENTRATIONS IN ENVIRONMENTAL SAMPLES

Table 8, Reporting Levels for Radioactivity Concentrations in Environmental Samples

Radionuclide	Water (pCi/L)	Air Particulates or Gases (pCi/m^3)	Fish (pCi/kg-wet)	Milk (pCi/L)	Food Products (pCi/Kg-wet)
H-3	30,000[2]	NA	NA	NA	NA
Mn-54	1,000	NA	30,000	NA	NA
Fe-59	400	NA	10,000	NA	NA
Co-58	1,000	NA	30,000	NA	NA
Co-60	300	NA	10,000	NA	NA
Zn-65	300	NA	20,000	NA	NA
Zr-Nb-95	400	NA	NA	NA	NA
I-131	20[3]	0.9	NA	3	100
Cs-134	30	10	1,000	60	1,000
Cs-137	50	20	2,000	70	2,000
Ba-La-140	200	NA	NA	300	NA

[2] **No** drinking water pathway exists on site or downstream. If a drinking water pathway existed, then the water reporting limit for H-3 would be 20,000 pCi/L.

[3] **No** drinking water pathway exists on site or downstream. If a drinking water pathway existed, then the reporting limit for I-131 would be 2 pCi/L.

Table 9, Lower Limits of Detection (LLD)

Radionuclide	Water (pCi/L)	Air Particulates or Gases (pCi/m^3)	Fish (pCi/kg-wet)	Milk (pCi/L)	Food Products (pCi/Kg-wet)	Sediment (pCi/Kg-dry)
Gross Beta	4	0.01	NA	NA	NA	NA
H-3	3,000[4]	NA	NA	NA	NA	NA
Mn-54	15	NA	130	NA	NA	NA
Fe-59	30	NA	260	NA	NA	NA
Co-58, Co-60	15	NA	130	NA	NA	NA
Zn-65	30	NA	260	NA	NA	NA
Zr-Nb-95	15	NA	NA	NA	NA	NA
I-131	15[5]	0.07	NA	1	60	NA
Cs-134	15	0.05	130	15	60	150
Cs-137	18	0.06	150	18	80	180
Ba-La-140	15	NA	NA	15	NA	NA

[4] **No** drinking water pathway exists on site or downstream. If a drinking water pathway existed, then the maximum LLD value would be 2,000 pCi/L.

[5] **No** drinking water pathway exists on site or downstream. If a drinking water pathway existed, then the maximum LLD value would be 1 pCi/L.

9.0 SAMPLING PROGRAM, PROGRAM MODIFICATION AND INTEPRETATION OF RESULTS

At most nuclear stations, historical[6] data was collected prior to plant operation to determine background radioactivity levels in the environment. Annual data is routinely compared to preoperational and/or 10-year average values to determine if changes in the environs are present. Strict comparison is difficult to make due to fallout from historical nuclear weapon testing. Cesium-137 can be routinely found in environmental samples as a results of above ground nuclear weapons testing. It is important to note, levels of Cs-137 in environment are observed to fluctuate, for example as silt distributions shift due to natural erosion and transport processes, Cs-137 may or may not be observed in sediment samples. Results from samples collected and analyzed during the year, 2021, are described below.

In the following sections, results from direct radiation, air, water, and food products analyzed as part of REMP in 2021 will be discussed. Sampling program descriptions and deviations will also be discussed.

9.1 Environmental Direct Radiation Dosimetry Sample Results

Dose is measured as net exposure (field reading less transit reading) normalized over 91 days and relies on comparison of indicator locations to the control location to determine plant impact. During this calendar year 2021, a total of 236 samples were collected and analyzed in accordance with the requirements in Table 2, Radiological Environmental Sampling Program – Exposure Pathway – Direct Radiation. There are different tools used to measure radiation exposure by measuring the intensity of visible light emitted from a sensitive crystal. Thermoluminescent Dosimeter (TLD) or Optical Stimulated Luminance Dosimeter (OSLD) can be used to measure radiation exposure. The SGS/HCGS direct radiation program uses TLD's. Environmental ODCM TLD results are compared by location to historical data to determine if results are within low and high ranges expected for each TLD location as shown in Table 10: TLD Average Sample Results Direct Radiation Summary.

Ambient radiation levels in the environment were monitored at locations on the Site and in the surrounding areas with pairs of passive dosimeters (PD) supplied and analyzed by Stamford Dosimetry/Environmental Dosimetry Co. Packets containing the PDs were placed in the owner-controlled area, around the Site at various distances, and in each land based meteorological sector. Six were placed in control locations and the balance of measurement locations were placed at areas of interest such as population centers, nearby residences, and schools.

[6] Preoperational or 10-year average data.

A total of 59 Immersion Dose Monitor (IDM) locations were established to monitor for direct radiation during 2021, including:

21 on-site locations:

01Q1, 01X2, 02S2a, 02X4, 03X1, 04X1, 05X1, 06X2, 07S1, 08S1, 08S2, 10S1, 11S1, 12S1, 14S2, 15S1, 15S2, 15S3 16S1, 16Q2, and 16X3

27 off-site locations within the 10 mile zone:

04D2, 05D1, 10D1, 14D1, 15D1, 02E1, 03E1, 11E2, 12E1, 13E1, 16E1, 01F1, 02F2, 02F6, 03F2, 04F2, 05F1, 06F1, 07F2, 09F1, 09F2, 10F2, 11F1, 12F1, 13F2, , 14F2, and 15F3

5 areas of interest (population centers, nearby residences, and schools)

02F5, 03F3, 13F3, 13F4 and 16F2

6 control locations beyond 10 miles:

01G3, 03G1, 10G1, 14G1, 16G1, and 03H1.

The PDs at each location are changed and analyzed quarterly.

Two PDs (Panasonic type UD-814) are placed at each location. The laboratory utilizes a Panasonic based system using UD-814 dosimeters that are constructed of three rectangular, lead-shielded (protects against low-energy gamma radiation) teflon wafers, impregnated with 25% calcium sulfate phosphor ($CaSO_4$:Dy) to monitor gamma radiation. Additionally, each PD has one lithium borate (LiBO:Mn) element to monitor beta radiation (which is not used).

In 2019 PSEG implemented American National Standards Institute (ANSI) N13.37-2014 Environmental Dosimetry - Criteria for System Design and Implementation for comparing each PD location dose result to its historical background dose. Per the standard a well-functioning dosimetry system should be able to detect a 5 mrem difference in the quarterly data and a 10 mrem difference in the yearly data above background.

Two on site ISFSI locations 01Q1 and 16Q2 showed measurable dose rates above background as seen in Table 15. The net dose radiation levels as measured by these site boundary locations ranged from 15.7 to 22.7 mrem/Standard Quarter and an annual dose of 85.9 mrem for Locations 01Q1, and 68.7 mrem for Location 16Q2.

Dose to the nearest resident due to direct radiation from ISFSI was calculated to be 0.007 mrem/yr, which is a very small fraction (0.03%) of the 25 mrem/yr limit per 40 CFR 190 and 10 CFR 72.104. Both regulations limit the dose to a real member of the public to 25 mrem in a year to the total body. The calculation was performed using the formula provided in ANSI/HPS N13.37-2014 as follows:

$$D_2 = OF * \left(\left(D_1 * R_1^{\,2} \right) / R_2^{\,2} \right)$$

Where:

D1 = Dose that was measured from TLD Location 1Q1 (16Q2 was also calculated and had a slightly lower dose)

D2 = Dose that will be extrapolated to Nearest Resident

R1 = Distance from the source to the location where D1 was obtained. (Distance from ISFSI to TLD at 16S2)

R2 = Distance from ISFSI to the location that dose will be extrapolated (Nearest Resident)

OF = Occupancy Factor (1 = full time)

Location	**R_1** (ft)	**D_1 Annual Net Dose** (mrem)	**R_2** (ft)	**OF**	**D_2 Annual Net Dose** (mrem)
Nearest Resident	203	68.7	19,536	1.0	7.42 E-03

Table 10: TLD Average Sample Results Direct Radiation Summary

Year	Average Inner Ring Gross Quarterly Dose* (0 - 5 Miles) *mR/QTR[1]*	Average Special Interest Gross Quarterly Dose* (Population) *mR/QTR[1]*	Average Outer Ring Gross Quarterly Dose* (5 - 10 Miles) *mR/QTR[1]*	Average Control Location Gross Quarterly Dose* (> 10 Miles) *mR/QTR[1]*
2011	14.5	15.2	14.8	14.8
2012	14.9	15.2	15.8	15.4
2013	13.4	14.2	14.3	14.2
2014	13.2	13.8	14.2	14.0
2015	13.0	13.5	13.9	13.8
2016	12.4	12.8	13.0	13.1
2017	12.8	13.6	13.5	13.6
2018	13.1	13.7	13.6	13.6
2019	12.5	13.4	13.5	13.5
2020	14.0	14.7	14.7	14.9
2021	14.3	15.0	14.9	15.2
2021 Average Sample Net Quarterly Dose* ***mR/QTR[1]***	14.9			

* Gross quarterly dose is the observed field value minus transit and extraneous dose. However, this net dose is not a final net value because the location background has not yet been subtracted. With background subtracted in accordance with ANSI/HPS N13.37-2014, section 7.3.5, all values would be non-detect (ND).

1 QTR is a standard quarter, which is normalized over 91 days.

2 Population Center TLDs: SA-IDM-02F5, 03F3, 13F3, 13F4, 16F2

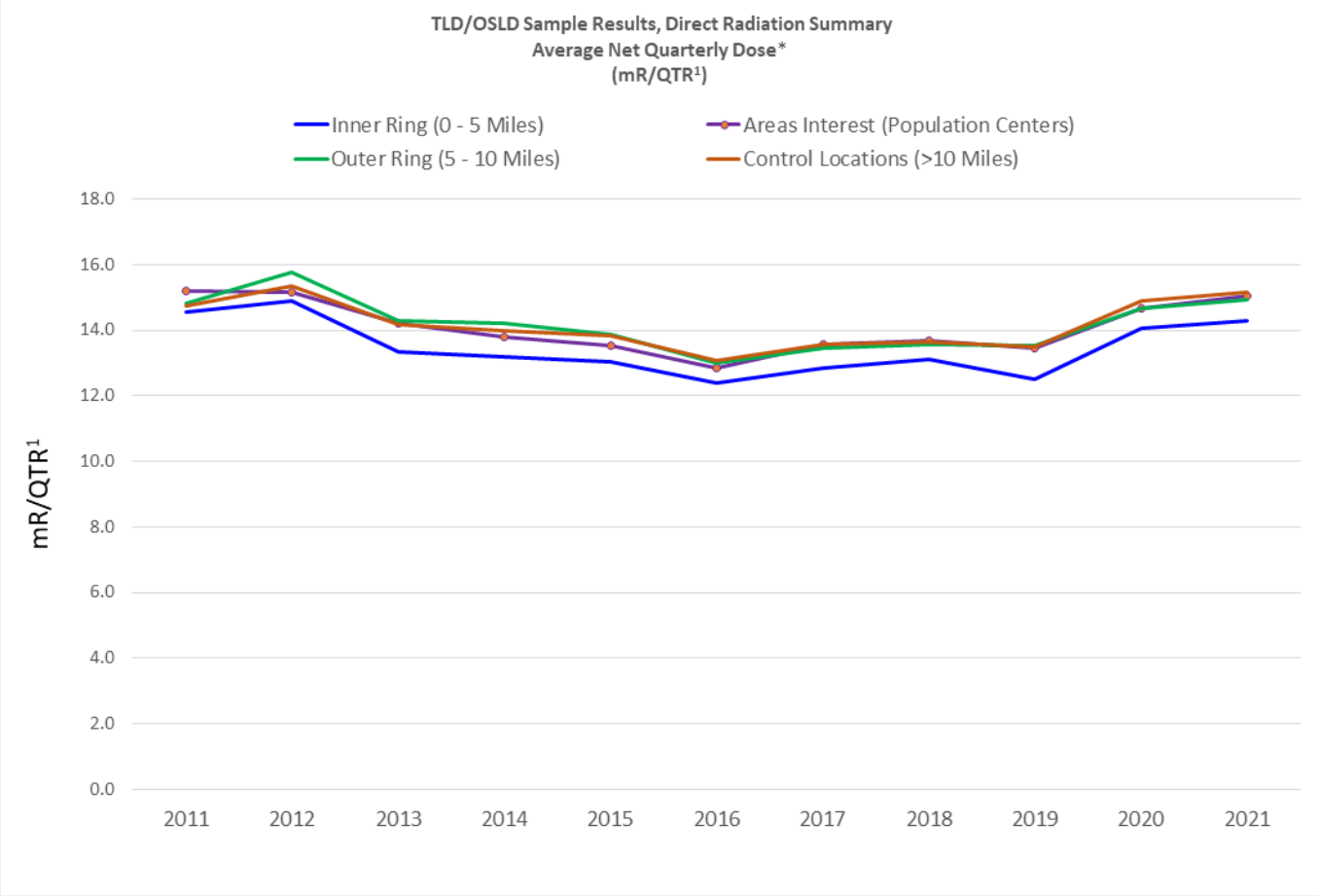

Figure 5, TLD Sample Results

9.2 Air Particulate and Radioiodine Sample Results

Air particulate filters and charcoal canisters were collected from locations specified in Table 3, Radiological Environmental Sampling Program – Exposure Pathway - Airborne. During this calendar year 2021, a total of 848 samples (424 particulate filters and 424 iodine cartridges) were collected and analyzed for gross beta, gamma emitters and Iodine - 131. Particulate samplers are used to analyze for gross beta activity following filter change out which occurs weekly. Gamma isotopic analysis is performed on composite samples collected at each location and is analyzed quarterly.

APT (Air Particulate) samples were collected on glass fiber filters with low-volume air samplers sampling at approximately 1.5 SCFM. Air sample volumes were measured with calibrated dry-gas meters.

AIO samples (Air Iodine) were collected from the air by adsorption on triethylene-diamine (TEDA) impregnated charcoal cartridges connected in series after the APT filters.

9.2.1 Air Particulates

APT samples were collected weekly at seven indicator locations (05X1, 06S1, 15S2, 05D1, 16E1, 01F1, and 02F6), one duplicate location (05S2) and one control location (14G1). Each weekly sample collected was analyzed for gross beta by TBE. Quarterly composites of the weekly samples from each location were analyzed for specific gamma emitters. The duplicate air location sample was shipped to GEL for analysis (Table 16, Table 17, and Table 18).

9.2.2 Gamma Spectroscopy

Gamma spectroscopy was performed on each of the 32 quarterly composite samples. Naturally occurring Be-7 was detected and no other gamma emitters were detected in any of the samples.

Naturally occurring Be-7, attributed to cosmic ray activity in the atmosphere, was detected in all 28 indicator location composites at concentrations ranging from 46E-03 pCi/m3 to 83E-03 pCi/m3 with an average concentration of 65E-03 pCi/m3, and in the four control location composites ranging in concentration from 56E-03 pCi/m3 to 67E-03 pCi/m3 with an average concentration of 61E-03 pCi/m3. The maximum preoperational level detected was 330E-03 pCi/m3 with an average concentration of 109E-03 pCi/m3 (Table 11, Table 16 and RMC-TR-77-03 [21]).

9.2.3 Gross Beta

Gross beta activity was detected in all 371 of the indicator location samples at concentrations ranging from 4E-03 pCi/m3 to 42E-03 pCi/m3 with an average concentration of 14E-03 pCi/m3, and in 53 of 53 of the control location samples at concentrations ranging from 5E-03 pCi/m3 to 25E-03 pCi/m3 with an average of 14E-03 pCi/m3. Gross beta activity was less than ten times the yearly mean of control samples. Therefore, per the ODCM gamma isotopic analysis was not required to be performed on the individual samples. The maximum preoperational level detected was 920E-03 pCi/m3 with an average concentration of 74E-03 pCi/m3 (Table 11, Table 17 and RMC-TR-77-03 [21]). See Figure 6.

9.2.4 Air Iodine

AIO were collected weekly at seven indicator locations (05X1, 06S1, 15S2, 05D1, 16E1, 01F1, and 02F6), one duplicate location (05S2) and one control location (14G1). The duplicate air location sample was shipped to GEL for analysis. Each sample was analyzed by TBE for I-131, and all 424 samples were less than the MDC for both indicator and control samples during the Reporting Period. The maximum preoperational level detected was 42E-03 pCi/m3 (Table 11, Table 18 and RMC-TR-77-03 [21]).

Table 11: Air Particulate and Radioiodine Comparison of Current Year and Historic Data

Analysis	Preoperational Data (pCi/m^3)	2021 Sample Result Average (pCi/m^3)
Gamma	109E-03	65E-03
Beta	74E-03	14E-03
Iodine	42E-03	< MDC

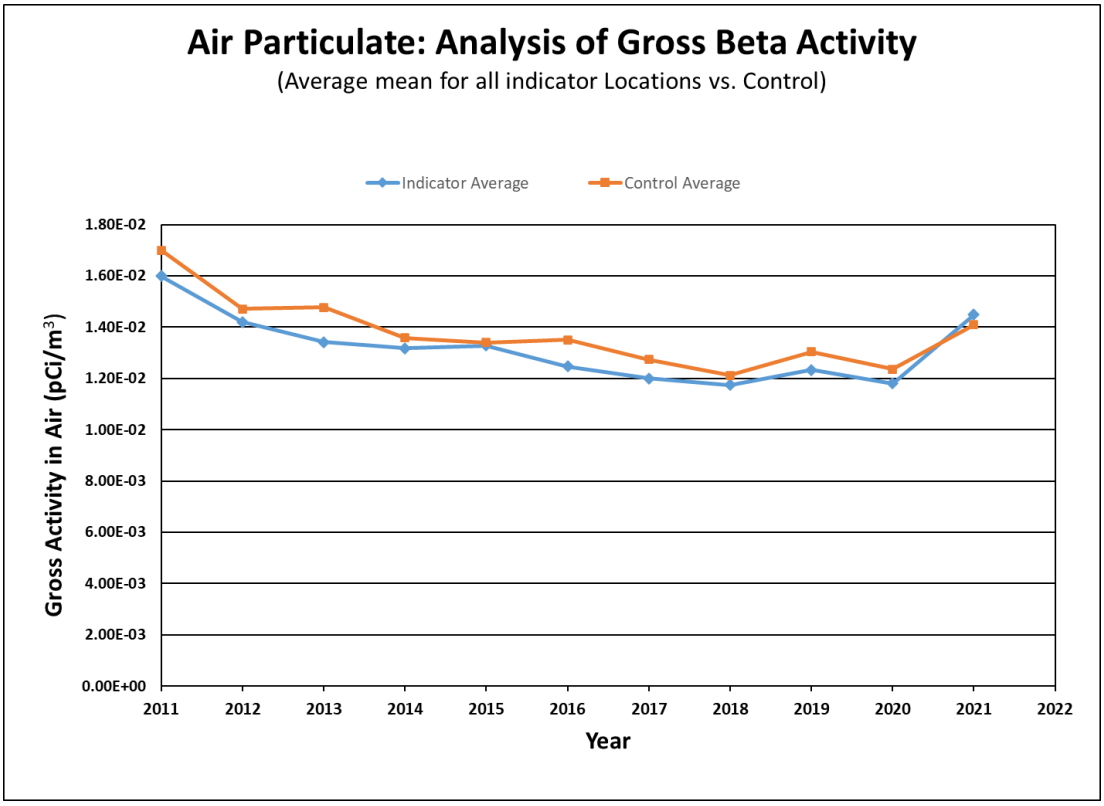

Figure 6: Air Particulate: Analysis for Gross Beta, Average Mean for All Indicator Vs. Control

Air particulate and radioiodine results from this monitoring period, 2021, were compared to preoperational data as shown in Table 11 and Figure 6, and there were no significant changes.

9.3 Waterborne Sample Results

9.3.1 Surface Water

Surface water samples were collected twice a month at four indicator locations and one control location in the Delaware River Estuary. The two samples for the month were combined to create a single monthly composite sample that was then analyzed. One location (11A1) is at the outfall area (which is the area potentially impacted by effluents discharged from the Site into the Delaware River), one location is downstream from the outfall area (07E1), and one location is directly west of the outfall area at the mouth of the Appoquinimink River (12B1). Samples were collected upstream in the Delaware River (01F2) and at the mouth of the Chesapeake and Delaware Canal (16F1) the latter being sampled when the flow was from the Canal into the river.

Surface water samples were collected offshore in new polyethylene containers that were rinsed twice with the sample medium prior to collection. The surface water samples were transported to TBE for analysis.

Location 12B1, located directly west of the Site, at the mouth of the Appoquinimink River, serves as the control. 12B1 was chosen as the control location because the physical characteristics of this location more closely resemble those of the outfall area than do those at the farther upstream location (01F2). As discussed in the preoperational summary report, due to its tidal nature, there were flow rate and salinity variations in the Delaware River Estuary. These variations accounted for the differences in K-40 concentrations.

During this calendar year 2021, a total of 60 surface water samples were collected and analyzed in accordance with the requirements of Table 4, Radiological Environmental Sampling Program – Exposure Pathway - Waterborne.

1. Tritium

Tritium activity was not detected above the MDC in any of the 48 indicator samples or none of the 12 control location samples. The maximum preoperational level detected was 600 pCi/L, with an average concentration of 210 pCi/L (Table 19 and RMC-TR-77-03 [21]). See Figure 7 for graphical presentation.

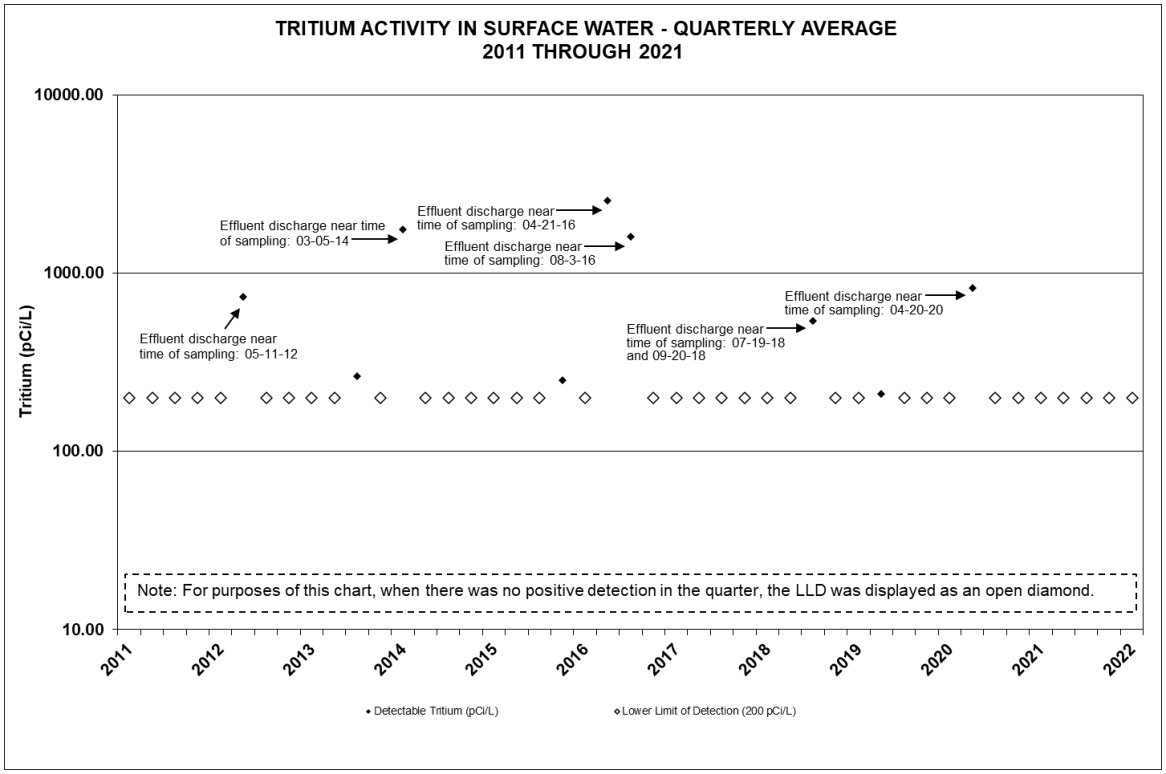

Figure 7: Surface Water Tritium Results

2. Gamma Spectroscopy

No plant related gamma emitters were detected above the MDC in any of the indicator or control surface water samples.

Naturally occurring K-40 was detected in 13 of the 48 indicator location samples at concentrations ranging from 51 pCi/L to 136 pCi/L, with an average of 86 pCi/L. K-40 was detected in 2 of the 12 control location samples at an average concentration of 72 pCi/L. The maximum preoperational level detected for K-40 was 200 pCi/L with an average concentration of 48 pCi/L (Table 20 and RMC-TR-77-03 [21]).

3. I-131Low Level

I-131 was not detected above the MDC in any of the 48 indicator samples or in any of the control location samples (Table 20).

9.3.2 Potable Water (Drinking Water)

Both raw and treated potable water samples were collected and composited at the local water treatment facility. Each sample consisted of weekly aliquots composited into a monthly sample. The raw water source for this plant is a combination of surface water from Laurel Lake and groundwater from its adjacent wells. These are Management Audit samples as no liquid effluents discharged from the Site directly affect this pathway.

1. Gross Alpha

No Gross alpha activity was detected above the MDC in any of the raw or treated water samples. The maximum preoperational level detected was 2.7 pCi/L (Table 21 and RMC-TR-77-03 [21]).

2. Gross Beta

Gross beta activity was detected in all 12 of the raw and 12 treated water samples. The concentrations for the raw samples ranged from 4.3 pCi/L to 9.7 pCi/L, with an average concentration of 6.8 pCi/L. Concentrations for the treated water ranged from 4.9 pCi/L to 8.6 pCi/L, with an average concentration of 6.8 pCi/L. The maximum preoperational level detected was 9.0 pCi/L with an average concentration of 4.2 pCi/L (Table 21 and RMC-TR-77-03 [21]).

3. Tritium

Tritium activity was not detected above the MDC in any of the 12 raw or 12 treated water samples. The maximum preoperational level detected was 350 pCi/L with an average of 179 pCi/L (Table 21 and RMC-TR-77-03 [21]).

4. I-131

I-131 activity was not detected above the MDC in any of the 12 raw or 12 treated water samples. No preoperational data were available for comparison, since I-131 was not analyzed as a specific radionuclide prior to 1989. However, I-131 analytical results to date have been below the MDC (Table 22 and RMC-TR-77-03 [21]).

5. Gamma Spectroscopy

No plant related gamma emitters were detected above the MDC in any of the 24 potable water samples. Naturally occurring K-40 was not detected in any of the potable water samples. No preoperational data were available for comparison. Naturally occurring Ra-226 was not detected in any raw or treated water samples. The maximum preoperational level detected for Ra-226 was 1.4 pCi/L (Table 22 and RMC-TR-77-03 [21]).

9.3.3 Well Water (Ground Water)

Although offsite wells in the vicinity of the Site are not directly affected by plant operations, well water samples were collected monthly from one farm (03E1). Samples from this well are considered Management Audit samples.

1. Gross Alpha

Gross alpha activity was not detected above the MDC in any of the 12 well water samples. The maximum preoperational level detected was 9.6 pCi/L (Table 23 and RMC-TR-77-03 [21]).

2. Gross Beta

Gross beta activity was detected in 3 of the 12 well water samples. Concentrations ranged from 2.7 pCi/L to 4.5 pCi/L with an average concentration of 3.5 pCi/L. The preoperational results ranged from <2.1 pCi/L to 38 pCi/L, with an average value of 9 pCi/L (Table 23 and RMC-TR-77-03 [21]).

3. Tritium

Tritium activity was not detected above the MDC in any of the 12 well water samples. The maximum preoperational level detected was 380 pCi/L (Table 23 and RMC-TR-77-03 [21]).

4. I-131

I-131 activity was not detected in any of the 12 well water samples. No preoperational data were available for comparison, since I-131 was not analyzed as a specific radionuclide prior to 1989. However, I-131 analytical results to date have been below the MDC (Table 24 and RMC-TR-77-03 [21]).

5. Gamma Spectroscopy

No plant related gamma emitters were detected above the MDC in any of the indicator or control location well water samples. Naturally occurring K-40 was not detected in any of the well water samples. The maximum preoperational levels detected were 30 pCi/L (Table 24 and RMC-TR-77-03 [21]).

9.3.4 Sediment

Sediment samples were collected semi-annually from six indicator locations and one control location. Location 05A1 was the only shoreline sediment sample location that was directly subjected to tidal fluctuations. The remaining locations were located offshore.

Sediment samples were taken with a bottom grab sampler and frozen in sealed polyethylene containers before being transported in ice chests to TBE. For the river bottom sediment, a marine GPS was used to locate the correct site and the sampling boat was maneuvered over the area until the correct amount of sample was obtained (grabbed) with the sediment dredge.

Location 05A1 shoreline sediment sample (an onsite location) was sampled as follows: A square area, measuring one meter on each side was staked out and then divided into a grid of nine smaller boxes, three per side. A one inch deep scoop from the center of each of the small grids was taken. All the aliquots were combined and the total sample transported in the ice chest to TBE and analyzed for gamma emitters.

Naturally occurring K-40 was detected in all 12 indicator location samples at concentrations ranging from 2,562 pCi/kg (dry) to 15,820 pCi/kg (dry), with an average concentration of 8,305 pCi/kg (dry). Both control locations samples had concentrations ranging from 16,410 pCi/kg (dry) to 16,950 pCi/kg (dry) with an average concentration of 16,680 pCi/kg (dry). The maximum preoperational level detected was 21,000 pCi/kg (dry) with an average concentration of 15,000 pCi/kg (dry) (Table 25 and RMC-TR-77-03 [21]).

Cs-137 was not detected in any of the indicator or control samples. The maximum preoperational level detected was 400 pCi/kg (dry) with an average concentration of 150 pCi/kg (dry) (Table 25 and RMC-TR-77-03 [21]).

Naturally occurring Ra-226 was not detected above the MDC in any indicator location samples and was not detected above the MDC in the control location samples. The maximum preoperational level detected was 1,200 pCi/kg (dry) with an average concentration of 760 pCi/kg (dry) (Table 25 and RMC-TR-77-03 [21]).

Naturally occurring Th-232 was detected in 9 of the 12 indicator location samples at concentrations ranging from 362 pCi/kg (dry) to 1,062 pCi/kg (dry) with an average concentration of 591 pCi/kg (dry), and in both of the control location samples at concentrations ranging from 822 pCi/kg (dry) to 975 pCi/kg (dry) with an average concentration of 898 pCi/kg (dry). The maximum preoperational level detected was 1,300 pCi/kg (dry) with an average concentration of 840 pCi/kg (dry). All other gamma emitters were less than the MDC (Table 25 and RMC-TR-77-03 [21]).

9.4 Ingestion Pathway Sample Results

9.4.1 Milk

Milk samples (MLK) were taken semi-monthly when cows were on pasture and monthly when cows were not grazing on open pasture, from two indicator locations (13E3, and14F4) and one control location (02G3). Animals were considered on pasture from April to November of each year. Samples were collected in new polyethylene containers, sodium bisulfite was added as a sample preservative, and then samples were frozen and transported in ice chests to TBE. Each sample was analyzed for I-131 and gamma emitters. Note: Location 03G1 was the previous control location, however, the dairy farm is no longer in business.

There is no dairy farm within three miles of the Site, and there is only one dairy farm within five miles (13E3). Therefore, broadleaf vegetation is grown, maintained, and harvested monthly during the growing season.

1. I-131

I-131 was not detected above MDC in any of the 60 samples analyzed. The maximum preoperational level detected was 65 pCi/L, which occurred following a period of atmospheric nuclear weapons (Table 26 and RMC-TR-77-03 [21]).

2. Gamma Spectroscopy

No plant related gamma emitters were detected above the MDC in any of the indicator or control location milk samples.

Naturally occurring K-40 was detected in all 40 milk samples with concentrations for the 40 indicator location samples ranging from 734 pCi/L to 1,914 pCi/L with an average concentration of 1,287 pCi/L, and the 20 control location sample concentrations ranging from 717 pCi/L to 1,426 pCi/L, with an average concentration of 1,170 pCi/L. The maximum preoperational level detected was 2,000 pCi/L with an average concentration of 1,437 pCi/L (Table 26 and RMC-TR-77-03 [21]).

9.4.2 Fish and Invertebrates

A total of 10 fish and invertebrate samples were analyzed in 2021, for gamma emitting radionuclides in accordance with requirements of Table 5, Radiological Environmental Sampling Program – Exposure Pathway - Ingestion. These samples are collected from the indicator and control areas as required by the ODCM.

1. Fish

Edible species of fish were collected semi-annually at two indicator locations and one control location and analyzed for gamma emitters in edible flesh. Sample species collected in 2021, was striped bass. Edible fish were collected using gill nets while crabs were caught in commercial traps. These samples were processed by separating the flesh from the bone and shell. The flesh was placed in sealed containers and frozen before being transported in ice chests to TBE for analysis.

No plant related gamma emitters were detected above the MDC in any of the indicator or control location fish samples. Naturally occurring K-40 was detected in all 4 indicator location samples at concentrations ranging from 3,061 pCi/kg (wet) to 4,102 pCi/kg (wet) with an average concentration of 3,490 pCi/kg (wet). The control location samples had concentrations ranging from 3,356 pCi/kg (wet) to 4,353 pCi/kg (wet), with an average of 3,855 pCi/kg (wet). The maximum preoperational detection was 13,000 pCi/kg (wet) with an average concentration of 2,900 pCi/kg (wet) (Table 27 and RMC-TR-77-03 [21]).

2. Blue Crab

Blue crab samples were collected twice during the season at one indicator and one control location. The edible portions were analyzed for gamma emitters. No plant related gamma emitters were detected above the MDC in any of the indicator or control location blue crab samples. Naturally occurring K-40 was detected in both indicator samples at concentrations of 2,590 pCi/kg (wet) and 3,379 pCi/kg (wet) with an average concentration of 2,985 pCi/kg (wet). The control location samples had concentrations ranging from 2,037 pCi/kg (wet) to 3,178 pCi/kg (wet), with an average concentration of 2,608 pCi/kg (wet). The maximum preoperational level for K-40 detected was 12,000 pCi/kg (wet) with an average concentration of 2,835 pCi/kg (wet). All other gamma emitters were less than the MDC (Table 28 and RMC-TR-77-03 [21]).

9.4.3 Vegetation

A total of 36 food samples were analyzed in 2021, for gamma emitting radionuclides in accordance with requirements of Table 5, Radiological Environmental Sampling Program – Exposure Pathway - Ingestion.

Locally grown vegetables (FPV) were collected at the time of harvest at seven locations (02F9, 03F8, 15F4, 01G1, 02G2, 09G2 and 03H5); fodder crops (VGT) were sampled at three locations (13E3, 14F4, and 02G3); and broad leaf vegetation (FPL) was sampled at three locations (06S1, 16S1, and 10D1). The vegetables and fodder samples are additional samples (Management Audit) taken to enhance the radiological monitoring program.

1. Broadleaf Vegetation

Broadleaf vegetation samples were collected since there were no dairy farms operating within the five km (three mile) radius of the Site. The closest dairy farm (13E3) was located in Odessa, DE at 5.0 miles to the West.

All samples were analyzed for gamma emitters and included kale, broccoli, and lambs ear. These samples were obtained from five indicator locations (11 samples) and one control locations (4 samples). The results for these samples are discussed below.

No plant related gamma emitters were detected above the MDC in any of the indicator or control location broadleaf vegetation samples.

Naturally occurring Be-7, attributed to cosmic ray activity in the atmosphere, was detected above the MDC in 4 of the 11 indicator location samples with concentrations ranging from 782 pCi/kg (wet) to 2,551 pCi/kg (wet), with an average concentration of 1,627 pCi/kg (wet). Be-7 was detected in 3 of the 4 control location samples, with concentrations ranging from 426 pCi/kg (wet) to 3,542 pCi/kg (wet), and an average concentration of 1,763 pCi/kg (wet). No preoperational Be-7 data was available for comparison (Table 29).

Naturally occurring K-40 was detected in all 11 indicator samples, with concentrations ranging from 5,284 pCi/kg (wet) to 14,110 pCi/kg (wet) with an average concentration of 8,740 pCi/kg (wet). K-40 was detected in all of the control location samples, with concentrations ranging from 4,790 pCi/kg (wet) to 19,270 pCi/kg (wet), and an average concentration of 9,415 pCi/kg (wet). The maximum preoperational level detected was 4,800 pCi/kg (wet) with an average concentration of 2,140 pCi/kg (wet) (Table 29 and RMC-TR-77-03 [21]).

Naturally occurring Th-232 was not detected in any of the indicator location samples or control location samples (Table 29).

2. Vegetables

There are no farm products that are irrigated with water in which plant effluents have been discharged. The Delaware River at the location of the Site is brackish and therefore is not used for irrigation.

A variety of food products were sampled on and around the Site; however, the variety was dependent on the farmer's preference. These vegetables were collected as Management Audit samples.

All samples were analyzed for gamma emitters and included asparagus, sweet corn, peppers, tomatoes, and peaches. These samples were obtained from seven indicator locations (21 samples). The results for these samples are discussed below.

No plant related gamma emitters were detected above the MDC in any of the indicator or control location vegetable samples.

Naturally occurring Be-7, attributed to cosmic ray activity in the atmosphere, was not detected above the MDC in any of the vegetable samples.

Naturally occurring K-40 was detected in all 21 indicator samples, with concentrations ranging from 1,220 pCi/kg (wet) to 2,717 pCi/kg (wet) with an average concentration of 1,815 pCi/kg (wet). The maximum preoperational level detected was 4,800 pCi/kg (wet) with an average concentration of 2,140 pCi/kg (wet) (Table 30 and RMC-TR-77-03 [21]).

3. Fodder Crops

Although not required by the Site ODCM, three samples of silage normally used as cattle feed were collected from three indicator locations. It was determined that these products could be an element in the food-chain pathway. These fodder crops were collected as Management Audit samples and analyzed for gamma emitters. All three locations from which samples were collected are milk sampling locations.

No plant related gamma emitters were detected above the MDC in any of the indicator or control location fodder crop samples. Naturally occurring Be-7, attributed to cosmic ray activity in the atmosphere, was detected in one of the three indicator samples with an average concentration of 341 pCi/kg (wet). The maximum preoperational level detected for fodder was 4,700 pCi/kg (wet) with an average concentration of 2,000 pCi/kg (wet) (Table 31 and RMC-TR-77-03 [21]).

Naturally occurring K-40 was detected in all three indicator samples at concentrations ranging from 2,908 pCi/kg (wet) to 5,104 pCi/kg (wet) with an average concentration of 4,203 pCi/kg (wet). Preoperational results averaged 7,000 pCi/kg (wet) (Table 31 and RMC-TR-77-03 [21]).

4. Game

Although not required by the Site ODCM, three muskrat samples were collected from three indicator locations. The game samples were collected as Management Audit samples and analyzed for gamma emitters.

No plant related gamma emitters were detected above the MDC in any of the indicator game samples. Naturally occurring K-40 was detected in all 3 samples at concentrations ranging from 2,387 to 2,890 pCi/kg (wet) with an average concentration of 2,601 pCi/kg (wet). No preoperational data was available for comparison (Table 32 and RMC-TR-77-03 [21]).

9.5 Terrestrial

9.5.1 Soil

Soil is sampled every three years and analyzed for gamma emitters. Nine locations were sampled last in 2019. These Management Audit samples were collected in areas that have been relatively undisturbed since the last collection in order to determine any change in the radionuclide inventory of the area.

The 2019 samples had naturally occurring K-40 was detected in all nine indicator samples at concentrations ranging from 4,610 to 14,410 pCi/kg (dry) with an average concentration of 9,376 pCi/kg (dry). The maximum preoperational level detected was 24,000 pCi/kg (dry) with an average of 10,000 pCi/kg (dry).

When soil was last collected in 2019, Cs-137 was detected in three of the nine indicator samples at concentrations ranging from 82 to 231 pCi/kg (dry) with an average concentration of 155 pCi/kg (dry). The maximum preoperational level detected was 2,800 pCi/kg (dry) with an average of 800 pCi/kg (dry). See Figure 8 for graphical presentation.

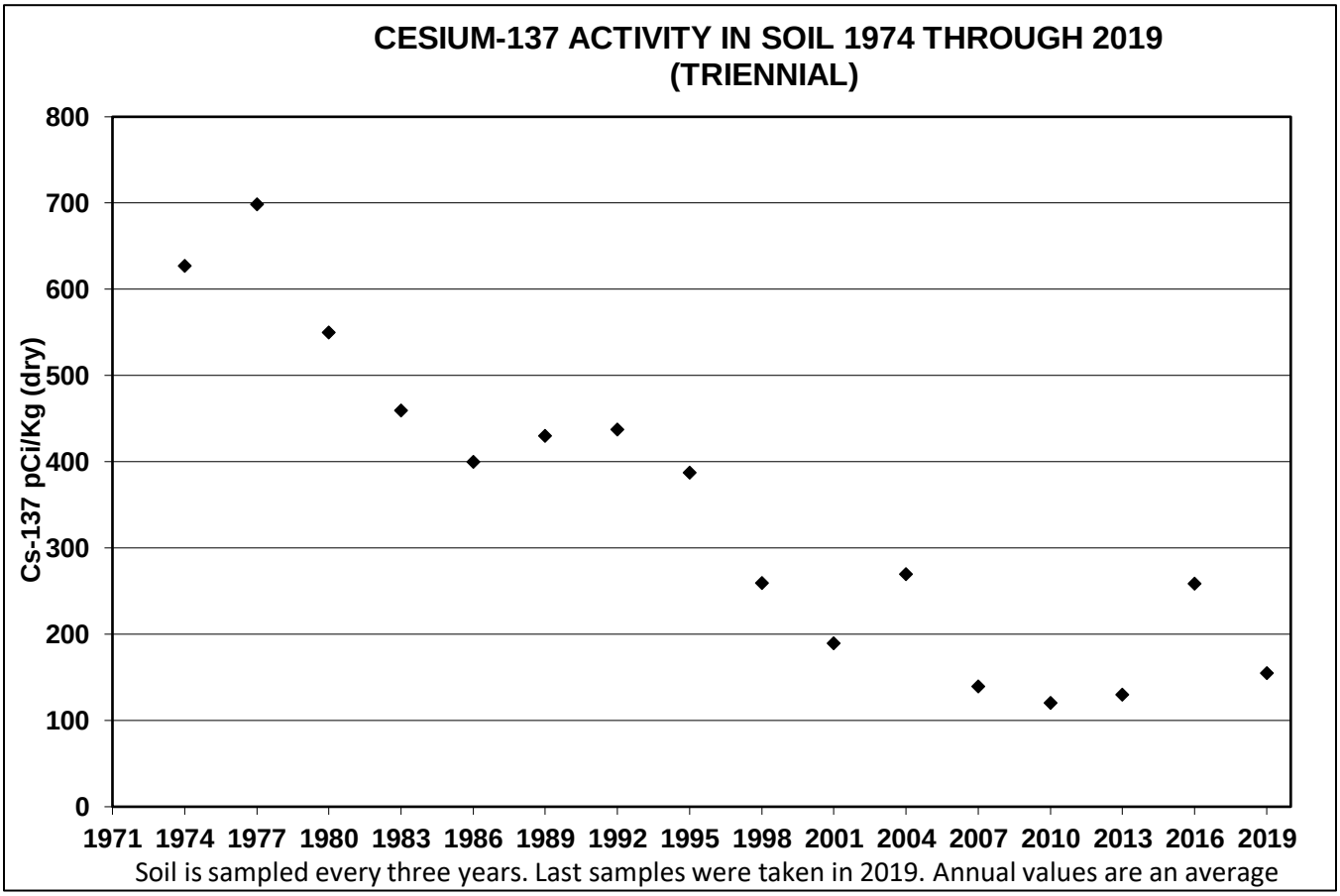

Figure 8, Cesium-137 Activity in Soil 1974 Through 2019

Historically, Cs-137 has been observed in REMP soil samples and attributed to weapons testing. The values observed in these samples are consistent with prior results, and are below the NRC's predicted values of Cs-137 for the New Jersey area soils as a result of fallout from atmospheric weapons testing. Furthermore, the analyzed samples were at concentrations many orders of magnitude above the theoretical impact by plant operation given the Cs-137 concentrations in plant effluents back through 2005.

Additionally, soil is not a formal component of the REMP, nor is it required to be collected as part of the REMP in accordance with the ODCM; it is collected as a REMP Management Audit sample. As such, the ODCM specifies no reportability or LLD thresholds for soil samples. PSEG REMP Implementation procedure, Attachment 1 (Analytical Results Investigation Levels) provides an investigation threshold of 1,000 pCi/kg for Cs-137 in soil and sediment, which is based on the expected concentrations for our region from sources other than plant operation as recognized by the NRC in DOCKET NO.50-219, RFTA NO. 99-040.

This evaluation validated suppositions and will appropriately characterize positive sample results obtained in future sampling evolutions as related to atmospheric testing, provided that:

- Soil concentrations are less than 1,000 pCi/kg
- Annual gaseous Cs-137 effluents are reviewed and do not show a significant increase
- Cs-134 is not detected (Cs-134 is plant related and has a much shorter half-life than Cs-137)
- D/Q values continue to be routinely evaluated and are updated as necessary

For the above reasons, it can be concluded that the samples are primarily the result of atmospheric testing, with negligible contribution from site operations at PSEG Nuclear's three reactors.

Although it has been concluded the Cs-137 in the soil is due to fallout from atmospheric weapons testing, there is essentially no radiological impact to the environment or a member of the public with respect to the annual dose. To demonstrate this, a skin dose calculation was performed for a theoretical person who stood on the soil at location 05F1 for 1,000 hours per year (arbitrary number). This calculation concluded the dose to a member of the public beyond the site boundary would be a mere 2.70E-1 mrem/yr (1.8% of the annual skin dose limit of 15 mrem/yr), which conforms to 10 CFR 50 Appendix I. Since this activity has been determined to be non-site related, a better comparison is the calculated skin dose against background radiation levels (or approximately 0.1% of the 300 mrem/yr background dose).

No soil samples were collected in 2021. Next scheduled sample will be in 2022.

10.0 LAND USE CENSUS EXPOSURE PATHWAY

Annual Land Use Census required by the Offsite Dose Calculation Manual is performed to ensure that changes in the use of areas at or beyond the site boundary are identified and modifications to REMP are made if required by changes in land use. Land use census satisfies the requirements of Section IV.B.3 of Appendix I to 10CFR50. "A land use census shall be conducted and shall identify within a distance of 8 km (5 mi.) the location, in each of the 16 meteorological sectors, of the nearest milk animal, the nearest residence and the nearest garden of greater than 50m^2 (500 ft^2) producing broad leaf vegetation." Note, per NUREG 1301/1302, Broad leaf vegetation sampling of at least three different kinds of vegetation may be performed at the SITE BOUNDARY in each of two different direction sectors with the highest predicted D/Qs in lieu of the garden census.

A Land Use Census was conducted during the calendar year, 2021, within the growing season to identify changes in land use, receptor locations, and new exposure pathways. The results for the 2021 Land Use Census are listed in Table 12: Land Use Census Results within 5 miles. In summary, the highest D/Q locations for nearest garden, nearest residence and nearest milk animal did not change following the 2021 census.

Table 12: Land Use Census Results within 5 miles

Sector	Direction	Nearest Residence (Miles)	Nearest Milk Animal (Miles)	Garden (Miles)	Meat Animal Distance (Miles)
1	N	None	None	None	None
2	NNE	5.0	None	None	None
3	NE	3.9	None	None	None
4	ENE	3.9	None	None	None
5	E	None	None	None	None
6	ESE	None	None	None	None
7	SE	None	None	None	None
8	SSE	None	None	None	None
9	S	None	None	None	None
10	SSW	3.9	None	None	None
11	SW	4.3	None	None	None
12	WSW	4.4	None	None	None
13	W	4.0	5.0	None	None
14	WNW	3.4	None	None	None
15	NW	3.7	None	None	None
16	NNW	4.2	None	None	None

11.0 SAMPLE DEVIATIONS, ANOMALIES, UNAVAILABILITY and PROGRAM CHANGES

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, 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” are defined as sample collection evolution with no available sample (i.e., food crop, TLD).

All required samples were collected and analyzed as scheduled except for the following:

Table 13: Sample Deviation and Anomally Summary

Sample Type	Analysis	Location	Collection Date or Period	Reason for not conducting REMP as required	Plans for preventing reoccurrence
APT/AIO[1]	Gross β Iodine	05S1	2/9/21 - 2/16/21	Loss of Power due to outlet	Restored power to outlet
APT/AIO[2]	Gross β Iodine	14G1	2/16/21 – 2/22/21	Power Outage	N/A
APT/AIO[3]	Gross β Iodine	05S1	2/22/21 – 3/1/21	Power Outage	N/A
APT/AIO[4]	Gross β Iodine	01F1	3/15/21 – 3/22/21	Pump failure	Replaced pump
APT/AIO[5]	Gross β Iodine	5X1*	4/12/21 – 4/19/21	Pump failure	Replaced pump
APT/AIO[6]	Gross β Iodine	02F6	4/26/21 – 5/3/21	Pump failure	Replaced pump
PWT[7]	Gross α	02F3	5/24/21	LLD not met	Resample SAT
APT/AIO[8]	Gross β Iodine	02F6	7/6/21 – 7/12/21	Power Strip Failure	Removed Power Strip install GFCI
APT/AIO[9]	Gross β Iodine	02F6	7/12/21 – 7/19/21	Power Outage	N/A
APT/AIO[10]	Gross β Iodine	16E1	9/20/21 – 9/27/21	Meter Failure	Replaced Meter
APT/AIO[11]	Gross β Iodine	06S1*	10/25/21 – 11/1/21	Pump Failure	Replaced Pump
TLD[12]		6X2	12/10/21	TLD Moved	Relocate
APT/AIO[13]	Gross B Iodine	05S1/07S2	3/5/21	N/A	N/A

1. **Sample Deviation (Order 80128431/210):** Air sampler 5S1 lost power during the 2/9/2021 to 2/16/2021 collection period. The total time the sampler was in operation was 166.7 hours. The total outage duration was 1.28 hours. A total of volume 14,800 cubic feet was collected for the sample period. Adequate sample volume was achieved during the sample collection period to meet the Gross Beta and I-131 ODCM LLD requirement. The power outage was due to an electrical outlet fault. Extension cord was run to another outlet until outlet was repaired.

   Note: Sample location 05S2 is a duplicate sample location. This sampler was functional for the entire duration.

2. **Sample Deviation (Order 80128431/220):** Air sampler 14G1 lost power during the 2/16/2021 to 2/22/2021 collection period. The total time the sampler was in operation was 125.6 hours. The total outage duration was 17.8 hours. A total of volume 11,500 cubic feet was collected for the sample period. Adequate sample volume was achieved during the sample collection period to meet the Gross Beta and I-131 ODCM LLD requirement.

3. **Sample Deviation (Order 80128431/240):** Air sampler 5S1 lost power during the 2/22/2021 to 3/1/2021 collection period. The total time the sampler was in operation was 86.9 hours. The total outage duration was 82.2 hours. A total of volume 7,600 cubic feet was collected for the sample period. Adequate sample volume was achieved during the sample collection period to meet the Gross Beta and I-131 ODCM LLD requirement.

   Note: Sample location 05S2 is a duplicate sample location. This sampler was functional for the entire duration.

4. **Sample Deviation (Order 80128431/230):** Air sampler 1F1 had a pump failure during the 3/15/2021 to 3/22/2021 collection period. The sample pump motor continued to run, which kept the totalizer running, however, only 6,900 cubic feet of sample was collected. Normal volume for a collection period is approximately 15,000 cubic feet. Adequate sample volume was achieved during the sample collection period to meet the Gross Beta and I-131 ODCM LLD requirement. The air sampler was replaced.

5. **Sample Deviation (Order 80128431/250):** Air sampler 5X1 had a motor failure during the 4/12/2021 to 4/19/2021 collection period. The total time the sampler was in operation was 143.6 hours. The total outage duration was 27.0 hours. A total of volume 11,400 cubic feet was collected for the sample period. Adequate sample volume was achieved during the sample collection period to meet the Gross Beta and I-131 ODCM LLD requirement. The air sampler pump motor was replaced.

   Note: Sample location 05S2 is a duplicate sample location. This sampler was functional for the entire duration.

6. **Sample Deviation (Order 80128431/260):** Air sampler 2F6 had a motor failure during the 4/26/2021 to 5/3/2021 collection period. The total time the sampler was in operation was 47.9 hours. The total outage duration was 118.2 hours. A total of volume 4,400 cubic feet was collected for the sample period. Adequate sample volume was achieved during the sample collection period to meet the I-131 ODCM LLD requirement. The ODCM LLD was not met for the gross beta analysis, however, gross beta was detected at normal levels. The air sampler was replaced.

7. **Sample Anomaly (Order 80128431/270):** Gross Alpha LLD was not achieved on a potable water sample collected on 5/24/2021 at location 2F3. The sample had larger amounts of sediment than usual. Resample was taken on 6/26/2021 and the LLD was met. Gross Alpha was not detected in either analysis.

8. **Sample Deviation (Order 80128431/280):** Air sampler 2F6 had a power strip failure during the 7/6/2021 to 7/12/2021 collection period. The total time the sampler was in operation was 77.4 hours. The total outage duration was 62.4 hours. A total of volume 7,100 cubic feet was collected for the sample period. Adequate sample volume was achieved during the sample collection period to meet the Gross Beta and I-131 ODCM LLD requirement. Power strips were removed from all sample pumps and replaced with GFCI was installed.

9. **Sample Deviation (Order 80128431/290):** Air sampler 2F6 had a power failure during the 7/12/2021 to 7/19/2021 collection period. The total time the sampler was in operation was

124.7 hours. The total outage duration was 47.9 hours. A total of volume 11,300 cubic feet was collected for the sample period. Adequate sample volume was achieved during the sample collection period to meet the Gross Beta and I-131 ODCM LLD requirement.

10. **Sample Deviation (Order 80128431/310):** Air sampler 16E1 had a low volume totalizer reading during the 9/20/2021 to 9/27/2021 collection period. The total time the sampler was in operation was 167.8 hours. The total outage duration was zero hours. The total indicated volume was 4,950 cubic feet. Normal sample volume for a week is approximately 15,000 cubic feet. Based on flow rate at time of sample change out (1.5 scfm) and the normal discoloration of filter, it appears that the volume totalizer malfunctioned. The total indicated volume was used for the analysis. Adequate sample volume was achieved during the sample collection period to meet the Gross Beta and I-131 ODCM LLD requirement.
11. **Sample Anomaly (Order 80128431/320):** Air sampler 6S1 had a GFCI trip during the 10/25/2021 to 11/1/2021 collection period. The total time the sampler was in operation was 102.6 hours. The total outage duration was 66.0 hours. A total of volume 9,300 cubic feet was collected for the sample period. Adequate sample volume was achieved during the sample collection period to meet the Gross Beta and I-131 ODCM LLD requirement. A new pump was installed and the GFCI was reset.
12. **Program Change (Order 80128431/340):** Nuclear Projects removed the light pole that hosted TLD 06X2 for the new SAFER/Wind Port work. 06X2 was relocated to the security fence on 1/5/22.
13. **Program Change:** Location 05S1 and 07S2 were renamed in ODCM Common REMP Rev 29 to 5X1 and 6S1 respectively. The revised ODCM Common REMP is included in the 2021 ARERR.

12.0 OTHER SUPPLEMENTAL INFORMATION

12.1 NEI 07-07 Onsite Radiological Groundwater Monitoring Program

Salem and Hope Creek Generating Stations has developed a Groundwater Protection Initiative (GPI) program in accordance with NEI 07-07, Industry Ground Water Protection Initiative – Final Guidance Document. The purpose of the GPI is to ensure timely detection and an effective response to situations involving inadvertent radiological releases to groundwater in order to prevent migration of licensed radioactive material off-site and to quantify impacts on decommissioning. During 2021, SGS/HCGS collected and analyzed groundwater samples in accordance with the requirements of site procedures.

Details of the GPI are included in the Salem and Hope Creek Generating Stations Annual Radiological Effluent Release Report. Table 14 provides a summary of the results.

Table 14: Groundwater Protection Program Monitoring Well Results

Well Name	Number of Positive Detections	Number of Analysis	Average Concentration[7] pCi/L	Maximum Concentration pCi/L
Well AA	4	4	1,470	2,360
Well AA-V	4	4	3,386	6,880
Well AB	1	1	5,420	5,420
Well AC	12	12	30,183	40,900
Well AD	3	3	7,980	8,520
Well AE	4	4	15,775	20,800
Well AF	2	2	312	411
Well AF-V	3	4	316	400
Well AG-D	2	2	897	905
Well AG-S	2	2	737	845
Well AH-D	2	2	570	605
Well AH-S	2	2	506	522
Well AI	2	2	938	1,510
Well AJ	3	3	10,513	11,100
Well AL	2	2	385	415
Well AM	4	4	16,818	27,700
Well AN	12	12	16,325	21,700
Well AP	2	2	1,470	1,680
Well AR	4	4	5,233	6,530
Well AS	2	2	5,505	6,210
Well AT	2	2	2,030	2,060
Well BA	0	2	N/D	N/D
Well BB	0	2	N/D	N/D
Well BC	12	12	1,764	2,970
Well BD	4	4	405	559
Well BE	5	5	705	1,370
Well BF	0	2	N/D	N/D
Well BG	1	4	209	209
Well BH	0	4	N/D	N/D
Well BH-V	0	2	N/D	N/D
Well BI	1	4	455	455
Well BJ	12	12	2,470	2,880
Well BK	0	2	N/D	N/D
Well BL	0	2	N/D	N/D
Well BM	4	4	459	520
Well BM-V	2	2	215	220
Well BN	4	4	780	1,710
Well BO	3	3	392	521
Well BP	0	2	N/D	N/D

[7] Tritium results <MDA should not be included in the average concentration calculation.

Table 14: Groundwater Protection Program Monitoring Well Results

Well Name	Number of Positive Detections	Number of Analysis	Average Concentration[7] pCi/L	Maximum Concentration pCi/L
Well BQ	0	4	N/D	N/D
Well BR	0	2	N/D	N/D
Well BS	0	2	N/D	N/D
Well BT	0	2	N/D	N/D
Well BU	0	2	N/D	N/D
Well BW	1	1	650	650
Well BX	1	1	674	674
Well BY	12	12	58,458	68,100
Well BY-V	4	4	5,916	11,700
Well BZ	2	2	1,325	1,510
Well CA	2	2	1,570	1,810
Well DA	9	9	2,873	3,600
Well DB	4	4	5,868	6,770
Well DC	8	8	3,300	5,250
Well DD	4	4	5,218	5,920
Well DE	4	4	16,575	17,000
Well DF	2	2	1,170	1,190
Well DG	4	4	2,830	3,180
Well DH	4	4	10,463	11,900
Well DI	4	4	2,708	4,420
Well DJ	5	5	3,558	4,250
Well K	0	2	N/D	N/D
Well L	0	2	N/D	N/D
Well M	4	4	6,045	8,480
Well N	4	4	8,265	10,400
Well O	4	4	28,798	52,600
Well P	0	2	N/D	N/D
Well R	12	12	7,738	10,300
Well S	1	1	8,160	8,160
Well S-V	4	4	2,280	2,720
Well T	0	4	N/D	N/D
Well U	4	4	309	359
Well V	2	2	210	221
Well W	4	4	2,113	2,500
Well Y	0	2	N/D	N/D
Well Z	2	2	425	427

12.2 Voluntary Notification

During 2021, Salem and Hope Creek Generating Stations did not make any voluntary NEI 07-07 notification to State/Local officials, NRC, or to other stakeholders required by site procedures.

12.3 Independent Spent Fuel Storage Installation (ISFSI) Monitoring Program

ISFSI information is reported in the Salem and Hope Creek Generating Stations Annual Radiological Effluent Release Report.

12.4 Corrections to Previous Reports

None

12.5 Hope Creek Technical Specification Limit For Primary Water Iodine Concentration

The HCGS primary coolant results for Dose Equivalent Iodine-131, Total Gamma, and Total Beta were reviewed. The specific activity of the primary coolant did not exceed 0.2 micro curies per gram Dose Equivalent I-131 (DEI).

The Total Gamma and the Total Beta activity (microcuries per gram) did not exceed the 100/E-Bar limit.

Therefore, HCGS did not exceed the Technical Specifications limit specified in section 3.4.5.

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Attachment 1, Data Table Summary

SALEM GENERATING STATION **DOCKET NO. 50-272/-311**
HOPE CREEK GENERATING STATION **DOCKET NO. 50-354**
SALEM COUNTY, NEW JERSEY **REPORTING PERIOD: January 1, 2021 to December 31, 2021**

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND ***TOTAL NUMBER*** OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION (LLD*)	ALL INDICATOR LOCATIONS	LOCATION WITH HIGHEST MEAN		CONTROL LOCATION	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
			MEAN **(f)** ** *(RANGE)*	NAME DISTANCE AND DIRECTION	MEAN **(f)** ** *(RANGE)*	MEAN **(f)** ** *(RANGE)*	
I. DIRECT							
DIRECT RADIATION (mR/standard quarter)	**TLD-QUARTERLY** ***236***	N/A	15.3 (212/212) *(10.7/36.3)*	SA-IDM-01Q1 0.58 MILES N	35.0 (4/4) *(33.1/36.3)*	15.2 (24/24) *(12.8/17.2)*	0
II. AIRBORNE							
AIR PARTICULATE (E-3 pCi/m^3)	**Gr-B** ***424***	10	14 (371/371) *(4/42)*	SA-APT-16E1 4.1 MILES NNW	15 (53/53) *(7/42)*	14 (53/53) *(5/25)*	0
	GAMMA ***32***						
	Be-7	N/A	65.2 (28/28) *(46.2/83.2)*	SA-APT-05D1 3.50 MILES E	68.9 (4/4) *(51.0/83.2)*	60.7 (4/4) *(55.5/66.8)*	0
	K-40	N/A	<MDC	N/A	N/A	<MDC	0
	Cs-134	50	<MDC	N/A	N/A	<MDC	0
	Cs-137	60	<MDC	N/A	N/A	<MDC	0
AIR IODINE (E-3 pCi/m^3)	**GAMMA** ***424*** I-131	70	<MDC	N/A	N/A	<MDC	0
III. WATERBORNE							
SURFACE WATER (pCi/L)	**H-3** ***60***	200	<MDC	N/A	N/A	<MDC	0
	I-131 (LOW LVL) ***60***	1	<MDC	N/A	N/A	<MDC	0
	GAMMA ***60***						
	K-40	N/A	86 (13/48) *(51/136)*	SA-SWA-07E1 4.5 MILES SE	103 (6/12) *(72/136)*	72 (2/12) *(60/85)*	0

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SALEM COUNTY, NEW JERSEY **REPORTING PERIOD: January 1, 2021 to December 31, 2021**

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND *TOTAL NUMBER* OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION (LLD*)	ALL INDICATOR LOCATIONS	LOCATION WITH HIGHEST MEAN		CONTROL LOCATION	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
			MEAN **(f)** ** *(RANGE)*	NAME DISTANCE AND DIRECTION	MEAN **(f)** ** *(RANGE)*	MEAN **(f)** ** *(RANGE)*	
Surface Water (cont.) (pCi/L)	Mn-54	15	<MDC	N/A	N/A	<MDC	0
	Co-58	15	<MDC	N/A	N/A	<MDC	0
	Fe-59	30	<MDC	N/A	N/A	<MDC	0
	Co-60	15	<MDC	N/A	N/A	<MDC	0
	Zn-65	30	<MDC	N/A	N/A	<MDC	0
	ZrNb-95	15	<MDC	N/A	N/A	<MDC	0
	Cs-134	15	<MDC	N/A	N/A	<MDC	0
	Cs-137	18	<MDC	N/A	N/A	<MDC	0
	BaLa-140	15	<MDC	N/A	N/A	<MDC	0
POTABLE WATER (RAW) (pCi/L)	**Gr-A** ***12***	3	<MDC	N/A	N/A	N/A	0
	Gr-B ***12***	4	6.8 (12/12) *(4.3/9.7)*	SA-PWR-02F3 8.0 MILES NNE	6.8 (12/12) *(4.3/9.7)*	N/A	0
	H-3 ***12***	200	<MDC	N/A	N/A	N/A	0
	I-131 (LOW LVL) ***12***	1	<MDC	N/A	N/A	N/A	0
	GAMMA ***12***						
	K-40	N/A	<MDC	N/A	N/A	N/A	0
	Mn-54	15	<MDC	N/A	N/A	N/A	0
	Co-58	15	<MDC	N/A	N/A	N/A	0

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SALEM COUNTY, NEW JERSEY **REPORTING PERIOD: January 1, 2021 to December 31, 2021**

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND *TOTAL NUMBER* OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION (LLD*)	ALL INDICATOR LOCATIONS	LOCATION WITH HIGHEST MEAN		CONTROL LOCATION	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
			MEAN **(f)** ** *(RANGE)*	NAME DISTANCE AND DIRECTION	MEAN **(f)** ** *(RANGE)*	MEAN **(f)** ** *(RANGE)*	
POTABLE WATER (RAW) (cont.) (pCi/L)	Fe-59	30	<MDC	N/A	N/A	N/A	0
	Co-60	15	<MDC	N/A	N/A	N/A	0
	Zn-65	30	<MDC	N/A	N/A	N/A	0
	ZrNb-95	15	<MDC	N/A	N/A	N/A	0
	Cs-134	15	<MDC	N/A	N/A	N/A	0
	Cs-137	18	<MDC	N/A	N/A	N/A	0
	BaLa-140	15	<MDC	N/A	N/A	N/A	0
	Ra-226	N/A	<MDC	N/A	N/A	N/A	0
POTABLE WATER (TREATED) (pCi/L)	**Gr-A** ***12***	**3**	<MDC	N/A	N/A	N/A	0
	Gr-B ***12***	**4**	6.8 (12/12) *(4.9/8.6)*	SA-PWT-02F3 8.0 MILES NNE	6.8 (12/12) *(4.9/8.6)*	N/A	0
	H-3 ***12***	**200**	<MDC	N/A	N/A	N/A	0
	I-131 (LOW LVL) ***12***	**1**	<MDC	N/A	N/A	N/A	0
	GAMMA ***12***						
	K-40	N/A	<MDC	N/A	N/A	N/A	0
	Mn-54	15	<MDC	N/A	N/A	N/A	0
	Co-58	15	<MDC	N/A	N/A	N/A	0

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MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND *TOTAL NUMBER* OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION (LLD*)	ALL INDICATOR LOCATIONS	LOCATION WITH HIGHEST MEAN		CONTROL LOCATION	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
			MEAN **(f)** ** *(RANGE)*	NAME DISTANCE AND DIRECTION	MEAN **(f)** ** *(RANGE)*	MEAN **(f)** ** *(RANGE)*	
POTABLE WATER (TREATED) (Cont) (pCi/L)	Fe-59	30	<MDC	N/A	N/A	N/A	0
	Co-60	15	<MDC	N/A	N/A	N/A	0
	Zn-65	30	<MDC	N/A	N/A	N/A	0
	ZrNb-95	15	<MDC	N/A	N/A	N/A	0
	Cs-134	15	<MDC	N/A	N/A	N/A	0
	Cs-137	18	<MDC	N/A	N/A	N/A	0
	BaLa-140	15	<MDC	N/A	N/A	N/A	0
	Ra-226	N/A	<MDC	N/A	N/A	N/A	0
WELL WATER (pCi/L)	**Gr-A** ***12***	3	<MDC	N/A	N/A	N/A	0
	Gr-B ***12***	4	3.5 (3/12) *(2.7/4.5)*	SA-WWA-03E1 4.2 MILES NE	3.5 (3/12) *(2.7/4.5)*	N/A	0
	H-3 ***12***	200	<MDC	N/A	N/A	N/A	0
	I-131 (LOW LVL) ***12***	1	<MDC	N/A	N/A	N/A	0
	GAMMA ***12***						
	K-40	N/A	<MDC	N/A	N/A	N/A	0
	Mn-54	15	<MDC	N/A	N/A	N/A	0
	Co-58	15	<MDC	N/A	N/A	N/A	0

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MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND *TOTAL NUMBER* OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION (LLD*)	ALL INDICATOR LOCATIONS	LOCATION WITH HIGHEST MEAN		CONTROL LOCATION	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
			MEAN **(f)** ** *(RANGE)*	NAME DISTANCE AND DIRECTION	MEAN **(f)** ** *(RANGE)*	MEAN **(f)** ** *(RANGE)*	
WELL WATER (cont.) (pCi/L)	Fe-59	30	<MDC	N/A	N/A	N/A	0
	Co-60	15	<MDC	N/A	N/A	N/A	0
	Zn-65	30	<MDC	N/A	N/A	N/A	0
	ZrNb-95	15		N/A	N/A	N/A	0
	Cs-134	15	<MDC	N/A	N/A	N/A	0
	Cs-137	18	<MDC	N/A	N/A	N/A	0
	BaLa-140	15	<MDC	N/A	N/A	N/A	0
	Ra-226	N/A	<MDC	N/A	N/A	N/A	0
SEDIMENT (pCi/kg dry)	**GAMMA** ***14***						
	Be-7	N/A	<MDC	N/A	N/A	<MDC	0
	K-40	N/A	8305 (12/12) *(2562/15820)*	SA-ESS-12B1 C 2.5 MILES WSW	16680 (2/2) *(16410/16950)*	16680 (2/2) *(16410/16950)*	0
	Cs-134	150	<MDC	N/A	N/A	<MDC	0
	Cs-137	180	<MDC	N/A	N/A	<MDC	0
	Ra-226	N/A	<MDC	N/A	N/A	<MDC	0
	Th-232	N/A	591 (9/12) *(362/1062)*	SA-ESS-12B1 C 2.5 MILES WSW	898 (2/2) *(822/975)*	898 (2/2) *(822/975)*	0

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MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND *TOTAL NUMBER* OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION (LLD*)	ALL INDICATOR LOCATIONS	LOCATION WITH HIGHEST MEAN		CONTROL LOCATION	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
			MEAN **(f)** ** *(RANGE)*	NAME DISTANCE AND DIRECTION	MEAN **(f)** ** *(RANGE)*	MEAN **(f)** ** *(RANGE)*	
IV. INGESTION							
MILK (pCi/L)	**I-131 (LOW LVL)** ***60***	1	<MDC	N/A	N/A	<MDC	0
	GAMMA ***60***						
	K-40	N/A	1287 (40/40) *(734/1914)*	SA-MLK-13E3 5.0 MILES W	1316 (20/20) *(734/1914)*	1170 (20/20) *(717/1426)*	0
	Cs-134	15	<MDC	N/A	N/A	<MDC	0
	Cs-137	18	<MDC	N/A	N/A	<MDC	0
	BaLa-140	15	<MDC	N/A	N/A	<MDC	0
	Ra-226	N/A	<MDC	N/A	N/A	<MDC	0
FISH (pCi/kg wet)	**GAMMA** ***6***						
	K-40	N/A	3490 (4/4) *(3061/4102)*	SA-ESF-12C1 C 2.5 MILES WSW	3855 (2/2) *(3356/4353)*	3855 (2/2) *(3356/4353)*	0
	Mn-54	130	<MDC	N/A	N/A	<MDC	0
	Co-58	130	<MDC	N/A	N/A	<MDC	0
	Fe-59	260	<MDC	N/A	N/A	<MDC	0
	Co-60	130	<MDC	N/A	N/A	<MDC	0
	Zn-65	260	<MDC	N/A	N/A	<MDC	0
	Cs-134	130	<MDC	N/A	N/A	<MDC	0

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			MEAN **(f)** ** *(RANGE)*	NAME DISTANCE AND DIRECTION	MEAN **(f)** ** *(RANGE)*	MEAN **(f)** ** *(RANGE)*	
FISH (cont.) (pCi/kg wet)	Cs-137	150	<MDC	N/A	N/A	<MDC	0
	Ra-226	N/A	<MDC	N/A	N/A	<MDC	0
BLUE CRABS (cont.) (pCi/kg wet)	**GAMMA** ***4***						
	K-40	N/A	2985 (2/2) *(2590/3379)*	SA-ECH-11A1 0.2 MILES SW	2985 (2/2) *(2590/3379)*	2608 (2/2) *(2037/3178)*	0
	Mn-54	130	<MDC	N/A	N/A	<MDC	0
	Co-58	130	<MDC	N/A	N/A	<MDC	0
	Fe-59	260	<MDC	N/A	N/A	<MDC	0
	Co-60	130	<MDC	N/A	N/A	<MDC	0
	Zn-65	260	<MDC	N/A	N/A	<MDC	0
	Cs-134	130	<MDC	N/A	N/A	<MDC	0
	Cs-137	150	<MDC	N/A	N/A	<MDC	0
	Ra-226	N/A	<MDC	N/A	N/A	<MDC	0
BROAD-LEAF VEGETATION, FPL (pCi/kg wet)	**GAMMA** ***15***						
	Be-7	N/A	1627 (4/11) *(782.3/2551)*	SA-FPL-06S1 0.17 MILES- ESE	2009 (2/5) *(1467/2551)*	1763 (3/4) (425.8/3542)	0
	K-40	N/A	8740 (11/11) *(5284/14110)*	SA-FPL-06S1 0.17 MILES- ESE	10268 (5/5) *(5284/14110)*	9415 (4/4) *(4790/19270)*	0

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			MEAN **(f)** ** *(RANGE)*	NAME DISTANCE AND DIRECTION	MEAN **(f)** ** *(RANGE)*	MEAN **(f)** ** *(RANGE)*	
BROAD-LEAF VEGETATION, FPL (cont.) (pCi/kg wet)	I-131	60	<MDC	N/A	N/A	<MDC	0
	Cs-134	60	<MDC	N/A	N/A	<MDC	0
	Cs-137	80	<MDC	N/A	N/A	<MDC	0
	Ra-226	N/A	<MDC	N/A	N/A	<MDC	0
	Th-232	N/A	<MDC	N/A	N/A	N/A	0
VEGETABLES, FPV (pCi/kg wet)	**GAMMA** ***21***						
	Be-7	N/A	<MDC	N/A	N/A	N/A	0
	K-40	N/A	1815 (21/21) *(1220/2717)*	SA-FPV-09G2 10.7 MILES S	2326 (1/1)	N/A	0
	I-131	60	<MDC	N/A	N/A	N/A	0
	Cs-134	60	<MDC	N/A	N/A	N/A	0
	Cs-137	80	<MDC	N/A	N/A	N/A	0
	Ra-226	N/A	<MDC	N/A	N/A	N/A	0
	Th-232	N/A	<MDC	N/A	N/A	N/A	0
FODDER CROPS (pCi/kg wet)	**GAMMA** ***3***						
	Be-7	N/A	340.7 (1/3)	SA-VGT-02G3 11.85 MILES NNE	340.7 (1/1)	N/A	0
	K-40	N/A	4203 (3/3) *(2908/5104)*	SA-VGT-02G3 11.85 MILES NNE	5104 (1/1)	N/A	0
	I-131	60	<MDC	N/A	N/A	N/A	0

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			MEAN **(f)** ** *(RANGE)*	NAME DISTANCE AND DIRECTION	MEAN **(f)** ** *(RANGE)*	MEAN **(f)** ** *(RANGE)*	
FODDER CROPS (cont.) (pCi/kg wet)	Cs-134	60	<MDC	N/A	N/A	N/A	0
	Cs-137	80	<MDC	N/A	N/A	N/A	0
	Ra-226	N/A	<MDC	N/A	N/A	N/A	0
	Th-232	N/A	<MDC	N/A	N/A	N/A	0
GAME (pCi/kg wet)	**GAMMA** ***3***						
	Be-7	N/A	<MDC	N/A	N/A	N/A	0
	K-40	N/A	2601 (3/3) *(2387/2890)*	SA-GAM-04C1 3.14 MILES ENE	2890 (1/1)	N/A	0
	I-131	60	<MDC	N/A	N/A	N/A	0
	Cs-134	60	<MDC	N/A	N/A	N/A	0
	Cs-137	80	<MDC	N/A	N/A	N/A	0
V. TERRESTRIAL							
SOIL (pCi/kg dry)	**GAMMA** ***0***						
	Be-7	N/A	N/A	N/A	N/A	N/A	0
	K-40	N/A	N/A	N/A	N/A	N/A	0
	Cs-134	150	N/A	N/A	N/A	N/A	0
	Cs-137	180	N/A	N/A	N/A	N/A	0
	Ra-226	N/A	N/A	N/A	N/A	N/A	0

SALEM GENERATING STATION **DOCKET NO. 50-272/-311**
HOPE CREEK GENERATING STATION **DOCKET NO. 50-354**

SALEM COUNTY, NEW JERSEY **REPORTING PERIOD: January 1, 2021 to December 31, 2021**

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	ANALYSIS AND *TOTAL NUMBER* OF ANALYSIS PERFORMED	LOWER LIMIT OF DETECTION (LLD*)	ALL INDICATOR LOCATIONS	LOCATION WITH HIGHEST MEAN		CONTROL LOCATION	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
			MEAN **(f)** ** *(RANGE)*	NAME DISTANCE AND DIRECTION	MEAN **(f)** ** *(RANGE)*	MEAN **(f)** ** *(RANGE)*	
SOIL (cont.) (pCi/kg dry)	Th-232	N/A	N/A	N/A	N/A	N/A	0

* The LLD listed is the Lower Limit of Detection, which was requested by PSEG to be achieved.

** Mean was calculated using values above the MDC only. f = the fraction of measurements above the MDC.

(C) = Control Location

N/A = Not Applicable

Attachment 2,
Complete Data Table for All Analysis Results Obtained In 2021

Table 15, Direct and Immersion Radiation Measurements, 2021

(REMP DOSIMETRY RESULTS*)

STATION ID	ANNUAL NET DOSE (mrem)	GROSS ANNUAL DOSE (mrem)	QUARTERLY NET DOSE AND GROSS DOSE (mrem/StandardQuarter)							
			JAN - MAR		APR - JUN		JUL - SEP		OCT - DEC	
			Net	Gross	Net	Gross	Net	Gross	Net	Gross
SA-IDM-01G3 (C)	ND	60.5	ND	16.0	ND	14.1	ND	15.0	ND	15.4
SA-IDM-03G1 (C)	ND	64.6	ND	17.2	ND	14.8	ND	15.6	ND	17.0
SA-IDM-10G1 (C)	ND	63.8	ND	16.9	ND	14.9	ND	15.2	ND	16.8
SA-IDM-14G1 (C)	ND	63.6	ND	17.0	ND	14.6	ND	15.4	ND	16.5
SA-IDM-16G1 (C)	ND	56.9	ND	15.1	ND	13.1	ND	13.9	ND	14.7
SA-IDM-03H1 (C)	ND	54.7	ND	14.9	ND	12.8	ND	13.0	ND	14.0
SA-IDM-01Q1 **	85.9	140.1	**22.6**	36.2	**19.5**	33.1	**21.0**	34.5	**22.7**	36.3
SA-IDM-01X2	ND	54.9	ND	14.7	ND	12.8	ND	13.1	ND	14.3
SA-IDM-02S2A	ND	61.5	ND	16.5	ND	14.2	ND	14.8	ND	16.0
SA-IDM-02X4	ND	58.6	ND	15.3	ND	13.8	ND	14.4	ND	15.0
SA-IDM-03X1	ND	54.1	ND	14.3	ND	12.6	ND	13.3	ND	13.8
SA-IDM-04X1	ND	54.9	ND	14.7	ND	12.8	ND	13.5	ND	14.0
SA-IDM-05X1	ND	52.5	ND	13.9	ND	12.5	ND	12.8	ND	13.3
SA-IDM-06X2	ND	60.4	ND	17.4	ND	14.9	ND	15.9	ND	12.2
SA-IDM-07S1	ND	54.0	ND	14.6	ND	12.4	ND	13.3	ND	13.6
SA-IDM-08S1	ND	47.4	ND	12.8	ND	10.7	ND	11.5	ND	12.4
SA-IDM-08S2	ND	47.0	ND	12.9	ND	10.7	ND	11.2	ND	12.1
SA-IDM-10S1	ND	51.8	ND	14.1	ND	11.9	ND	12.7	ND	13.0
SA-IDM-11S1	ND	49.3	ND	13.2	ND	11.3	ND	11.9	ND	12.8
SA-IDM-12S1	ND	60.9	ND	16.3	ND	13.3	ND	15.2	ND	16.1
SA-IDM-13S1	ND	69.5	ND	17.8	ND	15.2	ND	17.2	ND	19.3
SA-IDM-15S3	ND	70.0	ND	18.3	ND	15.7	ND	17.3	ND	18.8

Table 15, Direct and Immersion Radiation Measurements, 2021

(REMP DOSIMETRY RESULTS*)

STATION ID	ANNUAL NET DOSE (mrem)	GROSS ANNUAL DOSE (mrem)	QUARTERLY NET DOSE AND GROSS DOSE (mrem/StandardQuarter)							
			JAN - MAR		APR - JUN		JUL - SEP		OCT - DEC	
			Net	Gross	Net	Gross	Net	Gross	Net	Gross
SA-IDM-15S1	ND	51.3	ND	13.8	ND	11.9	ND	12.5	ND	13.0
SA-IDM-15S2	ND	56.9	ND	15.0	ND	13.1	ND	14.0	ND	14.8
SA-IDM-16S1	ND	60.8	ND	16.0	ND	14.2	ND	15.0	ND	15.6
SA-IDM-16Q2 **	68.7	122.9	**18.4**	31.9	**15.7**	29.3	**16.6**	30.1	**18.0**	31.6
SA-IDM-16X3	ND	52.7	ND	14.1	ND	12.4	ND	12.8	ND	13.5
SA-IDM-04D2	ND	62.0	ND	16.4	ND	14.4	ND	15.4	ND	15.7
SA-IDM-05D1	ND	59.9	ND	16.0	ND	13.7	ND	15.1	ND	15.2
SA-IDM-10D1	ND	63.4	ND	16.7	ND	14.2	ND	16.1	ND	16.4
SA-IDM-14D1	ND	55.9	ND	15.2	ND	12.9	ND	13.5	ND	14.2
SA-IDM-15D1	ND	60.1	ND	16.2	ND	14.1	ND	14.6	ND	15.2
SA-IDM-02E1	ND	57.5	ND	15.2	ND	13.3	ND	14.3	ND	14.8
SA-IDM-03E1	ND	50.8	ND	13.5	ND	11.9	ND	12.3	ND	13.1
SA-IDM-11E2	ND	64.5	ND	16.7	ND	15.5	ND	16.0	ND	16.3
SA-IDM-12E1	ND	63.1	ND	16.6	ND	14.8	ND	15.5	ND	16.2
SA-IDM-13E1	ND	52.6	ND	14.4	ND	12.0	ND	12.8	ND	13.5
SA-IDM-16E1	ND	59.0	ND	16.1	ND	13.5	ND	14.3	ND	15.1
SA-IDM-01F1	ND	75.5	ND	19.6	ND	17.7	ND	18.6	ND	19.6
SA-IDM-02F2	ND	54.6	ND	14.8	ND	12.7	ND	13.0	ND	14.1
SA-IDM-02F5	ND	60.8	ND	16.0	ND	14.1	ND	14.9	ND	15.8
SA-IDM-02F6	ND	55.9	ND	14.5	ND	13.0	ND	13.8	ND	14.5
SA-IDM-03F2	ND	54.4	ND	14.3	ND	13.3	ND	13.1	ND	13.7
SA-IDM-03F3	ND	53.6	ND	14.1	ND	12.8	ND	13.2	ND	13.5
SA-IDM-04F2	ND	52.1	ND	13.6	ND	11.9	ND	13.2	ND	13.3
SA-IDM-05F1	ND	55.2	ND	14.7	ND	12.8	ND	13.5	ND	14.2

Table 15, Direct and Immersion Radiation Measurements, 2021

(REMP DOSIMETRY RESULTS*)

STATION ID	ANNUAL NET DOSE (mrem)	GROSS ANNUAL DOSE (mrem)	QUARTERLY NET DOSE AND GROSS DOSE (mrem/StandardQuarter)							
			JAN - MAR		APR - JUN		JUL - SEP		OCT - DEC	
			Net	Gross	Net	Gross	Net	Gross	Net	Gross
SA-IDM-06F1	ND	47.1	ND	12.6	ND	10.7	ND	11.4	ND	12.5
SA-IDM-07F2	ND	56.5	ND	14.5	ND	13.8	ND	14.0	ND	14.2
SA-IDM-09F2	ND	52.8	ND	14.2	ND	12.4	ND	12.9	ND	13.3
SA-IDM-09F1	ND	65.9	ND	17.2	ND	15.2	ND	16.3	ND	17.2
SA-IDM-10F2	ND	62.0	ND	16.1	ND	14.4	ND	15.2	ND	16.3
SA-IDM-11F1	ND	65.8	ND	17.9	ND	15.5	ND	15.6	ND	16.8
SA-IDM-12F1	ND	61.7	ND	16.3	ND	14.0	ND	15.3	ND	16.0
SA-IDM-13F2	ND	60.4	ND	15.9	ND	14.1	ND	14.8	ND	15.7
SA-IDM-13F3	ND	63.8	ND	16.8	ND	14.7	ND	16.0	ND	16.4
SA-IDM-13F4	ND	63.9	ND	17.1	ND	14.6	ND	15.7	ND	16.6
SA-IDM-14F2	ND	67.2	ND	17.4	ND	15.6	ND	16.8	ND	17.4
SA-IDM-15F3	ND	68.3	ND	18.0	ND	15.6	ND	17.0	ND	17.8
SA-IDM-16F2	ND	58.7	ND	15.9	ND	13.5	ND	14.3	ND	15.1

ND NOT DETECTABLE ABOVE BACKGROUND

(C) CONTROL LOCATION

***** QUARTERLY ELEMENT TLD RESULTS BY VENDOR LABORATORY.

****** SAMPLE RESULTS ARE AFFECTED BY THE INDPENDENT SPENT FUEL STORAGE INSTALLATION (ISFSI)

Table 16, Concentrations of Gamma Emitters in Quarterly Composites of Air Particulates, 2021

Results in Units of E-03 pCi/m^3 ± 2σ

STATION ID	COLLECTION PERIOD START		COLLECTION PERIOD STOP	<----------GAMMA EMITTERS----------> Be-7	K-40	Cs-134	Cs-137
SA-APT-14G1 (C)	12/28/20	-	03/29/21	**67** ± 14	< 26	< 1	< 1
	03/29/21	-	06/28/21	**65** ± 14	< 28	< 1	< 1
	06/28/21	-	09/27/21	**56** ± 18	< 40	< 3	< 2
	09/27/21	-	01/03/22	**56** ± 14	< 30	< 1	< 2
			AVERAGE*	**61** ± 12	-	-	-
SA-APT-5X1	12/28/20	-	03/29/21	**63** ± 16	< 20	< 1	< 1
	03/29/21	-	06/28/21	**72** ± 18	< 32	< 2	< 1
	06/28/21	-	09/27/21	**76** ± 15	< 27	< 1	< 1
	09/27/21	-	01/04/22	**61** ± 12	< 20	< 1	< 1
			AVERAGE*	**68** ± 14	-	-	-
SA-APT-6S1	12/28/20	-	03/29/21	**60** ± 14	< 35	< 2	< 2
	03/29/21	-	06/28/21	**68** ± 17	< 37	< 3	< 2
	06/28/21	-	09/27/21	**64** ± 16	< 27	< 2	< 2
	09/27/21	-	01/04/22	**61** ± 14	< 26	< 1	< 1
			AVERAGE*	**63** ± 8	-	-	-
SA-APT-15S2	12/28/20	-	03/29/21	**63** ± 13	< 21	< 2	< 1
	03/29/21	-	06/28/21	**69** ± 15	< 26	< 1	< 1
	06/28/21	-	09/27/21	**66** ± 20	< 36	< 2	< 2
	09/27/21	-	01/04/22	**63** ± 11	< 18	< 1	< 1
			AVERAGE*	**65** ± 6	-	-	-
SA-APT-5D1	12/28/20	-	03/29/21	**75** ± 15	< 30	< 2	< 2
	03/29/21	-	06/28/21	**83** ± 17	< 37	< 3	< 2
	06/28/21	-	09/27/21	**66** ± 16	< 24	< 1	< 1
	09/27/21	-	01/04/22	**51** ± 12	< 22	< 1	< 1
			AVERAGE*	**69** ± 28	-	-	-
SA-APT-16E1	12/28/20	-	03/29/21	**73** ± 14	< 35	< 2	< 2
	03/29/21	-	06/28/21	**72** ± 14	< 28	< 1	< 1
	06/28/21	-	09/27/21	**68** ± 17	< 38	< 2	< 1
	09/27/21	-	01/03/22	**56** ± 11	< 21	< 1	< 2
			AVERAGE*	**67** ± 16	-	-	-

Table 16, Concentrations of Gamma Emitters in Quarterly Composites of Air Particulates, 2021

Results in Units of E-03 pCi/m^3 ± 2σ

STATION ID	COLLECTION PERIOD START		COLLECTION PERIOD STOP	<----------GAMMA EMITTERS----------> Be-7	K-40	Cs-134	Cs-137
SA-APT-1F1	12/28/20	-	03/29/21	**68** ± 20	< 36	< 2	< 2
	03/29/21	-	06/28/21	**61** ± 13	< 24	< 1	< 1
	06/28/21	-	09/27/21	**46** ± 18	< 31	< 1	< 1
	09/27/21	-	01/04/22	**63** ± 13	< 24	< 2	< 1
			AVERAGE*	**60** ± 19	-	-	-
SA-APT-2F6	12/28/20	-	03/29/21	**63** ± 12	< 26	< 1	< 1
	03/29/21	-	06/28/21	**73** ± 13	< 23	< 1	< 1
	06/28/21	-	09/27/21	**68** ± 13	< 24	< 1	< 1
	09/27/21	-	01/04/22	**53** ± 14	< 28	< 1	< 1
			AVERAGE*	**64** ± 17	-	-	-
			ALL INDICATOR AVERAGE * .	**65** ± 16	-	-	-

(C) CONTROL LOCATION.

* THE AVERAGE AND 2 STANDARD DEVIATION VALUES ARE CALCULATED USING THE POSITIVE VALUES. IF THERE IS ONLY 1 POSITIVE VALUE, THE AVERAGE AND THE ERROR ARE DISPLAYED.

\- INDICATES AVERAGE WAS NOT CALCULATED DUE TO NO POSITIVE VALUES FOR THE REPORTING PERIOD.

Table 17, Concentrations of Gross Beta Emitters in Air Particulates, 2021

Results in Units of E-03 pCi/m^3 ± 2σ

COLLECTION PERIOD		CONTROL	INDICATORS						
START	STOP	SA-APT-14G1	SA-APT-5X1	SA-APT-6S1	SA-APT-15S2	SA-APT-5D1	SA-APT-16E1	SA-APT-1F1	SA-APT-2F6
12/28/20	01/05/21	**11** ± 3	**9** ± 2	**9** ± 2	**10** ± 3	**9** ± 3	**8** ± 2	**8** ± 2	**9** ± 3
01/05/21	01/11/21	**9** ± 3	**8** ± 3	**8** ± 3	**9** ± 3	**8** ± 3	**10** ± 3	**11** ± 3	**8** ± 3
01/11/21	01/18/21	**25** ± 4	**20** ± 4	**20** ± 4	**19** ± 4	**21** ± 4	**23** ± 4	**19** ± 4	**19** ± 4
01/18/21	01/25/21	**13** ± 3	**11** ± 3	**10** ± 3	**9** ± 3	**10** ± 3	**10** ± 3	**11** ± 3	**10** ± 3
01/25/21	02/01/21	**10** ± 3	**8** ± 3	**7** ± 3	**9** ± 3	**11** ± 3	**10** ± 3	**8** ± 3	**8** ± 3
02/01/21	02/09/21	**14** ± 3	**16** ± 3	**10** ± 2	**13** ± 3	**15** ± 3	**15** ± 3	**13** ± 3	**15** ± 3
02/09/21	02/16/21	**16** ± 3	**17** ± 3	**16** ± 3	**17** ± 3	**18** ± 3	**18** ± 3	**16** ± 3	**13** ± 3
02/16/21	02/22/21	**19** ± 4	**16** ± 3	**16** ± 3	**16** ± 3	**16** ± 3	**18** ± 3	**17** ± 3	**16** ± 3
02/22/21	03/01/21	**10** ± 3	**8** ± 5	**8** ± 3	**10** ± 3	**11** ± 3	**10** ± 3	**12** ± 3	**13** ± 3
03/01/21	03/08/21	**14** ± 3	**13** ± 3	**13** ± 3	**11** ± 3	**15** ± 3	**14** ± 3	**12** ± 3	**14** ± 3
03/08/21	03/15/21	**17** ± 3	**15** ± 3	**15** ± 3	**14** ± 3	**17** ± 3	**15** ± 3	**16** ± 3	**16** ± 3
03/15/21	03/22/21	**15** ± 3	**17** ± 3	**14** ± 3	**18** ± 3	**14** ± 3	**15** ± 3	**15** ± 6	**14** ± 3
03/22/21	03/29/21	**10** ± 3	**12** ± 3	**9** ± 3	**9** ± 3	**9** ± 3	**14** ± 3	**9** ± 3	**8** ± 3
03/29/21	04/05/21	**17** ± 3	**18** ± 3	**15** ± 3	**18** ± 3	**19** ± 3	**17** ± 3	**14** ± 3	**17** ± 3
04/05/21	04/12/21	**10** ± 3	**11** ± 3	**10** ± 3	**11** ± 3	**13** ± 3	**11** ± 3	**12** ± 3	**9** ± 3
04/12/21	04/19/21	**5** ± 2	**6** ± 3	**5** ± 2	**5** ± 2	**7** ± 2	**7** ± 3	**4** ± 2	**5** ± 2
04/19/21	04/26/21	**17** ± 3	**18** ± 4	**15** ± 3	**19** ± 4	**20** ± 4	**16** ± 3	**21** ± 4	**21** ± 4
04/26/21	05/03/21	**21** ± 4	**18** ± 3	**18** ± 3	**18** ± 3	**20** ± 4	**17** ± 3	**17** ± 3	**20** ± 9
05/03/21	05/11/21	**5** ± 2	**9** ± 3	**6** ± 3	**9** ± 3	**9** ± 3	**7** ± 3	**6** ± 3	**6** ± 2
05/11/21	05/17/21	**11** ± 3	**13** ± 3	**12** ± 3	**16** ± 3	**11** ± 3	**14** ± 3	**12** ± 3	**11** ± 3
05/17/21	05/24/21	**22** ± 4	**20** ± 3	**19** ± 3	**20** ± 3	**18** ± 3	**23** ± 4	**15** ± 3	**19** ± 3
05/24/21	06/01/21	**11** ± 3	**10** ± 2	**10** ± 3	**10** ± 3	**14** ± 3	**11** ± 3	**11** ± 3	**10** ± 3
06/01/21	06/07/21	**16** ± 4	**14** ± 4	**15** ± 4	**17** ± 4	**15** ± 4	**15** ± 4	**11** ± 3	**12** ± 4
06/07/21	06/14/21	**10** ± 3	**7** ± 3	**8** ± 3	**7** ± 3	**7** ± 3	**9** ± 3	**7** ± 3	**8** ± 3
06/14/21	06/21/21	**11** ± 3	**12** ± 3	**10** ± 3	**14** ± 3	**12** ± 3	**11** ± 3	**12** ± 3	**11** ± 3
06/21/21	06/28/21	**8** ± 3	**8** ± 3	**9** ± 3	**10** ± 3	**9** ± 3	**10** ± 3	**9** ± 3	**10** ± 3
06/28/21	07/06/21	**9** ± 3	**8** ± 3	**8** ± 3	**9** ± 3	**10** ± 3	**8** ± 3	**10** ± 3	**11** ± 3
07/06/21	07/12/21	**17** ± 4	**18** ± 4	**17** ± 4	**20** ± 4	**13** ± 3	**17** ± 3	**14** ± 3	**23** ± 6
07/12/21	07/19/21	**16** ± 3	**18** ± 3	**13** ± 3	**18** ± 3	**16** ± 3	**13** ± 3	**11** ± 3	**17** ± 4
07/19/21	07/26/21	**16** ± 3	**17** ± 3	**15** ± 3	**18** ± 3	**19** ± 3	**19** ± 3	**14** ± 3	**16** ± 3
07/26/21	08/02/21	**18** ± 4	**19** ± 4	**19** ± 4	**18** ± 4	**13** ± 3	**15** ± 3	**13** ± 3	**17** ± 3
08/02/21	08/09/21	**15** ± 3	**15** ± 3	**13** ± 3	**18** ± 3	**13** ± 3	**15** ± 3	**13** ± 3	**16** ± 3
08/09/21	08/16/21	**13** ± 3	**16** ± 3	**15** ± 3	**17** ± 3	**14** ± 3	**15** ± 3	**16** ± 3	**15** ± 3
08/16/21	08/23/21	**9** ± 3	**12** ± 3	**11** ± 3	**10** ± 3	**10** ± 3	**11** ± 3	**10** ± 3	**13** ± 3

Table 17, Concentrations of Gross Beta Emitters in Air Particulates, 2021

Results in Units of E-03 pCi/m^3 ± 2σ

COLLECTION PERIOD		CONTROL	INDICATORS						
START	STOP	SA-APT-14G1	SA-APT-5X1	SA-APT-6S1	SA-APT-15S2	SA-APT-5D1	SA-APT-16E1	SA-APT-1F1	SA-APT-2F6
08/23/21 -	08/30/21	**21** ± 4	**24** ± 4	**18** ± 4	**28** ± 4	**23** ± 4	**17** ± 3	**19** ± 4	**23** ± 4
08/30/21 -	09/07/21	**16** ± 3	**15** ± 3	**11** ± 3	**15** ± 3	**13** ± 3	**12** ± 3	**13** ± 3	**14** ± 3
09/07/21 -	09/14/21	**17** ± 3	**20** ± 3	**18** ± 3	**18** ± 3	**19** ± 3	**18** ± 3	**13** ± 3	**19** ± 3
09/14/21 -	09/20/21	**19** ± 4	**23** ± 4	**22** ± 4	**22** ± 4	**23** ± 4	**22** ± 4	**22** ± 4	**23** ± 4
09/20/21 -	09/27/21	**8** ± 3	**8** ± 3	**11** ± 3	**12** ± 3	**11** ± 3	**42** ± 9	**11** ± 3	**10** ± 3
09/27/21 -	10/04/21	**17** ± 4	**23** ± 4	**24** ± 4	**25** ± 4	**21** ± 4	**19** ± 3	**20** ± 4	**15** ± 3
10/04/21 -	10/11/21	**10** ± 3	**11** ± 3	**8** ± 3	**10** ± 3	**8** ± 3	**9** ± 3	**8** ± 3	**9** ± 3
10/11/21 -	10/18/21	**12** ± 3	**15** ± 3	**15** ± 3	**16** ± 3	**14** ± 3	**15** ± 3	**16** ± 3	**13** ± 3
10/18/21 -	10/25/21	**17** ± 3	**25** ± 4	**23** ± 4	**23** ± 4	**24** ± 4	**20** ± 3	**22** ± 4	**16** ± 4
10/25/21 -	11/01/21	**11** ± 3	**10** ± 3	**14** ± 4	**13** ± 3	**10** ± 3	**16** ± 3	**12** ± 3	**12** ± 3
11/01/21 -	11/08/21	**14** ± 3	**14** ± 3	**12** ± 3	**12** ± 3	**11** ± 3	**16** ± 3	**10** ± 3	**16** ± 3
11/08/21 -	11/16/21	**17** ± 3	**18** ± 3	**20** ± 3	**19** ± 3	**20** ± 3	**20** ± 3	**20** ± 3	**17** ± 3
11/16/21 -	11/22/21	**14** ± 3	**16** ± 3	**14** ± 3	**14** ± 3	**17** ± 4	**17** ± 4	**15** ± 3	**18** ± 4
11/22/21 -	11/29/21	**8** ± 3	**13** ± 3	**14** ± 3	**11** ± 3	**13** ± 3	**15** ± 3	**11** ± 3	**13** ± 3
11/29/21 -	12/06/21	**18** ± 3	**17** ± 3	**18** ± 3	**18** ± 3	**16** ± 3	**21** ± 4	**15** ± 3	**22** ± 4
12/06/21 -	12/13/21	**17** ± 3	**17** ± 3	**15** ± 3	**17** ± 3	**20** ± 4	**16** ± 3	**19** ± 4	**20** ± 4
12/13/21 -	12/20/21	**18** ± 3	**17** ± 3	**21** ± 3	**20** ± 3	**20** ± 3	**17** ± 3	**17** ± 3	**18** ± 3
12/20/21 -	12/27/21	**24** ± 4	**23** ± 4	**25** ± 4	**23** ± 4	**22** ± 4	**20** ± 4	**21** ± 4	**21** ± 4
12/27/21 -	01/04/22	**14** ± 3	**16** ± 3	**15** ± 3	**18** ± 3	**18** ± 3	**17** ± 3	**16** ± 3	**19** ± 3
	AVERAGE*	**14** ± 9	**15** ± 10	**14** ± 10	**15** ± 10	**15** ± 9	**15** ± 11	**14** ± 8	**14** ± 9

ALL INDICATOR AVERAGE* **14** ± 10

* THE AVERAGE AND 2 STANDARD DEVIATION VALUES ARE CALCULATED USING ONLY THE POSITIVE VALUES. IF THERE IS ONLY 1 POSITIVE VALUE, THE AVERAGE AND THE ERROR ARE DISPLAYED.

Table 18, Concentrations of Iodine-131 in Filtered Air, 2021

Results in Units of E-03 pCi/m^3 ± 2σ

COLLECTION PERIOD			CONTROL	INDICATORS						
START		STOP	SA-AIO-14G1	SA-AIO-5X1	SA-AIO-6S1	SA-AIO-15S2	SA-AIO-5D1	SA-AIO-16E1	SA-AIO-1F1	SA-AIO-2F6
12/28/20	-	01/05/21	< 30	< 30	< 28	< 28	< 32	< 29	< 31	< 32
01/05/21	-	01/11/21	< 13	< 24	< 33	< 34	< 24	< 31	< 24	< 24
01/11/21	-	01/18/21	< 18	< 6	< 16	< 17	< 14	< 17	< 14	< 14
01/18/21	-	01/25/21	< 31	< 21	< 32	< 33	< 20	< 32	< 20	< 20
01/25/21	-	02/01/21	< 17	< 11	< 18	< 14	< 11	< 17	< 10	< 9
02/01/21	-	02/09/21	< 28	< 38	< 27	< 26	< 38	< 27	< 36	< 36
02/09/21	-	02/16/21	< 15	< 30	< 18	< 18	< 31	< 19	< 30	< 29
02/16/21	-	02/22/21	< 20	< 23	< 17	< 17	< 25	< 18	< 23	< 15
02/22/21	-	03/01/21	< 29	< 34	< 28	< 28	< 22	< 29	< 23	< 21
03/01/21	-	03/08/21	< 14	< 23	< 18	< 17	< 22	< 18	< 22	< 21
03/08/21	-	03/15/21	< 17	< 24	< 18	< 18	< 24	< 14	< 23	< 22
03/15/21	-	03/22/21	< 28	< 18	< 27	< 27	< 18	< 29	< 26	< 17
03/22/21	-	03/29/21	< 20	< 18	< 20	< 20	< 17	< 20	< 18	< 18
03/29/21	-	04/05/21	< 20	< 24	< 19	< 19	< 23	< 19	< 22	< 23
04/05/21	-	04/12/21	< 24	< 17	< 24	< 23	< 17	< 23	< 17	< 16
04/12/21	-	04/19/21	< 19	< 20	< 17	< 18	< 16	< 18	< 16	< 15
04/19/21	-	04/26/21	< 18	< 24	< 19	< 19	< 22	< 18	< 8	< 20
04/26/21	-	05/03/21	< 32	< 18	< 13	< 31	< 21	< 31	< 9	< 29
05/03/21	-	05/11/21	< 24	< 18	< 25	< 24	< 20	< 24	< 20	< 18
05/11/21	-	05/17/21	< 22	< 20	< 22	< 11	< 21	< 21	< 21	< 21
05/17/21	-	05/24/21	< 24	< 24	< 21	< 21	< 10	< 22	< 23	< 26
05/24/21	-	06/01/21	< 15	< 16	< 16	< 7	< 17	< 15	< 17	< 17
06/01/21	-	06/07/21	< 36	< 21	< 34	< 36	< 9	< 22	< 21	< 22
06/07/21	-	06/14/21	< 17	< 18	< 17	< 17	< 19	< 17	< 18	< 18
06/14/21	-	06/21/21	< 17	< 18	< 18	< 16	< 19	< 16	< 18	< 19
06/21/21	-	06/28/21	< 11	< 24	< 11	< 12	< 23	< 9	< 24	< 23
06/28/21	-	07/06/21	< 21	< 13	< 21	< 21	< 13	< 20	< 10	< 13
07/06/21	-	07/12/21	< 31	< 20	< 31	< 31	< 12	< 30	< 20	< 30
07/12/21	-	07/19/21	< 26	< 22	< 26	< 26	< 23	< 25	< 22	< 12
07/19/21	-	07/26/21	< 20	< 20	< 20	< 19	< 20	< 19	< 20	< 13
07/26/21	-	08/02/21	< 27	< 29	< 26	< 25	< 28	< 10	< 28	< 26
08/02/21	-	08/09/21	< 20	< 26	< 21	< 20	< 26	< 20	< 26	< 10
08/09/21	-	08/16/21	< 14	< 26	< 19	< 19	< 25	< 19	< 25	< 24

Table 18, Concentrations of Iodine-131 in Filtered Air, 2021

Results in Units of E-03 pCi/m^3 ± 2σ

COLLECTION PERIOD			CONTROL	INDICATORS						
START		STOP	SA-AIO-14G1	SA-AIO-5X1	SA-AIO-6S1	SA-AIO-15S2	SA-AIO-5D1	SA-AIO-16E1	SA-AIO-1F1	SA-AIO-2F6
08/16/21	-	08/23/21	< 23	< 26	< 22	< 22	< 26	< 23	< 25	< 11
08/23/21	-	08/30/21	< 22	< 25	< 22	< 9	< 24	< 21	< 23	< 22
08/30/21	-	09/07/21	< 14	< 20	< 8	< 12	< 20	< 13	< 20	< 23
09/07/21	-	09/14/21	< 15	< 17	< 15	< 15	< 18	< 15	< 17	< 18
09/14/21	-	09/20/21	< 10	< 34	< 24	< 25	< 36	< 23	< 35	< 34
09/20/21	-	09/27/21	< 15	< 24	< 13	< 13	< 25	< 35	< 24	< 23
09/27/21	-	10/04/21	< 31	< 26	< 28	< 29	< 27	< 30	< 27	< 24
10/04/21	-	10/11/21	< 21	< 14	< 20	< 20	< 18	< 21	< 18	< 18
10/11/21	-	10/18/21	< 31	< 26	< 31	< 32	< 27	< 33	< 26	< 27
10/18/21	-	10/25/21	< 22	< 24	< 23	< 23	< 25	< 9	< 26	< 27
10/25/21	-	11/01/21	< 21	< 10	< 31	< 19	< 22	< 19	< 22	< 22
11/01/21	-	11/08/21	< 18	< 21	< 7	< 18	< 24	< 18	< 23	< 20
11/08/21	-	11/16/21	< 15	< 11	< 7	< 15	< 14	< 15	< 13	< 13
11/16/21	-	11/22/21	< 26	< 26	< 11	< 26	< 28	< 26	< 28	< 27
11/22/21	-	11/29/21	< 11	< 20	< 12	< 12	< 21	< 11	< 20	< 19
11/29/21	-	12/06/21	< 23	< 17	< 23	< 23	< 18	< 23	< 17	< 17
12/06/21	-	12/13/21	< 17	< 20	< 17	< 17	< 21	< 17	< 21	< 21
12/13/21	-	12/20/21	< 17	< 25	< 18	< 18	< 26	< 17	< 26	< 26
12/20/21	-	12/27/21	< 24	< 29	< 24	< 24	< 30	< 24	< 30	< 30
12/27/21	-	01/04/22	< 21	< 18	< 17	< 17	< 18	< 21	< 18	< 19
AVERAGE*			-	-	-	-	-	-	-	-

* THE AVERAGE AND 2 STANDARD DEVIATION VALUES ARE CALCULATED USING ONLY THE POSITIVE VALUES. IF THERE IS ONLY 1 POSITIVE VALUE, THE AVERAGE AND THE ERROR ARE DISPLAYED.

\- INDICATES AVERAGE WAS NOT CALCULATED DUE TO NO POSITIVE VALUES FOR THE REPORTING PERIOD.

Table 19, Concentrations of Tritium in Surface Water, 2021

Results in Units of pCi/L ± 2σ

COLLECTION PERIOD			CONTROL	INDICATORS			
START		STOP	SA-SWA-12B1 (C)	SA-SWA-11A1	SA-SWA-7E1	SA-SWA-1F2	SA-SWA-16F1
01/05/21	-	01/19/21	< 160	< 161	< 155	< 161	< 155
02/08/21	-	02/26/21	< 177	< 176	< 176	< 174	< 176
03/09/21	-	03/22/21	< 178	< 178	< 171	< 176	< 176
04/06/21	-	04/20/21	< 194	< 197	< 194	< 190	< 194
05/05/21	-	05/20/21	< 180	< 178	< 179	< 182	< 182
06/12/21	-	06/23/21	< 178	< 176	< 176	< 173	< 173
07/06/21	-	07/19/21	< 177	< 173	< 174	< 181	< 180
08/02/21	-	08/16/21	< 177	< 177	< 178	< 179	< 179
09/09/21	-	09/24/21	< 190	< 186	< 185	< 185	< 187
10/04/21	-	10/20/21	< 194	< 176	< 189	< 187	< 182
11/10/21	-	11/24/21	< 190	< 182	< 182	< 173	< 171
12/08/21	-	12/20/21	< 185	< 176	< 179	< 185	< 185
		AVERAGE*	-	-	-	-	-

(C) CONTROL LOCATION.

* THE AVERAGE AND 2 STANDARD DEVIATION VALUES ARE CALCULATED USING THE POSITIVE VALUES. IF THERE IS ONLY 1 POSITIVE VALUE, THE AVERAGE AND THE ERROR ARE DISPLAYED.

\- INDICATES AVERAGE WAS NOT CALCULATED DUE TO NO POSITIVE VALUES FOR THE REPORTING PERIOD.

Table 20, Concentrations of Iodine-131 and Gamma Emitters in Surface Water, 2021

Results in Units of pCi/L ± 2σ

		<----------GAMMA EMITTERS---------->										
STATION ID	**Collection Date**	**I-131 LL**	**K-40**	**Mn-54**	**Co-58**	**Fe-59**	**Co-60**	**Zn-65**	**ZrNb-95**	**Cs-134**	**Cs-137**	**BaLa-140**
SA-SWA-12B1 (C)	01/05/21	< 0.8	< 17	< 2	< 2	< 4	< 2	< 4	< 2	< 2	< 2	< 4
	02/08/21	< 1	< 142	< 6	< 4	< 12	< 5	< 11	< 6	< 6	< 6	< 9
	03/09/21	< 0.8	< 51	< 2	< 3	< 5	< 3	< 6	< 3	< 3	< 3	< 5
	04/06/21	< 0.9	< 38	< 4	< 4	< 7	< 4	< 6	< 5	< 5	< 5	< 8
	05/05/21	< 0.8	< 126	< 7	< 6	< 14	< 8	< 16	< 6	< 8	< 8	< 12
	06/12/21	< 0.8	< 104	< 6	< 6	< 10	< 5	< 10	< 5	< 5	< 5	< 8
	07/06/21	< 0.9	**60** ± 37	< 3	< 3	< 6	< 3	< 5	< 3	< 3	< 3	< 5
	08/02/21	< 0.8	**85** ± 24	< 2	< 2	< 4	< 2	< 4	< 2	< 2	< 2	< 4
	09/09/21	< 0.9	< 119	< 6	< 6	< 16	< 4	< 16	< 5	< 8	< 7	< 9
	10/04/21	< 0.9	< 128	< 7	< 8	< 15	< 8	< 15	< 6	< 7	< 6	< 10
	11/10/21	< 0.8	< 96	< 4	< 5	< 10	< 4	< 8	< 5	< 6	< 4	< 9
	12/08/21	< 0.8	< 54	< 4	< 6	< 13	< 6	< 10	< 5	< 5	< 5	< 6
	AVERAGE*	-	**72** ± 36	-	-	-	-	-	-	-	-	-
SA-SWA-11A1	01/05/21	< 0.9	< 37	< 2	< 2	< 4	< 2	< 4	< 2	< 2	< 2	< 4
	02/08/21	< 0.8	< 132	< 6	< 7	< 14	< 8	< 13	< 7	< 9	< 8	< 9
	03/09/21	< 0.8	< 81	< 4	< 4	< 9	< 4	< 9	< 5	< 4	< 5	< 8
	04/06/21	< 0.9	**113** ± 72	< 4	< 5	< 9	< 4	< 9	< 5	< 5	< 5	< 9
	05/05/21	< 0.8	< 114	< 7	< 4	< 8	< 6	< 14	< 7	< 7	< 8	< 9
	06/12/21	< 0.8	< 92	< 6	< 5	< 8	< 4	< 9	< 4	< 5	< 5	< 7
	07/06/21	< 0.9	**62** ± 33	< 2	< 2	< 5	< 2	< 4	< 3	< 3	< 2	< 4
	08/02/21	< 0.9	**75** ± 34	< 2	< 2	< 5	< 2	< 5	< 2	< 3	< 2	< 4
	09/09/21	< 0.7	< 105	< 6	< 6	< 15	< 7	< 15	< 9	< 7	< 7	< 10
	10/04/21	< 0.9	< 61	< 5	< 5	< 12	< 6	< 8	< 6	< 6	< 6	< 9
	11/10/21	< 0.9	< 24	< 2	< 2	< 5	< 2	< 5	< 2	< 3	< 2	< 4
	12/08/21	< 0.9	< 97	< 4	< 4	< 8	< 4	< 9	< 5	< 5	< 6	< 8
	AVERAGE*	-	**84** ± 52	-	-	-	-	-	-	-	-	-

(C) CONTROL LOCATION.

***** THE AVERAGE AND 2 STANDARD DEVIATION VALUES ARE CALCULATED USING THE POSITIVE VALUES. IF THERE IS ONLY 1 POSITIVE VALUE, THE AVERAGE AND THE ERROR ARE DISPLAYED.

- INDICATES AVERAGE WAS NOT CALCULATED DUE TO NO POSITIVE VALUES FOR THE REPORTING PERIOD.

Table 20, Concentrations of Iodine-131 and Gamma Emitters in Surface Water, 2021

Results in Units of pCi/L ± 2σ

		<----------GAMMA EMITTERS---------->										
STATION ID	**Collection Date**	**I-131 LL**	**K-40**	**Mn-54**	**Co-58**	**Fe-59**	**Co-60**	**Zn-65**	**ZrNb-95**	**Cs-134**	**Cs-137**	**BaLa-140**
SA-SWA-7E1	01/05/21	< 0.9	< 93	< 6	< 5	< 10	< 7	< 10	< 6	< 6	< 5	< 11
	02/08/21	< 0.9	**109** ± 66	< 4	< 5	< 10	< 6	< 11	< 5	< 7	< 5	< 8
	03/09/21	< 0.9	**72** ± 33	< 2	< 3	< 5	< 3	< 5	< 3	< 3	< 2	< 5
	04/06/21	< 0.9	**131** ± 52	< 4	< 5	< 8	< 5	< 9	< 4	< 5	< 5	< 8
	05/05/21	< 0.9	< 155	< 5	< 6	< 11	< 8	< 11	< 5	< 6	< 7	< 12
	06/12/21	< 0.8	**92** ± 58	< 4	< 5	< 9	< 7	< 10	< 5	< 5	< 4	< 9
	07/06/21	< 0.8	< 46	< 3	< 3	< 7	< 3	< 7	< 3	< 3	< 4	< 6
	08/02/21	< 0.9	**78** ± 28	< 2	< 2	< 4	< 2	< 4	< 2	< 2	< 2	< 4
	09/09/21	< 0.8	< 100	< 6	< 4	< 11	< 5	< 14	< 6	< 7	< 5	< 7
	10/04/21	< 0.9	< 105	< 5	< 5	< 8	< 6	< 13	< 6	< 5	< 6	< 9
	11/10/21	< 0.8	**136** ± 67	< 3	< 4	< 11	< 6	< 8	< 5	< 5	< 5	< 8
	12/08/21	< 0.8	< 130	< 5	< 6	< 10	< 4	< 11	< 5	< 6	< 5	< 8
	AVERAGE*	-	**103** ± 54	-	-	-	-	-	-	-	-	-
SA-SWA-1F2	01/05/21	< 0.9	< 77	< 4	< 5	< 8	< 5	< 11	< 5	< 4	< 5	< 11
	02/08/21	< 1.0	< 134	< 6	< 7	< 13	< 7	< 13	< 5	< 7	< 8	< 9
	03/09/21	< 0.9	< 74	< 3	< 3	< 8	< 4	< 8	< 3	< 4	< 4	< 7
	04/06/21	< 0.9	< 124	< 5	< 7	< 13	< 9	< 11	< 8	< 5	< 7	< 12
	05/05/21	< 0.9	< 54	< 5	< 6	< 11	< 6	< 12	< 7	< 7	< 7	< 9
	06/12/21	< 0.9	< 49	< 5	< 4	< 11	< 5	< 8	< 4	< 7	< 6	< 8
	07/06/21	< 0.9	< 22	< 2	< 3	< 5	< 3	< 5	< 2	< 3	< 3	< 4
	08/02/21	< 0.8	< 21	< 2	< 2	< 5	< 2	< 4	< 2	< 3	< 2	< 4
	09/09/21	< 0.8	< 112	< 5	< 7	< 10	< 5	< 12	< 7	< 7	< 5	< 12
	10/04/21	< 0.8	< 123	< 7	< 6	< 13	< 8	< 14	< 6	< 7	< 7	< 13
	11/10/21	< 0.8	**58** ± 28	< 2	< 2	< 4	< 2	< 4	< 2	< 2	< 2	< 3
	12/08/21	< 0.9	< 73	< 4	< 4	< 10	< 5	< 7	< 5	< 5	< 3	< 7
	AVERAGE*	-	**58** ± 28	-	-	-	-	-	-	-	-	-

(C) CONTROL LOCATION.

***** THE AVERAGE AND 2 STANDARD DEVIATION VALUES ARE CALCULATED USING THE POSITIVE VALUES. IF THERE IS ONLY 1 POSITIVE VALUE, THE AVERAGE AND THE ERROR ARE DISPLAYED.

- INDICATES AVERAGE WAS NOT CALCULATED DUE TO NO POSITIVE VALUES FOR THE REPORTING PERIOD.

Table 20, Concentrations of Iodine-131 and Gamma Emitters in Surface Water, 2021

Results in Units of pCi/L ± 2σ

		<----------GAMMA EMITTERS---------->										
STATION ID	**Collection Date**	**I-131 LL**	**K-40**	**Mn-54**	**Co-58**	**Fe-59**	**Co-60**	**Zn-65**	**ZrNb-95**	**Cs-134**	**Cs-137**	**BaLa-140**
SA-SWA-16F1	01/05/21	< 0.8	< 23	< 2	< 2	< 4	< 3	< 5	< 2	< 2	< 2	< 3
	02/08/21	< 0.9	< 125	< 6	< 6	< 11	< 7	< 11	< 6	< 7	< 6	< 9
	03/09/21	< 0.8	< 79	< 4	< 5	< 9	< 5	< 11	< 5	< 5	< 5	< 8
	04/06/21	< 0.9	< 84	< 5	< 5	< 11	< 4	< 9	< 4	< 5	< 5	< 11
	05/05/21	< 0.9	**90** ± 56	< 5	< 5	< 9	< 5	< 11	< 6	< 6	< 6	< 9
	06/12/21	< 0.8	< 47	< 5	< 6	< 9	< 6	< 8	< 5	< 6	< 6	< 9
	07/06/21	< 0.9	< 23	< 2	< 2	< 5	< 2	< 4	< 2	< 3	< 2	< 4
	08/02/21	< 0.8	**51** ± 30	< 2	< 2	< 5	< 2	< 5	< 3	< 3	< 2	< 4
	09/09/21	< 0.7	< 57	< 5	< 5	< 13	< 4	< 10	< 6	< 8	< 7	< 8
	10/04/21	< 0.7	< 87	< 5	< 4	< 9	< 4	< 8	< 4	< 5	< 4	< 6
	11/10/21	< 0.9	**53** ± 27	< 2	< 2	< 4	< 2	< 4	< 2	< 2	< 2	< 3
	12/08/21	< 0.8	< 103	< 5	< 4	< 12	< 5	< 8	< 5	< 6	< 4	< 10
	AVERAGE*	**-**	**65 ± 44**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

ALL INDICATOR AVERAGE* **86 ± 57**

(C) CONTROL LOCATION.

***** THE AVERAGE AND 2 STANDARD DEVIATION VALUES ARE CALCULATED USING THE POSITIVE VALUES. IF THERE IS ONLY 1 POSITIVE VALUE, THE AVERAGE AND THE ERROR ARE DISPLAYED.

- INDICATES AVERAGE WAS NOT CALCULATED DUE TO NO POSITIVE VALUES FOR THE REPORTING PERIOD.

Table 21, Concentrations of Gross Alpha and Gross Beta Emitters, and Tritium in Raw and Treated Potable Water, 2021

Results in Units of pCi/L ± 2σ

STATION ID	COLLECTION PERIOD START		STOP	Gross Alpha	Gross Beta	H-3
SA-PWR-2F3**	12/28/20	-	01/25/21	< 1.4	**4.6** ± 1.8	< 159
	01/25/21	-	02/22/21	< 0.9	**9.7** ± 2.6	< 188
	02/22/21	-	03/29/21	< 1.8	**6.5** ± 1.9	< 177
	03/29/21	-	04/26/21	< 1.3	**5.9** ± 1.9	< 198
	06/26/21	-	06/26/21	< 1.8	**6.8** ± 2.3	< 174
	05/24/21	-	06/28/21	< 1.3	**8.7** ± 2.1	< 175
	06/28/21	-	07/26/21	< 2.7	**8.6** ± 2.7	< 188
	07/26/21	-	08/30/21	< 2.3	**4.3** ± 2.3	< 177
	08/30/21	-	09/27/21	< 2.7	**6.5** ± 2.1	< 183
	09/27/21	-	10/25/21	< 2.9	**6.9** ± 2.2	< 190
	10/25/21	-	11/29/21	< 0.8	**5.6** ± 1.8	< 183
	11/29/21	-	12/27/21	< 1.4	**7.7** ± 2.1	< 182
AVERAGE*				-	**6.8** ± 3.3	-
SA-PWT-2F3**	12/28/20	-	01/25/21	< 1.4	**5.2** ± 1.8	< 172
	01/25/21	-	02/22/21	< 2.7	**8.4** ± 2.1	< 195
	02/22/21	-	03/29/21	< 1.7	**7.5** ± 1.9	< 174
	03/29/21	-	04/26/21	< 1.3	**8.3** ± 2.0	< 199
	06/26/21	-	06/26/21	< 1.8	**5.5** ± 2.2	< 177
	05/24/21	-	06/28/21	< 1.3	**8.4** ± 2.1	< 176
	06/28/21	-	07/26/21	< 2.6	**7.1** ± 2.5	< 183
	07/26/21	-	08/30/21	< 2.4	**5.4** ± 2.4	< 179
	08/30/21	-	09/27/21	< 2.8	**5.5** ± 2.1	< 179
	09/27/21	-	10/25/21	< 2.8	**8.6** ± 2.3	< 177
	10/25/21	-	11/29/21	< 0.9	**4.9** ± 1.9	< 174
	11/29/21	-	12/27/21	< 1.4	**7.4** ± 2.1	< 162
AVERAGE*				-	**6.8** ± 2.9	-

***** THE AVERAGE AND 2 STANDARD DEVIATION VALUES ARE CALCULATED USING THE POSITIVE VALUES. IF THERE IS ONLY 1 POSITIVE VALUE THE AVERAGE AND THE ERROR ARE DISPLAYED.

****** MANAGEMENT AUDIT SAMPLE: NOT REQUIRED BY ODCM.

- INDICATES AVERAGE WAS NOT CALCULATED DUE TO NO POSITIVE VALUES FOR THE REPORTING PERIOD.

Table 22, Concentrations of Iodine-131 and Gamma Emitters in Raw and Treated Potable Water, 2021

Results in Units of pCi/L ± 2σ

	COLLECTION PERIOD			< - - - - - - - - - - - - - - GAMMA EMITTERS - - - - - - - - - - - - - - >										
STATION ID	START		STOP	I-131 LL	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	ZrNb-95	Cs-134	Cs-137	BaLa-140	Ra-226
SA-PWR-2F3**	12/28/20	-	01/25/21	< 0.9	< 117	< 6	< 7	< 10	< 7	< 13	< 7	< 6	< 7	< 8	< 154
	01/25/21	-	02/22/21	< 0.9	< 96	< 7	< 6	< 12	< 8	< 14	< 9	< 8	< 6	< 8	< 178
	02/22/21	-	03/29/21	< 0.9	< 133	< 5	< 7	< 17	< 7	< 20	< 6	< 7	< 7	< 9	< 145
	03/29/21	-	04/26/21	< 0.8	< 130	< 5	< 6	< 11	< 5	< 8	< 6	< 6	< 6	< 9	< 151
	06/26/21	-	06/26/21	< 0.9	< 81	< 5	< 4	< 10	< 5	< 9	< 6	< 6	< 5	< 7	< 128
	05/24/21	-	06/28/21	< 0.9	< 130	< 6	< 6	< 12	< 6	< 13	< 6	< 7	< 7	< 8	< 159
	06/28/21	-	07/26/21	< 0.8	< 79	< 5	< 4	< 9	< 6	< 8	< 5	< 4	< 6	< 8	< 131
	07/26/21	-	08/30/21	< 0.8	< 107	< 6	< 7	< 11	< 7	< 12	< 6	< 7	< 7	< 9	< 166
	08/30/21	-	09/27/21	< 0.8	< 126	< 6	< 6	< 13	< 4	< 14	< 8	< 8	< 7	< 8	< 169
	09/27/21	-	10/25/21	< 0.8	< 136	< 6	< 5	< 11	< 7	< 12	< 7	< 7	< 6	< 6	< 176
	10/25/21	-	11/29/21	< 0.9	< 122	< 6	< 7	< 13	< 8	< 14	< 7	< 8	< 7	< 9	< 152
	11/29/21	-	12/27/21	< 0.8	< 91	< 5	< 6	< 11	< 7	< 13	< 6	< 6	< 8	< 7	< 152
AVERAGE*				-	-	-	-	-	-	-	-	-	-	-	-
SA-PWT-2F3**	12/28/20	-	01/25/21	< 0.9	< 112	< 5	< 6	< 11	< 7	< 13	< 6	< 7	< 6	< 7	< 164
	01/25/21	-	02/22/21	< 0.8	< 98	< 5	< 5	< 11	< 5	< 9	< 5	< 5	< 5	< 7	< 116
	02/22/21	-	03/29/21	< 0.9	< 117	< 5	< 6	< 11	< 5	< 11	< 6	< 7	< 6	< 7	< 170
	03/29/21	-	04/26/21	< 0.7	< 115	< 6	< 7	< 15	< 6	< 15	< 6	< 7	< 7	< 5	< 159
	06/26/21	-	06/26/21	< 0.8	< 109	< 6	< 5	< 13	< 6	< 12	< 7	< 7	< 5	< 8	< 176
	05/24/21	-	06/28/21	< 0.9	< 129	< 7	< 5	< 11	< 7	< 11	< 7	< 7	< 7	< 6	< 166
	06/28/21	-	07/26/21	< 0.8	< 58	< 7	< 5	< 10	< 1	< 14	< 7	< 6	< 6	< 10	< 153
	07/26/21	-	08/30/21	< 0.9	< 131	< 7	< 5	< 13	< 7	< 12	< 7	< 6	< 5	< 8	< 173
	08/30/21	-	09/27/21	< 0.8	< 126	< 6	< 6	< 9	< 5	< 13	< 7	< 7	< 6	< 6	< 168
	09/27/21	-	10/25/21	< 0.8	< 110	< 5	< 5	< 15	< 7	< 10	< 6	< 6	< 7	< 9	< 146
	10/25/21	-	11/29/21	< 0.9	< 50	< 7	< 7	< 11	< 7	< 13	< 8	< 8	< 8	< 8	< 195
	11/29/21	-	12/27/21	< 0.8	< 77	< 4	< 4	< 8	< 5	< 10	< 6	< 6	< 5	< 7	< 115
AVERAGE*				-	-	-	-	-	-	-	-	-	-	-	-

***** THE AVERAGE AND 2 STANDARD DEVIATION VALUES ARE CALCULATED USING THE POSITIVE VALUES. IF THERE IS ONLY 1 POSITIVE VALUE THE AVERAGE AND THE ERROR ARE DISPLAYED.

****** MANAGEMENT AUDIT SAMPLE: NOT REQUIRED BY ODCM.

- INDICATES AVERAGE WAS NOT CALCULATED DUE TO NO POSITIVE VALUES FOR THE REPORTING PERIOD.

Table 23, Concentration of Gross Alpha and Beta Emitters, and Tritium in Well Water, 2021

Results in Units of pCi/L ± 2σ

STATION ID	COLLECTION DATE	Gross Alpha	Gross Beta	H-3
SA-WWA-3E1**	01/18/21	< 2.1	**2.7** ± 1.6	< 186
	02/16/21	< 2.4	< 2.0	< 170
	03/22/21	< 0.9	**4.5** ± 1.8	< 172
	04/19/21	< 1.4	< 1.8	< 193
	05/24/21	< 1.6	< 1.6	< 187
	06/21/21	< 1.6	< 1.9	< 183
	07/19/21	< 1.1	< 2.6	< 180
	08/16/21	< 1.6	< 2.3	< 191
	09/20/21	< 1.3	< 2.2	< 187
	10/18/21	< 2.1	< 2.4	< 188
	11/22/21	< 1.1	< 2.0	< 180
	12/20/21	< 2.1	**3.3** ± 1.8	< 166
	AVERAGE*	-	**3.5** ± 1.9	-

***** THE AVERAGE AND 2 STANDARD DEVIATION VALUES ARE CALCULATED USING THE POSITIVE VALUES. IF THERE IS ONLY 1 POSITIVE VALUE THE AVERAGE AND THE ERROR ARE DISPLAYED.

****** MANAGEMENT AUDIT SAMPLE: NOT REQUIRED BY ODCM.

- INDICATES AVERAGE WAS NOT CALCULATED DUE TO NO POSITIVE VALUES FOR THE REPORTING PERIOD.

Table 24, Concentrations of Iodine-131 and Gamma Emitters in Well Water, 2021

Results in Units of pCi/L ± 2σ

STATION ID	COLLECTION DATE	< - - - - - - - - - - - - - - GAMMA EMITTERS - - - - - - - - - - - - - - >											
		I-131 LL	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	ZrNb-95	Cs-134	Cs-137	BaLa-140	Ra-226
SA-WWA-3E1**	01/18/21	< 0.9	< 99	< 5	< 5	< 11	< 6	< 9	< 6	< 5	< 6	< 7	< 144
	02/16/21	< 0.9	< 52	< 5	< 6	< 11	< 3	< 11	< 6	< 5	< 6	< 9	< 156
	03/22/21	< 0.9	< 69	< 5	< 5	< 9	< 5	< 10	< 6	< 6	< 5	< 8	< 146
	04/19/21	< 0.8	< 135	< 7	< 7	< 12	< 7	< 19	< 8	< 7	< 8	< 9	< 197
	05/24/21	< 0.8	< 96	< 6	< 6	< 13	< 5	< 9	< 6	< 8	< 6	< 9	< 143
	06/21/21	< 0.5	< 69	< 4	< 4	< 10	< 5	< 10	< 5	< 6	< 5	< 8	< 129
	07/19/21	< 0.8	< 81	< 4	< 4	< 7	< 5	< 8	< 5	< 5	< 5	< 5	< 120
	08/16/21	< 0.8	< 59	< 5	< 4	< 8	< 5	< 9	< 5	< 5	< 4	< 6	< 126
	09/20/21	< 0.5	< 90	< 4	< 6	< 15	< 6	< 11	< 8	< 7	< 4	< 12	< 188
	10/18/21	< 0.9	< 127	< 7	< 7	< 15	< 7	< 16	< 8	< 8	< 7	< 10	< 209
	11/22/21	< 0.7	< 71	< 4	< 4	< 9	< 5	< 10	< 5	< 5	< 4	< 9	< 115
	12/20/21	< 0.8	< 117	< 8	< 5	< 15	< 6	< 16	< 7	< 9	< 7	< 8	< 170
	AVERAGE*	-	-	-	-	-	-	-	-	-	-	-	-

* THE AVERAGE AND 2 STANDARD DEVIATION VALUES ARE CALCULATED USING THE POSITIVE VALUES. IF THERE IS ONLY 1 POSITIVE VALUE THE AVERAGE AND THE ERROR ARE DISPLAYED.

** MANAGEMENT AUDIT SAMPLE: NOT REQUIRED BY ODCM.

- INDICATES AVERAGE WAS NOT CALCULATED DUE TO NO POSITIVE VALUES FOR THE REPORTING PERIOD.

Table 25, Concentrations of Gamma Emitters in Sediment, 2021

Results in Units of pCi/kg (dry) ± 2σ

STATION ID	Collection Date	<----------GAMMA EMITTERS----------> Be-7	K-40	Cs-134	Cs-137	Ra-226	Th-232
SA-ESS-12B1 (C)	07/27/21	< 848	**16,410** ± 2,069	< 131	< 103	< 2,312	**975** ± 245
	10/13/21	< 679	**16,950** ± 2,046	< 100	< 81	< 1,788	**822** ± 188
	AVERAGE*	**-**	**16,680** ± 764	-	-	-	**898** ± 216
SA-ESS-5A1	07/28/21	< 462	**3,686** ± 1,047	< 70	< 66	< 1,215	**522** ± 138
	10/22/21	< 386	**3,418** ± 940	< 60	< 60	< 1,176	< 282
	AVERAGE*	**-**	**3,552** ± 379	-	-	-	**522** ± 138
SA-ESS-11A1	07/27/21	< 529	**2,562** ± 905	< 78	< 54	< 1,427	< 329
	10/13/21	< 599	**3,868** ± 1,054	< 68	< 69	< 1,524	< 347
	AVERAGE*	**-**	**3,215** ± 1,847	-	-	-	-
SA-ESS-15A1	07/27/21	< 409	**6,004** ± 1,043	< 63	< 60	< 1,166	**362** ± 123
	10/13/21	< 535	**14,270** ± 1,544	< 99	< 66	< 1,112	**691** ± 180
	AVERAGE*	**-**	**10,137** ± 11,690	-	-	-	**527** ± 466
SA-ESS-15A2	07/27/21	< 573	**3,526** ± 1,062	< 89	< 57	< 1,542	**414** ± 166
	10/13/21	< 607	**13,320** ± 1,636	< 84	< 64	< 1,542	**659** ± 226
	AVERAGE*	**-**	**8,423** ± 13,851	-	-	-	**536** ± 347
SA-ESS-7E1	07/27/21	< 532	**12,760** ± 1,559	< 83	< 70	< 1,516	**596** ± 150
	10/13/21	< 717	**11,210** ± 1,532	< 95	< 70	< 1,262	**516** ± 204
	AVERAGE*	-	**11,985** ± 2,192	-	-	-	**556** ± 114
SA-ESS-16F1	07/27/21	< 563	**15,820** ± 1,719	< 104	< 88	< 1,801	**1062** ± 183
	10/13/21	< 632	**9,216** ± 1,423	< 99	< 74	< 1,286	**497** ± 167
	AVERAGE*	**-**	**12,518** ± 9,339	-	-	-	**780** ± 798
ALL INDICATOR AVERAGE		**-**	**8,305** ± 9,952	-	-	-	**591** ± 412

(C) CONTROL LOCATION.

***** THE AVERAGE AND 2 STANDARD DEVIATION VALUES ARE CALCULATED USING THE POSITIVE VALUES. IF THERE IS ONLY 1 POSITIVE VALUE, THE AVERAGE AND THE ERROR ARE DISPLAYED.

- INDICATES AVERAGE WAS NOT CALCULATED DUE TO NO POSITIVE VALUES FOR THE REPORTING PERIOD.

Table 26, Concentrations of Iodine-131 and Gamma Emitters in Milk, 2021

Results in Units of pCi/L ± 2σ

STATION ID	COLLECTION PERIOD START		STOP	< - - - - - - - - - - - - - - GAMMA EMITTERS - - - - - - - - - - - - - - >					
				I-131 LL	K-40	Cs-134	Cs-137	BaLa-140	Ra-226
SA-MLK-2G3 (C)	01/04/21	-	01/05/21	< 0.8	**1,158** ± 166	< 8	< 8	< 12	< 153
	02/08/21	-	02/09/21	< 0.9	**1,101** ± 174	< 10	< 9	< 7	< 194
	03/07/21	-	03/08/21	< 0.9	**1,228** ± 192	< 7	< 9	< 10	< 193
	04/04/21	-	04/05/21	< 0.6	**1,310** ± 182	< 9	< 7	< 12	< 165
	04/18/21	-	04/19/21	< 0.8	**1,281** ± 176	< 9	< 7	< 10	< 212
	05/02/21	-	05/03/21	< 0.9	**1,426** ± 138	< 8	< 6	< 8	< 140
	05/17/21	-	05/18/21	< 0.8	**1,152** ± 173	< 7	< 7	< 8	< 195
	06/06/21	-	06/07/21	< 0.9	**1,211** ± 161	< 6	< 6	< 7	< 145
	06/20/21	-	06/21/21	< 0.6	**1,328** ± 194	< 11	< 10	< 7	< 222
	07/06/21	-	07/08/21	< 0.8	**1,210** ± 182	< 9	< 8	< 11	< 195
	07/18/21	-	07/19/21	< 0.9	**1,166** ± 191	< 9	< 8	< 10	< 233
	08/01/21	-	08/02/21	< 0.9	**1,198** ± 195	< 10	< 10	< 7	< 199
	08/15/21	-	08/16/21	< 0.9	**759** ± 145	< 9	< 9	< 13	< 197
	09/06/21	-	09/07/21	< 0.8	**1,156** ± 169	< 9	< 8	< 12	< 215
	09/20/21	-	09/21/21	< 0.5	**717** ± 135	< 8	< 9	< 8	< 191
	10/03/21	-	10/04/21	< 0.8	**1,326** ± 198	< 9	< 6	< 11	< 182
	10/17/21	-	10/18/21	< 0.9	**817** ± 138	< 7	< 6	< 10	< 181
	11/07/21	-	11/08/21	< 0.9	**1,276** ± 175	< 9	< 7	< 7	< 174
	11/28/21	-	11/29/21	< 0.8	**1,266** ± 205	< 9	< 11	< 11	< 188
	12/12/21	-	12/13/21	< 0.9	**1,315** ± 175	< 8	< 7	< 8	< 149
	AVERAGE*			-	**1170** ± 384	-	-	-	-

(C) CONTROL LOCATION.

* THE AVERAGE AND 2 STANDARD DEVIATION VALUES ARE CALCULATED USING THE POSITIVE VALUES. IF THERE IS ONLY 1 POSITIVE VALUE, THE AVERAGE AND THE ERROR ARE DISPLAYED.

- INDICATES AVERAGE WAS NOT CALCULATED DUE TO NO POSITIVE VALUES FOR THE REPORTING PERIOD.

Table 26, Concentrations of Iodine-131 and Gamma Emitters in Milk, 2021

Results in Units of pCi/L ± 2σ

STATION ID	COLLECTION PERIOD START		STOP	< - - - - - - - - - - - - - - GAMMA EMITTERS - - - - - - - - - - - - - - >					
				I-131 LL	K-40	Cs-134	Cs-137	BaLa-140	Ra-226
SA-MLK-13E3	01/04/21	-	01/05/21	< 0.9	**1,230** ± 181	< 8	< 7	< 9	< 182
	02/08/21	-	02/09/21	< 0.9	**1,165** ± 184	< 9	< 9	< 14	< 173
	03/07/21	-	03/08/21	< 0.9	**1,505** ± 200	< 8	< 7	< 7	< 175
	04/04/21	-	04/05/21	< 0.8	**1,304** ± 166	< 7	< 8	< 11	< 179
	04/18/21	-	04/19/21	< 0.8	**1,450** ± 198	< 9	< 10	< 10	< 194
	05/02/21	-	05/03/21	< 0.8	**1,914** ± 184	< 7	< 7	< 10	< 153
	05/18/21	-	05/19/21	< 0.8	**1,374** ± 174	< 9	< 8	< 8	< 172
	06/06/21	-	06/07/21	< 0.9	**1,299** ± 160	< 7	< 6	< 8	< 129
	06/20/21	-	06/21/21	< 0.8	**1,514** ± 222	< 10	< 8	< 6	< 166
	07/06/21	-	07/08/21	< 0.6	**1,341** ± 195	< 8	< 8	< 10	< 159
	07/18/21	-	07/19/21	< 0.9	**1,318** ± 214	< 11	< 10	< 12	< 185
	08/01/21	-	08/02/21	< 0.9	**1,131** ± 185	< 9	< 8	< 9	< 211
	08/15/21	-	08/16/21	< 0.9	**974** ± 134	< 7	< 6	< 12	< 153
	09/06/21	-	09/07/21	< 0.8	**1,428** ± 167	< 8	< 9	< 10	< 172
	09/20/21	-	09/21/21	< 0.4	**734** ± 151	< 8	< 9	< 9	< 185
	10/03/21	-	10/04/21	< 0.6	**1,418** ± 179	< 8	< 5	< 11	< 182
	10/17/21	-	10/18/21	< 0.9	**909** ± 138	< 9	< 7	< 7	< 177
	11/07/21	-	11/08/21	< 0.9	**1,570** ± 172	< 8	< 8	< 9	< 190
	11/28/21	-	11/29/21	< 0.9	**1,285** ± 189	< 8	< 10	< 11	< 214
	12/12/21	-	12/13/21	< 0.8	**1,460** ± 143	< 7	< 6	< 9	< 142
	AVERAGE*			-	**1,316** ± 513	-	-	-	-

* THE AVERAGE AND 2 STANDARD DEVIATION VALUES ARE CALCULATED USING THE POSITIVE VALUES. IF THERE IS ONLY 1 POSITIVE VALUE, THE AVERAGE AND THE ERROR ARE DISPLAYED.

- INDICATES AVERAGE WAS NOT CALCULATED DUE TO NO POSITIVE VALUES FOR THE REPORTING PERIOD.

Table 26, Concentrations of Iodine-131 and Gamma Emitters in Milk, 2021

Results in Units of pCi/L ± 2σ

STATION ID	COLLECTION PERIOD START		STOP	< - - - - - - - - - - - - - - GAMMA EMITTERS - - - - - - - - - - - - - - >					
				I-131 LL	K-40	Cs-134	Cs-137	BaLa-140	Ra-226
SA-MLK-14F4	01/04/21	-	01/05/21	< 0.9	**1,342** ± 165	< 9	< 9	< 9	< 167
	02/08/21	-	02/09/21	< 0.9	**1,302** ± 205	< 9	< 8	< 12	< 181
	03/07/21	-	03/08/21	< 0.8	**1,364** ± 187	< 8	< 8	< 11	< 207
	04/04/21	-	04/05/21	< 0.8	**1,126** ± 180	< 9	< 8	< 7	< 191
	04/18/21	-	04/19/21	< 0.9	**1,357** ± 201	< 9	< 8	< 8	< 193
	05/02/21	-	05/03/21	< 0.9	**1,794** ± 196	< 8	< 7	< 11	< 193
	05/17/21	-	05/18/21	< 0.9	**1,325** ± 194	< 7	< 7	< 6	< 161
	06/06/21	-	06/07/21	< 0.8	**1,322** ± 175	< 8	< 7	< 8	< 148
	06/20/21	-	06/21/21	< 0.8	**1,484** ± 212	< 9	< 9	< 11	< 238
	07/06/21	-	07/08/21	< 0.8	**1,225** ± 182	< 11	< 7	< 8	< 190
	07/18/21	-	07/19/21	< 0.9	**1,246** ± 179	< 10	< 10	< 12	< 200
	08/01/21	-	08/02/21	< 0.8	**1,302** ± 171	< 9	< 7	< 11	< 165
	08/15/21	-	08/16/21	< 0.6	**979** ± 113	< 7	< 6	< 8	< 140
	09/06/21	-	09/07/21	< 0.5	**1,079** ± 180	< 8	< 9	< 8	< 168
	09/20/21	-	09/21/21	< 0.3	**755** ± 122	< 5	< 4	< 9	< 129
	10/03/21	-	10/04/21	< 0.8	**1,351** ± 146	< 5	< 5	< 11	< 135
	10/17/21	-	10/18/21	< 0.9	**895** ± 146	< 6	< 7	< 9	< 141
	11/07/21	-	11/08/21	< 0.8	**1,404** ± 202	< 9	< 10	< 8	< 171
	11/28/21	-	11/29/21	< 0.8	**1,274** ± 184	< 10	< 9	< 6	< 182
	12/12/21	-	12/13/21	< 0.7	**1,248** ± 160	< 8	< 7	< 10	< 157
	AVERAGE*			-	**1,259** ± 441	-	-	-	-

* THE AVERAGE AND 2 STANDARD DEVIATION VALUES ARE CALCULATED USING THE POSITIVE VALUES. IF THERE IS ONLY 1 POSITIVE VALUE, THE AVERAGE AND THE ERROR ARE DISPLAYED.

- INDICATES AVERAGE WAS NOT CALCULATED DUE TO NO POSITIVE VALUES FOR THE REPORTING PERIOD.

Table 27, Concentrations of Gamma Emitters in Edible Fish, 2021

Results in Units of pCi/kg (wet) ± 2σ

		<----------GAMMA EMITTERS---------->										
STATION ID	Collection Date	K-40			Mn-54	Co-58	Fe-59	Co-60	Zn-65	Cs-134	Cs-137	Ra-226
SA-ESF-12B1 (C)	05/04/21	**4,353**	±	1,005	< 42	< 49	< 112	< 58	< 121	< 51	< 58	< 1,149
	09/30/21	**3,356**	±	1,324	< 64	< 88	< 131	< 77	< 160	< 69	< 75	< 1,549
	AVERAGE*	**3,855**	±	1,410	-	-	-	-	-	-	-	-
SA-ESF-11A1	05/04/21	**3,524**	±	816	< 44	< 55	< 95	< 50	< 102	< 35	< 46	< 1,025
	09/30/21	**3,061**	±	1,084	< 61	< 61	< 105	< 73	< 134	< 59	< 60	< 1,324
	AVERAGE*	**3,293**	±	655	-	-	-	-	-	-	-	-
SA-ESF-7E1	05/04/21	**4,102**	±	1,077	< 66	< 60	< 134	< 55	< 120	< 76	< 65	< 1,320
	09/30/21	**3,271**	±	1,135	< 57	< 46	< 167	< 81	< 160	< 70	< 66	< 1,163
	AVERAGE*	**3,687**	±	1,175	-	-	-	-	-	-	-	-
ALL INDICATOR AVERAGE*		**3,490**	±	900								

(C) CONTROL LOCATION.

* THE AVERAGE AND 2 STANDARD DEVIATION VALUES ARE CALCULATED USING THE POSITIVE VALUES. IF THERE IS ONLY 1 POSITIVE VALUE, THE AVERAGE AND THE ERROR ARE DISPLAYED.

- INDICATES AVERAGE WAS NOT CALCULATED DUE TO NO POSITIVE VALUES FOR THE REPORTING PERIOD.

*** SEE 'SAMPLE ANOMOLIES AND PROGRAM EXCEPTIONS' SECTION OF THIS REPORT.

Table 28, Concentrations of Gamma Emitters in Blue Crabs, 2021

Results in Units of pCi/kg (wet) ± 2σ

STATION ID	Collection Date	<----------GAMMA EMITTERS----------> K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Cs-134	Cs-137	Ra-226
SA-ECH-12B1 (C)	07/20/21	**2,037** ± 985	< 75	< 84	< 172	< 85	< 207	< 95	< 103	< 1,710
	08/18/21	**3,178** ± 993	< 76	< 73	< 140	< 66	< 171	< 84	< 77	< 1,481
	AVERAGE*	**2,608** ± 1,614	-	-	-	-	-	-	-	-

STATION ID	Collection Date	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Cs-134	Cs-137	Ra-226
SA-ECH-11A1	07/20/21	**2,590** ± 959	< 66	< 53	< 69	< 65	< 152	< 61	< 57	< 1,005
	08/18/21	**3,379** ± 899	< 51	< 54	< 104	< 59	< 149	< 77	< 62	< 1,050
	AVERAGE*	**2,985** ± 1,116	-	-	-	-	-	-	-	-

(C) CONTROL LOCATION.

* THE AVERAGE AND 2 STANDARD DEVIATION VALUES ARE CALCULATED USING THE POSITIVE VALUES. IF THERE IS ONLY 1 POSITIVE VALUE, THE AVERAGE AND THE ERROR ARE DISPLAYED.

- INDICATES AVERAGE WAS NOT CALCULATED DUE TO NO POSITIVE VALUES FOR THE REPORTING PERIOD.

Table 29, Concentrations of Gamma Emitters in Broadleaf Vegetation (FPL), 2021

Results in Units of pCi/kg (wet) ± 2σ

STATION ID	COLLECTION DATE	SAMPLE TYPE	< - - - - - - - - - - - - - - GAMMA EMITTERS - - - - - - - - - - - - - - >											
			Be-7			K-40			I-131	Cs-134	Cs-137	Ra-226	Th-232	
SA-FPL-6S1	07/28/21	Kale		<	381	**13,660**	±	1,274	< 53	< 56	< 46	< 1,098	< 177	
SA-FPL-6S1	07/28/21	Broccoli		<	579	**10,430**	±	1,417	< 33	< 54	< 62	< 1,053	< 262	
SA-FPL-6S1	07/28/21	Lamb's Ear	**2,551**	±	477	**14,110**	±	1,177	< 51	< 54	< 52	< 827	< 182	
SA-FPL-6S1	08/31/21	Kale		<	478	**5,284**	±	944	< 50	< 47	< 41	< 1,036	< 192	
SA-FPL-6S1	08/31/21	Lamb's Ear	**1,467**	±	467	**7,856**	±	977	< 53	< 45	< 49	< 1,092	< 168	
SA-FPL-16S1	07/28/21	Kale		<	421	**8,865**	±	1,269	< 52	< 57	< 43	< 1,019	< 210	
SA-FPL-16S1	07/28/21	Broccoli		<	371	**7,041**	±	1,025	< 53	< 36	< 48	< 1,010	< 186	
SA-FPL-16S1	07/28/21	Lamb's Ear	**782**	±	334	**6,106**	±	900	< 36	< 40	< 34	< 738	< 151	
SA-FPL-16S1	08/31/21	Broccoli		<	289	**6,162**	±	638	< 57	< 33	< 36	< 861	< 128	
SA-FPL-16S1	08/31/21	Kale		<	315	**6,315**	±	611	< 56	< 34	< 32	< 700	< 121	
SA-FPL-16S1	08/31/21	Lamb's Ear	**1,708**	±	434	**10,310**	±	1,040	< 54	< 40	< 36	< 838	< 184	
SA-FPL-10D1 (C)	07/28/21	Lamb's Ear	**3,542**	±	569	**19,270**	±	1,732	< 53	< 52	< 47	< 1,183	< 291	
SA-FPL-10D1 (C)	08/31/21	Kale	**426**	±	238	**4,790**	±	810	< 36	< 40	< 42	< 769	< 137	
SA-FPL-10D1 (C)	08/31/21	Lamb's Ear	**1,322**	±	413	**7,861**	±	904	< 53	< 40	< 40	< 994	< 185	
SA-FPL-10D1 (C)	08/31/21	Broccoli		<	328	**5,738**	±	612	< 45	< 37	< 28	< 723	< 118	
ALL INDICATOR AVERAGE*			**1,627**	±	1,460	**8,740**	±	6,114	-	-	-	-		

(C) CONTROL LOCATION.

***** THE AVERAGE AND 2 STANDARD DEVIATION VALUES ARE CALCULATED USING THE POSITIVE VALUES. IF THERE IS ONLY 1 POSITIVE VALUE THE AVERAGE AND THE ERROR ARE DISPLAYED.

- INDICATES AVERAGE WAS NOT CALCULATED DUE TO NO POSITIVE VALUES FOR THE REPORTING PERIOD.

Table 30, Concentrations of Gamma Emitters in Vegetables (FPV), 2021

Results in Units of pCi/kg (wet) ± 2σ

STATION ID	COLLECTION DATE	SAMPLE TYPE	< - - - - - - - - - - - - - - GAMMA EMITTERS - - - - - - - - - - - - - - >						
			Be-7	K-40	I-131	Cs-134	Cs-137	Ra-226	Th-232
SA-FPV-2F9**	05/12/21	Asparagus	< 128	**1,521** ± 348	< 16	< 16	< 15	< 321	< 57
SA-FPV-2F9**	08/03/21	Tomatoes	< 125	**1,962** ± 323	< 19	< 13	< 13	< 288	< 47
SA-FPV-2F9**	08/03/21	Corn	< 157	**2,027** ± 309	< 21	< 20	< 17	< 389	< 73
SA-FPV-3F8**	08/03/21	Peaches	< 223	**2,055** ± 474	< 28	< 28	< 24	< 593	< 97
SA-FPV-15F4**	08/11/21	Tomatoes	< 128	**1,505** ± 276	< 17	< 16	< 14	< 347	< 71
SA-FPV-15F4**	08/11/21	Corn	< 103	**1,937** ± 306	< 12	< 13	< 14	< 280	< 65
SA-FPV-15F4**	08/11/21	Peppers	< 159	**1,520** ± 477	< 25	< 36	< 21	< 476	< 83
SA-FPV-1G1**	05/12/21	Asparagus	< 113	**1,885** ± 330	< 16	< 18	< 15	< 315	< 65
SA-FPV-1G1**	08/03/21	Corn	< 128	**2,347** ± 368	< 17	< 16	< 16	< 353	< 59
SA-FPV-1G1**	08/03/21	Peaches	< 161	**1,694** ± 360	< 23	< 17	< 15	< 406	< 79
SA-FPV-1G1**	08/03/21	Peppers	< 168	**1,445** ± 413	< 31	< 35	< 24	< 506	< 95
SA-FPV-1G1**	08/03/21	Tomatoes	< 116	**1,875** ± 286	< 20	< 14	< 13	< 316	< 52
SA-FPV-2G2**	08/11/21	Peppers	< 147	**1,289** ± 319	< 24	< 17	< 17	< 358	< 65
SA-FPV-2G2**	08/11/21	Tomatoes	< 112	**1,429** ± 305	< 16	< 20	< 19	< 398	< 71
SA-FPV-2G2**	08/11/21	Corn	< 118	**2,077** ± 304	< 16	< 14	< 16	< 315	< 48
SA-FPV-9G2**	08/11/21	Tomatoes	< 104	**2,326** ± 294	< 14	< 18	< 14	< 282	< 51
SA-FPV-3H5**	05/12/21	Asparagus	< 164	**2,104** ± 374	< 25	< 20	< 21	< 480	< 91
SA-FPV-3H5**	07/20/21	Peppers	< 104	**1,538** ± 308	< 16	< 19	< 20	< 375	< 61
SA-FPV-3H5**	07/20/21	Peaches	< 79	**1,220** ± 211	< 13	< 10	< 11	< 207	< 37
SA-FPV-3H5**	07/20/21	Corn	< 61	**1,641** ± 187	< 8	< 9	< 8	< 184	< 26
SA-FPV-3H5**	07/20/21	Tomatoes	< 85	**2,717** ± 255	< 12	< 12	< 12	< 241	< 40
AVERAGE*			-	**1,815** ± 770	-	-	-	-	-

***** THE AVERAGE AND 2 STANDARD DEVIATION VALUES ARE CALCULATED USING THE POSITIVE VALUES. IF THERE IS ONLY 1 POSITIVE VALUE THE AVERAGE AND THE ERROR ARE DISPLAYED.

****** MANAGEMENT AUDIT SAMPLE: NOT REQUIRED BY ODCM.

- INDICATES AVERAGE WAS NOT CALCULATED DUE TO NO POSITIVE VALUES FOR THE REPORTING PERIOD.

Table 31, Concentrations of Gamma Emitters in Fodder Crops**, 2021

Results in Units of pCi/kg (wet) ± 2σ

STATION ID	COLLECTION DATE	SAMPLE TYPE	< - - - - - - - - - - - - - - GAMMA EMITTERS - - - - - - - - - - - - - - >						
			Be-7	K-40	I-131	Cs-134	Cs-137	Ra-226	Th-232
SA-VGT-13E3**	11/29/21	Silage	< **125**	**2,908** ± 377	< 16	< 17	< 16	< 299	< 59
SA-VGT-14F4**	11/29/21	Silage	< **171**	**4,596** ± 446	< 15	< 18	< 17	< 357	< 59
SA-VGT-2G3**	11/29/21	Silage	**341** ± **158**	**5,104** ± 599	< 20	< 17	< 18	< 397	< 85
AVERAGE*			**341** ± 158	**4,203** ± 2,299	-	-	-	-	-

***** THE AVERAGE AND 2 STANDARD DEVIATION VALUES ARE CALCULATED USING THE POSITIVE VALUES. IF THERE IS ONLY 1 POSITIVE VALUE THE AVERAGE AND THE ERROR ARE DISPLAYED.

****** MANAGEMENT AUDIT SAMPLE: NOT REQUIRED BY ODCM.

- INDICATES AVERAGE WAS NOT CALCULATED DUE TO NO POSITIVE VALUES FOR THE REPORTING PERIOD.

Table 32, Concentrations of Gamma Emitters in Game, 2021

Results in Units of pCi/kg (wet) ± 2σ

STATION ID	COLLECTION DATE	SAMPLE TYPE	<----------GAMMA EMITTERS---------->				
			Be-7	K-40	I-131	Cs-134	Cs-137
SA-GAM-3E1**	01/11/21	Muskrat	< 75	**2,387** ± 219	< 15	< 13	< 9
SA-GAM-13E3**	03/08/21	Muskrat	< 79	**2,525** ± 251	< 13	< 11	< 9
SA-GAM-4C1**	01/11/21	Muskrat	< 114	**2,890** ± 384	< 26	< 17	< 13
ALL INDICATOR AVERAGE*			-	**2,601** ± 520	-	-	-

***** THE AVERAGE AND 2 STANDARD DEVIATION VALUES ARE CALCULATED USING THE POSITIVE VALUES. IF THERE IS ONLY 1 POSITIVE VALUE, THE AVERAGE AND THE ERROR ARE DISPLAYED.

** MANAGEMENT AUDIT SAMPLE: NOT REQUIRED BY ODCM.

- INDICATES AVERAGE WAS NOT CALCULATED DUE TO NO POSITIVE VALUES FOR THE REPORTING PERIOD.

Table 33, Concentrations of Gamma Emitters in Soil**, 2021

Soil is only sampled every 3 years.
Due again in 2022.

** MANAGEMENT AUDIT SAMPLE: NOT REQUIRED BY ODCM.

Attachment 3, Cross Check Intercomparison Program

Participation in cross check intercomparison studies is mandatory for laboratories performing analyses of REMP samples satisfying the requirements in the Offsite Site Dose Calculation Manual. Intercomparison studies provide a consistent and effective means to evaluate the accuracy and precision of analyses performed by a laboratory. Study results should fall within specified control limits and results that fall outside the control limits are investigated and corrected.

Teledyne Brown Engineering (TBE) and GEL Analytical Services (GEL) participated in the following proficiency testing studies provided by Environmental Resource Associates (ERA), Eckert Ziegler Analytics and DOE Mixed Analyte Performance Evaluation in 2021. The Laboratory's intercomparison program results for 2021 are shown in Table 34 to Table 39.

Teledyne Brown Engineering Summary of Results

The TBE Laboratory analyzed Performance Evaluation (PE) samples of air particulate (AP), air iodine, milk, soil, vegetation, and water matrices for various analytes. The PE samples supplied by Analytics Inc., Environmental Resource Associates (ERA) and Department of Energy (DOE) Mixed Analyte Performance Evaluation Program (MAPEP), were evaluated against the following pre-set acceptance criteria:

A. Analytics Evaluation Criteria

Analytics' evaluation report provides a ratio of TBE's result and Analytics' known value. Since flag values are not assigned by Analytics, TBE evaluates the reported ratios based on internal QC requirements based on the DOE MAPEP criteria.

B. ERA Evaluation Criteria

ERA's evaluation report provides an acceptance range for control and warning limits with associated flag values. ERA's acceptance limits are established per the US EPA, National Environmental Laboratory Accreditation Conference (NELAC), state-specific Performance Testing (PT) program requirements or ERA's SOP for the Generation of Performance Acceptance Limits, as applicable. The acceptance limits are either determined by a regression equation specific to each analyte or a fixed percentage limit promulgated under the appropriate regulatory document.

C. DOE Evaluation Criteria

MAPEP's evaluation report provides an acceptance range with associated flag values. MAPEP defines three levels of performance:

- Acceptable (flag = "A") - result within ± 20% of the reference value
- Acceptable with Warning (flag = "W") - result falls in the ± 20% to ± 30% of the reference value
- Not Acceptable (flag = "N") - bias is greater than 30% of the reference value

Note: The Department of Energy (DOE) Mixed Analyte Performance Evaluation Program (MAPEP) samples are created to mimic conditions found at DOE sites which do not resemble typical environmental samples obtained at commercial nuclear power facilities.

For the TBE laboratory, 146 out of 154 analyses performed met the specified acceptance criteria. Seven analyses did not meet the specified acceptance criteria and were addressed through the TBE Corrective Action Program. *NOTE: One analysis (soil for Tc-99) that did not meet acceptance criteria was performed for TBE information and is not on the list of required ICP analyses.* A summary is found below:

1. The ERA MRAD March 2021 Water Fe-55 result was evaluated as *Not Acceptable*. The reported value for Fe-55 was 579 pCi/L and the known result was 275 pCi/L (acceptance range 162 - 400). When reviewing the original sample data, it was found that the carrier yield was 52.6% (lower than typical water samples). Looking at the etched plate that was counted, it appeared that some loss of sample could have occurred. The sample was logged for reanalysis and used as the workgroup duplicate. The results were acceptable at 197 and 221 respectively. Yields were 97.4% and 105.7% and the plated samples were centered with no apparent loss of sample. The loss of sample during plating resulted in a low yield which produced an artificially high sample result. (NCR 21-01)
2. The MAPEP February 2021 AP Gross Alpha result was evaluated as *Not Acceptable*. The reported value was 0.371 Bq/sample and the known result was 1.77 Bq/sample (acceptance range 0.53 - 3.01). A similar failure had occurred several years prior due to the filter being placed with the wrong side up on the detector. At that time, a small dot was placed on the top of the filter prior to removal from the package to indicate the correct side for counting. The current sample was still in the detector when the result was received (dot side facing the detector). The sample was recounted with a similar result and was flipped and recounted. The flipped result was 0.661 Bq/sample, within the acceptable range. Because TBE cannot rely on receiving correct packaging from the provider, MAPEP AP cross-checks will be counted on both sides going forward. *NOTE: The August sample had the same packaging issue (upside down).* (NCR 21-02)
3. The MAPEP February 2021 soil Ni-63 was evaluated as *Not Acceptable*. The reported value was 310 Bq/kg and the known result was 689 (acceptance range 482 - 896). All workgroup QC was reviewed with no anomalies. The analytical procedure had been revised prior to this analysis to eliminate added interferences. The sample yield was >100%, indicative of incomplete separation from interferences, leading to a lower result. The procedure was again revised after acceptable results were obtained. (NCR 21-03)
4. The ERA October 2021 water Gross Beta result was evaluated as *Not Acceptable*. The reported value was 63.0 pCi/L and the known was 55.7 (acceptance range 38.1 - 62.6) or 113% of the known. The 2-sigma error was 6.8, placing the reported result well within the acceptable range. All QA was reviewed with no anomalies. A follow-up Quick Response cross-check was analyzed with a 120% ratio (see item 7). (NCR 21-10)
5. The ERA October 2021 water Tritium result was evaluated as *Not Acceptable*. The reported value was 13,800 pCi/L and the known was 17,200 (acceptance range 15,000 - 18,900). The 2-sigma error was 1,430, placing the result within the acceptable range. TBE's internal QC acceptance is 70% - 130%, while ERA's for this sample was 87% - 110%. All QA was reviewed with no anomalies. A Quick Response follow-up cross-check was analyzed with a result of 17,500 pCi/L (known 17,800 pCi/L). (NCR 21-11)
6. The MAPEP August 2021 soil Ni-63 result was evaluated as *Not Acceptable*. The reported value was 546 Bq/kg and the known result was 1,280 Bq/kg (acceptance range 896 - 1,664). All QC was reviewed and no anomalies found. The procedure revision to

remove added MAPAP interferences was ineffective for this sample. No client soil matrix samples were analyzed for Ni-63 in 2020 or 2021. The root cause investigation is still ongoing at this time. (NCR 21-13)

7. The ERA December 2021 Quick Response water Gross Beta result was evaluated as *Not Acceptable*. The reported value was 47.6 pCi/L and the known was 39.8 pCi/L or 120% of the known (acceptance range of 26.4 - 47.3). The 2-sigma error was 6.1, placing the reported result well within the acceptable range. All QA was reviewed with no anomalies. The original sample was recounted on a different detector with a result of 40.3 ± 6.27 pCi/L. The "failure" of this sample and the RAD-127 was due to the narrow upper acceptance ranges assigned (119% and 112%) (NCR 21-14)

The Inter-Laboratory Comparison Program provides evidence of "in control" counting systems and methods, and that the laboratories are producing accurate and reliable data.

GEL Laboratories Summary of Results

During 2021, forty-five (45) radioisotopes associated with seven (7) matrix types were analyzed under GEL's Performance Evaluation program in participation with ERA, MAPEP, and Eckert & Ziegler Analytics. Matrix types were representative of client analyses performed during 2021. Of the four hundred thirty three (433) total results, 96.5%% (418 of 433) were found to be acceptable within the PT providers three sigma or other statistical criteria. The list below contains the type of matrix evaluated by GEL.

- Air Filter
- Cartridge
- Water
- Milk
- Soil
- Liquid
- Vegetation

Graphs are provided in Figures 1-9 of this report to allow for the evaluation of trends or biases. These graphs include radioisotopes Cobalt-60, Cesium-137, Tritium, Strontium-90, Gross Alpha, Gross Beta, Iodine-131, Americium-241, and Plutonium-238.

Summary of Participation in the Eckert & Ziegler Analytics Environmental Cross-Check Program

Eckert & Ziegler Analytics provided samples for one hundred thirty (130) individual environmental analyses. The accuracy of each result reported to Eckert & Ziegler Analytics, Inc. is measured by the ratio of GEL's result to the known value. All results fell within GEL's acceptance criteria (100% within acceptance).

Summary of Participation in the MAPEP Monitoring Program

MAPEP Series 44 and 45 were analyzed by the laboratory. Of the one hundred thirty (130) analyses, 96.1% (125 out of 130) fell within the PT provider's acceptance criteria.

Summary of Participation in the ERA MRaD PT Program

The ERA MRad program provided samples (MRAD-34 and MRAD-35) for one hundred seventy-one (171) individual environmental analyses. Of the 171 analyses, 96.5% (165 out of 171) fell within the PT provider's acceptance criteria.

Summary of Participation in the ERA PT Program

The ERA program provided samples (RAD-124, RAD 125) for forty-three (43) individual environmental analyses. Of the 43 analyses, 88.4% (38 out of 43) fell within the PT provider's acceptance criteria.

All corrective actions are summarized in the Table below.

Corrective Action Request and Report (CARR)

There are two categories of corrective action at GEL. One is corrective action implemented at the analytical and data review level in accordance with the analytical SOP. The other is formal corrective action documented by the Quality Systems Team in accordance with GL-QS-E-002. A formal corrective action is initiated when a nonconformance reoccurs or is so significant that permanent elimination or prevention of the problem is required. Formal corrective action investigations include root cause analysis.

GEL includes quality requirements in most analytical standard operating procedures to ensure that data are reported only if the quality control criteria are met or the quality control measures that did not meet the acceptance criteria are documented. A formal corrective action is implemented according to GL-QS-E-002 for Conducting Corrective/Preventive Action and Identifying Opportunities for Improvement. Recording and documentation is performed following guidelines stated in GL-QS-E-012 for Client NCR Database Operation.

Any employee at GEL can identify and report a nonconformance and request that corrective action be taken. Any GEL employee can participate on a corrective action team as requested by the QS team or Group Leaders. The steps for conducting corrective action are detailed in GL-QS-E-002. In the event that correctness or validity of the laboratory's test results in doubt, the laboratory will take corrective action. If investigations show that the results have been impacted, affected clients will be informed of the issue in writing within five (5) calendar days of the discovery.

The table below provides the status of CARRs for radiological performance testing during 2021. **It has been determined that causes of the unacceptable results did not impact any data reported to our clients.**

- CARR 210311-1305 for PT Failures in RAD Study 124
- CARR 210524-1327 for PT Failures in RAD Study125
- CARR 210723-1339 for PT Failures in MAPEP Study 44
- CARR 210603-1329 for PT Failures in MRAD Study 34
- CARR 211216-1360 for PT Failures in MAPEP Study 45
- CARR 211215-1358 for PT Failures in MRAD Study 35

CORRECTIVE ACTION
&
PE FAILURE

Summary of RAD-124 Drinking Water Study Unacceptable Ratings

Sample ID	Parm	Reported Value	Reference Value	Acceptance Range
Naturals	Radium -226	8.42 pCi/L	15.5 pCi/L	11.5-17.8 pCi/L
Naturals	Radium-228	19.5 pCi/L	12.9 pCi/L	8.54-15.8 pCi/L
Strontium 89/90	Strontium-89	74.6 pCi/L	61.3 pCi/L	49.4-69.2 pCi/L

Upon receipt of the PT report, an investigation was initiated by the Quality Department and a Corrective Action (CARR) team assembled. The team consisted of representatives from the affected laboratories. The sample preparation and analytical processes were reviewed. This included review of reagents and standards used in the sample preparation steps, calibration records, process control samples, and interviews with the analysts.

The investigation determined that the laboratory met all quality control criteria specified in each method. Additionally, all internal procedures and policies were performed as required. These failures were tracked through GEL's internal non-conformance system.

Root Cause(s):

Radium-226: The laboratory reviewed the data of the original analysis and no anomalies were noted. A review of the sample preparation processes, and data set did not reveal any gross errors or possible contributors to the low bias. It is possible that an unknown systematic error must have occurred during the precipitation steps of the procedure resulting in the low bias.

Radium-228: The Batch data was reviewed and low gravemetric yields were identified. Ra-228 drinking water method includes two gravemetric yields and both yields were lower than normal for this method. It is apparent that the low yields, which are multiplied together to determine the final yield for the analysis, biased the result high. Original reported data was calculated with "typical" method yields obtaining result of 11.9 pCi/L (92% of known value). The low yields were not sample specific with MB and LCS yields being similar to the samples in the batch; therefore, an unknown systematic error must have occurred during the precipitation steps of the procedure that resulted in low yields.

Strontium-89: The result for Strontium-89 was 122% of the known value with the acceptance range limit of 114%. The Group Leader has reviewed the method to identify the bias. The method LCS trend was reviewed for the method and no anomalies were identified. The calibration used for the analysis was compared to the new calibration performed recently and the original reported data was processed with both calibrations for comparison. Data was comparable. Instrument run logs were reviewed and there was no indication of possible bias from run log. Sr89/90

drinking water method includes two gravemetric yields. Both gravemetric batch yields were reviewed and it was noted that the Yttrium yields appeared to be slightly higher than expected for this method. It is possible that the Yttrium yields were biased high due to analyst error during the drying process. The original reported data was processed with typically recovered Yttrium method yields and the Sr-89 value (65.8 pCi/L) was within the acceptance range at 108%.

Summary of RAD-125 Drinking Water Study Unacceptable Ratings

Sample ID	Parm	Reported Value	Reference Value	Acceptance Range
Naturals	Radium-226	14.2 pCi/L	19.3 pCi/L	14.3-22.0 pCi/L

Upon receipt of the PT report, an investigation was initiated by the Quality Department and a Corrective Action (CARR) team assembled. The team consisted of representatives from the affected laboratories. The sample preparation and analytical processes were reviewed. This included review of reagents and standards used in the sample preparation steps, calibration records, process control samples, and interviews with the analysts.

The investigation determined that the laboratory met all quality control criteria specified in each method. Additionally, all internal procedures and policies were performed as required. These failures were tracked through GEL's internal non-conformance system.

Summary of MRAD-34 Study Unacceptable Ratings

Sample ID	Parm	Reported Value	Reference Value	Acceptance Range
Air Filter Gross Alpha/Beta	Gross Alpha	391 pCi/F	96.1 pCi/F	50.2-158 pCi/F
Water Gross Alpha/Beta	Gross Alpha	87.8 pCi/L	62.2 pCi.L	22.7-85.8 pCi/L
Water Radionuclides	Iron-55	494 pCi/L	275 pCi/L	162-400 pCi/L

Upon receipt of the PT report, an investigation was initiated by the Quality Department and a Corrective Action (CARR) team assembled. The team consisted of representatives from the affected laboratories. The sample preparation and analytical processes were reviewed. This included review of reagents and standards used in the sample preparation steps, calibration records, process control samples, and interviews with the analysts.

The investigation determined that the laboratory met all quality control criteria specified in each method. Additionally, all internal procedures and policies were performed as required. These failures were tracked through GEL's internal non-conformance system.

Root Cause(s):

The results for this analysis were reviewed and it was noted that the result for the in-batch duplicate would have been acceptable recovering at 96% of the known value and met replication criteria. The laboratory investigated the transfer rig that was used to prep the unacceptable sample and noted loose fittings and cracked tubing. These may have contributed to the low bias in the sample preparation. The transfer rig was rebuilt and the other rigs inspected for possible wear issues that may need to be rebuilt or replaced.

The laboratory successfully completed study RAD-126 for Ra-226 by 903.1

Summary of MAPEP 44 Study Unacceptable Ratings

Sample ID	Parm	Reported Value	Reference Value	Acceptance Range
MAPEP-21-MaS44	Antimony	27.3 mg/kg	78 mg/kg	55-101 mg/kg
MAPEP-21-RdV44	Cesium-134 Strontium-90	2.51 Bq/samp. 0.444 Bq/samp.	3.6 Bq/samp. 0.673 Bq/samp.	2.52-4.68 Bq/samp. 0.471-0.875 Bq/samp.

Upon receipt of the PT report, an investigation was initiated by the Quality Department and a Corrective Action (CARR) team assembled. The team consisted of representatives from the affected laboratories. The sample preparation and analytical processes were reviewed. This included review of reagents and standards used in the sample preparation steps, calibration records, process control samples, and interviews with the analysts.

The investigation determined that the laboratory met all quality control criteria specified in each method. Additionally, all internal procedures and policies were performed as required. These failures were tracked through GEL's internal non-conformance system.

Root Cause(s):

MAPEP-21-MaS44: The sample was prepared using standard hot-acid leach per section 7.5 of SW-846 3050B. More rigorous digestions were used in an attempt to increase solubility without success. It is suspected that the low bias in the result is due to an unidentified matrix interferant.

MAPEP-21-RdV44: The data has been reviewed for these analyses and no errors were noted. The Cesium-134 and Strontium-90 failed with a low bias compared to the known. It was noted that several other reported isotopes had a low bias but were within the acceptance ranges for their parameters. It is suspected that the sample preparation had an unidentified error during the digestion process

Summary of MAPEP 45 Study Unacceptable Ratings

Sample ID	Parm	Reported Value	Reference Value	Acceptance Range
MAPEP-21-GrF45	Gross Alpha	1.73 Bq/S	0.960 Bq/S	0.288-1.632 Bq/S
MAPEP-21-MaS45 (Radiological)	Uranium-234	79.6 Bq/kg	51.4 Bq/kg	36.0-66.8 Bq/kg
MAPEP-21-MaSF45	Np-237 Sr-90 (W)	0.00736 Bq/S 0.482 Bq/S	NA 0.6649 Bq/S	False positive test 0.4654-0.8644 Bq/S
MAPEP-21-MaW45 (Radiological)	Ra-226	0.310 Bq/L	0.226 Bq/L	0.158-0.294 Bq/L
MAPEP-21-RdF45	Sr-90 (W)	0.195 Bq/S	0.273 Bq/S	0.191-0.355 Bq/S

Upon receipt of the PT report, an investigation was initiated by the Quality Department and a Corrective Action (CARR) team assembled. The team consisted of representatives from the affected laboratories. The sample preparation and analytical processes were reviewed. This included review of reagents and standards used in the sample preparation steps, calibration records, process control samples, and interviews with the analysts.

The investigation determined that the laboratory met all quality control criteria specified in each method. Additionally, all internal procedures and policies were performed as required. These failures were tracked through GEL's internal non-conformance system

Root Cause:

MAPEP-21-GrF45: Gross Alpha: The data for this analysis has been reviewed and no errors were noted. It was found that the result from the original count for the sample preparation was within the acceptance limits of the study. The sample initially did not meet replication criteria for the in-batch duplicate and was recounted. The duplicate sample was not recounted during the process.

MAPEP-21-MaS45 (radiological) U-234: The laboratory preparation and counting procedures were evaluated for potential contributors to the high bias of these results. None were noted and the batches met QC criteria for recovery and duplication.

MAPEP-21-MaSF45: Upon review, it is suspected that the bias in the Np result is due to an unidentified matrix interferant. The sample should have been returned to the lab for additional clean up steps. The Sr warning result recovered at 72.5% of the known value. The laboratory evaluated both the prep and instrument processes for possible causes for the low bias. A definitive cause was not determined.

MAPEP-21-MaW45 (Radiological):Ra-226: The data has been reviewed and no errors were found. It was noted that the in-batch duplicate sample result was within acceptance limits for the study. The samples met RER replication criteria.

MAPEP-21-RdF45: Sr: This warning result recovered at 71% of the known value. The laboratory evaluated both the prep and instrument processes for possible causes for the low bias. A definitive source was not determined. This Sr warning result was analyzed in a separate laboratory than the synthetic fecal sample which uses an entirely separate processes for analysis.

Summary of MRAD-35 Study Unacceptable Ratings

Sample ID	Parm	Reported Value	Reference Value	Acceptance Range
Air Filter	Uranium-234	9.62 pCi/F	7.76 pCi/F	5.75-9.09 pCi/F
Water	Uranium-234	49.6 pCi/L	40.8 pCi/L	31.1-46.7 pCi/L

Upon receipt of the PT report, an investigation was initiated by the Quality Department and a Corrective Action (CARR) team assembled. The team consisted of representatives from the affected laboratories. The sample preparation and analytical processes were reviewed. This included review of reagents and standards used in the sample preparation steps, calibration records, process control samples, and interviews with the analysts.

The investigation determined that the laboratory met all quality control criteria specified in each method. Additionally, all internal procedures and policies were performed as required. These failures were tracked through GEL's internal non-conformance system

Root Cause(s):

The laboratory reviewed the data and found no errors. It was noted that the sample was replicated in the analysis batch and met replication criteria. For the water analysis, the result of the duplicate sample was within the acceptance range of the study. All analysis data met the acceptance QC criteria and procedures for initial calibration, continuing calibration, instrument controls and process controls were met.

Summary of Results: Split Sample Comparison Program

To meet the requirement of ODCM 3/4.12.3, INTERLABORATORY COMPARISON PROGRAM, several duplicate environmental samples each year are sent to a second independent laboratory to compare results. The laboratory chosen for these Quality Control Analyses is General Engineering Laboratories (GEL).

Duplicate samples were obtained for some samples of weekly air iodine and particulates, quarterly air particulate, sediment, broad leaf vegetation, milk, and surface water. These samples were analyzed by GEL as comparison and quality assurance of TBE results. The GEL duplicate analysis results are shown in below.

Agreement between TBE and GEL is based on criteria for accepting measurements in NRC Inspection Procedure 84525.

Air Iodine

I-131 was not detected (less than MDC) by both TBE and GEL for all 52 air samples.

Air Particulates

Gross beta was detected by GEL and TBE in all 52 of the duplicate weekly APT samples. GEL detects significantly higher gross beta results. The variance between the lab results is due to different calibration energy sources used by each lab.

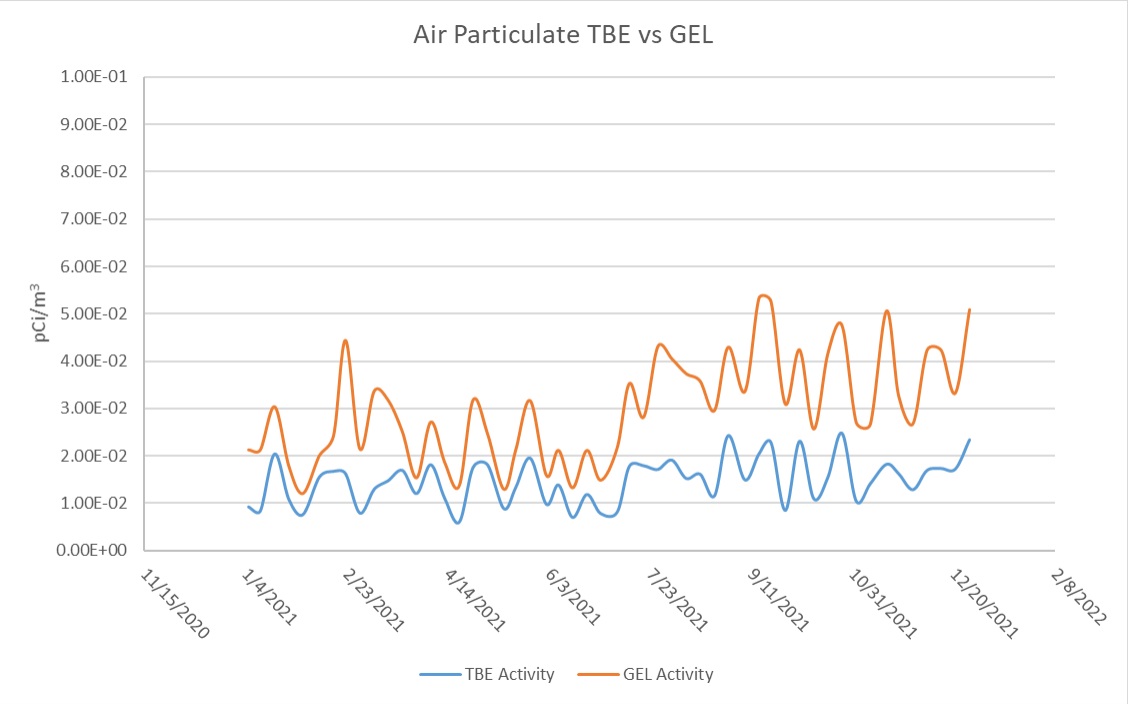

Figure 9, TBE vs GEL Gross Beta

All four duplicate quarterly composite samples analyzed had positive results for Be-7.

AIR PARTICULATE COMPOSITES												
TBE						GEL			TBE / GEL Comparison			
CRS #	Collection Date	Nuclide	Decay Corrected Activity	1 Sigma Error	Resolution	CRS #	Nuclide	Decay Corrected Activity	Ratio	Acceptance Critera		Agreement
L91361-1	Q1 2021	Be-7	6.35E-02	7.76E-03	8	540937	Be-7	7.62E-02	1.20	0.60	1.66	YES
L92507-1	Q2 2021	Be-7	7.20E-02	8.85E-03	8	550068	Be-7	7.72E-02	1.07	0.60	1.66	YES
L93872-1	Q3 2021	Be-7	7.60E-02	7.33E-03	10	560137	Be-7	8.72E-02	1.15	0.60	1.66	YES
L94867-1	Q4 2021	Be-7	6.08E-02	6.21E-03	10	567622	Be-7	6.70E-02	1.10	0.60	1.66	YES

Surface Water

Naturally occurring K-40 was not detected in TBE samples. K-40 was detected in all of the GEL samples.

SURFACE WATER											
TBE						GEL			TBE / GEL Comparison		
CRS #	Collection Date	Nuclide	Decay Corrected Activity	1 Sigma Error	Resolution	CRS #	Nuclide	Decay Corrected Activity	Ratio	Acceptance Critera	Agreement
L91345-2	3/22/21	K-40	<DL	N/A	N/A	539551	K-40	4.53E+01	No comparison result <MDL		
L92479-2	6/23/21	K-40	<DL	N/A	N/A	548557	K-40	4.46E+01	No comparison result <MDL		
L93542-2	9/24/21	K-40	<DL	N/A	N/A	557184	K-40	9.97E+00	No comparison result <MDL		
L94617-2	12/20/21	K-40	<DL	N/A	N/A	566052	K-40	7.04E+01	No comparison result <MDL		

Milk

Naturally occurring K-40 was detected in 9 duplicate samples and are all in agreement.

MILK												
TBE						GEL			TBE / GEL Comparison			
CRS #	Collection Date	Nuclide	Decay Corrected Activity	1 Sigma Error	Resolution	CRS #	Nuclide	Decay Corrected Activity	Ratio	Acceptance Critera		Agreement
L90464-3	1/5/2021	K-40	1.34E+03	8.26E+01	16	531546	K-40	1.41E+03	0.95	0.75	1.33	YES
L90896-3	2/9/2021	K-40	1.30E+03	1.02E+02	13	535126	K-40	1.83E+03	0.71	0.60	1.66	YES
L91132-3	3/8/2021	K-40	1.36E+03	9.33E+01	15	537473	K-40	1.43E+03	0.95	0.60	1.66	YES
L91446-3	4/5/2021	K-40	1.13E+03	9.02E+01	12	540166	K-40	1.31E+03	0.86	0.60	1.66	YES
L91813-3	5/3/2021	K-40	1.44E+03	1.06E+02	14	543702	K-40	1.25E+03	1.15	0.60	1.66	YES
L92254-3	6/7/2021	K-40	1.32E+03	8.75E+01	15	546906	K-40	1.35E+03	0.98	0.60	1.66	YES
L92628-3	7/8/2021	K-40	1.23E+03	9.11E+01	13	549259	K-40	1.33E+03	0.92	0.60	1.66	YES
L92975-3	8/2/2021	K-40	1.30E+03	8.55E+01	15	551879	K-40	1.34E+03	0.97	0.60	1.66	YES
L93360-3	9/7/2021	K-40	1.08E+03	9.01E+01	12	555443	K-40	1.33E+03	0.81	0.60	1.66	YES

Sediment

Naturally occurring K-40 was detected in the sample by both GEL and TBE. Results are in agreement.

SEDIMENT												
TBE						GEL			TBE / GEL Comparison			
CRS #	Collection Date	Nuclide	Decay Corrected Activity	1 Sigma Error	Resolution	CRS #	Nuclide	Decay Corrected Activity	Ratio	Acceptance Critera		Agreement
L88355-3	7/21/21	K-40	2.56E+03	4.52E+02	6	551876	7/27/2021	4.08E+03	0.63	0.50	2.00	YES

Broad Leaf Vegetation

Naturally occurring K-40 was detected by GEL and TBE in all 19 duplicate samples analyzed. All results are in agreement[DEW1].

[RT2]

VEGETATION												
TBE						GEL			TBE / GEL Comparison			
CRS #	Collection Date	Nuclide	Decay Corrected Activity	1 Sigma Error	Resolution	CRS #	Nuclide	Decay Corrected Activity	Ratio	Acceptance Critera		Agreement
L91926-2	5/12/21	K-40	1.89E+03	1.65E+02	11	544600	K-40	2.82E+03	0.67	0.60	1.66	YES
L91926-3	5/12/21	K-40	2.10E+03	1.87E+02	11	544600	K-40	2.19E+03	0.96	0.60	1.66	YES
L92795-4	7/20/21	K-40	1.22E+03	1.05E+02	12	550430	K-40	1.47E+03	0.83	0.60	1.66	YES
L92795-2	7/20/21	K-40	1.54E+03	1.54E+02	10	550430	K-40	1.66E+03	0.93	0.60	1.66	YES
L92795-3	7/20/21	K-40	2.72E+03	1.27E+02	21	550430	K-40	1.81E+03	1.50	0.75	1.33	NO
L92795-1	7/20/21	K-40	1.64E+03	9.33E+01	18	550430	K-40	2.34E+03	0.70	0.75	1.33	NO
L92890-6	7/28/21	K-40	6.11E+03	4.50E+02	14	551115	K-40	1.81E+04	0.34	0.60	1.66	NO
L92890-4	7/28/21	K-40	1.93E+04	8.66E+02	22	551115	K-40	7.16E+03	2.69	0.75	1.33	NO
L92998-3	8/3/21	K-40	1.88E+03	1.43E+02	13	552121	K-40	2.12E+03	0.88	0.60	1.66	YES
L92998-4	8/3/21	K-40	1.69E+03	1.80E+02	9	552121	K-40	2.06E+03	0.82	0.60	1.66	YES
L92998-1	8/3/21	K-40	2.35E+03	1.84E+02	13	552121	K-40	2.67E+03	0.88	0.60	1.66	YES
L92998-2	8/3/21	K-40	1.45E+03	2.06E+02	7	552121	K-40	1.39E+03	1.04	0.50	2.00	YES
L92998-5	8/3/21	K-40	2.03E+03	1.54E+02	13	552121	K-40	1.57E+03	1.29	0.60	1.66	YES
L92998-6	8/3/21	K-40	1.96E+03	1.62E+02	12	552121	K-40	2.14E+03	0.92	0.60	1.66	YES
L92998-7	8/3/21	K-40	2.06E+03	2.37E+02	9	552121	K-40	1.94E+03	1.06	0.60	1.66	YES
L93077-7	8/11/21	K-40	2.33E+03	1.47E+02	16	552740	K-40	1.81E+03	1.29	0.60	1.66	YES
L93077-3	8/11/21	K-40	1.51E+03	1.38E+02	11	552740	K-40	1.50E+03	1.00	0.60	1.66	YES
L93077-1	8/11/21	K-40	1.94E+03	1.53E+02	13	552740	K-40	1.78E+03	1.09	0.60	1.66	YES
L93077-5	8/11/21	K-40	1.29E+03	1.59E+02	8	552740	K-40	1.39E+03	0.93	0.60	1.66	YES
L93077-4	8/11/21	K-40	2.08E+03	1.52E+02	14	552740	K-40	2.36E+03	0.88	0.60	1.66	YES
L93077-6	8/11/21	K-40	1.43E+03	1.52E+02	9	552740	K-40	2.61E+03	0.55	0.60	1.66	NO

Fish

Naturally occurring K-40 was detected in the sample by both GEL and TBE. Results are in agreement.

FISH												
TBE						GEL			TBE / GEL Comparison			
CRS #	Collection Date	Nuclide	Decay Corrected Activity	1 Sigma Error	Resolution	CRS #	Nuclide	Decay Corrected Activity	Ratio	Acceptance Critera		Agreement
L91925-2	5/4/2021	K-40	3.52E+03	4.08E+02	9	544596	K-40	2.74E+03	0.78	0.60	1.66	YES

Table 34, Analytics Environmental Radioactivity Cross Check Program (TBE)

Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Value	Known Value [a]	Ratio of TBE to Known Result	Evaluation [b]
March 2021	E13466	Milk	Sr-89	pCi/L	84.6	87.1	0.97	A
			Sr-90	pCi/L	11.5	12.6	0.91	A
	E13467	Milk	Ce-141	pCi/L	111	125	0.89	A
			Co-58	pCi/L	123	128	0.96	A
			Co-60	pCi/L	140	154	0.91	A
			Cr-51	pCi/L	252	242	1.04	A
			Cs-134	pCi/L	130	151	0.86	A
			Cs-137	pCi/L	110	110	1.00	A
			Fe-59	pCi/L	105	109	0.96	A
			I-131	pCi/L	77.6	86.9	0.89	A
			Mn-54	pCi/L	111	112	0.99	A
			Zn-65	pCi/L	200	211	0.95	A
	E13468	Charcoal	I-131	pCi	83.5	88.5	0.94	A
	E13469	AP	Ce-141	pCi	103.0	103	1.00	A
			Co-58	pCi	93.3	105	0.89	A
			Co-60	pCi	136	126	1.08	A
			Cr-51	pCi	213	198	1.07	A
			Cs-134	pCi	123.0	124	0.99	A
			Cs-137	pCi	86.3	90.1	0.96	A
			Fe-59	pCi	81.3	89.6	0.91	A
			Mn-54	pCi	93.5	92.0	1.02	A
			Zn-65	pCi	166	173	0.96	A
	E13470	Soil	Ce-141	pCi/g	0.232	0.262	0.89	A
			Co-58	pCi/g	0.251	0.268	0.94	A
			Co-60	pCi/g	0.306	0.322	0.95	A
			Cr-51	pCi/g	0.517	0.506	1.02	A
			Cs-134	pCi/g	0.263	0.317	0.83	A
			Cs-137	pCi/g	0.278	0.301	0.92	A
			Fe-59	pCi/g	0.228	0.229	1.00	A
			Mn-54	pCi/g	0.221	0.235	0.94	A
			Zn-65	pCi/g	0.448	0.441	1.02	A
	E13471	AP	Sr-89	pCi	92.2	95.5	0.97	A
September 2021	E13472	Milk	Sr-89	pCi/L	66.4	85.4	0.78	W
			Sr-90	pCi/L	11.9	14.0	0.85	A
	E13473	Milk	Ce-141	pCi/L	118	114	1.03	A
			Co-58	pCi/L	116	118	0.98	A
			Co-60	pCi/L	142	145	0.98	A
			Cr-51	pCi/L	244	236	1.03	A
			Cs-134	pCi/L	81	93.1	0.87	A
			Cs-137	pCi/L	105	112	0.94	A
			Fe-59	pCi/L	105	102	1.03	A
			I-131	pCi/L	65.1	85.6	0.76	W
			Mn-54	pCi/L	128	128	1.00	A
			Zn-65	pCi/L	158	153	1.03	A
	E13474	Charcoal	I-131	pCi	85.2	90.9	0.94	A

Table 34, Analytics Environmental Radioactivity Cross Check Program (TBE)

Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Value	Known Value [(a)]	Ratio of TBE to Known Result	Evaluation [(b)]
	E13475	AP	Ce-141	pCi	126	135	0.94	A
			Co-58	pCi	148	139	1.07	A
			Co-60	pCi	183	171	1.07	A
			Cr-51	pCi	322	278	1.16	A
			Cs-134	pCi	118	110	1.08	A
			Cs-137	pCi	147	132	1.12	A
			Fe-59	pCi	131	120	1.09	A
			Mn-54	pCi	161	151	1.06	A
			Zn-65	pCi	202	180	1.12	A
	E13476	Soil	Ce-141	pCi/g	0.215	0.219	0.98	A
			Co-58	pCi/g	0.208	0.226	0.92	A
			Co-60	pCi/g	0.277	0.277	1.00	A
			Cr-51	pCi/g	0.388	0.452	0.86	A
			Cs-134	pCi/g	0.157	0.178	0.88	A
			Cs-137	pCi/g	0.270	0.284	0.95	A
			Fe-59	pCi/g	0.218	0.195	1.12	A
			Mn-54	pCi/g	0.239	0.246	0.97	A
			Zn-65	pCi/g	0.312	0.293	1.06	A
	E13477	AP	Sr-89	pCi	85.6	68.3	1.25	W
			Sr-90	pCi	12.6	11.2	1.13	A

(a) The Analytics known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation

(b) Analytics evaluation based on TBE internal QC limits:

A = Acceptable - reported result falls within ratio limits of 0.80-1.20

W = Acceptable with warning - reported result falls within 0.70-0.80 or 1.20-1.30

N = Not Acceptable - reported result falls outside the ratio limits of < 0.70 and > 1.30

Table 35, DOE's Mixed Analyte Performance Evaluation Program (MAPEP)(TBE)
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Value	Known Value [a]	Acceptance Range	Evaluation [b]
February 2021	21-GrF44	AP	Gross Alpha	Bq/sample	0.371	1.77	0.53 - 3.01	N[3]
			Gross Beta	Bq/sample	0.731	0.65	0.325 - 0.974	A
	21-MaS44	Soil	Ni-63	Bq/kg	310	689.0	482 - 896	N[4]
			Tc-99	Bq/kg	457	638	447 - 829	W
	21-MaSU44	Urine	Cs-134	Bq/L	2.34	2.73	1.91 - 3.55	A
			Cs-137	Bq/L	2.54	2.71	1.90 - 3.52	A
			Co-57	Bq/L	0.4100		*(1)*	A
			Co-60	Bq/L	2.24	2.44	1.71 - 3.17	A
			Mn-54	Bq/L	2.03	2.03	1.42 - 2.64	A
			K-40	Bq/L	52.8	54.0	38 - 70	A
			U-234	Bq/L	0.108	0.0877	0.0614 - 0.114	W
			U-238	Bq/L	0.101	0.091	0.064 - 0.118	A
			Zn-65	Bq/L	1.06	1.34	*(2)*	A
	21-MaW44	Water	Ni-63	Bq/L	6.7	8.2	5.7 - 10.7	A
			Tc-99	Bq/L	3.850	4.01	2.81 - 5.21	A
	21-RdV44	Vegetation	Cs-134	Bq/sample	3.13	3.60	2.5 - 4.7	A
			Cs-137	Bq/sample	4.64	4.69	3.28 - 6.10	A
			Co-57	Bq/sample	5.25	5.05	3.54 - 6.57	A
			Co-60	Bq/sample	2.86	2.99	2.09 - 3.89	A
			Mn-54	Bq/sample	5.02	5.25	3.68 - 6.83	A
			Sr-90	Bq/sample	0.631	0.673	0.471 - 0.875	A
			Zn-65	Bq/sample	-0.233		*(1)*	A
August 2021	21-GrF45	AP	Gross Alpha	Bq/sample	0.368	0.960	0.288 - 1.632	A
			Gross Beta	Bq/sample	0.595	0.553	0.277 - 0.830	A
	21-MaS45	Soil	Ni-63	Bq/kg	546	1280	896 - 1664	N[5]
			Tc-99	Bq/kg	453	777	544 - 1010	N[6]
	21-MaSU45	Urine	Cs-134	Bq/L	3.10	3.62	2.53 - 4.71	A
			Cs-137	Bq/L	0.083		*(1)*	A
			Co-57	Bq/L	0.844	0.87	0.606 - 1.125	A
			Co-60	Bq/L	0.0535		*(1)*	A
			Mn-54	Bq/L	0.459	0.417	*(2)*	A
			K-40	Bq/L	48.8	54.0	38 - 70	A
			U-234	Bq/L	0.133	0.116	0.081 - 0.151	A
			U-238	Bq/L	0.137	0.121	0.085 - 0.157	A
			Zn-65	Bq/L	0.339	0.420	*(2)*	A
	21-MaW45	Water	Ni-63	Bq/L	33.5	39.5	27.7 - 51.4	A
			Tc-99	Bq/L	3.5	3.7	2.60 - 4.82	A
	21-RdV45	Vegetation	Cs-134	Bq/sample	3.42	4.34	3.04 - 5.64	W
			Cs-137	Bq/sample	2.14	2.21	1.55 - 2.87	A
			Co-57	Bq/sample	4.08	4.66	3.26 - 6.06	A
			Co-60	Bq/sample	2.81	3.51	2.46 - 4.56	A
			Mn-54	Bq/sample	0.035		*(1)*	A
			Sr-90	Bq/sample	1.15	1.320	0.92 - 1.72	A
			Zn-65	Bq/sample	2.05	2.43	1.70 - 3.16	A

Table 35, DOE's Mixed Analyte Performance Evaluation Program (MAPEP)(TBE)
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Value	Known Value [a]	Acceptance Range	Evaluation [b]
February 2021	21-GrF44	AP	Gross Alpha	Bq/sample	0.371	1.77	0.53 - 3.01	N(3)
			Gross Beta	Bq/sample	0.731	0.65	0.325 - 0.974	A
	21-MaS44	Soil	Ni-63	Bq/kg	310	689.0	482 - 896	N(4)
			Tc-99	Bq/kg	457	638	447 - 829	W
	21-MaSU44	Urine	Cs-134	Bq/L	2.34	2.73	1.91 - 3.55	A
			Cs-137	Bq/L	2.54	2.71	1.90 - 3.52	A
			Co-57	Bq/L	0.4100		*(1)*	A

(a) The MAPEP known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation

(b) DOE/MAPEP evaluation:

A = Acceptable - reported result falls within ratio limits of 0.80-1.20

W = Acceptable with warning - reported result falls within 0.70-0.80 or 1.20-1.30

N = Not Acceptable - reported result falls outside the ratio limits of < 0.70 and > 1.30

(1) False positive test

(2) Sensitivity evaluation

*(3) See **NCR 21-02***

*(4) See **NCR 21-03***

*(5) See **NCR 21-13***

(6) Tc-99 cross-checks done for TBE information only - not required

Table 36, ERA Environmental Radioactivity Cross Check Program (TBE)
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Value	Known Value [a]	Acceptance Limits	Evaluation [b]
March 2021	MRAD-34	Water	Am-241	pCi/L	175	157	108 - 201	A
			Fe-55	pCi/L	579	275	162 - 400	N(1)
			Pu-238	pCi/L	181	171	103 - 222	A
			Pu-239	pCi/L	153	142	87.9 - 175	A
		Soil	Sr-90	pCi/kg	6570	9190	2860 - 14,300	A
		AP	Fe-55	pCi/filter	107	121	44.2 - 193	A
			U-234	pCi/filter	25.99	25.5	18.9 - 29.9	A
			U-238	pCi/filter	24.7	25.3	19.1 - 30.2	A
April 2021	RAD-125	Water	Ba-133	pCi/L	92.3	90.5	76.2 - 99.6	A
			Cs-134	pCi/L	62.9	70.5	57.5 - 77.6	A
			Cs-137	pCi/L	161	168	151 - 187	A
			Co-60	pCi/L	22.5	20.9	17.7 - 25.8	A
			Zn-65	pCi/L	183	177.0	159 - 208	A
			GR-A	pCi/L	30.8	30.2	15.4 - 39.4	A
			GR-B	pCi/L	60.1	67.5	46.8 - 74.2	A
			U-Nat	pCi/L	36.45	36.9	30.0 - 40.8	A
			H-3	pCi/L	13,400	14,600	12,800 - 16,100	A
			Sr-89	pCi/L	64.5	63.5	51.4 - 71.5	A
			Sr-90	pCi/L	22.8	23.0	16.5 - 27.0	A
			I-131	pCi/L	28.2	26.7	22.2 - 31.4	A
September 2021	MRAD-35	Water	Am-241	pCi/L	68	63.7	43.7 - 81.5	A
			Fe-55	pCi/L	179	246	145 - 358	A
			Pu-238	pCi/L	102	114	68.5 - 148	A
			Pu-239	pCi/L	32	34.3	21.2 - 42.3	A
		Soil	Sr-90	pCi/kg	6160	6090	1,900 - 9,490	A
		AP	Fe-55	pCi/filter	493	548	200 - 874	A
			Pu-238	pCi/filter	28	28.5	21.5 - 35.0	A
			Pu-239	pCi/filter	21	21.6	16.1 - 26.1	A
			U-234	pCi/filter	7.95	7.76	5.75 - 9.09	A
			U-238	pCi/filter	8.0	7.69	5.81 - 9.17	A
October 2021	RAD-127	Water	Ba-133	pCi/L	82.8	87.5	73.6 - 96.2	A
			Cs-134	pCi/L	64.0	70.1	57.1 - 77.1	A
			Cs-137	pCi/L	145	156	140 - 174	A
			Co-60	pCi/L	83.2	85.9	77.3 - 96.8	A
			Zn-65	pCi/L	133	145	130 - 171	A
			GR-A	pCi/L	76.0	66.7	35.0 - 82.5	A
			GR-B	pCi/L	63.0	55.7	38.1 - 62.6	N(2)
			U-Nat	pCi/L	52.88	55.5	45.3 - 61.1	A
			H-3	pCi/L	13,800	17,200	15,000 - 18,900	N(3)
			Sr-89	pCi/L	54.9	61.0	49.1 - 68.9	A
			Sr-90	pCi/L	24.8	29.3	21.3 - 34.0	A
			I-131	pCi/L	27.4	26.4	21.9 - 31.1	A

Table 36, ERA Environmental Radioactivity Cross Check Program (TBE)
Teledyne Brown Engineering Environmental Services

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Value	Known Value [a]	Acceptance Limits	Evaluation [b]
December 2021	QR 120121Y	Water	GR-B	pCi/L	47.6	39.8	26.4 - 47.3	N[4]
			H-3	pCi/L	17,500	17,800	15,600 - 19,600	A

(a) The ERA known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation.

(b) ERA evaluation:
A = Acceptable - Reported value falls within the Acceptance Limits
N = Not Acceptable - Reported value falls outside of the Acceptance Limits

*(1) See **NCR 21-01***

*(2) See **NCR 21-10***

*(3) See **NCR 21-11***

*(4) See **NCR 21-14***

Table 37, 2021 Eckert & Ziegler Analytics Performance Evaluation Results (GEL)

PT Provider	Quarter / Year	Report Received Date	Sample Number	Sample Media	Unit	Analyte / Nuclide	GEL Value	Known value	Acceptance Range/ Ratio	Evaluation
EZA	1st/2021	03/11/21	E13356	Cartridge	pCi	Iodine-131	9.34E+01	8.80E+01	1.06	Acceptable
EZA	1st/2021	03/11/21	E13357	Milk	pCi/L	Strontium-89	9.55E+01	8.71E+01	1.1	Acceptable
EZA	1st/2021	03/11/21	E13357	Milk	pCi/L	Strontium-90	1.14E+01	1.26E+01	0.9	Acceptable
EZA	1st/2021	03/11/21	E13358	Milk	pCi/L	Cerium-141	1.32E+02	1.25E+02	1.05	Acceptable
EZA	1st/2021	03/11/21	E13358	Milk	pCi/L	Cobalt-58	1.33E+02	1.28E+02	1.04	Acceptable
EZA	1st/2021	03/11/21	E13358	Milk	pCi/L	Cobalt-60	1.57E+02	1.54E+02	1.02	Acceptable
EZA	1st/2021	03/11/21	E13358	Milk	pCi/L	Chromium-51	2.33E+02	2.42E+02	0.96	Acceptable
EZA	1st/2021	03/11/21	E13358	Milk	pCi/L	Cesium-134	1.37E+02	1.51E+02	0.9	Acceptable
EZA	1st/2021	03/11/21	E13358	Milk	pCi/L	Cesium-137	1.12E+02	1.10E+02	1.02	Acceptable
EZA	1st/2021	03/11/21	E13358	Milk	pCi/L	Manganese-54	1.15E+02	1.12E+02	1.02	Acceptable
EZA	1st/2021	03/11/21	E13358	Milk	pCi/L	Iron-59	1.21E+02	1.09E+02	1.11	Acceptable
EZA	1st/2021	03/11/21	E13358	Milk	pCi/L	Iodine-131	8.39E+01	8.69E+01	0.97	Acceptable
EZA	1st/2021	03/11/21	E13358	Milk	pCi/L	Zinc-65	2.38E+02	2.11E+02	1.13	Acceptable
EZA	1st/2021	03/11/21	E13359	Water	pCi/L	Cerium-141	1.26E+02	1.24E+02	1.02	Acceptable
EZA	1st/2021	03/11/21	E13359	Water	pCi/L	Cobalt-58	1.34E+02	1.26E+02	1.06	Acceptable
EZA	1st/2021	03/11/21	E13359	Water	pCi/L	Cobalt-60	1.54E+02	1.52E+02	1.01	Acceptable
EZA	1st/2021	03/11/21	E13359	Water	pCi/L	Cesium-134	1.35E+02	1.50E+02	0.9	Acceptable
EZA	1st/2021	03/11/21	E13359	Water	pCi/L	Cesium-137	1.15E+02	1.09E+02	1.06	Acceptable
EZA	1st/2021	03/11/21	E13359	Water	pCi/L	Iodine-131	9.64E+01	8.79E+01	1.1	Acceptable
EZA	1st/2021	03/11/21	E13359	Water	pCi/L	Iron-59	1.12E+02	1.08E+02	1.04	Acceptable
EZA	1st/2021	03/11/21	E13359	Water	pCi/L	Manganese-54	1.17E+02	1.11E+02	1.05	Acceptable
EZA	1st/2021	03/11/21	E13359	Water	pCi/L	Zinc-65	2.24E+02	2.08E+02	1.08	Acceptable
EZA	2nd/2021	08/06/21	E13360	Cartridge	pCi	Iodine-131	9.99E+01	9.08E+01	1.10	Acceptable
EZA	2nd/2021	08/06/21	E13362	Milk	pCi/L	Cerium-141	2.12E+02	2.17E+02	0.98	Acceptable
EZA	2nd/2021	08/06/21	E13362	Milk	pCi/L	Cobalt-58	2.09E+02	2.16E+02	0.97	Acceptable
EZA	2nd/2021	08/06/21	E13362	Milk	pCi/L	Cobalt-60	2.62E+02	2.60E+02	1.01	Acceptable
EZA	2nd/2021	08/06/21	E13362	Milk	pCi/L	Chromium-51	2.66E+02	6.42E+02	1.02	Acceptable
EZA	2nd/2021	08/06/21	E13362	Milk	pCi/L	Cesium-134	2.34E+02	2.57E+02	0.91	Acceptable
EZA	2nd/2021	08/06/21	E13362	Milk	pCi/L	Cesium-137	2.32E+02	2.26E+02	1.03	Acceptable
EZA	2nd/2021	08/06/21	E13362	Milk	pCi/L	Iron-59	2.50E+02	2.21E+02	1.13	Acceptable
EZA	2nd/2021	08/06/21	E13362	Milk	pCi/L	Iodine-131	8.04E+01	8.38E+01	0.96	Acceptable
EZA	2nd/2021	08/06/21	E13362	Milk	pCi/L	Manganese-54	3.05E+02	3.00E+02	1.02	Acceptable
EZA	2nd/2021	08/06/21	E13362	Milk	pCi/L	Zinc-65	3.93E+02	3.62E+02	1.09	Acceptable
EZA	2nd/2021	08/06/21	E13363	Water	pCi/L	Cerium-141	1.96E+02	1.80E+02	1.09	Acceptable
EZA	2nd/2021	08/06/21	E13174	Water	pCi/L	Cobalt-58	1.84E+02	1.79E+02	1.03	Acceptable
EZA	2nd/2021	08/06/21	E13174	Water	pCi/L	Cobalt-60	2.20E+02	2.15E+02	1.02	Acceptable
EZA	2nd/2021	08/06/21	E13174	Water	pCi/L	Chromium-51	5.65E+02	5.33E+02	1.06	Acceptable
EZA	2nd/2021	08/06/21	E13174	Water	pCi/L	Cesium-134	2.02E+02	2.13E+02	0.95	Acceptable
EZA	2nd/2021	08/06/21	E13174	Water	pCi/L	Cesium-137	2.00E+02	1.88E+02	1.07	Acceptable
EZA	2nd/2021	08/06/21	E13174	Water	pCi/L	Iron-59	2.12E+02	1.83E+02	1.16	Acceptable
EZA	2nd/2021	08/06/21	E13174	Water	pCi/L	Iodine-131	9.21E+01	9.20E+01	1.00	Acceptable

Table 37, 2021 Eckert & Ziegler Analytics Performance Evaluation Results (GEL)

PT Provider	Quarter / Year	Report Received Date	Sample Number	Sample Media	Unit	Analyte / Nuclide	GEL Value	Known value	Acceptance Range/ Ratio	Evaluation
EZA	2nd/2021	08/06/21	E13174	Water	pCi/L	Manganese-54	2.75E+02	2.49E+02	1.10	Acceptable
EZA	2nd/2021	08/06/21	E13174	Water	pCi/L	Zinc-65	3.35E+02	3.00E+02	1.12	Acceptable
EZA	3rd/2021	11/08/21	E13364	Cartridge	pCi	Iodine-131	1.02E+02	9.08E+01	112	Acceptable
EZA	3rd/2021	11/08/21	E13365	Milk	pCi/L	Strontium-89	8.92E+01	8.54E+01	1.04	Acceptable
EZA	3rd/2021	11/08/21	E13365	Milk	pCi/L	Strontium-90	1.01E+01	1.40E+01	0.72	Acceptable
EZA	3rd/2021	11/08/21	E13366	Milk	pCi/L	Cerium-141	1.17E+02	1.14E+02	1.02	Acceptable
EZA	3rd/2021	11/08/21	E13366	Milk	pCi/L	Cobalt-58	1.25E+02	1.18E+02	1.06	Acceptable
EZA	3rd/2021	11/08/21	E13366	Milk	pCi/L	Cobalt-60	1.46E+02	1.45E+02	1.01	Acceptable
EZA	3rd/2021	11/08/21	E13366	Milk	pCi/L	Chromium-51	2.69E+02	2.36E+02	1.14	Acceptable
EZA	3rd/2021	11/08/21	E13366	Milk	pCi/L	Cesium-134	9.00E+01	9.31E+01	0.97	Acceptable
EZA	3rd/2021	11/08/21	E13366	Milk	pCi/L	Cesium-137	1.14E+02	1.12E+02	1.02	Acceptable
EZA	3rd/2021	11/08/21	E13366	Milk	pCi/L	Iron-59	1.23E+02	1.02E+02	1.21	Acceptable
EZA	3rd/2021	11/08/21	E13366	Milk	pCi/L	Iodine-131	9.08E+01	8.56E+01	1.06	Acceptable
EZA	3rd/2021	11/08/21	E13366	Milk	pCi/L	Manganese-54	1.31E+02	1.28E+02	1.02	Acceptable
EZA	3rd/2021	11/08/21	E13366	Milk	pCi/L	Zinc-65	1.65E+02	1.53E+02	1.08	Acceptable
EZA	3rd/2021	11/08/21	E13367	Water	pCi/L	Cerium-141	1.54E+02	1.51E+02	1.02	Acceptable
EZA	3rd/2021	11/08/21	E13367	Water	pCi/L	Cobalt-58	1.62E+02	1.56E+02	1.04	Acceptable
EZA	3rd/2021	11/08/21	E13367	Water	pCi/L	Cobalt-60	2.07E+02	1.91E+02	1.08	Acceptable
EZA	3rd/2021	11/08/21	E13367	Water	pCi/L	Chromium-51	3.30E+02	3.12E+02	1.06	Acceptable
EZA	3rd/2021	11/08/21	E13367	Water	pCi/L	Cesium-134	1.13E+02	1.23E+02	0.92	Acceptable
EZA	3rd/2021	11/08/21	E13367	Water	pCi/L	Cesium-137	1.57E+02	1.48E+02	1.06	Acceptable
EZA	3rd/2021	11/08/21	E13367	Water	pCi/L	Iron-59	1.52E+02	1.35E+02	1.13	Acceptable
EZA	3rd/2021	11/08/21	E13367	Water	pCi/L	Iodine-131	2.71E+02	2.47E+02	1.10	Acceptable
EZA	3rd/2021	11/08/21	E13367	Water	pCi/L	Manganese-54	1.83E+02	1.70E+02	1.08	Acceptable
EZA	3rd/2021	11/08/21	E13367	Water	pCi/L	Zinc-65	2.33E+02	2.02E+02	1.15	Acceptable
EZA	4th/2021	02/02/22	E13368	Cartridge	pCi	Iodine-131	9.78E+01	9.35E+01	1.05	Acceptable
EZA	4th/2021	02/02/22	E13370	Milk	pCi/L	Strontium-89	7.54E+01	9.08E+01	0.83	Acceptable
EZA	4th/2021	02/02/22	E13370	Milk	pCi/L	Strontium-90	1.10E+01	1.30E+01	0.85	Acceptable
EZA	4th/2021	02/02/22	E13366	Milk	pCi/L	Cerium-141	1.32E+02	1.32E+02	1.00	Acceptable
EZA	4th/2021	02/02/22	E13366	Milk	pCi/L	Cobalt-58	1.14E+02	1.14E+02	1.00	Acceptable
EZA	4th/2021	02/02/22	E13366	Milk	pCi/L	Cobalt-60	2.27E+02	2.23E+02	1.02	Acceptable
EZA	4th/2021	02/02/22	E13366	Milk	pCi/L	Chromium-51	2.84E+02	2.93E+02	0.97	Acceptable
EZA	4th/2021	02/02/22	E13366	Milk	pCi/L	Cesium-134	1.51E+02	1.66E+02	0.91	Acceptable
EZA	4th/2021	02/02/22	E13366	Milk	pCi/L	Cesium-137	1.15E+02	1.17E+02	0.98	Acceptable
EZA	4th/2021	02/02/22	E13366	Milk	pCi/L	Iron-59	1.27E+02	1.13E+02	1.13	Acceptable
EZA	4th/2021	02/02/22	E13366	Milk	pCi/L	Iodine-131	9.28E+01	9.03E+01	1.03	Acceptable
EZA	4th/2021	02/02/22	E13366	Milk	pCi/L	Manganese-54	1.60E+02	1.52E+02	1.06	Acceptable
EZA	4th/2021	02/02/22	E13366	Milk	pCi/L	Zinc-65	2.87E+02	2.57E+02	1.12	Acceptable
EZA	4th/2021	02/02/22	E13367	Water	pCi/L	Cerium-141	1.53E+02	1.54E+02	0.99	Acceptable
EZA	4th/2021	02/02/22	E13367	Water	pCi/L	Cobalt-58	1.42E+02	1.34E+02	1.06	Acceptable
EZA	4th/2021	02/02/22	E13367	Water	pCi/L	Cobalt-60	2.82E+02	2.61E+02	1.08	Acceptable

Table 37, 2021 Eckert & Ziegler Analytics Performance Evaluation Results (GEL)

PT Provider	Quarter / Year	Report Received Date	Sample Number	Sample Media	Unit	Analyte / Nuclide	GEL Value	Known value	Acceptance Range/ Ratio	Evaluation
EZA	4th/2021	02/02/22	E13367	Water	pCi/L	Chromium-51	3.75E+02	3.42E+02	1.1	Acceptable
EZA	4th/2021	02/02/22	E13367	Water	pCi/L	Cesium-134	1.82E+02	1.94E+02	0.94	Acceptable
EZA	4th/2021	02/02/22	E13367	Water	pCi/L	Cesium-137	1.41E+02	1.37E+02	1.03	Acceptable
EZA	4th/2021	02/02/22	E13367	Water	pCi/L	Iron-59	1.44E+02	1.32E+02	1.09	Acceptable
EZA	4th/2021	02/02/22	E13367	Water	pCi/L	Iodine-131	9.66E+01	9.13E+01	1.06	Acceptable
EZA	4th/2021	02/02/22	E13367	Water	pCi/L	Manganese-54	1.88E+02	1.77E+02	1.06	Acceptable
EZA	4th/2021	02/02/22	E13367	Water	pCi/L	Zinc-65	3.45E+02	3.01E+02	1.15	Acceptable

Table 38, 2021 ERA Program (MRAD) Performance Evaluation Results (GEL)

PT Provider	Quarter / Year	Report Received Date	Sample Number	Sample Media	Unit	Analyte / Nuclide	GEL Value	Known value	Acceptance Range/ Ratio	Evaluation
ERA	2nd/2021	5/25/2021	RAD 125	Water	pCi/L	Radium-226	14.2	19.3	14.3 - 22.0	**Not Acceptable**
ERA	2nd/2021	5/25/2021	RAD 125	Water	pCi/L	Radium-228	9.98	10.3	6.71 - 12.8	Acceptable
ERA	2nd/2021	5/25/2021	RAD 125	Water	pCi/L	Strontium-89	59.3	63.5	51.4 - 71.5	Acceptable
ERA	1st/2021	03/02/21	RAD-124	Water	pCi/L	Barium-133	22.3	23.8	18.4 - 27.4	Acceptable
ERA	1st/2021	03/02/21	RAD-124	Water	pCi/L	Cesium-134	46.8	42.8	34.2 - 47.1	Acceptable
ERA	1st/2021	03/02/21	RAD-124	Water	pCi/L	Cesium-137	148	148	133 - 165	Acceptable
ERA	1st/2021	03/02/21	RAD-124	Water	pCi/L	Cesium-137	148	148	133 - 165	Acceptable
ERA	1st/2021	03/02/21	RAD-124	Water	pCi/L	Cobalt-60	36.7	34.6	30.8 - 40.8	Acceptable
ERA	1st/2021	03/02/21	RAD-124	Water	pCi/L	Zinc-65	68.2	61.6	54.6 - 75.0	Acceptable
ERA	1st/2021	03/02/21	RAD-124	Water	pCi/L	Gross Alpha	69.6	63.3	33.2 - 78.5	Acceptable
ERA	1st/2021	03/02/21	RAD-124	Water	pCi/L	Gross Beta	38.8	39.8	26.4 - 47.3	Acceptable
ERA	1st/2021	03/02/21	RAD-124	Water	pCi/L	Radium-226	8.42*	15.5	11.5 - 17.8	**Not Acceptable**
ERA	1st/2021	03/02/21	RAD-124	Water	pCi/L	Radium-228	19.5*	12.9	8.54 - 15.8	**Not Acceptable**
ERA	1st/2021	03/02/21	RAD-124	Water	pCi/L	Radium-228	14.6	12.9	8.54 - 15.8	Acceptable
ERA	1st/2021	03/02/21	RAD-124	Water	pCi/L	Uranium (Nat)	29.4	30.1	24.4 - 33.4	Acceptable
ERA	1st/2021	03/02/21	RAD-124	Water	pCi/L	Uranium (Nat) mass	44.6	43.9	35.5 - 48.7	Acceptable
ERA	1st/2021	03/02/21	RAD-124	Water	pCi/L	Tritium	2000	2120	1750 - 2350	Acceptable
ERA	1st/2021	03/02/21	RAD-124	Water	pCi/L	Tritium	2020	2120	1750 - 2350	Acceptable
ERA	1st/2021	03/02/21	RAD-124	Water	pCi/L	Strontium-89	74.6	61.3	49.4 - 69.2	**Not Acceptable**
ERA	1st/2021	03/02/21	RAD-124	Water	pCi/L	Strontium-89	65.7	61.3	49.4 - 69.2	Acceptable
ERA	1st/2021	03/02/21	RAD-124	Water	pCi/L	Strontium-90	32.5	40.6	29.9 - 46.7	Acceptable
ERA	1st/2021	03/02/21	RAD-124	Water	pCi/L	Strontium-90	38.2	40.6	29.9 - 46.7	Acceptable
ERA	1st/2021	03/02/21	RAD-124	Water	pCi/L	Iodine-131	30.2	27.9	23.2 - 32.8	Acceptable
ERA	1st/2021	03/02/21	RAD-124	Water	pCi/L	Iodine-131	31.7	27.9	23.2 - 32.8	Acceptable
ERA	3rd /2021	08/30/21	RAD-126	Water	pCi/L	Barium-133	48.9	45.5	37.2 - 50.6	Acceptable
ERA	3rd /2021	08/30/21	RAD-126	Water	pCi/L	Cesium-134	84.4	87.5	71.8 - 96.2	Acceptable
ERA	3rd /2021	08/30/21	RAD-126	Water	pCi/L	Cesium-137	211	208	187 - 230	Acceptable
ERA	3rd /2021	08/30/21	RAD-126	Water	pCi/L	Cobalt-60	93	87.1	78.4 - 98.1	Acceptable
ERA	3rd /2021	08/30/21	RAD-126	Water	pCi/L	Zinc-65	108	102	91.8 - 122	Acceptable
ERA	3rd /2021	08/30/21	RAD-126	Water	pCi/L	Gross Alpha	39.1	49.1	25.6 - 61.7	Acceptable
ERA	3rd /2021	08/30/21	RAD-126	Water	pCi/L	Gross Alpha	40.3	49.1	25.6 - 61.7	Acceptable
ERA	3rd /2021	08/30/21	RAD-126	Water	pCi/L	Gross Beta	30.4	31.5	20.3 - 39.2	Acceptable
ERA	3rd /2021	08/30/21	RAD-126	Water	pCi/L	Radium-226	11.2	13.4	9.99 - 15.4	Acceptable
ERA	3rd /2021	08/30/21	RAD-126	Water	pCi/L	Radium-228	6.8	7.59	4.81 - 9.68	Acceptable
ERA	3rd /2021	08/30/21	RAD-126	Water	pCi/L	Radium-228	6.69	7.59	4.81 - 9.68	Acceptable
ERA	3rd /2021	08/30/21	RAD-126	Water	pCi/L	Uranium (Nat)	59.6	62.3	50.9 - 68.5	Acceptable
ERA	3rd /2021	08/30/21	RAD-126	Water	µg/L	Uranium (Nat) mass	94	90.9	74.2 - 100	Acceptable
ERA	3rd /2021	08/30/21	RAD-126	Water	pCi/L	Tritium	9820	10400	9050 - 11400	Acceptable
ERA	3rd /2021	08/30/21	RAD-126	Water	pCi/L	Tritium	10300	10400	9050 - 11400	Acceptable
ERA	3rd /2021	08/30/21	RAD-126	Water	pCi/L	Strontium-89	50.3	55.9	44.6 - 63.6	Acceptable
ERA	3rd /2021	08/30/21	RAD-126	Water	pCi/L	Strontium-90	46.2	40.1	29.5 - 46.1	**Not Acceptable**

Table 38, 2021 ERA Program (MRAD) Performance Evaluation Results (GEL)

PT Provider	Quarter / Year	Report Received Date	Sample Number	Sample Media	Unit	Analyte / Nuclide	GEL Value	Known value	Acceptance Range/ Ratio	Evaluation
ERA	3rd /2021	08/30/21	RAD-126	Water	pCi/L	Iodine-131	17.6	20.8	17.2 - 25.0	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Soil	pCi/kg	Actinium-228	3260	3170	2090 - 3990	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Soil	pCi/kg	Americium-241	1580	1620	875 - 2290	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Soil	pCi/kg	Bismuth-212	3300	3280	939 - 4890	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Soil	pCi/kg	Bismuth-214	1370	1380	662 - 2050	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Soil	pCi/kg	Cesium-134	5380	5920	4050 - 7080	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Soil	pCi/kg	Cesium-137	7580	7570	5720 - 9570	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Soil	pCi/kg	Cobalt-60	4660	5060	3980 - 6250	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Soil	pCi/kg	Lead-212	3830	3350	2340 - 4240	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Soil	pCi/kg	Lead-212	3830	3350	2340 - 4240	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Soil	pCi/kg	Lead-214	1760	1440	605 - 2260	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Soil	pCi/kg	Manganese-54	<28.3	<1000	<1000	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Soil	pCi/kg	Plutonium-238	1810	1930	963 - 2930	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Soil	pCi/kg	Plutonium-239	1610	1720	937 - 2480	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Soil	pCi/kg	Potassium-40	24400	24700	17000 - 29500	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Soil	pCi/kg	Strontium-90	10200	9190	2860 - 14300	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Soil	pCi/kg	Thorium-234	4870	4020	1520 - 6880	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Soil	pCi/kg	Uranium-234	3650	4060	1900 - 5320	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Soil	pCi/kg	Uranium-234	3740	4060	1900 - 5320	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Soil	pCi/kg	Uranium-238	3480	4020	2210 - 5400	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Soil	pCi/kg	Uranium-238	3320	4020	2210 - 5400	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Soil	pCi/kg	Uranium-Total	7300	8260	4580 - 10700	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Soil	pCi/kg	Uranium-Total	7060	8260	4580 - 10700	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Soil	µg/kg	Uranium-Total (mass)	10400	12000	5420 - 16200	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Soil	µg/kg	Uranium-Total (mass)	9950	12000	5420 - 16200	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Soil	pCi/kg	Zinc-65	7090	7040	5620 - 9600	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	veg	pCi/kg	Americium-241	2210	2460	1520 - 3470	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	veg	pCi/kg	Cesium-134	1920	2350	1560 - 3130	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	veg	pCi/kg	Cesium-137	2590	2720	2090 - 3660	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	veg	pCi/kg	Cobalt-60	1640	1610	1260 - 2100	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	veg	pCi/kg	Curium-244	3260	3750	2110 - 4660	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	veg	pCi/kg	Manganese-54	<26.8	<300	<300	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	veg	pCi/kg	Plutonium-238	3450	3610	2500 - 4660	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	veg	pCi/kg	Plutonium-239	1750	1820	1260 - 2300	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	veg	pCi/kg	Potassium-40	36700	33300	25000 - 42200	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	veg	pCi/kg	Strontium-90	986	1260	710 - 1640	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	veg	pCi/kg	Strontium-90	986	1260	710 - 1640	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	veg	pCi/kg	Uranium-234	1370	1420	998 - 1810	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	veg	pCi/kg	Uranium-238	1380	1410	996 - 1760	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	veg	pCi/kg	Uranium-Total	2830	2900	1850 - 3910	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	veg	µg/kg	Uranium-Total (mass)	4150	4230	3250 - 5240	Acceptable

Table 38, 2021 ERA Program (MRAD) Performance Evaluation Results (GEL)

PT Provider	Quarter / Year	Report Received Date	Sample Number	Sample Media	Unit	Analyte / Nuclide	GEL Value	Known value	Acceptance Range/ Ratio	Evaluation
ERA	2nd/2021	5/25/2021	MRAD 34	veg	pCi/kg	Zinc-65	797	766	572 - 1140	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	veg	pCi/Filter	Americium-241	61.8	60.2	43.0 - 80.3	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Filter	pCi/Filter	Cesium-134	958	1030	668 - 1260	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Filter	pCi/Filter	Cesium-134	958	1030	668 - 1260	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Filter	pCi/Filter	Cesium-137	159	163	134 - 214	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Filter	pCi/Filter	Cesium-137	159	163	134 - 214	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Filter	pCi/Filter	Cobalt-60	1280	1220	1040 - 1550	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Filter	pCi/Filter	Iron-55	103	121	44.2 - 193	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Filter	pCi/Filter	Manganese-54	<6.46	<50.0	<50.0	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Filter	pCi/Filter	Plutonium-238	35.9	35.4	26.7 - 43.5	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Filter	pCi/Filter	Plutonium-239	20.1	20.5	15.3 - 24.7	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Filter	pCi/Filter	Strontium-90	181	189	120 - 257	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Filter	pCi/Filter	Uranium-234	24.1	25.5	18.9 - 29.9	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Filter	pCi/Filter	Uranium-234	26.4	25.5	18.9 - 29.9	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Filter	pCi/Filter	Uranium-238	24.6	25.3	19.1 - 30.2	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Filter	pCi/Filter	Uranium-238	23.5	25.3	19.1 - 30.2	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Filter	pCi/Filter	Uranium-Total	50	52	38.0 - 61.7	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Filter	pCi/Filter	Uranium-Total	49.9	52	38.0 - 61.7	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Filter	µg/Filter	Uranium-Total (mass)	73.8	75.9	60.9 - 88.9	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Filter	µg/Filter	Uranium-Total (mass)	70.5	75.9	60.9 - 88.9	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Filter	pCi/Filter	Zinc-65	840	771	632 - 1180	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Filter	pCi/Filter	Gross Alpha	391*	96.1	50.2 - 158	**Not Acceptable**
ERA	2nd/2021	5/25/2021	MRAD 34	Filter	pCi/Filter	Gross Beta	71.5	62.6	38.0 - 94.6	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Water	pCi/L	Americium-241	160	157	108 - 201	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Water	pCi/L	Cesium-134	1550	1610	1220 - 1770	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Water	pCi/L	Cesium-137	595	578	495 - 657	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Water	pCi/L	Cobalt-60	2310	2180	1880 - 2500	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Water	pCi/L	Cobalt-60	2310	2180	1880 - 2500	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Water	pCi/L	Cobalt-60	2310	2180	1880 - 2500	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Water	pCi/L	Iron-55	494	275	162 - 400	**Not Acceptable**
ERA	2nd/2021	5/25/2021	MRAD 34	Water	pCi/L	Manganese-54	<6.01	<100	<100	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Water	pCi/L	Plutonium-238	115	171	103 - 222	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Water	pCi/L	Plutonium-239	95.2	142	87.9 - 175	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Water	pCi/L	Strontium-90	736	671	483 - 829	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Water	pCi/L	Uranium-234	140	160	122 - 183	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Water	pCi/L	Uranium-234	162	160	122 - 183	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Water	pCi/L	Uranium-234	152	160	122 - 183	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Water	pCi/L	Uranium-238	146	158	122 - 186	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Water	pCi/L	Uranium-238	158	158	122 - 186	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Water	pCi/L	Uranium-238	145	158	122 - 186	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Water	pCi/L	Uranium-Total	292	325	254 - 370	Acceptable

Table 38, 2021 ERA Program (MRAD) Performance Evaluation Results (GEL)

PT Provider	Quarter / Year	Report Received Date	Sample Number	Sample Media	Unit	Analyte / Nuclide	GEL Value	Known value	Acceptance Range/ Ratio	Evaluation
ERA	2nd/2021	5/25/2021	MRAD 34	Water	pCi/L	Uranium-Total	297	325	254 - 370	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Water	µg/L	Uranium-Total (mass)	436	474	384 - 538	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Water	µg/L	Uranium-Total (mass)	433	474	384 - 538	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Water	pCi/L	Zinc-65	1900	1720	1530 - 2170	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Water	pCi/L	Gross Alpha	87.8	62.2	22.7 - 85.8	**Not Acceptable**
ERA	2nd/2021	5/25/2021	MRAD 34	Water	pCi/L	Gross Beta	73.7	103	51.5 - 142	Acceptable
ERA	2nd/2021	5/25/2021	MRAD 34	Water	pCi/L	Tritium	24900	22800	17200 - 27800	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Soil	pCi/kg	Actinium-228	3370	3240	2140 - 4080	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Soil	pCi/kg	Americium-241	922	891	481 - 1260	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Soil	pCi/kg	Bismuth-212	3320	3350	959 - 4990	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Soil	pCi/kg	Bismuth-214	1140	1370	658 - 2040	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Soil	pCi/kg	Cesium-134	2410	2650	1810 - 3170	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Soil	pCi/kg	Cesium-134	2410	2650	1810 - 3170	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Soil	pCi/kg	Cesium-137	3720	3660	2770 - 4630	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Soil	pCi/kg	Cobalt-60	4680	4730	3720 - 5840	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Soil	pCi/kg	Lead-212	3840	3420	2390 - 4320	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Soil	pCi/kg	Lead-214	1480	1490	626 - 2340	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Soil	pCi/kg	Manganese-54	<27.4	<1000	<1000	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Soil	pCi/kg	Plutonium-238	1230	1250	623 - 1900	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Soil	pCi/kg	Plutonium-239	1440	1450	790 - 2090	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Soil	pCi/kg	Potassium-40	25600	24700	17000 - 29500	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Soil	pCi/kg	Strontium-90	8770	6090	1900 - 9490	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Soil	pCi/kg	Thorium-234	3350	2720	1030 - 4660	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Soil	pCi/kg	Uranium-234	2620	2740	1280 - 3590	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Soil	pCi/kg	Uranium-234	3260	2740	1280 - 3590	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Soil	pCi/kg	Uranium-238	2870	2720	1490 - 3650	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Soil	pCi/kg	Uranium-238	3400	2720	1490 - 3650	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Soil	pCi/kg	Uranium-Total	5670	5580	3100 - 7210	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Soil	pCi/kg	Uranium-Total	5670	5580	3100 - 7210	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Soil	pCi/kg	Uranium-Total	6817	5580	3100 - 7210	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Soil	µg/kg	Uranium (mass)	8630	8140	3670 - 11000	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Soil	µg/kg	Uranium (mass)	10200	8140	3670 - 11000	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Soil	pCi/kg	Zinc-65	5540	4860	3880 - 6630	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Veg	pCi/kg	Americium-241	4040	4040	2500 - 5710	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Veg	pCi/kg	Cesium-134	918	923	613 - 1230	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Veg	pCi/kg	Cesium-137	2180	2210	1700 - 2980	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Veg	pCi/kg	Cobalt-60	1670	1590	1250 - 2080	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Veg	pCi/kg	Cobalt-60	1670	1590	1250 - 2080	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Veg	pCi/kg	Curium-244	2830	2840	1600 - 3530	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Veg	pCi/kg	Manganese-54	<47.1	<300	<300	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Veg	pCi/kg	Plutonium-238	1730	1620	1120 - 2090	Acceptable

Table 38, 2021 ERA Program (MRAD) Performance Evaluation Results (GEL)

PT Provider	Quarter / Year	Report Received Date	Sample Number	Sample Media	Unit	Analyte / Nuclide	GEL Value	Known value	Acceptance Range/ Ratio	Evaluation
ERA	4th/2021	11/23/21	MRAD-35	Veg	pCi/kg	Plutonium-239	1620	1440	995 - 1820	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Veg	pCi/kg	Potassium-40	30200	33300	25000 - 42200	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Veg	pCi/kg	Strontium-90	5760	5720	3220 - 7450	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Veg	pCi/kg	Uranium-234	1410	1350	948 - 1720	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Veg	pCi/kg	Uranium-238	1420	1340	946 - 1680	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Veg	pCi/kg	Uranium-Total	2900	2750	1760 - 3710	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Veg	µg/kg	Uranium (mass)	4250	4010	3080 - 4970	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Veg	pCi/kg	Zinc-65	1340	1200	896 - 1780	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Filter	pCi/Filter	Americium-241	28.1	27.7	19.8 - 36.9	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Filter	pCi/Filter	Cesium-134	217	241	156 - 296	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Filter	pCi/Filter	Cesium-137	187	187	154 - 245	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Filter	pCi/Filter	Cobalt-60	324	310	264 - 394	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Filter	pCi/Filter	Cobalt-60	324	310	264 - 394	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Filter	pCi/Filter	Iron-55	508	548	200 - 874	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Filter	pCi/Filter	Manganese-54	<3.06	<50.0	<50.0	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Filter	pCi/Filter	Plutonium-238	27.8	28.5	21.5 - 35.0	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Filter	pCi/Filter	Plutonium-239	22.6	21.6	16.1 - 26.1	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Filter	pCi/Filter	Strontium-90	23.4*	19.2	12.1 - 26.1	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Filter	pCi/Filter	Uranium-234	7.96	7.76	5.75 - 9.09	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Filter	pCi/Filter	Uranium-234	9.62*	7.76	5.75 - 9.09	**Not Acceptable**
ERA	4th/2021	11/23/21	MRAD-35	Filter	pCi/Filter	Uranium-238	7.35	7.69	5.81 - 9.17	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Filter	pCi/Filter	Uranium-238	7.38	7.69	5.81 - 9.17	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Filter	pCi/Filter	Uranium-Total	15.8	15.8	11.5 - 18.7	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Filter	pCi/Filter	Uranium-Total	17	15.8	11.5 - 18.7	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Filter	µg/Filter	Uranium (mass)	22.1	23.1	18.5 - 27.1	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Filter	µg/Filter	Uranium (mass)	22.1	23.1	18.5 - 27.1	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Filter	pCi/Filter	Zinc-65	414	366	300 - 559	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Filter	pCi/Filter	Gross Alpha	95.4	77.6	40.5 - 128	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Filter	pCi/Filter	Gross Beta	87	80.6	48.9 - 122	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Water	pCi/L	Americium-241	70.5	63.7	43.7 - 81.5	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Water	pCi/L	Cesium-134	626	649	490 - 714	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Water	pCi/L	Cesium-137	2210	2170	1860 - 2470	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Water	pCi/L	Cobalt-60	1040	964	831 - 1110	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Water	pCi/L	Iron-55	339*	246	145 - 358	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Water	pCi/L	Plutonium-238	74.1	114	68.5 - 148	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Water	pCi/L	Plutonium-239	21.3	34.3	21.2 - 42.3	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Water	pCi/L	Strontium-90	915	936	674 - 1160	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Water	pCi/L	Uranium-234	39.9	40.8	31.1 - 46.7	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Water	pCi/L	Uranium-234	49.8*	40.8	31.1 - 46.7	**Not Acceptable**
ERA	4th/2021	11/23/21	MRAD-35	Water	pCi/L	Uranium-238	40.3	40.5	31.4 - 47.7	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Water	pCi/L	Uranium-238	41.2	40.5	31.4 - 47.7	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Water	pCi/L	Uranium-Total	83.1	83.2	64.9 - 94.8	Acceptable

Table 38, 2021 ERA Program (MRAD) Performance Evaluation Results (GEL)

PT Provider	Quarter / Year	Report Received Date	Sample Number	Sample Media	Unit	Analyte / Nuclide	GEL Value	Known value	Acceptance Range/ Ratio	Evaluation
ERA	4th/2021	11/23/21	MRAD-35	Water	pCi/L	Uranium-Total	92.9*	83.2	64.9 - 94.8	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Water	µg/L	Uranium (mass)	121	121	98.0 - 137	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Water	µg/L	Uranium (mass)	123	121	98.0 - 137	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Water	pCi/L	Zinc-65	449	394	351 - 497	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Water	pCi/L	Gross Alpha	74.7	93.9	34.3 - 129	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Water	pCi/L	Gross Beta	96.1	97	48.5 - 133	Acceptable
ERA	4th/2021	11/23/21	MRAD-35	Water	pCi/L	Tritium	12600	12800	9650 - 15600	Acceptable

Table 39, 2021 Department of Energy Mixed Analyte Performance Evaluation Program (MAPEP) RESULTS (GEL)

PT Provider	Quarter / Year	Report Received Date	Sample Number	Sample Media	Unit	Analyte / Nuclide	GEL Value	Known value	Acceptance Range/ Ratio	Evaluation
MAPEP	2nd/2021	06/22/21	MAPEP-21-GrF44	Filter	Bq/smpl	Gross Alpha	0.864	1.77	0.53-3.01	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-GrF44	Filter	Bq/smpl	Gross Beta	0.639	0.649	0.325-0.974	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-GrF44	Water	Bq/L	Gross Alpha	0.782	0.87	0.26-1.48	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-GrF44	Water	Bq/L	Gross Beta	2.40	2.50	1.25-3.75	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-MaS44	Soil	Bq/Kg	Americium-241	89.6	88	62-114	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-MaS44	Soil	Bq/Kg	Cesium-134	2.92		False pos. test	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-MaS44	Soil	Bq/Kg	Cesium-137	1590	1550	1085-2015	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-MaS44	Soil	Bq/Kg	Cobalt-57	1010	920	644-1196	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-MaS44	Soil	Bq/Kg	Cobalt-60	1320	1370	959-1781	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-MaS44	Soil	Bq/Kg	Iron-55	1150	910	637-1183	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-MaS44	Soil	Bq/Kg	Manganese-54	1.84		False pos. test	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-MaS44	Soil	Bq/Kg	Nickel-63	597	689	482-896	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-MaS44	Soil	Bq/Kg	Plutonium-238	51.2	49.1	34.4-63.8	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-MaS44	Soil	Bq/Kg	Plutonium-239/240	-0.819		False pos. test	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-MaS44	Soil	Bq/Kg	Potassium-40	618	618	433-803	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-MaS44	Soil	Bq/Kg	Strontium-90	313	272	190-354	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-MaS44	Soil	Bq/Kg	Technetium-99	576	638	447-829	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-MaS44	Soil	Bq/Kg	U-234/233	57.1	59	41-77	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-MaS44	Soil	Bq/Kg	Uranium-238	194	208	146-270	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-MaS44	Soil	Bq/Kg	Zinc-65	627	604	423-785	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-MaW44	Water	Bq/L	Americium-241	0.0145		False pos. test	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-MaW44	Water	Bq/L	Cesium-134	10.6	11.5	8.1-15.0	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-MaW44	Water	Bq/L	Cesium-137	8.54	7.9	5.5-10.3	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-MaW44	Water	Bq/L	Cobalt-57	12.2	11.4	8.0-14.8	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-MaW44	Water	Bq/L	Cobalt-60	0.146		False pos. test	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-MaW44	Water	Bq/L	Hydrogen-3	2.27		False pos. test	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-MaW44	Water	Bq/L	Iron-55	27.1	26.9	18.8-35.0	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-MaW44	Water	Bq/L	Manganese-54	16.7	15.5	10.9-20.2	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-MaW44	Water	Bq/L	Nickel-63	10.4	8.2	5.7-10.7	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-MaW44	Water	Bq/L	Plutonium-238	0.515	0.577	0.404-0.750	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-MaW44	Water	Bq/L	Plutonium-239/240	0.564	0.649	0.454-0.844	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-MaW44	Water	Bq/L	Potassium-40	-0.886		False pos. test	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-MaW44	Water	Bq/L	Radium-226	0.538	0.632	0.442-0.822	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-MaW44	Water	Bq/L	Strontium-90	4.95	4.47	3.13-5.81	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-MaW44	Water	Bq/L	Technetium-99	3.69	4.01	2.81-5.21	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-MaW44	Water	Bq/L	Uranium-234/233	0.884	0.85	0.60-1.11	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-MaW44	Water	Bq/L	Uranium-238	0.913	0.86	0.60-1.12	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-MaW44	Water	Bq/L	Zinc-65	11.6	10.5	7.4-13.7	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-RdF44	Filter	ug/smpl	Uranium-235	0.0366	0.0353	0.0247-0.0459	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-RdF44	Filter	ug/smpl	Uranium-238	5.19	5.03	3.52-6.54	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-RdF44	Filter	ug/smpl	Uranium-Total	5.22	5.07	3.55-6.59	Acceptable

Table 39, 2021 Department of Energy Mixed Analyte Performance Evaluation Program (MAPEP) RESULTS (GEL)

PT Provider	Quarter / Year	Report Received Date	Sample Number	Sample Media	Unit	Analyte / Nuclide	GEL Value	Known value	Acceptance Range/ Ratio	Evaluation
MAPEP	2nd/2021	06/22/21	MAPEP-21-RdF44	Filter	Bq/smpl	Americium-241	0.0385	0.037	0.026-0.048	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-RdF44	Filter	Bq/smpl	Cesium-134	2.12	2.14	1.50-2.78	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-RdF44	Filter	Bq/smpl	Cesium-137	-0.0168		False pos. test	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-RdF44	Filter	Bq/smpl	Cobalt-57	0.74	0.686	0.480-0.892	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-RdF44	Filter	Bq/smpl	Cobalt-60	0.0325		False pos. test	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-RdF44	Filter	Bq/smpl	Manganese-54	0.368	0.312	0.218-0.406	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-RdF44	Filter	Bq/smpl	Plutonium-238	0.0207	0.0228	0.0160-0.0296	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-RdF44	Filter	Bq/smpl	Plutonium-239/240	0.0417	0.0453	0.0317-0.0589	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-RdF44	Filter	Bq/smpl	Strontium-90	0.89	0.749	0.524-0.974	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-RdF44	Filter	Bq/smpl	Uranium-234/233	0.063	0.06	0.04-0.08	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-RdF44	Filter	Bq/smpl	Uranium-238	0.0617	0.063	0.044-0.082	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-RdF44	Filter	Bq/smpl	Zinc-65	0.457	0.352	0.246-0.458	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-RdV44	veg	Bq/smpl	Americium-241	0.0605	0.0586	0.0410-0.0762	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-RdV44	veg	Bq/smpl	Cesium-134	2.51	3.6	2.52-4.68	**Not Acceptable**
MAPEP	2nd/2021	06/22/21	MAPEP-21-RdV44	veg	Bq/smpl	Cesium-137	3.75	4.69	3.28-6.10	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-RdV44	veg	Bq/smpl	Cobalt-57	3.73	5.05	3.54-6.57	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-RdV44	veg	Bq/smpl	Cobalt-60	2.36	2.99	2.09-3.89	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-RdV44	veg	Bq/smpl	Manganese-54	4.13	5.25	3.68-6.83	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-RdV44	veg	Bq/smpl	Plutonium-238	0.0467	0.0446	0.0312-0.058	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-RdV44	veg	Bq/smpl	Plutonium-239/240	0.0912	0.0912	0.0645-0.1197	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-RdV44	veg	Bq/smpl	Strontium-90	0.444	0.673	0.471-0.875	**Not Acceptable**
MAPEP	2nd/2021	06/22/21	MAPEP-21-RdV44	veg	Bq/smpl	Uranium-234/233	0.136	0.138	0.097-0.179	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-RdV44	veg	Bq/smpl	Uranium-238	0.143	0.143	0.100-0.186	Acceptable
MAPEP	2nd/2021	06/22/21	MAPEP-21-RdV44	veg	Bq/smpl	Zinc-65	-0.0042		False pos. test	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-GrF45	Filter	Bq/sample	Gross Alpha	1.73	0.98	0.288-1.632	**Not Acceptable**
MAPEP	4th/2021	12/16/21	MAPEP-21-GrF45	Filter	Bq/sample	Gross Beta	0.642	0.553	0.277-0.830	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-GrW45	Water	Bq/L	Gross Alpha	0.226	0.232	0.070-0.394	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-GrW45	Water	Bq/L	Gross Beta	2.73	2.8707	1.404-4.211	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-MaS45	Soil	Bq/Kg	Americium-241	106.0	98.0	69-127	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-MaS45	Soil	Bq/Kg	Cesium-134	993	1170	819-1521	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-MaS45	Soil	Bq/Kg	Cesium-137	579.00	572	400-744	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-MaS45	Soil	Bq/Kg	Cobalt-57	0.375		False Pos Test	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-MaS45	Soil	Bq/Kg	Cobalt-60	692	722	505-939	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-MaS45	Soil	Bq/Kg	Iron-55	994	1020	714-1326	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-MaS45	Soil	Bq/Kg	Manganese-54	412	410	287-533	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-MaS45	Soil	Bq/Kg	Nickel-63	1170	1280	896-1664	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-MaS45	Soil	Bq/Kg	Plutonium-238	55.9	59.8	41.9-77.7	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-MaS45	Soil	Bq/Kg	Plutonium-239/240	66.3	71.3	49.9-92.7	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-MaS45	Soil	Bq/Kg	Potassium-40	612	607	425-789	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-MaS45	Soil	Bq/Kg	Strontium-90	0.161		False Pos Test	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-MaS45	Soil	Bq/Kg	Technetium-99	747	777	544-1010	Acceptable

Table 39, 2021 Department of Energy Mixed Analyte Performance Evaluation Program (MAPEP) RESULTS (GEL)

PT Provider	Quarter / Year	Report Received Date	Sample Number	Sample Media	Unit	Analyte / Nuclide	GEL Value	Known value	Acceptance Range/ Ratio	Evaluation
MAPEP	4th/2021	12/16/21	MAPEP-21-MaS45	Soil	Bq/Kg	U-234/233	80	51	36.0-66.8	**Not Acceptable**
MAPEP	4th/2021	12/16/21	MAPEP-21-MaS45	Soil	Bq/Kg	Uranium-238	177	168	118-218	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-MaS45	Soil	Bq/Kg	Zinc-65	945	907	635-1179	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-MaW45	Water	Bq/L	Americium-241	0.407	0.426	0.298-0.554	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-MaW45	Water	Bq/L	Cesium-134	9.5	10.4	7.3-13.5	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-MaW45	Water	Bq/L	Cesium-137	-0.04		False Pos Test	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-MaW45	Water	Bq/L	Cobalt-57	14	13.9	9.7-18.1	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-MaW45	Water	Bq/L	Cobalt-60	14.5	14.0	9.8-18.2	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-MaW45	Water	Bq/L	Hydrogen-3	231	250	175-325	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-MaW45	Water	Bq/L	Iron-55	47.9	49.8	34.9-64.7	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-MaW45	Water	Bq/L	Manganese-54	9.47	9.0	6.3-11.7	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-MaW45	Water	Bq/L	Nickel-63	41.4	39.5	27.7-51.4	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-MaW45	Water	Bq/L	Plutonium-238	-0.00169	0.0096	Sens. Evaluation	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-MaW45	Water	Bq/L	Plutonium-239/240	0.470	0.528	0.370-0.689	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-MaW45	Water	Bq/L	Potassium-40	0.005		False Pos Test	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-MaW45	Water	Bq/L	Radium-226	0.310	0.226	0.158-0.294	**Not Acceptable**
MAPEP	4th/2021	12/16/21	MAPEP-21-MaW45	Water	Bq/L	Strontium-90	3.50	3.86	2.70-5.02	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-MaW45	Water	Bq/L	Technetium-99	3.79	3.71	2.60-4.82	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-MaW45	Water	Bq/L	Uranium-234/233	0.0203	0.0215	Sens. Evaluation	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-MaW45	Water	Bq/L	Uranium-238	0.00975	0.0123	Sens. Evaluation	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-MaW45	Water	Bq/L	Zinc-65	0.122		False Pos Test	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-RdF45	Filter	ug/sample	Uranium-235	0.0594	0.0588	0.0412-0.0764	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-RdF45	Filter	ug/sample	Uranium-238	8.5	8.3	5.8-10.8	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-RdF45	Filter	ug/sample	Uranium-Total	8.579	8.4	5.9-10.9	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-RdF45	Filter	Bq/sample	Americium-241	0.109	0.119	0.083-0.155	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-RdF45	Filter	Bq/sample	Cesium-134	1.23	1.32	0.92-1.72	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-RdF45	Filter	Bq/sample	Cesium-137	1.31	1.280	0.90-1.66	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-RdF45	Filter	Bq/sample	Cobalt-57	0.82800	0.83	0.58-1.08	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-RdF45	Filter	Bq/sample	Cobalt-60	2.37	2.28	1.60-2.96	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-RdF45	Filter	Bq/sample	Manganese-54	1.60	1.46	1.02-1.90	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-RdF45	Filter	Bq/sample	Plutonium-238	0.0023	0.0030	Sens. Evaluation	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-RdF45	Filter	Bq/sample	Plutonium-239/240	0.0574	0.0609	0.0426-0.0792	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-RdF45	Filter	Bq/sample	Strontium-90	0.195	0.273	0.191-0.355	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-RdF45	Filter	Bq/sample	Uranium-234/233	0.101	0.100	0.070-0.130	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-RdF45	Filter	Bq/sample	Uranium-238	0.107	0.104	0.073-0.135	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-RdF45	Filter	Bq/sample	Zinc-65	0.0579		False Pos Test	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-RdV45	Vegetation	Bq/sample	Americium-241	0.0724	0.0747	0.0523-0.0971	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-RdV45	Vegetation	Bq/sample	Cesium-134	4.02	4.34	3.04-5.64	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-RdV45	Vegetation	Bq/sample	Cesium-137	2.28	2.21	1.55-2.87	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-RdV45	Vegetation	Bq/sample	Cobalt-57	4.56	4.66	3.26-6.06	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-RdV45	Vegetation	Bq/sample	Cobalt-60	3.44	3.51	2.46-4.56	Acceptable

Table 39, 2021 Department of Energy Mixed Analyte Performance Evaluation Program (MAPEP) RESULTS (GEL)

PT Provider	Quarter / Year	Report Received Date	Sample Number	Sample Media	Unit	Analyte / Nuclide	GEL Value	Known value	Acceptance Range/ Ratio	Evaluation
MAPEP	4th/2021	12/16/21	MAPEP-21-RdV45	Vegetation	Bq/sample	Manganese-54	-0.0404		False Pos Test	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-RdV45	Vegetation	Bq/sample	Plutonium-238	0.0603	0.0655	0.0459-0.0852	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-RdV45	Vegetation	Bq/sample	Plutonium-239/240	0.00140		False Pos Test	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-RdV45	Vegetation	Bq/sample	Strontium-90	1.10	1.32	0.92-1.72	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-RdV45	Vegetation	Bq/sample	Uranium-234/233	0.1740	0.1830	0.128-0.238	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-RdV45	Vegetation	Bq/sample	Uranium-238	0.1770	0.1760	1.123-0.229	Acceptable
MAPEP	4th/2021	12/16/21	MAPEP-21-RdV45	Vegetation	Bq/sample	Zinc-65	2.57	2.43	1.70-3.16	Acceptable

Attachment 4, 2021 Thermoluminescent Dosimetry Annual Quality Assurance Status Report

1.0 EXECUTIVE SUMMARY

Routine quality control (QC) testing was performed for dosimeters issued by the Environmental Dosimetry Company (EDC).

During this annual period 100% (72/72) of the individual dosimeters, evaluated against the EDC internal performance acceptance criteria (high-energy photons only), met the criterion for accuracy and 100% (72/72) met the criterion for precision (Table 40). In addition, 100% (12/12) of the dosimeter sets evaluated against the internal tolerance limits met EDC acceptance criteria (Table 41) and 100% (6/6) of independent testing passed the performance criteria (Table 3). Trending graphs, which evaluate performance statistic for high-energy photon irradiations and co-located stations are given in Appendix A.

One internal assessment was performed in 2021.There were no findings.

1.1 INTRODUCTION

The TLD systems at the Environmental Dosimetry Company (EDC) are calibrated and operated to ensure consistent and accurate evaluation of TLDs. The quality of the dosimetric results reported to EDC clients is ensured by in house performance testing and independent performance testing by EDC clients, and both internal and client directed program assessments.

The purpose of the dosimetry quality assurance program is to provide performance documentation of the routine processing of EDC dosimeters. Performance testing provides a statistical measure of the bias and precision of dosimetry processing against a reliable standard, which in turn points out any trends or performance changes. Two programs are used:

1.1.1 QC Program

Dosimetry quality control tests are performed on EDC Panasonic 814 Environmental dosimeters. These tests include: (1) the in house testing program coordinated by the EDC QA Officer and (2) independent test perform by EDC clients. In-house tests are performed using six pairs of 814 dosimeters, a pair is reported as an individual result and six pairs are reported as the mean result. The results of these tests are described in this report.

Excluded from this report are instrumentation checks. Although instrumentation checks represent an important aspect of the quality assurance program, they are not included as process checks in this report. Instrumentation checks represent between 5-10% of the TLDs processed.

1.1.2 QA Program

An internal assessment of dosimetry activities is conducted annually by the Quality Assurance Officer (Reference 1). The purpose of the assessment is to review procedures, results, materials, or components to identify opportunities to improve or enhance processes and/or services.

2.0 PERFORMANCE EVALUATION CRITERIA

2.1 Acceptance Criteria for Internal Evaluations

2.1.1 Bias

For each dosimeter tested, the measure of bias is the percent deviation of the reported result relative to the delivered exposure. The percent deviation relative to the delivered exposure is calculated as follows:

$$\frac{\left(H_i^{'} - H_i\right)}{H_i} 100$$

where:

H_i' = the corresponding reported exposure for the i^{th} dosimeter (i.e., the reported exposure)

H_i = the exposure delivered to the i^{th} irradiated dosimeter (i.e., the delivered exposure)

2.1.2 Mean Bias

For each group of test dosimeters, the mean bias is the average percent deviation of the reported result relative to the delivered exposure. The mean percent deviation relative to the delivered exposure is calculated as follows:

$$\sum \left(\frac{\left(H_i^{'} - H_i\right)}{H_i} \right) 100 \left(\frac{1}{n}\right)$$

where:

H_i' = the corresponding reported exposure for the ith dosimeter (i.e., the reported exposure)

H_i = the exposure delivered to the ith irradiated test dosimeter (i.e., the delivered exposure)

n = the number of dosimeters in the test group

2.1.3 Precision

For a group of test dosimeters irradiated to a given exposure, the measure of precision is the percent deviation of individual results relative to the mean reported exposure. At least two values are required for the determination of precision. The measure of precision for the i^{th} dosimeter is:

$$\left(\frac{\left(H_i^{'} - \bar{H}\right)}{\bar{H}} \right) 100$$

where:

H_i' = the reported exposure for the i^{th} dosimeter (i.e., the reported exposure)

$\bar{H}$ = the mean reported exposure, i.e., $\bar{H} = \sum H_i' \left(\frac{1}{n}\right)$

n = the number of dosimeters in the test group

2.1.4 EDC Internal Tolerance Limits

All evaluation criteria are taken from the "EDC Quality System Manual," (Reference 2). These criteria are only applied to individual test dosimeters irradiated with high-energy photons (Cs 137) and are as follows for Panasonic Environmental dosimeters: ± 15% for bias and ± 12.8% for precision.

2.2 QC Investigation Criteria and Result Reporting

EDC Quality System Manual (Reference 2) specifies when an investigation is required due to a QC analysis that has failed the EDC bias criteria. The criteria are as follows:

1. No investigation is necessary when an individual QC result falls outside the QC performance criteria for accuracy.

2. Investigations are initiated when the mean of a QC processing batch is outside the performance criterion for bias.

2.3 Reporting of Environmental Dosimetry Results to EDC Customers

1. All results are to be reported in a timely fashion.

2. If the QA Officer determines that an investigation is required for a process, the results shall be issued as normal. If the QC results prompting the investigation have a mean bias from the known of greater than ±20%, the results shall be issued with a note indicating that they may be updated in the future, pending resolution of a QA issue.

3. Environmental dosimetry results do not require updating if the investigation has shown that the mean bias between the original results and the corrected results, based on applicable correction factors from the investigation, does not exceed ± 20%.

3.0 DATA SUMMARY FOR ISSUANCE PERIOD JANUARY-DECEMBER 2021

3.1 General Discussion

Results of performance tests conducted are summarized and discussed in the following sections. Summaries of the performance tests for the reporting period are given in Table 40 through Table 42 and Figure 10 through Figure 13.

Table 40 provides a summary of individual dosimeter results evaluated against the EDC internal acceptance criteria for high-energy photons only. During this period100% (72/72) of the individual dosimeters, evaluated against these criteria, met the tolerance limits for accuracy and 100% (72/72) met the criterion for precision. A graphical interpretation is provided in Figure 10 and Figure 11.

Table 41 provides the bias and standard deviation results for each group (N=6) of dosimeters evaluated against the internal tolerance criteria. Overall,100% (12/12) of the dosimeter sets, evaluated against the internal tolerance performance criteria, met these criteria. A graphical interpretation is provided in Figure 12.

Table 42 presents the independent blind spike results for dosimeters processed during this annual period. All results passed the performance acceptance criterion. Figure 4 is a graphical interpretation of Seabrook Station blind co-located station results.

3.2 Result Trending

One of the main benefits of performing quality control tests on a routine basis is to identify trends or performance changes. The results of the Panasonic environmental dosimeter performance tests are presented in Figure 10 through Figure 13. The results are evaluated against each of the performance criteria listed in Section II, namely: individual dosimeter accuracy, individual dosimeter precision, and mean bias.

4.0 STATUS OF EDC CONDITION REPORTS (CR)

No condition reports were issued during this annual period.

5.0 STATUS OF AUDITS/ASSESSMENTS

5.1 Internal

EDC Internal Quality Assurance Assessment was conducted during the fourth quarter 2021. There were no findings identified.

5.2 External

None.

6.0 PROCEDURES AND MANUALS REVISED DURING JANUARY - DECEMBER 2021

Several procedures were reissued with no changes as part of the 5 year review cycle.

7.0 VII. CONCLUSION AND RECOMMENDATIONS

The quality control evaluations continue to indicate the dosimetry processing programs at the EDC satisfy the criteria specified in the Quality System Manual. The EDC demonstrated the ability to meet all applicable acceptance criteria.

8.0 REFERENCES

1. EDC Quality Control and Audit Assessment Schedule, 2021.

2. EDC Manual 1, Quality System Manual, Rev. 4, September 28, 2020.

Table 40, Percentage of Individual Dosimeters that Passed EDC Internal Criteria, January – December 2021

Dosimeter Type	Number Tested	% Passed Bias Criteria	% Passed Precision Criteria
Panasonic Environmental	72	100	100

This table summarizes results of tests conducted by EDC.
Environmental dosimeter results are free in air.

Table 41, Mean Dosimeter Analyses (N=6), January – December 2021

Process Date	Exposure Level	Mean Bias %	Standard Deviation %	Tolerance Limit +/-15%
5/04/2021	33	0.6	0.9	Pass
5/06/2021	120	-0.2	1.4	Pass
5/26/2021	53	-3.8	1.6	Pass
7/27/2021	67	2.8	1.4	Pass
8/04/2021	91	-1.8	2.3	Pass
9/14/2021	47	-0.2	2.3	Pass
11/01/2021	28	3.7	0.6	Pass
11/03/2021	74	1.9	1.9	Pass
11/09/2021	103	1.1	1.1	Pass
01/26/2022	37	2.6	1.9	Pass
01/30/2022	85	-4.2	1.1	Pass
02/06/2022	58	2.9	1.2	Pass

This table summarizes results of tests conducted by EDC for TLDs issued in 2021.
Environmental dosimeter results are free in air.

Table 42, **Summary of Independent Dosimeter Testing, January – December 2021**

Issuance Period	Client	Mean Bias %	Standard Deviation %	Pass / Fail
1st Qtr. 2021	SONGS	-3.8	1.4	Pass
1st Qtr. 2021	SONGS	-4.7	1.1	Pass
2nd Qtr.2021	Seabrook	3.1	1.0	Pass
3rd Qtr. 2021	Millstone	-4.7	1.4	Pass
4th Qtr.2021	PSEG(PNNL) 50mR	1.3	0.8	Pass
4th Qtr.2021	PSEG(PNNL) 100mR	1.8	0.8	Pass
4th Qtr.2021	PSEG(PNNL) 150mR	-0.6	0.5	Pass
4th Qtr.2021	PSEG(PNNL) 200mR	-2.6	2.0	Pass
4th Qtr.2021	Seabrook	2.6	1.4	Pass

Performance criteria are +/- 15%.
Blind spike irradiations using Cs-137

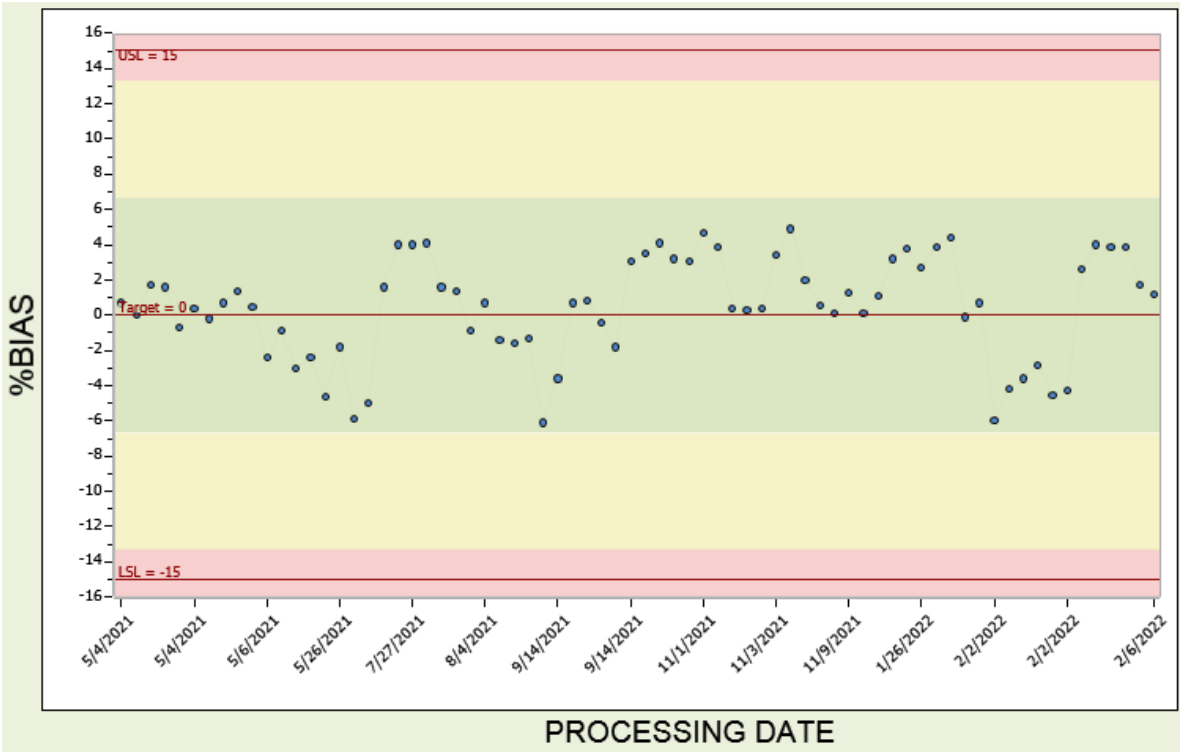

Figure 10, Individual Accuracy Environmental

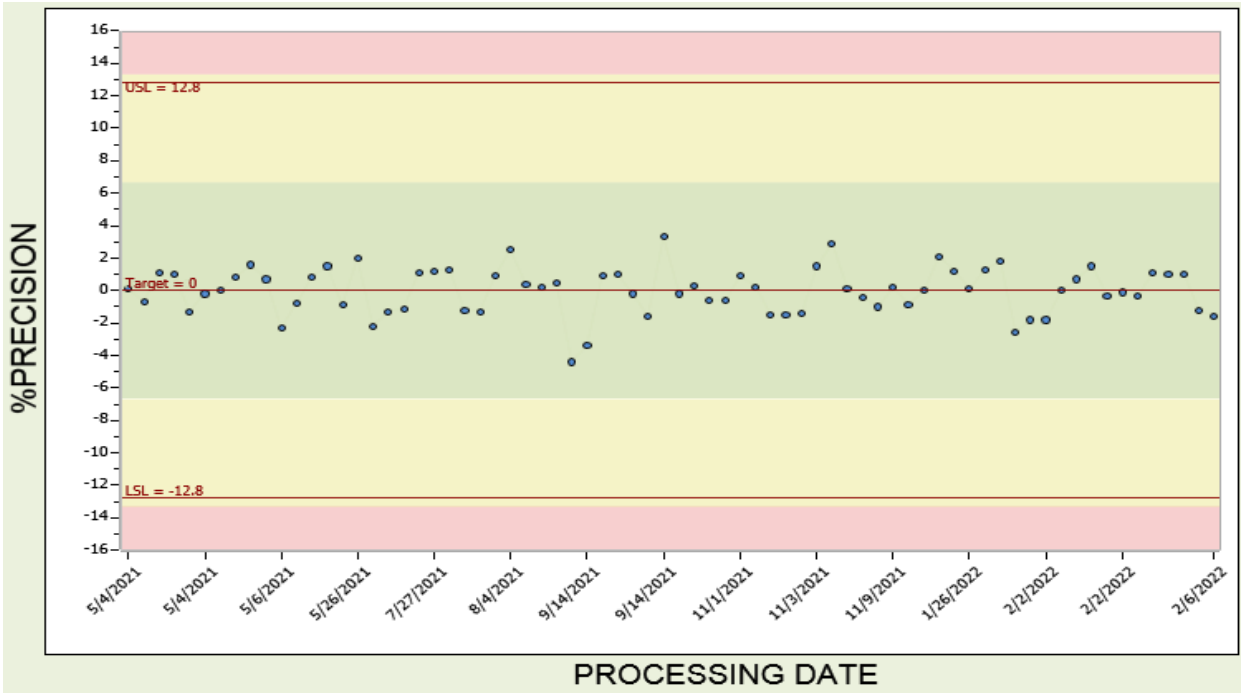

Figure 11, Individual Precision Environmental

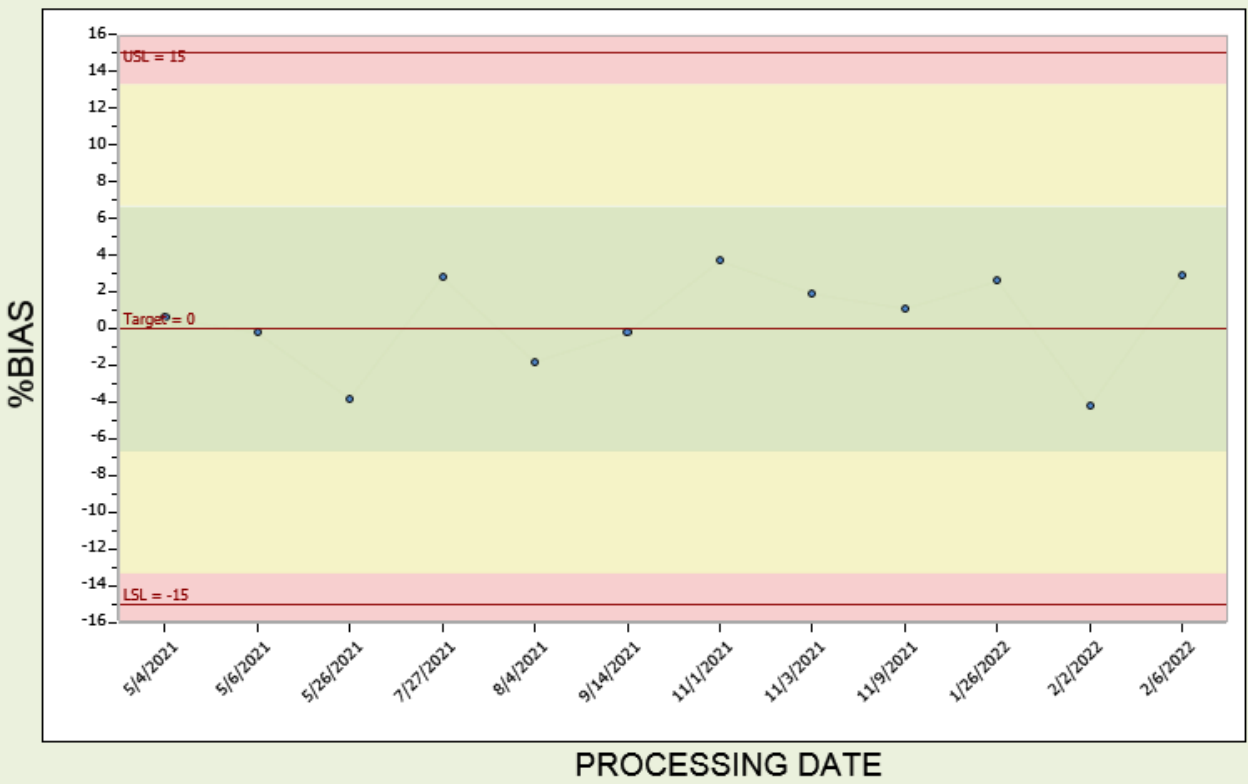

Figure 12, Mean Accuracy Environmental

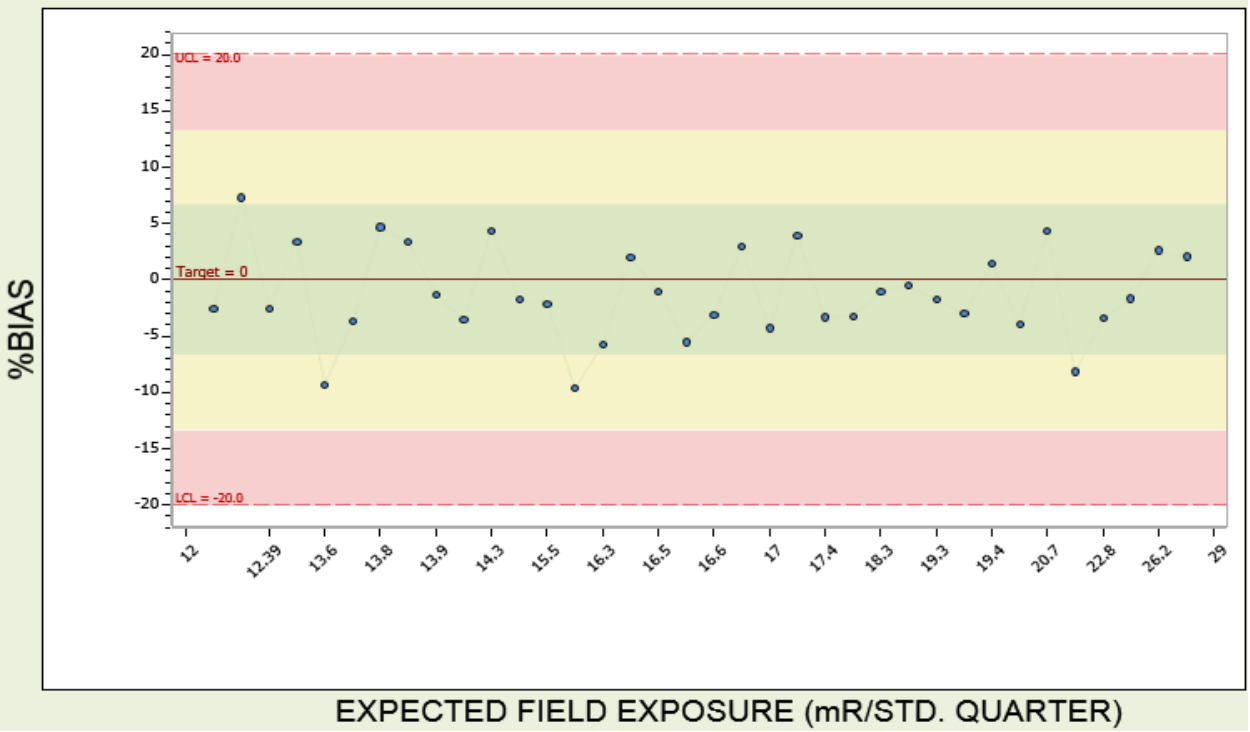

Figure 13, Seabrook Co-located TLD Accuracy