

Dominion Energy
North Anna Power Station
Radiological Environmental Monitoring Program
January 1, 2022 to December 31, 2022



Prepared by
Dominion Energy, North Anna Power Station

Annual Radiological Environmental Operating Report

North Anna Power Station

January 1, 2022 to December 31, 2022

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1. EXECUTIVE SUMMARY

This document is a detailed report of the 2022 North Anna Nuclear Power Station Radiological Environmental Monitoring Program (REMP). It is submitted in accordance with North Anna Unit 1 and 2 Technical Specification 5.6.2 and North Anna Independent Spent Fuel Storage Installation (ISFSI) Technical Specification 5.5.2. Radioactivity levels from January 1 through December 31, 2022, in water, silt, shoreline sediment, aquatic biota, food products, vegetation, and direct exposure pathways have been analyzed, evaluated and summarized. The REMP is designed to confirm that radiological effluent releases are As Low As Reasonably Achievable (ALARA), no undue environmental effects occur, and the health and safety of the public are protected. The program also detects any unexpected environmental processes that could allow radiation accumulations in the environment or food pathway chains.

Radiation and radioactivity in the environment are monitored within a 25-mile radius of the station. North Anna Power Station (NAPS) personnel collect a variety of samples within this area. A number of sampling locations for each medium are selected using available meteorological, land use, and water use data. Two types of samples are obtained. Control samples are collected from areas that are beyond the measurable influence of North Anna Power Station (NAPS) or any other nuclear facility. These samples are used as reference data. Normal background radiation levels, or radiation present due to causes other than North Anna Power Station (NAPS), can be compared to the environment surrounding the station. Indicator samples are the second sample type obtained. These samples show how much radiation is contributed to the environment by the station. Indicator samples are taken from areas close to the station where any station contribution will be at the highest concentration.

Prior to station operation, samples were collected and analyzed to determine the amount of radioactivity present in the area. The resulting values are used as a "pre-operational baseline." Analysis results from the indicator samples are compared to both current control sample values and the pre-operational baseline to determine if changes in radioactivity levels are attributable to station operations, or causes such as the Chernobyl accident, Fukushima Daiichi or natural variation.

Mirion Technologies provided thermoluminescent dosimetry (TLD) services and Teledyne Brown Engineering Environmental Services provided radioanalytical services. Participation in an Interlaboratory Comparison Program provides an independent check of sample measurement precision and accuracy. Typically, radioactivity levels in the environment are so low that analysis values frequently fall below the minimum detection limits of state-of-the-art measurement methods. Because of this, the Nuclear Regulatory Commission (NRC) requires equipment used for radiological environmental monitoring be able to detect specified minimum Lower Limits of Detection (LLDs). This ensures that analyses are as accurate as possible. The NRC also mandates a reporting level for certain radionuclides. Licensed nuclear facilities must report the radionuclide activities in those environmental samples that are equal to or greater than the specified reporting level. Environmental radiation levels are sometimes referred to as a percent of the reporting level.

Analytical results are reported for all possible radiation exposure pathways to man. These pathways include airborne, water, aquatic, terrestrial, and direct radiation exposure. The airborne exposure pathway includes radioactive airborne iodine and particulates, and precipitation. The 2022 airborne results were similar to previous years. Fallout or natural radioactivity levels remained at levels consistent with past years' results.

Water and aquatic exposure pathway samples include precipitation, surface, river and well water, silt and shoreline sediments, and fish. The average tritium activity in surface water for 2022 was 6508 pCi/liter. No other plant related isotopes were reported in any surface or river water. River water collected from the North Anna River, 5.8 miles downstream of the site had an average tritium level of 5518 pCi/liter. No plant related isotopes were detected in quarterly precipitation samples. Silt samples indicated the presence of naturally

occurring potassium-40 and thorium and uranium decay daughters at levels consistent with the natural background. Plant related isotope, Cs-137, was not identified in any indicator sample during the reporting period. The detection of Cs-137 in bottom sediment is historically common with positive indication usually apparent in both indicator and control samples. Shoreline soil, which may provide a direct exposure pathway, indicated the presence of potassium-40 and thorium and uranium decay daughters also at levels consistent with natural levels. No plant related isotope was detected in the indicator or control locations in shoreline soil. No plant related isotope was detected in fish samples from either Lake Anna or the control location, Lake Orange.

Soil samples, which are collected every three years from twelve stations, were collected in 2022. During the preoperational phase Cs-137 was routinely detected and was attributed to fallout. Levels during this phase varied by location and date and ranged from 88 to 1390 pCi/Kg. The average was 645 pCi/kg. Cs-137 was detected in five of eleven indicator location samples obtained during the reporting period with an average of 227.83 pCi/Kg and ranged from 59.06 to 322.60 pCi/Kg.

The terrestrial exposure pathway includes milk and food/vegetation products. No milk samples were obtained during the reporting period since the last operating dairy farm within the sampling area closed on 01/01/2018 rendering milk samples unavailable. No plant related isotope was detected in any vegetation sample. Low levels of Cs-137 have been detected intermittently in past years due to weapons testing, Chernobyl, and Fukushima.

The direct exposure pathway measures environmental radiation doses by use of thermoluminescent dosimeters (TLDs). TLD results have remained essentially constant over the years.

During 2022, as in previous years, operation of the North Anna Power Station and the Independent Spent Fuel Storage Installation (ISFSI) created no adverse environmental effects or health hazards. The maximum total body dose calculated for a hypothetical individual at the station site boundary due to liquid and gaseous effluents released from the station during 2022 was 0.874 millirem. For reference, this dose may be compared to the 620 millirem average annual exposure to every person in the United States from natural and man-made sources. Natural background sources in the environment provide approximately 50% of radiation exposure to man, while medical uses provide approximately 48%. By comparison, nuclear power contributes less than 0.1%. These results demonstrate not only compliance with federal and state regulations but also demonstrate the adequacy of radioactive effluent control at North Anna Power Station.

2. PROGRAM DESCRIPTION

2.1 Introduction

This report documents the 2022 North Anna Power Station operational Radiological Environmental Monitoring Program (REMP).

The North Anna Power Station of Virginia Electric and Power Company (Dominion Energy) is located on Lake Anna in Mineral, Virginia, approximately 35 miles southwest of Fredericksburg, Virginia. The site consists of two units, each with a pressurized water reactor (PWR) nuclear steam supply system and turbine generator furnished by Westinghouse Electric Corporation. Each unit has a gross electrical output of 1029 megawatts electric (MWe). Unit 1 achieved commercial operation on June 6, 1978 and Unit 2 on December 14, 1980. An independent spent fuel storage facility was licensed for dry cask storage of spent fuel in 1998.

The United States Nuclear Regulatory Commission (USNRC) regulations require that nuclear power plants be designed, constructed, and operated to keep levels of radioactive material in effluents to unrestricted areas as low as reasonably achievable (ALARA). To ensure these criteria are met, the operating license for North Anna Power Station includes Technical Specifications which address the release of radioactive effluents. In-plant monitoring is used to ensure release limits are not exceeded. As a precaution against unexpected or undefined environmental processes which might allow undue accumulation of radioactivity in the environment, a program for monitoring the plant environs is also included in the North Anna Power Station Offsite Dose Calculation Manual (ODCM).

North Anna Power Station is responsible for collecting the various indicator and control environmental samples. Mirion Technologies is utilized for processing the TLDs. Teledyne Brown Engineering Environmental Services (TBE) is utilized for sample analyses. The results of the analyses are used to determine if changes in radioactivity levels may be attributable to station operations. Measured values are compared with control levels, which vary with time due to external events, such as cosmic ray bombardment, nuclear weapons test fallout and seasonal variations of naturally occurring radioisotopes. Data collected prior to station operation is used to indicate the degree of natural variation to be expected. The pre-operational data is compared with data collected during the operational phase to assist in evaluating any radiological impact of station operation.

Occasionally samples of environmental media show the presence of man-made isotopes. As a method of referencing the measured radionuclide concentrations in the sample media to a dose consequence to man, the data is compared to the reporting level concentrations listed in North Anna's ODCM. These concentrations are based upon the annual dose commitment recommended by 10CFR50, Appendix I, to meet the criterion of "As Low As Is Reasonably Achievable".

This report documents the results of the Radiological Environmental Monitoring Program for 2022 and satisfies the following objectives of the program:

- To provide measurements of radiation and of radioactive materials in those exposure pathways and for those radionuclides that lead to the highest potential radiation exposure of the maximum exposed member of the public resulting from station operations.
- To supplement the radiological effluent monitoring program by verifying that radioactive effluents are within allowable limits.
- To identify changes in radioactivity in the environment.

- To verify that station operations have no detrimental effect on the health and safety of the public.

2.2 Sampling and Analysis Program

Table 2-1 summarizes the 2022 sampling program for North Anna Power Station. All samples listed in Table 2-1 are taken at indicator locations except those labeled "control." The North Anna Radiological Monitoring Locations maps denote sample locations for North Anna Power Station. The locations are color coded to designate sample types. Table 2-2 summarizes the analysis program conducted by TBE for North Anna Power Station during the year 2022.

TABLE 2-1
 North Anna Power Station – 2022
 RADIOLOGICAL SAMPLING STATION
 DISTANCE AND DIRECTION FROM UNIT NO. 1

Sample Media	Location	Station	Distance	Direction	Degrees	Collection	Remarks
						Frequency	
Environmental Dosimetry (TLD)	NAPS Sewage Treatment Plant	01	0.20	NE	42°	Quarterly & Annually	
	Fredericks Hall	02	5.30	SSW	203°	Quarterly & Annually	
	Mineral, Va	03	7.10	WSW	243°	Quarterly & Annually	
	Wares Crossroads	04	5.10	WNW	287°	Quarterly & Annually	
	Route 752	05	4.20	NNE	20°	Quarterly & Annually	
	Sturgeon's Creek Marina	05A	2.04	N	11°	Quarterly & Annually	
	Levy, VA	06	4.70	ESE	115°	Quarterly & Annually	
	Bumpass, VA	07	7.30	SSE	167°	Quarterly & Annually	
	End of Route 685	21	1.00	WNW	301°	Quarterly & Annually	
	Route 700	22	1.00	WSW	242°	Quarterly & Annually	
	"Aspen Hills"	23	0.93	SSE	158°	Quarterly & Annually	
	Orange, VA	24	22.00	NW	325°	Quarterly & Annually	Control
	Bearing Cooling Tower	N-1/33	0.06	N	10°	Quarterly	
	Sturgeon's Creek Marina	N-2/34	2.04	N	11°	Quarterly	
	Parking Lot "C" (on-site)	NNE-3/35	0.24	NNE	32°	Quarterly	
	Good Hope Church	NNE-4/36	3.77	NNE	25°	Quarterly	
	Parking Lot "B"	NE-5/37	0.20	NE	42°	Quarterly	
	Lake Anna Marina (Bogg's Dr)	NE-6/38	1.46	NE	34°	Quarterly	
	Weather Tower Fence	ENE-7/39	0.36	ENE	74°	Quarterly	
	Route 689	ENE-8/40	2.43	ENE	65°	Quarterly	
	Near Training Facility	E-9/41	0.30	E	91°	Quarterly	
	"Morning Glory Hill"	E-10/42	2.85	E	93°	Quarterly	
	Island Dike	ESE-11/43	0.12	ESE	103°	Quarterly	
	Route 622	ESE-12/44	4.70	ESE	115°	Quarterly	
	DVP Biology Lab	SE-13/45	0.64	SE	138°	Quarterly	
	Route 701 (Dam Entrance)	SE-14/46	5.88	SE	137°	Quarterly	
	"Aspen Hills"	SSE-15/47	0.93	SSE	158°	Quarterly	
	Elk Creek	SSE-16/48	2.33	SSE	165°	Quarterly	
	NAPS Access Rd.	S-17/49	0.36	S	173°	Quarterly	

TABLE 2-1
North Anna Power Station – 2022
RADIOLOGICAL SAMPLING STATION
DISTANCE AND DIRECTION FROM UNIT NO. 1

Sample Media	Location	Station	Distance	Direction	Degrees	Collection Frequency	Remarks
Environmental	Elk Creek Church	S-18/50	1.55	S	178°	Quarterly	
Thermoluminescent Dosimetry (TLD)	NAPS Access Rd.	SSW-19/51	0.24	SSW	197°	Quarterly	
	Route 618	SSW-20/52	5.30	SSW	205°	Quarterly	
	500kv Tower	SW-21/53	0.60	SW	218°	Quarterly	
	Route 700	SW-22/54	3.96	SW	232°	Quarterly	
	NAPS SE Switchyard	WSW-23/55	0.38	WSW	237°	Quarterly	
	Route 700 (Exclusion Boundary)	WSW-24/56	1.00	WSW	242°	Quarterly	
	South Gate Switchyard	W-25/57	0.32	W	279°	Quarterly	
	Route 685	W-26/58	1.55	W	274°	Quarterly	
	End of Route 685	WNW-27/59	1.00	WNW	301°	Quarterly	
	Route 685	WNW-28/60	1.40	WNW	303°	Quarterly	
	North Gate - Laydown Area	NW-29/61	0.52	NW	321°	Quarterly	
	Lake Anna Campground	NW-30/62	2.54	NW	319°	Quarterly	
	#1/#2 Intake	NNW-31/63	0.07	NNW	349°	Quarterly	
	Route 208	NNW-32/64	2.21	NNW	344°	Quarterly	
	Bumpass Post Office	C-1/2	7.30	SSE	167°	Quarterly	
	Orange, VA	C-3/4	22.00	NW	325°	Quarterly	Control
	Mineral, VA	C-5/6	7.10	WSW	243°	Quarterly	
	Louisa, VA	C-7/8	11.54	WSW	257°	Quarterly	Control
Airborne Particulate and Radioiodine	NAPS Sewage Treatment Plant	01	0.20	NE	42°	Weekly	
	Biology Lab	01A	0.64	SE	138°	Weekly	
	Fredericks Hall	02	5.30	SSW	203°	Weekly	
	Mineral, VA	03	7.10	WSW	243°	Weekly	
	Wares Crossroads	04	5.10	WNW	287°	Weekly	
	Route 752	05	4.20	NNE	20°	Weekly	
	Sturgeon's Creek Marina	05A	2.04	N	11°	Weekly	
	Levy, VA	06	4.70	ESE	115°	Weekly	
	Bumpass, VA	07	7.30	SSE	167°	Weekly	

TABLE 2-1
 North Anna Power Station – 2022
 RADIOLOGICAL SAMPLING STATION
 DISTANCE AND DIRECTION FROM UNIT NO. 1

Sample Media	Location	Station	Distance	Direction	Degrees	Collection Frequency	Remarks
Airborne Particulate and Radioiodine	End of Route 685	21	1.00	WNW	301°	Weekly	
	Route 700	22	1.00	WSW	242°	Weekly	
	"Aspen Hills"	23	0.93	SSE	158°	Weekly	
	Orange, VA	24	22.00	NW	325°	Weekly	Control
Surface Water	Waste Heat Treatment Facility (Second Cooling Lagoon)	08	3.37	SSE	148°	Monthly	
	Lake Anna (upstream) (Route 669 Bridge)	09A	12.90	WNW	295°	Monthly	Control
River Water	North Anna River (downstream)	11	5.80	SE	128°	Monthly	
Ground Water (Well Water)	Biology Lab	01A	0.64	SE	138°	Quarterly	
Precipitation	Biology Lab	01A	0.64	SE	138°	Monthly	
Aquatic Sediment	Waste Heat Treatment Facility (Second Cooling Lagoon)	08	3.37	SSE	148°	Semi-Annually	
	Lake Anna (upstream) (Route 669 Bridge)	09A	12.90	WNW	295°	Semi-Annually	Control
	North Anna River (downstream)	11	5.80	SE	128°	Semi-Annually	
Shoreline Soil	Waste Heat Treatment Facility (Second Cooling Lagoon)	08	3.37	SSE	148°	Semi-Annually	
Soil	NAPS Sewage Treatment Plant	01	0.20	NE	42°	Once/3 years	
	Fredericks Hall	02	5.30	SSW	203°	Once/3 years	
	Mineral, VA	03	7.10	WSW	243°	Once/3 years	
	Wares Crossroads	04	5.10	WNW	287°	Once/3 years	
	Route 752	05	4.20	NNE	20°	Once/3 years	
	Sturgeon's Creek Marina	05A	2.04	N	11°	Once/3 years	
	Levy, VA	06	4.70	ESE	115°	Once/3 years	

TABLE 2-1
 North Anna Power Station – 2022
 RADIOLOGICAL SAMPLING STATION
 DISTANCE AND DIRECTION FROM UNIT NO. 1

Sample Media	Location	Station	Distance	Direction	Degrees	Collection	Remarks
						Frequency	
Soil	Bumpass, VA	07	7.30	SSE	167°	Once/3 years	
	End of Route 685	21	1.00	WNW	301°	Once/3 years	
	Route 700 (Exclusion Boundary)	22	1.00	WSW	242°	Once/3 years	
	"Aspen Hills"	23	0.93	SSE	158°	Once/3 years	
	Orange, VA	24	22.00	NW	325°	Once/3 years	Control
Fish	Waste Heat Treatment Facility (Second Cooling Lagoon)	08	3.37	SSE	148°	Semi-Annually	
	Lake Orange	25	16.5	NW	312°	Semi-Annually	Control
Food Products (Vegetation)	Stagecoach Road	14B	1.22	NNE	40°	Monthly if available or at harvest	
	Route 614	15	1.37	SE	133°	Monthly if available or at harvest	
	Route 629/522	16	12.60	NW	314°	Monthly if available or at harvest	Control
	Aspen Hills	23	0.93	SSE	158°	Monthly if available or at harvest	
	"Historic Lane"	26	1.15	S	172°	Monthly if available or at harvest	

TABLE 2-2
North Anna Power Station
SAMPLE ANALYSIS PROGRAM

SAMPLE MEDIA	FREQUENCY	ANALYSIS	LLD	REPORT UNITS
Thermoluminescent Dosimetry (TLD)				
(84 TLDs)	Quarterly	Gamma Dose	2 mR+2mR	mR/std. Month
(12 TLDs)	Annually	Gamma Dose	2 mR+2mR	mR/std. Month
Airborne Radioiodine	Weekly	I-131	0.07	pCi/m ³
Airborne Particulate	Weekly	Gross Beta	0.01	pCi/m ³
	Quarterly (a)	Gamma Isotopic		pCi/m ³
		Cs-134	0.05	
	2 nd Quarter Composite	Cs-137	0.06	
Sr-89		(b)		pCi/m ³
Surface Water	Monthly	Sr-90	(b)	
		I-131	1(c)	pCi/L
		Gamma Isotopic		pCi/L
		Mn-54	15	
		Fe-59	30	
		Co-58	15	
		Co-60	15	
		Zn-65	30	
		Zr-95	30	
		Nb-95	15	
		Cs-134	15	
		Cs-137	18	
		Ba-140	60	
	La-140	15		
	Quarterly(a)	Tritium (H-3)	2000	pCi/L
	2 nd Quarter	Sr-89	(b)	pCi/L
	Composite	Sr-90	(b)	
River Water	Monthly	Sr-90	(b)	
		I-131	1(c)	pCi/L
		Gamma Isotopic		pCi/L
		Mn-54	15	
		Fe-59	30	
		Co-58	15	
		Co-60	15	
		Zn-65	30	
		Zr-95	30	
		Nb-95	15	
		Cs-134	15	
		Cs-137	18	
		Ba-140	60	
La-140	15			

*LLDs indicate those levels to which environmental samples are required to be analyzed. Actual analysis of samples may be lower than the listed values.

(a) Quarterly composite of each location's samples are used for the required analysis

(b) There are no required LLDs for Sr-89/90

(c) LLD for non-drinking water is 10 pCi/liter

(d) LLD applied are those for water samples. However, since this is a semi-annual composite no LLD is applied for these nuclides due to their short half-lives.

TABLE 2-2
North Anna Power Station
SAMPLE ANALYSIS PROGRAM

SAMPLE MEDIA	FREQUENCY	ANALYSIS	LLD	REPORT UNITS
River Water	Quarterly(a)	Tritium (H-3)	2000	pCi/L
	2 nd Quarter	Sr-89	(b)	pCi/L
	Composite	Sr-90	(b)	
Ground Water (Well Water)	Quarterly	Gamma Isotopic		pCi/L
		Mn-54	15	
		Fe-59	30	
		Co-58	15	
		Co-60	15	
		Zn-65	30	
		Zr-95	30	
		Nb-95	15	
		I-131	10(c)	
		Cs-134	15	
		Cs-137	18	
		Ba-140	60	
		La-140	15	
		Quarterly(a)	Tritium (H-3)	2000
	2 nd Quarter	Sr-89	(b)	pCi/L
	Sr-90	(b)		
Aquatic Sediment	Semi-Annually	Gamma Isotopic		pCi/kg (dry)
		Cs-134	150	
		Cs-137	180	
	Annually	Sr-89	(b)	pCi/kg (dry)
		Sr-90	(b)	
Precipitation	Monthly	Gross Beta	4	pCi/L
	Semi-Annual	Gamma Isotopic		pCi/L
	Composite	Mn-54	15	
		Fe-59	30	
		Co-58	15	
		Co-60	15	
		Zn-65	30	
		Zr-95	30	
		Nb-95	15	
		I-131	(d)	
		Cs-134	15	
		Cs-137	18	
		Ba-140	(d)	
		La-140	(d)	
Shoreline Soil	Semi-Annually	Gamma Isotopic		pCi/kg (dry)
		Cs-134	150	
		Cs-137	180	
	Annually	Sr-89	(b)	pCi/kg (dry)
		Sr-90	(b)	

*LLDs indicate those levels to which environmental samples are required to be analyzed. Actual analysis of samples may be lower than the listed values.

(a) Quarterly composite of each location's samples are used for the required analysis

(b) There are no required LLDs for Sr-89/90

(c) LLD for non-drinking water is 10 pCi/liter

(d) LLD applied are those for water samples. However, since this is a semi-annual composite no LLD is applied for these nuclides due to their short half-lives.

TABLE 2-2
North Anna Power Station
SAMPLE ANALYSIS PROGRAM

SAMPLE MEDIA	FREQUENCY	ANALYSIS	LLD	REPORT UNITS
Soil	Once per 3 years	Gamma Isotopic		pCi/kg (dry)
		Cs-134	150	
		Cs-137	180	
		Sr-89	(b)	pCi/kg (dry)
		Sr-90	(b)	
Milk	Monthly, if available	I-131	1	pCi/L
		Gamma Isotopic		
	Monthly, if available	Cs-134	15	pCi/L
		Cs-137	18	
		Ba-140	60	
		La-140	15	
		Sr-89	(b)	
	Quarterly	Sr-90	(b)	
Fish	Semi-Annually	Gamma Isotopic		pCi/kg (wet)
		Mn-54	130	
		Fe-59	260	
		Co-58	130	
		Co-60	130	
		Zn-65	260	
		Cs-134	130	
		Cs-137	150	
Food Products (Broadleaf Vegetation)	Monthly, if available, or at harvest	Gamma Isotopic		pCi/kg (wet)
		Cs-134	60	
		Cs-137	80	
		I-131	60	

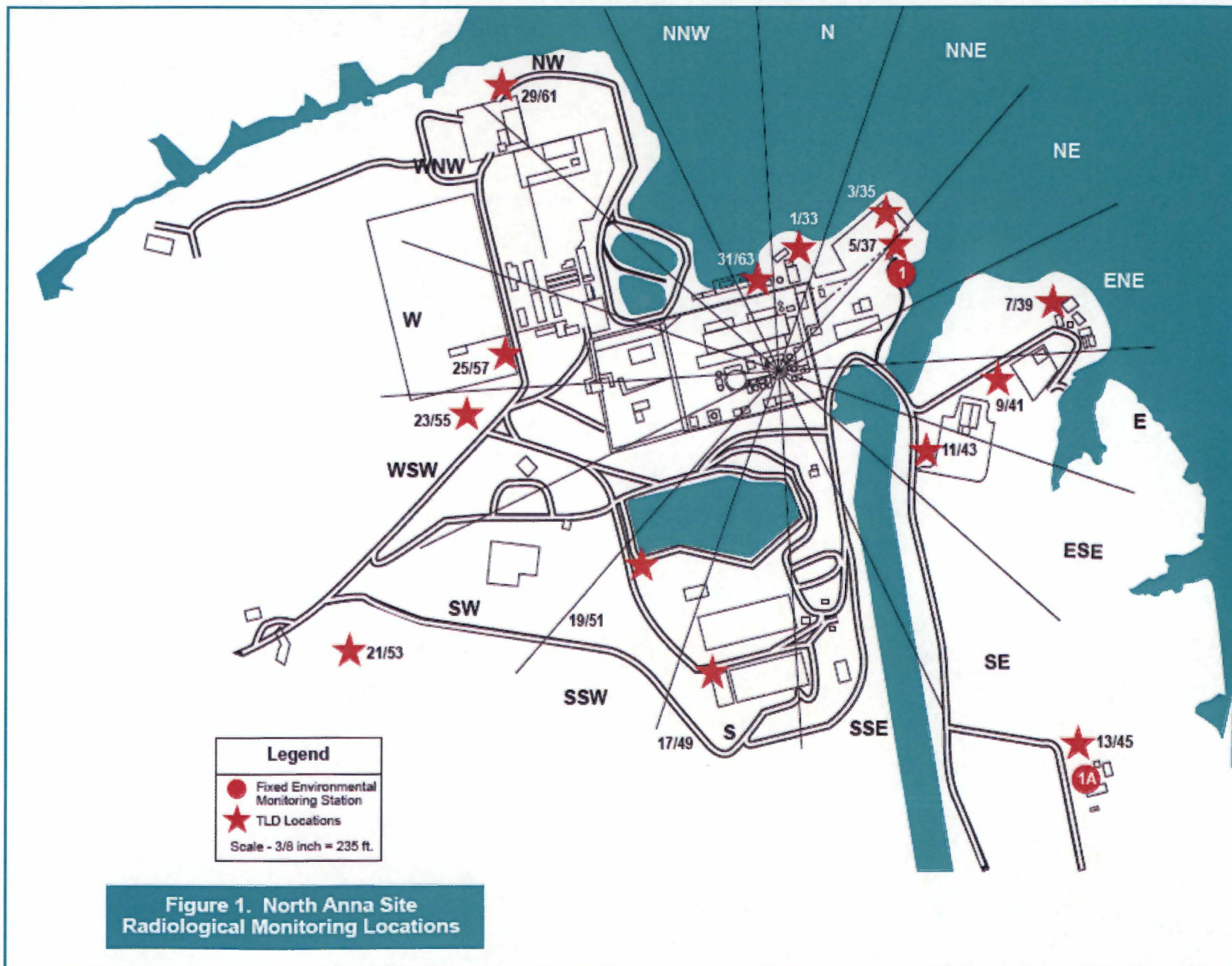
*LLDs indicate those levels to which environmental samples are required to be analyzed. Actual analysis of samples may be lower than the listed values.

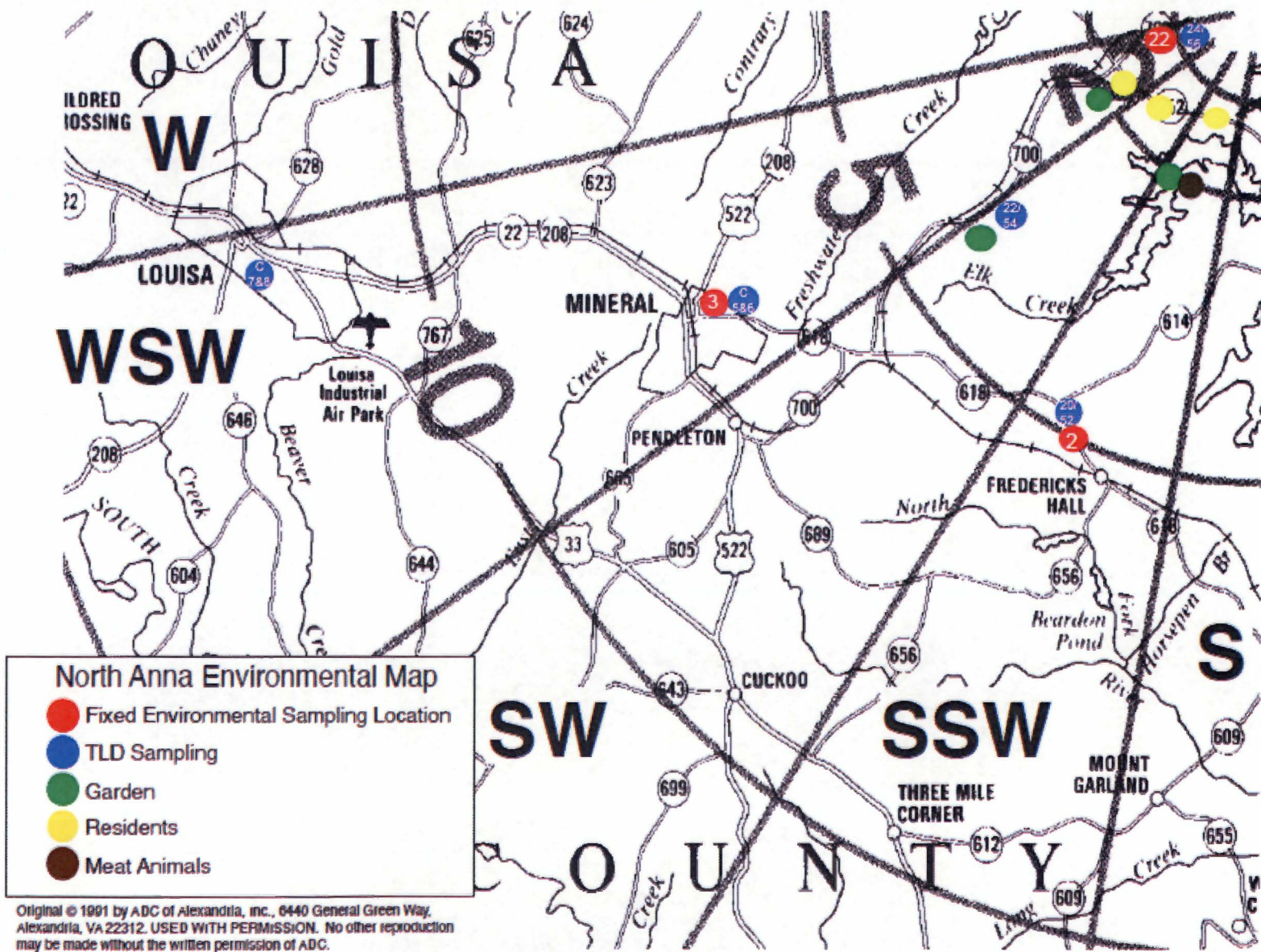
- (a) Quarterly composite of each location's samples are used for the required analysis
- (b) There are no required LLDs for Sr-89/90
- (c) LLD for non-drinking water is 10 pCi/liter
- (d) LLD applied are those for water samples. However, since this is a semi-annual composite no LLD is applied for these nuclides due to their short half-lives.

**Legend For The North Anna Power Station
Environmental Monitoring Stations Overview Maps**

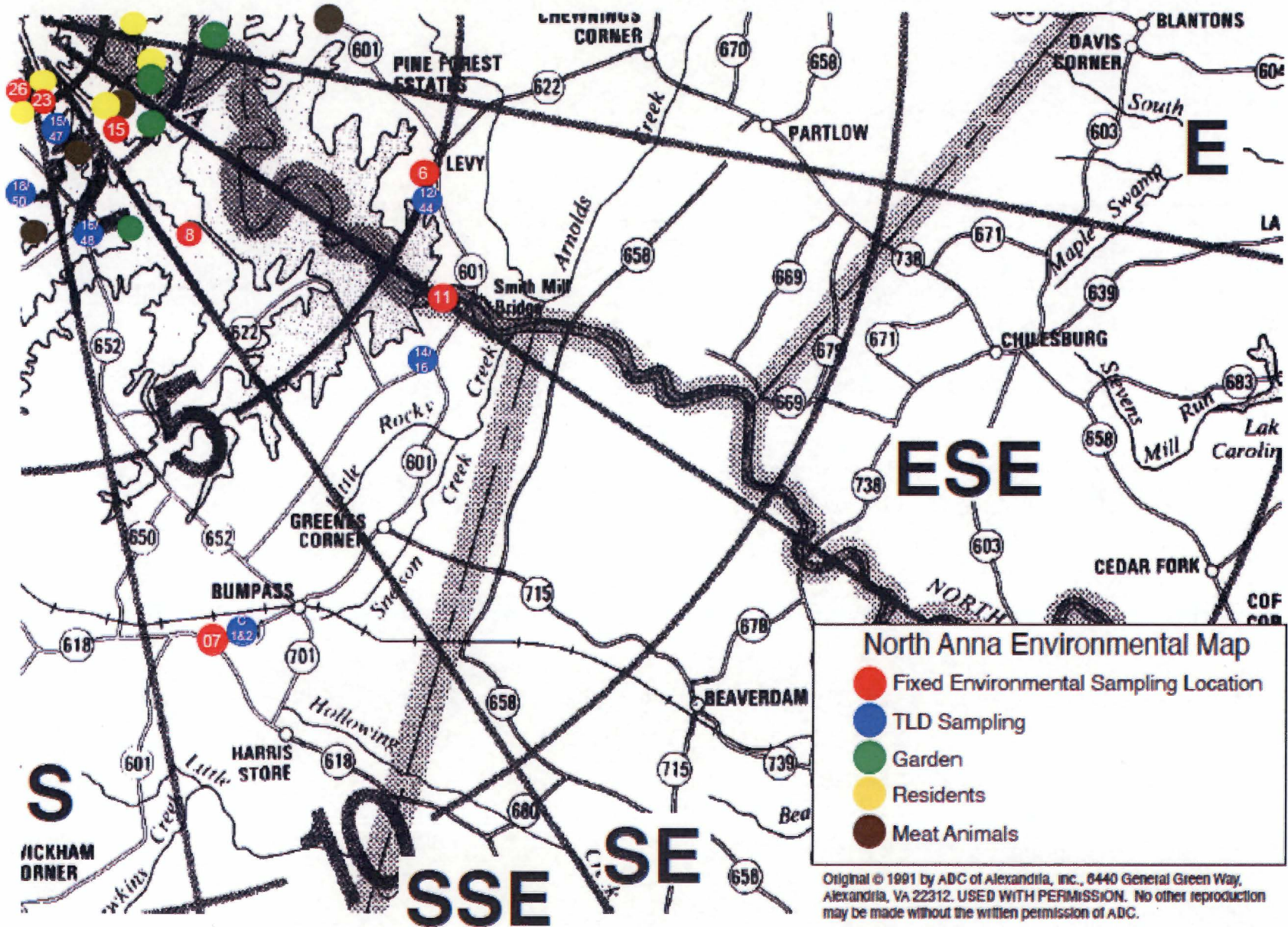
Map Designation	Environmental Station Identification	Map Designation	Environmental Station Identification
1 (a)	01,NE-5/37	7/8	C-7/8
1A	01A,SE-13/45	1/33	N-1/33
2 (a)	02,SSW-20/52	31/63	NNW-31/63
3 (a)	03,C-5/6	29/61	NW-29/61
4 (a)	04	3/35	NNE-3/35
5 (a)	05	7/39	ENE-7/39
5A (a)	05A,N-2/34	9/41	E-9/41
6 (a)	06,ESE-12/44	11/43	ESE-11/43
7 (a)	07, C-1/2	17/49	S-17/49
8	08-Water, Fish, Sediment, Shoreline Soil	19/51	SSW-19/51
9A	09A-Water sample, Sediment	21/53	SW-21/53
11	11-River Water, Sediment	23/55	WSW-23/55
14B	14B-Vegetation	16/48	SSE-16/48
15	15-Vegetation	14/46	SE-14/46
16	16-Vegetation	22/54	SW-22/54
21 (a)	21,WNW-27/59	26/58	W-26/58
22 (a)	22,WSW-24/56	28/60	WNW-28/60
23 (a)	23-SSE-15/47,Vegetation	32/64	NNW-32/64
24 (a)(b)	24,C-3/4	8/40	ENE-8/40
25 (c)	25-Fish	4/36	NNE-4/36
26	26-Vegetation	10/42	E-10/42

(a) Indicates air sample station, annual and quarterly TLD, Triennial soil.
(b) In Orange
(c) In Lake Orange





CB2283Q



CB32B2G

3. ANALYTICAL RESULTS

3.1 *Summary of Results*

In accordance with the North Anna Offsite Dose Calculation Manual (ODCM), a summary table of the analytical results has been prepared and is presented in Table 3-1. This data is presented in accordance with the format of the USNRC Branch Technical Position, "Acceptable Radiological Environmental Monitoring Program", Rev. 1, November 1979. The LLD listed value is taken from the ODCM. For radioanalytic analyses, the values listed in the columns indicated as "Mean/Range" include any results above the Minimum Detectable Concentration, MDC. Results are considered true positives when the measured value exceeds both the MDC and the 2σ error. For TLDs the mean and range include all values.

A more detailed analysis of the data is given in Section 4 where a discussion of the variations in the data explains many aspects that are not evident in the Summary Table because of the basic limitation of data summaries.

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Docket No. 50-338/339 2022

Medium or Pathway Sampled (Units)	Analysis Type	Total Number	LLD*	Indicator Locations	Indicator Location with Highest Mean			Control Locations	Non-Routine Reported Measurement
				Mean (Range)	Number	Distance Direction	Mean (Range)	Mean (Range)	
Direct Radiation (mR.std. Month) (Sector TLDs)	Gamma Dose	253	2	3.7 (253/253) (0.6-7.5)	29/81	0.52 Mi. NW	6.4 (8/8) (4.7-7.5)	3.0 (16/16) (2.3-4.0)	0
** C3/4, -7/8 used for control locations									
Direct Radiation (mR.std. Month) (Pre-operational TLDs)	Gamma Dose	32	2	2.3 (16/16) (0.9-3.0)	C-1/2	7.30 Mi. SSE	2.8 (16/16) (2.3-3.0)	3.0 (16/16) (2.3-4.0)	0
** C3/4, -7/8 used for control locations									
Direct Radiation (mR.std. Month) (Emergency Sector TLDs)	Gamma Dose	40	2	4.6 (40/40) (2.0-8.4)	EPSP 09/10	0.37 Mi. ENE	6.9 (8/8) (5.0-8.4)	3.0 (16/16) (2.3-4.0)	0
** C3/4, -7/8 used for control locations									
Direct Radiation (mR.std. Month) (Environmental TLDs)	Gamma Dose	48	2	3.0 (44/44) (1.4-5.2)	STA-23	0.93 Mi. SSE	4.6 (4/4) (2.3-2.9)	2.6 (4/4) (2.3-2.9)	0
Direct Radiation (mR.std. Month) (Annual TLDs)	Gamma Dose	12	2	3.1 (11/11) (1.4-4.6)	STA-23	0.93 Mi. SSE	4.6 (1/1) (4.6)	3.1 (1/1) (3.1)	0
Air Particulate (10e ⁻³ pCi/m ³)	GR-B	662	0.01	16.1 (612/612) (5.75-34.7)	23	0.93 Mi. SSE	17.4 (51/51) (6.69-29.6)	16.5 (50/50) (8.25-30.9)	0
	GAMMA BE-7	52	-	131.7 (48/48) (78.8-174)	23	0.93 Mi. SSE	145.7 (4/4) (100.7-174)	134.9 (4/4) (101.6-152.5)	0
	Cs-134	52	0.05	(0/48)	N/A	N/A	N/A	(0/4)	0
	Cs-137	52	0.06	(0/48)	N/A	N/A	N/A	(0/4)	0
	Sr-89	13	0.01	(0/48)	N/A	N/A	N/A	(0/4)	0
	Sr-90	13	0.01	(0/48)	N/A	N/A	N/A	(0/4)	0
Air Iodine (10e ⁻³ pCi/m ³)	I-131	662	0.07	(0/612)	N/A	N/A	N/A	(0/50)	0
Soil*** (pCi/kg dry wt.)	GAMMA K-40	12	-	11978 (11/11) (4905-24060)	01	0.20 Mi. NE	24080 (1/1) (24060)	23200 (1/1) (23200)	0
	CS-134	12	150	(0/11)	N/A	N/A	N/A	(0/1)	0
	CS-137	12	180	227.83 (5/11) (59.060-322.60)	02	5.3 Mi. SSW	322.60 (1/1) (322.6)	(0/1)	0
	Ra-226	12	-	2193.8 (4/11) (1357.0-3095.0)	23	0.93 Mi. SSE	3095.0 (1/1) (3095.0)	(0/1)	0

* LLD identified in ODCM

**C-3/4,-7/8 used as control locations

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				Mean (Range)	Number	Distance Direction	Mean (Range)	Mean (Range)	
Soil*** (cont'd) (pCi/kg dry wt.)	Th-228	12	-	1066.0 (1/11) (185.90-1958.0)	06	4.7 Mi. ESE	1958.0 (1/1) (1958.0)	185.10 (1/1) (185.10)	0
	Th-232	12	-	1232.4 (0/11) (581.00-1852.0)	06	4.7 Mi. ESE	1852.0 (1/1) (1852.0)	(0/1)	0
	Sr-89	12	-	(0/11)	N/A	N/A	N/A	(0/1)	0
	Sr-90	12	-	(0/11)	N/A	N/A	N/A	(0/1)	0
***Soil samples are obtained triennially.									
Precipitation (pCi/liter)	GR-B	12	4	4.3 (10/12) (1.8-10.8)	01A	0.64 MI. SE	4.3 (10/12) (1.8-10.8)	N/A	0
	H-3	12	2000	(0/12)	N/A	N/A	N/A	N/A	0
	GAMMA	2							
	Be-7	2	-	(0/2)	N/A	N/A	N/A	N/A	0
	Mn-54	2	15	(0/2)	N/A	N/A	N/A	N/A	0
	Fe-59	2	30	(0/2)	N/A	N/A	N/A	N/A	0
	Co-58	2	15	(0/2)	N/A	N/A	N/A	N/A	0
	Co-60	2	15	(0/2)	N/A	N/A	N/A	N/A	0
	Zn-65	2	30	(0/2)	N/A	N/A	N/A	N/A	0
	Zr-95	2	30	(0/2)	N/A	N/A	N/A	N/A	0
	Nb-95	2	15	(0/2)	N/A	N/A	N/A	N/A	0
	Cs-134	2	15	(0/2)	N/A	N/A	N/A	N/A	0
	Cs-137	2	18	(0/2)	N/A	N/A	N/A	N/A	0
	Ba-140	2	60	(0/2)	N/A	N/A	N/A	N/A	0
	La-140	2	15	(0/2)	N/A	N/A	N/A	N/A	0
I-131	2	10	(0/2)	N/A	N/A	N/A	N/A	0	

* LLD identified in ODCM

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				Mean (Range)	Number	Distance Direction	Mean (Range)	Mean (Range)	
Precipitation (cont'd) (pCi/liter)	Th-228	2	-	(0/2)	N/A	N/A	N/A	N/A	0
Fruits & Vegetables (pCi/kg wet wt.)	GAMMA	35	-	2482 (28/28) (591.3-10330)	23	0.93 Mi. SSE	2886 (7/7) (591.3-7708)	2119 (7/7) (792.7-3175)	0
	Be-7	35	-	4358 (28/28) (2025-6185)	14B	1.22 Mi. NNE	5042 (7/7) (3552-6185)	4452 (7/7) (3358-5736)	0
	K-40	35	-	(0/28)	N/A	N/A	N/A	(0/7)	0
	I-131	35	60	(0/28)	N/A	N/A	N/A	(0/7)	0
	Cs-134	35	60	(0/28)	N/A	N/A	N/A	(0/7)	0
	Cs-137	35	80	(0/28)	N/A	N/A	N/A	(0/7)	0
	Th-228	35	-	134.7 (3/28) (103.2-166.8)	23	0.93 Mi. SSE	135.0 (2/7) (103.2-166.8)	47.70 (1/7) (47.70)	0
	Th-232	35	-	(0/28)	N/A	N/A	N/A	(0/7)	0
Well Water (pCi/liter)	H-3	4	2000	(0/4)	N/A	N/A	N/A	N/A	0
	GAMMA	4							
	Mn-54	4	15	(0/4)	N/A	N/A	N/A	N/A	0
	Fe-59	4	30	(0/4)	N/A	N/A	N/A	N/A	0
	Co-58	4	15	(0/4)	N/A	N/A	N/A	N/A	0
	Co-60	4	15	(0/4)	N/A	N/A	N/A	N/A	0
	Zn-65	4	30	(0/4)	N/A	N/A	N/A	N/A	0
	Zr-95	4	30	(0/4)	N/A	N/A	N/A	N/A	0
	Nb-95	4	15	(0/4)	N/A	N/A	N/A	N/A	0
	I-131	4	10	(0/4)	N/A	N/A	N/A	N/A	0
	Cs-134	4	15	(0/4)	N/A	N/A	N/A	N/A	0
	Cs-137	4	18	(0/4)	N/A	N/A	N/A	N/A	0

* LLD identified in ODCM

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				Mean (Range)	Number	Distance Direction	Mean (Range)	Mean (Range)	
Well Water (cont'd) (pCi/liter)	Ba-140	4	60	(0/4)	N/A	N/A	N/A	N/A	0
	La-140	4	15	(0/4)	N/A	N/A	N/A	N/A	0
	Sr-89	1	-	(0/1)	N/A	N/A	N/A	N/A	0
	Sr-90	1	-	(0/1)	N/A	N/A	N/A	N/A	0
River Water (pCi/liter)	H-3	4	2000	5518 (4/4) (4680-6940)	11	5.80 Mi. SE	5518 (4/4) (4680-6940)	N/A	0
	GAMMA	12							
	Mn-54	12	15	(0/12)	N/A	N/A	N/A	N/A	0
	Fe-59	12	30	(0/12)	N/A	N/A	N/A	N/A	0
	Co-58	12	15	(0/12)	N/A	N/A	N/A	N/A	0
	Co-60	12	15	(0/12)	N/A	N/A	N/A	N/A	0
	Zn-65	12	30	(0/12)	N/A	N/A	N/A	N/A	0
	Zr-95	12	30	(0/12)	N/A	N/A	N/A	N/A	0
	Nb-95	12	15	(0/12)	N/A	N/A	N/A	N/A	0
	I-131	12	1	(0/12)	N/A	N/A	N/A	N/A	0
	Cs-134	12	15	(0/12)	N/A	N/A	N/A	N/A	0
	Cs-137	12	18	(0/12)	N/A	N/A	N/A	N/A	0
	Ba-140	12	60	(0/12)	N/A	N/A	N/A	N/A	0
	La-140	12	15	(0/12)	N/A	N/A	N/A	N/A	0
	Sr-89	1	-	(0/1)	N/A	N/A	N/A	N/A	0
	Sr-90	1	-	(0/1)	N/A	N/A	N/A	N/A	0

* LLD identified in ODCM

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				Mean (Range)	Number	Distance Direction	Mean (Range)	Mean (Range)	
Surface Water (pCi/liter)	H-3	8	2000	6508 (4/4) (4170-8440)	08	3.37 Mi. SSE	6508 (4/4) (4170-8440)	(0/4)	0
	GAMMA	24							
	Mn-54	24	15	(0/12)	N/A	N/A	N/A	(0/12)	0
	Fe-59	24	30	(0/12)	N/A	N/A	N/A	(0/12)	0
	Co-58	24	15	(0/12)	N/A	N/A	N/A	(0/12)	0
	Co-60	24	15	(0/12)	N/A	N/A	N/A	(0/12)	0
	Zn-65	24	30	(0/12)	N/A	N/A	N/A	(0/12)	0
	Zr-95	24	30	(0/12)	N/A	N/A	N/A	(0/12)	0
	Nb-95	24	30	(0/12)	N/A	N/A	N/A	(0/12)	0
	I-131	24	1	(0/12)	N/A	N/A	N/A	(0/12)	0
	Cs-134	24	15	(0/12)	N/A	N/A	N/A	(0/12)	0
	Cs-137	24	18	(0/12)	N/A	N/A	N/A	(0/12)	0
	Ba-140	24	60	(0/12)	N/A	N/A	N/A	(0/12)	0
	La-140	24	15	(0/12)	N/A	N/A	N/A	(0/12)	0
	Sr-89	2	-	(0/1)	N/A	N/A	N/A	(0/1)	0
	Sr-90	2	-	(0/1)	N/A	N/A	N/A	(0/1)	0
Sediment Silt (pCi/kg dry wt.)	GAMMA	6							
	K-40	6	-	8799 (4/4) (1716-18050)	11	5.80 Mi. SE	17830 (2/2) (17610-18050)	13960 (2/2) (13340-14580)	0
	Cs-134	6	150	(0/4)	N/A	N/A	N/A	(0/2)	0
	Cs-137	6	180	(0/4)	N/A	N/A	N/A	(0/2)	0
	Ra-226	6	-	(0/4)	N/A	N/A	N/A	(0/2)	0

* LLD identified in ODCM

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				Mean (Range)	Number	Distance Direction	Mean (Range)	Mean (Range)	
Sediment Silt (cont'd) (pCi/kg dry wt.)	Th-228	6	-	672.8 (2/4) (635.4-710.2)	11	5.80 Mi. SE	672.8 (2/2) (635.4-710.2)	165.9 (2/2) (90.94-240.8)	0
	Th-232	6	-	952.3 (1/4) (952.3)	11	5.80 Mi. SE	952.3 (1/2) (952.3)	(0/2)	0
	Sr-89 (Annually)	3	-	(0/2)	N/A	N/A	N/A	(0/1)	0
	Sr-90 (Annually)	3	-	(0/2)	N/A	N/A	N/A	(0/1)	0
Shoreline Soil (pCi/kg dry wt.)	GAMMA	2							
	K-40	2	-	1266 (2/2) (1011-1521)	08	3.37 Mi. SSE	1266 (2/2) (1011-1521)	N/A	0
	Cs-134	2	150	(0/2)	N/A	N/A	N/A	N/A	0
	Cs-137	2	160	(0/2)	N/A	N/A	N/A	N/A	0
	Ra-226	2	-	(0/2)	N/A	N/A	N/A	N/A	0
	Th-228	2	-	99.27 (1/2) (99.27)	08	3.37 Mi. SSE	99.27 (1/2) (99.27)	N/A	0
	Th-232	2	-	(0/2)	N/A	N/A	N/A	N/A	0
	Sr-89 (Annually)	1	-	(0/1)	N/A	N/A	N/A	N/A	0
Sr-90 (Annually)	1	-	(0/1)	N/A	N/A	N/A	N/A	0	
Fish - Other (pCi/kg wet wt.)	GAMMA	8							
	K-40	8	-	1097 (4/4) (648.1-1457)	08	3.37 Mi. SSE	1097 (4/4) (648.1-1457)	1631 (4/4) (1349-2096)	0
	Mn-54	8	130	(0/4)	N/A	N/A	N/A	(0/4)	0
	Fe-59	8	260	(0/4)	N/A	N/A	N/A	(0/4)	0
	Co-58	8	130	(0/4)	N/A	N/A	N/A	(0/4)	0
	Co-60	8	130	(0/4)	N/A	N/A	N/A	(0/4)	0
	Zn-65	8	260	(0/4)	N/A	N/A	N/A	(0/4)	0
	Cs-134	8	130	(0/4)	N/A	N/A	N/A	(0/4)	0
Cs-137	8	150	(0/4)	N/A	N/A	N/A	(0/4)	0	

* LLD identified in ODCM

3.2 Analytical Results of 2022 REMP Samples

Radiological analyses of environmental media characteristically approach and frequently fall below the detection limits of state-of-the-art measurement methods. The data reported in the following tables are strictly counting statistics. The reported error is two times the standard deviation (2σ) of the net activity. Unless otherwise noted, the overall error (counting, sample size, chemistry, errors, etc.) is estimated to be 2 to 5 times that listed. Results are considered true positives when the measured value exceeds both the MDC and the $2\sum$ error.

Because of counting statistics, negative values, zeros and numbers below the Minimum Detectable Level (MDL) are statistically valid pieces of data¹. For clarity of this report only detectable results are presented. TBE's analytical methods meet the Lower Limit of Detection (LLD) requirements given in Table 2 of the USNRC Branch Technical Position, "An Acceptable Radiological Environmental Monitoring Program", (November 1979, Revision 1) and the North Anna ODCM.

Data are given according to sample type as indicated below.

1. Gamma Exposure Rate
2. Air Particulates, Gross Beta Radioactivity
3. Air Particulates, Weekly I-131
4. Air Particulates, Quantitative Gamma Spectra
5. Air Particulate Strontium
6. Soil
7. Precipitation
8. Cow Milk
9. Food Products and Vegetation
10. Well Water
11. River Water
12. Surface Water
13. Bottom Sediment/Silt
14. Shoreline Soil
15. Fish

¹ Analytical results are handled as recommended by HASL ("*Reporting of Analytical Results from HASL*," letter by Leo B. Higginbotham) and NUREG/CR-4007 (Sept. 1984).

TABLE 3-2
 QUARTERLY
 GAMMA EXPOSURE RATE
 (mR/Std. Month) \pm 2 Sigma

Station	First Quarter 12/28/2021- 3/29/2022	Second Quarter 3/29/2022- 6/28/2022	Third Quarter 6/28/2022- 9/28/2022	Fourth Quarter 9/28/2022- 12/27/2022	Quarterly Average* (+/-) 2 S.D.
N-1	3.3	4.3	4.6	4.3	4.2 (+/-) 1.1
N-33	3.3	4.7	4.3	4.6	
N-2	2.0	3.0	3.0	2.9	2.6 (+/-) 0.7
N-34	2.3	2.7	2.3	2.3	
NNE-3	4.7	5.7	5.0	5.8	5.2 (+/-) 1.3
NNE-35	4.0	5.3	5.6	5.8	
NNE-4	3.0	4.0	4.0	4.1	3.7 (+/-) 1.0
NNE-36	3.0	4.0	3.3	4.1	
NE-5	3.3	4.3	4.0	3.8	3.8 (+/-) 0.7
NE-37	3.3	3.7	3.6	4.1	
NE-6	2.3	3.0	3.0	3.2	3.0 (+/-) 0.6
NE-38	3.0	3.0	3.0	3.5	
ENE-7	4.0	4.3	5.0	5.5	4.8 (+/-) 1.4
ENE-39	3.7	5.3	5.0	5.5	
ENE-8	2.0	2.3	1.7	1.2	1.7 (+/-) 0.9
ENE-40	2.0	1.3	1.7	1.7	
E-9	3.3	4.7	4.3	5.2	4.5 (+/-) 1.6
E-41	3.3	4.3	5.0	5.5	
E-10	3.0	4.0	3.3	4.1	3.6 (+/-) 1.0
E-42	3.0	3.7	3.6	4.3	
ESE-11	3.3	4.3	4.0	3.8	3.8 (+/-) 0.8
ESE-43	3.0	3.7	4.0	4.1	
ESE-12	3.0	4.0	3.3	4.3	3.7 (+/-) 1.2
ESE-44	3.0	4.3	3.6	4.3	
SE-13	3.0	3.7	4.0	3.5	3.6 (+/-) 0.8
SE-45	3.0	4.0	3.6	4.1	
SE-14	4.3	5.7	4.6	5.2	5.0 (+/-) 1.3
SE-46	4.0	5.3	5.0	5.8	
SSE-15	3.7	5.3	5.3	5.2	4.5 (+/-) 1.7
SSE-47	3.3	4.0	4.0	5.2	
SSE-16	(a)	2.3	2.6	2.6	2.4 (+/-) 0.3
SSE-48	(a)	2.3	2.3	2.3	
S-17	3.3	4.3	4.0	4.6	4.4 (+/-) 1.1
S-49	4.0	4.7	4.6	5.2	

(a) TLD was missing and unable to be analyzed.

*Average of collocated TLDs

TABLE 3-2
 QUARTERLY
 GAMMA EXPOSURE RATE
 (mR/Std. Month) \pm 2 Sigma

Station	First Quarter 12/28/2021- 3/29/2022	Second Quarter 3/29/2022- 6/28/2022	Third Quarter 6/28/2022- 9/28/2022	Fourth Quarter 9/28/2022- 12/27/2022	Quarterly Average* (+/-) 2 S.D.
S-18	2.0	(a)	2.3	2.0	2.0 (+/-) 0.3
S-50	2.0	2.0	2.0	1.7	
SSW-19	4.3	5.7	5.9	7.2	5.8 (+/-) 2.3
SSW-51	4.0	6.0	5.9	7.2	
SSW-20	1.7	2.0	2.3	1.7	2.0 (+/-) 0.5
SSW-52	2.0	2.0	2.3	1.7	
SW-21	2.7	3.7	3.0	3.5	3.3 (+/-) 0.8
SW-53	3.0	3.7	3.6	3.5	
SW-22	3.0	4.0	4.0	4.6	3.8 (+/-) 1.1
SW-54	3.0	3.7	4.0	4.1	
WSW-23	3.0	4.0	4.3	4.3	4.2 (+/-) 1.7
WSW-55	3.3	4.7	4.0	5.8	
WSW-24	3.0	4.0	3.3	3.8	3.3 (+/-) 0.9
WSW-56	2.7	3.0	3.3	3.5	
W-25	4.3	5.7	5.9	6.1	5.5 (+/-) 1.6
W-57	4.3	5.7	5.9	6.4	
W-26	2.3	2.7	3.0	2.6	2.5 (+/-) 0.8
W-58	2.0	3.0	2.6	2.0	
WNW-27	2.3	2.7	3.0	3.2	2.7 (+/-) 0.7
WNW-59	2.3	3.0	3.0	2.3	
WNW-28	2.0	3.0	3.3	2.9	2.7 (+/-) 0.9
WNW-60	2.3	3.0	2.3	2.9	
NW-29	4.7	7.0	6.9	7.2	6.4 (+/-) 2.0
NW-61	5.3	6.7	5.9	7.5	
NW-30	1.7	2.0	1.7	1.4	1.6 (+/-) 0.9
NW-62	1.7	2.0	1.7	0.6	
NNW-31	3.0	3.3	3.6	4.6	3.6 (+/-) 1.2
NNW-63	3.0	3.7	3.3	4.3	
NNW-32	2.7	3.3	3.3	2.9	3.1 (+/-) 0.6
NNW-64	3.0	3.7	3.3	2.9	
				Mean	3.7 (+/-) 2.6

(a) TLD was missing and unable to be analyzed.

*Average of collocated TLDs

TABLE 3-2
 QUARTERLY
 GAMMA EXPOSURE RATE
 (mR/Std. Month) \pm 2 Sigma

Station	First Quarter 12/28/2021- 3/29/2022	Second Quarter 3/29/2022- 6/28/2022	Third Quarter 6/28/2022- 9/28/2022	Fourth Quarter 9/28/2022- 12/27/2022	Quarterly Average* (+/-) 2 S.D.
C-1	2.3	3.0	3.0	2.9	2.8 (+/-) 0.6
C-2	2.3	3.0	3.0	2.9	
C-3**	2.3	3.0	2.6	2.9	2.7 (+/-) 0.4
C-4**	2.7	2.7	2.6	2.6	
C-5	1.7	2.0	1.7	1.7	1.9 (+/-) 1.1
C-6	2.0	2.7	2.3	0.9	
C-7**	2.7	3.7	4.0	3.5	3.3 (+/-) 1.0
C-8**	2.7	3.0	3.6	3.5	
				Indicator Mean	2.3 (+/-) 1.3
				Control Mean	3.0 (+/-) 1.0
EP SA-01***	3.7	4.0	3.6	4.3	4.0 (+/-) 0.7
EP SA-02***	3.7	4.0	4.0	4.6	
EP SF-03***	3.0	4.0	3.6	3.8	3.6 (+/-) 0.8
EP SF-04***	3.0	3.7	4.0	3.8	
EP SR-05***	5.0	6.3	5.0	5.5	5.2 (+/-) 1.4
EP SR-06***	4.0	5.7	4.6	5.5	
EP SJ-07***	2.7	3.7	2.0	3.2	3.1 (+/-) 1.2
EP SJ-08***	2.7	3.3	3.3	3.8	
EP SP-09***	5.0	7.7	6.3	8.4	6.9 (+/-) 2.8
EP SP-10***	5.0	7.7	6.6	8.4	
				Mean	4.6 (+/-) 3.1

(a) TLD was missing and unable to be analyzed.

*Average of collocated TLDs

** Control Location

***Emergency Plan TLDs.

TABLE 3-2
 QUARTERLY
 GAMMA EXPOSURE RATE
 (mR/Std. Month) \pm 2 Sigma

Station	First Quarter 12/28/2021- 3/29/2022	Second Quarter 3/29/2022- 6/28/2022	Third Quarter 6/28/2022- 9/28/2022	Fourth Quarter 9/28/2022- 12/27/2022	Quarterly Average* (+/-) 2 S.D.	Annual TLD
STA-01	3.3	3.7	4.3	4.1	3.8 (+/-) 0.8	3.4
STA-02	1.7	1.7	2.3	1.7	1.8 (+/-) 0.6	2.4
STA-03	1.7	2.0	2.0	1.4	1.8 (+/-) 0.5	1.4
STA-04	1.7	2.0	2.3	1.4	1.9 (+/-) 0.8	2.3
STA-05	2.3	3.3	3.3	2.9	3.0 (+/-) 0.9	3.2
STA-05A	2.3	2.7	2.3	3.2	2.6 (+/-) 0.8	2.7
STA-06	3.0	4.0	4.0	4.6	3.9 (+/-) 1.3	3.9
STA-07	2.0	2.7	3.3	3.2	2.8 (+/-) 1.2	3.1
STA-21	2.3	3.0	3.3	3.2	3.0 (+/-) 0.9	3.4
STA-22	2.7	4.0	3.0	4.3	3.5 (+/-) 1.6	3.7
STA-23	3.3	5.2	5.1	4.6	4.6 (+/-) 1.7	4.6
STA-24**	2.7	2.7	2.3	2.9	2.6 (+/-) 0.5	3.1
				Mean Indicator Locations	3.0 (+/-) 2.0	3.1 (+/-) 1.7

*Average of collocated TLDs

** Control

TABLE 3-3
 AIR PARTICULATES
 GROSS BETA RADIOACTIVITY
 (10^{-3} pCi/m³)

PERIOD ENDING	D1		D2		D3		D4		D5		D6		D7		D1	
	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)
01/05/22	13.00	2.400	12.60	2.950	12.10	2.910	12.40	2.950	15.20	2.790	15.20	3.120	15.70	2.620	12.30	2.930
01/12/22	21.90	3.180	22.20	3.750	18.40	3.380	21.70	3.270	21.80	3.180	21.90	6.280	22.70	3.220	15.60	3.720
01/18/22	18.40	3.340	15.70	3.120	15.60	3.130	11.00	2.850	21.10	3.420	21.00	3.420	22.30	3.480	19.30	3.330
01/25/22	19.10	2.930	23.40	3.280	16.30	2.780	23.80	3.160	21.60	3.060	18.20	2.880	17.80	2.850	24.90	3.360
02/01/22	19.90	3.160	19.70	3.180	17.50	3.070	19.20	3.160	19.10	3.150	13.90	2.890	16.80	3.040	19.20	3.160
02/08/22	14.70	2.760	13.10	2.670	15.10	2.780	17.30	2.900	12.00	2.600	14.80	2.760	17.70	2.920	13.70	2.700
02/15/22	22.50	3.120	20.00	3.110	20.50	3.130	23.00	3.260	21.60	3.200	21.40	3.200	19.30	3.060	19.20	3.100
02/22/22	19.60	3.100	16.90	3.020	15.50	2.960	20.20	3.140	16.50	2.970	16.20	2.970	19.00	3.130	18.20	3.040
03/01/22	13.30	2.890	12.20	2.830	11.00	2.760	14.20	2.940	14.10	2.920	9.520	2.680	15.60	3.010	11.20	2.770
03/08/22	19.10	2.940	16.00	2.770	17.70	2.870	19.50	2.960	19.70	2.970	20.90	3.170	17.60	2.850	19.60	2.960
03/15/22	14.10	2.650	13.90	2.640	14.00	2.760	11.10	2.470	12.80	2.560	13.00	2.580	12.00	2.530	12.20	2.540
03/22/22	14.50	2.730	12.80	2.630	16.10	2.820	14.40	2.720	13.60	2.690	21.30	4.340	14.90	2.750	10.70	2.500
03/29/22	9.350	2.470	10.40	2.500	11.10	2.550	9.960	2.480	7.420	2.320	9.220	2.430	10.60	2.510	8.510	2.400
04/05/22	14.70	2.730	10.70	2.530	12.00	2.610	15.50	2.800	10.90	2.540	15.50	2.920	13.00	2.660	14.60	2.750
04/12/22	8.100	2.320	10.10	2.450	8.760	2.360	8.060	2.370	7.920	2.400	7.300	2.260	11.50	2.530	8.910	2.370
04/19/22	13.00	2.830	8.140	2.560	12.40	2.810	12.50	2.810	11.80	2.800	15.10	2.970	12.40	2.810	9.610	2.650
04/26/22	18.70	2.920	16.70	2.810	21.00	3.030	21.30	3.050	17.70	2.850	16.30	2.790	21.80	3.070	10.80	2.480
05/03/22	19.20	2.920	18.70	2.900	19.10	2.920	19.70	2.950	20.30	2.990	20.90	3.020	19.00	2.920	19.00	2.910
05/10/22	14.70	2.800	9.200	2.480	6.710	2.310	9.220	2.480	11.50	2.620	11.80	2.660	11.50	2.610	11.20	2.600
05/17/22	10.90	2.540	5.750	2.210	7.850	2.350	8.610	2.400	8.520	2.390	6.960	2.280	10.20	2.500	8.070	2.360
05/24/22	17.80	3.010	7.530	2.430	16.70	2.960	15.30	2.880	16.50	2.960	14.70	2.860	11.30	2.660	14.40	2.840
05/31/22	7.140	2.340	8.630	2.430	6.890	2.320	9.390	2.480	7.650	2.370	9.460	2.480	10.30	2.540	9.160	2.460
06/07/22	17.00	2.850	15.60	2.780	15.80	2.790	16.10	2.810	20.40	3.020	16.40	2.820	16.20	2.820	17.10	2.860
06/14/22	16.80	2.760	12.50	2.510	15.20	2.660	19.30	2.890	15.90	2.690	14.40	2.610	15.90	2.700	12.20	2.490
06/22/22	14.00	2.420	12.10	2.310	12.40	2.330	12.50	2.330	13.60	2.410	13.50	2.430	13.70	2.400	11.90	2.300
06/28/22	10.60	2.620	10.90	2.700	11.30	2.770	12.90	2.850	11.80	2.800	12.70	2.850	9.800	2.640	11.00	2.690

TABLE 3-3
 AIR PARTICULATES
 GROSS BETA RADIOACTIVITY
 (10^{-3} pCi/m³)

LOCATIONS

PERIOD ENDING	01		02		03		04		05		06		07		21	
	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	
07/05/22	17.90	3.190	13.90	2.920	12.50	2.810	12.60	2.830	13.10	2.840	19.70	3.190	12.60	2.840	13.40	2.910
07/12/22 (a)																
07/20/22	18.70	2.960	13.80	2.730	15.50	2.820	18.70	2.960	13.60	2.740	18.30	2.930	15.70	2.830	14.80	2.780
07/26/22	18.90	3.850	13.30	3.590	18.20	3.810	15.10	3.670	14.40	3.620	20.40	3.900	14.30	3.640	12.90	3.560
08/02/22	15.10	2.840	16.20	2.900	13.80	2.770	16.80	2.930	16.30	2.910	15.10	2.850	13.70	2.760	12.90	2.730
08/09/22	12.90	2.580	11.80	2.510	11.00	2.460	11.30	2.480	15.40	2.710	12.00	2.520	13.20	2.580	10.00	2.400
08/16/22	12.20	2.720	10.60	2.640	13.20	2.770	13.30	2.780	16.60	2.940	15.00	2.860	12.30	2.730	12.30	2.730
08/23/22	12.70	2.630	18.20	2.920	13.10	2.650	13.80	2.690	16.90	2.870	18.20	2.930	14.90	2.750	14.10	2.710
08/30/22	28.50	3.450	25.60	3.330	29.90	3.510	31.10	3.570	27.40	3.410	24.80	3.290	28.10	3.430	27.90	3.430
09/06/22	10.10	2.440	16.10	2.770	13.90	2.660	16.50	2.790	16.50	2.790	17.20	2.820	14.00	2.650	11.00	2.490
09/13/22	9.090	2.490	8.850	2.470	9.420	2.500	11.40	2.610	8.960	2.470	9.840	2.520	9.020	2.490	7.910	2.420
09/20/22	26.40	3.250	23.50	3.130	26.50	3.260	29.20	3.380	23.70	3.150	24.60	3.190	21.70	3.050	23.30	3.120
09/28/22	23.40	2.800	22.00	2.730	25.90	2.870	25.90	2.880	21.10	2.680	25.70	2.890	27.00	2.950	11.90	2.200
10/04/22	8.030	2.560	6.480	2.470	8.510	2.670	8.990	2.670	8.370	2.600	9.050	2.650	6.730	2.490	6.140	2.450
10/11/22	18.60	2.910	15.70	2.750	18.00	2.870	18.40	2.890	18.20	2.870	14.80	2.700	15.00	2.720	7.620	2.290
10/18/22	24.70	3.200	28.50	3.370	24.60	3.200	20.30	3.000	21.80	3.090	25.40	3.250	24.30	3.190	21.70	3.070
10/25/22	18.30	2.920	16.90	2.850	16.70	2.840	18.00	2.900	17.30	2.870	19.70	2.980	13.90	2.680	15.80	2.800
11/02/22	15.50	2.380	9.910	2.070	14.80	2.350	16.50	2.440	12.50	2.220	17.00	2.460	14.80	2.350	12.30	2.210
11/09/22	23.20	3.100	21.70	3.040	19.40	2.930	22.80	3.080	15.60	2.740	23.70	3.130	14.90	2.700	19.20	2.920
11/15/22	9.150	2.810	11.10	2.970	7.760	2.710	11.00	2.910	10.20	2.860	9.930	2.840	11.60	3.000	6.720	2.650
11/22/22	20.90	3.020	22.00	3.080	17.30	2.850	17.80	2.870	19.70	2.970	11.60	2.550	18.70	2.910	18.20	2.890
11/29/22	25.00	3.220	23.80	3.160	22.10	3.080	23.90	3.170	23.80	3.150	20.70	3.010	22.90	3.120	22.30	3.090
12/07/22	24.60	2.860	22.40	2.780	22.20	2.770	25.50	2.920	21.70	2.750	22.70	2.800	24.30	2.870	23.60	2.830
12/13/22	19.40	3.460	19.00	3.440	19.00	3.440	23.00	3.630	19.00	3.430	16.80	3.310	22.30	3.600	18.20	3.410
12/20/22	15.40	2.760	14.60	2.840	16.10	2.800	15.90	2.790	14.10	2.840	18.00	3.050	14.50	2.840	12.30	2.590
12/27/22	23.90	2.860	26.50	3.090	20.40	2.680	22.20	2.770	23.10	2.940	23.90	2.980	23.60	2.850	23.30	2.830
Mean	16.76	2.863	15.45	2.825	15.62	2.827	16.82	2.882	16.08	2.846	16.58	2.966	16.13	2.841	14.56	2.780

(a) Weekly set was lost in transit and unable to be analyzed.

TABLE 3-3
 AIR PARTICULATES
 GROSS BETA RADIOACTIVITY
 (10^{-3} pCi/m³)

LOCATIONS

PERIOD ENDING	22		23		24*		01A		05A	
		(+/-)		(+/-)		(+/-)		(+/-)		(+/-)
01/05/22	13.90	2.460	18.50	3.270	14.40	2.480	15.50	2.530	15.10	3.070
01/12/22	18.80	3.020	16.30	6.250	20.90	3.130	20.40	3.090	24.30	3.610
01/18/22	19.80	3.350	25.00	3.630	15.60	3.130	18.90	3.300	18.20	3.270
01/25/22	21.00	3.020	26.20	3.420	22.00	3.070	20.10	2.980	22.30	3.090
02/01/22	17.40	3.070	20.20	3.210	22.00	3.300	18.20	3.110	17.50	3.080
02/08/22	13.10	2.670	16.70	2.860	16.10	2.830	16.80	2.870	12.60	2.640
02/15/22	16.90	2.970	20.30	2.940	18.10	2.910	15.00	2.860	18.70	3.040
02/22/22	16.50	2.940	19.90	3.340	19.30	3.080	18.10	3.160	21.00	3.210
03/01/22	12.20	2.830	13.80	2.920	16.20	3.020	11.80	2.820	13.40	2.890
03/08/22	17.40	2.850	19.80	3.090	17.40	2.860	17.00	2.940	18.70	3.030
03/15/22	13.70	2.630	15.30	2.840	14.40	2.660	13.50	2.610	14.00	2.740
03/22/22	15.80	2.800	16.30	2.940	16.00	2.830	13.80	2.690	17.80	2.920
03/29/22	12.20	2.620	11.40	2.580	9.930	2.470	10.00	2.500	10.70	2.520
04/05/22	13.40	2.680	17.20	3.000	14.40	2.740	10.80	2.520	11.90	2.600
04/12/22	7.940	2.310	9.250	2.400	8.670	2.340	9.180	2.390	8.500	2.340
04/19/22	11.90	2.760	7.240	2.500	10.90	2.750	10.60	2.700	11.10	2.750
04/26/22	18.20	2.890	21.90	3.080	19.10	2.930	21.40	3.060	18.80	2.910
05/03/22	21.90	3.060	21.50	3.040	20.20	2.990	21.30	3.030	22.70	3.110
05/10/22	10.30	2.550	12.10	2.660	13.90	2.750	14.10	2.780	11.70	2.620
05/17/22	7.050	2.290	10.10	2.490	10.00	2.480	9.000	2.420	12.10	2.610
05/24/22	14.40	2.840	16.30	2.940	14.30	2.850	12.30	2.720	15.60	2.910
05/31/22	8.630	2.430	10.10	2.520	8.250	2.410	6.060	2.270	11.60	2.620
06/07/22	17.70	2.890	18.50	2.930	20.20	3.010	17.00	2.850	16.50	2.820
06/14/22	14.10	2.610	14.80	2.650	18.40	2.820	15.30	2.680	7.190	2.150
06/22/22	10.10	2.190	13.00	2.360	8.920	2.120	11.20	2.250	13.40	2.390
06/28/22	9.500	2.570	10.90	2.690	10.20	2.730	12.60	2.950	11.40	2.780

*Control Station

TABLE 3-3
AIR PARTICULATES
GROSS BETA RADIOACTIVITY
(10⁻³ pCi/m³)

PERIOD ENDING	LOCATIONS									
	22		23		24*		01A		05A	
		(+/-)		(+/-)		(+/-)		(+/-)		(+/-)
07/05/22	16.10	3.070	19.10	3.200	9.170	2.600	18.50	3.210	12.70	2.820
07/12/22 (a)										
07/20/22	14.00	2.740	14.40	2.780	15.20	2.820	17.30	2.900	17.60	2.930
07/26/22	11.30	3.480	15.50	3.690	19.70	3.870	15.20	3.670	17.40	3.770
08/02/22	17.40	2.960	15.60	2.860	14.30	2.810	15.20	2.860	18.40	3.020
08/09/22	11.60	2.500	13.40	2.600	14.40	2.650	12.50	2.550	13.40	2.600
08/16/22	13.20	2.770	15.00	2.860	12.90	2.730	12.50	2.730	14.00	2.800
08/23/22	14.70	2.740	14.70	2.740	14.30	2.760	14.90	2.750	19.20	2.980
08/30/22	29.50	3.500	29.60	3.500	30.90	3.550	14.90	2.830	34.70	3.700
09/06/22	14.80	2.700	17.90	2.860	17.50	2.840	15.30	2.730	15.20	2.730
09/13/22	6.280	2.320	9.440	2.510	9.210	2.480	8.370	2.450	7.550	2.390
09/20/22	23.20	3.100	19.40	2.930	25.80	3.250	27.70	3.310	29.10	3.390
09/28/22	21.00	2.680	24.30	2.820	24.20	2.820	22.50	2.760	23.10	2.770
10/04/22	6.590	2.490	6.690	2.500	9.500	2.680	9.860	2.690	9.310	2.660
10/11/22	15.20	2.730	18.00	2.880	19.20	2.910	16.30	2.790	23.20	3.110
10/18/22	24.00	3.170	24.70	3.200	23.60	3.180	26.20	3.270	30.10	3.460
10/25/22	16.40	2.830	19.60	2.980	17.70	2.890	16.80	2.840	14.50	2.720
11/02/22	16.60	2.440	18.00	2.520	15.80	2.400	13.00	2.250	15.70	2.410
11/09/22	20.90	3.000	22.30	3.060	20.50	2.980	19.40	2.930	22.70	3.090
11/15/22	8.590	2.830	9.740	2.900	10.30	2.840	9.240	2.810	11.30	2.920
11/22/22	18.80	2.920	22.50	3.100	23.00	3.140	14.70	2.710	20.00	2.980
11/29/22	19.70	2.970	27.80	3.340	20.90	3.020	20.20	2.990	25.60	3.240
12/07/22	18.40	2.590	24.20	2.860	19.40	2.650	20.80	2.700	24.60	2.880
12/13/22	20.00	3.490	18.30	3.410	22.60	3.590	15.80	3.280	19.60	3.450
12/20/22	13.00	2.630	18.10	2.900	15.00	2.750	8.780	2.400	17.90	3.030
12/27/22	19.90	2.650	25.70	3.050	(b)		23.40	2.940	23.40	2.840
Mean	15.39	2.796	17.38	2.992	16.50	2.858	15.48	2.812	17.20	2.910
*Control Station									16.25	2.870

(a) Weekly set was lost in transit and unable to be analyzed.
(b) Due to a pump malfunction run time was 4.5 hours.

TABLE 3-4
AIRBORNE IODINE
(10⁻³ pCi/m³)

PERIOD ENDING	LOCATIONS							
	01	02	03	04	05	06	07	21
01/05/22	< 38.44	< 51.68	< 51.47	< 21.72	< 44.40	< 13.28	< 24.40	< 31.27
01/12/22	< 50.75	< 64.15	< 59.99	< 42.55	< 40.74	< 43.61	< 40.60	< 58.32
01/18/22	< 10.55	< 22.52	< 22.57	< 22.57	< 22.57	< 19.53	< 19.45	< 19.49
01/25/22	< 20.08	< 10.43	< 20.08	< 20.08	< 20.12	< 16.92	< 16.92	< 18.20
02/01/22	< 17.51	< 17.54	< 17.54	< 26.13	< 26.18	< 10.98	< 26.13	< 26.13
02/08/22	< 7.981	< 13.54	< 13.54	< 13.57	< 13.52	< 11.49	< 11.49	< 11.49
02/15/22	< 65.94	< 69.58	< 69.32	< 46.90	< 47.08	< 47.25	< 19.49	< 47.60
02/22/22	< 17.20	< 17.73	< 8.439	< 17.29	< 17.47	< 17.61	< 17.73	< 17.30
03/01/22	< 18.30	< 8.651	< 18.27	< 18.27	< 18.20	< 20.82	< 20.82	< 20.86
03/08/22	< 20.39	< 20.32	< 9.263	< 20.36	< 20.36	< 21.31	< 13.28	< 19.89
03/15/22	< 42.13	< 42.13	< 44.65	< 28.70	< 28.50	< 28.50	< 28.70	< 24.10
03/22/22	< 20.52	< 20.52	< 20.52	< 20.52	< 8.652	< 21.40	< 31.06	< 31.06
03/29/22	< 14.24	< 33.42	< 33.42	< 33.48	< 33.42	< 19.24	< 19.20	< 19.30
04/05/22	< 19.33	< 19.60	< 19.64	< 23.85	< 23.90	< 10.59	< 23.85	< 23.77
04/12/22	< 14.59	< 14.54	< 14.54	< 20.79	< 9.665	< 20.21	< 20.24	< 20.21
04/19/22	< 11.24	< 11.34	< 11.34	< 11.32	< 6.729	< 13.39	< 19.91	< 19.88
04/26/22	< 12.50	< 12.48	< 12.48	< 12.48	< 12.44	< 33.76	< 33.76	< 14.21
05/03/22	< 24.26	< 24.26	< 24.26	< 24.22	< 10.21	< 16.39	< 19.59	< 19.52
05/10/22	< 25.80	< 25.75	< 25.75	< 18.29	< 18.26	< 15.52	< 18.26	< 18.29
05/17/22	< 19.64	< 8.953	< 19.68	< 19.64	< 19.61	< 17.28	< 14.58	< 17.34
05/24/22	< 19.71	< 19.74	< 19.74	< 19.74	< 13.28	< 9.582	< 20.95	< 20.95
05/31/22	< 14.12	< 16.82	< 16.82	< 16.82	< 16.82	< 17.51	< 8.971	< 17.51
06/07/22	< 45.00	< 18.91	< 45.08	< 45.08	< 45.00	< 14.03	< 30.83	< 30.73
06/14/22	< 28.21	< 28.06	< 28.06	< 12.16	< 26.50	< 26.59	< 26.68	< 26.73
06/22/22	< 36.50	< 36.50	< 36.50	< 36.45	< 15.40	< 13.32	< 25.48	< 25.48
06/28/22	< 39.43	< 40.89	< 17.47	< 41.23	< 41.57	< 16.34	< 38.72	< 38.09

TABLE 3-4
AIRBORNE IODINE
(10⁻³ pCi/m³)

PERIOD ENDING	LOCATIONS							
	01	02	03	04	05	06	07	21
07/05/22	< 13.33	< 12.93	< 30.42	< 30.68	< 30.42	< 18.18	< 18.24	< 18.47
07/12/22 (a)								
07/20/22	< 23.45	< 11.38	< 23.56	< 23.45	< 23.67	< 28.21	< 14.54	< 28.47
07/26/22	< 20.42	< 9.311	< 20.42	< 20.42	< 20.34	< 27.92	< 11.78	< 28.03
08/02/22	< 25.19	< 25.19	< 25.19	< 25.19	< 10.62	< 27.85	< 27.70	< 11.70
08/09/22	< 19.52	< 19.45	< 19.45	< 9.365	< 22.29	< 22.33	< 22.33	< 22.33
08/16/22	< 15.22	< 15.22	< 15.22	< 8.992	< 21.33	< 21.29	< 21.44	< 21.44
08/23/22	< 21.29	< 21.36	< 10.91	< 21.36	< 21.51	< 8.708	< 19.04	< 19.04
08/30/22	< 22.41	< 22.37	< 22.41	< 10.86	< 22.37	< 23.34	< 23.34	< 23.38
09/06/22	< 36.04	< 15.14	< 36.10	< 35.97	< 35.97	< 33.97	< 33.97	< 33.97
09/13/22	< 18.35	< 43.59	< 43.59	< 43.59	< 43.44	< 44.28	< 18.67	< 44.36
09/20/22	< 17.62	< 17.71	< 17.71	< 17.71	< 8.114	< 14.34	< 17.00	< 17.00
09/28/22	< 13.44	< 31.74	< 31.07	< 31.40	< 31.69	< 11.19	< 26.68	< 26.68
10/04/22	< 31.66	< 31.92	< 13.78	< 32.38	< 31.98	< 20.11	< 20.07	< 20.07
10/11/22	< 12.11	< 24.99	< 24.99	< 24.99	< 24.82	< 19.10	< 19.20	< 19.20
10/18/22	< 17.58	< 17.65	< 17.65	< 23.15	< 9.810	< 23.27	< 23.15	< 23.15
10/25/22	< 39.00	< 39.00	< 16.42	< 39.00	< 38.94	< 24.44	< 24.44	< 24.49
11/02/22	< 26.54	< 11.15	< 26.58	< 26.58	< 26.58	< 14.79	< 35.28	< 35.22
11/09/22	< 25.00	< 25.05	< 25.05	< 25.05	< 10.50	< 33.02	< 33.02	< 32.96
11/15/22	< 39.16	< 39.99	< 39.07	< 23.05	< 23.00	< 22.91	< 9.894	< 23.05
11/22/22	< 14.37	< 31.63	< 31.63	< 31.63	< 31.74	< 22.38	< 26.52	< 26.56
11/29/22	< 13.27	< 31.64	< 31.64	< 31.64	< 31.53	< 20.96	< 21.00	< 21.00
12/07/22	< 22.15	< 22.19	< 22.15	< 29.34	< 12.34	< 29.43	< 29.39	< 29.34
12/13/22	< 15.01	< 35.79	< 35.79	< 35.79	< 35.57	< 23.44	< 23.63	< 11.23
12/20/22	< 15.95	< 16.96	< 15.95	< 15.95	< 8.137	< 7.421	< 15.20	< 14.24
12/27/22	< 31.84	< 33.79	< 31.90	< 31.90	< 14.33	< 10.11	< 20.78	< 20.74

(a) Weekly set was lost in transit and unable to be analyzed.

TABLE 3-4
AIRBORNE IODINE
(10^{-3} pCi/m³)

PERIOD ENDING	LOCATIONS				
	22	23	24*	01A	05A
01/05/22	< 23.39	< 31.15	< 27.46	< 27.46	< 36.58
01/12/22	< 25.74	< 33.50	< 25.88	< 25.74	< 29.72
01/18/22	< 19.45	< 8.208	< 8.898	< 8.880	< 8.898
01/25/22	< 16.92	< 9.295	< 15.56	< 15.56	< 15.56
02/01/22	< 20.53	< 20.53	< 20.57	< 9.326	< 20.57
02/08/22	< 11.47	< 11.47	< 30.56	< 30.67	< 30.61
02/15/22	< 28.73	< 25.98	< 22.73	< 28.78	< 28.41
02/22/22	< 17.27	< 9.246	< 20.53	< 21.84	< 20.94
03/01/22	< 20.86	< 13.95	< 18.12	< 18.38	< 18.25
03/08/22	< 19.89	< 21.07	< 15.29	< 16.11	< 16.08
03/15/22	< 33.61	< 35.82	< 15.18	< 33.61	< 35.42
03/22/22	< 31.06	< 32.91	< 20.24	< 20.10	< 20.21
03/29/22	< 19.30	< 16.26	< 23.74	< 24.02	< 23.78
04/05/22	< 14.64	< 15.50	< 14.75	< 12.25	< 14.75
04/12/22	< 24.71	< 24.71	< 24.37	< 24.71	< 10.29
04/19/22	< 19.74	< 19.81	< 18.12	< 17.77	< 18.06
04/26/22	< 33.87	< 33.82	< 6.758	< 6.805	< 6.758
05/03/22	< 19.56	< 19.56	< 16.39	< 16.30	< 16.39
05/10/22	< 21.86	< 21.86	< 9.896	< 21.98	< 21.75
05/17/22	< 17.31	< 17.31	< 20.78	< 20.85	< 20.81
05/24/22	< 20.95	< 20.95	< 21.42	< 21.23	< 21.38
05/31/22	< 17.51	< 17.51	< 16.40	< 16.40	< 16.46
06/07/22	< 30.73	< 30.73	< 28.06	< 28.11	< 28.06
06/14/22	< 27.84	< 27.79	< 27.50	< 27.89	< 18.40
06/22/22	< 25.40	< 25.40	< 23.04	< 22.93	< 23.14
06/28/22	< 37.86	< 38.17	< 38.92	< 40.04	< 38.27

*Control Station

TABLE 3-4
AIRBORNE IODINE
(10⁻³ pCi/m³)

PERIOD ENDING	LOCATIONS				
	22	23	24*	01A	05A
07/05/22	< 8.477	< 18.50	< 30.46	< 32.10	< 30.78
07/12/22 (a)					
07/20/22	< 28.38	< 28.64	< 25.45	< 25.13	< 25.33
07/26/22	< 28.03	< 28.03	< 25.84	< 25.95	< 25.84
08/02/22	< 27.70	< 27.70	< 24.39	< 24.43	< 24.39
08/09/22	< 29.43	< 29.38	< 29.23	< 29.43	< 12.28
08/16/22	< 18.39	< 18.39	< 15.20	< 18.36	< 18.29
08/23/22	< 19.04	< 19.04	< 17.26	< 16.93	< 17.05
08/30/22	< 23.38	< 11.09	< 22.99	< 22.99	< 22.95
09/06/22	< 34.03	< 14.27	< 25.39	< 25.39	< 25.48
09/13/22	< 44.51	< 44.44	< 40.49	< 40.92	< 40.77
09/20/22	< 16.91	< 16.97	< 19.65	< 19.37	< 19.61
09/28/22	< 26.68	< 26.60	< 26.53	< 26.73	< 26.57
10/04/22	< 20.15	< 16.89	< 28.01	< 27.83	< 27.95
10/11/22	< 27.32	< 27.32	< 11.32	< 27.32	< 27.08
10/18/22	< 16.07	< 16.10	< 16.33	< 7.624	< 16.24
10/25/22	< 10.31	< 24.49	< 29.49	< 29.49	< 29.44
11/02/22	< 35.22	< 35.28	< 18.79	< 18.76	< 18.88
11/09/22	< 13.82	< 32.96	< 23.50	< 23.46	< 23.50
11/15/22	< 31.72	< 31.72	< 30.48	< 30.92	< 12.92
11/22/22	< 26.56	< 26.56	< 27.88	< 27.63	< 27.73
11/29/22	< 21.00	< 14.04	< 19.99	< 20.06	< 19.99
12/07/22	< 18.19	< 18.19	< 18.25	< 15.27	< 18.25
12/13/22	< 23.63	< 23.63	< 23.00	< 23.18	< 23.00
12/20/22	< 14.27	< 14.27	< 21.20	< 21.16	< 22.54
12/27/22	< 20.74	< 21.97	(b)	< 26.67	< 25.08

*Control Station

(a) Weekly set was lost in transit and unable to be analyzed.

(b) Due to a pump malfunction run time was 4.5 hours.

TABLE 3-5
AIR PARTICULATES
(10⁻³ pCi/m³)

GAMMA SPECTRA - QTR 1 (12/28/21 - 03/29/22)

LOCATION	Be-7		Cs-134	Cs-137
	(+/-)			
01	146.70	22.110	< 1.1610	< 0.6558
02	106.70	24.860	< 1.2750	< 0.8541
03	140.00	25.160	< 1.4070	< 1.0860
04	129.80	21.210	< 1.2020	< 0.9061
05	142.20	28.860	< 1.3170	< 1.4670
06	121.20	26.310	< 1.1430	< 1.0090
07	156.70	30.390	< 1.7070	< 1.7800
21	150.80	28.020	< 1.1770	< 0.9580
22	107.00	23.170	< 0.9635	< 0.8978
23	154.90	28.350	< 1.1480	< 0.9796
24*	152.50	22.010	< 0.8287	< 0.6876
01A	103.40	23.500	< 1.0310	< 0.9434
05A	152.30	29.940	< 1.8880	< 1.3310

GAMMA SPECTRA AND STRONTIUM 89/90- QTR 2 (03/29/22 - 06/28/22)

LOCATION	Be-7		Cs-134	Cs-137	Sr-89	Sr-90
	(+/-)					
01	141.20	26.410	< 1.7590	< 1.8750	< 9.4100	< 3.7100
02	132.10	22.940	< 1.2940	< 0.8569	< 7.8100	< 4.2500
03	172.20	22.820	< 0.9318	< 0.9674	< 8.6000	< 4.0800
04	148.10	27.950	< 1.9660	< 1.7460	< 9.3600	< 4.0200
05	136.40	22.900	< 1.1350	< 0.9706	< 9.0600	< 4.2800
06	144.60	23.330	< 1.3900	< 1.3850	< 9.2800	< 4.1700
07	158.00	30.840	< 1.6490	< 0.9719	< 9.3000	< 3.6000
21	142.20	21.730	< 1.0520	< 1.2780	< 8.7700	< 4.8300
22	118.60	19.090	< 0.8579	< 0.8938	< 9.5000	< 5.5600
23	174.00	24.180	< 1.2690	< 1.1080	< 9.6100	< 4.2100
24*	151.70	29.910	< 1.9400	< 1.4570	< 8.3100	< 4.1800
01A	125.70	20.340	< 1.0870	< 0.7541	< 9.6700	< 3.9700
05A	148.60	26.040	< 1.1940	< 1.0070	< 9.7600	< 0.9600

* Control Location

TABLE 3-5
AIR PARTICULATES
(10⁻³ pCi/m³)

GAMMA SPECTRA - QTR 3 (06/28/22 - 09/28/22)

LOCATION	Be-7		Cs-134	Cs-137
	(+/-)			
01	158.10	28.860	< 1.2500	< 0.8641
02	151.80	27.380	< 1.2430	< 1.1850
03	166.50	34.400	< 1.8300	< 2.0750
04	139.50	27.070	< 1.0160	< 0.7964
05	134.10	26.730	< 0.8645	< 1.1200
06	141.80	27.910	< 1.2100	< 0.8691
07	156.80	24.360	< 1.3800	< 0.9361
21	119.60	28.640	< 1.2790	< 1.5550
22	134.70	27.050	< 1.3450	< 0.8991
23	153.20	28.140	< 1.4070	< 1.1790
24*	133.70	35.900	< 1.6660	< 1.2980
01A	139.20	26.340	< 1.1720	< 0.9337
05A	153.20	25.740	< 1.3870	< 0.7364

GAMMA SPECTRA - QTR 4 (09/28/22 - 12/27/22)

LOCATION	Be-7		Cs-134	Cs-137	Annual Mean	
	(+/-)				Be-7 (+/-)	
01	108.90	19.300	< 1.2140	< 0.9932	138.73	24.17
02	100.90	22.620	< 1.0180	< 1.1350	122.88	24.45
03	93.520	19.260	< 1.1190	< 0.8909	143.06	25.41
04	115.10	22.450	< 1.2900	< 1.0020	133.13	24.67
05	78.750	16.610	< 1.4490	< 0.7666	122.86	23.78
06	95.950	18.760	< 1.0240	< 0.7673	125.89	24.08
07	105.10	22.420	< 1.2230	< 0.6274	144.15	27.00
21	97.520	20.500	< 1.5930	< 1.3320	127.53	24.72
22	112.00	26.070	< 1.9740	< 1.4110	118.08	23.85
23	100.70	22.820	< 0.8962	< 1.0030	145.70	25.87
24*	101.60	21.440	< 1.0600	< 1.1560	134.88	27.32
01A	108.10	17.880	< 1.1670	< 1.1890	119.10	22.02
05A	103.50	19.750	< 1.0390	< 0.8355	139.40	25.37

Mean of All Indicator Locations 131.71 24.615

* Control Location

TABLE 3-6
Soil
(pCi/kg dry wt.)

LOCATION	COLLECTION DATE	Sr-89		Sr-90		K-40		Cs-134		Cs-137		Ra-226	
						(+/-)				(+/-)		(+/-)	
01	07/05/22	< 1120.0	< 36.600	24060	2027.0	< 78.050	< 78.830	< 1431.0					
02	07/05/22	< 2110.0	< 35.300	10020	1437.0	< 91.440	322.60 92.190	1918.0 1137.0					
03	07/05/22	< 1340.0	< 40.000	5401.0	1160.0	< 89.130	168.30 78.270	< 1946.0					
04	07/05/22	< 2300.0	< 37.900	5718.0	1263.0	< 109.30	< 147.60	< 2139.0					
05	07/05/22	< 2050.0	< 33.300	13000	1963.0	< 108.20	269.90 110.70	< 1965.0					
06	07/05/22	< 1910.0	< 29.900	9652.0	1687.0	< 145.60	< 140.00	< 2471.0					
07	07/05/22	< 2090.0	< 29.900	4905.0	1148.0	< 122.40	< 135.30	< 1983.0					
21	07/05/22	< 2060.0	< 30.300	10120	1527.0	< 93.620	319.30 99.200	< 1779.0					
22	07/05/22	< 1900.0	< 35.000	16560	1063.0	< 66.250	< 67.980	2405.0 1165.0					
23	07/05/22	< 2710.0	< 31.100	23470	1369.0	< 71.470	< 64.750	3095.0 817.10					
24*	07/05/22	< 1360.0	< 20.700	23200	1243.0	< 47.840	< 45.300	< 865.00					
05A	07/05/22	< 1750.0	< 28.300	8857.0	776.20	< 50.750	59.060 28.140	1357.0 643.30					
Mean		-	-	12914	1388.6	-	227.83 81.700	2193.8 940.60					

LOCATION	COLLECTION DATE	Th-228		Th-232	
		(+/-)	(+/-)	(+/-)	(+/-)
01	07/05/22	185.90	145.10	< 315.80	
02	07/05/22	762.90	179.20	715.60	187.00
03	07/05/22	480.40	147.10	581.00	209.00
04	07/05/22	781.00	139.70	< 539.10	
05	07/05/22	1155.0	170.20	1350.0	277.80
06	07/05/22	1958.0	190.60	1852.0	335.20
07	07/05/22	1106.0	225.30	1374.0	224.10
21	07/05/22	1118.0	147.50	1215.0	231.40
22	07/05/22	1672.0	97.430	1553.0	124.70
23	07/05/22	1768.0	86.770	1718.0	173.50
24*	07/05/22	185.10	58.590	< 214.10	
05A	07/05/22	738.90	74.780	733.00	107.90
Mean		992.60	138.52	1232.40	207.84

* Control Location

TABLE 3-7
Precipitation
(pCi/L)

LOCATION 01A

<u>COLLECTION DATE</u>	<u>Gr-B</u>		<u>H-3</u>	<u>RainFall (inches)</u>
	(+/-)			
01/25/22	1.8	1.0	< 878	5.48
02/22/22	< 1.6		< 1020	1.38
03/29/22	2.6	1.1	< 923	4.26
04/26/22	2.7	1.1	< 942	2.30
05/31/22	4.4	1.3	< 1010	4.87
06/28/22	2.7	1.1	< 936	4.07
07/26/22	10.8	1.8	< 961	2.88
08/30/22	5.3	1.4	< 934	5.30
09/28/22	4.5	1.4	< 961	3.26
10/25/22	< 1.5		< 939	2.44
11/29/22	2.6	1.2	< 1020	2.83
12/27/22	5.2	1.3	< 1180	4.76
Mean	4.3	1.3	-	Total 43.83

TABLE 3-7
Precipitation
(pCi/L)

LOCATION 01A

COLLECTION DATE	Be-7	Mn-54	Fe-59	Co-58	Co-60	Zn-65	Zr-95
06/28/22	< 86.08	< 1.423	< 28.55	< 4.863	< 1.115	< 2.916	< 11.79
12/27/22	< 44.92	< 1.759	< 12.12	< 3.792	< 1.619	< 3.813	< 7.186
Mean	-	-	-	-	-	-	-

COLLECTION DATE	Nb-95	Cs-134	Cs-137	Ba-140	La-140	I-131	Th-228
06/28/22	< 6.922	< 1.274	< 0.982	< 78240 (a)	< 27250 (a)	< 539000 (a)	< 2.277
12/27/22	< 4.141	< 1.826	< 1.570	< 1220	< 396.4	< 8490	< 3.180
Mean	-	-	-	-	-	-	-

(a) Laboratory scheduled composite late causing the results to be higher than typical.

TABLE 3-8
MILK
(pCi/L)

LOCATION	COLLECTION DATE	K-40 (+/-)	Sr-89	Sr-90	I-131*	Cs-134*	Cs-137*	Ba-140*	La-140*
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*Milk samples could not be obtained in 2022 due to the lack of dairy farms within the sampling area.

*LLD Identified in ODCM

TABLE 3-9
Food and Vegetation
(pCi/kg wet wt.)

LOCATION 14B									
COLLECTION DATE	Be-7		K-40		I-131**	Cs-134**	Cs-137**	Th-228	
	(+/-)	(+/-)	(+/-)	(+/-)				(+/-)	(+/-)
04/12/22	10330	770.0	3552	667.8	< 52.00	< 47.98	< 40.91	134.2	80.15
05/10/22	1072	259.5	4644	607.3	< 33.20	< 29.55	< 20.14	< 41.91	< 46.94
06/14/22	1458	265.9	5851	577.2	< 49.40	< 27.11	< 26.43	< 99.97	< 57.79
07/12/22	1946	507.6	5640	1062	< 44.50	< 47.87	< 52.79	< 55.12	< 71.34
08/09/22	1335	305.1	5414	658.2	< 57.10	< 24.14	< 31.26	< 55.12	< 71.34
09/13/22	1074	343.4	4005	653.1	< 31.40	< 31.01	< 26.47	< 55.12	< 71.34
10/11/22	1878	521.8	6185	947.2	< 29.30	< 54.25	< 52.10	< 55.12	< 71.34
Mean	2728	424.8	5042	739.0	-	-	-	134.2	80.15

LOCATION 15									
COLLECTION DATE	Be-7		K-40		I-131**	Cs-134**	Cs-137**	Th-228	
	(+/-)	(+/-)	(+/-)	(+/-)				(+/-)	(+/-)
04/12/22	4755	625.1	5479	846.6	< 38.10	< 36.86	< 37.62		
05/10/22	1015	362.7	5084	750.5	< 32.10	< 45.41	< 40.98		
06/14/22	1848	391.5	5514	795.0	< 34.20	< 35.25	< 26.19		
07/12/22	960.9	337.5	5536	908.4	< 44.30	< 48.68	< 41.73		
08/09/22	1467	308.7	5480	816.9	< 47.90	< 31.86	< 31.83		
09/13/22	742.9	277.3	4691	723.6	< 42.80	< 30.51	< 30.24		
10/11/22	2126	313.9	2025	471.8	< 26.40	< 36.36	< 31.90		
Mean	1845	373.8	4830	759.0	-	-	-		

LOCATION 16*									
COLLECTION DATE	Be-7		K-40		I-131**	Cs-134**	Cs-137**	Th-228	
	(+/-)	(+/-)	(+/-)	(+/-)				(+/-)	(+/-)
04/12/22	3175	442.0	5147	849.7	< 43.80	< 37.94	< 39.46	< 73.13	< 45.08
05/10/22	792.7	224.5	3811	552.7	< 31.50	< 30.05	< 28.41	< 67.65	< 92.48
06/14/22	2669	422.6	5147	743.3	< 42.50	< 36.22	< 34.41	47.70	37.17
07/12/22	3081	535.5	5736	848.5	< 41.90	< 48.14	< 40.41	< 46.70	< 67.58
08/09/22	843.9	264.9	3461	602.3	< 43.90	< 26.77	< 30.60	< 46.70	< 67.58
09/13/22	1380	268.6	3358	492.3	< 42.70	< 25.30	< 27.83	< 46.70	< 67.58
10/11/22	2890	402.5	4505	638.5	< 22.90	< 30.87	< 33.66	< 46.70	< 67.58
Mean	2119	365.8	4452	675.3	-	-	-	47.70	37.17

*Control Station

** LLD identified in ODCM

TABLE 3-9
Food and Vegetation
(pCi/kg wet wt.)

LOCATION 23									
COLLECTION DATE	Be-7		K-40		I-131**	Cs-134**	Cs-137**	Th-228	
	(+/-)		(+/-)					(+/-)	
04/12/22	7708	645.3	3538	595.6	< 48.50	< 45.53	< 38.26	166.8	75.65
05/10/22	591.3	247.1	5142	696.0	< 46.00	< 40.30	< 34.26	< 47.04	
06/14/22	1973	375.2	4246	642.2	< 38.60	< 38.27	< 35.43	< 59.26	
07/12/22	593.8	311.4	5325	890.7	< 39.20	< 44.07	< 39.99	< 77.08	
08/09/22	3230	504.0	3984	800.4	< 58.70	< 45.35	< 40.47	< 70.70	
09/13/22	3254	439.3	2473	531.6	< 46.40	< 40.11	< 33.10	103.2	58.43
10/11/22	2713	416.6	3483	572.9	< 25.00	< 34.77	< 34.95	< 79.18	
Mean	2866	419.8	4027	675.6	-	-	-	135.0	67.04

LOCATION 26									
COLLECTION DATE	Be-7		K-40		I-131**	Cs-134**	Cs-137**		
	(+/-)		(+/-)						
04/12/22	7308	665.1	3296	719.8	< 53.10	< 43.97	< 34.92		
05/10/22	751.4	385.9	4782	659.5	< 19.90	< 26.06	< 31.43		
06/14/22	1572	237.6	3513	459.2	< 36.30	< 24.56	< 24.22		
07/12/22	1683	348.1	4012	671.0	< 52.40	< 32.79	< 43.40		
08/09/22	2002	326.1	3159	596.2	< 42.90	< 27.70	< 36.29		
09/13/22	1260	350.2	3100	806.3	< 47.30	< 32.47	< 29.70		
10/11/22	2856	533.1	2857	619.0	< 20.10	< 43.57	< 38.81		
Mean	2490	406.6	3531	647.3	-	-	-		

All Indicator Mean	Be-7		K-40		I-131**	Cs-134**	Cs-137**	Th-228	
	(+/-)		(+/-)					(+/-)	
	2482	406.3	4358	705.2	-	-	-	134.7	134.7

** LLD identified in ODCM

TABLE 3-10
WELL WATER
(pCi/L)

LOCATION	COLLECTION DATE	H-3	Sr-89	Sr-90	Mn-54	Fe-59	Co-58	Co-60	Zn-65
01A	03/29/22	< 921	(a)	(a)	< 8.52	< 14.2	< 9.08	< 8.92	< 18.1
	06/28/22	< 931	< 3.73	< 0.808	< 6.70	< 14.1	< 6.94	< 7.79	< 15.9
	09/28/22	< 957	(a)	(a)	< 5.86	< 11.5	< 5.35	< 7.24	< 12.6
	12/27/22	< 1190	(a)	(a)	< 6.57	< 14.9	< 7.45	< 8.14	< 16.3
	Mean	-	-	-	-	-	-	-	-

LOCATION	COLLECTION DATE	Zr-95	Nb-95	I-131	Cs-134	Cs-137	Ba-140	La-140
01A	03/29/22	< 14.7	< 10.7	< 9.46	< 8.60	< 8.37	< 32.6	< 13.6
	06/28/22	< 12.7	< 9.81	< 9.85	< 7.66	< 7.37	< 26.6	< 10.0
	09/28/22	< 9.28	< 7.82	< 8.84	< 5.18	< 5.86	< 24.4	< 7.82
	12/27/22	< 13.1	< 9.15	< 9.78	< 8.51	< 7.97	< 29.6	< 10.3
	Mean	-	-	-	-	-	-	-

(a) Sr-89/90 analyses performed on the second quarter sample.

TABLE 3-11
River Water
(pCi/L)

LOCATION 11

COLLECTION DATE	H-3 (+/-)	Sr-89	Sr-90	Mn-54*	Fe-59*	Co-58*	Co-60*	Zn-65*
01/12/22	(a)	(b)	(b)	< 5.538	< 10.96	< 5.484	< 5.659	< 14.02
02/15/22	(a)	(b)	(b)	< 4.818	< 7.197	< 4.094	< 4.414	< 9.321
03/15/22	4680 857.0	(b)	(b)	< 4.623	< 8.991	< 4.024	< 6.118	< 9.141
04/12/22	(a)	(b)	(b)	< 6.155	< 14.46	< 5.101	< 5.140	< 10.58
05/17/22	(a)	(b)	(b)	< 5.257	< 12.64	< 6.068	< 7.538	< 11.38
06/14/22	5120 902.0	< 4.700	< 0.874	< 4.204	< 8.122	< 4.953	< 6.233	< 9.332
07/26/22	(a)	(b)	(b)	< 7.937	< 11.96	< 7.202	< 9.687	< 14.92
08/16/22	(a)	(b)	(b)	< 4.615	< 8.733	< 4.878	< 5.285	< 11.54
09/13/22	5330 892.0	(b)	(b)	< 5.302	< 11.94	< 6.453	< 9.192	< 8.477
10/11/22	(a)	(b)	(b)	< 1.678	< 3.689	< 1.977	< 1.925	< 3.369
11/15/22	(a)	(b)	(b)	< 4.662	< 9.791	< 5.049	< 7.461	< 11.61
12/13/22	6940 972.0	(b)	(b)	< 5.584	< 12.32	< 5.087	< 6.466	< 11.65
Mean	5518 905.8	-	-	-	-	-	-	-
	Nb-95*	Zr-95*	I-131*	Cs-134*	Cs-137*	Ba-140*	La-140*	
01/12/22	< 5.472	< 10.28	< 0.427	< 6.006	< 6.311	< 24.48	< 9.000	
02/15/22	< 4.713	< 8.468	< 0.825	< 5.486	< 5.164	< 26.18	< 6.604	
03/15/22	< 4.079	< 9.833	< 0.775	< 4.190	< 5.368	< 21.63	< 8.527	
04/12/22	< 6.283	< 10.30	< 0.751	< 6.275	< 7.051	< 26.86	< 6.444	
05/17/22	< 5.707	< 10.72	< 0.827	< 6.100	< 4.822	< 23.84	< 8.002	
06/14/22	< 4.374	< 6.342	< 0.712	< 5.818	< 5.788	< 24.34	< 7.141	
07/26/22	< 7.288	< 12.55	< 0.852	< 8.857	< 4.194	< 23.95	< 10.99	
08/16/22	< 4.584	< 7.664	< 0.794	< 4.338	< 5.053	< 20.56	< 5.052	
09/13/22	< 6.451	< 11.57	< 0.854	< 6.992	< 5.981	< 22.66	< 9.192	
10/11/22	< 1.710	< 2.825	< 0.320	< 1.746	< 1.701	< 6.496	< 2.099	
11/15/22	< 5.493	< 10.06	< 0.985	< 6.181	< 7.007	< 25.82	< 7.902	
12/13/22	< 5.469	< 11.17	< 0.920	< 6.162	< 7.024	< 22.13	< 6.497	
Mean	-	-	-	-	-	-	-	

* LLD identified in ODCM.

(a) Tritium analyses on quarterly composite.

(b) Sr-89/90 performed on 2nd quarter composite sample.

TABLE 3-12
Surface Water
(pCi/L)

LOCATION 08

COLLECTION DATE	H-3 (+/-)	Sr-89	Sr-90	Mn-54*	Fe-59*	Co-58*	Co-60*	Zn-65*
01/12/22	(a)	(b)	(b)	< 4.601	< 8.796	< 5.429	< 7.196	< 11.75
02/15/22	(a)	(b)	(b)	< 4.890	< 10.94	< 4.805	< 5.618	< 10.95
03/15/22	4170 831.0	(b)	(b)	< 4.486	< 12.02	< 4.500	< 4.745	< 11.44
04/12/22	(a)	(b)	(b)	< 5.544	< 15.33	< 6.333	< 5.071	< 13.57
05/17/22	(a)	(b)	(b)	< 6.888	< 13.41	< 7.139	< 7.206	< 8.779
06/14/22	7750 1020	< 3.460	< 0.901	< 6.350	< 14.04	< 7.071	< 8.001	< 15.31
07/26/22	(a)	(b)	(b)	< 5.954	< 10.68	< 5.505	< 6.609	< 13.89
08/16/22	(a)	(b)	(b)	< 5.612	< 10.16	< 6.940	< 7.412	< 13.68
09/13/22	5670 908.0	(b)	(b)	< 6.137	< 14.80	< 6.041	< 7.716	< 14.43
10/11/22	(a)	(b)	(b)	< 3.044	< 6.222	< 3.384	< 3.764	< 6.401
11/15/22	(a)	(b)	(b)	< 6.794	< 15.23	< 6.914	< 5.596	< 13.22
12/13/22	8440 1040	(b)	(b)	< 4.327	< 11.10	< 7.389	< 5.789	< 10.93
Mean	6508 949.8	-	-	-	-	-	-	-
	Nb-95*	Zr-95*	I-131*	Cs-134*	Cs-137*	Ba-140*	La-140*	
01/12/22	< 5.162	< 7.977	< 0.730	< 5.668	< 5.810	< 21.61	< 5.244	
02/15/22	< 5.898	< 10.82	< 0.724	< 5.389	< 5.603	< 23.35	< 8.395	
03/15/22	< 6.333	< 7.744	< 0.837	< 6.610	< 4.678	< 31.18	< 8.381	
04/12/22	< 8.348	< 11.69	< 0.831	< 6.519	< 7.259	< 25.07	< 6.767	
05/17/22	< 6.247	< 9.926	< 0.872	< 8.978	< 6.568	< 24.69	< 9.780	
06/14/22	< 8.972	< 10.33	< 0.820	< 6.203	< 6.689	< 26.46	< 7.235	
07/26/22	< 4.827	< 12.73	< 0.871	< 6.916	< 6.110	< 23.36	< 9.286	
08/16/22	< 6.787	< 12.07	< 0.696	< 5.996	< 7.036	< 22.32	< 7.100	
09/13/22	< 7.589	< 12.92	< 0.834	< 5.105	< 5.141	< 21.26	< 5.672	
10/11/22	< 2.757	< 5.009	< 0.922	< 2.871	< 3.247	< 10.85	< 4.189	
11/15/22	< 6.480	< 12.13	< 0.827	< 6.729	< 6.946	< 25.66	< 6.863	
12/13/22	< 5.863	< 10.89	< 0.887	< 8.035	< 7.531	< 21.14	< 8.290	
Mean	-	-	-	-	-	-	-	

* LLD identified in ODCM.

(a) Tritium analyses on quarterly composite.

(b) Sr-89/90 performed on 2nd quarter composite sample.

TABLE 3-12
Surface Water
(pCi/L)

LOCATION 09A**

COLLECTION DATE	H-3	Sr-89	Sr-90	Mn-54*	Fe-59*	Co-58*	Co-60*	Zn-65*
01/12/22	(a)	(b)	(b)	< 7.158	< 12.09	< 7.207	< 7.924	< 16.10
02/15/22	(a)	(b)	(b)	< 4.987	< 11.48	< 4.613	< 6.083	< 12.49
03/15/22	< 954	(b)	(b)	< 4.433	< 10.77	< 4.208	< 4.000	< 10.56
04/12/22	(a)	(b)	(b)	< 7.319	< 14.39	< 6.191	< 5.729	< 12.73
05/17/22	(a)	(b)	(b)	< 6.017	< 10.05	< 6.660	< 5.635	< 13.72
06/14/22	< 1010	< 4.300	< 0.806	< 6.867	< 12.04	< 6.241	< 9.396	< 8.959
07/26/22	(a)	(b)	(b)	< 6.277	< 9.120	< 5.734	< 6.110	< 10.74
08/16/22	(a)	(b)	(b)	< 6.703	< 10.01	< 5.357	< 6.002	< 15.02
09/13/22	< 964	(b)	(b)	< 6.301	< 11.52	< 5.065	< 5.750	< 13.97
10/11/22	(a)	(b)	(b)	< 3.080	< 5.969	< 2.640	< 3.368	< 6.117
11/15/22	(a)	(b)	(b)	< 5.837	< 12.15	< 6.532	< 7.493	< 9.547
12/13/22	< 984	(b)	(b)	< 7.172	< 13.53	< 6.543	< 7.937	< 12.78
Mean	-	-	-	-	-	-	-	-
	Nb-95*	Zr-95*	I-131*	Cs-134*	Cs-137*	Ba-140*	La-140*	
01/12/22	< 6.898	< 11.74	< 0.369	< 7.439	< 7.095	< 22.81	< 5.928	
02/15/22	< 5.280	< 10.00	< 0.782	< 5.189	< 5.507	< 22.76	< 9.534	
03/15/22	< 4.522	< 8.827	< 0.877	< 5.495	< 5.029	< 23.32	< 8.740	
04/12/22	< 5.246	< 11.64	< 0.880	< 5.824	< 5.052	< 17.05	< 9.231	
05/17/22	< 7.220	< 11.19	< 0.803	< 8.092	< 7.521	< 20.47	< 8.864	
06/14/22	< 4.876	< 9.037	< 0.779	< 6.033	< 5.593	< 18.11	< 8.289	
07/26/22	< 5.742	< 8.953	< 0.882	< 7.159	< 5.503	< 23.43	< 7.006	
08/16/22	< 5.188	< 10.53	< 0.724	< 6.170	< 6.756	< 23.79	< 8.765	
09/13/22	< 6.151	< 9.520	< 0.797	< 5.840	< 5.982	< 20.62	< 7.647	
10/11/22	< 2.788	< 4.689	< 0.327	< 2.983	< 3.466	< 11.34	< 4.276	
11/15/22	< 5.897	< 7.724	< 0.878	< 7.394	< 6.140	< 16.31	< 8.670	
12/13/22	< 7.806	< 12.76	< 0.903	< 8.615	< 7.599	< 30.36	< 6.506	
Mean	-	-	-	-	-	-	-	

* LLD identified in ODCM.

**Control location.

(a) Tritium analyses on quarterly composite.

(b) Sr-89/90 performed on 2nd quarter composite sample.

TABLE 3-13
Sediment Silt
(pCi/kg dry wt.)

LOCATION	COLLECTION DATE	Sr-89		Sr-90		K-40		Cs-134		Cs-137		Ra-226	
							(+/-)						(+/-)
08	04/12/22	(a)		(a)		1716	517.6	< 42.74		< 31.34		< 917.5	
09A*	04/12/22	(a)		(a)		14580	1482	< 53.91		< 52.93		< 1065	
11	04/12/22	(a)		(a)		17610	1829	< 89.23		< 73.39		< 1797	
08	10/17/22	< 1750		< 30.30		1819	681.4	< 46.23		< 48.15		< 899.1	
09A*	10/17/22	< 1810		< 29.70		13340	1677	< 68.58		< 70.64		< 1304	
11	10/17/22	< 1680		< 32.30		18050	1692	< 86.90		< 72.94		< 1321	
	Indicator Mean	-		-		9799	1180	-		-		-	
	Control Mean	-		-		13960	1580	-		-		-	

LOCATION	COLLECTION DATE	Th-228		Th-232	
			(+/-)		(+/-)
08	04/12/22	< 68.22		< 133.3	
09A*	04/12/22	90.94	58.49	< 279.3	
11	04/12/22	635.4	118.7	< 445.5	
08	10/17/22	< 76.41		< 239.5	
09A*	10/17/22	240.8	93.43	< 380.1	
11	10/17/22	710.2	114.7	952.3	205.7
	Indicator Mean	672.8	116.7	952.3	205.7
	Control Mean	165.9	75.96	-	-

(a) Sr-89/90 analyses performed annually.
* Control location, Background location

TABLE 3-14
Shoreline Soil
(pCi/kg dry wt.)

		LOCATIONS						
LOCATION	COLLECTION DATE	Sr-89	Sr-90	K-40 (+/-)		Cs-134*	Cs-137*	Ra-226
08	04/12/22	(a)	(a)	1521	571.0	< 45.44	< 48.63	< 789.6
08	10/17/22	< 1780	< 45.10	1011	548.0	< 64.21	< 48.69	< 967.3
	Mean	-	-	1266	559.5	-	-	-

LOCATION	COLLECTION DATE	Th-228 (+/-)		Th-232
08	04/12/22	99.27	56.17	< 265.2
08	10/17/22	< 86.09		< 184.4
	Mean	99.27	56.17	-

*LLD identified on ODCM

(a) Sr-89/90 analyses performed annually.

TABLE 3-15
Fish
(pCi/kg wet wt.)

LOCATION	Fish Type	COLLECTION DATE	K-40		Mn-54*	Fe-59*	Co-58*	Co-60*	Zn-65*
				(+/-)					
08	(a)	05/09/22	1166	300.2	< 19.48	< 41.25	< 18.74	< 20.81	< 41.73
	(b)	05/09/22	1457	382.3	< 23.14	< 48.86	< 23.72	< 23.13	< 47.58
	(a)	11/02/22	1117	351.7	< 23.93	< 59.71	< 22.75	< 28.05	< 50.78
	(b)	11/02/22	648.1	405.6	< 31.85	< 61.01	< 33.96	< 29.15	< 61.93
25**	(a)	05/11/22	1350	820.3	< 57.54	< 109.2	< 73.26	< 64.77	< 136.8
	(b)	05/11/22	1728	993.3	< 66.65	< 125.6	< 64.84	< 48.22	< 103.9
	(a)	11/28/22	1349	694.8	< 52.61	< 102.2	< 63.59	< 69.73	< 103.6
	(b)	11/29/22	2096	1098	< 67.21	< 181.0	< 77.62	< 81.00	< 152.2
		Mean	1364	630.8	-	-	-	-	-
		Indicator Mean	1097	360.0	-	-	-	-	-
		Control Mean	1631	901.6	-	-	-	-	-
LOCATION		COLLECTION DATE	Cs-134*		Cs-137*				
08	(a)	05/09/22	< 21.24		< 20.66				
	(b)	05/09/22	< 24.45		< 25.25				
	(a)	11/02/22	< 24.48		< 24.52				
	(b)	11/02/22	< 34.07		< 35.94				
25**	(a)	05/11/22	< 61.59		< 53.92				
	(b)	05/11/22	< 63.66		< 55.94				
	(a)	11/28/22	< 58.51		< 52.57				
	(b)	11/29/22	< 74.92		< 76.38				
		Mean	-		-				
		Indicator Mean	-		-				
		Control Mean	-		-				

* LLD identified in ODCM

**Control Station

(a) Non-bottom dwelling species of gamefish.

(b) Bottom dwelling species of fish.

4. DISCUSSION OF RESULTS

Data from the radiological analyses of environmental media collected during 2022 and tabulated in Section 3, are discussed below. Except for TLDs, Teledyne Brown Engineering analyzed all samples throughout the year. The procedures and specifications followed for these analyses are as required in the TBE quality assurance manuals and laboratory procedures. In addition to internal quality control measurements performed by each laboratory, they also participate in an Interlaboratory Comparison Program. Participation in this program ensures that independent checks on the precision and accuracy of the measurements of radioactive material in environmental samples are performed. The results of the Interlaboratory Comparison Programs are provided in Appendix B.

The predominant radioactivity detected throughout 2022 was that from external sources, such as fallout from nuclear weapons tests and naturally occurring radionuclides. Naturally occurring nuclides such as Be-7, K-40, Th-228 and Th-232 were detected in numerous samples. Th-228 & Th-232 results were variable and are generally at levels higher than plant related radionuclides. In the past, Cs-137, a plant related nuclide, has been detected in soil and aquatic sediment samples at levels corresponding to levels associated with fallout from nuclear weapons tests.

The following is a discussion and summary of the results of the environmental measurements taken during the 2022 reporting period.

4.1 *Gamma Exposure Rate*

A thermoluminescent dosimeter (TLD) is an inorganic crystal used to detect ambient radiation. TLDs are placed in two concentric rings around the station. The inner ring is located at the site boundary, and the outer ring is located at approximately five miles from the station. TLDs are also placed in special interest areas, such as population areas and nearby residences. Additional TLDs serve as controls. Ambient radiation comes from naturally occurring radioisotopes in the air and soil, radiation from cosmic origin, fallout from nuclear weapons testing, station effluents and direct radiation from the station.

The results of the analyses are presented in Table 3-2. Figure 4-1 shows the historical trend of TLD exposure rate measurements. Control and indicator averages indicate a steady relationship. Two dosimeters made of CaF and LiF sensitive elements are deployed at each sampling location. These TLDs replaced the previously used CaSO₄:Dy in Teflon TLDs in January 2001. The dose with the replacement TLDs is lower than that of the previously used TLDs. This will continue to be monitored.

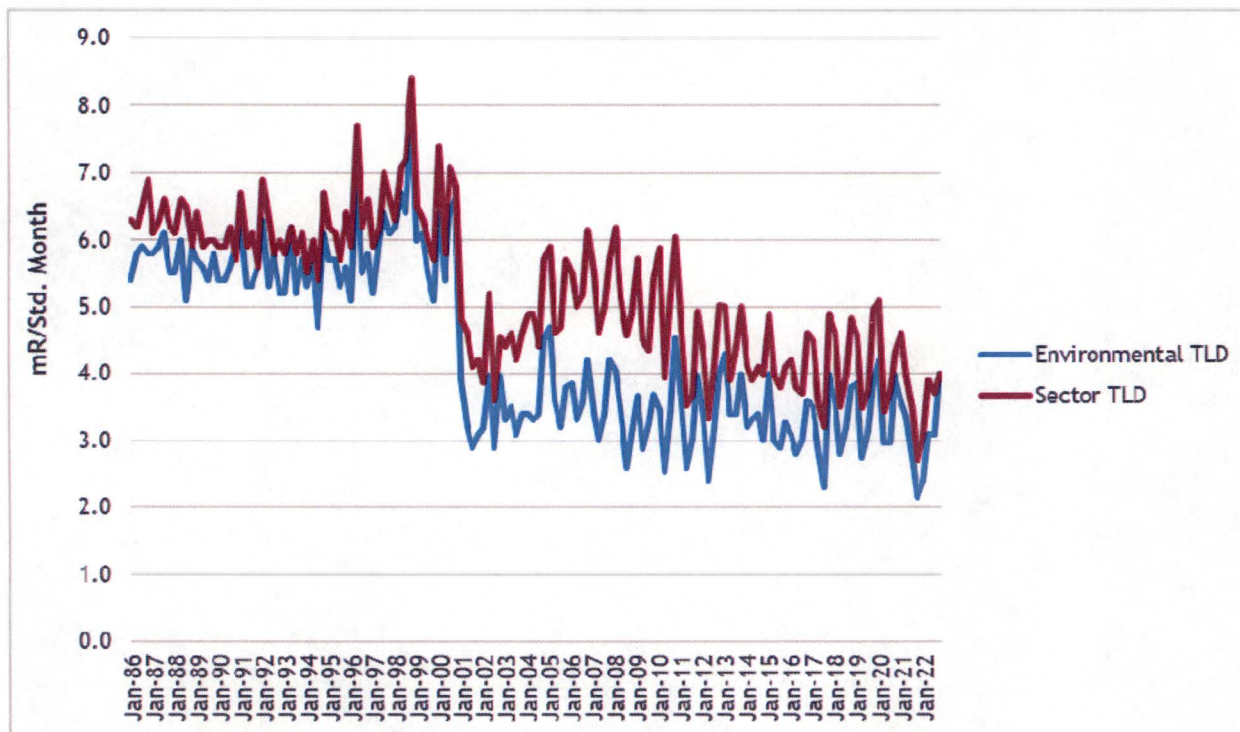


Figure 4-1 TLD (mrem/Standard Month)

Sector TLDs are deployed quarterly at thirty-two locations in the environs of the North Anna site. Two badges are placed at each location. The average level of these 32 sector TLD locations (two badges at each location) was 3.7 mR/standard month with a range of 0.6 to 7.5 mR/standard month. The highest quarterly average reading for any single location was obtained at location NW-29/61. This value was 6.4 mR/standard month. This location is on site on the Laydown Area north gate. Quarterly and annual TLDs are also located at twelve environmental air sampling stations. For the eleven indicator locations within 10 miles of the station the average quarterly reading was 3.0 mR/standard month with a range of 1.4 to 5.2 mR/standard month. The average annual reading for these locations was 3.1 mR/standard month with a range from 1.4 to 4.6 mR/standard month. The control location showed a quarterly average of 2.6 mR/standard month with a range of 2.3 to 2.9 mR/standard month. Its annual reading was 3.1 mR/standard month. 10 emergency sector TLDs, which are all located onsite had a quarterly average of 4.6 mR/standard month with EPSP-9/10 having the highest quarterly average of 6.9 mR/standard month. Eight other TLDs, designated C-1 thru C-8, which were pre-operational controls, were collected quarterly from four locations. Stations C-3/4 and C-7/8 are designated controls. These had a quarterly average of 3.0 mR/standard month, while Station C-1/2 and C-5/6 had a quarterly average of 2.3 mR/standard month with a range of 0.9 to 3.0 mR/standard month. During the pre-operational period (starting in 1977) the doses were measured between 4.3 and 8.8 mR/standard month.

4.2 Airborne Gross Beta

Results of the weekly gross beta analyses are presented in Table 3-3. A review of the historical plot in Figure 4-2, indicates gross beta activity levels have remained relatively unchanged. The drop indicated in 2009 is a function of a return to the vendor used from 1988 until 2001. Inner and outer ring monitoring locations continue to show no significant variation in measured activities (see Figure 4-3). This indicates that any station contribution is not measurable.

Gross beta activity found during the pre-operational and early operating period of North Anna Power Station was higher because of nuclear weapons testing. During that time, nearly 740 nuclear weapons were tested worldwide. In 1985 weapons testing ceased, and with the exception of the Chernobyl accident in 1986, airborne gross beta results have remained steady. During the preoperational period of July 1, 1974 through March 31, 1978 gross beta activities ranged from a low of 0.005 pCi/m³ to a high of 0.75 pCi/m³.

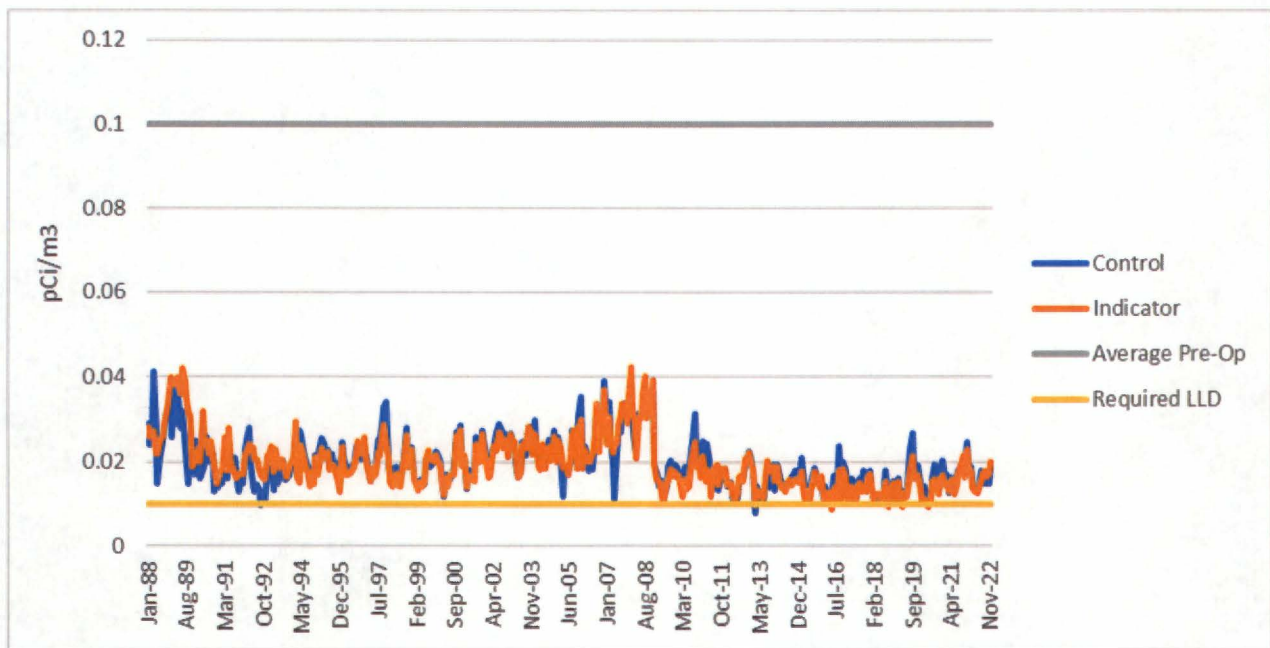


Figure 4-2 Historical Gross Beta in Air Particulates

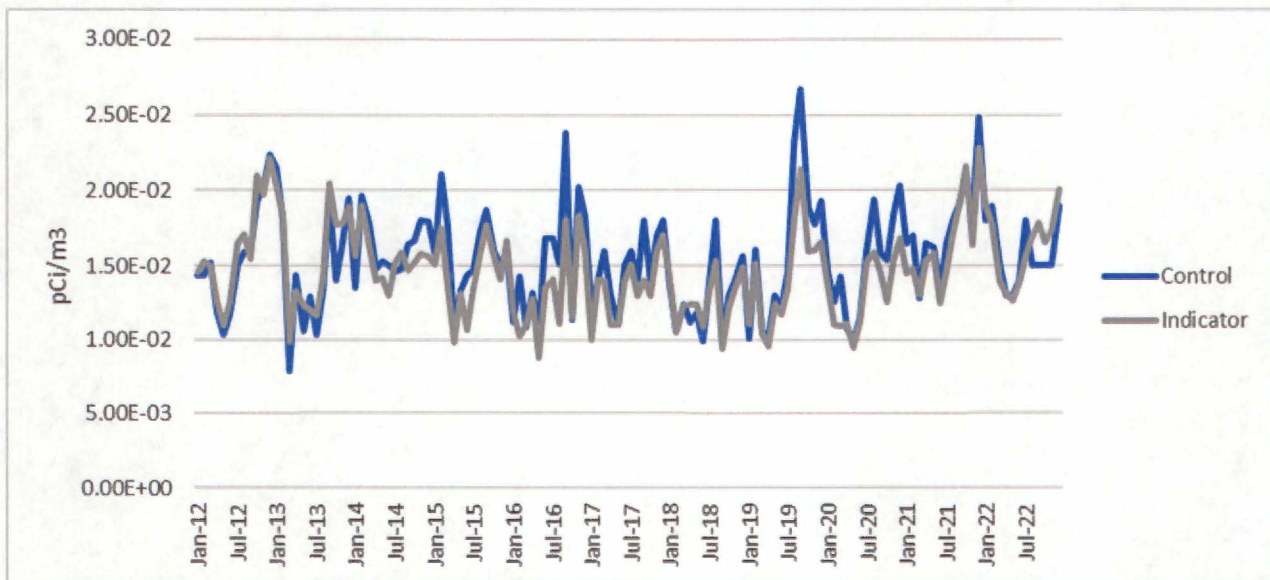


Figure 4-3 2022 Gross Beta in Air Particulates (pCi/m³)

4.3 Airborne Radioiodine

Charcoal cartridges are used to collect airborne radioiodine. Once a week the samples are collected and analyzed. The results of the analyses are presented in Table 3-4. These results are similar to pre-operational data and the results of samples taken prior to and after the 1986 accident in the Soviet Union at Chernobyl and the effect of the Fukushima Daiichi event.

4.4 Air Particulate Gamma

The air particulate filters that are utilized for the weekly gross beta analyses are composited by location and analyzed quarterly by gamma spectroscopy. The results are listed in Table 3-5. The results indicate the presence of naturally occurring Be-7, which is produced by cosmic processes. Examination of pre-operational data indicates comparable measurements of Be-7, as would be expected. The results of these analyses indicate the lack of station effects on the environment.

4.5 Air Particulate Strontium

Strontium-89 and 90 analyses are performed on the second quarter composites of air particulate filters from all monitoring stations. There has been no detection of these fission products at any of the indicator or control stations in recent years.

4.6 Soil

Soil samples, which are collected every three years from twelve stations, were collected in 2022. Cs-137 was identified in 5 of 11 indicator samples. The average for indicator stations was 227.83 pCi/Kg. No plant related isotopes were identified in the sample from the control station. During the preoperational phase Cs-137 was routinely detected and was attributed to fallout. Levels during this phase varied by location and date and ranged from 88 to 1390 pCi/Kg. The average was 645 pCi/kg. The current levels are also varied significantly by location and date. The decrease in the average, and the fact that the averages for the control location and the indicator locations are similar is indicative of fallout. No other plant related isotopes were identified in Soil samples during 2022.

4.7 Precipitation

A sample of rain water was collected monthly, when available, at on-site station 01A and analyzed for gross beta activity and H-3. The results are presented in Table 3-7. Twelve precipitation samples were obtained in 2022. Semi-annual composites are prepared and analyzed for gamma emitting isotopes in accordance with program requirements. No plant related isotopes were reported in any precipitation water sample at the indicator location. Naturally occurring gamma emitting radioisotopes were not detected. No positive H-3 result was reported. During the pre-operational period gross beta activity in rain water was expressed in nCi per square meter of the collector surface, thus a direct comparison cannot be made to the 2022 period. During the pre-operational period, tritium was measured in over half of the few quarterly composites made. This tritium activity ranged from 100 to 330 pCi/liter.

4.8 Cow Milk

Milk samples were unavailable during the reporting period due to the closure of the final operating dairy within the sampling area on 1/1/18.

4.9 Food Products and Vegetation

Food/vegetation samples were collected from five locations and analyzed by gamma spectroscopy. The results of the analyses are presented in Table 3-9. Low levels of Cs-137, attributable to fallout, have been seen periodically in vegetation samples. Naturally occurring potassium-40 and cosmogenic beryllium-7 were detected in all samples. Naturally occurring thorium-228 was detected in four of thirty five samples. No plant related isotopes were identified in any vegetation sample during 2022.

4.10 Well Water

Water was sampled quarterly from the onsite well at the metrology laboratory. These samples were analyzed for gamma

radiation and for tritium. The second quarter sample was analyzed by vendor for Sr-89, Sr-90, H-3, I-131, and gamma emitters. The results of these analyses are presented in Table 3-10. No plant related isotopes were detected. No gamma emitting isotopes were detected during the pre-operational period.

4.11 River Water

Samples of water from the North Anna River were collected monthly. The analyses are presented in Table 3-11. All monthly samples are analyzed by gamma spectroscopy. The monthly samples are composited quarterly and analyzed for tritium. Additionally, the second quarter samples are analyzed for strontium-89 and strontium-90 in accordance with program requirements. There has been no detection of these fission products at any of the indicator or control stations in recent years.

No gamma emitting radioisotopes were positively identified in any of the samples. There was no measured activity of strontium-89 or strontium-90. Tritium was measured in all four samples with an average annual concentration of 5518 pCi/liter and a range of 4680 to 6940 pCi/liter, see Figure 4-4. No river water samples were collected during the pre-operational period.

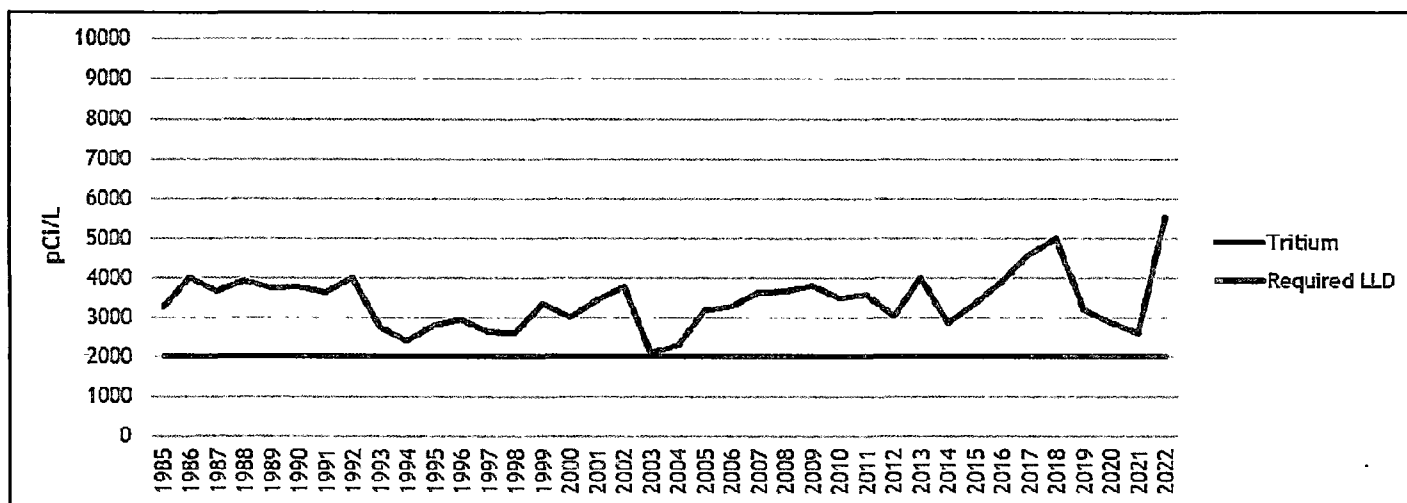


Figure 4-4 Tritium in River water

4.12 Surface Water

Samples of surface water were collected monthly from two stations, an indicator station located at the discharge lagoon and a control station located 12.9 miles WNW. The samples were analyzed by gamma spectroscopy and for iodine-131 by radiochemical separation. A quarterly composite from each station was prepared and analyzed for tritium. Additionally, the second quarter samples are analyzed for strontium-89 and strontium-90. There has been no positive indication of these fission products at any of the indicator or control stations in recent years. The results are presented in Table 3-12.

No non-naturally occurring gamma emitting radioisotopes, including iodine were detected in any of the samples. Tritium was not detected in any sample at the control location. The average level of tritium activity at the indicator location was 6508 pCi/L with a range of 4170 to 8440 pCi/L.

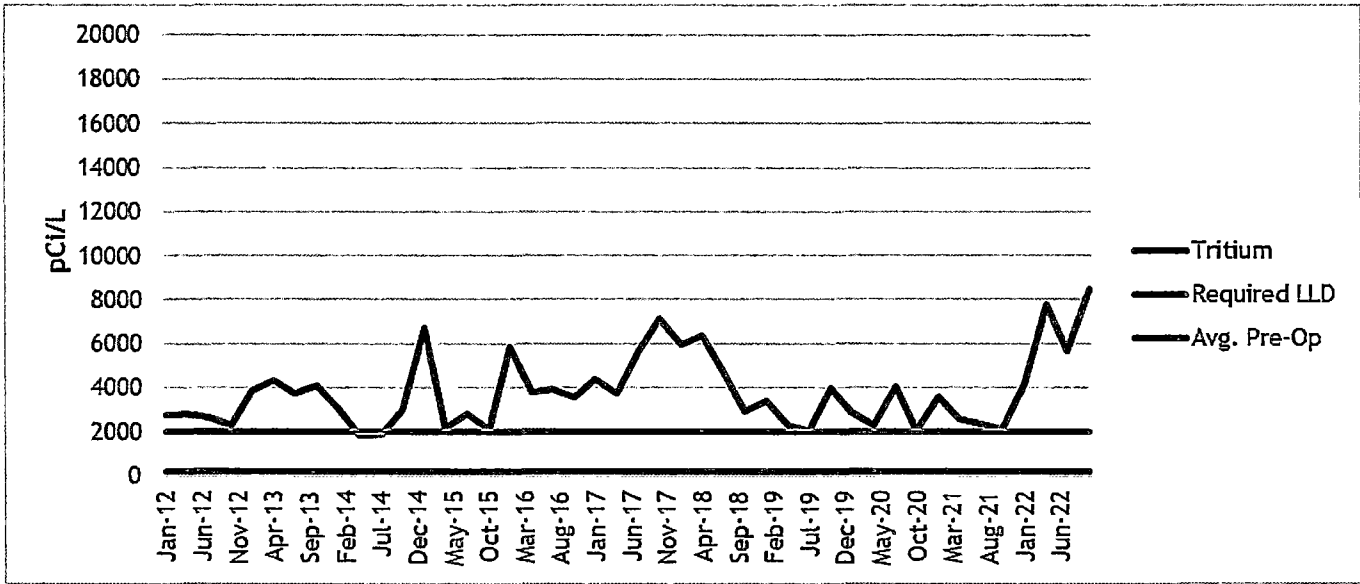


Figure 4.5 Tritium in Surface Water

4.13 Bottom Sediment

Bottom sediment or silt is sampled to evaluate any buildup of radionuclides in the environment due to the operation of the station. Buildup of radionuclides in bottom sediment could indirectly lead to increasing radioactivity levels in fish.

Sediment samples were collected during April and October from each of three locations and were analyzed by gamma spectroscopy. The October samples were analyzed for strontium-89 and strontium-90. The results are presented in Table 3-13.

No plant related isotopes were detected in 2022. The detection of Cs-137 in bottom sediment is historically common with positive indications usually apparent in both indicator and control samples. The detection of Cs-137 is the result of accumulation and runoff into the lake of residual weapons testing fallout; its global presence has been well documented. During the pre-operational period sediment samples were also analyzed by gamma spectroscopy. Figure 4-6 shows the historical trend of Cs-137 in sediments.

Neither Strontium-89 nor Strontium-90 was detected in any samples of aquatic sediment/silt in 2022. Strontium-90 has been detected occasionally in the past at both the indicator and control locations and is attributable to fallout from past bomb tests. Several naturally occurring radioisotopes were detected in these samples at background levels.

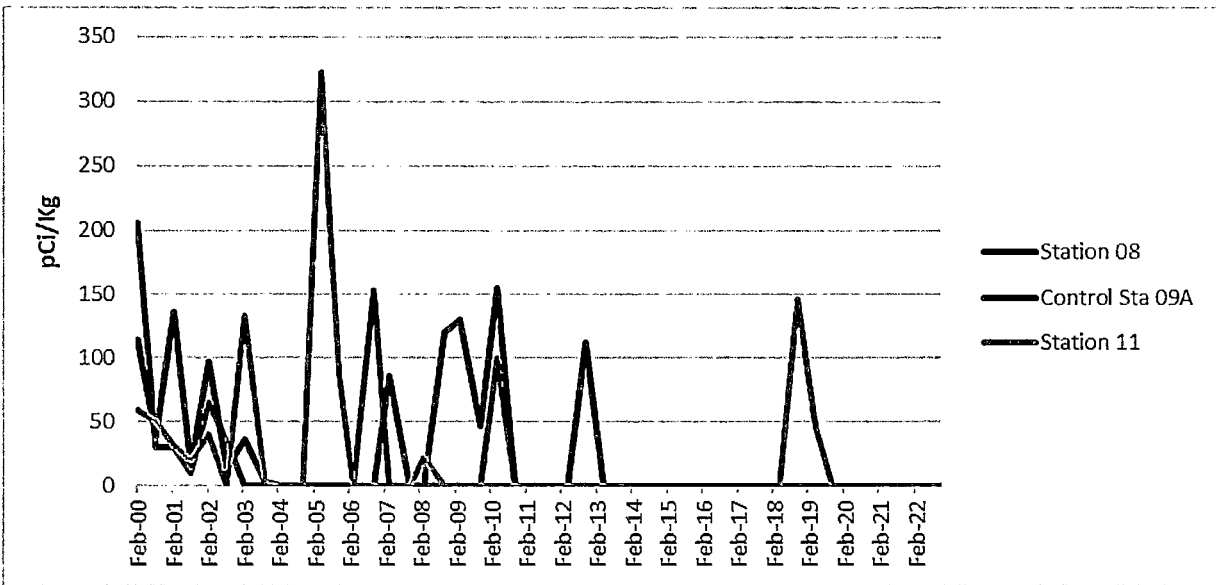


Figure 4-6 Cs-137 in Sediment/Silt

4.14 Shoreline Soil

Shoreline soil/sediment, unlike bottom sediment, may provide a direct dose to humans. Buildup of radioisotopes along the shoreline may provide a source of direct exposure for those using the area for commercial and recreational uses. Samples of shoreline soil were collected in April and October from indicator station 08. The samples were analyzed by gamma spectroscopy. The October sample was analyzed for strontium-89 and strontium-90. The results are presented in Table 3-14.

Naturally occurring radioisotopes were detected at concentrations equivalent to normal background activities. No plant related isotopes were detected in any indicator samples analyzed. Strontium-90 is often detected in this media, however as discussed previously, the presence of Sr-90 and Cs-137 is attributed to accumulation of residual global fallout from past atmospheric weapons testing.

4.15 Fish

Four sample sets of fish, two from Lake Anna and two from the control station, Lake Orange, were collected during 2022 and analyzed by gamma spectroscopy. Each sample set consisted of a sample of game species and a sample of bottom-dwelling species, which were analyzed separately. The results are presented in Table 3-15. Naturally occurring K-40 was detected in all samples. No plant related isotopes were detected. Cs-137 was measured in pre-operational environmental fish samples.

5. PROGRAM EXCEPTIONS

REMP Exceptions for Scheduled Sampling and Analysis during 2022 – North Anna

Location	Description	Date of Sampling	Reason(s) for Loss/Exception
14B,15,16,23,26	Vegetation	01/12/22	Seasonal unavailability
14B,15,16,23,26	Vegetation	02/08/22	Seasonal unavailability
14B,15,16,23,26	Vegetation	03/08/22	Seasonal unavailability
14B,15,16,23,26	Vegetation	11/09/22	Seasonal unavailability
14B,15,16,23,26	Vegetation	12/13/22	Seasonal unavailability
SSE-16/48	TLD	03/29/22	TLD's missing due to power pole being replaced
01-07,01A,05A 21- 24	AP / Charcoal	07/25/22	Shipping container damaged, samples lost
08,09A,11	Surface Water River Water	07/25/22	Shipping container damaged, samples lost. Re-sampled 7/26/22.
S-18	TLD	06/28/22	TLD was misplaced by vendor for 2 nd Quarter 2022
24	AP / Charcoal	12/27/22	Air sampler malfunction. Insufficient sample volume to meet required LLD.

REFERENCES

Dominion, North Anna Power Station Technical Specifications, Units 1 and 2.

Dominion, North Anna Power Station Independent Spent Fuel Storage Installation Technical Specifications.

Dominion, Station Administrative Procedure, VPAP-2103N, "Offsite Dose Calculation Manual".

Virginia Electric and Power Company, North Anna Technical Procedure, HP-3051.010, "Radiological Environmental Monitoring Program".

Title 10 Code of Federal Regulation, Part 50 (10CFR50), "Domestic Licensing of Production and Utilization Facilities".

United States Nuclear Regulatory Commission Regulatory Guide 1.109, Rev. 1, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10CFR50, Appendix I", October, 1977.

United States Nuclear Regulatory Commission, Regulatory Guide 4.8 "Environmental Technical Specifications for Nuclear Power Plants", December 1975.

USNRC Branch Technical Position, "Acceptable Radiological Environmental Monitoring Program", Rev. 1, November 1979.

NUREG 0472, "Radiological Effluent Technical Specifications for PWRs", Rev. 3, March 1982.

HASL-300, Environmental Measurements Laboratory, "EML Procedures Manual," 27th Edition, Volume 1, February 1992.

NUREG/CR-4007, "Lower Limit of Detection: Definition and Elaboration of a Proposed Position for Radiological Effluent and Environmental Measurements," September 1984.

APPENDICES

APPENDIX A: LAND USE CENSUS

Year 2022

LAND USE CENSUS

North Anna Power Station

Louisa County, Virginia

January 1 to December 31, 2022

<i>Direction</i>	<i>Distance (miles)</i>					
	<i>Nearest Site Boundary</i>	<i>Nearest Resident</i>	<i>Nearest Garden (> 50m²)</i>	<i>Nearest Meat Animal</i>	<i>Nearest Milch Cow</i>	<i>Nearest Milch Goat</i>
<i>N</i>	0.87	1.3	2.75	NONE	NONE	NONE
<i>NNE</i>	0.85	0.9	3.25	1.6	NONE	NONE
<i>NE</i>	0.82	0.9	1.6	1.6	NONE	NONE
<i>ENE</i>	0.81	2.37	2.4	2.49	NONE	NONE
<i>E</i>	0.83	1.25	2.05	3.5	NONE	NONE
<i>ESE</i>	0.85	1.53	1.7	NONE	NONE	NONE
<i>SE</i>	0.88	1.4	1.9	1.4	NONE	NONE
<i>SSE</i>	0.91	1.0	2.66	1.6	NONE	NONE
<i>S</i>	0.94	1.03	1.48	2.0	NONE	NONE
<i>SSW</i>	1.01	1.11	2.00	2.0	NONE	NONE
<i>SW</i>	1.06	1.56	3.96	NONE	NONE	NONE
<i>WSW</i>	1.09	1.62	2.26	NONE	NONE	NONE
<i>W</i>	1.06	1.5	1.96	NONE	NONE	NONE
<i>WNW</i>	1.02	1.1	2.67	NONE	NONE	NONE
<i>NW</i>	0.97	0.98	1.09	NONE	NONE	NONE
<i>NNW</i>	0.90	1.0	1.33	2.3	NONE	NONE

2021 to 2022 Land Use Census Changes

Nearest	Direction	2021 Distance	2022 Distance
Resident	ESE	1.70	1.53
	SW	1.65	1.56
Site Boundary	NONE		
Garden	ESE	1.70*	1.70*
	SE	1.40	1.90
	W	1.93	1.96
Meat Animal	NONE		
Milch Cow	NONE		
Milch Goat	NONE		

*Physical Address Changed, Distance Stayed the Same

APPENDIX B: SUMMARY OF INTERLABORATORY COMPARISONS

YEAR 2022

Summary of Results – Inter-laboratory Comparison Program (ICP)

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 $\pm 20\%$ of the reference value
- Acceptable with Warning (flag = "W") - result falls in the $\pm 20\%$ to $\pm 30\%$ 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, 142 out of 150 analyses performed met the specified acceptance criteria. Eight analyses did not meet the specified acceptance criteria and were addressed through the TBE Corrective Action Program. *NOTE: Two analyses (soil for Tc-99 and U-238) 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 Analytics March 2022 AP Ce-141 result was evaluated as *Not Acceptable*. The reported value for Ce-141 was 60.9 pCi and the known result was 42.0 pCi/L (1.45 ratio of reported result vs. known; TBE's internal acceptance range is 0.70 - 1.30). This sample was used as the workgroup duplicate with a result of 45.7 (109% of known) and was also counted on a different detector with a result of 50.9 (121% of known). This was TBE's first failure for AP Ce-141. (NCR 22-04)
2. The MAPEP February 2022 Urine U-234 & U-238 results were evaluated as *Not Acceptable*.

TBE's reported values of 0.142 and 0.0254 were above the known upper ranges of 0.0096 and 0.0134 respectively for U-234 and U-238. These spiked values were below TBE's typical MDC for urine client samples. The samples were re-prepped using a larger sample aliquot and counted for 60 hours as opposed to 48 hours. The recount results were 0.00732 for U-234 and 0.0119 for U-238 (both within acceptable range). MAPEP urine samples will be flagged to use a larger sample aliquot and counting time than typical client samples. MAPEP did not include any urine cross-check samples in August. (NCR 22-05)

3. The ERA MRAD September 2022 AP Pu-238 was evaluated as *Not Acceptable*. The reported value was 38.8 pCi and the known result was 29.9 (acceptance range 22.6 – 36.7). The AP filter was cut in half prior to digestion (shared with Fe-55) but should have been completely digested together and aliquotted afterwards like typical client samples. This is the first failure for AP Pu-238. (NCR 22-19)
4. The ERA October 2022 water Uranium result was evaluated as *Not Acceptable*. The reported value was 10.54 pCi/L and the known was 8.53 (acceptance range 6.60 – 9.88) or 124% of the known (acceptable for TBE QC). The 2-sigma error was 3.2, placing the reported result well within the acceptable range. This sample was used as the workgroup duplicate with a result of 8.2 +/- 2.9 pCi/L (also within the acceptable range). All other QA was reviewed with no anomalies. (NCR 22-20)
5. The Analytics AP Co-60 result was evaluated as *Not Acceptable*. The reported value was 207 pCi and the known was 147 (141% of the known). TBE's internal QC acceptance is 70 - 130%. All QA was reviewed with no anomalies. This sample was used as the workgroup duplicate and counted on a different detector with a result of 167 pCi (114% of the known). This is the first failure for AP Co-60 – average result ratio compared to the known is 109%. (NCR 22-21)
6. The MAPEP August 2022 water Tc-99 result was evaluated as *Not Acceptable*. The reported value was 1.86 +/- 0.414 Bq/L for this "false positive" test. The evaluation of the submitted result to the 3 times the uncertainty indicated a slight positive. This sample was used as the workgroup duplicate with a result of 0.88 +/- 0.374 Bq/L. All QC was reviewed, and no anomalies found. This is the first unacceptable since the resumption of reporting water Tc-99 for the 3rd quarter of 2020. TBE to known ratios have ranged from 94-109% during this time. (NCR 22-22)

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

**Analytics Environmental Radioactivity Cross Check Program
Teledyne Brown Engineering Environmental Services**

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value ^(a)	Ratio of TBE to Analytics Result	Evaluation ^(b)
March 2022	E13706	Milk	Sr-89	pCi/L	80.3	96.8	0.83	A
			Sr-90	pCi/L	12.7	12.6	1.01	A
	E13707	Milk	Ce-141	pCi/L	62.3	65	0.96	A
			Co-58	pCi/L	158	164	0.96	A
			Co-60	pCi/L	286	302	0.95	A
			Cr-51	pCi/L	314	339	0.93	A
			Cs-134	pCi/L	155	182	0.85	A
			Cs-137	pCi/L	210	223	0.94	A
			Fe-59	pCi/L	211	185	1.14	A
			I-131	pCi/L	88.0	96.7	0.91	A
			Mn-54	pCi/L	169	164	1.03	A
			Zn-65	pCi/L	238	246	0.97	A
			E13708	Charcoal	I-131	pCi	79.9	87.1
	E13709	AP	Ce-141	pCi	60.9	42.0	1.45	N ^(d)
			Co-58	pCi	118	107	1.11	A
			Co-60	pCi	218	196	1.11	A
			Cr-51	pCi	251	221	1.14	A
			Cs-134	pCi	129	118	1.09	A
			Cs-137	pCi	156	145.0	1.07	A
			Fe-59	pCi	124	120.0	1.03	A
			Mn-54	pCi	120	107	1.12	A
	E13710	Soil	Ce-141	pCi/g	0.123	0.103	1.19	A
			Co-58	pCi/g	0.254	0.263	0.97	A
			Co-60	pCi/g	0.493	0.483	1.02	A
			Cr-51	pCi/g	0.603	0.543	1.11	A
			Cs-134	pCi/g	0.268	0.292	0.92	A
			Cs-137	pCi/g	0.399	0.431	0.93	A
			Fe-59	pCi/g	0.320	0.296	1.08	A
			Mn-54	pCi/g	0.263	0.263	1.00	A
	E13711	AP	Sr-89	pCi	83.2	97.4	0.85	A
			Sr-90	pCi	12.7	12.7	1.00	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

**Analytics Environmental Radioactivity Cross Check Program
Teledyne Brown Engineering Environmental Services**

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value ^(a)	Ratio of TBE to Analytics Result	Evaluation ^(b)		
September 2022	E13712	Milk	Sr-89	pCi/L	71.1	89.1	0.80	A		
			Sr-90	pCi/L	12.0	13.6	0.88	A		
	E13713	Milk	Ce-141	pCi/L	148	161	0.92	A		
			Co-58	pCi/L	178	189	0.94	A		
			Co-60	pCi/L	229	260	0.88	A		
			Cr-51	pCi/L	486	456	1.07	A		
			Cs-134	pCi/L	220	252	0.87	A		
			Cs-137	pCi/L	203	222	0.92	A		
			Fe-59	pCi/L	174	173	1.01	A		
			I-131	pCi/L	75.9	94.2	0.81	A		
			Mn-54	pCi/L	269	282	0.95	A		
			Zn-65	pCi/L	364	373	0.97	A		
			E13714	Charcoal	I-131	pCi	81.4	83.6	0.97	A
			E13715	AP	Ce-141	pCi	102	91	1.12	A
					Co-58	pCi	118	107	1.11	A
Co-60	pCi	207			147	1.41	N ⁽²⁾			
Cr-51	pCi	310			257	1.21	W			
Cs-134	pCi	148			142	1.04	A			
Cs-137	pCi	137			125	1.10	A			
Fe-59	pCi	115			98	1.18	A			
Mn-54	pCi	168			159	1.05	A			
Zn-65	pCi	240			211	1.14	A			
E13716	Soil	Ce-141	pCi/g	0.288	0.284	1.01	A			
		Co-58	pCi/g	0.320	0.334	0.96	A			
		Co-60	pCi/g	0.445	0.459	0.97	A			
		Cr-51	pCi/g	0.883	0.805	1.10	A			
		Cs-134	pCi/g	0.410	0.446	0.92	A			
		Cs-137	pCi/g	0.447	0.465	0.96	A			
		Fe-59	pCi/g	0.314	0.305	1.03	A			
		Mn-54	pCi/g	0.489	0.499	0.98	A			
		Zn-65	pCi/g	0.666	0.660	1.01	A			
E13717	AP	Sr-89	pCi	87.5	98.3	0.89	A			
		Sr-90	pCi	12.6	15.0	0.84	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

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

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value ^(a)	Acceptance Range	Evaluation ^(b)
February 2022	22-GrF46	AP	Gross Alpha	Bq/sample	0.402	1.20	0.36 - 2.04	A
			Gross Beta	Bq/sample	0.669	0.68	0.341 - 1.022	A
	22-MaS46	Soil	Ni-63	Bq/kg	645	780	546 - 1014	A
			Tc-99	Bq/kg	526	778	545 - 1011	N ⁽³⁾
	22-MaSU46	Urine	Cs-134	Bq/L	1.67	1.77	1.24 - 2.30	A
			Cs-137	Bq/L	1.50	1.56	1.09 - 2.03	A
			Co-57	Bq/L	4.93	5.39	3.77 - 7.01	A
			Co-60	Bq/L	2.13	2.06	1.44 - 2.68	A
			Mn-54	Bq/L	4.83	5.08	3.56 - 6.60	A
			U-234	Bq/L	0.142	0.0074	0.0052 - 0.0096	N ⁽⁴⁾
			U-238	Bq/L	0.0254	0.0103	0.0072 - 0.0134	N ⁽⁴⁾
			Zn-65	Bq/L	4.71	4.48	3.14 - 5.82	A
	22-MaW46	Water	Ni-63	Bq/L	28.6	34.0	23.8 - 44.2	A
			Tc-99	Bq/L	8.59	7.90	5.5 - 10.3	A
	22-RdV46	Vegetation	Cs-134	Bq/sample	6.61	7.61	5.33 - 9.89	A
			Cs-137	Bq/sample	1.50	1.52	1.06 - 1.98	A
			Co-57	Bq/sample	5.11	5.09	3.56 - 6.62	A
			Co-60	Bq/sample	0.0162		(1)	A
			Mn-54	Bq/sample	2.42	2.59	1.81 - 3.37	A
			Sr-90	Bq/sample	0.684	0.789	0.552 - 1.026	A
			Zn-65	Bq/sample	1.44	1.47	1.03 - 1.91	A
	August 2022	22-MaS47	Soil	Ni-63	Bq/kg	14.6		(1)
Tc-99				Bq/kg	994	1000	700 - 1300	A
22-MaW47		Water	Ni-63	Bq/L	24.4	32.9	23.0 - 42.8	A
			Tc-99	Bq/L	1.9		(1)	N ⁽⁵⁾
25-RdV47		Vegetation	Cs-134	Bq/sample	0.032		(1)	A
			Cs-137	Bq/sample	0.891	1.08	0.758 - 1.408	A
			Co-57	Bq/sample	0.006		(1)	A
			Co-60	Bq/sample	4.04	4.62	3.23 - 6.01	A
			Mn-54	Bq/sample	2.01	2.43	1.70 - 3.16	A
			Sr-90	Bq/sample	1.25	1.60	1.12 - 2.08	W
			Zn-65	Bq/sample	6.16	7.49	5.24 - 9.74	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) Tc-99 soil cross-checks done for TBE information only - not required

(4) See NCR 22-05

**ERA Environmental Radioactivity Cross Check Program
Teledyne Brown Engineering Environmental Services**

Month/Year	Identification Number	Matrix	Nuclide	Units	TBE Reported Value	Known Value ^(a)	Acceptance Limits	Evaluation ^(b)	
March 2022	MRAD-38	Water	Am-241	pCi/L	68.3	74.6	51.2 - 95.4	A	
			Fe-55	pCi/L	797	1140	670 - 1660	A	
			Pu-238	pCi/L	146	147	88.4 - 180	A	
			Pu-239	pCi/L	69.9	71.9	44.5 - 88.6	A	
		Soil	Sr-90	pCi/kg	8050	6720	2090 - 10500	A	
			AP	Fe-55	pCi/filter	148	127	46.4 - 203	A
				Pu-238	pCi/filter	29.9	29.6	22.3 - 36.4	A
				Pu-239	pCi/filter	51.6	49.7	37.2 - 60.0	A
				U-234	pCi/filter	59.9	67.3	49.9 - 78.9	A
				U-238	pCi/filter	59.0	66.7	50.4 - 79.6	A
				GR-A	pCi/filter	95.6	94.2	49.2 - 155	A
				GR-B	pCi/filter	71.2	66.8	40.5 - 101	A
				April 2022	RAD-129	Water	Ba-133	pCi/L	61.7
Cs-134	pCi/L	80.9	81.6				68.8 - 89.8	A	
Cs-137	pCi/L	37.4	36.6				32.1 - 43.3	A	
Co-60	pCi/L	103	97.4				87.7 - 109	A	
Zn-65	pCi/L	318	302				272 - 353	A	
GR-A	pCi/L	26.9	20.8				10.4 - 28.3	A	
GR-B	pCi/L	49.7	51.0				34.7 - 58.1	A	
U-Nat	pCi/L	56.3	68.9				56.3 - 75.8	A	
H-3	pCi/L	17,000	18,100				15,800 - 19,000	A	
Sr-89	pCi/L	65.3	67.9				55.3 - 76.1	A	
Sr-90	pCi/L	42.1	42.7				31.5 - 49.0	A	
I-131	pCi/L	25.7	26.2				21.8 - 30.9	A	
September 2022	MRAD-37	Water	Am-241				pCi/L	111	96.2
			Fe-55	pCi/L	850	926	544 - 1350	A	
			Pu-238	pCi/L	62.1	52.6	31.6 - 68.2	A	
			Pu-239	pCi/L	139.5	117	72.5 - 144	A	
		Soil	Sr-90	pCi/kg	3350	6270	1950 - 9770	A	
			U-234	pCi/kg	1684	3350	1570 - 4390	A	
			U-238	pCi/kg	1658	3320	1820 - 4460	N ⁽²⁾	
		AP	Fe-55	pCi/filter	71.9	122	44.5 - 195	A	
			Pu-238	pCi/filter	38.8	29.9	22.8 - 36.7	N ⁽¹⁾	
			Pu-239	pCi/filter	14.5	13.0	9.73 - 15.7	A	
			U-234	pCi/filter	78.0	71.5	53.0 - 83.8	A	
			U-238	pCi/filter	79.7	70.9	53.5 - 84.6	A	
			GR-A	pCi/filter	62.8	55.5	29.0 - 91.4	A	
GR-B	pCi/filter	70.9	64.8	39.3 - 97.9	A				
October 2022	RAD-131	Water	Ba-133	pCi/L	76.2	79.4	66.6 - 87.3	A	
			Cs-134	pCi/L	28.0	30.5	23.9 - 33.6	A	
			Cs-137	pCi/L	202	212	191 - 235	A	
			Co-60	pCi/L	52.4	51.4	46.3 - 59.1	A	
			Zn-65	pCi/L	216	216	194 - 253	A	
			GR-A	pCi/L	19.7	16.9	8.28 - 23.7	A	
			GR-B	pCi/L	49.8	53.0	36.1 - 60.0	A	
			U-Nat	pCi/L	10.54	8.53	6.60 - 9.88	N ⁽³⁾	
			H-3	pCi/L	13,900	15,100	13,200 - 16,600	A	
			Sr-89	pCi/L	59.7	64.5	52.3 - 72.5	A	
			Sr-90	pCi/L	32.9	37.3	27.4 - 43.0	A	
			I-131	pCi/L	26.9	24.4	20.2 - 28.9	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 22-19

(2) U soil cross-checks done for TBE information only - not required

(3) See NCR 22-20