VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

APR 27 2020

United States Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

Serial No.	20-154
S&L/JWD	R0
Docket Nos.	50-280
	50-281
	72-2
	72-55
License Nos.	DPR-32
	DPR-37
	SNM-2501

VIRGINIA ELECTRIC AND POWER COMPANY
SURRY POWER STATION UNITS 1 AND 2
INDEPENDENT SPENT FUEL STORAGE INSTALLATION
ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

Surry Units 1 and 2 Technical Specification 6.6.B.2 requires the submittal of an Annual Radiological Environmental Operating Report (AREOR) for Surry Power Station. Surry Independent Spent Fuel Storage Installation (ISFSI) Technical Specification Appendix C, Item 1.3.1 requires that the Surry ISFSI be included in the environmental monitoring for Surry Power Station. Accordingly, enclosed is the Surry Power Station AREOR for the period of January 1, 2019 through December 31, 2019, which includes environmental monitoring for the Surry ISFSI.

If you have any further questions, please contact William Terrry at 757-365-2010.

Sincerely,

David Wilson (Apr 27, 2020)

David H. Wilson
Director Safety & Licensing
Surry Power Station

Attachment

Commitments made in this letter: None

IE25
NMSS26
NRR
NMSS

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Serial No. 20-154
Docket Nos.: 50-280
50-281
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ATTACHMENT 1

2019 Annual Radiological Environmental Operating Report

SURRY POWER STATION UNITS 1 AND 2
VIRGINIA ELECTRIC AND POWER COMPANY

Dominion Energy

Surry Power Station

Radiological Environmental Monitoring Program

January 1, 2019 to December 31, 2019

Annual Radiological Environmental Operating Report

Surry Power Station

January 1, 2019 to December 31, 2019

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PREFACE

This report is submitted as required by Technical Specification 6.6.B.2, Annual Radiological Environment Operating Report, for Surry, Units 1 and 2, Virginia Electric and Power Company Docket Nos. 50-280 and 50-281, and the Surry Independent Spent Fuel Storage Installation (ISFSI) Technical Specifications, Appendix C, Item 1.3.1.

1. EXECUTIVE SUMMARY

This document is a detailed report of the 2019 Surry Power Station Radiological Environmental Monitoring Program (REMP). Radioactivity levels from January 1 through December 31, 2019, in air, water, silt, shoreline sediment, milk, aquatic biota, food products and direct exposure pathways have been analyzed, evaluated and summarized. The REMP is designed to confirm that radiological effluent releases are As Low As (is) 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 20-mile radius of the station. Surry Power Station 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. The first type, control samples, is collected from areas that are beyond the measurable influence of Surry Power Station or any other nuclear facility. These samples represent normal background radiation levels. Background radiation levels 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 control sample values and the pre-operational baseline to determine if changes in radioactivity levels are attributable to station operations, or natural variation, or other causes such as the Chernobyl and Fukushima Daiichi accidents that released radioactive material to the environment.

Teledyne Brown Engineering, Inc. (TBE) provides radioanalyses for this program and Mirion Technologies provides thermoluminescent dosimetry (TLD) 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 United States Nuclear Regulatory Commission (USNRC) requires that equipment used for radiological environmental monitoring must be able to detect specified minimum Lower Limits of Detection (LLDs). This ensures that analyses are as accurate as possible. The USNRC also mandates a reporting level for 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, aquatic, terrestrial and direct radiation exposure. The airborne exposure pathway includes radioactive airborne iodine and particulates. The 2019 airborne results were comparable to previous years. No station related radioactivity was detected and natural radioactivity levels remained at levels consistent with past years' results. Aquatic exposure pathway samples include well and river water, silt and shoreline sediments, crabs, fish, clams and oysters. Naturally occurring radionuclides such as beryllium-7, potassium-40, radium-226, thorium-228 and thorium-232 were detected at average environmental levels. No man-made radionuclides were detected in well water. This trend is consistent throughout the operational environmental monitoring program. No man-made radionuclides were detected in river water. Silt samples indicated the presence of cesium-137 and naturally occurring radionuclides. Cesium-137 concentrations were present in indicator location samples at nominal background levels. No other man-made radionuclides were detected. These background levels are attributable to fallout from historic weapons testing and nuclear accidents such as Chernobyl. Naturally occurring potassium-40, beryllium-7, radium-226 thorium-228 and thorium-232 were detected at average environmental levels. Shoreline sediment, which may provide a direct exposure pathway, contained no station related radionuclides. Naturally occurring radionuclides potassium-40, radium-226 thorium-228 and thorium-232 were detected at average environmental levels. The terrestrial exposure pathway includes milk and food products. Iodine-131 was not detected in any 2019 milk samples and has not been detected in milk prior to or since the 1986 Chernobyl accident. Strontium-90 was detected in milk and this activity is attributable to past atmospheric nuclear weapons testing. No other man-made radionuclides were detected in milk samples. Consistent with historical data, naturally occurring potassium-40 was detected in milk. No man-made radionuclides were detected in food product samples. Naturally occurring potassium-40 was detected in food product samples. The direct exposure pathway measures environmental radiation dose using TLDs. TLD results have remained relatively constant over the years.

During 2019, as in previous years, the operation of Surry Power Station has 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 2019 was 0.033 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 sources in the environment provide approximately 50% of radiation exposure to man, while nuclear power contributes less than 0.1%. These results demonstrate compliance with federal and state regulations and also demonstrate the adequacy of radioactive effluent controls at Surry Power Station.

2. PROGRAM DESCRIPTION

2.1 Introduction

This report documents the 2019 Surry Power Station operational Radiological Environmental Monitoring Program (REMP). Dominion Energy's Surry Power Station is located on the Gravel Neck peninsula adjacent to the James River, approximately 25 miles upstream of the Chesapeake Bay. 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 is designed with a nominal gross electrical output of 910 megawatts electric (MWe). Unit 1 achieved commercial operation on December 22, 1972, and Unit 2 on May 1, 1973.

The United States Nuclear Regulatory Commission regulations (10CFR50.34a) require that nuclear power plants be designed, constructed and operated to keep levels of radioactive material in effluents to unrestricted areas As Low As (is) Reasonably Achievable. To ensure these criteria are met, the operating license for Surry Power Station includes Technical Specifications that address the release of radioactive effluents. In-plant monitoring is used to ensure that these 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 station environs is also included in Surry Power Station Technical Specifications.

Dominion personnel are responsible for collecting the various indicator and control environmental samples. Mirion Technologies is responsible for processing the TLDs. Teledyne Brown Engineering is responsible 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 values, which vary with time due to external events, such as cosmic ray bombardment, nuclear weapons test fallout and seasonal variations of naturally occurring radionuclides. Data collected prior to station operation is used to indicate the degree of natural variation to be expected. This 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 may show the presence of man-made radionuclides. 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 the USNRC Regulatory Guide 4.8, "Environmental Technical Specifications for Nuclear Power Plants", (December, 1975) and VPAP-2103S, Offsite Dose Calculation Manual (Surry). 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 REMP for 2019 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 2019 sampling program for Surry Power Station. All samples listed in Table 2-1 are taken at indicator locations except those labeled "control location." Dominion Energy personnel collect all samples listed in Table 2-1.

Table 2-2 summarizes the analysis program conducted by Teledyne Brown Engineering and Mirion Technologies for Surry Power Station. All samples, with the exception of the TLDs, are shipped to Teledyne Brown Engineering, located in Knoxville, TN, for analysis. The TLDs are shipped to Mirion Technologies, located in Irvine, CA, for processing.

The Surry Radiological Monitoring Locations maps (Figures 1 – 5) denote sample locations for Surry Power Station. The locations are color coded to designate sample types.

Table 2-1

SURRY - 2019

RADIOLOGICAL SAMPLING STATIONS

DISTANCE AND DIRECTION FROM UNIT NO. 1

Sample Media	Location	Station	Distance Miles	Direction	Degrees	Collection Frequency	Remarks
Environmental	Control	(00)	-	-	-	Quarterly	Onsite (Stored in a lead shield outside the protected area)
TLDs	West North West	(02)	0.2	WNW	293°	Quarterly	Site Boundary
	Surry Station Discharge	(03)	0.4	NW	321°	Quarterly	Site Boundary
	North North West	(04)	0.2	NNW	329°	Quarterly	Site Boundary
	North	(05)	0.3	N	4°	Quarterly	Site Boundary
	North North East	(06)	0.3	NNE	28°	Quarterly	Site Boundary
	North East	(07)	0.3	NE	44°	Quarterly	Site Boundary
	East North East	(08)	0.4	ENE	67°	Quarterly	Site Boundary
	East	(09)	0.3	E	89°	Quarterly	Site Boundary
	West	(10)	0.1	W	271°	Quarterly	Site Boundary
	West South West	(11)	0.4	WSW	252°	Quarterly	Site Boundary
	South West	(12)	0.3	SW	228°	Quarterly	Site Boundary
	South South West	(13)	0.3	SSW	201°	Quarterly	Site Boundary
	South	(14)	0.4	S	182°	Quarterly	Site Boundary
	South South East	(15)	0.6	SSE	157°	Quarterly	Site Boundary
	South East	(16)	0.9	SE	135°	Quarterly	Site Boundary
	Station Intake	(18)	1.6	ESE	115°	Quarterly	Site Boundary
	Hog Island Reserve	(19)	2.0	NNE	26°	Quarterly	Near Resident
	Bacon's Castle	(20)	4.5	SSW	202°	Quarterly	Apx. 5 mile
	Route 633	(21)	4.9	SW	227°	Quarterly	Apx. 5 mile
	Alliance	(22)	5.1	WSW	247°	Quarterly	Apx. 5 mile
	Surry	(23)	7.7	WSW	256°	Quarterly	Population Center
	Route 636 and 637	(24)	4.0	W	270°	Quarterly	Apx. 5 mile
	Scotland Wharf	(25)	5.0	WNW	284°	Quarterly	Apx. 5 mile
	Jamestown	(26)	6.3	NW	308°	Quarterly	Apx. 5 mile
	Colonial Parkway	(27)	3.8	NNW	333°	Quarterly	Apx. 5 mile
	Route 617 and 618	(28)	4.9	NNW	340°	Quarterly	Apx. 5 mile
	Kingsmill	(29)	4.6	N	2°	Quarterly	Apx. 5 mile
	Williamsburg	(30)	7.8	N	0°	Quarterly	Population Center
	Kingsmill North	(31)	5.5	NNE	12°	Quarterly	Apx. 5 mile
	Budweiser	(32)	5.8	NNE	27°	Quarterly	Population Center
	Water Plant	(33)	5.0	NE	46°	Quarterly	Apx. 5 mile

Table 2-1

SURRY - 2019
RADIOLOGICAL SAMPLING STATIONS
DISTANCE AND DIRECTION FROM UNIT NO. 1

Sample Media	Location	Station	Distance Miles	Direction	Degrees	Collection Frequency	Remarks
Environmental	BASF	(34)	5.1	ENE	70°	Quarterly	Apx. 5 mile
TLDs	Lee Hall	(35)	7.1	ENE	75°	Quarterly	Population Center
	Goose Island	(36)	5.1	E	90°	Quarterly	Apx. 5 mile
	Fort Eustis	(37)	4.9	ESE	104°	Quarterly	Apx. 5 mile
	Newport News	(38)	19.3	SE	130°	Quarterly	Population Center
	James River Bridge	(39)	17.1	SE	142°	Quarterly	Control Location
	Benn's Church	(40)	17.0	SSE	159°	Quarterly	Control Location
	Smithfield	(41)	13.4	SSE	167°	Quarterly	Control Location
	Rushmere	(42)	5.3	SSE	156°	Quarterly	Apx. 5 mile
	Route 628	(43)	5.1	S	177°	Quarterly	Apx. 5 mile
Air Charcoal	Surry Station	(SS)	0.3	NNE	18°	Weekly	Site boundary location with highest D/Q
and Particulate	Hog Island Reserve	(HIR)	2.0	NNE	26°	Weekly	
	Bacon's Castle	(BC)	4.5	SSW	202°	Weekly	
	Alliance	(ALL)	5.1	WSW	247°	Weekly	
	Colonial Parkway	(CP)	3.8	NNW	333°	Weekly	
	BASF	(BASF)	5.1	ENE	70°	Weekly	
	Fort Eustis	(FE)	4.9	ESE	104°	Weekly	
	Newport News	(NN)	19.3	SE	130°	Weekly	Control Location
River Water	Surry Station Discharge	(SD)	0.4	NW	323°	Monthly	
	Scotland Wharf	(SW)	4.9	WNW	284°	Monthly	Control Location
Well Water	Surry Station	(SS)	0.1	SW	227°	Quarterly	Onsite
	Hog Island Reserve	(HIR)	2.0	NNE	28°	Quarterly	
	Construction Site	(CS)	0.3	E	87°	Quarterly	
Shoreline	Hog Island Reserve	(HIR)	0.6	N	7°	Semi-Annually	
Sediment	Chickahominy River	(CHIC)	11.2	WNW	301°	Semi-Annually	Control Location
Silt	Chickahominy River	(CHIC)	11.2	WNW	300°	Semi-Annually	Control Location
	Surry Station Discharge	(SD)	0.5	NW	315°	Semi-Annually	
	Surry Station Intake	(SI)	1.8	ESE	112°	Semi-Annually	

Table 2-1

SURRY - 2019

RADIOLOGICAL SAMPLING STATIONS

DISTANCE AND DIRECTION FROM UNIT NO. 1

Sample Media	Location	Station	Distance Miles	Direction	Degrees	Collection Frequency	Remarks
Milk	Colonial Parkway	(CP)	3.7	NNW	336°	Monthly	
	Beachy Farm	(BF)	12.0	SW	220°	Monthly	Control Location
	Epps	(EPPS)	4.8	SSW	200°	Monthly	
Oysters	Point of Shoals	(POS)	6.4	SSE	157°	Semi-Annually	
	Mulberry Point	(MP)	4.9	ESE	124°	Semi-Annually	
	Swash Hole Island	(SHI)	6.8	SE	128°	Semi-Annually	
Clams	Chickahominy River	(CHIC)	11.2	WNW	300°	Semi-Annually	Control Location
	Surry Station Discharge	(SD)	1.3	NNW	341°	Semi-Annually	
	Jamestown Island	(JI)	3.9	NW	324°	Semi-Annually	
Fish	Surry Station Discharge	(SD)	1.3	NNW	341°	Semi-Annually	
Crabs	Surry Station Discharge	(SD)	1.3	NNW	341°	Annually	
Crops (Corn, Peanuts, Soybeans)	Brock's Farm	(BROCK)	3.8	S	183°	Annually	
	Slade's Farm	(SLADE)	3.2	S	179°	Annually	

Table 2-2
SURRY - 2019
SAMPLE ANALYSIS PROGRAM

SAMPLE MEDIA	FREQUENCY	ANALYSIS	LLD*	REPORT UNITS
Thermoluminescent Dosimetry (TLD)	Quarterly	Gamma Dose	2	mR/Std. Month
Air Iodine	Weekly	I-131	0.07	pCi/m^3
Air Particulate	Weekly	Gross Beta	0.01	pCi/m^3
	Quarterly (a)	Gamma Isotopic		pCi/m^3
		Cs-134	0.05	
		Cs-137	0.06	
River Water	Quarterly Composite of monthly sample	Tritium (H-3)	2000	pCi/L
	Monthly	I-131	10	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	
Well Water	Quarterly	Tritium (H-3)	2000	pCi/L
		I-131	1	
		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	

Footnotes located at end of table.

Table 2-2

SURRY - 2019

SAMPLE ANALYSIS PROGRAM

SAMPLE MEDIA	FREQUENCY	ANALYSIS	LLD*	REPORT UNITS
Shoreline Sediment	Semi-Annually	Gamma Isotopic		pCi/kg - dry
		Cs-134	150	
		Cs-137	180	
Silt	Semi-Annually	Gamma Isotopic		pCi/kg - dry
		Cs-134	150	
		Cs-137	180	
Milk	Monthly	I-131	1	pCi/L
		Gamma Isotopic		pCi/L
		Cs-134	15	
		Cs-137	18	
		Ba-140	60	
		La-140	15	
	Quarterly Composite of CP monthly sample	Sr-89	NA	pCi/L
		Sr-90	NA	
Oysters	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	
Clams	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	
Crabs	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	

Footnotes located at end of table.

Table 2-2

SURRY - 2019

SAMPLE ANALYSIS PROGRAM

SAMPLE MEDIA	FREQUENCY	ANALYSIS	LLD*	REPORT UNITS
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	Annually	Gamma Isotopic		pCi/kg - wet
		I-131	60	
		Cs-134	60	
		Cs-137	80	

Note: This table is not a complete listing of nuclides that can be detected and reported. Other peaks that are measurable and identifiable, together with the above nuclides, are also identified and reported.

* LLD is the Lower Limit of Detection as defined and required in the USNRC Branch Technical Position on an Acceptable Radiological Environmental Monitoring Program, Revision 1, November 1979. LLDs indicate those concentrations to which environmental samples are required to be analyzed. Actual analysis of samples may be lower than these listed values.

(a) Quarterly composites of each location's weekly air particulate samples are analyzed for gamma emitters.

NA None assigned

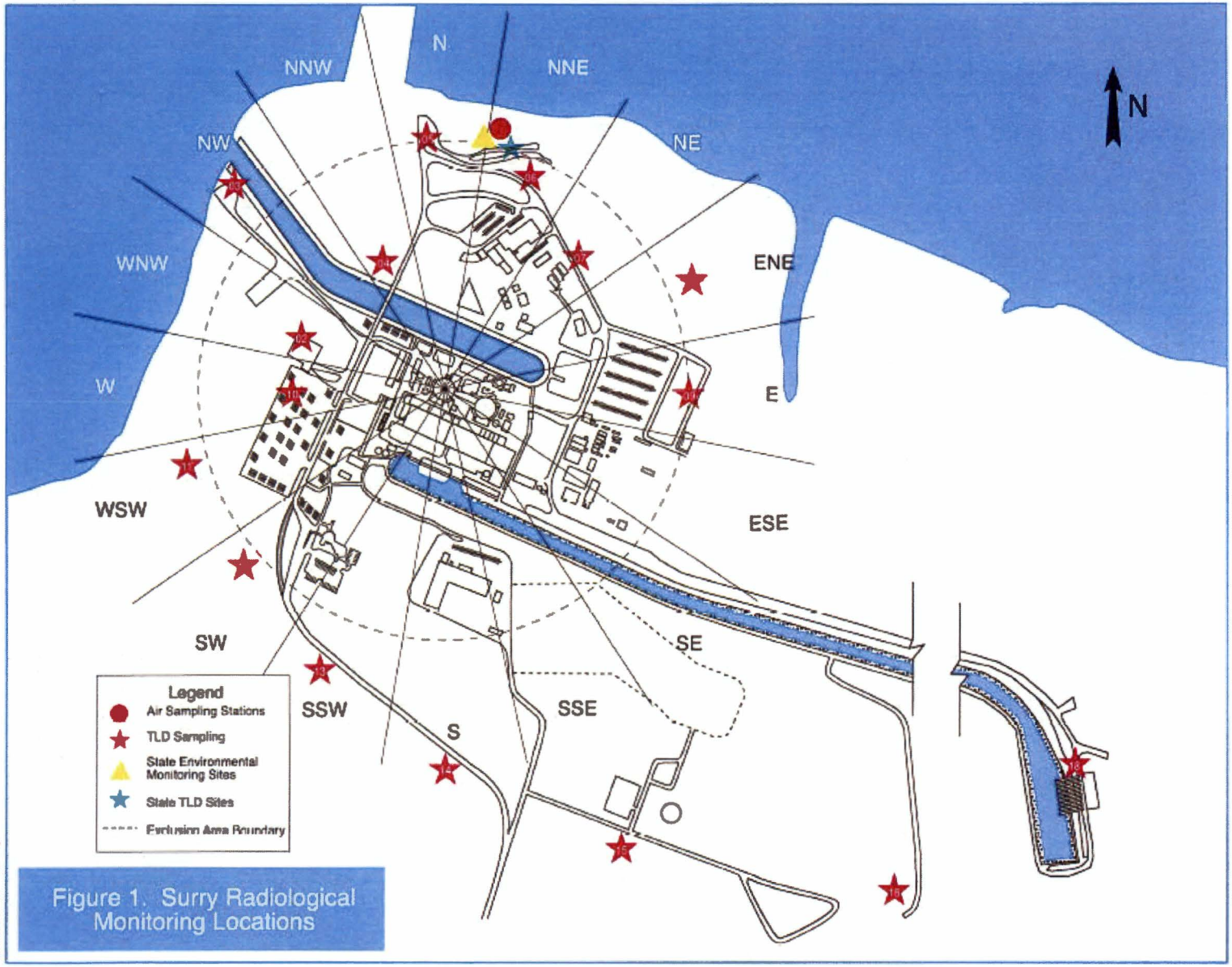

Figure 1. Surry Radiological Monitoring Locations

Graphics No. SVP45F

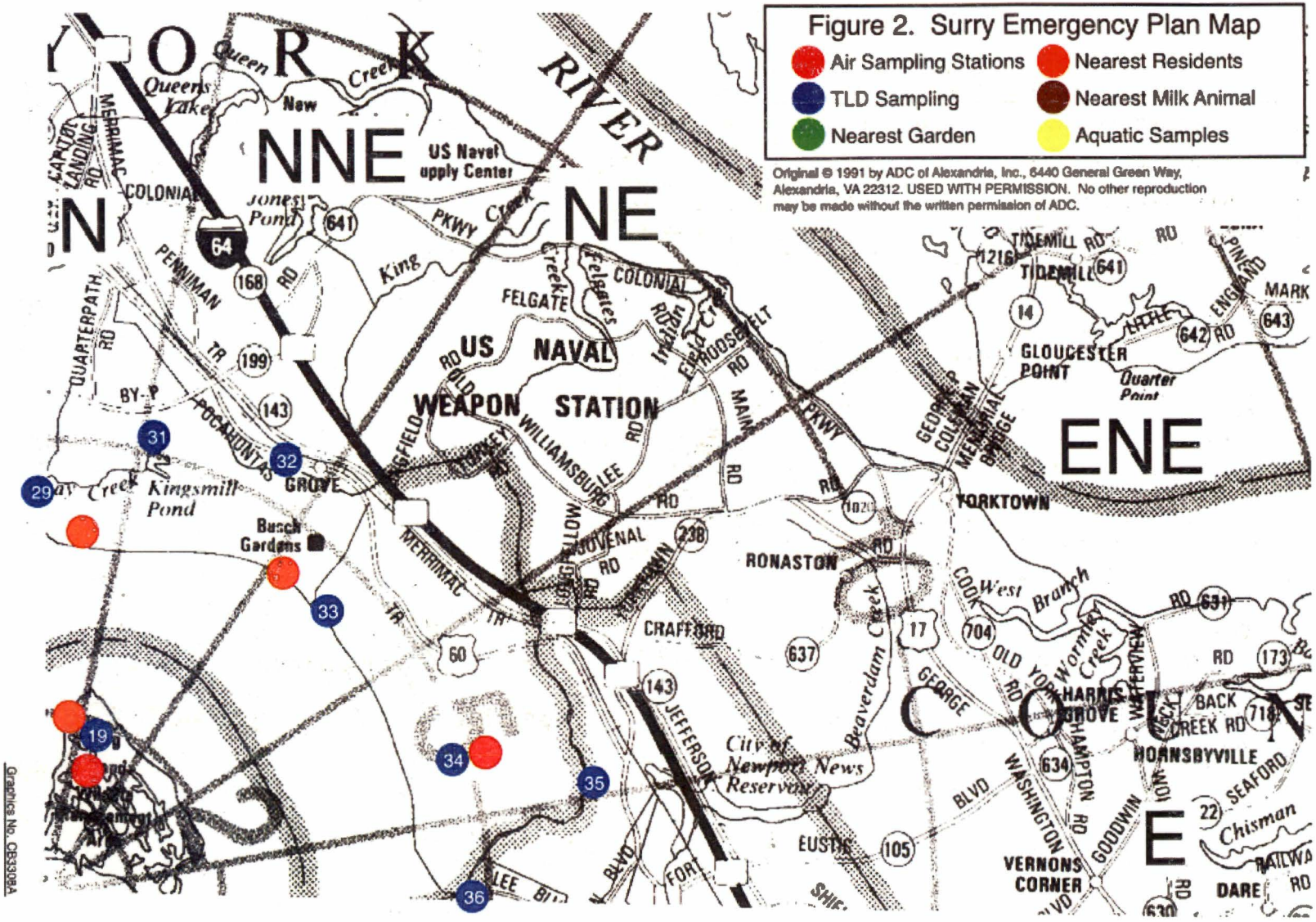
Figure 2. Surry Emergency Plan Map
Air Sampling Stations
Nearest Residents
TLD Sampling
Nearest Milk Animal
Nearest Garden
Aquatic Samples
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NE
ENE
E
US Naval Supply Center
US NAVAL WEAPON STATION
GLOUCESTER POINT
YORKTOWN
RONASTON
CRAFFORD
HORNSBYVILLE
VERNONS CORNER
Queens Lake
Kingsmill Pond
Busch Gardens
Jones Pond
Beaverdam Creek
City of Newport News Reservoir
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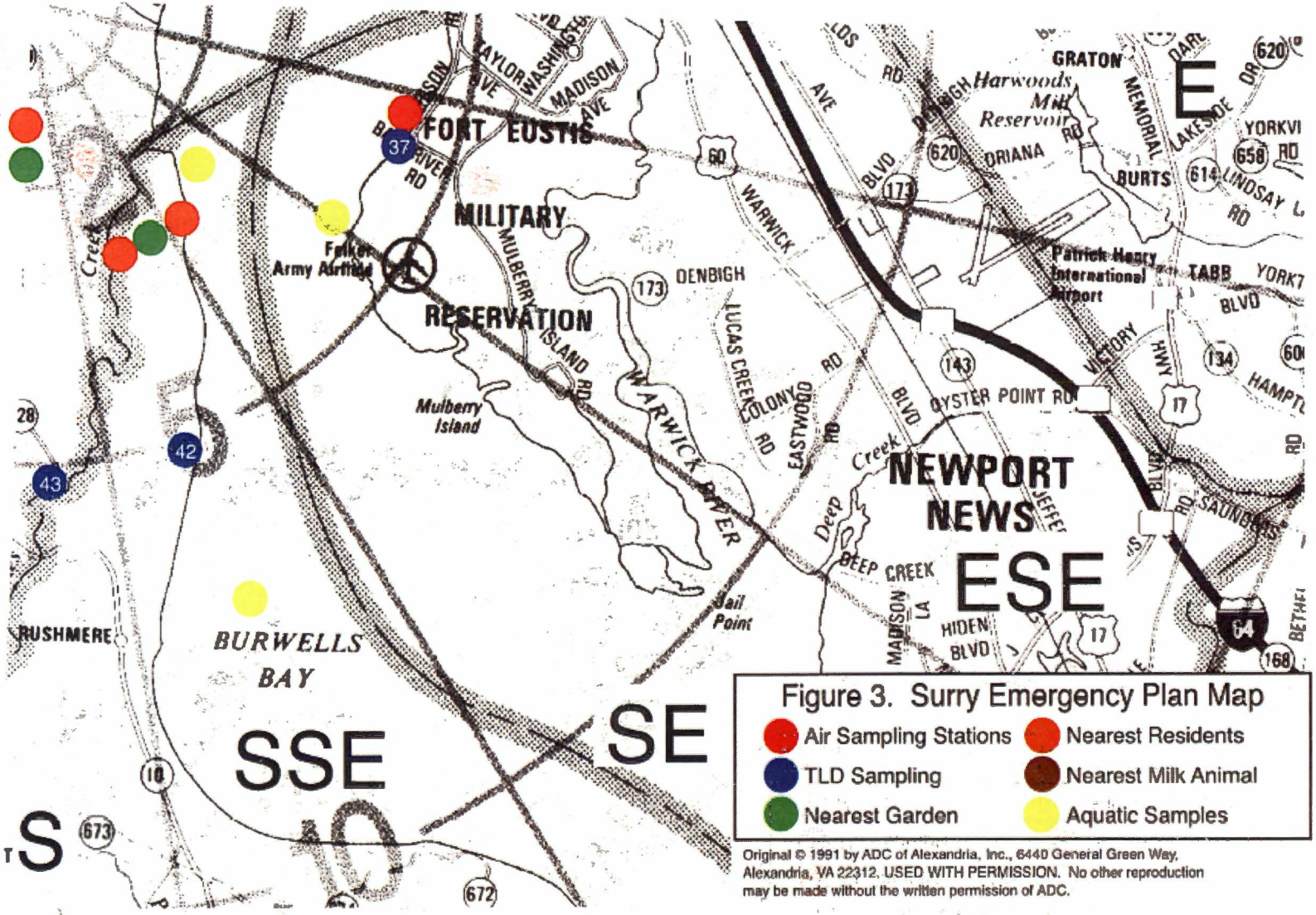
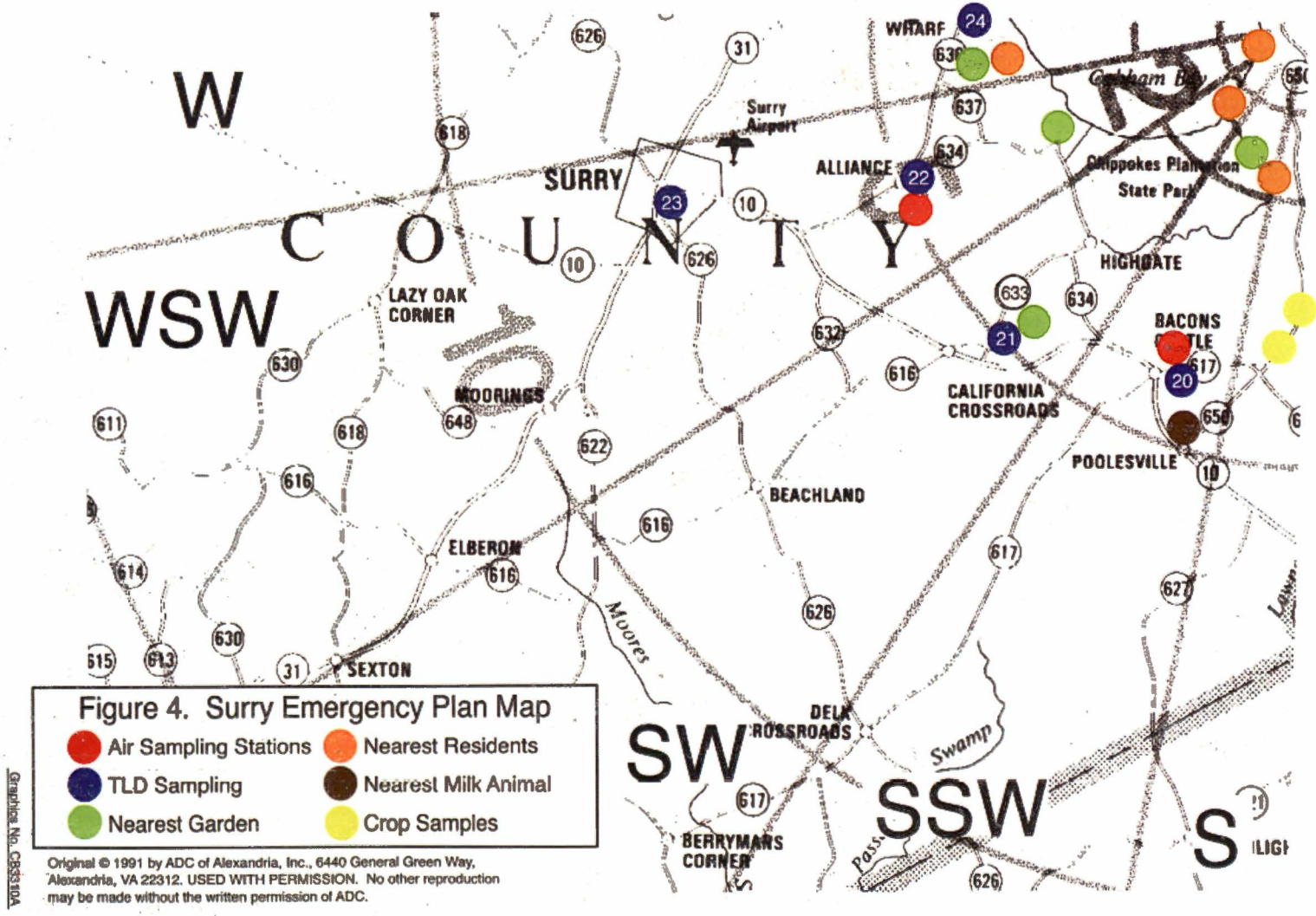


Figure 3. Surry Emergency Plan Map

- Air Sampling Stations
- Nearest Residents
- TLD Sampling
- Nearest Milk Animal
- Nearest Garden
- Aquatic Samples



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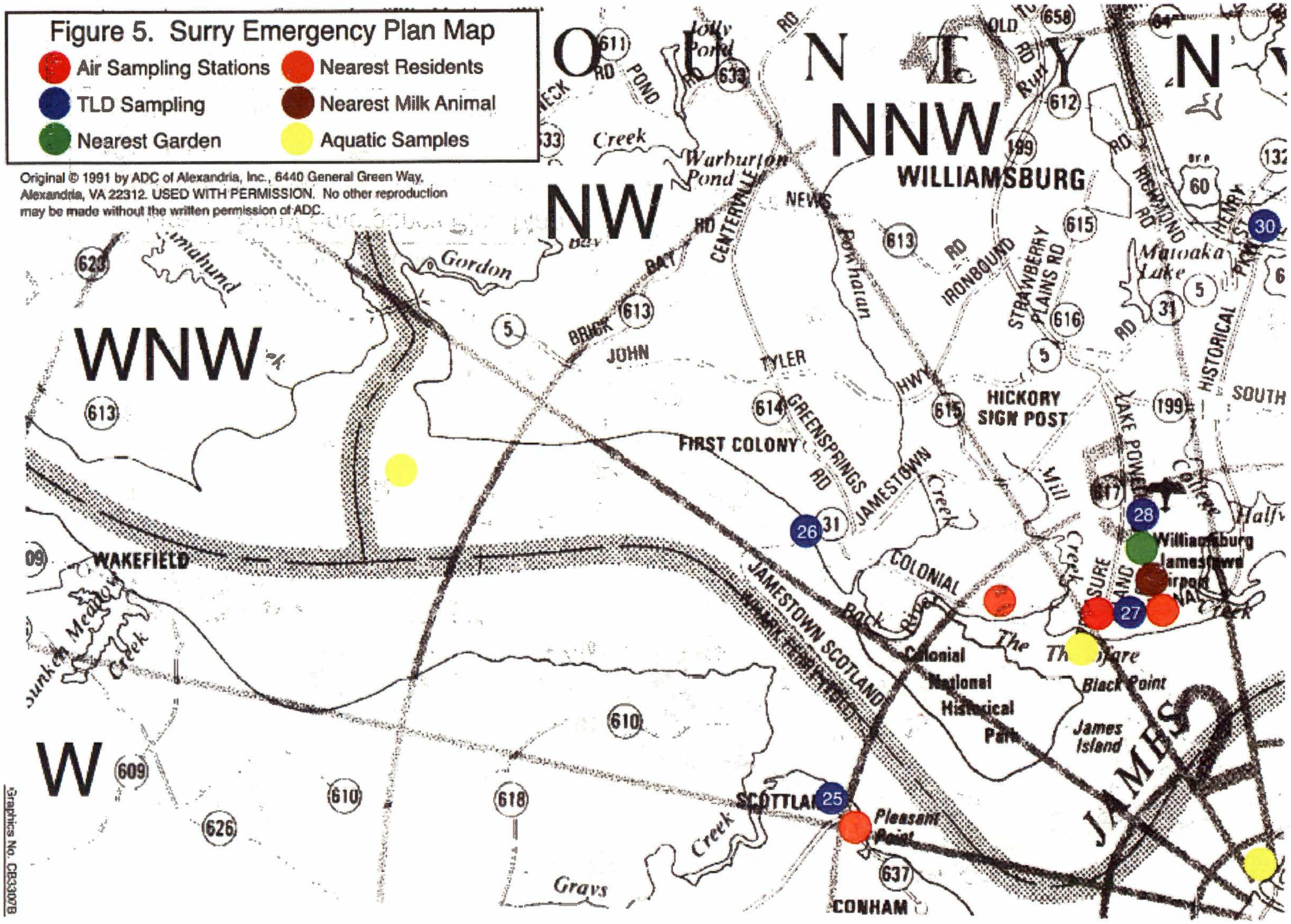

Figure 5. Surry Emergency Plan Map

Graphics No. CB3307B

3. ANALYTICAL RESULTS

3.1 Summary of Results

In accordance with the Surry 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", Revision 1, November 1979. A more detailed analysis of the data is given in Section 4.

TABLE 3-1: RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Surry Power Station, Surry County, Virginia - 2019

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Medium or Pathway Sampled (Units)	Analysis Type	Analysis Total No.	LLD	Indicator Locations Mean Range	Location with Highest Mean Name	Location with Highest Mean Distance Direction	Location with Highest Mean Mean Range	Control Locations Mean Range	Non-Routine Reported Measurements
Direct Radiation *TLD (mR/ Std Quarter)*	**Gamma**	164	2	**16.8 (151/152) (11.7 - 23.9)**	**STA-9**	**0.3 mi E**	**23.0 (4/4) (22.4 - 23.9)**	**17.9 (12/12) (15.1 - 23.0)**	0
Air Particulate *(1E-3 pCi/m3)*	**Gross Beta**	416	10	**14.2 (363/364) (5.80 - 25.1)**	**BASF**	**5.1 mi ENE**	**15.7 (52/52) (7.54 - 24.9)**	**14.0 (52/52) (6.74 - 26.8)**	0
	Gamma	32							
	Be-7	32		**150 (28/28) (97.6 - 198)**	**BASF**	**5.1 mi ENE**	**167 (4/4) (131 - 191)**	**149 (4/4) (143 - 154)**	0
	K-40	32		**21.3 (1/28) (21.3 - 21.3)**	**ALL**	**5.1 mi WSW**	**21.3 (1/28) (21.3 - 21.3)**	< LLD	0
	Cs-134	32	50	< LLD	N/A		< LLD	< LLD	0
	Cs-137	32	60	< LLD	N/A		< LLD	< LLD	0
Air Iodine *(1E-3 pCi/m3)*	**I-131**	416	70	< LLD	N/A		< LLD	< LLD	0
Milk *(pCi/Liter)*	**Strontium**	4							
	Sr-89	4		< LLD	N/A		< LLD	< LLD	0
	Sr-90	4		**1.37 (2/4) (1.28 - 1.46)**	**CP**	**3.7 mi NNW**	**1.37 (2/4) (1.28 - 1.46)**	< LLD	0
	Gamma	36							
	K-40	36		**1282 (24/24) (1010 - 1520)**	**EPPS**	**4.8 mi SSW**	**1334 (12/12) (1080 - 1520)**	**1114 (11/12) (827 - 1300)**	0
	I-131	36	1	< LLD	N/A		< LLD	< LLD	0
	Cs-134	36	15	< LLD	N/A		< LLD	< LLD	0
	Cs-137	36	18	< LLD	N/A		< LLD	< LLD	0
	Ba-140	36	60	< LLD	N/A		< LLD	< LLD	0
	La-140	36	15	< LLD	N/A		< LLD	< LLD	0

TABLE 3-1: RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

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Medium or Pathway Sampled (Units)	Analysis Type	Analysis Total No.	LLD	Indicator Locations Mean Range	Location with Highest Mean Name	Location with Highest Mean Distance Direction	Location with Highest Mean Mean Range	Control Locations Mean Range	Non-Routine Reported Measurements
Food Products *(pCi/kg wet)*	**Gamma**	3							
	K-40	3		**9413 (3/3) (3430 - 17800)**	**Slade**	**3.2 mi S**	**17800 (1/1) (17800-17800)**	N/A	0
	Be-7	3		< LLD	N/A		< LLD	N/A	0
	Th-228	3		< LLD	N/A		< LLD	N/A	0
	I-131	3	60	< LLD	N/A		< LLD	N/A	0
	Cs-134	3	60	< LLD	N/A		< LLD	N/A	0
	Cs-137	3	80	< LLD	N/A		< LLD	N/A	0
Well Water *(pCi/Liter)*	**H-3**	12	2000	< LLD	N/A		< LLD	N/A	0
	Gamma	12							
	Mn-54	12	15	< LLD	N/A		< LLD	N/A	0
	Co-58	12	15	< LLD	N/A		< LLD	N/A	0
	Fe-59	12	30	< LLD	N/A		< LLD	N/A	0
	Co-60	12	15	< LLD	N/A		< LLD	N/A	0
	Zn-65	12	30	< LLD	N/A		< LLD	N/A	0

TABLE 3-1: RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

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Medium or Pathway Sampled (Units)	Analysis Type	Analysis Total No.	LLD	Indicator Locations Mean Range	Location with Highest Mean Name	Location with Highest Mean Distance Direction	Location with Highest Mean Mean Range	Control Locations Mean Range	Non-Routine Reported Measurements
Well Water *(pCi/Liter)*	Nb-95	12	15	< LLD	N/A		< LLD	N/A	0
	Zr-95	12	30	< LLD	N/A		< LLD	N/A	0
	I-131	12	1	< LLD	N/A		< LLD	N/A	0
	Cs-134	12	15	< LLD	N/A		< LLD	N/A	0
	Cs-137	12	18	< LLD	N/A		< LLD	N/A	0
	Ba-140	12	60	< LLD	N/A		< LLD	N/A	0
	La-140	12	15	< LLD	N/A		< LLD	N/A	0
River Water *(pCi/Liter)*	**H-3**	8	2000	< LLD	N/A		< LLD	< LLD	0
	Gamma	24							
	K-40	24		**148 (3/12) (96.3 - 207.0)**	**SD**	**0.4 mi NW**	**148 (3/12) (96.3 - 207.0)**	**76.9 (2/12) (62.2 - 91.6)**	0
	Ra-226	24		< LLD	N/A		< LLD	**267 (1/12) (267 - 267)**	0
	Th-228	24		< LLD	N/A		< LLD	< LLD	0
	Mn-54	24	15	< LLD	N/A		< LLD	< LLD	0
	Co-58	24	15	< LLD	N/A		< LLD	< LLD	0
	Fe-59	24	30	< LLD	N/A		< LLD	< LLD	0
	Co-60	24	15	< LLD	N/A		< LLD	< LLD	0
	Zn-65	24	30	< LLD	N/A		< LLD	< LLD	0

TABLE 3-1: RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

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Medium or Pathway Sampled (Units)	Analysis Type	Analysis Total No.	LLD	Indicator Locations Mean Range	Location with Highest Mean Name	Location with Highest Mean Distance Direction	Location with Highest Mean Mean Range	Control Locations Mean Range	Non-Routine Reported Measurements
River Water *(pCi/Liter)*	Nb-95	24	15	< LLD	N/A		< LLD	< LLD	0
	Zr-95	24	30	< LLD	N/A		< LLD	< LLD	0
	I-131	24	10	< LLD	N/A		< LLD	< LLD	0
	Cs-134	24	15	< LLD	N/A		< LLD	< LLD	0
	Cs-137	24	18	< LLD	N/A		< LLD	< LLD	0
	Ba-140	24	60	< LLD	N/A		< LLD	< LLD	0
	La-140	24	15	< LLD	N/A		< LLD	< LLD	0
Silt *(pCi/kg dry)*	**Gamma**	6							
	Be-7	6		**2640 (2/4) (2110-3170)**	SI	1.8 mi ESE	**3170 (1/4) (3170 - 3170)**	< LLD	0
	K-40	6		**16800 (4/4) (12400-20400)**	SI	1.8 mi ESE	**12400 (2/4) (16400-20400)**	**16750 (2/2) (16500-17000)**	0
	Cs-134	6	150	< LLD	N/A		< LLD	< LLD	0
	Cs-137	6	180	**195 (2/4) (164 - 225)**	SD	1.3 mi NNW	**194.5 (2/4) (164.0 - 225.0)**	< LLD	0
	Ra-226	6		**4085 (2/4) (3090 - 5080)**	SD	1.3 mi NNW	**5080 (1/4) (5080 - 5080)**	**3800 (1/2) (3800 - 3800)**	0
	Th-228	6		**1348 (4/4) (880 - 1740)**	SI	1.8 mi ESE	**1310 (2/4) (880 - 1740)**	**1360 (2/2) (1270 - 1450)**	0
	Th-232	4		**1200 (4/4) (1020 - 1480)**	SI	1.8 mi ESE	**1250 (2/4) (1020 - 1480)**	**1325 (2/2) (1280 - 1370)**	0

TABLE 3-1: RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

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Medium or Pathway Sampled (Units)	Analysis Type	Analysis Total No.	LLD	Indicator Locations Mean Range	Location with Highest Mean Name	Location with Highest Mean Distance Direction	Location with Highest Mean Mean Range	Control Locations Mean Range	Non-Routine Reported Measurements
Shoreline Sediment *(pCi/kg dry)*	K-40	4		**4980 (2/2) (3820 - 6140)**	HIR	**0.6 mi N**	**4980 (2/2) (3820 - 6140)**	**5822 (2/2) (1510 - 10200)**	0
	Cs-134	4	150	< LLD	N/A		< LLD	< LLD	0
	Cs-137	4	180	< LLD	N/A		< LLD	**126 (1/2) (126 - 126)**	0
	Ra-226	4		< LLD	N/A		< LLD	< LLD	0
	Th-228	4		< LLD	N/A		< LLD	**594 (2/2) (278 - 909)**	0
	Th-232	4		< LLD	N/A		< LLD	**866 (1/2) (866 - 866)**	0
Fish *(pCi/kg wet)*	**Gamma**	4							
	K-40	4		**2055 (4/4) (1350 - 2590)**	**SD**	**1.3 mi NNW**	**2055 (4/4) (1350 - 2590)**	N/A	0
	Mn-54	4	130	< LLD	N/A		< LLD	N/A	0
	Co-58	4	130	< LLD	N/A		< LLD	N/A	0
	Fe-59	4	260	< LLD	N/A		< LLD	N/A	0
	Co-60	4	130	< LLD	N/A		< LLD	N/A	0
	Zn-65	4	260	< LLD	N/A		< LLD	N/A	0
	Cs-134	4	130	< LLD	N/A		< LLD	N/A	0
	Cs-137	4	150	< LLD	N/A		< LLD	N/A	0

TABLE 3-1: RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

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Medium or Pathway Sampled (Units)	Analysis Type	Analysis Total No.	LLD	Indicator Locations Mean Range	Location with Highest Mean Name	Location with Highest Mean Distance Direction	Location with Highest Mean Mean Range	Control Locations Mean Range	Non-Routine Reported Measurements
Oysters *(pCi/kg wet)*	**Gamma**	6							
	K-40	6		**674 (3/6) (540 - 787)**	**SHI**	**6.8 mi SE**	**674 (3/6) (540 - 787)**	N/A	0
	Mn-54	6	130	< LLD	N/A		< LLD	N/A	0
	Fe-59	6	260	< LLD	N/A		< LLD	N/A	0
	Co-58	6	130	< LLD	N/A		< LLD	N/A	0
	Co-60	6	130	< LLD	N/A		< LLD	N/A	0
	Zn-65	6	260	< LLD	N/A		< LLD	N/A	0
	Cs-134	6	130	< LLD	N/A		< LLD	N/A	0
	Cs-137	6	150	< LLD	N/A		< LLD	N/A	0
Clams *(pCi/kg wet)*	**Gamma**	6							
	K-40	6		**586 (2/4) (485 - 687)**	**JI**	**3.9 mi NW**	**586 (2/4) (485 - 687)**	< LLD	0
	Mn-54	6	130	< LLD	N/A		< LLD	< LLD	0
	Co-58	6	130	< LLD	N/A		< LLD	< LLD	0
	Fe-59	6	260	< LLD	N/A		< LLD	< LLD	0
	Co-60	6	130	< LLD	N/A		< LLD	< LLD	0
	Zn-65	6	260	< LLD	N/A		< LLD	< LLD	0
	Cs-134	6	130	< LLD	N/A		< LLD	< LLD	0
	Cs-137	6	150	< LLD	N/A		< LLD	< LLD	0

TABLE 3-1: RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

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Medium or Pathway Sampled (Units)	Analysis Type	Analysis Total No.	LLD	Indicator Locations Mean Range	Location with Highest Mean Name	Location with Highest Mean Distance Direction	Location with Highest Mean Mean Range	Control Locations Mean Range	Non-Routine Reported Measurements
Crabs *(pCi/kg wet)*	**Gamma**	1							
	K-40	1		**1630 (1/1) (1630 - 1630)**	**SD**	**1.3 mi NNW**	**1630 (1/1) (1630 - 1630)**	N/A	0
	Mn-54	1	130	< LLD	N/A		< LLD	N/A	0
	Co-58	1	130	< LLD	N/A		< LLD	N/A	0
	Fe-59	1	260	< LLD	N/A		< LLD	N/A	0
	Co-60	1	130	< LLD	N/A		< LLD	N/A	0
	Zn-65	1	260	< LLD	N/A		< LLD	N/A	0
	Cs-134	1	130	< LLD	N/A		< LLD	N/A	0
	Cs-137	1	150	< LLD	N/A		< LLD	N/A	0

3.2 Analytical Results of 2019 REMP Samples

Radiological analyses of environmental media characteristically approach and frequently fall below the detection limits of state-of-the-art measurement methods. 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 positive when the measured value exceeds 2σ uncertainty, unless otherwise noted. MDC is noted in the footnote in several tables. The term <MDC means the value is less than its Minimum Detectable Concentration and is therefore, not considered a positive value or result. Positive values or results are indicated by **bold** text.

Teledyne Brown Engineering 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 Surry ODCM.

Data are given according to sample type as indicated below.

1. Gamma Exposure Rate
2. Air Particulates, Weekly Gross Beta Radioactivity
3. Air Particulates, Weekly I-131
4. Air Particulates, Quarterly Gamma Spectroscopy
5. Animal Milk
6. Food Products
7. Well Water
8. River Water
9. Silt
10. Shoreline Sediment
11. Fish
12. Oysters
13. Clams
14. Crabs

TABLE 3-2: GAMMA EXPOSURE RATE

Surry Power Station, Surry County, Virginia – 2019

$MDD_Q = 3 \times \sigma_Q = 3 \times 1.0 = 5$ Note: IF $MDD_Q < 5$ mR, THEN MDD_Q rounded to 5 mR (ANSI N13.37)

$MDD_A = 3 \times \sigma_A = 3 \times 2.3 = 10$ Note: IF $MDD_A < 10$ mR, THEN MDD_A rounded to 10 mR (ANSI N13.37)

Monitoring Location	Quarterly Baseline, B_Q Baseline, (mrem)	Normalized Quarterly Monitoring Data, M_Q (mrem per standard quarter)				Quarterly Facility Dose,[a] $F_Q = M_Q - B_Q$ (mrem)				Annual Baseline, B_A (mrem)	Annual Monitoring Data, M_A (mrem)	Annual Facility Dose,[b] $F_A = M_A - B_A$ (mrem)
		1	2	3	4	1	2	3	4			
2	19.8	18.9	18.1	21.0	19.7	ND	ND	ND	ND	79.2	77.7	ND
3	19.2	19.0	19.0	20.7	19.5	ND	ND	ND	ND	76.9	78.1	ND
4	17.9	17.0	17.3	21.2	17.2	ND	ND	ND	ND	71.7	72.7	ND
5	19.0	18.3	17.9	19.7	19.4	ND	ND	ND	ND	76.0	75.3	ND
6	18.4	17.1	18.3	19.4	18.8	ND	ND	ND	ND	73.8	73.6	ND
7	18.7	17.0	16.6	19.2	17.4	ND	ND	ND	ND	74.6	70.3	ND
8	17.0	15.9	16.9	18.6	17.1	ND	ND	ND	ND	68.4	68.5	ND
9	23.2	22.4	22.9	23.9	22.9	ND	ND	ND	ND	92.8	92.0	ND
10	18.1	17.0	17.5	19.5	18.2	ND	ND	ND	ND	72.5	72.3	ND
11	16.1	15.7	15.0	17.9	14.3	ND	ND	ND	ND	64.2	63.0	ND
12	16.6	15.8	16.0	17.9	15.7	ND	ND	ND	ND	66.4	65.5	ND
13	18.6	18.2	18.5	19.4	18.0	ND	ND	ND	ND	74.5	74.1	ND
14	17.9	16.8	17.8	19.4	16.9	ND	ND	ND	ND	71.6	71.0	ND
15	18.5	17.2	18.1	20.1	18.7	ND	ND	ND	ND	74.1	74.1	ND
16	17.0	16.0	17.0	18.3	16.9	ND	ND	ND	ND	67.7	68.3	ND
18	14.5	14.2	15.3	16.3	15.3	ND	ND	ND	ND	58.0	61.1	ND
19	15.5	15.2	15.7	15.9	15.4	ND	ND	ND	ND	62.1	62.2	ND
20	14.3	14.3	13.9	14.7	14.5	ND	ND	ND	ND	57.4	57.4	ND
21	15.1	14.6	15.1	m	15.6	ND	ND	N/A	ND	60.5	60.4	ND
22	13.2	13.1	13.1	13.8	13.2	ND	ND	ND	ND	52.7	53.3	ND
23	18.1	18.1	18.9	19.3	18.1	ND	ND	ND	ND	72.3	74.4	ND
24	14.8	14.2	14.2	15.5	14.9	ND	ND	ND	ND	59.2	58.8	ND
25	18.1	18.1	18.8	18.7	18.5	ND	ND	ND	ND	72.3	74.0	ND
26	15.7	14.6	15.4	16.1	16.5	ND	ND	ND	ND	62.9	62.7	ND
27	14.7	13.8	14.6	16.4	15.3	ND	ND	ND	ND	58.7	60.1	ND
28	14.2	14.0	14.4	13.8	15.6	ND	ND	ND	ND	56.8	57.7	ND
29	13.2	12.7	13.1	13.2	13.6	ND	ND	ND	ND	52.9	52.6	ND
30	14.4	14.4	13.4	15.3	15.4	ND	ND	ND	ND	57.7	58.5	ND
31	12.3	12.1	11.7	12.9	12.9	ND	ND	ND	ND	49.2	49.7	ND
32	15.2	14.2	13.7	14.7	15.1	ND	ND	ND	ND	60.7	57.7	ND
33	14.2	15.0	15.3	15.0	15.3	ND	ND	ND	ND	57.1	60.6	ND
34	16.0	15.8	16.5	17.0	17.2	ND	ND	ND	ND	64.1	66.5	ND
35	18.6	18.9	18.3	19.3	20.5	ND	ND	ND	ND	74.4	77.1	ND
36	18.6	19.1	18.3	20.2	20.1	ND	ND	ND	ND	74.4	77.6	ND
37	15.4	16.0	15.8	16.4	15.2	ND	ND	ND	ND	61.7	63.4	ND
38	20.9	20.6	19.1	17.6	17.2	ND	ND	ND	ND	83.6	74.6	ND
39	14.9	15.1	15.5	17.3	16.6	ND	ND	ND	ND	59.7	64.5	ND
40	16.2	15.7	16.2	16.1	15.6	ND	ND	ND	ND	64.7	63.7	ND
41	21.8	21.4	21.0	23.0	21.6	ND	ND	ND	ND	87.3	87.1	ND
42	16.4	16.0	16.3	17.0	15.7	ND	ND	ND	ND	65.5	65.0	ND
43	14.3	13.7	14.0	14.7	15.0	ND	ND	ND	ND	57.3	57.4	ND

[a] ND = Not detected, where $M_Q < (B_Q + MDD_Q)$

[b] ND = Not detected, where $M_A < (B_A + MDD_A)$

d = Damaged TLDs; m = Missing TLDs; v = Vendor reports TLD not received

N/A = Missing or Damaged TLD Reading Not Available for Calculation

Note: Table formatted in accordance with ANSI/HPS N13.37-2014, Environmental Dosimetry - Criteria for system Design and Implementation.

TABLE 3-3: GROSS BETA CONCENTRATION IN FILTERED AIR

Surry Nuclear Power Station, Surry County, Virginia - 2019

1.0E-3 pCi/m3 ± 2 Sigma

COLLECTION DATE	SAMPLING LOCATIONS SS	HIR	BC	ALL	CP	BASF	FE	NN-C
January 08	**15.1** ± 3.17	**16.3** ± 3.23	**16.6** ± 3.30	**16.7** ± 3.27	**16.5** ± 3.22	**16.0** ± 3.17	**17.0** ± 3.23	**12.5** ± 2.96
January 15	**7.51** ± 2.26	**8.39** ± 2.30	**10.8** ± 2.51	**10.0** ± 2.41	**9.56** ± 2.38	**9.95** ± 2.41	**10.2** ± 2.42	**8.52** ± 2.30
January 22	0.00 ± 0.00 **B**	**11.1** ± 2.66	**10.8** ± 2.71	**12.1** ± 2.73	**10.8** ± 2.65	**12.9** ± 2.75	**10.2** ± 2.67	**11.0** ± 2.67
January 29	**9.55** ± 2.38	**13.6** ± 2.60	**10.4** ± 2.45	**13.4** ± 2.63	**12.7** ± 2.53	**14.1** ± 2.61	**13.1** ± 2.57	**24.4** ± 3.19
February 05	**20.3** ± 3.21	**20.0** ± 3.18	**19.8** ± 3.24	**25.1** ± 3.46	**20.8** ± 3.21	**24.9** ± 3.38	**19.8** ± 3.14	**19.7** ± 3.16
February 12	**19.3** ± 3.16	**20.1** ± 3.17	**19.5** ± 3.23	**20.4** ± 3.27	**18.8** ± 3.10	**19.7** ± 3.15	**16.0** ± 2.96	**15.9** ± 2.96
February 19	**12.2** ± 2.58	**12.7** ± 2.58	**11.6** ± 2.57	**15.2** ± 2.77	**14.2** ± 2.65	**17.4** ± 2.85	**12.5** ± 2.56	**11.0** ± 2.49
February 25	**14.1** ± 3.03	**13.6** ± 2.97	**13.9** ± 3.07	**15.1** ± 3.14	**16.0** ± 3.12	**17.7** ± 3.21	**14.5** ± 3.04	**14.2** ± 3.01
March 05	**11.9** ± 2.39	**11.2** ± 2.34	**12.1** ± 2.43	**15.0** ± 2.58	**12.9** ± 2.42	**14.9** ± 2.51	**11.1** ± 2.32	**12.1** ± 2.19
March 11	**13.1** ± 2.77	**11.4** ± 2.65	**13.0** ± 2.80	**11.6** ± 2.72	**12.9** ± 2.74	**13.0** ± 2.74	**10.5** ± 2.59	**10.3** ± 2.86
March 19	**17.6** ± 2.67	**15.7** ± 2.56	**17.7** ± 2.71	**18.7** ± 2.76	**15.0** ± 2.50	**17.8** ± 2.64	**15.1** ± 2.50	**14.7** ± 2.48
March 25	**7.93** ± 2.80	**7.80** ± 2.78	**8.74** ± 2.90	**10.9** ± 3.06	**10.2** ± 2.92	**10.9** ± 2.96	**8.47** ± 2.81	**8.10** ± 2.76
Qtr. Avg. ± 2 s.d.	**12.4 ± 11.3**	**13.5 ± 7.9**	**13.7 ± 7.5**	**15.4 ± 8.8**	**14.2 ± 6.8**	**15.8 ± 8.2**	**13.2 ± 6.7**	**13.5 ± 9.4**
April 02	**11.3** ± 2.33	**13.1** ± 2.42	**12.7** ± 2.41	**14.0** ± 2.50	**10.8** ± 2.28	**16.5** ± 2.59	**11.8** ± 2.33	**13.0** ± 2.40
April 09	**10.2** ± 2.35	**11.8** ± 2.42	**11.3** ± 2.50	**14.8** ± 2.73	**10.1** ± 2.38	**14.7** ± 2.65	**12.6** ± 2.52	**11.3** ± 2.47
April 16	**5.80** ± 2.34	**9.45** ± 2.52	**6.75** ± 2.33	**8.65** ± 2.53	**6.30** ± 2.24	**8.65** ± 2.39	**5.85** ± 2.21	**6.74** ± 2.28
April 23	**7.97** ± 2.27	**10.2** ± 2.37	**10.1** ± 2.45	**7.76** ± 2.31	**10.5** ± 2.43	**9.94** ± 2.40	**9.49** ± 2.37	**9.12** ± 2.33
April 30	**14.3** ± 3.10	**14.2** ± 3.02	**11.8** ± 2.84	**17.0** ± 3.17	**12.8** ± 2.86	**15.5** ± 2.99	**13.7** ± 2.91	**12.1** ± 2.84
May 08	**13.5** ± 2.59	**10.5** ± 2.36	**12.5** ± 2.52	**15.1** ± 2.70	**12.0** ± 2.45	**15.9** ± 2.65	**15.2** ± 2.63	**10.5** ± 2.37
May 14	**6.91** ± 2.81	**8.43** ± 2.84	**8.54** ± 2.87	**7.88** ± 2.88	**8.70** ± 2.85	**11.1** ± 3.01	**6.07** ± 2.68	**9.74** ± 2.93
May 21	**16.1** ± 2.89	**12.6** ± 2.66	**17.0** ± 2.90	**12.8** ± 2.69	**13.1** ± 2.68	**17.5** ± 2.89	**13.3** ± 2.69	**13.1** ± 2.68
May 28	**12.5** ± 2.66	**10.4** ± 2.49	**10.7** ± 2.53	**11.3** ± 2.57	**11.5** ± 2.56	**11.6** ± 2.56	**14.3** ± 3.09	**11.6** ± 2.57
June 04	**17.1** ± 2.96	**12.8** ± 2.66	**14.9** ± 2.80	**17.7** ± 2.99	**14.5** ± 2.75	**17.0** ± 2.86	**16.9** ± 2.88	**14.4** ± 2.75
June 11	**11.8** ± 2.62	**11.9** ± 2.56	**11.4** ± 2.57	**13.8** ± 2.77	**13.5** ± 2.70	**16.6** ± 2.87	**13.5** ± 2.69	**12.9** ± 2.63
June 19	**11.9** ± 2.51	**11.3** ± 2.43	**10.9** ± 2.43	**13.7** ± 2.64	**13.5** ± 2.56	**11.9** ± 2.47	**10.8** ± 2.41	**9.77** ± 2.34
June 25	**8.96** ± 2.63	**7.93** ± 2.53	**11.1** ± 2.79	**11.3** ± 2.82	**9.20** ± 2.62	**7.54** ± 2.49	**9.63** ± 2.64	**8.65** ± 2.58
Qtr. Avg. ± 2 s.d.	**11.4 ± 6.8**	**11.1 ± 3.7**	**11.5 ± 5.1**	**12.8 ± 6.5**	**11.3 ± 4.6**	**13.4 ± 6.9**	**11.8 ± 6.6**	**11.0 ± 4.3**

B = Visual inspection indicated very little particulate material on filter; result not included.

TABLE 3-3: GROSS BETA CONCENTRATION IN FILTERED AIR

Surry Nuclear Power Station, Surry County, Virginia - 2019

1.0E-3 pCi/m3 ± 2 Sigma

COLLECTION DATE	SAMPLING LOCATIONS							
	SS	HIR	BC	ALL	CP	BASF	FE	NN
July 02	**16.5** ± 2.86	**12.7** ± 2.59	**16.7** ± 2.85	**15.8** ± 2.82	**15.3** ± 2.72	**16.0** ± 2.75	**16.6** ± 2.79	**12.0** ± 2.54
July 9	**15.8** ± 2.93	**12.0** ± 2.67	**15.9** ± 2.91	**17.8** ± 3.04	**17.7** ± 2.99	**16.7** ± 2.90	**13.1** ± 2.70	**11.3** ± 2.60
July 16	**12.1** ± 2.60	**12.4** ± 2.56	**12.7** ± 2.63	**11.5** ± 2.58	**10.4** ± 2.46	**15.3** ± 2.76	**12.6** ± 2.60	**10.4** ± 2.49
July 22	**18.0** ± 3.52	**16.0** ± 3.32	**19.9** ± 3.58	**18.0** ± 3.53	**16.9** ± 3.39	**22.1** ± 3.66	**17.4** ± 3.42	**18.5** ± 3.48
July 30	**11.0** ± 2.57	**9.15** ± 2.44	**11.4** ± 2.69	**12.9** ± 2.79	**10.0** ± 2.59	**13.1** ± 2.72	**9.92** ± 2.55	**8.64** ± 2.48
August 06	**13.6** ± 2.84	**15.8** ± 2.90	**16.6** ± 2.87	**17.3** ± 2.94	**13.9** ± 2.69	**19.2** ± 2.96	**13.6** ± 2.66	**11.6** ± 2.55
August 13	**15.1** ± 2.86	**13.9** ± 2.75	**17.7** ± 2.98	**15.6** ± 2.90	**14.3** ± 2.79	**18.0** ± 2.97	**17.5** ± 2.94	**13.7** ± 2.75
August 20	**16.1** ± 3.00	**12.3** ± 2.73	**13.1** ± 2.81	**18.2** ± 3.12	**16.2** ± 2.94	**16.0** ± 2.94	**11.3** ± 2.68	**12.7** ± 2.79
August 26	**12.9** ± 3.02	**13.1** ± 2.95	**14.9** ± 3.20	**14.6** ± 3.18	**14.0** ± 3.11	**12.7** ± 3.01	**9.80** ± 2.84	**12.3** ± 3.00
September 03	**13.7** ± 2.75	**12.3** ± 2.59	**17.6** ± 2.87	**15.6** ± 2.78	**5.84** ± 2.16	**16.8** ± 2.75	**15.7** ± 2.71	**12.2** ± 2.56
September 10	**12.6** ± 2.76	**14.9** ± 2.83	**17.3** ± 3.06	**16.2** ± 3.00	**13.8** ± 2.85	**17.3** ± 3.02	**15.8** ± 2.93	**11.3** ± 2.70
September 17	**21.1** ± 3.38	**18.5** ± 3.17	**24.5** ± 3.42	**21.2** ± 3.31	**25.0** ± 3.44	**22.5** ± 3.29	**19.5** ± 3.15	**19.6** ± 3.14
September 24	**16.5** ± 3.01	**13.9** ± 2.80	**17.1** ± 3.02	**18.8** ± 3.12	**14.9** ± 2.89	**15.9** ± 2.91	**13.3** ± 2.77	**17.6** ± 3.01
September 30	**21.9** ± 3.55	**20.4** ± 3.38	**19.6** ± 3.41	**18.0** ± 3.34	**17.6** ± 3.27	**24.5** ± 3.59	**21.7** ± 3.45	**22.5** ± 3.49
Qtr. Avg. ± 2 s.d.	**15.5 ± 6.4**	**14.1 ± 5.8**	**16.8 ± 6.6**	**16.5 ± 5.0**	**14.7 ± 8.8**	**17.6 ± 6.9**	**14.8 ± 7.0**	**13.9 ± 8.0**
October 08	**18.8** ± 2.95	**20.2** ± 2.96	**20.8** ± 3.04	**17.9** ± 2.90	**19.0** ± 2.91	**20.5** ± 2.95	**15.4** ± 2.71	**18.8** ± 2.88
October 16	**19.5** ± 2.90	**18.6** ± 2.79	**20.9** ± 2.96	**17.8** ± 2.83	**18.4** ± 2.82	**23.1** ± 3.01	**19.0** ± 2.84	**21.2** ± 2.95
October 22	**9.92** ± 2.95	**9.30** ± 2.83	**9.31** ± 2.90	**9.12** ± 2.89	**10.2** ± 2.90	**11.1** ± 3.03	**10.5** ± 2.88	**11.3** ± 2.93
October 29	**12.3** ± 2.71	**11.4** ± 2.61	**13.5** ± 2.77	**9.21** ± 2.53	**12.8** ± 2.71	**15.3** ± 2.83	**11.0** ± 2.61	**17.3** ± 2.96
November 05	**10.3** ± 2.58	**9.30** ± 2.47	**10.6** ± 2.56	**9.40** ± 2.48	**12.6** ± 2.64	**10.9** ± 2.51	**10.6** ± 2.51	**11.7** ± 2.57
November 12	**20.5** ± 3.21	**18.8** ± 3.08	**24.1** ± 3.37	**20.2** ± 3.20	**22.4** ± 3.27	**18.9** ± 3.06	**19.9** ± 3.14	**26.8** ± 3.46
November 19	**11.5** ± 2.48	**12.4** ± 2.50	**14.3** ± 2.64	**9.94** ± 2.38	**10.9** ± 2.42	**9.71** ± 2.31	**10.6** ± 2.38	**13.9** ± 2.58
November 26	**17.6** ± 3.09	**15.1** ± 2.93	**19.7** ± 3.19	**16.3** ± 3.03	**16.7** ± 3.02	**20.9** ± 3.18	**17.1** ± 3.01	**20.9** ± 3.21
December 03	**8.70** ± 2.34	**9.53** ± 2.36	**12.3** ± 2.55	**10.4** ± 2.44	**10.4** ± 2.40	**12.4** ± 2.49	**8.59** ± 2.27	**16.6** ± 2.77
December 10	**9.34** ± 2.60	**10.5** ± 2.61	**11.3** ± 2.68	**8.10** ± 2.52	**9.08** ± 2.54	**10.4** ± 2.58	**11.0** ± 2.64	**12.6** ± 2.76
December 17	**14.3** ± 3.04	**12.9** ± 2.90	**15.7** ± 3.08	**14.0** ± 3.03	**16.1** ± 3.10	**12.6** ± 2.85	**11.6** ± 2.83	**16.7** ± 3.13
December 23	**19.9** ± 3.49	**17.9** ± 3.32	**24.9** ± 3.72	**18.8** ± 3.42	**22.5** ± 3.59	**21.7** ± 3.50	**20.4** ± 3.46	**22.1** ± 3.57
December 31	**16.3** ± 2.61	**14.8** ± 2.48	**19.8** ± 2.83	**17.9** ± 2.74	**20.7** ± 2.83	**19.8** ± 2.78	**17.7** ± 2.69	**20.3** ± 2.83
Qtr. Avg. ± 2 s.d.	**14.5 ± 8.8**	**13.8 ± 7.9**	**16.5 ± 10.4**	**13.7 ± 8.8**	**15.1 ± 9.1**	**15.8 ± 9.7**	**13.9 ± 8.2**	**17.2 ± 9.3**

TABLE 3-4: IODINE-131 CONCENTRATION IN FILTERED AIR

Surry Power Station, Surry County, Virginia - 2019

1.0E-3 pCi/m3 ± 2 Sigma

COLLECTION DATE	SAMPLING LOCATIONS							
	SS	HIR	BC	ALL	CP	BASF	FE	NN-C
January 08	15.0 ± 20.4	14.9 ± 20.2	15.2 ± 20.6	14.9 ± 20.2	22.0 ± 29.9	21.7 ± 29.5	21.7 ± 29.5	21.6 ± 29.4
January 15	-0.39 ± 14.6	-0.38 ± 14.4	-0.40 ± 14.8	-0.38 ± 14.4	-2.05 ± 6.53	-2.05 ± 6.52	-2.04 ± 6.50	-2.01 ± 6.41
January 22	-2.32 ± 20.7	-2.29 ± 20.5	-2.36 ± 21.1	-2.30 ± 20.5	2.83 ± 23.0	2.81 ± 22.8	2.91 ± 23.6	2.82 ± 22.9
January 29	14.6 ± 19.1	14.3 ± 18.7	14.7 ± 19.2	14.7 ± 19.2	-9.87 ± 23.3	-9.87 ± 23.3	-9.97 ± 23.5	-9.98 ± 23.6
	±	±	±	±	±	±	±	±
February 05	8.09 ± 12.1	8.01 ± 12.0	8.27 ± 12.4	8.16 ± 12.2	-7.01 ± 20.0	-6.94 ± 19.8	-6.93 ± 19.8	-7.00 ± 20.0
February 12	3.90 ± 11.1	3.83 ± 10.9	3.99 ± 11.4	3.97 ± 11.3	0.48 ± 7.04	0.48 ± 7.04	0.40 ± 5.89	0.48 ± 7.05
February 19	-14.7 ± 14.7	-14.5 ± 14.5	-14.9 ± 15.0	-14.8 ± 14.9	1.94 ± 17.3	1.96 ± 17.4	1.94 ± 17.3	1.95 ± 17.4
February 25	5.08 ± 9.86	5.01 ± 9.71	5.20 ± 10.1	5.19 ± 10.1	-5.41 ± 14.8	-5.39 ± 14.7	-5.40 ± 14.7	-5.37 ± 14.7
March 05/06	-3.55 ± 14.1	-3.50 ± 13.9	-3.58 ± 14.2	-3.56 ± 14.1	-2.64 ± 21.9	-2.62 ± 21.6	-2.63 ± 21.8	-2.25 ± 18.6
March 11	20.1 ± 21.1	20.0 ± 21.0	20.4 ± 21.5	20.5 ± 21.5	2.73 ± 11.6	6.50 ± 27.7	6.52 ± 27.8	7.22 ± 30.8
March 19	5.69 ± 14.3	5.64 ± 14.1	5.79 ± 14.5	5.75 ± 14.4	8.90 ± 20.9	8.89 ± 20.8	8.88 ± 20.8	8.84 ± 20.7
March 25	-1.58 ± 4.72	-1.58 ± 4.70	-1.62 ± 4.82	-1.63 ± 4.87	-1.33 ± 19.7	-1.33 ± 19.7	-1.33 ± 19.6	-1.30 ± 19.3
April 02	-2.15 ± 18.7	-2.15 ± 18.6	-2.15 ± 18.7	-2.18 ± 18.9	9.69 ± 18.6	9.63 ± 18.5	9.65 ± 18.5	9.58 ± 18.4
April 09	4.28 ± 22.0	4.21 ± 21.6	4.54 ± 23.3	4.59 ± 23.5	18.1 ± 26.2	17.9 ± 26.1	17.9 ± 26.0	18.0 ± 26.2
April 16	-4.61 ± 12.9	-4.45 ± 12.4	-4.47 ± 12.5	-4.63 ± 12.9	-15.2 ± 16.9	-15.1 ± 16.7	-15.1 ± 16.8	-15.2 ± 16.9
April 23	1.90 ± 13.6	1.85 ± 13.3	1.96 ± 14.1	1.98 ± 14.2	-23.7 ± 25.7	-23.6 ± 25.6	-23.6 ± 25.6	-23.3 ± 25.3
April 30	-2.31 ± 11.1	-2.24 ± 10.8	-2.21 ± 10.7	-2.25 ± 10.9	-9.07 ± 17.1	-9.02 ± 17.0	-9.04 ± 17.0	-9.07 ± 17.1
May 08	-10.5 ± 19.0	-10.2 ± 18.5	-10.5 ± 18.9	-10.6 ± 19.2	-0.28 ± 16.7	-0.28 ± 16.6	-0.28 ± 16.7	-0.28 ± 16.5
May 14	-0.52 ± 6.81	-0.50 ± 6.61	-0.51 ± 6.68	-0.52 ± 6.81	-0.27 ± 3.55	1.36 ± 8.59	0.57 ± 3.58	1.35 ± 8.53
May 21	-0.65 ± 15.3	-0.63 ± 15.0	-0.64 ± 15.0	-0.64 ± 15.0	-0.53 ± 12.4	14.3 ± 24.6	14.4 ± 24.8	14.4 ± 24.7
May 28	-10.1 ± 12.0	-9.85 ± 11.7	-9.93 ± 11.8	-9.97 ± 11.9	-0.26 ± 7.59	-0.25 ± 7.53	-0.30 ± 9.01	-0.25 ± 7.51
June 04	0.61 ± 11.8	0.59 ± 11.5	0.60 ± 11.6	0.61 ± 11.7	-7.64 ± 18.9	-7.47 ± 18.5	-7.56 ± 18.7	-7.58 ± 18.7
June 11	-4.82 ± 10.7	-4.66 ± 10.4	-4.74 ± 10.5	-4.87 ± 10.8	-12.7 ± 12.6	-12.7 ± 12.5	-12.6 ± 12.5	-12.4 ± 12.3
June 19	-1.86 ± 8.71	-1.81 ± 8.48	-1.83 ± 8.55	-1.88 ± 8.80	-0.76 ± 3.55	-4.50 ± 5.08	-4.49 ± 5.08	-4.45 ± 5.04
June 25	2.99 ± 11.2	2.94 ± 11.0	3.00 ± 11.2	3.04 ± 11.4	1.63 ± 15.5	1.62 ± 15.3	1.62 ± 15.4	1.61 ± 15.3

A: < MDC

TABLE 3-4: IODINE-131 CONCENTRATION IN FILTERED AIR

Surry Power Station, Surry County, Virginia - 2019

1.0E-3 pCi/m3 ± 2 Sigma

COLLECTION DATE	SAMPLING LOCATIONS SS	HIR	BC	ALL	CP	BASF	FE	NN-C
July 02	8.66 ± 15.4	8.42 ± 15.0	8.55 ± 15.3	8.61 ± 15.4	6.94 ± 12.4	0.80 ± 19.1	0.81 ± 19.2	0.80 ± 19.2
July 9	8.74 ± 11.9	8.54 ± 11.7	8.61 ± 11.8	8.70 ± 11.9	-6.03 ± 19.2	-5.89 ± 18.8	-5.89 ± 18.8	-5.88 ± 18.8
July 16	1.94 ± 11.7	1.88 ± 11.4	1.92 ± 11.6	1.95 ± 11.8	-7.86 ± 21.3	-7.90 ± 21.4	-3.28 ± 8.87	-7.88 ± 21.3
July 22	4.89 ± 9.68	4.74 ± 9.37	4.81 ± 9.52	4.91 ± 9.70	1.38 ± 10.8	1.38 ± 10.8	1.38 ± 10.8	1.38 ± 10.8
July 30	0.03 ± 6.96	0.03 ± 6.86	0.03 ± 7.40	0.03 ± 7.46	1.01 ± 12.1	0.99 ± 11.8	0.98 ± 11.8	0.98 ± 11.8
August 06	-3.90 ± 11.7	-3.77 ± 11.3	-3.68 ± 11.0	-3.73 ± 11.2	6.57 ± 14.0	6.49 ± 13.8	6.50 ± 13.8	6.52 ± 13.9
August 13	-14.1 ± 15.9	-13.7 ± 15.5	-13.8 ± 15.6	-14.1 ± 15.9	0.18 ± 13.8	0.17 ± 13.7	0.17 ± 13.6	0.17 ± 13.6
August 20	-9.07 ± 15.8	-8.77 ± 15.2	-8.92 ± 15.5	-9.05 ± 15.7	-4.35 ± 6.54	-4.37 ± 6.56	-4.36 ± 6.55	-4.40 ± 6.61
August 26	-3.31 ± 11.4	-3.20 ± 11.0	-3.44 ± 11.8	-3.43 ± 11.8	-3.24 ± 13.5	-3.21 ± 13.3	-3.22 ± 13.4	-3.21 ± 13.3
September 03	-5.78 ± 13.5	-5.57 ± 13.0	-5.61 ± 13.1	-5.62 ± 13.1	-3.94 ± 16.0	-3.90 ± 15.9	-3.92 ± 16.0	-3.96 ± 16.1
September 10	4.78 ± 11.9	4.65 ± 11.6	4.92 ± 12.2	4.91 ± 12.2	0.57 ± 14.8	0.56 ± 14.6	0.56 ± 14.5	0.56 ± 14.7
September 17	-2.04 ± 13.6	-1.98 ± 13.2	-1.96 ± 13.1	-1.99 ± 13.3	9.25 ± 20.6	9.09 ± 20.3	9.12 ± 20.4	9.02 ± 20.1
September 24	4.05 ± 16.3	3.91 ± 15.8	4.02 ± 16.2	4.05 ± 16.3	-0.42 ± 10.2	-0.41 ± 10.0	-0.41 ± 10.0	-0.34 ± 8.42
September 30	0.17 ± 8.67	0.16 ± 8.35	0.17 ± 8.61	0.17 ± 8.66	3.71 ± 12.9	3.65 ± 12.7	3.64 ± 12.7	3.63 ± 12.7
October 08	-1.18 ± 6.07	-2.73 ± 14.1	-2.79 ± 14.4	-2.78 ± 14.3	-2.72 ± 14.0	7.22 ± 16.4	7.24 ± 16.4	7.23 ± 16.4
October 16	9.42 ± 11.8	7.62 ± 9.54	9.36 ± 11.7	9.42 ± 11.8	-1.87 ± 15.4	-1.84 ± 15.1	-1.86 ± 15.3	-1.86 ± 15.3
October 22	-4.47 ± 18.9	-4.31 ± 18.2	-4.44 ± 18.8	-4.43 ± 18.7	-8.99 ± 13.5	-9.25 ± 13.9	-8.80 ± 13.3	-8.78 ± 13.2
October 29	-2.00 ± 15.7	-1.95 ± 15.3	-1.99 ± 15.6	-2.00 ± 15.7	-6.93 ± 12.8	-3.10 ± 5.75	-6.88 ± 12.8	-6.87 ± 12.7
November 05	-0.93 ± 10.2	-0.91 ± 9.92	-0.91 ± 9.93	-0.91 ± 9.91	0.41 ± 15.8	0.40 ± 15.5	0.40 ± 15.6	0.40 ± 15.6
November 12	0.08 ± 8.48	0.08 ± 8.29	0.08 ± 8.43	0.08 ± 8.48	-0.03 ± 6.78	-0.03 ± 6.66	-0.03 ± 6.73	-0.03 ± 6.72
November 19	14.4 ± 12.2 **A**	14.1 ± 12.0 **A**	14.4 ± 12.2 **A**	14.4 ± 12.2 **A**	6.10 ± 10.7	2.88 ± 5.06	5.98 ± 10.5	5.96 ± 10.5
November 26	-1.59 ± 11.5	-1.56 ± 11.3	-1.58 ± 11.4	-1.58 ± 11.4	-1.31 ± 9.43	-2.10 ± 4.54	-2.52 ± 5.45	-2.53 ± 5.47
December 03	1.35 ± 9.04	3.16 ± 21.1	3.19 ± 21.4	3.19 ± 21.4	3.11 ± 20.8	-6.85 ± 11.5	-6.94 ± 11.6	-5.86 ± 9.80
December 10	-8.88 ± 23.3	-8.62 ± 22.6	-8.74 ± 23.0	-8.83 ± 23.2	3.65 ± 14.6	3.57 ± 14.3	3.61 ± 14.4	3.67 ± 14.7
December 17	-12.0 ± 21.2	-11.6 ± 20.6	-11.7 ± 20.8	-12.0 ± 21.2	-1.93 ± 11.7	-1.88 ± 11.4	-1.91 ± 11.6	-1.92 ± 11.7
December 23	-5.75 ± 11.0	-13.3 ± 25.4	-13.5 ± 25.8	-13.6 ± 26.0	-13.3 ± 25.4	-6.06 ± 16.8	-6.10 ± 16.9	-5.15 ± 14.3
December 31	-8.23 ± 11.1	-7.99 ± 10.7	-7.12 ± 9.56	-8.49 ± 11.4	-8.27 ± 11.1	-1.24 ± 15.8	-1.25 ± 15.9	-0.53 ± 6.70

A: < MDC

TABLE 3-5: GAMMA EMITTER CONCENTRATION IN FILTERED AIR

Surry Power Station, Surry County, Virginia - 2019

1.0E-3 pCi/m3 ± 2 Sigma

SAMPLING LOCATIONS	NUCLIDE	FIRST QUARTER	SECOND QUARTER	THIRD QUARTER	FOURTH QUARTER	AVERAGE ± 2 SIGMA
SS	Cs-134	-0.96 ± 0.92	0.22 ± 0.93	-0.25 ± 0.70	-0.57 ± 0.60	
	Cs-137	0.17 ± 0.75	0.50 ± 0.81	-0.06 ± 0.55	-0.08 ± 0.55	
	Be-7	**151** ± 25.3	**165** ± 34.4	**156** ± 23.7	**109** ± 18.1	145 ± 49.7
HIR	Cs-134	0.03 ± 0.68	-0.42 ± 0.65	-0.32 ± 0.78	-0.53 ± 0.83	
	Cs-137	0.81 ± 0.74 **A**	0.48 ± 0.66	0.69 ± 0.67 **A**	-0.33 ± 0.78	
	Be-7	**194** ± 34.3	**159** ± 23.4	**150** ± 22.6	**115** ± 23.0	155 ± 64.9
BC	Cs-134	0.26 ± 1.09	-0.03 ± 1.19	0.21 ± 0.68	-0.13 ± 0.43	
	Cs-137	-0.39 ± 0.72	-0.20 ± 0.87	-0.27 ± 0.60	0.18 ± 0.59	
	Be-7	**198** ± 29.4	**176** ± 30.1	**157** ± 23.7	**122** ± 21.4	163 ± 64.4
ALL	Cs-134	-0.37 ± 0.75	0.12 ± 0.81	1.03 ± 0.96 **A**	-0.78 ± 0.88	
	Cs-137	0.01 ± 0.70	0.96 ± 0.734 **A**	0.12 ± 0.91	-0.08 ± 0.77	
	Be-7	**151** ± 27.9	**129** ± 28.4	**141** ± 27.7	**97.6** ± 19.6	130 ± 46.4
	K-40				**21.3** ± 13.7	21.3 ± 13.7
CP	Cs-134	-0.10 ± 1.16	0.39 ± 0.66	-0.32 ± 1.04	-0.76 ± 0.68	
	Cs-137	-0.45 ± 1.03	-0.11 ± 0.49	0.37 ± 0.83	0.26 ± 0.54	
	Be-7	**190** ± 35.0	**155** ± 27.6	**124** ± 25.3	**114** ± 20.5	146 ± 68.6
BASF	Cs-134	-0.45 ± 0.69	-0.18 ± 0.77	-0.05 ± 0.80	-0.04 ± 0.89	
	Cs-137	-0.36 ± 0.65	0.13 ± 0.64	0.34 ± 0.64	0.38 ± 0.65	
	Be-7	**188** ± 27.5	**191** ± 30.1	**159** ± 24.4	**131** ± 23.2	167 ± 56.3
FE	Cs-134	0.50 ± 0.95	-0.19 ± 0.70	-0.14 ± 0.86	-0.19 ± 1.06	
	Cs-137	0.32 ± 0.90	0.43 ± 0.59	-0.05 ± 0.53	0.76 ± 0.87	
	Be-7	**155** ± 24.1	**143** ± 22.3	**142** ± 23.6	**131** ± 25.5	143 ± 19.6
NN-C	Cs-134	-0.24 ± 0.83	-0.23 ± 0.89	0.12 ± 0.86	-0.54 ± 0.80	
	Cs-137	-0.40 ± 0.61	-0.08 ± 0.79	0.10 ± 0.74	-0.01 ± 0.72	
	Be-7	**154** ± 23.3	**149** ± 29.1	**150** ± 29.3	**143** ± 25.7	149 ± 9.1

A: < MDC

TABLE 3-6: GAMMA EMITTER AND STRONTIUM CONCENTRATIONS IN MILK

Surry Power Station, Surry County, Virginia - 2019

pCi/Liter ± 2 Sigma

NUCLIDE	EPPS	COLONIAL PARKWAY	BEACHY FARM-C
JANUARY			
Cs-134	0.61 ± 5.73	0.72 ± 5.96	-1.89 ± 5.35
Cs-137	-1.31 ± 5.55	2.85 ± 5.52	1.11 ± 4.50
Ba-140	0.48 ± 22.9	-9.59 ± 23.8	0.91 ± 18.2
La-140	1.64 ± 5.85	-4.29 ± 8.16	-0.60 ± 5.75
I-131	-0.33 ± 0.29	-0.25 ± 0.32	0.18 ± 0.33
K-40	**1,300** ± 146	**1,140** ± 181	**1110** ± 164
FEBRUARY			
Cs-134	0.11 ± 6.79	-0.77 ± 4.42	-3.43 ± 5.46
Cs-137	5.65 ± 5.78	0.93 ± 4.63	1.98 ± 5.58
Ba-140	12.4 ± 25.7	8.50 ± 19.5	-6.95 ± 23.6
La-140	3.26 ± 5.76	-2.95 ± 5.58	-5.16 ± 5.94
I-131	-0.28 ± 0.32	0.24 ± 0.29	-0.14 ± 0.41
K-40	**1250** ± 162	**1170** ± 178	**1020** ± 138
MARCH			
Cs-134	1.85 ± 6.26	0.88 ± 3.82	5.10 ± 5.67
Cs-137	1.67 ± 5.83	3.05 ± 3.58	2.03 ± 4.86
Ba-140	2.53 ± 23.4	-0.13 ± 16.8	-17.0 ± 26.1
La-140	1.94 ± 7.12	1.53 ± 5.57	2.46 ± 6.32
I-131	-0.33 ± 0.51	-0.35 ± 0.33	-0.06 ± 0.30
K-40	**1080** ± 138	**1010** ± 139	**898** ± 130
Sr-89		0.93 ± 2.52	
Sr-90		**1.28** ± 0.55	
APRIL			
Cs-134	4.06 ± 3.81 **A**	2.54 ± 4.21	-0.82 ± 4.41
Cs-137	-1.53 ± 3.56	-5.21 ± 4.20	2.80 ± 4.04
Ba-140	8.17 ± 18.3	-0.16 ± 20.0	-11.9 ± 18.2
La-140	-0.33 ± 5.87	2.12 ± 7.13	-0.33 ± 7.07
I-131	-0.01 ± 0.36	0.21 ± 0.41	0.52 ± 0.49 **A**
K-40	**1290** ± 164	**1200** ± 157	**827** ± 169

A: <MDC

TABLE 3-6: GAMMA EMITTER AND STRONTIUM CONCENTRATIONS IN MILK

Surry Power Station, Surry County, Virginia - 2019

pCi/Liter ± 2 Sigma

NUCLIDE	EPPS	COLONIAL PARKWAY	BEACHY FARM-C
MAY			
Cs-134	-1.02 ± 4.57	0.55 ± 5.57	2.56 ± 4.78
Cs-137	0.62 ± 4.64	2.62 ± 5.47	4.91 ± 3.89
Ba-140	-20.1 ± 19.7	1.42 ± 21.9	7.06 ± 15.9
La-140	0.75 ± 5.25	4.90 ± 7.42	-2.61 ± 4.53
I-131	-0.19 ± 0.34	-0.06 ± 0.42	-0.74 ± 0.44
K-40	**1400** ± 197	**1280** ± 182	**1280** ± 172
JUNE			
Cs-134	-1.91 ± 4.46	-0.39 ± 4.42	-2.01 ± 5.43
Cs-137	-3.65 ± 4.06	-0.53 ± 5.21	0.22 ± 5.61
Ba-140	3.14 ± 15.4	4.78 ± 17.7	7.04 ± 25.9
La-140	-0.74 ± 3.03	-1.23 ± 5.47	-3.08 ± 7.67
I-131	0.25 ± 0.29	-0.03 ± 0.39	0.31 ± 0.39
K-40	**1520** ± 191	**1340** ± 197	**1280** ± 183
Sr-89		-0.25 ± 2.37	
Sr-90		0.89 ± 0.63 **A**	
JULY			
Cs-134	-0.05 ± 4.67	2.27 ± 6.93	2.49 ± 4.01
Cs-137	0.58 ± 4.69	2.62 ± 6.32	3.16 ± 5.22
Ba-140	-30.1 ± 23.2	16.8 ± 29.3	7.50 ± 18.3
La-140	-2.48 ± 5.32	4.69 ± 5.91	-0.01 ± 5.77
I-131	-0.02 ± 0.51	0.03 ± 0.37	-0.15 ± 0.41
K-40	**1380** ± 163	**1070** ± 174	**1300** ± 191
AUGUST			
Cs-134	-1.40 ± 4.25	-6.88 ± 6.04	2.58 ± 5.69
Cs-137	4.26 ± 5.29	-3.44 ± 4.94	2.31 ± 5.95
Ba-140	3.77 ± 14.2	11.3 ± 18.0	2.75 ± 19.1
La-140	3.03 ± 4.31	-1.86 ± 6.02	0.27 ± 5.49
I-131	-0.12 ± 0.37	0.19 ± 0.35	-0.10 ± 0.33
K-40	**1410** ± 176	**1150** ± 199	**1130** ± 197

A: <MDC

TABLE 3-6: GAMMA EMITTER AND STRONTIUM CONCENTRATIONS IN MILK

Surry Power Station, Surry County, Virginia - 2019

pCi/Liter ± 2 Sigma

NUCLIDE	EPPS	COLONIAL PARKWAY	BEACHY FARM-C
SEPTEMBER			
Cs-134	2.04 ± 4.08	5.32 ± 5.85	-0.49 ± 3.68
Cs-137	1.77 ± 4.26	-0.83 ± 6.61	2.69 ± 3.65
Ba-140	1.86 ± 17.8	-4.46 ± 26.9	-10.5 ± 13.8
La-140	2.21 ± 6.13	4.56 ± 8.33	-1.66 ± 4.60
I-131	0.47 ± 0.47 **A**	-0.25 ± 0.45	-0.18 ± 0.55
K-40	**1160** ± 159	**1480** ± 188	**1200** ± 144
Sr-89		2.54 ± 3.06	
Sr-90		**1.23** ± 0.61	
OCTOBER			
Cs-134	1.30 ± 5.25	1.68 ± 2.52	-2.64 ± 4.27
Cs-137	-0.34 ± 5.96	-0.60 ± 2.40	-2.56 ± 4.33
Ba-140	-1.50 ± 26.3	5.38 ± 8.72	-3.38 ± 18.8
La-140	-1.32 ± 7.52	1.51 ± 2.58	-1.81 ± 7.06
I-131	-0.20 ± 0.36	0.38 ± 0.48	0.32 ± 0.43
K-40	**1410** ± 196	**1150** ± 99.3	**1220** ± 168
NOVEMBER			
Cs-134	4.50 ± 4.18 **A**	-0.10 ± 5.23	-1.52 ± 4.20
Cs-137	-1.34 ± 4.72	2.08 ± 4.79	-4.18 ± 4.66
Ba-140	3.13 ± 14.6	0.99 ± 21.7	15.4 ± 17.7
La-140	-2.59 ± 4.61	4.32 ± 7.14	-0.82 ± 4.96
I-131	-0.27 ± 0.53	-0.06 ± 0.42	0.00 ± 0.44
K-40	**1440** ± 183	**1350** ± 203	**1120** ± 182
DECEMBER			
Cs-134	-2.46 ± 4.98	-3.59 ± 6.18	-1.27 ± 4.50
Cs-137	1.09 ± 4.88	-1.72 ± 5.27	-0.38 ± 4.68
Ba-140	-0.09 ± 23.4	15.1 ± 26.0	27.0 ± 21.3 **A**
La-140	1.91 ± 6.16	-4.60 ± 7.56	0.74 ± 8.31
I-131	-0.07 ± 0.51	-0.13 ± 0.57	0.05 ± 0.43
K-40	**1370** ± 188	**1420** ± 197	**981** ± 158
Sr-89		2.64 ± 2.45 **A**	
Sr-90		**1.46** ± 0.67	

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TABLE 3-7: GAMMA EMITTER CONCENTRATION IN FOOD PRODUCTS

Surry Power Station, Surry County, Virginia - 2019

pCi/kg (wet) ± 2 Sigma

SAMPLING LOCATIONS	COLLECTION DATE	SAMPLE TYPE	ISOTOPE			
			Cs-134	**Cs-137**	**I-131**	**K-40**
BROCK	11/5/2019	Peanuts	-5.56 ± 23.6	8.73 ± 19.1	19.1 ± 24.1	**7010** ± 805
FARM	11/5/2019	Corn	0.65 ± 10.8	-11.6 ± 9.71	-8.29 ± 11.8	**3430** ± 463
			Cs-134	**Cs-137**	**I-131**	**K-40**
SLADE FARM	11/26/2019	Soybeans	-14.3 ± 22.0	-1.63 ± 20.5	27.5 ± 25.9	**17800** ± 1260

TABLE 3-8: GAMMA EMITTER AND TRITIUM CONCENTRATIONS IN WELL WATER

Surry Power Station, Surry County, Virginia - 2019

pCi/Liter ± 2 Sigma

SAMPLING LOCATIONS	COLLECTION DATE	ISOTOPE				
		Mn-54	**Co-58**	**Fe-59**	**Co-60**	**Zn-65**
SS	3/5/2019	-2.64 ± 3.34	0.65 ± 3.82	-4.52 ± 8.36	3.58 ± 4.90	-5.17 ± 8.68
	6/4/2019	0.99 ± 3.56	-0.82 ± 3.01	5.48 ± 7.13	0.57 ± 3.46	-7.86 ± 7.07
	9/4/2019	2.79 ± 3.20	-0.14 ± 3.39	-1.28 ± 9.05	2.82 ± 4.27	-9.27 ± 9.71
	12/5/2019	-3.72 ± 3.91	0.06 ± 4.16	4.21 ± 7.04	0.67 ± 3.77	-9.21 ± 9.36
		Nb-95	**Zr-95**	**I-131**	**Cs-134**	**Cs-137**
	3/5/2019	0.08 ± 3.08	8.39 ± 7.76 **A**	0.35 ± 0.47	0.17 ± 2.53	-1.22 ± 3.35
	6/4/2019	2.81 ± 4.09	-0.01 ± 6.25	0.00 ± 0.48	-4.39 ± 4.12	-2.79 ± 4.07
	9/4/2019	-2.12 ± 4.72	-5.00 ± 6.04	0.03 ± 0.31	-2.15 ± 4.59	1.10 ± 3.61
	12/5/2019	5.83 ± 3.82 **A**	0.83 ± 6.36	-0.38 ± 0.38	-0.74 ± 3.63	0.71 ± 3.78
		Ba-140	**La-140**	**H-3**		
	3/5/2019	14.4 ± 15.9	-3.39 ± 6.10	80.4 ± 663		
	6/4/2019	-1.07 ± 17.2	0.48 ± 5.02	279 ± 841		
	9/4/2019	-1.48 ± 14.8	1.84 ± 4.12	-12.8 ± 531		
	12/5/2019	-0.59 ± 15.9	0.99 ± 4.90	-60.1 ± 171		
		Mn-54	**Co-58**	**Fe-59**	**Co-60**	**Zn-65**
HIR	3/5/2019	-0.65 ± 3.30	-2.82 ± 3.45	-3.94 ± 7.23	2.20 ± 2.67	1.99 ± 8.94
	6/4/2019	-2.45 ± 3.28	0.45 ± 3.06	-0.63 ± 6.22	-1.08 ± 4.00	-2.07 ± 7.68
	9/10/2019	-0.78 ± 3.52	-0.06 ± 3.49	-0.87 ± 8.32	0.14 ± 3.23	-10.4 ± 8.90
	12/5/2019	-3.72 ± 4.30	-0.31 ± 3.84	8.10 ± 7.99 **A**	-0.44 ± 3.32	-11.8 ± 10.2
		Nb-95	**Zr-95**	**I-131**	**Cs-134**	**Cs-137**
	3/5/2019	1.52 ± 3.68	-1.10 ± 6.64	-0.90 ± 0.33	1.08 ± 3.86	0.52 ± 3.67
	6/4/2019	-1.04 ± 3.17	-4.44 ± 6.05	-0.04 ± 0.42	0.28 ± 3.00	-0.02 ± 3.50
	9/10/2019	-2.40 ± 4.08	-2.12 ± 6.41	-0.04 ± 0.48	4.79 ± 3.95 **A**	0.53 ± 3.89
	12/5/2019	2.15 ± 4.37	-3.59 ± 6.84	-0.37 ± 0.38	-4.79 ± 5.17	-0.36 ± 4.30
		Ba-140	**La-140**	**H-3**		
	3/5/2019	-15.5 ± 14.0	3.50 ± 5.10	204 ± 653		
	6/4/2019	-7.65 ± 16.3	1.83 ± 4.03	-74.0 ± 794		
	9/10/2019	-10.8 ± 14.7	0.03 ± 3.45	-280 ± 544		
	12/5/2019	-2.59 ± 17.4	-4.00 ± 5.94	22.2 ± 177		

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TABLE 3-8: GAMMA EMITTER AND TRITIUM CONCENTRATIONS IN WELL WATER

Surry Power Station, Surry County, Virginia - 2019

pCi/Liter ± 2 Sigma

SAMPLING LOCATIONS	COLLECTION DATE	ISOTOPE				
		Mn-54	**Co-58**	**Fe-59**	**Co-60**	**Zn-65**
TC	3/5/2019	2.57 ± 3.34	1.14 ± 3.47	0.29 ± 6.94	1.79 ± 2.97	-0.27 ± 7.85
	6/4/2019	0.48 ± 2.37	0.10 ± 2.88	1.19 ± 7.20	0.04 ± 3.01	-1.15 ± 6.81
	9/10/2019	-0.59 ± 4.46	1.97 ± 4.90	-2.05 ± 6.86	1.62 ± 4.72	-1.88 ± 10.3
	12/5/2019	-0.71 ± 3.13	-0.35 ± 3.48	3.69 ± 6.86	2.18 ± 3.74	-15.0 ± 11.1
		Nb-95	**Zr-95**	**I-131**	**Cs-134**	**Cs-137**
	3/5/2019	0.64 ± 3.09	-0.19 ± 5.45	0.18 ± 0.35	2.05 ± 4.12	0.29 ± 3.94
	6/4/2019	-0.87 ± 3.06	2.31 ± 5.01	0.10 ± 0.38	1.74 ± 3.01	0.75 ± 3.28
	9/10/2019	4.95 ± 5.37	4.91 ± 6.57	0.14 ± 0.57	-0.74 ± 4.74	-0.63 ± 5.29
	12/5/2019	1.11 ± 3.66	-3.66 ± 5.89	-0.10 ± 0.45	-2.85 ± 3.33	-3.07 ± 3.91
		Ba-140	**La-140**	**H-3**		
	3/5/2019	1.43 ± 13.8	0.98 ± 6.12	280 ± 664		
	6/4/2019	5.49 ± 14.4	-1.05 ± 4.67	300 ± 840		
	9/10/2019	6.86 ± 15.4	1.00 ± 6.58	148 ± 583		
	12/5/2019	-6.96 ± 15.3	3.46 ± 3.71	83.0 ± 184		

TABLE 3-9: GAMMA EMITTER AND TRITIUM CONCENTRATIONS IN RIVER WATER

Surry Power Station, Surry County, Virginia - 2019

pCi/Liter ± 2 Sigma

SAMPLING LOCATIONS	COLLECTION DATE	ISOTOPE				
		Mn-54	**Co-58**	**Fe-59**	**Co-60**	**Zn-65**
SD	1/2/2019	1.73 ± 2.82	-2.55 ± 3.46	5.74 ± 7.10	-0.84 ± 4.02	-5.61 ± 8.25
	2/11/2019	1.47 ± 1.77	-1.36 ± 1.74	-0.21 ± 4.39	1.08 ± 2.32	-0.42 ± 4.29
	3/19/2019	1.13 ± 3.91	1.06 ± 4.06	-4.87 ± 9.12	-1.33 ± 4.87	-8.33 ± 10.3
	4/10/2019	1.19 ± 3.31	-0.35 ± 3.04	-1.86 ± 6.09	3.47 ± 4.11	-8.11 ± 8.15
	5/14/2019	-2.79 ± 3.39	-0.74 ± 3.65	-0.12 ± 6.43	-1.98 ± 4.64	1.58 ± 8.15
	6/4/2019	-1.73 ± 3.84	2.51 ± 3.72	-2.47 ± 6.92	0.43 ± 3.21	-2.00 ± 8.71
	7/2/2019	0.65 ± 4.25	2.69 ± 3.41	-3.38 ± 7.78	1.69 ± 3.85	5.08 ± 8.04
	8/6/2019	-1.02 ± 2.84	-0.29 ± 3.04	2.69 ± 6.34	-0.70 ± 3.42	-4.32 ± 7.87
	9/3/2019	-1.24 ± 3.06	-0.52 ± 3.05	-7.03 ± 8.58	-0.16 ± 4.11	-2.67 ± 11.3
	10/21/2019	0.78 ± 4.11	0.60 ± 3.91	-6.82 ± 8.50	2.43 ± 3.95	-19.9 ± 12.7
	11/26/2019	-0.82 ± 2.84	0.27 ± 2.92	-0.59 ± 6.39	1.43 ± 3.46	-0.06 ± 6.78
	12/3/2019	0.68 ± 3.05	-0.90 ± 2.76	-3.26 ± 6.53	0.68 ± 3.39	-2.86 ± 7.19
		Nb-95	**Zr-95**	**I-131**	**Cs-134**	**Cs-137**
	1/2/2019	1.06 ± 2.80	-0.19 ± 5.97	4.00 ± 4.69	3.25 ± 3.75	-1.44 ± 3.57
	2/11/2019	0.30 ± 1.96	-0.86 ± 3.11	-0.77 ± 2.34	2.54 ± 2.00 **A**	-0.75 ± 1.84
	3/19/2019	-2.70 ± 4.03	1.40 ± 7.58	-4.82 ± 5.77	0.92 ± 5.33	-2.28 ± 4.63
	4/10/2019	-0.93 ± 3.31	-3.05 ± 6.53	2.99 ± 5.58	-0.65 ± 3.87	0.55 ± 3.49
	5/14/2019	0.61 ± 4.12	5.57 ± 6.05	1.31 ± 4.26	-0.27 ± 3.37	0.10 ± 3.73
	6/4/2019	0.52 ± 3.35	-1.36 ± 6.17	-4.23 ± 6.11	1.97 ± 3.75	1.08 ± 3.79
	7/2/2019	2.58 ± 4.24	1.56 ± 6.85	1.51 ± 5.46	-1.59 ± 3.85	6.58 ± 4.16 **A**
	8/6/2019	-1.16 ± 3.13	-2.84 ± 5.73	-1.16 ± 3.46	0.79 ± 3.42	-1.62 ± 3.80
	9/3/2019	-1.68 ± 4.21	-3.38 ± 6.73	3.45 ± 4.35	3.56 ± 4.48	-2.21 ± 4.00
	10/21/2019	3.68 ± 4.80	-0.93 ± 7.88	0.22 ± 5.57	-2.43 ± 4.38	-6.06 ± 5.02
	11/26/2019	-0.26 ± 3.27	1.84 ± 4.76	-0.75 ± 4.95	-2.79 ± 3.09	-0.06 ± 2.89
	12/3/2019	-0.13 ± 3.20	0.19 ± 5.39	1.57 ± 5.59	-1.41 ± 3.46	-0.55 ± 3.19
		Ba-140	**La-140**	**H-3**	**K-40**	
	1/2/2019	-1.25 ± 14.3	0.67 ± 2.74			
	2/11/2019	-0.11 ± 7.42	-2.15 ± 2.55			
	3/19/2019	6.84 ± 18.6	0.83 ± 5.41	131 ± 457		
	4/10/2019	-0.61 ± 14.5	-1.23 ± 3.87			
	5/14/2019	6.13 ± 14.4	0.22 ± 5.18			
	6/4/2019	-0.31 ± 17.1	0.38 ± 5.17	-620 ± 458		
	7/2/2019	8.67 ± 15.1	-4.45 ± 5.49			
	8/6/2019	3.92 ± 11.0	-0.82 ± 3.65		**142** ± 61.0	
	9/3/2019	-6.99 ± 14.3	7.27 ± 6.58 **A**	-232 ± 471		
	10/21/2019	-16.1 ± 17.6	0.10 ± 4.97		**96.3** ± 92.0	
	11/26/2019	5.93 ± 15.0	-2.72 ± 4.81			
	12/3/2019	-5.74 ± 15.0	0.06 ± 5.10	605 ± 636	**207** ± 71.3	

A: < MDC

TABLE 3-9: GAMMA EMITTER AND TRITIUM CONCENTRATIONS IN RIVER WATER

Surry Power Station, Surry County, Virginia - 2019

pCi/Liter ± 2 Sigma

SAMPLING LOCATIONS	COLLECTION DATE	ISOTOPES				
		Mn-54	**Co-58**	**Fe-59**	**Co-60**	**Zn-65**
SW-C	1/2/2019	2.00 ± 3.50	1.79 ± 3.55	-2.20 ± 6.60	0.48 ± 3.01	-4.43 ± 7.21
	2/12/2019	-0.37 ± 3.89	-3.63 ± 3.50	1.11 ± 7.87	1.00 ± 3.14	1.50 ± 8.19
	3/19/2019	-0.20 ± 3.63	-3.32 ± 3.97	5.27 ± 7.51	-1.05 ± 3.75	-4.56 ± 8.48
	4/16/2019	2.50 ± 3.28	-2.96 ± 3.75	1.36 ± 6.99	-0.78 ± 3.55	-7.33 ± 8.91
	5/14/2019	1.35 ± 2.45	1.50 ± 3.55	0.50 ± 7.31	2.74 ± 3.65	8.45 ± 7.85 **A**
	6/4/2019	-1.76 ± 3.49	-0.27 ± 3.06	1.81 ± 6.63	0.67 ± 3.34	-3.29 ± 6.69
	7/2/2019	-2.99 ± 2.95	-0.66 ± 3.22	0.72 ± 5.86	-0.32 ± 2.99	-1.40 ± 7.94
	8/6/2019	2.45 ± 3.41	-0.03 ± 3.71	-0.71 ± 6.03	1.91 ± 4.07	-5.82 ± 7.98
	9/3/2019	-1.48 ± 3.59	3.94 ± 4.00	-1.00 ± 7.93	-1.30 ± 3.82	-8.35 ± 10.4
	10/22/2019	-0.24 ± 4.27	-0.69 ± 4.15	-5.42 ± 7.35	0.93 ± 4.67	-20.7 ± 11.6
	11/26/2019	0.43 ± 3.59	-3.01 ± 3.09	4.45 ± 7.66	-0.20 ± 3.19	-10.1 ± 7.42
	12/3/2019	2.62 ± 3.61	-2.51 ± 3.55	4.45 ± 7.47	-0.67 ± 3.86	-13.1 ± 8.91
		Nb-95	**Zr-95**	**I-131**	**Cs-134**	**Cs-137**
	1/2/2019	3.26 ± 3.70	-3.58 ± 5.74	-2.46 ± 5.53	1.78 ± 4.20	-1.18 ± 3.61
	2/12/2019	-0.80 ± 4.04	0.43 ± 6.34	-1.83 ± 4.38	-1.05 ± 4.51	0.33 ± 4.12
	3/19/2019	-1.17 ± 4.20	-0.31 ± 7.13	-0.08 ± 5.31	-0.08 ± 4.45	-0.97 ± 4.32
	4/16/2019	1.71 ± 3.37	0.07 ± 5.25	-0.82 ± 4.69	1.58 ± 4.37	-1.90 ± 3.88
	5/14/2019	-1.63 ± 3.72	-1.69 ± 5.60	-3.01 ± 4.44	0.17 ± 3.67	0.52 ± 3.91
	6/4/2019	0.99 ± 3.61	3.37 ± 4.99	-3.45 ± 4.30	-0.87 ± 3.50	-0.73 ± 3.01
	7/2/2019	2.99 ± 2.98 **A**	0.73 ± 4.99	2.19 ± 4.01	4.15 ± 3.20 **A**	-0.28 ± 3.30
	8/6/2019	-1.86 ± 3.51	7.20 ± 6.57 **A**	4.28 ± 4.13 **A**	-1.18 ± 3.88	-3.93 ± 3.45
	9/3/2019	-0.69 ± 4.52	1.90 ± 5.15	0.83 ± 4.97	-2.20 ± 3.60	-0.50 ± 4.00
	10/22/2019	0.93 ± 4.67	2.96 ± 7.25	-2.68 ± 4.67	1.71 ± 4.09	0.21 ± 4.67
	11/26/2019	2.23 ± 3.38	2.26 ± 5.69	-1.76 ± 5.40	-0.88 ± 3.67	-0.24 ± 3.97
	12/3/2019	1.86 ± 3.50	-0.16 ± 6.34	-6.78 ± 6.19	2.32 ± 4.21	0.24 ± 4.17
		Ba-140	**La-140**	**H-3**	**K-40**	**Ra-226**
	1/2/2019	-3.12 ± 19.2	0.18 ± 4.67			
	2/12/2019	1.15 ± 13.8	-1.61 ± 4.71			
	3/19/2019	5.63 ± 17.5	-0.30 ± 4.55	-45.9 ± 444		
	4/16/2019	15.0 ± 13.1 **A**	-4.17 ± 5.37			**267** ± 189
	5/14/2019	-10.2 ± 14.5	-1.88 ± 4.15			
	6/4/2019	-3.27 ± 13.0	1.36 ± 3.52	-416 ± 465		
	7/2/2019	0.68 ± 12.2	-1.39 ± 3.53			
	8/6/2019	-4.69 ± 14.4	-0.82 ± 4.15		**62.2** ± 58.4	
	9/3/2019	-12.9 ± 16.3	1.17 ± 4.30	302 ± 507		
	10/22/2019	4.70 ± 15.8	5.74 ± 5.06 **A**			
	11/26/2019	1.47 ± 15.3	3.68 ± 6.42			
	12/3/2019	-5.09 ± 17.3	-1.18 ± 5.82	455 ± 620	**91.6** ± 74.1	

A: < MDC

TABLE 3-10: GAMMA EMITTER CONCENTRATIONS IN SILT

Surry Power Station, Surry County, Virginia - 2019

pCi/kg (dry) ± 2 Sigma

SAMPLING LOCATIONS	COLLECTION DATE	ISOTOPE				
		Cs-134	**Cs-137**	**K-40**	**Th-228**	**Th-232**
SD	3/11/2019	70.6 ± 76.8	**225** ± 114	**18000** ± 2220	**1490** ± 181	**1190** ± 262
	9/11/2019	87.5 ± 63.4 **A**	**164** ± 99.2	**16400** ± 1990	**1280** ± 185	**1110** ± 295
		Ra-226	**Be-7**			
	3/11/2019	**5080** ± 2700				
	9/11/2019		**2110** ± 1040			
		Cs-134	**Cs-137**	**K-40**	**Th-228**	**Th-232**
CHIC-C	3/11/2019	26.9 ± 81.0	112 ± 79.4 **A**	**17000** ± 2290	**1270** ± 231	**1280** ± 287
	9/25/2019	2.61 ± 66.0	92.6 ± 65.3 **A**	**16500** ± 1880	**1450** ± 175	**1370** ± 245
		Ra-226				
	3/11/2019					
	9/25/2019	**3800** ± 2050				
		Cs-134	**Cs-137**	**K-40**	**Th-228**	**Th-232**
SI	3/11/2019	95.0 ± 99.8	126 ± 78.3 **A**	**20400** ± 2420	**1740** ± 187	**1480** ± 257
	9/12/2019	47.9 ± 60.5	112 ± 73.5 **A**	**12400** ± 2290	**880** ± 184	**1020** ± 267
		Ra-226	**Be-7**			
	3/11/2019	**3090** ± 2290	**3170** ± 1310			
	9/12/2019					

A: < MDC

TABLE 3-11: GAMMA EMITTER CONCENTRATIONS IN SHORELINE SEDIMENT

Surry Power Station, Surry County, Virginia - 2019

pCi/kg (dry) ± 2 Sigma

SAMPLING LOCATIONS	COLLECTION DATE	ISOTOPE				
		Cs-134	**Cs-137**	**K-40**		
HIR	2/11/2019	5.87 ± 18.3	8.05 ± 17.9	**3820** ± 690		
	8/6/2019	0.16 ± 27.5	-10.7 ± 26.3	**6140** ± 1090		
		Cs-134	**Cs-137**	**K-40**	**Th-228**	**Th-232**
CHIC-C	2/12/2019	30.9 ± 45.5	**126** ± 83.6	**10200** ± 1200	**909** ± 105	**866** ± 194
	8/6/2019	28.2 ± 38.8	1.77 ± 31.8	**1510** ± 740	**278** ± 121	

A: < MDC

TABLE 3-12: GAMMA EMITTER CONCENTRATION IN FISH

Surry Power Station, Surry County, Virginia - 2019

pCi/kg (wet) ± 2 Sigma

SAMPLING LOCATION	COLLECTION DATE	SAMPLE TYPE	ISOTOPE			
			K-40	**Mn-54**	**Co-58**	**Fe-59**
SD	4/3/2019	Catfish	**1840** ± 727	4.35 ± 30.0	-13.1 ± 30.6	-0.33 ± 76.2
	4/3/2019	Game fish	**2440** ± 835	13.8 ± 37.1	2.12 ± 34.9	20.4 ± 102
	10/23/2019	Catfish	**1350** ± 675	-4.79 ± 24.8	-1.00 ± 29.7	0.01 ± 53.3
	10/15/2019	Game fish	**2590** ± 921	13.5 ± 37.3	-11.2 ± 36.4	-78.1 ± 90.1
			Co-60	**Zn-65**	**Cs-134**	**Cs-137**
	4/3/2019	Catfish	-3.50 ± 31.2	-32.9 ± 57.8	10.2 ± 33.2	-4.01 ± 31.3
	4/3/2019	Game fish	-22.5 ± 47.7	-70.5 ± 104	41.5 ± 43.1	5.01 ± 37.2
	10/23/2019	Catfish	13.5 ± 27.7	-88.2 ± 73.7	-4.50 ± 33.2	4.10 ± 29.9
	10/15/2019	Game fish	27.8 ± 33.1	-202 ± 107	-20.8 ± 39.1	53.4 ± 38.6 **A**

A: < MDC

TABLE 3-13: GAMMA EMITTER CONCENTRATIONS IN OYSTERS

Surry Power Station, Surry County, Virginia - 2019

pCi/kg (wet) ± 2 Sigma

SAMPLING LOCATIONS	COLLECTION DATE	ISOTOPE			
		Mn-54	**Co-58**	**Fe-59**	**Co-60**
POS	3/13/2019	9.84 ± 52.1	-28.0 ± 70.7	-132 ± 151	26.4 ± 46.6
	9/12/2019	2.18 ± 23.7	16.1 ± 32.4	47.5 ± 78.0	13.0 ± 22.2
		Zn-65	**Cs-134**	**Cs-137**	**K-40**
	3/13/2019	-71.5 ± 106	8.83 ± 51.9	42.3 ± 54.2	
	9/12/2019	34.4 ± 56.0	-7.24 ± 26.0	16.0 ± 22.9	**695** ± 399
		Mn-54	**Co-58**	**Fe-59**	**Co-60**
MP	3/12/2019	-15.7 ± 40.9	-37.4 ± 47.2	25.5 ± 93.0	-5.00 ± 43.7
	9/12/2019	-0.92 ± 20.0	-0.62 ± 29.1	8.48 ± 69.3	-0.81 ± 18.6
		Zn-65	**Cs-134**	**Cs-137**	**K-40**
	3/12/2019	-37.1 ± 97.0	-7.80 ± 49.4	7.91 ± 39.0	
	9/12/2019	-60.7 ± 45.7	-1.06 ± 23.3	14.8 ± 19.3	**540** ± 376
		Mn-54	**Co-58**	**Fe-59**	**Co-60**
SHI	3/13/2019	20.0 ± 44.5	-56.4 ± 57.9	1.53 ± 126	21.6 ± 37.2
	9/12/2019	5.17 ± 16.1	5.45 ± 22.9	-2.46 ± 60.5	-0.04 ± 20.7
		Zn-65	**Cs-134**	**Cs-137**	**K-40**
	3/13/2019	68.5 ± 104	8.27 ± 51.8	-22.9 ± 42.1	
	9/12/2019	-46.0 ± 37.7	16.2 ± 16.9	0.60 ± 14.9	**787** ± 290

A: <MDC

TABLE 3-14: GAMMA EMITTER CONCENTRATIONS IN CLAMS

Surry Power Station, Surry County, Virginia - 2019

pCi/kg (wet) ± 2 Sigma

SAMPLING LOCATIONS	COLLECTION DATE	ISOTOPE			
		Mn-54	**Co-58**	**Fe-59**	**Co-60**
JI	3/12/2019	-6.07 ± 47.8	-17.8 ± 58.6	111 ± 117	26.4 ± 29.0
	9/25/2019	-14.6 ± 20.6	0.34 ± 22.4	2.17 ± 60.1	-2.73 ± 19.6
		Zn-65	**Cs-134**	**Cs-137**	**K-40**
	3/12/2019	-36.3 ± 101	8.21 ± 44.4	21.5 ± 42.1	
	9/25/2019	-57.1 ± 48.0	-7.85 ± 21.3	18.5 ± 20.8	**687** ± 509
		Mn-54	**Co-58**	**Fe-59**	**Co-60**
SD	3/11/2019	-15.9 ± 43.1	16.4 ± 48.9	42.1 ± 134	-29.1 ± 40.3
	9/25/2019	-2.70 ± 13.5	-1.87 ± 17.5	43.5 ± 44.2	-1.73 ± 14.5
		Zn-65	**Cs-134**	**Cs-137**	**K-40**
	3/11/2019	41.5 ± 104	-22.2 ± 41.1	9.99 ± 42.6	
	9/25/2019	-29.6 ± 34.5	-6.93 ± 15.5	-3.95 ± 13.8	**485** ± 274
		Mn-54	**Co-58**	**Fe-59**	**Co-60**
CHIC-C	3/11/2019	11.4 ± 30.5	-20.7 ± 44.4	11.7 ± 100	-2.43 ± 26.1
	9/25/2019	0.82 ± 15.4	-8.23 ± 19.5	11.5 ± 43.8	4.53 ± 15.6
		Zn-65	**Cs-134**	**Cs-137**	
	3/11/2019	-61.6 ± 96.0	14.9 ± 37.1	-18.9 ± 42.6	
	9/25/2019	-22.8 ± 38.3	2.54 ± 16.1	-15.0 ± 14.7	

A: < MDC

TABLE 3-15: GAMMA EMITTER CONCENTRATIONS IN CRABS

Surry Power Station, Surry County, Virginia - 2019

pCi/kg (wet) ± 2 Sigma

SAMPLING LOCATIONS	COLLECTION DATE	ISOTOPE			
		K-40	**Mn-54**	**Co-58**	**Fe-59**
SD	6/4/2019	**1630** ± 351	-2.63 ± 15.6	-9.70 ± 16.5	-9.25 ± 36.1
		Co-60	**Zn-65**	**Cs-134**	**Cs-137**
	6/4/2019	13.6 ± 15.8	-26.7 ± 36.1	7.71 ± 15.6	-7.19 ± 13.9

4. DISCUSSION OF RESULTS

Data from the radiological analyses of environmental media collected during 2019 and tabulated in Section 3, are discussed below. The procedures and specifications followed in the laboratory for these analyses are as required in the Teledyne Brown Engineering quality assurance manuals and laboratory procedures. In addition to internal quality control measures performed by the laboratories, 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 Program are provided in Appendix B.

The predominant radioactivity detected throughout 2019 was from external sources, such as fallout from nuclear weapons tests (cesium-137) and naturally occurring radionuclides. Naturally occurring nuclides, such as beryllium-7, radium-226, thorium-228, thorium-232 and potassium-40, were detected in numerous samples.

The following is a discussion and summary of the results of the environmental measurements taken during the 2019 reporting period.

4.3 Airborne Radioiodine

Air is also continuously sampled for radioiodines by passing air through charcoal cartridges. Once a week, the charcoal cartridge samples are collected and analyzed. The results of the analyses are presented in Table 3-4. All results are below the lower limit of detection. No positive iodine-131 was detected in air samples in 2019.

4.4 Air Particulate Gamma

The air particulate filters from 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 potassium-40 and beryllium-7, which are produced by cosmic processes. No man-made radionuclides were identified. These analyses confirm no effects from station effluents.

4.5 Animal Milk

Analysis of milk samples is generally the most sensitive indicator of fission product existence in the terrestrial environment. This, in combination with the significant human consumption of milk, results in this pathway often being the most critical as it relates to station radiological effluents. This pathway also shows measurable amounts of nuclear weapons testing fallout. Therefore, this media needs to be carefully evaluated when determining the effects from station effluents.

Results of gamma spectroscopy indicate no detectable station related radioactivity was identified in milk samples in 2019. The results of the analyses are presented in Table 3-6. In years past, cesium-137 had been detected sporadically. The occurrences were attributed to residual global fallout from past atmospheric weapons testing.

At the request of the Commonwealth of Virginia, a quarterly composite sample is prepared from the monthly milk samples from the Colonial Parkway collection station. The composite samples are analyzed for strontium-89 and strontium-90. No strontium-89 was detected in the four composites analyzed. Strontium-90 was detected in two of the four composite samples, with an average concentration of 1.32 pCi/L. Strontium-90 is not a component of station radiological effluents and is a product of nuclear weapons testing fallout.

4.6 Food Products

Three food product samples (corn, peanuts, and soybeans) were collected and analyzed by gamma spectroscopy. The results of the analyses are presented in Table 3-7. As expected, only naturally occurring potassium-40 was detected in all samples. No station related radioactivity was detected in this pathway.

4.7 Well Water

Well water is not considered to be affected by station operations because there are no discharges made to this pathway. However, Surry Power Station monitors well water quarterly at three indicator locations. Well water samples are analyzed for gamma radiation and tritium. The results of these analyses are presented in Table 3-8. No station related radioactivity was detected in 2019. Historically, during the pre-operational period, no gamma emitting isotopes were detected.

4.8 River Water

Samples of the James River water are collected monthly and the results are presented in Table 3-9. All samples are analyzed by gamma spectroscopy. The monthly samples are also composited and analyzed for tritium on a quarterly basis. No positive tritium was detected. Only naturally occurring potassium-40 and radium-226 radionuclides were detected. No station related radioactivity was detected.

4.9 Silt

Silt is sampled to evaluate any buildup of radionuclides in the environment due to the operation of the station. Sampling of this pathway provides a good indication of the dispersion effects of effluents to the river. Buildup of radionuclides in silt could indirectly lead to increasing radioactivity levels in clams, oysters, crabs and fish.

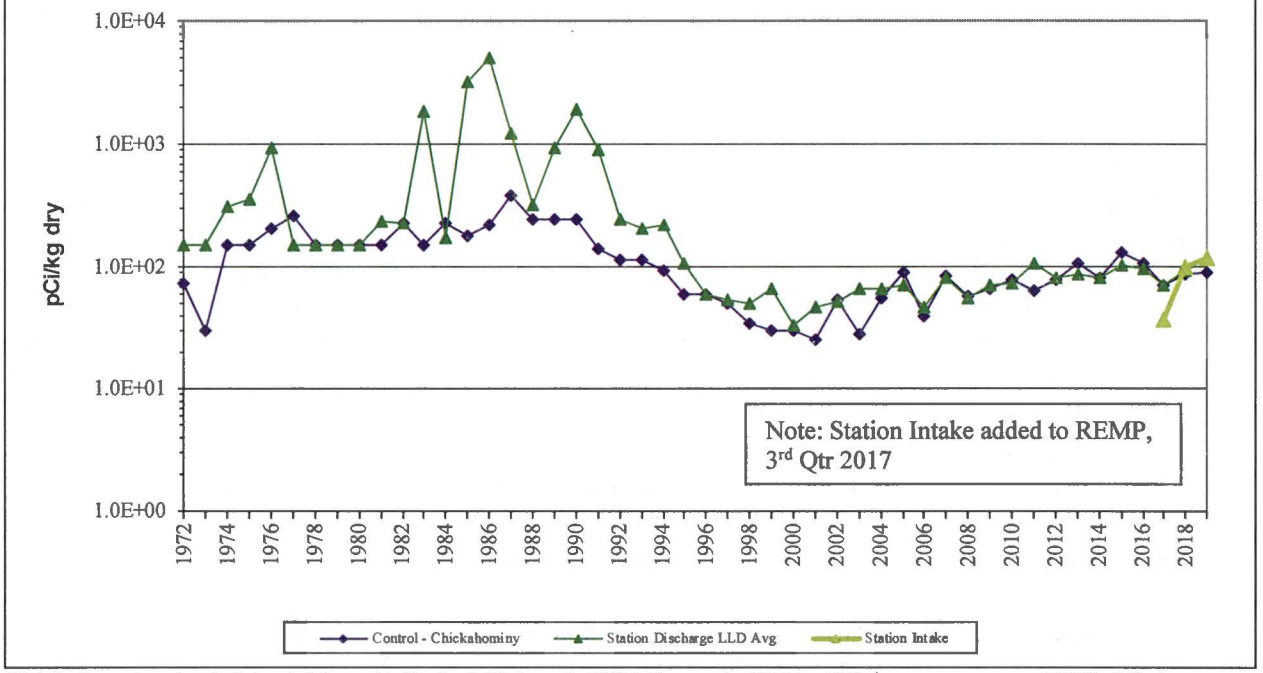
Samples of silt are collected from three locations, one upstream, one downstream of the station and one in the dredge area of the station intake. The station intake silt sample was added in third quarter of 2017 to provide data for future station intake dredging operations. The results of the gamma spectroscopy analyses are presented in Table 3-10. Naturally occurring beryllium-7, potassium-40, radium-226, thorium-228, and thorium-232 were detected. Historically, cobalt-60 has been detected in samples obtained from the station discharge indicator location. Cobalt-60 has not been detected since 2003. A trend graph of cesium-137 and cobalt-60 concentrations is presented in Figures 4-4 and 4-5. The trend graph of cesium-137 is displayed in Figure 4-5. For three decades, the general concentration for cesium-137 has continued to decrease. The trended data is the calculated average of the semi-annual sample analysis results.

The average concentration in the control sample continues to show a decreasing trend. The average concentration in the Station Discharge indicator sample also indicates an overall decreasing trend; however, an increase in concentration was observed in 2018 and 2019. The increase in the silt cesium-137 concentration corresponds to the increase of cesium-137 discharged in the liquid waste effluent. In 2019, the cesium-137 concentration in the liquid waste effluent pathway was reduced. A decreasing trend in the silt concentration is expected to follow. This location will continue to be monitored.

The Station Intake indicator sample was added to the REMP in 2017. The additional sample is located in the dredge channel area at the station intake. The dredge channel is approximately 150' wide and 1750' in length. This location was added to support future station intake channel dredging operations. The trend for the station intake is currently being established and carefully monitored.
The presence of cesium-137 in indicator location, Station Intake, and control location, Chick is indicative of the accumulation, through runoff, of cesium-137 into the James River from residual weapons testing fallout. Its global presence has been well documented. Samples collected from the James River, during the pre-operational period, indicated the presence of cesium-137. The pre-operational average cesium-137 concentration is indicated in Figure 4-5.

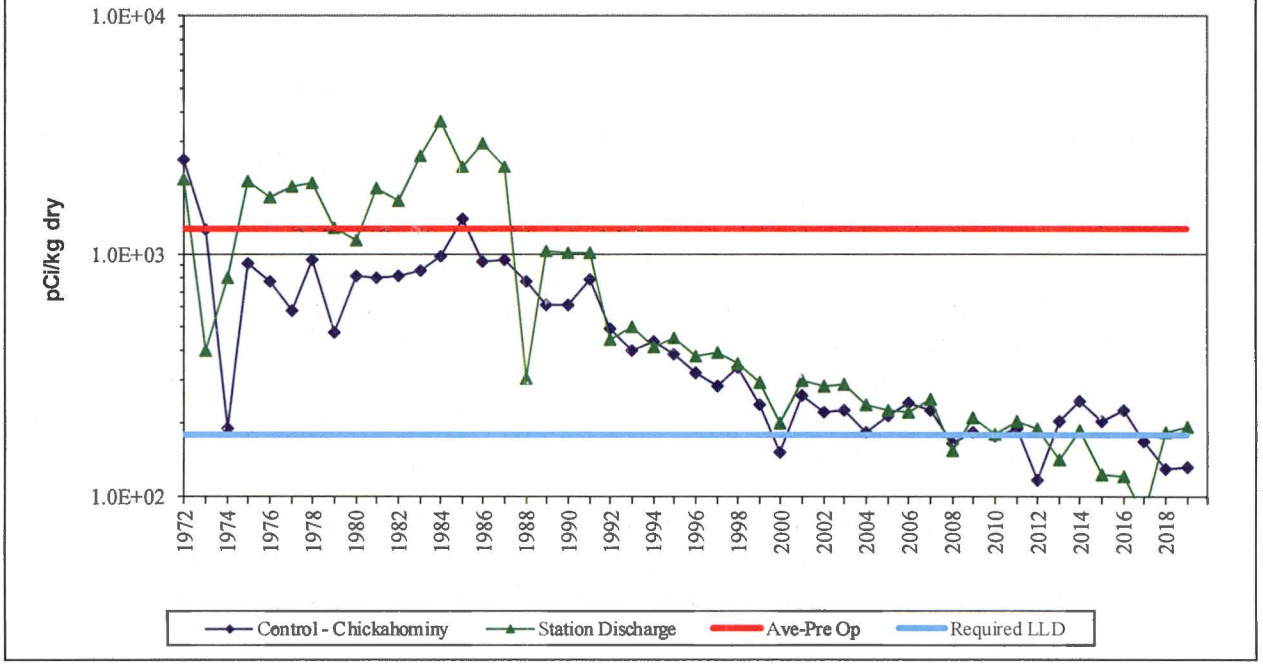
The highest silt indicator location in 2019 is the Station Discharge, with an average cesium-137 concentration of 225 pCi/kg. This concentration remains consistent with aquatic sediment samples collected in control locations of the James River.

Figure 4-4:
COBALT-60 IN SILT



Chickahominy had detectable activity in 1982 and 1984 through 1994. Other years were <MDC, Minimum Detectable Concentration. Station Discharge was <MDC activity 1996 through 1998 and 2004 through 2019.

Figure 4-5:
CESIUM-137 IN SILT



4.10 Shoreline Sediment

Shoreline sediment, unlike river silt, may provide a direct dose to humans. Buildup of radionuclides along the shoreline may provide a source of direct exposure for those using the area for commercial and recreational uses. The results are presented in Table 3-11.

The naturally occurring radionuclides potassium-40, radium-226, thorium-228, and thorium-232 were detected at concentrations equivalent to normal background activities. There were no radionuclides attributable to the operation of the station detected in any shoreline sediment samples.

4.11 Fish

The radioactivity measured in fish sampled from the Station Discharge Canal and analyzed by gamma spectroscopy is presented in Table 3-12. The 2019 results are similar to those seen over the last decade. No activity was observed in this media except for naturally occurring potassium-40.

4.12 Oysters

Oysters were collected from three different locations. The results of the oyster analyses are presented in Table 3-13. No gamma emitting radionuclides were detected in oysters sampled, except for naturally occurring potassium-40. No station related radioactivity has been detected in this media since 1991.

4.13 Clams

Clams are analyzed from three different locations. The results of the gamma spectroscopy analyses are presented in Table 3-14. Other than naturally occurring potassium-40, no other gamma emitting radionuclides related to station effluents were detected in the sample.

4.14 Crabs

An annual crab sample was collected from the station discharge canal and analyzed by gamma spectroscopy. The results of the analysis are presented in Table 3-15. Other than naturally occurring potassium-40, no other gamma emitting radionuclides related to station effluents were detected in the sample. This is consistent with pre-operational data and data collected over the past decade.

5. PROGRAM EXCEPTIONS

There were three exceptions from the REMP sampling schedule in 2019. The three exceptions are detailed below:

1. The Surry Site (SS) air sample particulate filter was invalid for the collection period 1/15/2019 – 1/22/2019. A visual inspection of the particulate filter, at time of collection, identified very little particulate material was deposited on the patch. Teledyne Brown Engineering (TBE) was notified, documented their observation and validated through analysis that the sample is invalid. TBE removed the sample from the quarterly composite group.

2. The Bacon's Castle (BC) air sampler has a 10-minute difference between the stop time and start time on 3/25/2019. This non-run time occurred to allow removal and calibration the instrument.

3. All three TLDs from location Route 633 (#21) were missing when attempting to collect them during the quarterly TLD exchange. The TLDs were mounted to a power pole. This pole was discarded and replaced. The TLD processor (Mirion) was notified of the discrepancy.

6. CONCLUSIONS

The results of the 2019 Radiological Environmental Monitoring Program for Surry Power Station have been presented in previous sections. This section presents conclusions for each pathway.

- **Direct Radiation Exposure Pathway** - There was no detectable external dose to members of the public from Surry Power Station in 2019.
  Note: The units for the Direct Radiation Exposure Pathway, as displayed in Table 3-1, have changed. The new units (mRem/Standard Quarter) match units reported in Table 3-2: Gamma Exposure Rate.

- **Airborne Exposure Pathway** – Radioiodine analysis of charcoal cartridge samples indicated that no positive activity was detected. Quarterly gamma isotopic analyses of the composite particulate samples identified only naturally occurring beryllium-7 and potassium-40. All indicator locations for air particulate gross beta concentrations trend well with the control locations. The effluent data was reviewed for the period of interest and concluded the station contribution is not measurable.

- **Milk** - Milk samples are an important indicator measuring the effect of radioactive iodine and radionuclides in airborne releases. No positive cesium-137 or iodine-131 activity was detected in any of the thirty-six samples. Naturally occurring potassium-40 was detected at a similar level when compared to the averages of the previous years.

  Strontium-90 was detected in two samples at an average concentration of 1.32 pCi/L. Strontium-90 is not a component of station effluents, but rather, a product of nuclear weapons testing fallout.

- **Food Products** - As expected, naturally occurring potassium-40 was detected in all three food product samples. In the past, cesium-137 had occasionally been detected in these samples and is attributable to global fallout from past nuclear weapons testing. No positive cesium-137 activity was detected in food product samples in 2019.

- **Well Water** - Well water sample analyses indicate no radioactivity was attributable to the operation of the station.

- **River Water** - River water samples were analyzed for gamma emitting radionuclides and tritium. Only naturally occurring potassium-40 and radium-226 were detected. No positive tritium activity was detected.

- **Silt** – No radioactivity attributable to the operation of the station was detected in the control location. Only naturally occurring radionuclides were present.

  The indicator sample with the highest average concentration of cesium-137 during 2019 is the station discharge sample, with an average concentration of 195 pCi/kg. This concentration is consistent with aquatic sediment samples collected in control locations of the James River. The presence of cesium-137 is attributable to residual weapons testing fallout.

- **Shoreline Sediment** - There were no radionuclides attributable to the operation of Surry Power Station identified in any sample. Naturally occurring radionuclides were detected at concentrations equivalent to normal background activities.

Aquatic Biota

- **Fish** - As expected, naturally occurring potassium-40 was detected. There were no other positive gamma emitting radionuclides detected in any of the fish samples.

- **Oysters** – Other than naturally occurring potassium-40, there were no other positive gamma emitting radionuclides detected in any of the oyster samples.

- **Clams** - Other than naturally occurring potassium-40, there were no other positive gamma emitting radionuclides detected in any of the clam samples.

- **Crabs** – Other than naturally occurring potassium-40, there were no other positive gamma emitting radionuclides detected in any of the clam samples.

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References

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5. Dominion, Station Administrative Procedure, VPAP-2103S, "Offsite Dose Calculation Manual (Surry)".

6. Virginia Electric and Power Company, Surry Power Station Technical Specifications, Units 1 and 2.

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

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

9. NCRP Report No. 160, "Ionizing Radiation Exposure of the Population of the United States," March 2009.

10. Position paper on "Implementation of ANSI/HPS N13.37-2014 Environmental Dosimetry Criteria at Surry Power Station", November 2016 by John M. Sukosky, CHP.

APPENDICES

APPENDIX A: LAND USE CENSUS

Year 2019

*LAND USE CENSUS**

Surry Power Station, Surry County, Virginia
January 1 - December 31, 2019 Page 1 of 1

Sector	Direction	Nearest Resident	Nearest Garden **	Nearest Cow	Nearest Goat
A	N	4.1 @ 10°	(a)	(a)	(a)
B	NNE	1.9 @ 32°	(a)	(a)	(a)
C	NE	4.7 @ 35°	(a)	(a)	(a)
D	ENE	(a)	(a)	(a)	(a)
E	E	(a)	(a)	(a)	(a)
F	ESE	(a)	(a)	(a)	(a)
G	SE	2.8 @ 142°	(a)	(a)	(a)
H	SSE	2.7 @ 158°	2.7 @ 158°	(a)	(a)
J	S	1.7 @ 181°	2.0 @ 183°	(a)	(a)
K	SSW	1.9 @ 192°	1.9 @ 192°	4.8 @ 200°	(a)
L	SW	1.23 @ 216°	4.7 @ 228°	(a)	(a)
M	WSW	0.4 @ 244°	3.6 @ 245°	(a)	(a)
N	WSW	3.1 @ 260°	3.4 @ 260°	(a)	(a)
P	WNW	4.9 @ 283°	(a)	(a)	(a)
Q	NW	4.6 @ 321°	(a)	(a)	(a)
R	NNW	3.8 @ 338°	4.4 @ 334°	3.7 @ 336°	(a)

* Locations are listed by miles and degrees heading relative to true north from center of Unit 1 Containment.

** Area greater than 50 m^2 and contains broadleaf vegetation.

(a) None

INTRODUCTION

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

A. Analytics Evaluation Criteria

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

B. ERA Evaluation Criteria

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

C. DOE Evaluation Criteria

- MAPEP's evaluation report provides an acceptance range with associated flag values. MAPEP defines three levels of performance:
- Acceptable (flag = "A") - result within ± 20% of the reference value
- Acceptable with Warning (flag = "W") - result falls in the ± 20% to ± 30% of the reference value
- Not Acceptable (flag = "N") - bias is greater than 30% of the reference value

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

RESULTS

For the TBE laboratory, 119 out of 129 analyses performed met the specified acceptance criteria. Ten analyses did not meet the specified acceptance criteria for the following reasons and were addressed through the TBE Corrective Action Program. A summary is found below:

1. The ERA April 2019 water Cs-134 result was evaluated as Not Acceptable. The reported value was 15.2 pCi/L (error 2.82 pCi/L) and the known result was 12.1 pCi/L (acceptance range of 8.39 - 14.4 pCi/L). With the error, the reported result overlaps the acceptable range. This sample was run as the workgroup duplicate on a different detector with a result of 10.7 pCi/L (within acceptable range). (NCR 19-10)

2. The ERA April 2019 water Sr-89 result was evaluated as Not Acceptable. The reported value was 44.9 pCi/L and the known result was 33.3 pCi/L (acceptance range of 24.5 - 40.1 pCi/L). The sample was only counted for 15 minutes instead of 200 minutes. The sample was re-prepped in duplicate and counted for 200 minutes with results of 30.7 ± 5.37 pCi/L and 33.0 ± 8.71 pCi/L. This was the 1st "high" failure for Sr-89 in 5 years. (NCR 19-11)

3. The MAPEP February 2019 soil Sr-90 result was not submitted and therefore evaluated as Not Acceptable. The sample was run in duplicate, with results of -1.32 ± 4.09 Bq/kg (<6.87) and -1.030 ± 3.55 Bq/kg (<5.97). The known result was a false positive test (no significant activity). TBE did not submit a result because it appeared that the results may not be accurate. TBE analyzed a substitute soil Sr-90 sample from another vendor, with a result within the acceptable range. (NCR 19-12)

4. The MAPEP February 2019 water Am-241 result was evaluated as Not Acceptable. The reported value was 0.764 ± 0.00725 Bq/L with a known result of 0.582 Bq/L (acceptable range 0.407 - 0.757 Bq/L). TBE's result falls within the upper acceptable range with the error. It appeared that a non-radiological interference was added and lead to an increased mass and higher result. (NCR 19-13)

5. The MAPEP February 2019 vegetation Sr-90 result was evaluated as Not Acceptable. The reported result was -0.1060 ± 0.0328 Bq/kg and the known result was a false positive test (no significant activity). TBE's result was correct in that there was no activity. MAPEP's evaluation was a "statistical failure" at 3 standard deviations. (NCR 19-14)

6. The ERA October 2019 water Gross Alpha result was evaluated as Not Acceptable. TBE's reported result was 40.5 ± 10.3 pCi/L and the known result was 27.6 pCi/L (ratio of TBE to known result at 135%). With the associated error, the result falls within the acceptable range (14.0 - 36.3 pCi/L). The sample was run as the workgroup duplicate on a different detector with a result of 30.8 ± 9.17 pCi/L (within the acceptable range). This was the first failure for drinking water Gr-A since 2012. (NCR 19-23)

7. The ERA October 2019 water Sr-90 result was evaluated as Not Acceptable. TBE's reported result was 32.5 ± 2.12 pCi/L and the known result was 26.5 pCi/L (ratio of TBE to known result at 123%). With the associated error, the result falls within the acceptable range (19.2 - 30.9 pCi/L). The sample was run as the workgroup duplicate on a different detector with a result of 20.0 ± 1.91 pCi/L (within the acceptable range). Both TBE results are within internal QC limits. A substitute "quick response" sample was analyzed with an acceptable result of 20.1 pCi/L (known range of 13.2 - 22.1 pCi/L). (NCR 19-24)

8. The MAPEP August 2019 soil Ni-63 result of 436 ± 22.8 Bq/kg was evaluated as Not Acceptable. The known result was 629 Bq/kg (acceptable range 440 - 818 Bq/kg). With the associated error, the TBE result falls within the lower acceptance range. All associated QC was acceptable. No reason for failure could be found. This is the first failure for soil Ni-63 since 2012. (NCR 19-25)

9. The MAPEP August 2019 water Am-241 result was not reported and therefore evaluated as Not Acceptable. Initial review of the results showed a large peak where Am-241 should be (same as the February, 2019 sample results). It is believed that Th-228 was intentionally added as an interference. The sample was re-prepped and analyzed using a smaller sample aliquot. The unusual large peak (Th-228) was seen again and also this time a smaller peak (Am-241). The result was 436 ± 22.8 Bq/L (acceptable range 0.365 ± 0.679 Bq/L). Th-228 is not a typical nuclide requested by clients, so there is no analytical purpose to take samples through an additional separation step. TBE will pursue using another vendor for Am-241 water cross-checks that more closely reflects actual customer samples. (NCR 19-26)

10. The Analytics September 2019 soil Cr-51 sample was evaluated as Not Acceptable. TBE's reported result of 0.765 ± 0.135 pCi/g exceeded the upper acceptance range (140% of the known result of 0.547 pCi/g). The TBE result was within the acceptable range (0.63 - 0.90 pCi/g) with the associated error. The Cr-51 result is very close to TBE's normal detection limit. In order to get a reportable result, the sample must be counted for 15 hours (10x longer than client samples). There is no client or regulatory requirement for this nuclide and TBE will remove Cr-51 from the reported gamma nuclides going forward. (NCR 19-27)

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 2019	E12468A	Milk	Sr-89	pCi/L	87.1	96	0.91	A
			Sr-90	pCi/L	12.6	12.6	1.00	A
	E12469A	Milk	Ce-141	pCi/L	113	117	0.97	A
			Co-58	pCi/L	153	143	1.07	A
			Co-60	pCi/L	289	299	0.97	A
			Cr-51	pCi/L	233	293	0.80	A
			Cs-134	pCi/L	147	160	0.92	A
			Cs-137	pCi/L	193	196	0.98	A
			Fe-59	pCi/L	153	159	0.96	A
			I-131	pCi/L	91.5	89.5	1.02	A
			Mn-54	pCi/L	149	143	1.04	A
			Zn-65	pCi/L	209	220	0.95	A
	E12470	Charcoal	I-131	pCi	77.5	75.2	1.03	A
	E12471	AP	Ce-141	pCi	60.7	70.2	0.87	A
			Co-58	pCi	87.9	85.8	1.02	A
			Co-60	pCi	175	179	0.98	A
			Cr-51	pCi	165	176	0.94	A
			Cs-134	pCi	91.2	95.9	0.95	A
			Cs-137	pCi	120	118	1.02	A
			Fe-59	pCi	108	95.3	1.13	A
			Mn-54	pCi	94.2	85.7	1.10	A
			Zn-65	pCi	102	132	0.77	W
	E12472	Water	Fe-55	pCi/L	2230	1920	1.16	A
	E12473	Soil	Ce-141	pCi/g	0.189	0.183	1.03	A
			Co-58	pCi/g	0.209	0.224	0.93	A
			Co-60	pCi/g	0.481	0.466	1.03	A
			Cr-51	pCi/g	0.522	0.457	1.14	A
			Cs-134	pCi/g	0.218	0.250	0.87	A
			Cs-137	pCi/g	0.370	0.381	0.97	A
			Fe-59	pCi/g	0.263	0.248	1.06	A
			Mn-54	pCi/g	0.248	0.223	1.11	A
			Zn-65	pCi/g	0.371	0.344	1.08	A
	E12474	AP	Sr-89	pCi	88.3	95.2	0.93	A
			Sr-90	pCi	11.7	12.5	0.94	A
August 2019	E12562	Soil	Sr-90	pCi/g	4.710	6.710	0.70	W

(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 2019	E12475	Milk	Sr-89	pCi/L	70.0	93.9	0.75	W
			Sr-90	pCi/L	12.0	12.9	0.93	A
	E12476	Milk	Ce-141	pCi/L	150	167	0.90	A
			Co-58	pCi/L	170	175	0.97	A
			Co-60	pCi/L	211	211	1.00	A
			Cr-51	pCi/L	323	331	0.98	A
			Cs-134	pCi/L	180	207	0.87	A
			Cs-137	pCi/L	147	151	0.97	A
			Fe-59	pCi/L	156	148	1.05	A
			I-131	pCi/L	81.1	92.1	0.88	A
			Mn-54	pCi/L	160	154	1.04	A
			Zn-65	pCi/L	303	293	1.03	A
	E12477	Charcoal	I-131	pCi	95.9	95.1	1.01	A
	E12478	AP	Ce-141	pCi	129	138	0.93	A
			Co-58	pCi	128	145	0.88	A
			Co-60	pCi	181	174	1.04	A
			Cr-51	pCi	292	274	1.07	A
			Cs-134	pCi	166	171	0.97	A
			Cs-137	pCi	115	125	0.92	A
			Fe-59	pCi	119	123	0.97	A
			Mn-54	pCi	129	128	1.01	A
			Zn-65	pCi	230	242	0.95	A
	E12479	Water	Fe-55	pCi/L	1810	1850	0.98	A
	E12480	Soil	Ce-141	pCi/g	0.305	0.276	1.10	A
			Co-58	pCi/g	0.270	0.289	0.93	A
			Co-60	pCi/g	0.358	0.348	1.03	A
			Cr-51	pCi/g	0.765	0.547	1.40	N[1]
			Cs-134	pCi/g	0.327	0.343	0.95	A
			Cs-137	pCi/g	0.308	0.321	0.96	A
			Fe-59	pCi/g	0.257	0.245	1.05	A
			Mn-54	pCi/g	0.274	0.255	1.07	A
			Zn-65	pCi/g	0.536	0.485	1.11	A
	E12481	AP	Sr-89	pCi	95.9	91.9	1.04	A
			Sr-90	pCi	12.3	12.6	0.97	A
	E12563	Soil	Sr-90	pCi/g	0.392	0.360	1.09	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

*(1) See **NCR 19-27***

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 2019	19-GrF40	AP	Gross Alpha	Bq/sample	0.184	0.528	0.158 - 0.898	A
			Gross Beta	Bq/sample	0.785	0.948	0.474 - 1.422	A
	19-MaS40	Soil	Ni-63	Bq/kg	420	519.0	363 - 675	A
			Sr-90	Bq/kg			*(1)*	NR[3]
	19-MaW40	Water	Am-241	Bq/L	0.764	0.582	0.407 - 0.757	N[4]
			Ni-63	Bq/L	4.72	5.8	4.1 - 7.5	A
			Pu-238	Bq/L	0.443	0.451	0.316 - 0.586	A
			Pu-239/240	Bq/L	-0.00161	0.0045	*(2)*	A
	19-RdF40	AP	U-234/233	Bq/sample	0.1138	0.106	0.074 - 0.138	A
			U-238	Bq/sample	0.107	0.110	0.077 - 0.143	A
	19-RdV40	Vegetation	Cs-134	Bq/sample	2.14	2.44	1.71 - 3.17	A
			Cs-137	Bq/sample	2.22	2.30	1.61 - 2.99	A
			Co-57	Bq/sample	2.16	2.07	1.45 - 2.69	A
			Co-60	Bq/sample	0.02382		*(1)*	A
			Mn-54	Bq/sample	-0.03607		*(1)*	A
			Sr-90	Bq/sample	-0.1060		*(1)*	N[5]
			Zn-65	Bq/sample	1.35	1.71	1.20 - 2.22	W
August 2019	19-GrF41	AP	Gross Alpha	Bq/sample	0.192	0.528	0.158 - 0.898	W
			Gross Beta	Bq/sample	0.722	0.937	0.469 - 1.406	A
	19-MaS41	Soil	Ni-63	Bq/kg	436	629	440 - 818	N[6]
			Sr-90	Bq/kg	444	572	400 - 744	W
	19-MaW41	Water	Am-241	Bq/L				NR[7]
			Ni-63	Bq/L	7.28	9.7	6.8 - 12.6	W
			Pu-238	Bq/L	0.0207	0.0063	*(2)*	A
			Pu-239/240	Bq/L	0.741	0.727	0.509 - 0.945	A
	19-RdF41	AP	U-234/233	Bq/sample	0.0966	0.093	0.065 - 0.121	A
			U-238	Bq/sample	0.0852	0.096	0.067-0.125	A
	19-RdV41	Vegetation	Cs-134	Bq/sample	0.0197		*(1)*	A
			Cs-137	Bq/sample	3.21	3.28	2.30 - 4.26	A
			Co-57	Bq/sample	4.62	4.57	3.20 - 5.94	A
			Co-60	Bq/sample	4.88	5.30	3.71 - 6.89	A
			Mn-54	Bq/sample	4.54	4.49	3.14 - 5.84	A
			Sr-90	Bq/sample	0.889	1.00	0.70 - 1.30	A
			Zn-65	Bq/sample	2.78	2.85	2.00 - 3.71	A

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

(b) DOE/MAPEP evaluation:

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

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

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

(1) False positive test; (2) Sensitivity evaluation; (3) See NCR 19-12; (4) See NCR 19-13; (5) See NCR 19-14; (6) See NCR 19-2; (7) See NCR 19-26

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]
April 2019	Rad-117	Water	Ba-133	pCi/L	26.3	24.1	18.6 - 27.8	A
			Cs-134	pCi/L	15.2	12.1	8.39 - 14.4	N[(1)]
			Cs-137	pCi/L	33.6	33.1	28.8 - 39.4	A
			Co-60	pCi/L	11.9	11.5	8.67 - 15.5	A
			Zn-65	pCi/L	87.1	89.2	80.3 - 107	A
			GR-A	pCi/L	19	19.3	9.56 - 26.5	A
			GR-B	pCi/L	20.2	29.9	19.1 - 37.7	A
			U-Nat	pCi/L	55.5	55.9	45.6 - 61.5	A
			H-3	pCi/L	21500	21400	18700 - 23500	A
			Sr-89	pCi/L	44.9	33.3	24.5 - 40.1	N[(2)]
			Sr-90	pCi/L	24.5	26.3	19.0 - 30.7	A
			I-131	pCi/L	28.9	28.4	23.6 - 33.3	A
October 2019	Rad-119	Water	Ba-133	pCi/L	42.7	43.8	35.7 - 48.8	A
			Cs-134	pCi/L	53.5	55.9	45.2 - 61.5	A
			Cs-137	pCi/L	77.7	78.7	70.8 - 89.2	A
			Co-60	pCi/L	51.5	53.4	48.1 - 61.3	A
			Zn-65	pCi/L	36.6	34.0	28.5 - 43.1	A
			GR-A	pCi/L	40.5	27.6	14.0 - 36.3	N[(3)]
			GR-B	pCi/L	36.3	39.8	26.4 - 47.3	A
			U-Nat	pCi/L	27.66	28.0	22.6 - 31.1	A
			H-3	pCi/L	22800	23400	20500 - 25700	A
			Sr-89	pCi/L	47.1	45.5	35.4 - 52.7	A
			Sr-90	pCi/L	32.5	26.5	19.2 - 30.9	N[(4)]
			I-131	pCi/L	26.0	23.9	19.8 - 28.4	A
December 2019	QR 120419D	Water	Sr-90	pCi/L	20.1	18.6	13.2 - 22.1	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 19-10***

*(2) See **NCR 19-11***

*(3) See **NCR 19-23***

*(4) See **NCR 19-24***