VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

May 2, 2016

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

Serial No.	16-163
SS&L/TSC	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, 2015 through December 31, 2015, which includes environmental monitoring for the Surry ISFSI.

If you have any further questions, please contact Jason Eggart at 757-365-2010.

Sincerely,

Douglas C. Lawrence
Director Safety & Licensing
Surry Power Station

Attachment

Commitments made in this letter: None

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Serial No. 16-163
Docket Nos.: 50-280
50-281
72-2
72-55

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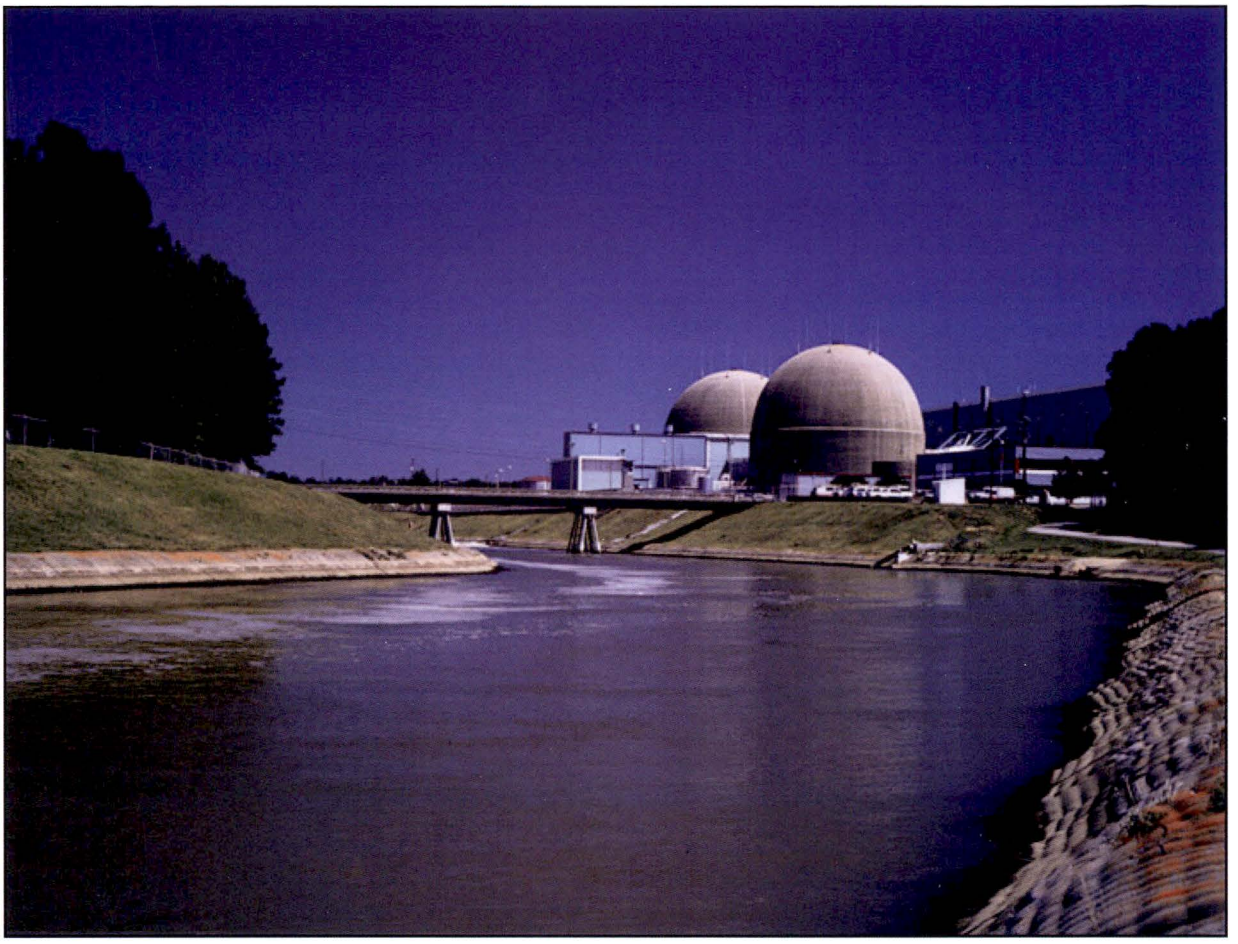
Serial No. 16-163
Docket Nos.: 50-280
50-281
72-2
72-55

ATTACHMENT 1

2015 Annual Radiological Environmental Operating Report

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

Surry Power Station



2015 Annual Radiological Environmental Operating Report

Dominion®

Dominion

Surry Power Station

Radiological Environmental Monitoring Program

January 1, 2015 to December 31, 2015

Annual Radiological Environmental Operating Report

Surry Power Station

January 1, 2015 to December 31, 2015

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Table of Contents

PREFACE 4
1. EXECUTIVE SUMMARY 5
2. PROGRAM DESCRIPTION 7
    2.1 Introduction 7
    2.2 Sampling and Analysis Program 8
3. ANALYTICAL RESULTS 20
    3.1 Summary of Results 20
    3.2 Analytical Results of 2015 REMP Samples 27
4. DISCUSSION OF RESULTS 48
    4.1 Gamma Exposure Rate 48
    4.2 Airborne Gross Beta 49
    4.3 Airborne Radioiodine 51
    4.4 Air Particulate Gamma 51
    4.5 Cow Milk 52
    4.6 Food Products 52
    4.7 Well Water 52
    4.8 River Water 52
    4.9 Silt 53
    4.10 Shoreline Sediment 55
    4.11 Fish 55
    4.12 Oysters 56
    4.13 Clams 56
    4.14 Crabs 56
5. PROGRAM EXCEPTIONS 57
6. CONCLUSIONS 58
REFERENCES 60
APPENDICES 62
  APPENDIX A: LAND USE CENSUS 63
  APPENDIX B: SUMMARY OF INTERLABORATORY COMPARISONS 65
  APPENDIX C: ERRATA 73

PREFACE

This report is submitted as required by Technical Specification 6.6.B.2, Annual Radiological Environmental 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 2015 Surry Power Station Radiological Environmental Monitoring Program (REMP). Radioactivity levels from January 1 through December 31, 2015, 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 Global Dosimetry Solutions, Inc. 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 2015 airborne results were similar 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 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. The cesium-137 activity was present in the control and indicator locations and is attributable to global fallout from past nuclear weapons testing and nuclear accidents such as Chernobyl. Shoreline sediment, which may provide a direct exposure pathway, contained no station related radionuclides. Naturally occurring radionuclides potassium, radium and thorium were detected at average environmental levels. The terrestrial exposure pathway includes milk and food products. Iodine-131 was not detected in any 2015 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 man-made radionuclides were detected in food product samples. Consistent with historical data, naturally occurring potassium-40 was detected in milk and food products. The direct exposure pathway measures environmental radiation doses using TLDs. TLD results have remained relatively constant over the years.

During 2015, 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 2015 was 0.030 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 2015 Surry Power Station operational Radiological Environmental Monitoring Program (REMP). The Dominion 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. Global Dosimetry Solutions Incorporated 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 2015 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 2015 sampling program for Surry Power Station. All samples listed in Table 2-1 are taken at indicator locations except those labeled "control." Dominion personnel collect all samples listed in Table 2-1.

Table 2-2 summarizes the analysis program conducted by Teledyne Brown Engineering and Global Dosimetry Solutions 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 Global Dosimetry Solutions, located in Costa Mesa, 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 - 2015

RADIOLOGICAL SAMPLING STATIONS

DISTANCE AND DIRECTION FROM UNIT NO. 1

Sample Media	Location	Station	Distance Miles	Direction	Degrees	Collection Frequency	Remarks
Environmental TLDs	Control	(00)	-	-	-	Quarterly	Onsite (Stored in a lead shield outside the protected area)
	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 - 2015
RADIOLOGICAL SAMPLING STATIONS
DISTANCE AND DIRECTION FROM UNIT NO. 1

Sample Media	Location	Station	Distance Miles	Direction	Degrees	Collection Frequency	Remarks
Environmental TLDs	BASF	(34)	5.1	ENE	70°	Quarterly	Apx. 5 mile
	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 and Particulate	Surry Station	(SS)	0.3	NNE	18°	Weekly	Site boundary location with highest D/Q
	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 Sediment	Hog Island Reserve	(HIR)	0.6	N	7°	Semi-Annually	
	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)	1.3	NNW	341°	Semi-Annually	

Table 2-1

SURRY - 2015
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	
	Williams	(WMS)	27.5	S	175°	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	
	Lawne's Creek	(LC)	2.4	SE	131°	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	Brock's Farm	(BROCK)	3.8	S	183°	Annually	
(Corn, Peanuts, Soybeans)	Slade's Farm	(SLADE)	3.2	S	179°	Annually	

Table 2-2

SURRY - 2015

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	
		Co-58	15	
		Fe-59	30	
		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	
		Co-58	15	
		Fe-59	30	
		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 - 2015

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	
		Co-58	130	
		Fe-59	260	
		Co-60	130	
		Zn-65	260	
		Cs-134	130	
		Cs-137	150	
Clams	Semi-Annually	Gamma Isotopic		pCi/kg - wet
		Mn-54	130	
		Co-58	130	
		Fe-59	260	
		Co-60	130	
		Zn-65	260	
		Cs-134	130	
		Cs-137	150	
Crabs	Annually	Gamma Isotopic		pCi/kg - wet
		Mn-54	130	
		Co-58	130	
		Fe-59	260	
		Co-60	130	
		Zn-65	260	
		Cs-134	130	
		Cs-137	150	

Footnotes located at end of table.

Table 2-2

SURRY - 2015

SAMPLE ANALYSIS PROGRAM

SAMPLE MEDIA	FREQUENCY	ANALYSIS	LLD*	REPORT UNITS
Fish	Semi-Annually	Gamma Isotopic		pCi/kg - wet
		Mn-54	130	
		Co-58	130	
		Fe-59	260	
		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 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

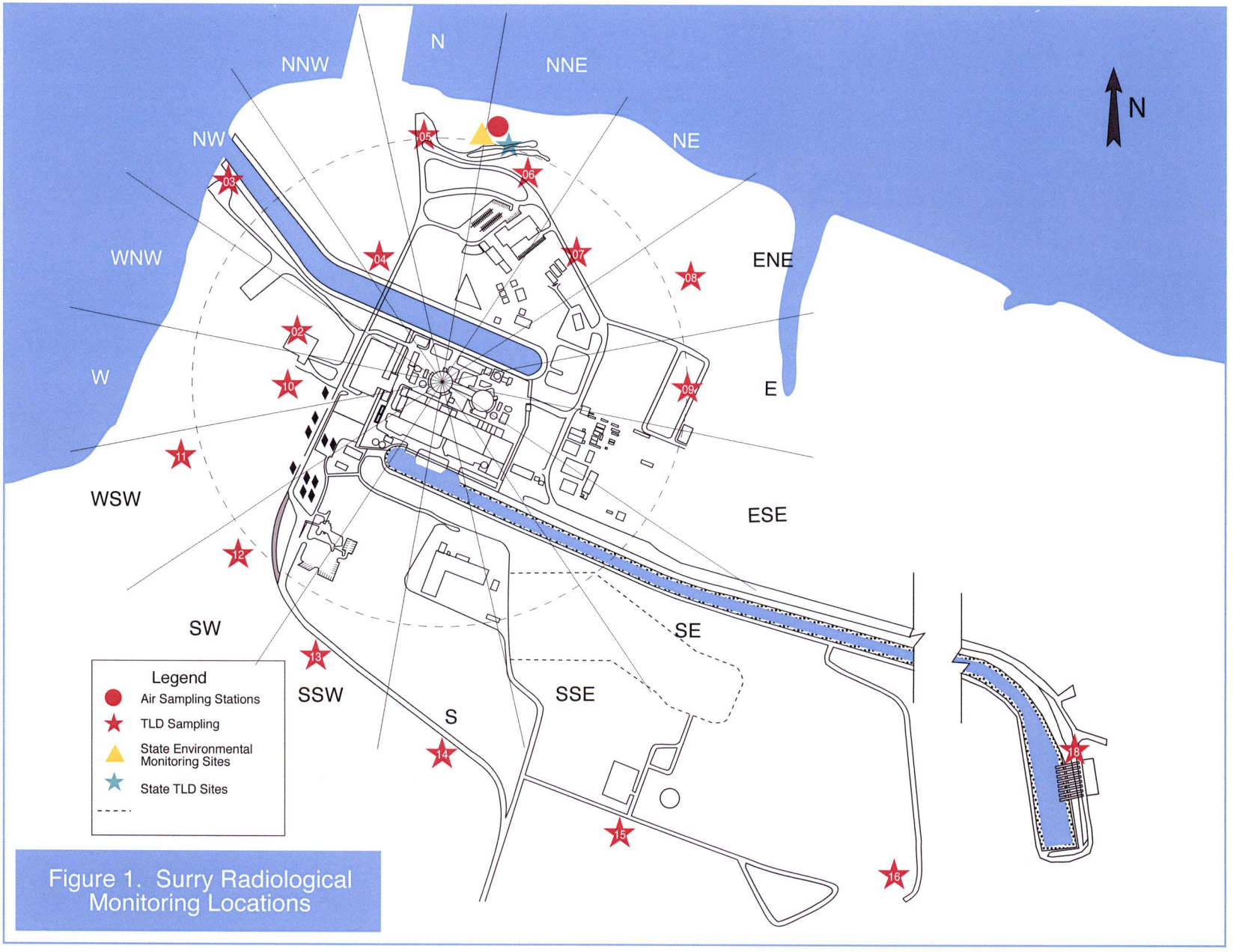

Figure 1. Surry Radiological Monitoring Locations

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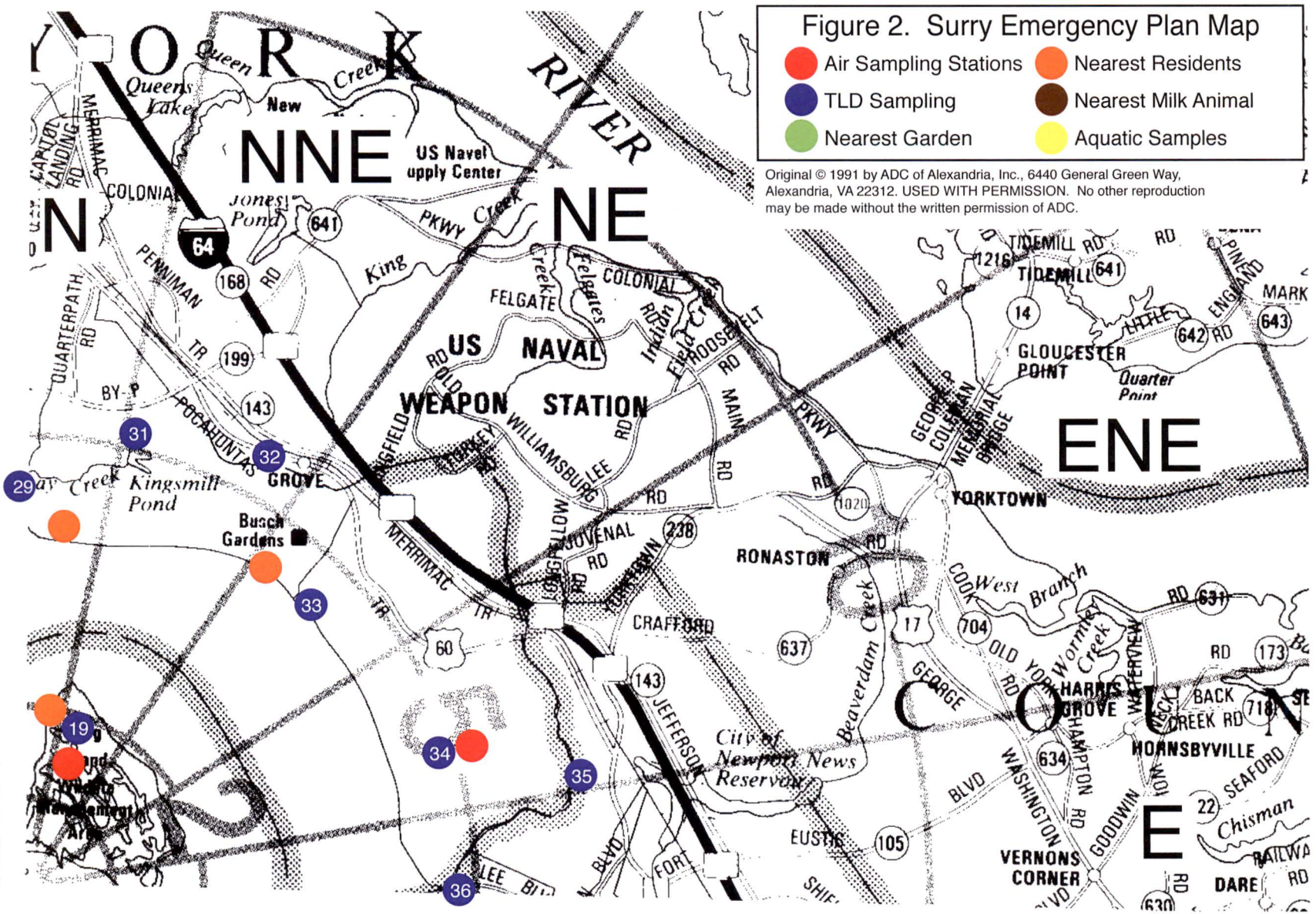

Figure 2. Surry Emergency Plan Map

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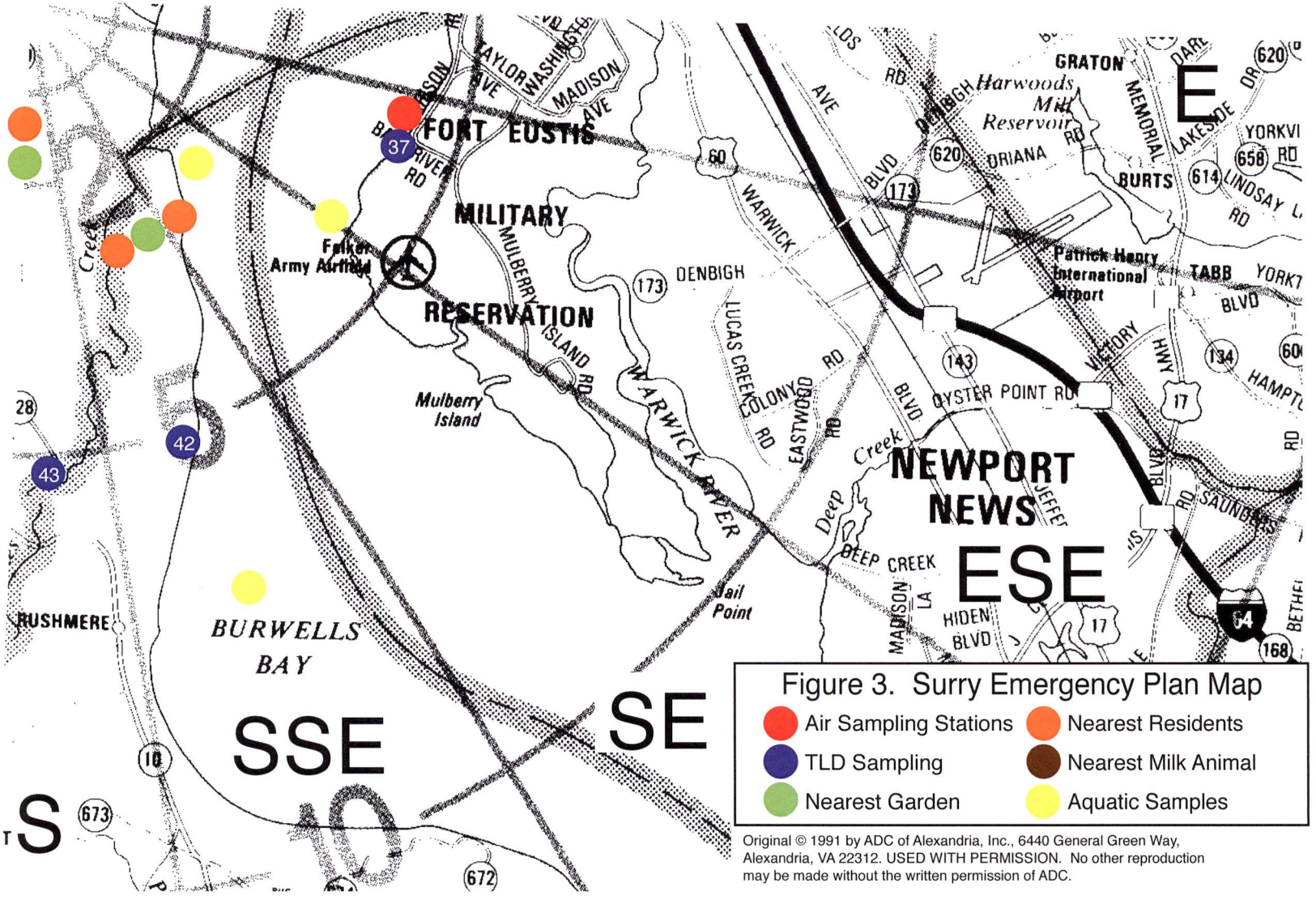

Figure 3. Surry Emergency Plan Map

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

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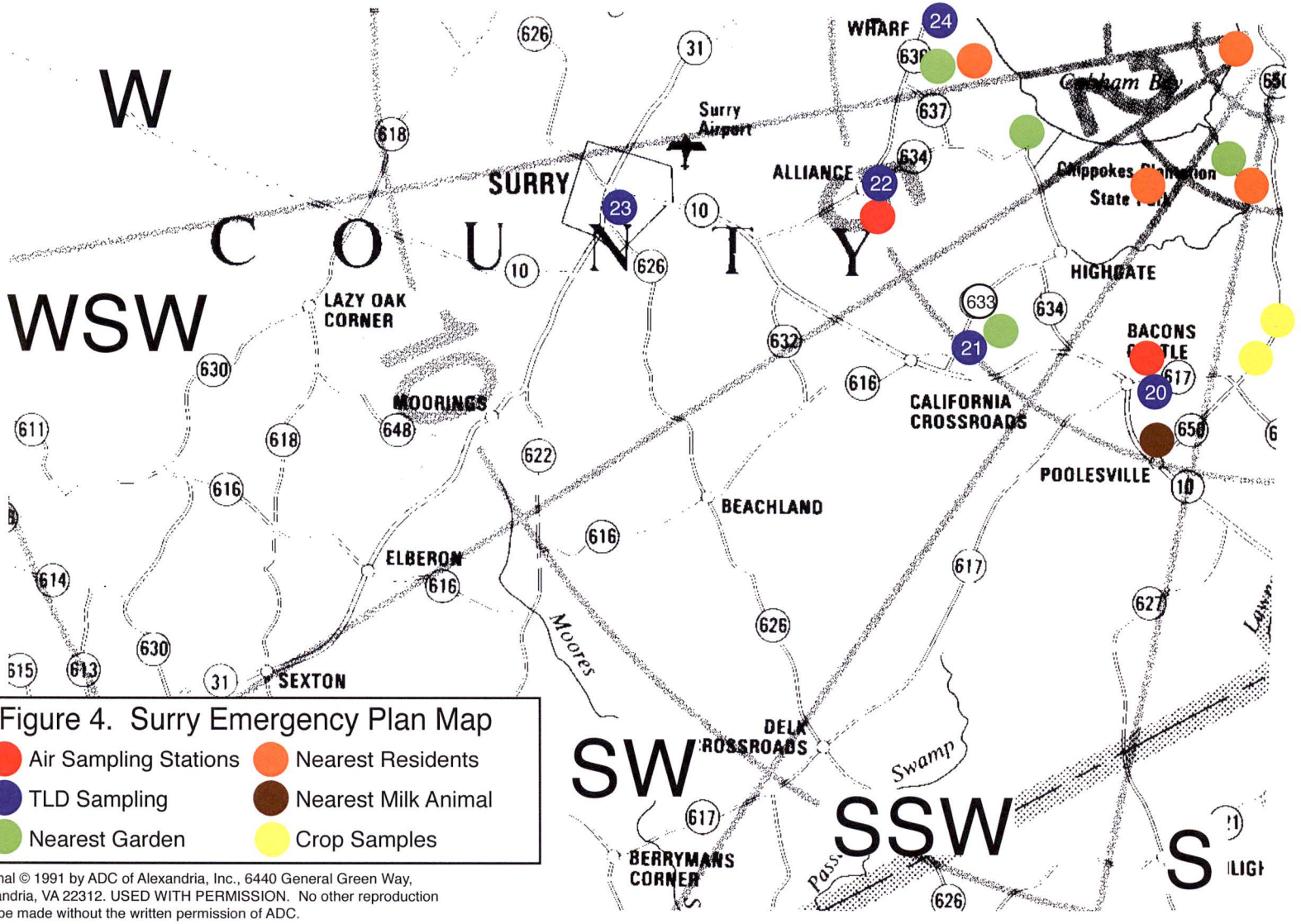

Figure 4. Surry Emergency Plan Map

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

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Figure 5. Surry Emergency Plan Map

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

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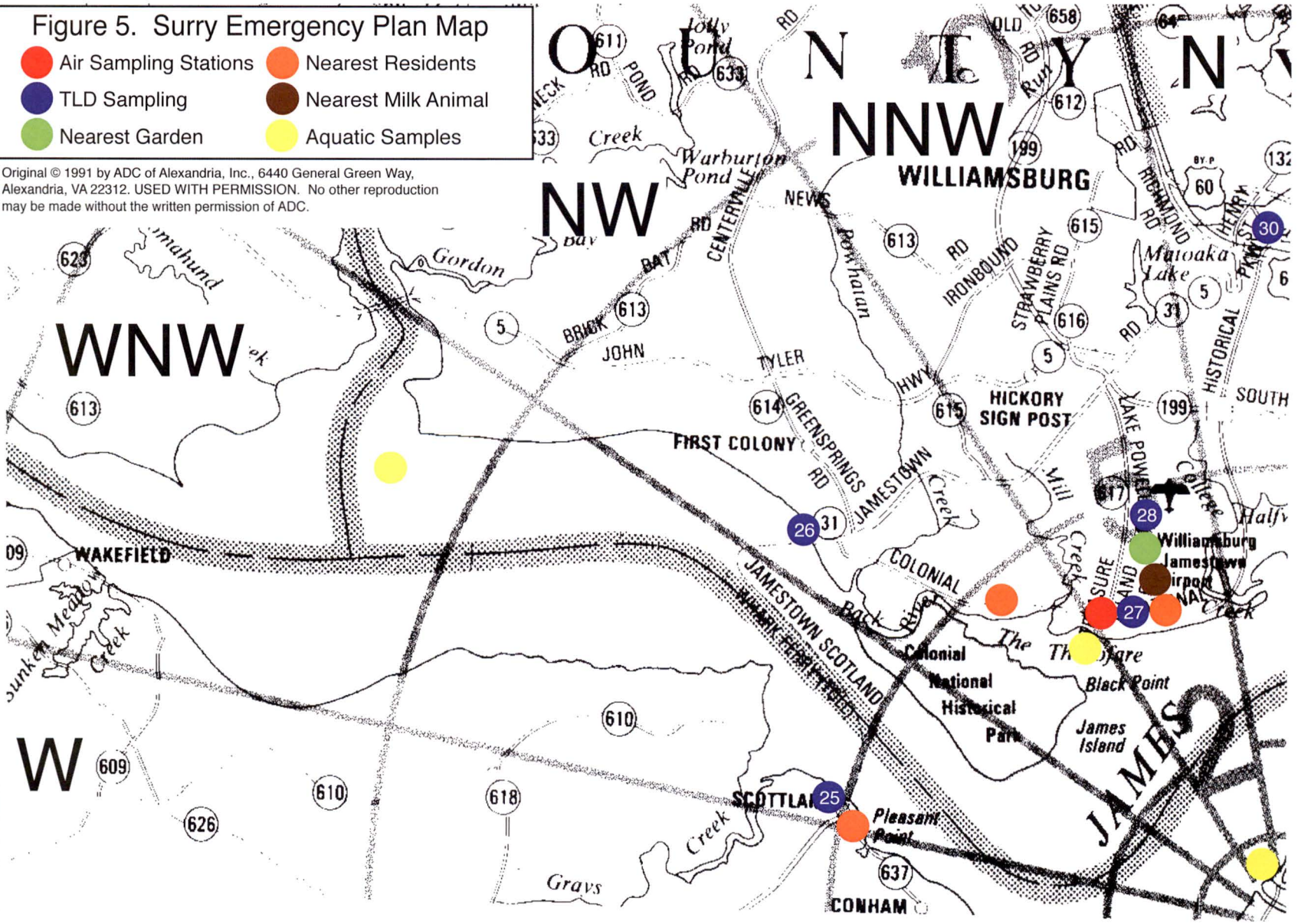


Graphics No. CB3307B

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 - 2015
Docket No. 50-280-281 Page 1 of 6

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 Month)*	**Gamma**	164	2	**5.7 (152/152) (3.4 - 8.2)**	**STA-9**	**0.3 mi E**	**7.8 (4/4) (7.3 - 8.2)**	**6.0 (12/12) (5.0 - 7.5)**	0
Air Particulate *(1E-3 pCi/m3)*	**Gross Beta**	416	10	**14.7 (359/364) (2.91 - 36.3)**	**BC**	**4.5 mi SSW**	**17.1 (52/52) (2.94 - 36.3)**	**15.9 (51/52) (3.12 - 32.8)**	0
	Gamma	32							
	Be-7	32		**130 (28/28) (94.1 - 187)**	**ALL**	**5.1 mi WSW**	**165 (4/4) (128 - 187)**	**141 (4/4) (136 - 151)**	0
	K-40	32		**17.2 (5/28) (10.0 - 24.6)**	**HIR**	**2.0 mi NNE**	**22.8 (1/4) (22.8 - 22.8)**	< 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		**1.78 (2/4) (1.76 - 1.80)**	**CP**	**3.7 mi NNW**	**1.78 (2/4) (1.76 - 1.80)**	< LLD	0
	Gamma	36							
	K-40	36		**1323 (24/24) (1070 - 1570)**	**EPPS**	**4.8 mi SSW**	**1352 (12/12) (1240 - 1570)**	**1296 (12/12) (1130 - 1430)**	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

Surry Power Station, Surry County, Virginia - 2015
Docket No. 50-280-281 Page 2 of 6

Medium or Pathway Sampled (Units)	Analysis Type	Total No.	LLD	Indicator Locations Mean Range	Location with Highest Mean Name	Distance Direction	Mean Range	Control Locations Mean Range	Non-Routine Reported Measurements
Food Products *(pCi/kg wet)*	**Gamma**	3							
	K-40	3		**9090 (3/3) (3830 - 17800)**	**Slade**	**3.2 mi S**	**17800 (1/1) (17800-17800)**	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							
	K-40	12		**88.5 (1/12) (88.5 - 88.5)**	**CS**	**0.3 mi E**	**88.5 (1/12) (88.5 - 88.5)**	N/A	0
	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
	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

TABLE 3-1: RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Surry Power Station, Surry County, Virginia - 2015
Docket No. 50-280-281 Page 3 of 6

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)*	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		**102 (8/12) (45.4 - 177)**	**SD**	**0.4 mi NW**	**102 (8/12) (45.4 - 177)**	**103 (3/12) (68.9 - 167)**	0
	Th-228	24		< LLD	**SW**	**4.9 mi WNW**	**9.95 (2/12) (4.69 - 15.2)**	**9.95 (2/12) (4.69 - 15.2)**	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
	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

TABLE 3-1: RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Surry Power Station, Surry County, Virginia - 2015
Docket No. 50-280-281 Page 4 of 6

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
Silt *(pCi/kg dry)*	**Gamma**	4							
	K-40	4		**17000 (2/2) (12900-21100)**	**CHIC**	**11.2 mi WNW**	**19050 (2/2) (16900-21200)**	**19050 (2/2) (16900-21200)**	0
	Cs-134	4	150	< LLD	N/A		< LLD	< LLD	0
	Cs-137	4	180	< LLD	**CHIC**	**11.2 mi WNW**	**205 (2/2) (196 - 214)**	**205 (2/2) (196 - 214)**	0
	Ra-226	4		**3260 (1/2) (3260 - 3260)**	**SD**	**1.3 mi NNW**	**3260 (1/2) (3260 - 3260)**	**2260 (1/2) (2260 - 2260)**	0
	Th-228	4		**1340 (2/2) (1110 - 1340)**	**CHIC**	**11.2 mi WNW**	**1365 (2/2) (1270 - 1460)**	**1365 (2/2) (1270 - 1460)**	0
	Th-232	4		**1415 (2/2) (1320 - 1415)**	**CHIC**	**11.2 mi WNW**	**1460 (2/2) (1130 - 1790)**	**1460 (2/2) (1130 - 1790)**	0
Shoreline Sediment *(pCi/kg dry)*	**Gamma**	4							
	K-40	4		**6740 (2/2) (5720 - 7760)**	**HIR**	**0.6 mi N**	**6740 (2/2) (5720 - 7760)**	**2035 (2/2) (1640 - 2430)**	0
	Cs-134	4	150	< LLD	N/A		< LLD	< LLD	0
	Cs-137	4	180	< LLD	N/A		< LLD	< LLD	0
	Ra-226	4		**1420 (1/2) (1420 - 1420)**	**CHIC**	**11.2 mi WNW**	**1639 (2/2) (927 - 2350)**	**1639 (2/2) (927 - 2350)**	0
	Th-228	4		**525 (2/2) (315 - 734)**	**CHIC**	**11.2 mi WNW**	**850 (2/2) (330 - 1370)**	**850 (2/2) (330 - 1370)**	0
	Th-232	4		**591 (2/2) (444 - 737)**	**CHIC**	**11.2 mi WNW**	**882 (2/2) (413 - 1350)**	**882 (2/2) (413 - 1350)**	0
Fish *(pCi/kg wet)*	**Gamma**	4							
	K-40	4		**1898 (4/4) (1040 - 2910)**	**SD**	**1.3 mi NNW**	**1898 (4/4) (1040 - 2910)**	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

TABLE 3-1: RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Surry Power Station, Surry County, Virginia - 2015
Docket No. 50-280-281 Page 5 of 6

Medium or Pathway Sampled (Units)	Analysis Type	Total No.	LLD	Indicator Locations Mean Range	Location with Highest Mean: Name	Distance Direction	Mean Range	Control Locations Mean Range	Non-Routine Reported Measurements
Fish *(pCi/kg wet)*	**Gamma**	4							
	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
Oysters *(pCi/kg wet)*	**Gamma**	6							
	K-40	6		**811 (3/6) (611 - 955)**	**MP**	**4.9 mi ESE**	**955 (1/2) (955 - 955)**	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							
	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

TABLE 3-1: RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Surry Power Station, Surry County, Virginia - 2015
Docket No. 50-280-281 Page 6 of 6

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
Clams *(pCi/kg wet)*	**Gamma**	6							
	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
Crabs *(pCi/kg wet)*	**Gamma**	1							
	K-40	1		**1140 (1/1) (1140 - 1140)**	**SD**	**1.3 mi NNW**	**1140 (1/1) (1140 - 1140)**	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 2015 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.

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. Cow 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 - 2015

mR/Std Month ± 2 Sigma

STATION NUMBER	FIRST QUARTER	SECOND QUARTER	THIRD QUARTER	FOURTH QUARTER	AVERAGE ± 2 SIGMA
02	6.3 ± 0.8	6.7 ± 0.4	6.9 ± 0.8	7.1 ± 0.6	6.8 ± 0.7
03	6.2 ± 0.6	6.4 ± 0.7	5.5 ± 1.7	6.4 ± 0.5	6.1 ± 0.9
04	5.6 ± 0.5	5.9 ± 0.9	6.0 ± 0.5	6.1 ± 1.1	5.9 ± 0.4
05	6.2 ± 1.2	5.8 ± 1.0	6.7 ± 0.6	6.4 ± 0.5	6.3 ± 0.8
06	5.8 ± 0.4	6.2 ± 1.0	6.5 ± 0.3	6.2 ± 0.2	6.2 ± 0.6
07	6.1 ± 0.8	5.8 ± 0.6	6.2 ± 0.4	6.3 ± 0.5	6.1 ± 0.4
08	5.5 ± 0.8	5.7 ± 1.2	5.7 ± 0.3	5.8 ± 0.4	5.7 ± 0.3
09	7.5 ± 0.7	7.3 ± 1.1	7.8 ± 0.7	7.8 ± 0.5	7.6 ± 0.5
10	5.7 ± 0.6	5.8 ± 1.2	6.4 ± 0.8	6.1 ± 0.4	6.0 ± 0.6
11	5.2 ± 0.5	5.4 ± 0.9	5.2 ± 0.1	5.6 ± 0.3	5.4 ± 0.4
12	5.2 ± 0.6	5.4 ± 0.5	5.8 ± 0.4	5.6 ± 0.3	5.5 ± 0.5
13	5.9 ± 0.5	6.3 ± 0.8	6.5 ± 0.6	6.4 ± 0.4	6.3 ± 0.5
14	5.7 ± 0.5	5.9 ± 0.7	5.9 ± 0.2	6.0 ± 0.6	5.9 ± 0.3
15	5.6 ± 0.7	5.9 ± 1.0	6.2 ± 0.6	6.5 ± 0.5	6.1 ± 0.8
16	5.0 ± 1.0	5.8 ± 0.3	3.4 ± 1.0	5.7 ± 0.8	5.0 ± 2.2
18	4.5 ± 0.3	4.6 ± 0.6	4.9 ± 0.4	4.9 ± 0.5	4.7 ± 0.4
19	4.8 ± 0.6	5.3 ± 0.6	5.2 ± 0.6	5.3 ± 0.4	5.2 ± 0.5
20	4.2 ± 0.5	4.9 ± 0.4	4.8 ± 0.3	5.0 ± 0.6	4.7 ± 0.7
21	4.5 ± 0.2	4.9 ± 0.7	5.4 ± 0.3	5.1 ± 0.4	5.0 ± 0.8
22	3.9 ± 0.4	4.4 ± 0.4	4.4 ± 0.3	4.7 ± 0.9	4.4 ± 0.7
23	5.6 ± 0.3	6.2 ± 0.9	6.2 ± 0.4	6.1 ± 0.7	6.0 ± 0.6
24	4.6 ± 0.7	5.0 ± 0.5	5.1 ± 0.5	5.0 ± 0.3	4.9 ± 0.4
25	6.0 ± 1.0	5.5 ± 0.1	6.2 ± 0.4	6.3 ± 0.5	6.0 ± 0.7
26	5.2 ± 0.3	5.4 ± 0.7	5.1 ± 0.5	5.0 ± 0.2	5.2 ± 0.3
27	4.7 ± 0.4	5.0 ± 0.4	5.1 ± 0.3	4.7 ± 0.4	4.9 ± 0.4
28	4.4 ± 0.3	4.7 ± 0.4	5.0 ± 0.5	4.6 ± 0.3	4.7 ± 0.5
29	4.1 ± 0.4	4.4 ± 0.6	4.6 ± 0.5	4.5 ± 0.3	4.4 ± 0.4
30	4.4 ± 0.4	4.8 ± 0.5	4.8 ± 0.6	4.9 ± 0.4	4.7 ± 0.4
31	4.0 ± 0.8	4.3 ± 0.4	4.3 ± 0.6	4.1 ± 0.3	4.2 ± 0.3
32	4.5 ± 0.4	5.7 ± 1.3	5.2 ± 0.4	5.3 ± 0.3	5.2 ± 1.0
33	4.5 ± 0.5	5.7 ± 1.6	4.8 ± 0.7	4.8 ± 0.5	5.0 ± 1.0
34	4.9 ± 0.5	5.4 ± 0.5	5.5 ± 0.6	5.5 ± 0.5	5.3 ± 0.6
35	6.0 ± 0.5	5.8 ± 1.4	6.4 ± 0.3	6.5 ± 0.5	6.2 ± 0.7
36	5.6 ± 0.1	5.9 ± 1.4	6.3 ± 0.6	6.6 ± 0.5	6.1 ± 0.9
37	4.9 ± 0.5	5.3 ± 0.3	5.3 ± 0.5	5.2 ± 0.4	5.2 ± 0.4
38	6.5 ± 0.8	6.7 ± 0.6	6.6 ± 0.4	6.7 ± 0.7	6.6 ± 0.2
39-C	4.7 ± 0.7	5.0 ± 0.5	5.1 ± 0.2	5.2 ± 0.6	5.0 ± 0.4
40-C	5.1 ± 0.3	5.5 ± 0.3	5.4 ± 0.4	5.4 ± 0.3	5.4 ± 0.3
41-C	6.9 ± 1.3	7.3 ± 0.6	7.3 ± 0.4	7.5 ± 0.7	7.3 ± 0.5
42	5.1 ± 0.5	5.4 ± 0.2	5.7 ± 0.3	5.2 ± 0.5	5.4 ± 0.5
43	4.4 ± 0.3	4.7 ± 0.5	4.9 ± 0.6	4.9 ± 0.3	4.7 ± 0.5

TABLE 3-3: GROSS BETA CONCENTRATION IN FILTERED AIR

Surry Nuclear Power Station, Surry County, Virginia - 2015

1.0E-3 pCi/m3 ± 2 Sigma

COLLECTION DATE	SAMPLING LOCATIONS SS	HIR	BC	ALL	CP	BASF	FE	NN-C
January 06	17.5 ± 3.16	14.6 ± 3.03	25.5 ± 3.63	17.3 ± 3.16	15.1 ± 3.04	17.7 ± 3.15	22.2 ± 3.38	19.8 ± 3.22
January 13	14.3 ± 2.99	12.2 ± 2.92	18.7 ± 3.26	14.0 ± 2.98	14.0 ± 2.99	15.4 ± 8.76	16.2 ± 3.09	18.0 ± 3.13
January 20	16.4 ± 2.81	13.1 ± 2.63	20.4 ± 3.07	19.5 ± 2.97	15.0 ± 2.75	A	14.9 ± 2.71	18.5 ± 2.92
January 26	8.70 ± 2.93	9.19 ± 2.97	6.70 ± 2.86	9.72 ± 2.98	8.29 ± 2.92	12.8 ± 3.14	11.4 ± 3.07	10.3 ± 3.03
February 03	8.86 ± 2.30	8.49 ± 2.29	12.7 ± 2.55	10.1 ± 2.37	6.12 ± 2.16	11.8 ± 2.46	9.87 ± 2.33	11.0 ± 2.42
February 09	12.9 ± 3.09	14.6 ± 3.21	23.3 ± 3.70	17.2 ± 3.32	16.4 ± 3.32	16.1 ± 3.23	18.8 ± 3.40	18.4 ± 3.36
February 16	14.6 ± 2.96	12.2 ± 2.88	18.8 ± 3.22	14.7 ± 2.95	14.4 ± 2.96	14.3 ± 2.93	16.3 ± 3.04	16.6 ± 3.04
February 23	21.9 ± 3.23	20.2 ± 3.18	23.2 ± 3.34	28.9 ± 3.54	22.9 ± 3.29	24.4 ± 3.32	26.0 ± 3.40	28.4 ± 3.56
March 02	20.0 ± 3.07	15.1 ± 28.6	21.5 ± 3.18	19.3 ± 3.02	15.2 ± 2.85	20.6 ± 3.09	19.3 ± 3.03	25.1 ± 3.29
March 09	15.1 ± 2.83	13.0 ± 2.75	20.0 ± 3.15	14.3 ± 2.78	14.4 ± 2.80	15.2 ± 2.83	16.4 ± 2.89	15.7 ± 2.85
March 16	8.78 ± 2.56	7.86 ± 2.53	19.1 ± 3.19	11.8 ± 2.71	8.89 ± 2.55	11.0 ± 2.66	12.0 ± 2.72	12.5 ± 2.77
March 24	10.8 ± 2.37	10.7 ± 2.40	18.3 ± 2.84	11.1 ± 2.38	9.91 ± 2.32	9.16 ± 2.26	12.9 ± 2.48	14.0 ± 2.59
March 31	10.0 ± 2.87	9.47 ± 2.81	20.1 ± 3.41	14.3 ± 2.99	10.2 ± 2.82	12.9 ± 2.92	11.9 ± 2.87	16.6 ± 3.15
Qtr. Avg. ± 2 s.d.	**13.8 ± 8.70**	**12.4 ± 6.74**	**19.1 ± 9.67**	**15.6 ± 10.3**	**13.1 ± 8.78**	**15.1 ± 8.49**	**16.0 ± 9.31**	**17.3 ± 10.3**
April 07	10.5 ± 2.73	12.3 ± 2.88	21.1 ± 3.40	12.6 ± 2.82	10.6 ± 2.78	11.0 ± 2.72	12.7 ± 2.83	15.6 ± 2.99
April 14	11.0 ± 2.60	13.0 ± 2.75	21.8 ± 3.27	14.0 ± 2.74	2.89 ± 2.05	13.5 ± 2.75	14.1 ± 2.79	17.4 ± 2.97
April 21	8.86 ± 2.56	8.46 ± 2.58	13.0 ± 2.89	9.57 ± 2.57	10.3 ± 2.65	8.20 ± 2.51	9.33 ± 2.59	10.4 ± 2.65
April 28	8.25 ± 2.39	7.46 ± 2.38	17.3 ± 2.98	9.81 ± 2.47	10.7 ± 2.56	10.6 ± 2.53	10.5 ± 2.54	10.3 ± 2.51
May 05	6.37 ± 2.46	4.03 ± 2.34	12.1 ± 2.87	7.21 ± 2.48	8.63 ± 2.63	6.38 ± 2.44	7.25 ± 2.52	7.19 ± 2.50
May 12	8.66 ± 2.53	9.29 ± 2.61	15.1 ± 2.95	9.49 ± 2.55	10.1 ± 2.64	8.83 ± 2.53	8.95 ± 2.55	11.5 ± 2.68
May 19	17.4 ± 3.10	14.7 ± 3.00	24.4 ± 3.53	15.8 ± 3.00	17.9 ± 3.13	15.9 ± 3.05	17.7 ± 3.11	19.0 ± 3.16
May 26	18.7 ± 2.94	10.7 ± 2.76	15.1 ± 3.00	11.6 ± 2.77	16.0 ± 3.01	14.1 ± 2.89	14.2 ± 2.89	18.9 ± 3.13
June 02	13.0 ± 2.79	11.2 ± 2.72	12.5 ± 2.80	16.0 ± 2.95	12.4 ± 2.75	12.7 ± 2.75	10.8 ± 2.62	15.3 ± 2.89
June 09	8.55 ± 2.32	7.04 ± 2.25	7.60 ± 2.27	5.76 ± 2.07	6.84 ± 2.18	8.50 ± 2.30	6.50 ± 2.15	8.20 ± 2.27
June 16	14.9 ± 2.77	10.1 ± 2.51	13.1 ± 2.69	12.4 ± 2.60	12.4 ± 2.60	13.6 ± 2.67	14.7 ± 2.73	14.9 ± 2.74
June 23	12.3 ± 2.52	8.92 ± 2.32	14.5 ± 2.68	16.3 ± 2.75	12.7 ± 2.54	12.3 ± 2.52	14.5 ± 2.66	15.2 ± 2.70
June 30	5.46 ± 2.43	3.51 ± 2.34	9.29 ± 2.72	7.15 ± 2.54	9.06 ± 2.67	9.32 ± 2.66	5.63 ± 2.43	7.85 ± 2.54
Qtr. Avg. ± 2 s.d.	**11.1 ± 8.11**	**9.29 ± 6.55**	**15.1 ± 9.78**	**11.4 ± 7.09**	**11.5 ± 7.59**	**11.1 ± 5.60**	**11.3 ± 7.37**	**13.2 ± 8.36**

A: No power at sampling station

April 14: CP <Minimum Detectable Activity

TABLE 3-3: GROSS BETA CONCENTRATION IN FILTERED AIR

Surry Nuclear Power Station, Surry County, Virginia - 2015

1.0E-3 pCi/m3 ± 2 Sigma

COLLECTION DATE	SAMPLING LOCATIONS SS	HIR	BC	ALL	CP	BASF	FE	NN
July 07	13.0 ± 2.70	9.28 ± 2.49	13.3 ± 2.74	12.6 ± 2.69	12.8 ± 2.67	11.8 ± 2.61	11.9 ± 2.66	A
July 14	12.7 ± 2.57	9.59 ± 2.41	15.9 ± 2.79	14.5 ± 2.68	13.4 ± 2.62	14.4 ± 2.69	11.0 ± 2.48	16.2 ± 2.82
July 21	12.5 ± 2.48	9.32 ± 2.30	11.4 ± 2.43	10.3 ± 2.31	11.0 ± 2.36	10.3 ± 2.33	12.4 ± 2.45	13.1 ± 2.50
July 28	13.1 ± 2.90	10.0 ± 2.75	13.9 ± 2.96	11.0 ± 2.74	9.56 ± 2.67	9.88 ± 2.71	12.2 ± 2.83	13.2 ± 2.86
August 04	17.7 ± 3.06	15.0 ± 2.96	20.3 ± 3.22	20.9 ± 3.21	23.4 ± 3.36	20.8 ± 3.23	19.9 ± 3.16	22.2 ± 3.28
August 11	9.03 ± 2.54	8.93 ± 2.57	11.1 ± 2.69	9.69 ± 2.56	13.4 ± 2.79	11.5 ± 2.65	10.4 ± 2.61	10.3 ± 2.59
August 18	14.4 ± 2.84	10.8 ± 2.67	15.2 ± 2.93	12.5 ± 2.74	14.5 ± 2.88	15.5 ± 2.91	15.5 ± 2.91	16.3 ± 2.94
August 25	18.7 ± 3.24	7.64 ± 2.67	20.4 ± 3.38	17.0 ± 3.16	19.6 ± 3.31	18.8 ± 3.25	16.5 ± 3.12	19.8 ± 3.29
September 01	16.0 ± 2.93	17.9 ± 3.04	18.1 ± 3.11	20.4 ± 3.20	21.3 ± 3.23	19.0 ± 3.10	19.2 ± 3.12	14.9 ± 2.89
September 07	27.6 ± 3.93	28.1 ± 3.98	32.5 ± 4.23	32.2 ± 4.15	30.8 ± 4.10	27.4 ± 3.91	30.6 ± 4.06	25.5 ± 3.83
September 15	16.3 ± 2.71	15.2 ± 2.65	15.8 ± 2.74	15.9 ± 2.68	16.7 ± 2.75	14.4 ± 2.61	16.1 ± 2.70	16.5 ± 2.71
September 22	26.8 ± 3.41	24.0 ± 3.32	24.4 ± 3.36	29.1 ± 3.56	23.4 ± 3.30	24.4 ± 3.34	25.8 ± 3.39	26.0 ± 3.39
September 29	11.9 ± 2.54	9.29 ± 2.40	9.91 ± 2.47	8.45 ± 2.32	8.70 ± 2.35	9.56 ± 2.39	10.5 ± 2.45	14.0 ± 2.64
Qtr. Avg. ± 2 s.d.	**16.1 ± 11.1**	**13.5 ± 12.8**	**17.1 ± 12.4**	**16.5 ± 14.8**	**16.8 ± 13.0**	**16.0 ± 11.5**	**16.3 ± 12.4**	**17.3 ± 10.0**
October 06	3.30 ± 1.99	2.45 ± 1.93	2.94 ± 1.98	2.91 ± 1.91	2.45 ± 1.93	2.59 ± 1.88	3.63 ± 2.02	3.12 ± 1.92
October 13	14.8 ± 2.86	14.1 ± 2.86	15.7 ± 2.98	15.8 ± 2.93	16.5 ± 2.99	14.1 ± 2.85	14.7 ± 2.88	14.8 ± 2.88
October 20	16.5 ± 3.18	15.7 ± 3.16	21.7 ± 3.49	18.9 ± 3.29	17.4 ± 3.26	18.4 ± 3.27	16.2 ± 3.15	17.6 ± 3.24
October 27	19.3 ± 3.42	20.0 ± 3.45	21.4 ± 3.56	21.1 ± 3.47	21.4 ± 3.52	16.7 ± 3.25	17.8 ± 3.31	15.9 ± 3.22
November 03	15.3 ± 2.87	16.7 ± 2.94	16.1 ± 2.94	16.9 ± 2.93	15.9 ± 2.90	16.1 ± 2.88	15.5 ± 2.85	17.1 ± 2.93
November 10	15.6 ± 2.98	15.7 ± 2.98	17.5 ± 3.10	18.4 ± 3.09	17.4 ± 3.10	13.4 ± 2.84	15.5 ± 2.96	16.4 ± 2.99
November 17	18.2 ± 3.19	13.0 ± 2.94	16.7 ± 3.17	20.5 ± 3.30	15.6 ± 3.11	17.4 ± 3.14	18.8 ± 3.21	17.3 ± 3.13
November 24	14.1 ± 2.70	12.0 ± 2.56	14.3 ± 2.73	14.3 ± 2.69	11.3 ± 2.53	11.0 ± 2.49	11.0 ± 2.48	13.7 ± 2.64
December 01	14.0 ± 2.95	11.9 ± 2.85	13.9 ± 2.98	13.2 ± 2.89	11.4 ± 2.85	13.7 ± 2.93	13.0 ± 2.88	14.0 ± 2.92
December 08	24.3 ± 3.18	21.8 ± 3.07	21.9 ± 3.11	25.9 ± 3.28	25.2 ± 3.27	22.6 ± 3.12	25.5 ± 3.25	23.9 ± 3.17
December 15	29.6 ± 3.50	29.9 ± 3.54	36.3 ± 3.84	30.6 ± 3.57	30.3 ± 3.57	29.7 ± 3.53	30.1 ± 3.54	32.8 ± 3.62
December 22	11.8 ± 2.54	12.6 ± 2.59	13.7 ± 2.67	13.0 ± 2.61	11.7 ± 2.57	11.5 ± 2.52	12.8 ± 2.59	13.0 ± 2.60
December 29	5.38 ± 2.09	7.62 ± 2.26	7.19 ± 2.24	6.32 ± 2.16	7.69 ± 2.28	5.89 ± 2.12	7.17 ± 2.20	7.69 ± 2.23
Qtr. Avg. ± 2 s.d.	**15.6 ± 13.8**	**15.9 ± 11.6**	**16.9 ± 15.9**	**16.8 ± 14.7**	**16.8 ± 12.7**	**15.9 ± 12.1**	**15.5 ± 13.8**	**15.9 ± 14.2**
Ann. Avg. ± 2 s.d.	**14.1 ± 11.1**	**12.7 ± 10.6**	**17.1 ± 12.2**	**15.0 ± 12.6**	**14.6 ± 11.3**	**14.5 ± 10.3**	**14.8 ± 11.5**	**15.9 ± 11.2**

A: No power at sampling station

October 06: HIR, CP and BASF <Minimum Detectable Activity

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

Surry Power Station, Surry County, Virginia - 2015

1.0E-3 pCi/m3 ± 2 Sigma

COLLECTION DATE	SAMPLING LOCATIONS							
	SS	HIR	BC	ALL	CP	BASF	FE	NN-C
January 06	9.54 ± 20.8	9.62 ± 21.0	9.87 ± 21.5	9.57 ± 20.9	-16.6 ± 17.2	-16.3 ± 16.9	-16.3 ± 16.9	-16.0 ± 16.6
January 13	-2.00 ± 41.6	-2.03 ± 42.3	-2.05 ± 42.6	-2.00 ± 41.6	18.7 ± 22.9	29.2 ± 35.7	18.5 ± 22.6	18.0 ± 22.0
January 20	-1.33 ± 20.3	-1.34 ± 20.4	-1.35 ± 20.7	-1.32 ± 20.1	-4.63 ± 19.6	A	-4.54 ± 19.1	-4.54 ± 19.1
January 26	9.39 ± 36.5	9.42 ± 36.6	9.59 ± 37.3	9.31 ± 36.1	-7.08 ± 32.3	-6.95 ± 31.7	-6.95 ± 31.7	-7.00 ± 31.9
February 03	40.8 ± 33.6	41.0 ± 33.8	41.5 ± 34.2	40.6 ± 33.4	9.55 ± 38.6	9.39 ± 37.9	9.26 ± 37.4	9.35 ± 37.8
February 09	20.3 ± 15.5	20.5 ± 15.6	20.6 ± 15.7	20.1 ± 15.3	-1.28 ± 16.0	-1.24 ± 15.5	-1.25 ± 15.6	-1.24 ± 15.4
February 16	4.58 ± 22.3	4.69 ± 22.8	4.66 ± 22.6	4.55 ± 22.1	-7.10 ± 16.8	-7.03 ± 16.6	-7.02 ± 16.6	-6.92 ± 16.4
February 23	9.26 ± 18.2	9.47 ± 18.6	9.45 ± 18.6	9.18 ± 18.1	-0.84 ± 18.4	-0.82 ± 18.1	-0.82 ± 18.1	-0.84 ± 18.3
March 02	4.04 ± 21.1	4.13 ± 21.6	4.10 ± 21.4	4.00 ± 20.9	2.68 ± 18.5	2.62 ± 18.1	2.62 ± 18.1	2.59 ± 17.9
March 09	-12.7 ± 20.6	-13.0 ± 21.0	-13.1 ± 21.1	-12.6 ± 20.4	7.52 ± 17.7	7.46 ± 17.6	7.45 ± 17.5	7.36 ± 17.3
March 16	-17.4 ± 31.1	-17.7 ± 31.5	-17.9 ± 32.0	-17.2 ± 30.6	8.69 ± 25.2	8.60 ± 24.9	8.58 ± 24.9	8.61 ± 25.0
March 24	-4.01 ± 23.6	-4.09 ± 24.0	-4.15 ± 24.4	-3.98 ± 23.4	-14.0 ± 16.4	-13.9 ± 16.2	-13.9 ± 16.2	-14.1 ± 16.5
March 31	5.12 ± 12.6	5.17 ± 12.8	5.24 ± 12.9	4.97 ± 12.3	6.91 ± 16.5	6.76 ± 16.1	6.75 ± 16.1	6.78 ± 16.2
April 07	8.85 ± 33.8	9.05 ± 34.6	9.19 ± 35.1	8.68 ± 33.2	-20.3 ± 45.8	-23.3 ± 44.5	-23.3 ± 44.5	-23.1 ± 44.2
April 14	-19.8 ± 40.8	-20.1 ± 41.5	-20.4 ± 42.1	-19.3 ± 39.9	42.2 ± 35.7	41.7 ± 35.4	41.7 ± 35.3	41.7 ± 35.3
April 21	6.96 ± 31.0	7.08 ± 31.5	7.21 ± 32.1	6.82 ± 30.4	0.10 ± 24.8	-38.4 ± 46.6	-38.5 ± 46.7	-38.3 ± 46.4
April 28	-5.57 ± 9.88	8.01 ± 14.9	8.09 ± 15.0	7.73 ± 14.3	-10.8 ± 19.1	-10.6 ± 18.9	-10.7 ± 19.0	-10.6 ± 18.8
May 05	2.50 ± 33.7	2.55 ± 34.3	2.57 ± 34.6	2.45 ± 33.1	-8.84 ± 31.4	-8.65 ± 30.7	-8.72 ± 30.9	-8.64 ± 30.7
May 12	-15.6 ± 17.2	-15.9 ± 17.5	-16.0 ± 17.6	-15.3 ± 16.9	2.58 ± 13.0	2.53 ± 12.8	2.54 ± 12.8	2.52 ± 12.7
May 19	4.83 ± 30.9	4.92 ± 31.4	5.03 ± 32.2	4.78 ± 30.5	6.07 ± 20.2	6.13 ± 20.4	6.02 ± 20.0	5.98 ± 19.9
May 26	-6.20 ± 14.6	-6.31 ± 14.9	-2.45 ± 5.77	-6.18 ± 14.6	-4.99 ± 14.8	-4.94 ± 14.7	-4.93 ± 14.7	-4.90 ± 14.6
June 02	2.93 ± 11.9	2.97 ± 12.1	2.99 ± 12.1	2.91 ± 11.8	-9.64 ± 17.1	-9.55 ± 17.0	-9.45 ± 16.8	-9.48 ± 16.9
June 09	20.2 ± 38.4	20.7 ± 39.3	20.4 ± 38.8	8.69 ± 16.5	-2.85 ± 36.1	-2.85 ± 36.1	-2.83 ± 35.8	-2.82 ± 35.7
June 16	-15.9 ± 24.3	-16.0 ± 24.5	-16.0 ± 24.5	-15.6 ± 23.9	18.6 ± 26.4	18.6 ± 26.3	18.5 ± 26.2	18.4 ± 26.1
June 23	3.87 ± 11.5	3.91 ± 11.6	3.91 ± 11.6	1.49 ± 4.41	0.71 ± 14.7	0.71 ± 14.7	0.71 ± 14.7	0.71 ± 14.7
June 30	-7.61 ± 23.2	-7.72 ± 23.5	-7.78 ± 23.7	3.77 ± 25.4	3.78 ± 25.5	3.73 ± 25.1	3.71 ± 25.0	1.29 ± 8.73

A: No power at sampling station

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

Surry Power Station, Surry County, Virginia - 2015

1.0E-3 pCi/m3 ± 2 Sigma

COLLECTION DATE	SAMPLING LOCATIONS							
	SS	HIR	BC	ALL	CP	BASF	FE	NN-C
July 07	15.2 ± 37.8	15.4 ± 38.2	15.4 ± 38.3	15.4 ± 38.2	-22.7 ± 38.5	-22.7 ± 38.5	-23.3 ± 39.2	A
July 14	-3.97 ± 14.6	-4.04 ± 14.9	-4.03 ± 14.9	-3.96 ± 14.6	14.8 ± 24.4	14.8 ± 24.5	6.22 ± 10.3	15.0 ± 24.8
July 21	10.4 ± 22.0	4.13 ± 8.69	10.6 ± 22.3	10.3 ± 21.6	-14.9 ± 21.2	-15.0 ± 21.3	-14.9 ± 21.2	-14.8 ± 21.1
July 28	-4.38 ± 10.8	-4.43 ± 10.9	-4.42 ± 10.9	-4.30 ± 10.6	13.5 ± 17.7	13.6 ± 17.8	13.5 ± 17.7	13.3 ± 17.5
August 04	-8.62 ± 23.8	-8.76 ± 24.2	-8.71 ± 24.0	-8.54 ± 23.6	10.1 ± 18.6	10.1 ± 18.6	9.93 ± 18.3	9.89 ± 18.3
August 11	-2.94 ± 23.1	-2.99 ± 23.5	-2.96 ± 23.3	-2.18 ± 30.0	-2.19 ± 30.1	-0.90 ± 12.4	-2.17 ± 29.8	-2.14 ± 29.5
August 18	-0.72 ± 24.3	-0.73 ± 24.7	-0.73 ± 24.8	-0.72 ± 24.3	5.57 ± 25.2	5.49 ± 24.9	5.47 ± 24.8	5.42 ± 24.6
August 25	-27.8 ± 20.9	-28.3 ± 21.3	-28.5 ± 21.4	-27.8 ± 20.9	5.93 ± 12.4	5.89 ± 12.3	5.83 ± 12.2	5.81 ± 12.2
September 01	-3.91 ± 17.1	-3.92 ± 17.2	-4.03 ± 17.7	-3.97 ± 17.4	-19.1 ± 25.8	-18.9 ± 25.6	-19.0 ± 25.6	-18.9 ± 25.5
September 07	11.8 ± 28.0	11.9 ± 28.2	12.1 ± 28.8	11.8 ± 28.0	-1.21 ± 25.8	-1.19 ± 25.4	-1.19 ± 25.4	-1.19 ± 25.4
September 15	14.5 ± 18.7	14.4 ± 18.7	14.8 ± 19.2	14.4 ± 18.6	-7.50 ± 15.3	-7.42 ± 15.1	-7.41 ± 15.1	-7.36 ± 15.0
September 22	6.24 ± 15.8	6.35 ± 16.1	6.41 ± 16.2	6.33 ± 16.0	7.77 ± 17.6	7.72 ± 17.5	7.68 ± 17.4	7.59 ± 17.2
September 29	-1.05 ± 14.7	-1.06 ± 14.8	-1.07 ± 15.0	-1.04 ± 14.6	-3.89 ± 14.8	-3.85 ± 14.6	-3.83 ± 14.6	-3.77 ± 14.3
October 06	3.94 ± 19.5	3.96 ± 19.6	3.97 ± 19.6	3.82 ± 18.8	33.1 ± 29.6	31.8 ± 28.4	32.9 ± 29.4	31.6 ± 28.3
October 13	-24.2 ± 22.7	-24.5 ± 23.0	-24.8 ± 23.3	-24.2 ± 22.7	8.17 ± 17.2	8.10 ± 17.0	8.09 ± 29.7	8.01 ± 16.8
October 20	5.32 ± 30.1	5.34 ± 30.2	5.43 ± 30.7	5.28 ± 2.98	5.43 ± 20.2	5.35 ± 19.9	5.32 ± 19.8	5.33 ± 19.8
October 27	6.16 ± 24.4	6.15 ± 24.3	6.24 ± 24.7	3.16 ± 19.2	3.19 ± 19.4	1.22 ± 7.37	3.13 ± 19.0	3.11 ± 18.9
November 03	10.0 ± 36.3	9.96 ± 36.0	10.1 ± 36.5	9.83 ± 35.6	2.85 ± 34.1	2.80 ± 33.5	2.80 ± 33.5	2.79 ± 33.3
November 10	0.01 ± 26.9	0.01 ± 26.9	0.01 ± 27.2	5.85 ± 16.2	14.3 ± 39.5	14.0 ± 38.6	13.9 ± 38.5	13.8 ± 38.1
November 17	-4.95 ± 16.4	-4.99 ± 16.5	-5.06 ± 16.7	-4.96 ± 16.4	-20.5 ± 32.2	-19.8 ± 31.2	-19.9 ± 31.3	-19.7 ± 31.1
November 24	-29.4 ± 29.5	-29.1 ± 29.2	-29.7 ± 29.8	5.40 ± 18.9	5.45 ± 19.0	5.36 ± 18.7	2.07 ± 7.22	5.32 ± 18.6
December 01	-5.24 ± 33.7	-5.26 ± 33.9	-5.29 ± 34.1	-1.09 ± 31.6	-1.12 ± 32.4	-1.09 ± 31.5	-1.08 ± 31.4	-0.45 ± 13.0
December 08	-7.71 ± 24.8	-7.78 ± 25.0	-7.89 ± 25.3	-7.81 ± 25.1	-7.14 ± 38.9	-7.07 ± 38.6	-6.99 ± 38.1	-6.96 ± 38.0
December 15	12.3 ± 39.4	12.4 ± 39.8	12.5 ± 40.1	12.4 ± 39.7	-16.9 ± 30.0	-16.7 ± 29.7	-16.7 ± 29.6	-16.3 ± 28.9
December 22	-8.14 ± 27.1	-8.14 ± 27.1	-8.19 ± 27.3	27.4 ± 25.1	27.9 ± 25.6	27.2 ± 25.0	14.9 ± 13.7	26.9 ± 24.7
December 29	9.17 ± 33.7	9.24 ± 33.9	9.28 ± 34.1	14.2 ± 23.0	14.4 ± 23.2	14.1 ± 22.7	5.42 ± 8.75	13.8 ± 22.3

A: No power at sampling station

TABLE 3-5: GAMMA EMITTER CONCENTRATION IN FILTERED AIR

Surry Power Station, Surry County, Virginia - 2015

1.0E-3 pCi/m3 ± 2 Sigma

SAMPLING LOCATIONS	NUCLIDE	FIRST QUARTER	SECOND QUARTER	THIRD QUARTER	FOURTH QUARTER	AVERAGE ± 2 SIGMA
SS	Cs-134	0.19 ± 0.87	0.27 ± 0.81	-0.23 ± 0.84	0.53 ± 0.74	
	Cs-137	-1.20 ± 0.73	0.65 ± 0.86	-0.73 ± 0.89	0.17 ± 0.81	
	Be-7	115 ± 32.8	126 ± 30.2	141 ± 46.2	104 ± 24.2	122 ± 31.6
HIR	Cs-134	0.22 ± 0.98	0.54 ± 0.77	0.49 ± 0.68	1.62 ± 0.94	
	Cs-137	0.39 ± 0.90	-0.41 ± 0.67	0.26 ± 0.68	-0.23 ± 0.90	
	Be-7	94.1 ± 38.9	111 ± 27.8	143 ± 33.6	118 ± 22.7	117 ± 40.6
	K-40				22.8 ± 13.3	22.8 ± 13.3
BC	Cs-134	0.83 ± 0.97	0.63 ± 1.26	0.08 ± 0.85	1.25 ± 1.35	
	Cs-137	0.74 ± 0.83	0.00 ± 1.39	0.72 ± 0.83	0.04 ± 1.16	
	Be-7	124 ± 33.7	153 ± 44.1	108 ± 35.8	120 ± 42.1	126 ± 38.2
ALL	Cs-134	0.05 ± 0.92	-0.91 ± 0.75	0.27 ± 0.92	-0.94 ± 0.91	
	Cs-137	0.13 ± 0.71	-0.01 ± 0.51	-0.36 ± 0.64	-0.35 ± 0.71	
	Be-7	128 ± 48.8	186 ± 36.6	187 ± 40.5	159 ± 28.6	165 ± 55.7
	K-40				14.3 ± 11.9	14.3 ± 11.9
CP	Cs-134	0.25 ± 0.95	0.90 ± 1.08	0.75 ± 0.81	-0.26 ± 0.85	
	Cs-137	0.20 ± 0.77	-0.05 ± 1.10	-0.18 ± 0.78	0.29 ± 0.77	
	Be-7	108 ± 30.1	115 ± 39.4	122 ± 30.3	103 ± 25.0	112 ± 16.6
	K-40		14.3 ± 14.0		24.6 ± 12.2	19.5 ± 14.6
BASF	Cs-134	0.10 ± 0.78	0.36 ± 0.69	-0.63 ± 1.24	0.27 ± 1.31	
	Cs-137	-0.10 ± 0.71	-0.33 ± 0.56	1.32 ± 1.32	-0.11 ± 0.98	
	Be-7	133 ± 33.5	98.0 ± 25.6	128 ± 54.7	105 ± 33.0	116 ± 34.2
	K-40		9.99 ± 7.37			9.99 ± 7.37
FE	Cs-134	-0.17 ± 0.90	0.99 ± 0.81	0.49 ± 0.85	0.60 ± 0.76	
	Cs-137	-0.67 ± 0.80	0.10 ± 0.75	0.70 ± 0.72	0.43 ± 0.69	
	Be-7	155 ± 33.3	168 ± 32.1	132 ± 29.6	141 ± 24.2	149 ± 31.6
NN-C	Cs-134	1.31 ± 1.10	0.66 ± 0.84	0.42 ± 0.80	-0.13 ± 0.72	
	Cs-137	-0.29 ± 0.86	-0.13 ± 0.77	-0.43 ± 0.73	0.39 ± 0.57	
	Be-7	136 ± 46.9	136 ± 38.5	151 ± 34.1	140 ± 26.9	141 ± 14.2

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

Surry Power Station, Surry County, Virginia - 2015

pCi/Liter ± 2 Sigma

NUCLIDE	EPPS	COLONIAL PARKWAY	WILLIAMS-C
JANUARY			
Cs-134	-8.07 ± 4.24	4.10 ± 5.27	-1.57 ± 6.15
Cs-137	-0.57 ± 3.46	4.08 ± 5.41	1.98 ± 5.80
Ba-140	-3.80 ± 17.4	-20.2 ± 28.8	10.2 ± 23.9
La-140	-0.27 ± 3.94	7.35 ± 6.24	-5.86 ± 9.20
I-131	-0.47 ± 0.43	-0.24 ± 0.24	0.22 ± 0.35
K-40	1330 ± 140	1100 ± 195	1200 ± 184
FEBRUARY			
Cs-134	-2.82 ± 2.68	0.09 ± 4.03	0.44 ± 4.65
Cs-137	-0.48 ± 2.50	0.13 ± 3.85	1.29 ± 4.28
Ba-140	-6.70 ± 15.0	-9.14 ± 21.1	1.90 ± 24.0
La-140	0.77 ± 3.99	-1.23 ± 6.89	-2.29 ± 6.16
I-131	-0.74 ± 0.33	-0.32 ± 0.31	-0.16 ± 0.31
K-40	1330 ± 117	1330 ± 170	1200 ± 152
MARCH			
Cs-134	-1.16 ± 3.66	2.02 ± 3.05	-1.78 ± 4.93
Cs-137	-1.04 ± 3.68	-2.07 ± 3.42	0.08 ± 5.18
Ba-140	1.25 ± 18.1	16.7 ± 16.6	-30.3 ± 25.9
La-140	1.24 ± 3.93	-3.81 ± 4.73	-2.60 ± 6.57
I-131	-0.05 ± 0.31	-0.18 ± 0.31	-0.03 ± 0.23
K-40	1240 ± 114	1370 ± 136	1410 ± 186
Sr-89		0.11 ± 2.84	
Sr-90		-0.31 ± 0.31	
APRIL			
Cs-134	-5.45 ± 3.83	0.34 ± 4.01	-0.29 ± 5.09
Cs-137	1.17 ± 3.86	2.67 ± 4.92	2.52 ± 5.20
Ba-140	-2.34 ± 23.6	-24.6 ± 24.4	11.1 ± 25.8
La-140	-0.15 ± 7.74	-8.58 ± 6.96	0.91 ± 7.11
I-131	0.10 ± 0.38	-0.18 ± 0.34	-0.16 ± 0.25
K-40	1390 ± 167	1250 ± 179	1160 ± 179

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

Surry Power Station, Surry County, Virginia - 2015

pCi/Liter ± 2 Sigma

NUCLIDE	EPPS	COLONIAL PARKWAY	WILLIAMS-C
MAY			
Cs-134	-7.61 ± 4.78	-4.93 ± 3.93	-3.38 ± 4.75
Cs-137	-3.62 ± 6.22	2.06 ± 3.72	0.90 ± 4.75
Ba-140	-9.91 ± 30.4	-19.5 ± 22.4	-1.92 ± 22.4
La-140	-3.66 ± 8.61	0.41 ± 5.61	-3.26 ± 7.73
I-131	-0.32 ± 0.41	-0.25 ± 0.44	-0.19 ± 0.51
K-40	1280 ± 188	1340 ± 140	1320 ± 171
JUNE			
Cs-134	-4.33 ± 3.34	-2.75 ± 3.21	-7.88 ± 4.65
Cs-137	-1.21 ± 3.51	0.80 ± 2.64	1.12 ± 4.46
Ba-140	15.4 ± 18.6	6.36 ± 12.3	-2.25 ± 21.0
La-140	0.23 ± 4.69	0.69 ± 3.85	-0.70 ± 6.35
I-131	-0.38 ± 0.34	-0.06 ± 0.41	-0.02 ± 0.25
K-40	1360 ± 121	1130 ± 96.7	1430 ± 151
Sr-89		3.67 ± 3.08	
Sr-90		1.76 ± 0.46	
JULY			
Cs-134	-2.73 ± 2.67	0.28 ± 3.91	1.13 ± 4.37
Cs-137	2.50 ± 3.20	-1.29 ± 4.70	2.09 ± 4.09
Ba-140	2.81 ± 17.1	18.6 ± 22.1	-0.56 ± 20.0
La-140	0.87 ± 4.30	4.49 ± 5.23	-3.31 ± 5.58
I-131	-0.32 ± 0.40	-0.44 ± 0.48	-0.09 ± 0.28
K-40	1460 ± 151	1300 ± 179	1300 ± 140
AUGUST			
Cs-134	-5.02 ± 4.84	-1.14 ± 5.91	-2.53 ± 4.18
Cs-137	-2.99 ± 5.19	-1.62 ± 6.26	3.34 ± 4.84
Ba-140	16.7 ± 20.7	-7.70 ± 28.8	9.12 ± 18.8
La-140	0.53 ± 6.59	4.77 ± 7.28	-0.24 ± 4.55
I-131	-0.07 ± 0.43	-0.42 ± 0.45	-0.30 ± 0.50
K-40	1300 ± 185	1430 ± 209	1420 ± 181

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

Surry Power Station, Surry County, Virginia - 2015

pCi/Liter ± 2 Sigma

NUCLIDE	EPPS	COLONIAL PARKWAY	WILLIAMS-C
SEPTEMBER			
Cs-134	-3.46 ± 6.13	-2.98 ± 5.71	-1.00 ± 5.67
Cs-137	-4.92 ± 5.91	-2.29 ± 6.02	4.22 ± 6.73
Ba-140	5.71 ± 24.0	-15.0 ± 19.9	-1.70 ± 19.2
La-140	3.37 ± 6.79	4.22 ± 5.86	-2.12 ± 9.22
I-131	-0.13 ± 0.26	-0.54 ± 0.26	-0.10 ± 0.16
K-40	1570 ± 233	1340 ± 211	1130 ± 227
Sr-89		4.17 ± 2.89	
Sr-90		1.80 ± 0.49	
OCTOBER			
Cs-134	4.04 ± 4.03	-2.06 ± 3.13	-5.90 ± 3.58
Cs-137	2.67 ± 3.69	1.08 ± 3.68	-3.12 ± 3.83
Ba-140	-3.90 ± 14.5	10.7 ± 12.0	-6.30 ± 13.8
La-140	2.48 ± 3.30	-1.31 ± 3.49	0.02 ± 3.22
I-131	-0.30 ± 0.31	-0.19 ± 0.34	-0.51 ± 0.36
K-40	1280 ± 132	1070 ± 144	1340 ± 163
NOVEMBER			
Cs-134	3.18 ± 5.54	-2.30 ± 4.80	-6.05 ± 6.11
Cs-137	2.35 ± 6.16	1.68 ± 4.52	2.98 ± 6.74
Ba-140	-9.92 ± 24.8	12.9 ± 22.3	10.4 ± 27.2
La-140	1.27 ± 6.28	1.46 ± 6.48	-1.84 ± 9.76
I-131	-0.43 ± 0.42	-0.10 ± 0.41	-0.09 ± 0.33
K-40	1390 ± 215	1320 ± 167	1360 ± 231
DECEMBER			
Cs-134	0.18 ± 5.19	1.20 ± 5.12	1.95 ± 5.36
Cs-137	0.08 ± 5.05	0.74 ± 5.62	1.99 ± 5.77
Ba-140	4.15 ± 23.5	-6.34 ± 26.0	-2.40 ± 23.5
La-140	1.25 ± 6.64	2.03 ± 8.25	2.36 ± 5.48
I-131	-0.09 ± 0.36	-0.19 ± 0.48	-0.26 ± 0.52
K-40	1290 ± 186	1540 ± 213	1280 ± 201
Sr-89		1.28 ± 2.23	
Sr-90		-0.07 ± 0.30	

TABLE 3-7: GAMMA EMITTER CONCENTRATION IN FOOD PRODUCTS

Surry Power Station, Surry County, Virginia - 2015

pCi/kg (wet) ± 2 Sigma

SAMPLING LOCATIONS	COLLECTION DATE	SAMPLE TYPE	ISOTOPE			
			Cs-134	**Cs-137**	**I-131**	**K-40**
BROCK FARM	11/24/2015	Corn	8.89 ± 12.9	4.27 ± 13.0	6.51 ± 21.3	3830 ± 483
			Cs-134	**Cs-137**	**I-131**	**K-40**
	11/24/2015	Peanuts	-2.96 ± 14.7	5.71 ± 15.7	3.20 ± 28.1	5640 ± 688
			Cs-134	**Cs-137**	**I-131**	**K-40**
SLADE FARM	11/24/2015	Soybeans	-0.58 ± 15.0	8.44 ± 17.0	9.86 ± 32.2	17800 ± 880

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

Surry Power Station, Surry County, Virginia - 2015

pCi/Liter ± 2 Sigma

SAMPLING LOCATIONS	COLLECTION DATE	ISOTOPE				
		Mn-54	**Co-58**	**Fe-59**	**Co-60**	**Zn-65**
SS	3/2/2015	-1.17 ± 2.53	-0.06 ± 2.48	-0.51 ± 4.89	-0.84 ± 2.12	-1.47 ± 5.21
	6/3/2015	-0.50 ± 1.81	-0.87 ± 2.05	1.63 ± 4.45	-1.20 ± 1.83	-3.49 ± 4.50
	9/7/2015	0.00 ± 4.33	-1.61 ± 3.97	-4.07 ± 7.75	4.62 ± 3.63	-2.65 ± 8.62
	12/1/2015	-0.99 ± 2.88	-0.34 ± 2.78	-0.87 ± 5.54	0.57 ± 3.41	1.93 ± 5.79
		Nb-95	**Zr-95**	**I-131**	**Cs-134**	**Cs-137**
	3/2/2015	2.60 ± 2.44	-1.15 ± 3.93	-0.37 ± 0.24	1.28 ± 3.27	-1.21 ± 2.75
	6/3/2015	-1.46 ± 2.06	-0.03 ± 3.92	-0.16 ± 0.22	-0.42 ± 2.17	0.94 ± 2.01
	9/7/2015	2.23 ± 4.36	-1.09 ± 7.16	-0.12 ± 0.35	-7.08 ± 4.76	-1.37 ± 4.37
	12/1/2015	0.99 ± 2.81	5.47 ± 4.77	3.21 ± 5.70	-1.85 ± 3.46	-1.10 ± 2.86
		Ba-140	**La-140**	**H-3**		
	3/2/2015	2.96 ± 12.2	2.04 ± 3.92	711 ± 1200		
	6/3/2015	-4.24 ± 11.7	2.41 ± 4.06	-30.8 ± 772		
	9/7/2015	-5.46 ± 17.6	0.17 ± 5.28	38.0 ± 568		
	12/1/2015	0.97 ± 14.8	-5.60 ± 5.16	38.2 ± 1200		
		Mn-54	**Co-58**	**Fe-59**	**Co-60**	**Zn-65**
HIR	3/2/2015	0.00 ± 2.67	0.20 ± 3.33	0.93 ± 5.92	2.02 ± 2.77	-5.93 ± 6.65
	6/3/2015	-1.01 ± 1.94	-0.39 ± 2.19	-0.76 ± 4.69	0.25 ± 1.92	-4.54 ± 4.91
	9/7/2015	-2.47 ± 3.42	0.87 ± 3.53	0.45 ± 8.45	-0.57 ± 4.43	-0.98 ± 8.40
	12/1/2015	-1.80 ± 2.73	-0.12 ± 2.67	1.14 ± 5.19	-0.28 ± 2.95	3.39 ± 5.91
		Nb-95	**Zr-95**	**I-131**	**Cs-134**	**Cs-137**
	3/2/2015	-2.78 ± 3.35	-2.86 ± 5.61	-0.29 ± 0.24	-5.54 ± 3.90	2.02 ± 3.55
	6/3/2015	1.01 ± 2.27	0.03 ± 4.36	-0.25 ± 0.29	-6.00 ± 2.25	-0.54 ± 2.08
	9/7/2015	-0.56 ± 4.20	3.64 ± 6.12	-0.06 ± 0.10	1.77 ± 3.72	3.53 ± 4.59
	12/1/2015	1.92 ± 3.12	0.00 ± 4.56	2.61 ± 5.44	0.13 ± 2.69	1.51 ± 2.55
		Ba-140	**La-140**	**H-3**		
	3/2/2015	16.7 ± 16.8	-0.15 ± 4.13	-177 ± 995		
	6/3/2015	-10.0 ± 13.7	0.01 ± 4.55	272 ± 805		
	9/7/2015	-1.31 ± 15.7	1.64 ± 3.32	203 ± 582		
	12/1/2015	1.49 ± 13.8	-1.89 ± 3.98	351 ± 817		

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

Surry Power Station, Surry County, Virginia - 2015

pCi/Liter ± 2 Sigma

SAMPLING LOCATIONS	COLLECTION DATE	ISOTOPE				
		Mn-54	**Co-58**	**Fe-59**	**Co-60**	**Zn-65**
CS	3/2/2015	-2.15 ± 3.19	-0.31 ± 3.72	-3.56 ± 7.10	-0.34 ± 3.47	-8.11 ± 8.12
	6/3/2015	-0.60 ± 0.94	0.08 ± 0.99	0.69 ± 1.94	-0.13 ± 0.96	0.18 ± 2.08
	9/7/2015	-2.79 ± 3.98	2.53 ± 3.79	0.71 ± 8.30	0.06 ± 3.77	8.28 ± 9.65
	12/1/2015	-0.43 ± 2.91	-0.37 ± 2.98	2.23 ± 6.66	3.26 ± 3.48	-2.02 ± 7.53
		Nb-95	**Zr-95**	**I-131**	**Cs-134**	**Cs-137**
	3/2/2015	-2.05 ± 3.07	-2.65 ± 5.75	-0.20 ± 0.24	1.70 ± 3.26	0.30 ± 3.53
	6/3/2015	0.39 ± 0.95	0.18 ± 1.71	-0.08 ± 0.22	-0.06 ± 0.98	0.02 ± 0.96
	9/7/2015	2.69 ± 3.95	2.41 ± 6.84	-0.01 ± 0.11	-5.14 ± 4.84	2.34 ± 3.87
	12/1/2015	-0.30 ± 3.13	1.22 ± 5.91	-0.69 ± 6.24	-2.18 ± 3.54	0.47 ± 3.56
		Ba-140	**La-140**	**H-3**	**K-40**	
	3/2/2015	6.39 ± 16.4	3.03 ± 6.51	710 ± 1200		
	6/3/2015	3.23 ± 5.48	-1.55 ± 1.85	-115 ± 745		
	9/7/2015	3.91 ± 16.4	-2.36 ± 4.49	12.7 ± 567	88.5 ± 71.8	
	12/1/2015	5.44 ± 15.0	-1.61 ± 6.00	717 ± 850		

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

Surry Power Station, Surry County, Virginia - 2015

pCi/Liter ± 2 Sigma

SAMPLING LOCATIONS	COLLECTION DATE	ISOTOPE				
		Mn-54	**Co-58**	**Fe-59**	**Co-60**	**Zn-65**
SD	1/13/2015	-0.70 ± 2.33	-1.76 ± 2.46	1.77 ± 4.80	-0.13 ± 2.42	-0.18 ± 4.65
	2/16/2015	0.21 ± 1.68	-0.79 ± 1.33	1.54 ± 4.49	-0.57 ± 1.48	1.98 ± 3.29
	3/9/2015	-0.79 ± 1.95	0.28 ± 1.83	-0.74 ± 4.08	0.13 ± 1.47	-0.53 ± 3.95
	4/21/2015	-1.30 ± 2.95	-1.51 ± 3.06	2.49 ± 6.21	0.65 ± 3.07	-12.2 ± 7.03
	5/25/2015	0.20 ± 1.43	0.66 ± 1.46	-0.28 ± 3.35	1.47 ± 1.52	-1.62 ± 3.08
	6/9/2015	2.90 ± 3.31	-1.67 ± 2.95	2.37 ± 5.60	-0.71 ± 3.41	-0.98 ± 5.81
	7/14/2015	-0.08 ± 4.11	0.11 ± 3.95	0.94 ± 7.03	0.35 ± 3.83	-0.22 ± 8.39
	8/11/2015	-0.65 ± 3.11	-0.75 ± 3.47	-2.67 ± 6.10	-0.44 ± 2.46	0.63 ± 7.14
	9/7/2015	1.33 ± 3.74	-2.06 ± 3.71	-6.35 ± 9.63	-3.22 ± 5.00	-1.69 ± 6.82
	10/13/2015	-1.24 ± 2.35	0.73 ± 2.12	0.21 ± 4.19	-0.30 ± 2.08	-8.02 ± 5.12
	11/6/2015	1.77 ± 3.38	1.98 ± 3.68	2.01 ± 6.76	-2.20 ± 3.95	-1.74 ± 7.76
	12/1/2015	-0.60 ± 3.11	0.85 ± 3.03	2.09 ± 5.46	2.07 ± 3.65	-2.26 ± 6.79
		Nb-95	**Zr-95**	**I-131**	**Cs-134**	**Cs-137**
	1/13/2015	0.26 ± 2.62	-5.37 ± 4.40	2.09 ± 5.32	-1.32 ± 2.75	0.31 ± 2.54
	2/16/2015	0.14 ± 1.85	-1.06 ± 2.79	-2.91 ± 4.27	-0.60 ± 1.52	0.76 ± 1.75
	3/9/2015	1.74 ± 2.41	-2.27 ± 3.69	-4.74 ± 4.67	0.26 ± 2.39	0.06 ± 2.11
	4/21/2015	2.83 ± 3.05	-7.51 ± 5.54	-2.13 ± 6.28	-1.47 ± 5.53	-1.16 ± 3.43
	5/25/2015	-0.01 ± 1.80	-0.79 ± 2.80	0.78 ± 3.63	0.91 ± 1.46	-0.36 ± 1.61
	6/9/2015	-0.11 ± 3.21	-6.62 ± 5.66	-4.07 ± 5.95	-3.12 ± 3.24	1.70 ± 3.50
	7/14/2015	1.95 ± 3.62	2.51 ± 5.97	4.00 ± 4.95	-8.32 ± 4.20	1.89 ± 3.87
	8/11/2015	-0.03 ± 3.13	-1.79 ± 5.31	-0.74 ± 5.99	-1.15 ± 3.67	0.03 ± 3.64
	9/7/2015	4.33 ± 4.79	-3.06 ± 8.54	0.04 ± 5.80	-0.97 ± 3.82	-2.30 ± 5.52
	10/13/2015	1.21 ± 2.17	-1.14 ± 3.96	-0.75 ± 2.99	1.25 ± 2.28	-0.77 ± 2.75
	11/6/2015	1.33 ± 3.39	2.50 ± 6.07	-0.87 ± 4.78	1.25 ± 3.86	-5.05 ± 3.75
	12/1/2015	-1.27 ± 3.11	0.89 ± 5.30	-3.28 ± 5.30	-1.16 ± 3.34	-0.17 ± 3.32
		Ba-140	**La-140**	**H-3**	**K-40**	
	1/13/2015	2.58 ± 12.4	-1.84 ± 3.61			
	2/16/2015	-3.76 ± 9.75	-2.29 ± 2.81			
	3/9/2015	15.4 ± 11.4	1.48 ± 3.47	-89.9 ± 483		
	4/21/2015	-4.08 ± 12.4	-2.05 ± 4.31			
	5/25/2015	0.77 ± 8.62	0.23 ± 2.78		45.4 ± 39.8	
	6/9/2015	-2.77 ± 16.2	-0.76 ± 4.51	893 ± 1200	98.1 ± 48.9	
	7/14/2015	6.59 ± 13.4	0.15 ± 4.60		98.1 ± 74.2	
	8/11/2015	-11.7 ± 15.1	-1.54 ± 5.11		122 ± 69.0	
	9/7/2015	-0.46 ± 19.4	2.02 ± 6.80	-155 ± 579	177 ± 142	
	10/13/2015	-3.42 ± 9.49	-1.23 ± 2.90		84.5 ± 49.2	
	11/6/2015	2.62 ± 14.4	-1.98 ± 4.98		100 ± 66.0	
	12/1/2015	1.93 ± 15.1	0.98 ± 4.11	404 ± 575	87.3 ± 49.6	

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

Surry Power Station, Surry County, Virginia - 2015

pCi/Liter ± 2 Sigma

SAMPLING LOCATIONS	COLLECTION DATE	ISOTOPES				
		Mn-54	**Co-58**	**Fe-59**	**Co-60**	**Zn-65**
SW-C	1/13/2015	-0.63 ± 2.54	0.20 ± 2.87	-2.88 ± 5.62	-1.03 ± 2.79	-7.78 ± 6.59
	2/16/2015	0.22 ± 1.54	-0.21 ± 1.72	1.83 ± 5.27	-0.20 ± 2.47	1.66 ± 2.58
	3/9/2015	-1.79 ± 2.13	-2.06 ± 2.31	0.50 ± 4.60	-1.02 ± 2.00	-5.79 ± 4.60
	4/21/2015	-1.49 ± 2.76	-1.35 ± 2.75	0.45 ± 5.53	-0.82 ± 2.35	-0.08 ± 5.70
	5/26/2015	-0.66 ± 1.29	-0.45 ± 1.26	-1.67 ± 2.57	0.14 ± 1.40	-4.49 ± 3.19
	6/9/2015	-2.38 ± 2.93	0.28 ± 3.03	-0.07 ± 6.97	0.54 ± 4.03	1.89 ± 6.51
	7/14/2015	1.07 ± 4.36	6.06 ± 5.03	-5.73 ± 9.50	-4.39 ± 5.25	12.2 ± 10.8
	8/11/2015	0.56 ± 3.36	1.19 ± 3.45	4.42 ± 8.10	-1.98 ± 4.08	-7.35 ± 8.54
	9/7/2015	-5.12 ± 5.40	1.01 ± 3.54	1.94 ± 12.6	-0.56 ± 5.34	-4.64 ± 11.4
	10/13/2015	1.70 ± 2.89	-0.47 ± 2.42	2.50 ± 5.34	0.69 ± 2.97	-7.61 ± 6.13
	11/6/2015	-1.74 ± 2.98	-1.28 ± 3.01	-0.19 ± 5.28	0.08 ± 3.84	-5.20 ± 8.60
	12/1/2015	1.10 ± 2.84	-0.56 ± 2.79	6.18 ± 6.16	0.00 ± 2.67	-6.45 ± 6.86
		Nb-95	**Zr-95**	**I-131**	**Cs-134**	**Cs-137**
	1/13/2015	2.06 ± 2.91	1.30 ± 5.34	2.30 ± 5.29	0.71 ± 3.21	0.54 ± 2.95
	2/16/2015	1.53 ± 2.73	1.93 ± 3.89	2.08 ± 5.18	-0.13 ± 2.44	-0.38 ± 2.51
	3/9/2015	-0.19 ± 2.29	0.79 ± 4.28	3.09 ± 5.65	-3.72 ± 2.50	-0.96 ± 2.40
	4/21/2015	0.71 ± 2.72	2.19 ± 5.06	-4.04 ± 5.98	0.54 ± 4.45	0.31 ± 2.80
	5/26/2015	1.28 ± 1.39	0.60 ± 2.19	1.23 ± 2.82	-0.03 ± 1.63	0.72 ± 1.33
	6/9/2015	1.05 ± 3.02	1.12 ± 5.94	0.65 ± 5.67	-1.70 ± 3.34	0.08 ± 3.43
	7/14/2015	1.49 ± 4.45	3.26 ± 8.16	-3.75 ± 6.11	1.54 ± 4.63	-1.00 ± 5.09
	8/11/2015	1.73 ± 3.19	2.10 ± 5.50	-4.43 ± 5.69	-0.65 ± 3.33	-0.11 ± 3.85
	9/7/2015	-0.56 ± 4.56	0.75 ± 7.87	-0.79 ± 5.54	0.33 ± 4.40	0.50 ± 5.22
	10/13/2015	0.36 ± 2.85	-3.34 ± 4.84	3.83 ± 3.78	-1.08 ± 3.06	2.11 ± 3.03
	11/6/2015	-1.23 ± 3.66	2.33 ± 5.15	1.76 ± 5.27	-1.78 ± 3.12	1.13 ± 3.66
	12/1/2015	-0.33 ± 2.79	3.49 ± 5.22	3.02 ± 5.37	2.55 ± 2.54	1.22 ± 3.08
		Ba-140	**La-140**	**H-3**	**K-40**	**Th-228**
	1/13/2015	-9.77 ± 13.6	4.49 ± 4.92			
	2/16/2015	1.62 ± 8.85	3.22 ± 4.84			
	3/9/2015	6.29 ± 13.8	-3.61 ± 3.34	-244 ± 470		
	4/21/2015	-8.12 ± 14.7	0.49 ± 3.92			
	5/26/2015	0.50 ± 7.02	0.52 ± 2.15			4.69 ± 2.61
	6/9/2015	-4.06 ± 22.2	1.78 ± 5.95	-1090 ± 962	71.7 ± 52.7	
	7/14/2015	-1.90 ± 20.2	-1.49 ± 5.79			15.2 ± 10.0
	8/11/2015	0.52 ± 16.4	-5.08 ± 6.31		68.9 ± 63.7	
	9/7/2015	-6.41 ± 13.9	-3.81 ± 7.32	-360 ± 563	167 ± 128	
	10/13/2015	4.53 ± 10.6	1.80 ± 3.68			
	11/6/2015	-0.15 ± 12.6	0.83 ± 4.09			
	12/1/2015	-2.75 ± 15.1	-3.29 ± 4.69	161 ± 551		

TABLE 3-10: GAMMA EMITTER CONCENTRATIONS IN SILT

Surry Power Station, Surry County, Virginia - 2015

pCi/kg (dry) ± 2 Sigma

SAMPLING LOCATIONS	COLLECTION DATE	ISOTOPE				
		Cs-134	**Cs-137**	**K-40**	**Th-232**	**Th-228**
SD	3/9/2015	21.4 ± 43.5	24.1 ± 50.8	12900 ± 1330	1510 ± 207	1570 ± 129
	9/3/2015	9.64 ± 79.7	76.4 ± 90.5	21100 ± 2630	1320 ± 285	1110 ± 177
		Ra-226				
	3/9/2015	3260 ± 1660				
	9/3/2015					
		Cs-134	**Cs-137**	**K-40**	**Th-232**	**Th-228**
CHIC-C	3/9/2015	14.5 ± 89.7	196 ± 134	21200 ± 2830	1790 ± 444	1460 ± 389
	9/2/2015	-5.42 ± 105	214 ± 130	16900 ± 2770	1130 ± 302	1270 ± 263
		Ra-226				
	3/9/2015					
	9/2/2015	2260 ± 2200				

TABLE 3-11: GAMMA EMITTER CONCENTRATIONS IN SHORELINE SEDIMENT

Surry Power Station, Surry County, Virginia - 2015

pCi/kg (dry) ± 2 Sigma

SAMPLING LOCATIONS	COLLECTION DATE	ISOTOPE				
		Cs-134	**Cs-137**	**K-40**	**Ra-226**	**Th-228**
HIR	2/23/2015	-10.1 ± 31.6	-4.60 ± 23.7	7760 ± 1000	1420 ± 912	315 ± 88.5
	8/11/2015	-13.5 ± 29.8	-12.5 ± 29.6	5720 ± 819		734 ± 79.6
		Th-232				
	2/23/2015	444 ± 102				
	8/11/2015	737 ± 108				
CHIC-C	2/23/2015	0.25 ± 18.4	-7.78 ± 18.3	2430 ± 495	927 ± 639	330 ± 53.0
	8/11/2015	34.3 ± 35.4	-17.2 ± 33.9	1640 ± 600	2350 ± 1250	1370 ± 106
		Th-232				
	2/23/2015	413 ± 86.9				
	8/11/2015	1350 ± 173				

TABLE 3-12: GAMMA EMITTER CONCENTRATION IN FISH

Surry Power Station, Surry County, Virginia - 2015

pCi/kg (wet) ± 2 Sigma

SAMPLING LOCATION	COLLECTION DATE	SAMPLE TYPE	ISOTOPE			
			K-40	**Mn-54**	**Co-58**	**Fe-59**
SD	4/6/2015	Catfish	2910 ± 871	1.20 ± 37.3	-4.54 ± 34.6	0.18 ± 63.7
	4/6/2015	Game fish	1040 ± 600	-14.5 ± 33.8	-21.6 ± 34.1	-16.8 ± 75.4
	10/7/2015	Catfish	1690 ± 547	-8.83 ± 21.4	5.86 ± 20.6	21.8 ± 52.9
	10/7/2015	Game fish	1950 ± 771	2.28 ± 29.2	-3.01 ± 33.8	19.5 ± 93.8
			Co-60	**Zn-65**	**Cs-134**	**Cs-137**
	4/6/2015	Catfish	-13.3 ± 35.1	-61.0 ± 79.8	8.94 ± 39.9	19.8 ± 38.3
	4/6/2015	Game fish	25.9 ± 33.2	-14.0 ± 73.2	-81.6 ± 40.6	-4.67 ± 38.8
	10/7/2015	Catfish	4.30 ± 24.3	0.42 ± 42.6	2.65 ± 25.6	9.87 ± 23.1
	10/7/2015	Game fish	31.9 ± 30.8	31.0 ± 79.6	-2.74 ± 35.1	-21.9 ± 36.8

TABLE 3-13: GAMMA EMITTER CONCENTRATIONS IN OYSTERS

Surry Power Station, Surry County, Virginia - 2015

pCi/kg (wet) ± 2 Sigma

SAMPLING LOCATIONS	COLLECTION DATE	ISOTOPE			
		Mn-54	**Co-58**	**Fe-59**	**Co-60**
POS	3/9/2015	-2.26 ± 23.0	-12.4 ± 25.7	5.51 ± 44.7	16.7 ± 24.2
	9/3/2015	31.2 ± 32.1	-9.59 ± 41.4	-61.9 ± 72.5	-6.36 ± 32.8
		Zn-65	**Cs-134**	**Cs-137**	**K-40**
	3/9/2015	23.0 ± 49.9	-20.0 ± 24.1	2.75 ± 25.2	867 ± 539
	9/3/2015	19.5 ± 34.8	15.7 ± 33.5	0.70 ± 35.8	
		Mn-54	**Co-58**	**Fe-59**	**Co-60**
MP	3/10/2015	-22.3 ± 33.1	-34.7 ± 36.6	-44.9 ± 65.0	0.98 ± 31.8
	9/3/2015	-4.80 ± 26.6	0.23 ± 25.7	-31.6 ± 60.6	-25.2 ± 25.1
		Zn-65	**Cs-134**	**Cs-137**	**K-40**
	3/10/2015	-105 ± 84.6	16.2 ± 42.1	19.7 ± 36.2	955 ± 643
	9/3/2015	-72.9 ± 84.5	15.9 ± 27.7	9.34 ± 24.9	
		Mn-54	**Co-58**	**Fe-59**	**Co-60**
LC	3/10/2015	-12.9 ± 19.4	5.73 ± 20.4	13.4 ± 54.6	19.6 ± 22.1
	9/3/2015	-12.6 ± 37.9	9.64 ± 40.1	-74.2 ± 114	2.49 ± 24.8
		Zn-65	**Cs-134**	**Cs-137**	**K-40**
	3/13/2013	-26.7 ± 38.8	-3.04 ± 21.6	4.29 ± 19.4	611 ± 399
	9/3/2015	-6.90 ± 96.6	0.53 ± 36.0	7.16 ± 30.5	

TABLE 3-14: GAMMA EMITTER CONCENTRATIONS IN CLAMS

Surry Power Station, Surry County, Virginia - 2015

pCi/kg (wet) ± 2 Sigma

SAMPLING LOCATIONS	COLLECTION DATE	ISOTOPE			
		Mn-54	**Co-58**	**Fe-59**	**Co-60**
JI	3/9/2015	-1.79 ± 22.0	-4.38 ± 28.0	21.2 ± 51.6	-3.30 ± 25.9
	9/2/2015	4.35 ± 27.7	5.45 ± 24.7	-1.48 ± 61.9	6.07 ± 22.2
		Zn-65	**Cs-134**	**Cs-137**	
	3/9/2015	-36.4 ± 52.1	-17.2 ± 25.4	13.2 ± 24.9	
	9/2/2015	-7.41 ± 44.4	-0.84 ± 28.5	-17.3 ± 36.8	
		Mn-54	**Co-58**	**Fe-59**	**Co-60**
SD	3/9/2015	12.4 ± 27.1	-8.75 ± 28.4	-23.5 ± 61.9	13.0 ± 29.4
	9/3/2015	-10.7 ± 23.5	-14.8 ± 34.8	-27.5 ± 61.0	-9.49 ± 30.1
		Zn-65	**Cs-134**	**Cs-137**	
	3/9/2015	-46.5 ± 67.4	-22.7 ± 37.4	16.0 ± 30.0	
	9/3/2015	23.2 ± 63.4	3.44 ± 29.5	-14.6 ± 31.3	
		Mn-54	**Co-58**	**Fe-59**	**Co-60**
CHIC-C	3/9/2015	-1.36 ± 20.1	-8.33 ± 22.0	15.6 ± 52.8	-2.10 ± 17.8
	9/2/2015	9.52 ± 21.7	8.29 ± 22.5	16.9 ± 39.7	2.06 ± 21.6
		Zn-65	**Cs-134**	**Cs-137**	
	3/9/2015	-66.1 ± 46.5	2.24 ± 28.1	0.41 ± 22.0	
	9/2/2015	-51.4 ± 60.8	-10.3 ± 20.5	-16.8 ± 25.1	

TABLE 3-15: GAMMA EMITTER CONCENTRATIONS IN CRABS

Surry Power Station, Surry County, Virginia - 2015

pCi/kg (wet) ± 2 Sigma

SAMPLING LOCATIONS	COLLECTION DATE	ISOTOPE			
		K-40	**Mn-54**	**Co-58**	**Fe-59**
SD	6/9/2015	1140 ± 725	-9.54 ± 30.5	9.19 ± 33.8	-21.1 ± 78.9
		Co-60	**Zn-65**	**Cs-134**	**Cs-137**
		18.3 ± 27.9	-55.4 ± 75.8	-25.0 ± 33.3	17.7 ± 34.2

4. DISCUSSION OF RESULTS

Data from the radiological analyses of environmental media collected during 2015 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 2015 was from external sources, such as fallout from nuclear weapons tests (cesium-137) and naturally occurring radionuclides. Naturally occurring nuclides such as beryllium-7, potassium-40, radium-226, thorium-228 and thorium-232 were detected in numerous samples.

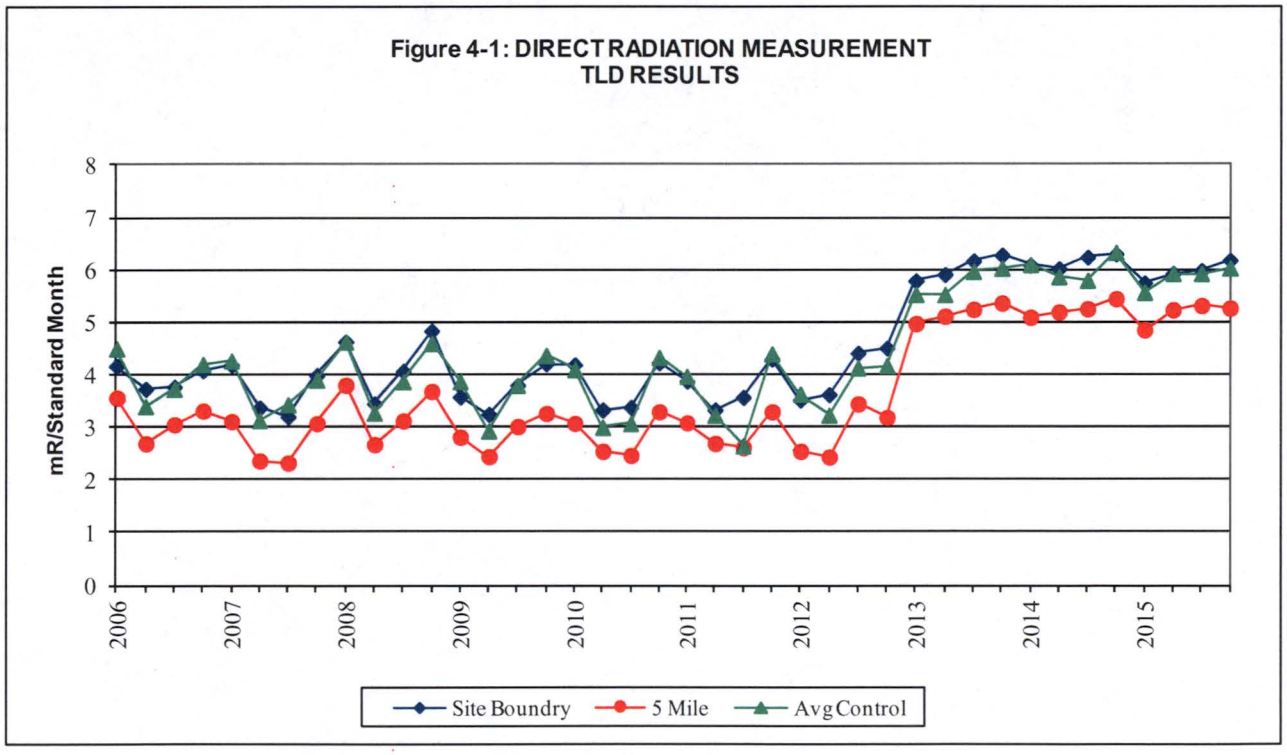
The following is a discussion and summary of the results of the environmental measurements taken during the 2015 reporting period.

4.1 Gamma Exposure Rate

A thermoluminescent dosimeter (TLD) is an inorganic crystal used to detect ambient radiation. Two TLDs, made of CaF and LiF elements and specifically designed for environmental monitoring, are deployed at each sampling location. TLDs are placed in two concentric rings around the station. The inner ring is located in the vicinity of the site boundary, and the outer ring is located at approximately five miles from the station. TLDs are also placed in special interest areas, such as population centers and nearby residences. Additional TLDs serve as controls. Ambient radiation comes from naturally occurring radioisotopes in the air and soil, radiation from cosmic origin, fallout from nuclear weapons testing, station effluents and direct radiation from the station.

The results of the TLD analyses are presented in Table 3-2. Figure 4-1 shows a historical trend of TLD exposure rate measurements, comparing the average of indicator TLDs located near the site boundary and at 5 miles to the average of all control TLD locations. Control and indicator averages indicate a steady relationship. In 2013, Panasonic UD-814 environmental TLDs replaced Harshaw environmental TLDs that were used since 2001. Benchmarking showed that Panasonic UD-814 TLDs were the industry best environmental TLD with improved precision over the Harshaw TLDs. Along with implementing new environmental

TLDs in 2013, an improved method for calculating control dosimeter dose was implemented to estimate transit dose. A program review found that control dosimeters cannot be used directly to assess the transit dose, since control dosimeters also accrue dose from cosmic radiation while stored in the shielded storage cask/cave. Therefore, additional calculations must be made in order to determine the transit dose component. This transit dose component was determined by processing the control dosimeters, and subtracting out the monitoring period storage dose. Previously, control dosimeters were assumed to be a direct measurement of transit dose which resulted in a non-conservative (lower) result of reported field doses. The field dose with the replacement TLDs is higher than that of the previously used TLDs as the greater precision and accuracy of the replacement TLD along with improved control dosimeter dose provides a more representative response to ambient radiation.

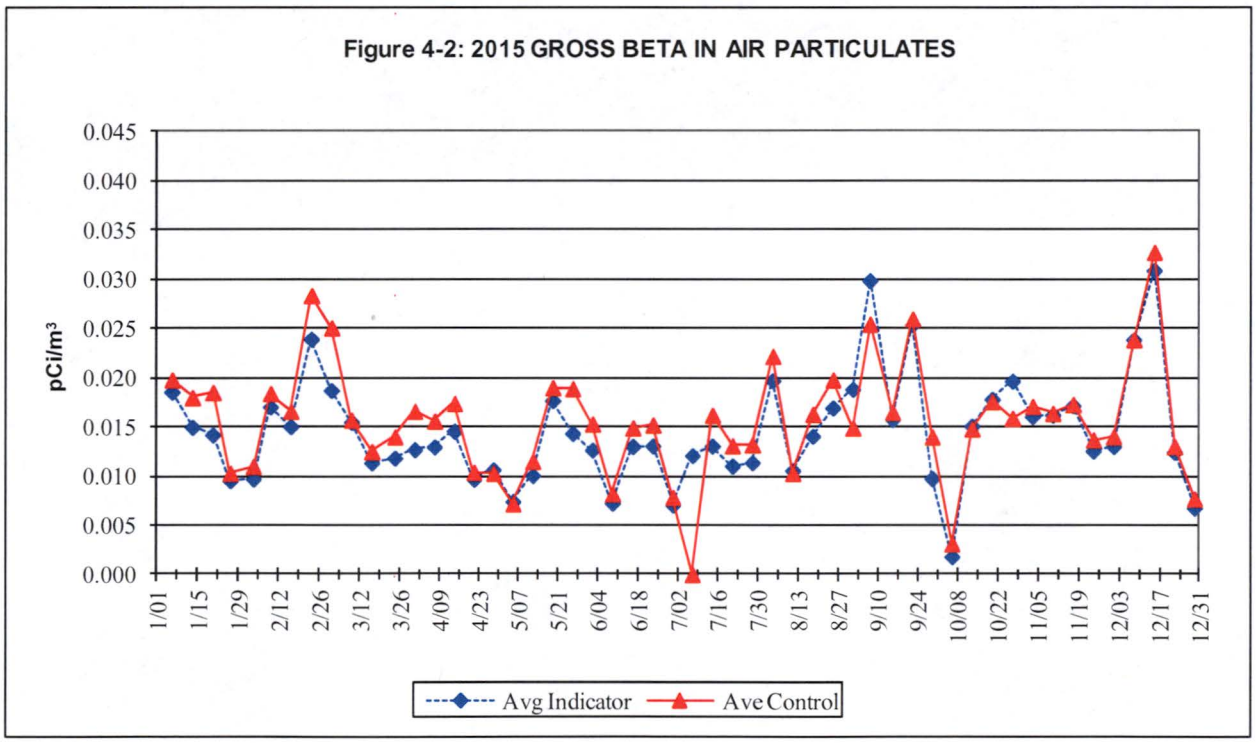


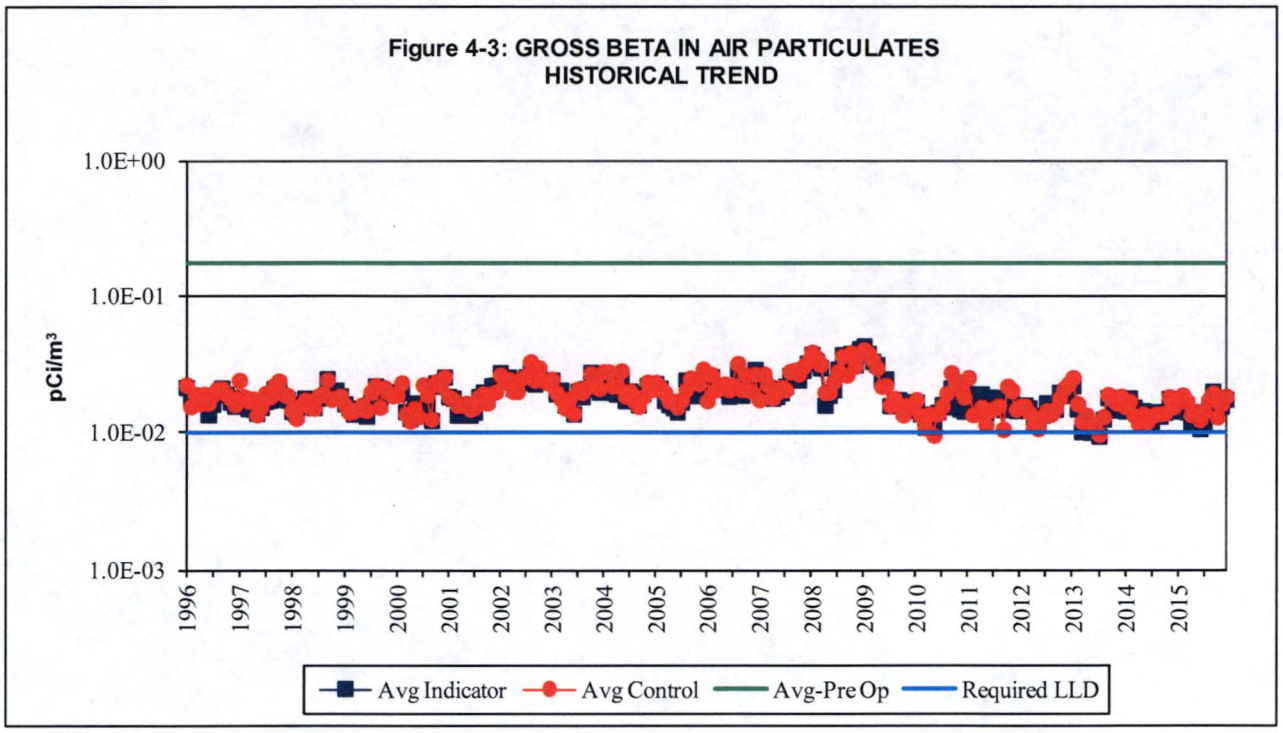
4.2 Airborne Gross Beta

Air is continuously sampled by passing it through glass fiber particulate filters. The filters collect airborne particulate radionuclides. Once a week the samples are collected and analyzed for gross beta activity. Results of the weekly gross beta analyses are presented in Table 3-3. A review of the results from control and indicator locations continues to show no significant variation in measured activities (see Figure 4-2 and 4-3). This indicates that any station contribution is

activities (see Figure 4-2 and 4-3). This indicates that any station contribution is not measurable. As evident in Figure 4-2, the control gross beta concentration deviated from the norm for the sampling period of June 30 – July 7. Electrical power was lost to the control sampler during this sampling period.

Gross beta activity found during the pre-operational and early operating period of Surry Power Station was higher because of nuclear weapons testing. During that time, nearly 740 nuclear weapons were tested worldwide. In 1985 weapons testing ceased, and with the exception of the Chernobyl accident in 1986, airborne gross beta results have remained steady.





4.3 Airborne Radioiodine

Air is also continuously sampled for radioiodines by passing it 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. These results are similar to pre-operational data and the results of samples taken prior to and after the 1986 accident in the Soviet Union at Chernobyl and the Fukushima Daiichi nuclear incident in 2011.

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 is produced by cosmic processes. No man-made radionuclides were identified. These analyses confirm the lack of station effects.

4.5 Cow Milk

Analysis of milk samples is generally the most sensitive indicator of fission product existence in the terrestrial environment. This, in combination with the fact that consumption of milk is significant, results in this pathway usually being the most critical from the plant release viewpoint. This pathway also shows measurable amounts of nuclear weapons testing fallout. Therefore, this media needs to be carefully evaluated when trying to determine if there is any station effect.

Results of gamma spectroscopy indicate no detectable station related radioactivity in the milk samples. In years past, cesium-137 had been detected sporadically. The occurrences were attributed to residual global fallout from past atmospheric weapons testing. Cs-137 was not detected at a level above the LLD in 2015.

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 composite samples at an average concentration of 1.78 pCi/L. Sr-90 is not a component of the station radiological effluents and is a product of nuclear weapons testing fallout which has been well documented.

4.6 Food Products

Three samples were collected and analyzed by gamma spectroscopy. The results of the analyses are presented in Table 3-7. As expected, naturally occurring potassium-40 was detected in all samples. The average concentration is consistent with that observed in previous years. No station related radioactivity was detected.

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 and analyzes for gamma radiation and for tritium. The results of these analyses are presented in Table 3-8. Consistent with past monitoring, no station related radioactivity was detected. No gamma emitting isotopes were detected during the pre-operational period.

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

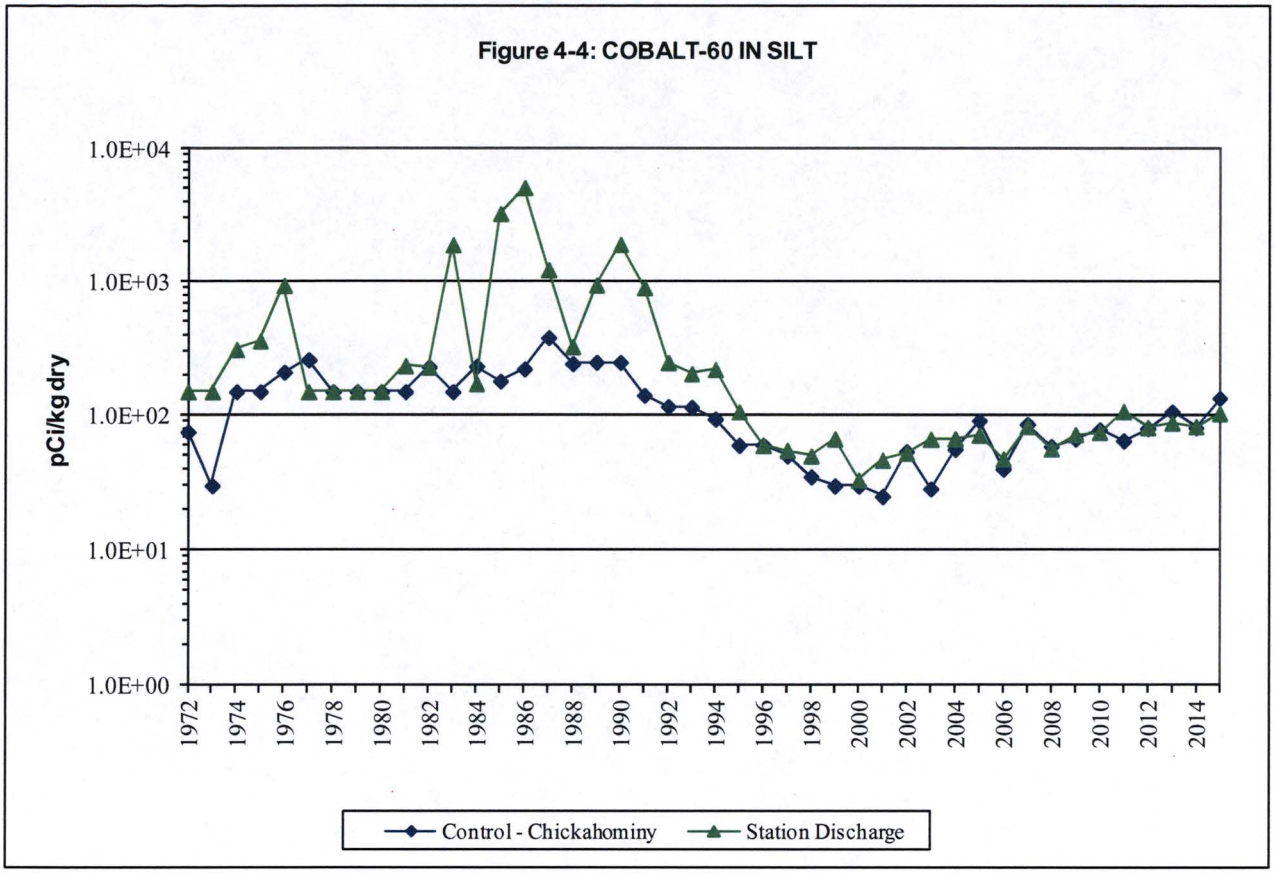
monthly samples are also composited and analyzed for tritium on a quarterly basis. Tritium was not detected and, with the exception of natural products, no other gamma emitters were detected. The naturally occurring radionuclides detected were potassium-40 and thorium-228. No station related radioactivity was detected.

4.9 Silt

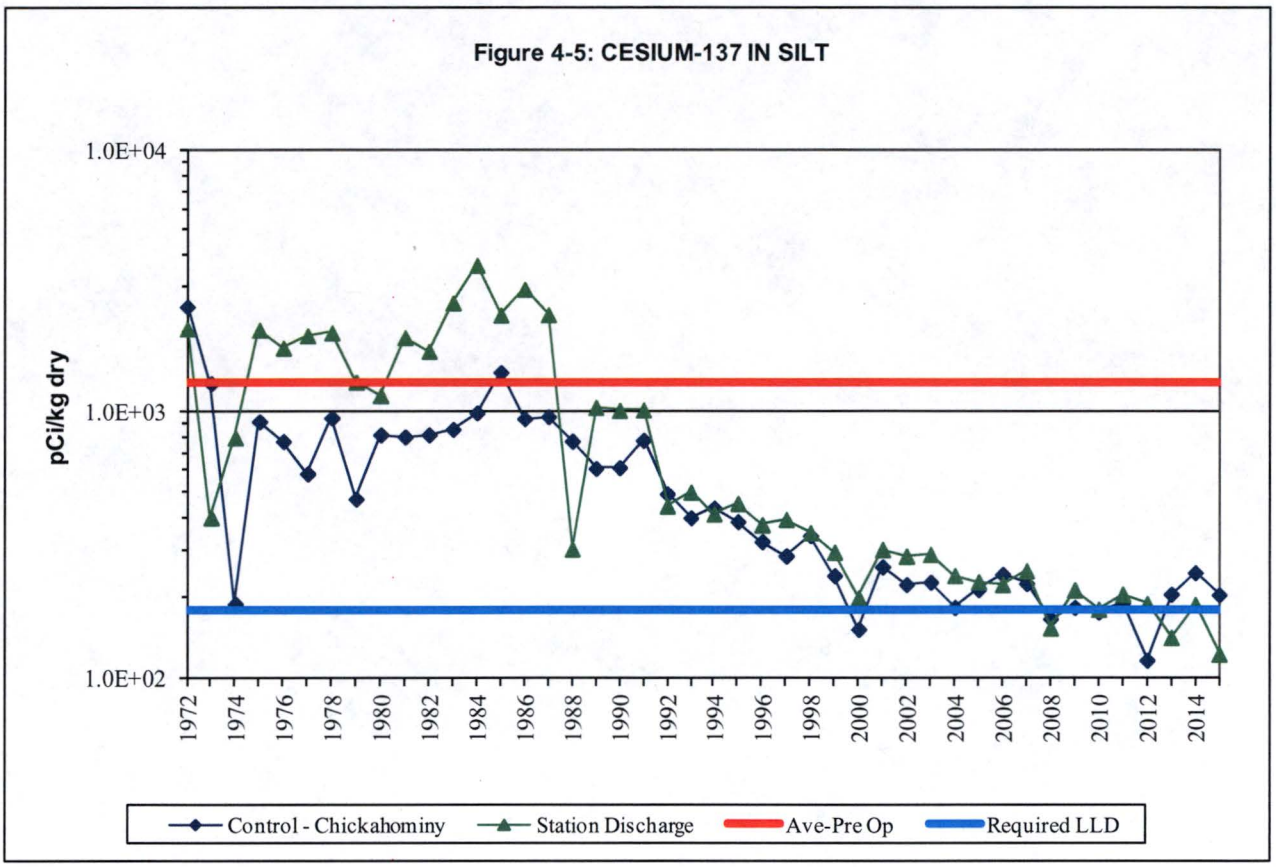
Silt is sampled to evaluate any buildup of radionuclides in the environment due to the operation of the station. Sampling of this pathway provides a good indication of the dispersion effects of effluents to the river. Buildup of radionuclides in silt could indirectly lead to increasing radioactivity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

Samples of silt are collected from two locations, one upstream and one downstream of the station. The results of the gamma spectroscopy analyses are presented in Table 3-10. Naturally occurring potassium-40, radium-226, thorium-228 and thorium-232 were detected. Historically, cobalt-60 has been detected in samples obtained from the indicator location (SD). Cobalt-60 has not been detected since 2003. Trend graphs of cobalt-60 and cesium-137 in silt appear in Figures 4-4 and 4-5.

The concentrations of cesium-137 detected indicate a continual decreasing trend as seen for over two decades. The detection of cesium-137 in both control and indicator samples and decreasing levels indicate that the presence of cesium-137 is the result of accumulation and runoff into the river of residual weapons testing fallout. Its global presence has been well documented. During the pre-operational period, cesium-137 was detected in silt samples with an average concentration as indicated in Figure 4-5. At the control location, cesium-137 was detected with an average concentration of 205 pCi/kg. In 2015, for the first time, cesium-137 was not detected in the indicator location. The cesium-137 concentrations in silt continue to decline and fluctuate around the REMP lower limit of detection (LLD) concentration, which could account for the non-detect. This trend will continue to be closely monitored.



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 2015.



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. The activities of these radionuclides indicate a steady trend. There were no radionuclides attributable to the operation of the station found 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. These results are the same as 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.

There were no gamma emitting radionuclides detected in oysters sampled except for naturally occurring potassium-40. No station related radioactivity has been detected in this media since 1991. The absence of station related radionuclides is attributable to the replacement of steam generators in 1982 and past improvements made to liquid effluent treatment systems.

4.13 Clams

Clams are analyzed from three different locations. The results of the gamma spectroscopy analyses are presented in Table 3-14. Like oysters, no station related radioactivity was detected.

4.14 Crabs

A crab sample was collected in June 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 were detected in the sample. This is consistent with pre-operational data and data collected over the past decade.

5. PROGRAM EXCEPTIONS

There were two REMP exceptions for scheduled sampling and analysis during 2015.

1. For the sample period Jan 13 – 20, samples for gross beta and iodine-131 in air were not obtained from the BASF air sampling station. The BASF air sampler was located within a substation that was permanently removed from service during the Jan 13 – 20 sample period. It was unknown to Surry Power Station that the substation was to be removed from service. Prior to the loss of power to the sampler, insufficient sample volume had accumulated to meet the lower limit of detection for gross beta and iodine-131 analyses.
2. For the sample period Jun 30 – Jul 7, samples for gross beta and iodine-131 in air were not obtained from the NN air sampling station. The sampler was found inoperable upon arrival at the NN air sampling station. Prior to the loss of power to the sampler, insufficient sample volume had accumulated to meet the lower limit of detection for gross beta and iodine-131 analyses.

NOTE: Due to the issues described above, Surry Power station has installed electronic monitoring devices on all REMP air samplers. These devices monitor for loss of power and low sample flow rate. If either of these conditions is detected on an air sampler, the device makes an immediate notification by page and e-mail. The condition can then be assessed and appropriate actions taken to prevent the loss of monitoring for a sampling period.

The 2013 Annual Radiological Environmental Operating Report was submitted with iodine-131 in air sample data omitted for the sample period February 05 through 12 for all eight sampling stations. Appendix C contains the revised analysis data table for iodine-131 in air for 2013.

6. CONCLUSIONS

The results of the 2015 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** - Control and indicator location averages continue to indicate a steady relationship and trend over the long term.

- **Airborne Exposure Pathway** - Analysis of charcoal cartridge samples for radioiodines indicated no positive activity was detected. Quarterly gamma isotopic analyses of the composite particulate samples identified only naturally occurring beryllium-7 and potassium-40. Air particulate gross beta concentrations at all of the indicator locations for 2015 trend well with the control location.

- **Milk** - Milk samples are an important indicator measuring the effect of radioactive iodine and radionuclides in airborne releases. Cesium-137 and iodine-131 were not 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 1.78 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 samples. In the past, cesium-137 had occasionally been detected in these samples and is attributable to global fallout from past nuclear weapons testing. Cesium-137 was not detected in any of the three samples collected in 2015.

- **Well Water** - Well water sample analyses indicated there was no radioactivity attributable to the operation of the station. This trend is consistent throughout the monitoring period.

- **River Water** - River water samples were analyzed for gamma emitting radionuclides and tritium. Only the naturally occurring gamma emitting radionuclides potassium-40 and thorium-228 were detected. Tritium was not detected.

- **Silt** - Cesium-137 was detected in the control sample and not in the indicator sample. The presence of cesium-137 is attributable to residual weapons testing fallout and its presence has been well documented. Cobalt-60 has not been detected since 2003.

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

Aquatic Biota

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

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

- **Crabs** – Naturally occurring potassium-40 was detected. No other gamma emitting radionuclides were detected.

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References

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

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

4. United States Nuclear Regulatory Commission Branch Technical Position, "Acceptable Radiological Environmental Monitoring Program", Rev. 1, November 1979.

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.

APPENDICES

APPENDIX A: LAND USE CENSUS

Year 2015

*LAND USE CENSUS**

Surry Power Station, Surry County, Virginia

January 1 to December 31, 2015 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	2.3 @ 221°	4.7 @ 228°	(a)	(a)
M	WSW	0.4 @ 244°	3.6 @ 245°	(a)	(a)
N	W	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

APPENDIX B: SUMMARY OF INTERLABORATORY COMPARISONS

Year 2015

INTRODUCTION

This appendix covers the Interlaboratory Comparison Program (ICP) of Teledyne Brown Engineering (TBE). TBE use QA/QC samples provided by Eckert & Ziegler Analytics, Inc., Environmental Resource Associates (ERA) and the Mixed Analyte Performance Evaluation Program (MAPEP) to monitor the quality of analytical processing associated with the REMP. Each provider has a documented Quality Assurance program and the capability to prepare Quality Control materials traceable to the National Institute of Standards and Technology (NIST). The providers supply the samples to TBE, and upon receipt, the laboratories perform the analyses in a normal manner. The results are then reported to the provider for evaluation. The suite of QA/QC samples is designed to provide sample media and radionuclide combinations that are offered by the providers and included in the REMP and typically includes:

- milk for gamma nuclides and low-level iodine-131 analyses,
- milk for Sr-89 and Sr-90 analyses,
- water for gamma nuclides, low-level iodine-131, and gross beta analyses,
- water for tritium, Sr-89, and Sr-90 analyses,
- cartridge for I-131 analyses,
- air filter for gamma nuclide, gross beta, and Sr-90 analyses.

The accuracy of each result reported to Eckert & Ziegler Analytics, Inc. is measured by the ratio of the TBE result to the known value. Accuracy for all other results is based on statistically derived acceptance ranges calculated by the providers. An investigation is undertaken whenever the ratio or reported result fell outside of the acceptance range.

RESULTS

The TBE ICP results are included in the following tables for the first through the fourth quarters of 2015. Some analyses did not meet the acceptance criteria. TBE initiated non-conformance reports (NCRs) to document and address the analyses. The results of the NCRs are as follows.

1. NCR 15-09, ERA water sample RAD-101 failed Sr-89 and Sr-90. For Sr-89, the TBE value of 45.2 pCi/L was lower than the known value of 63.2 pCi/L, failing below the lower acceptance limit of 51.1 pCi/L. For Sr-90, the TBE value of 28.0 pCi/L was lower than the known value of 41.9pCi/L, failing below the lower acceptance limit of 30.8 pCi/L. A reanalysis could not be performed because the sample was consumed in the original analysis. Raw and QC data associated with the analysis were reviewed. The original strontium gravimetric yields were very high at 97.6 % and 103.8%. Yields this high indicates the presence of excess calcium and would likely benefit

from a second fuming HNO_3 separation. Typical strontium yields run around 60% or 70%. Higher yields would result in lower activities. Going forward, a second fuming HNO_3 separation will be performed on samples with high yields.

2. NCR 15-18, Eckert & Ziegler Analytics air particulate filter sample E11237 failed Cr-51. The TBE value of 323 pCi was higher than the known value of 233 pCi. The resultant ratio was 1.39 failing above the high acceptance limit of 1.30. All raw and associated QC data were reviewed and fell within acceptance criteria limits. The air particulate sample is counted at a distance above the surface of the detector to avoid detector summing which could alter the results. Chromium-51 has the shortest half-life (27.7 days) and the lowest gamma energy (320.08 keV) of this mixed nuclide sample. Additionally, Cr-51 has only one gamma energy and also has a low intensity (9.38 gamma photons produced per 100 disintegrations). This geometry produces a larger error for the Cr-51 and other gamma emitters as any distance from the detector decreases the counting rate and the probability of accurately detecting the nuclide energy. Taking into consideration the uncertainty, the activity of Cr-51 overlaps with the known value at a ratio of 1.19, which would statistically be considered acceptable. TBE believes this failure is specific to the sample and has no impact on client samples.
3. NCR 15-21, MAPEP filter sample 15-RdF33 failed Sr-90. The TBE value of 1.5 Bq/sample was lower than the known value of 2.18 Bq/sample, failing below the lower acceptance limit of 1.53. A rerun of the sample was acceptable, 1.94 Bq, however still below 2.18 Bq. It appears that the Sr-90 was lost during the separation chemistry although the exact cause could not be identified. In the past, MAPEP has added substances (unusual compounds found in DOE complexes) to various matrices that have resulted in incomplete removal of the isotope of interest for the laboratories analyzing the cross checks. This is possibly the case with this sample. Many compounds, if not properly accounted for or removed in the sample matrix, can cause interferences to either indicate lower or higher activity. TBE will no longer analyze the air particulate Sr-90 through MAPEP but will participate in the Analytics cross check program to perform Sr-90 in the air particulate matrix.

ECKERT & ZIEGLER ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES
(PAGE 1 OF 3)

Month/Year	Identification Number	Matrix	Nuclide	Units	Reported Value (a)	Known Value (b)	Ratio (c) TBE/Analytics	Evaluation (d)
March 2015	E11181	Milk	Sr-89	pCi/L	88.9	97.2	0.91	A
			Sr-90	pCi/L	12.2	17.4	0.70	W
	E11182	Milk	I-131	pCi/L	61.3	65	0.94	A
			Ce-141	pCi/L	104	113	0.92	A
			Cr-51	pCi/L	265	276	0.96	A
			Cs-134	pCi/L	138	154	0.90	A
			Cs-137	pCi/L	205	207	0.99	A
			Co-58	pCi/L	178	183	0.97	A
			Mn-54	pCi/L	187	188	0.99	A
			Fe-59	pCi/L	182	177	1.03	A
			Zn-65	pCi/L	345	351	0.98	A
			Co-60	pCi/L	379	405	0.94	A
	E11184	Filter	Ce-141	pCi	107	85.0	1.26	W
			Cr-51	pCi	261	224	1.17	A
			Cs-134	pCi	74.6	77.0	0.97	A
			Cs-137	pCi	99.6	102	0.98	A
			Co-58	pCi	99.8	101	0.99	A
			Mn-54	pCi	99.2	96.9	1.02	A
			Fe-59	pCi	109	119	0.92	A
			Zn-65	pCi	188	183	1.03	A
			Co-60	pCi	200	201	1.00	A
	E11183	Charcoal	I-131	pCi	82.9	85.4	0.97	A
June 2015	E11234	Milk	Sr-89	pCi/L	94.9	92.6	1.02	A
			Sr-90	pCi/L	14.3	12.7	1.13	A
	E11238	Milk	I-131	pCi/L	93.2	95.9	0.97	A
			Cr-51	pCi/L	349	276	1.26	W
			Cs-134	pCi/L	165	163	1.01	A
			Cs-137	pCi/L	143.0	125	1.14	A
			Co-58	pCi/L	82.0	68.4	1.20	A
			Mn-54	pCi/L	113	101	1.12	A
			Fe-59	pCi/L	184	151	1.22	W
			Zn-65	pCi/L	269	248	1.08	A
			Co-60	pCi/L	208	193	1.08	A

Footnotes are on page 3 of 3.

ECKERT & ZIEGLER ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES
(PAGE 2 OF 3)

Month/Year	Identification Number	Matrix	Nuclide	Units	Reported Value (a)	Known Value (b)	Ratio (c) TBE/Analytics	Evaluation (d)
June 2015	E11237	Filter	Cr-51	pCi	323	233	1.39	N (1)
			Cs-134	pCi	139	138	1.01	A
			Cs-137	pCi	111	106	1.05	A
			Co-58	pCi	54.0	57.8	0.93	A
			Mn-54	pCi	96.8	84.9	1.14	A
			Fe-59	pCi	162	128	1.27	W
			Zn-65	pCi	198	210	0.94	A
			Co-60	pCi	178	163	1.09	A
	E11236	Charcoal	I-131	pCi	93.9	80	1.17	A
September 2015	E11289	Milk	Sr-89	pCi/L	95.7	99.1	0.97	A
			Sr-90	pCi/L	15.4	16.4	0.94	A
	E11290	Milk	I-131	pCi/L	94.9	99.9	0.95	A
			Ce-141	pCi/L	228	213	1.07	A
			Cr-51	pCi/L	499	538	0.93	A
			Cs-134	pCi/L	208	212	0.98	A
			Cs-137	pCi/L	270	255	1.06	A
			Co-58	pCi/L	275	263	1.05	A
			Mn-54	pCi/L	320	290	1.10	A
			Fe-59	pCi/L	255	226	1.13	A
			Zn-65	pCi/L	392	353	1.11	A
			Co-60	pCi/L	350	330	1.06	A
	E11292	Filter	Ce-141	pCi	104	85.1	1.22	W
			Cr-51	pCi	262	215	1.22	W
			Cs-134	pCi	86.1	85	1.02	A
			Cs-137	pCi	93.0	102	0.91	A
			Co-58	pCi	106	105.0	1.01	A
			Mn-54	pCi	117	116	1.01	A
			Fe-59	pCi	94.8	90	1.05	A
			Zn-65	pCi	160	141	1.13	A
			Co-60	pCi	146	132	1.11	A
	E11291	Charcoal	I-131	pCi	85.9	81.7	1.05	A
December 2015	E11354	Milk	Sr-89	pCi/L	96.2	86.8	1.11	A
			Sr-90	pCi/L	14.8	12.5	1.18	A

Footnotes are on page 3 of 3.

ECKERT & ZIEGLER ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES
(PAGE 3 OF 3)

Month/Year	Identification Number	Matrix	Nuclide	Units	Reported Value (a)	Known Value (b)	Ratio (c) TBE/Analytics	Evaluation (d)
December 2015	E11355	Milk	I-131	pCi/L	95.1	91.2	1.04	A
			Ce-141	pCi/L	117	129	0.91	A
			Cr-51	pCi/L	265	281	0.94	A
			Cs-134	pCi/L	153	160	0.96	A
			Cs-137	pCi/L	119	115	1.03	A
			Co-58	pCi/L	107	110	0.97	A
			Mn-54	pCi/L	153	145	1.06	A
			Fe-59	pCi/L	117	108	1.08	A
			Zn-65	pCi/L	261	248	1.05	A
			Co-60	pCi/L	212	213	1.00	A
	E11357	Filter	Ce-141	pCi	89.9	84.0	1.07	A
			Cr-51	pCi	215	184	1.17	A
			Cs-134	pCi	103	105	0.98	A
			Cs-137	pCi	76.6	74.8	1.02	A
			Co-58	pCi	76.2	71.9	1.06	A
			Mn-54	pCi	91.4	94.4	0.97	A
			Fe-59	pCi	78.6	70.3	1.12	A
			Zn-65	pCi	173	162	1.07	A
			Co-60	pCi	138	139	0.99	A
	E11356	Charcoal	I-131	pCi	74.9	75.2	1.00	A
	E11422	Filter	Sr-89	pCi	98.0	96.9	1.01	A
			Sr-90	pCi	10.0	14.0	0.71	W

(1) Cr-51 has the shortest half-life and the weakest gamma energy of the mixed nuclide sample, which produces a large error. Taking into account the error, the lowest value would be 119% of the reference value, which would be considered acceptable. NCR 15-18

(a) Teledyne Brown Engineering reported result.

(b) 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.

(c) Ratio of Teledyne Brown Engineering to Analytics results.

(d) Analytics evaluation based on TBE internal QC limits: A= Acceptable, reported result falls within ratio limits of 0.80-1.20. W-Acceptable with warning, reported result falls within 0.70-0.80 or 1.20-1.30. N = Not Acceptable, reported result falls outside the ratio limits of < 0.70 and > 1.30.

DOE's MIXED ANALYTE PERFORMANCE EVALUATION PROGRAM (MAPEP)
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES
(PAGE 1 OF 1)

Month/Year	Identification Number	Media	Nuclide	Units	Reported Value (a)	Known Value (b)	Acceptance Range	Evaluation (c)
March 2015	15-GrF32	Filter	Gr-B	Bq/sample	0.758	0.75	0.38 - 1.13	A
	15-RdF32	Filter	Sr-90	Bq/sample	-0.0991		(1)	A
September 2015	15-GrF33	Filter	Gr-B	Bq/sample	1.340	1.56	0.78 - 2.34	A
	15-RdF33	Filter	Sr-90	Bq/sample	1.5	2.18	1.53 - 2.83	N (2)

(1) False positive test.
(2) Sr-90 was lost during separation, possible from substance added by MAPEP. NCR 15-21
(a) Teledyne Brown Engineering reported result.
(b) 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.
(c) DOE/MAPEP evaluation: A=acceptable, W=acceptable with warning, N=not acceptable.

ERA ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM
TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES
(PAGE 1 OF 1)

Month/Year	Identification Number	Media	Nuclide	Units	Reported Value (a)	Known Value (b)	Acceptance Limits	Evaluation (c)
May 2015	RAD-101	Water	Sr-89	pCi/L	45.2	63.2	51.1 - 71.2	N (1)
			Sr-90	pCi/L	28.0	41.9	30.8 - 48.1	N (1)
			Ba-133	pCi/L	80.6	82.5	63.9 - 90.8	A
			Cs-134	pCi/L	71.7	75.7	61.8 - 83.3	A
			Cs-137	pCi/L	187	189	170 - 210	A
			Co-60	pCi/L	85.7	84.5	76.0 - 95.3	A
			Zn-65	pCi/L	197	203	183 - 238	A
			Gr-B	pCi/L	28.8	32.9	21.3 - 40.6	A
			I-131	pCi/L	23.5	23.8	19.7 - 28.3	A
			H-3	pCi/L	3145	3280	2770 - 3620	A
November 2015	RAD-103	Water	Sr-89	pCi/L	40.9	35.7	26.7 - 42.5	A
			Sr-90	pCi/L	29.3	31.1	22.7 - 36.1	A
			Ba-133	pCi/L	31.5	32.5	25.9 - 36.7	A
			Cs-134	pCi/L	59.65	62.3	50.6 - 68.5	A
			Cs-137	pCi/L	156	157	141 - 175	A
			Co-60	pCi/L	70.6	71.1	64.0 - 80.7	A
			Zn-65	pCi/L	145	126	113 - 149	A
			Gr-B	pCi/L	42.0	36.6	24.1 - 44.2	A
			I-131	pCi/L	24.8	26.3	21.9 - 31.0	A
			H-3	pCi/L	21100	21300	18700 - 23400	A

(1) Yield on the high side of acceptance range indicates possibility of calcium interference. NCR 15-09
(a) Teledyne Brown Engineering reported result.
(b) 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.
(c) ERA evaluation: A=acceptable. Reported result falls within the Warning Limits. NA=not acceptable. Reported result falls outside of the Control Limits. CE=check for Error. Reported result falls within the Control Limits and outside of the Warning Limit.

APPENDIX C: ERRATA/CORRECTIONS TO PREVIOUS REPORTS

The 2013 Annual Radiological Environmental Operating Report was submitted with iodine-131 in air sample data omitted for the sample period February 05 through 12 for all eight sampling stations. The following pages contain the revised analysis data table for iodine-131 in air for 2013.

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

Surry Power Station, Surry County, Virginia - 2013

1.0E-3 pCi/m3 ± 2 Sigma

COLLECTION DATE	SAMPLING LOCATIONS							
	SS	HIR	BC	ALL	CP	BASF	FE	NN-C
January 08	14.0 ± 25.2	13.9 ± 25.0	14.2 ± 25.6	13.5 ± 24.3	-6.29 ± 24.6	-6.12 ± 2.39	-6.32 ± 24.7	-6.30 ± 24.6
January 15	3.16 ± 22.2	3.14 ± 22.1	3.16 ± 22.2	3.08 ± 21.7	-6.16 ± 24.3	-6.00 ± 23.7	-6.16 ± 24.3	-6.19 ± 24.5
January 22	5.59 ± 17.0	5.45 ± 16.6	5.55 ± 16.9	5.43 ± 16.5	12.6 ± 16.9	12.2 ± 16.3	12.5 ± 16.6	12.5 ± 16.7
January 29	-4.76 ± 16.9	-4.62 ± 16.4	-4.72 ± 16.7	-4.63 ± 16.4	3.56 ± 19.9	2.71 ± 15.1	2.72 ± 15.2	2.80 ± 15.6
February 05	2.62 ± 19.1	2.55 ± 18.7	2.64 ± 19.3	2.54 ± 18.6	-10.3 ± 21.2	-7.94 ± 16.3	-8.04 ± 16.5	-8.16 ± 16.8
February 12	-6.39 ± 10.9	-6.23 ± 10.7	-6.38 ± 10.9	-6.22 ± 10.7	-0.14 ± 17.1	-0.14 ± 16.8	-0.14 ± 16.9	-0.14 ± 17.1
February 19	-14.6 ± 13.9	-14.4 ± 13.6	-14.7 ± 13.9	-14.3 ± 13.6	-7.30 ± 15.1	-7.10 ± 14.7	-7.24 ± 15.0	-7.39 ± 15.3
February 26	6.77 ± 18.1	6.65 ± 17.7	6.82 ± 18.2	6.64 ± 17.7	-2.83 ± 16.7	-2.76 ± 16.2	-2.80 ± 16.5	-2.85 ± 16.8
March 05	-13.6 ± 21.3	-13.3 ± 20.8	-13.6 ± 21.3	-13.3 ± 20.7	7.00 ± 13.3	6.87 ± 13.1	6.94 ± 13.2	7.09 ± 13.5
March 12	0.55 ± 10.0	0.54 ± 9.80	0.55 ± 10.0	0.54 ± 9.76	7.68 ± 22.8	7.57 ± 22.5	7.69 ± 22.9	7.80 ± 23.2
March 18	-1.09 ± 15.1	-1.07 ± 14.8	-1.09 ± 15.1	-1.06 ± 14.7	6.24 ± 17.9	6.14 ± 17.6	6.22 ± 17.8	6.33 ± 18.1
March 26	-6.94 ± 11.3	-6.81 ± 11.2	-6.96 ± 11.3	-6.78 ± 11.0	9.48 ± 12.9	9.39 ± 12.7	9.45 ± 12.8	9.60 ± 13.0
April 02	-4.38 ± 17.1	-4.30 ± 16.7	-4.38 ± 17.1	-4.25 ± 16.6	-9.71 ± 21.1	-9.55 ± 20.8	-9.72 ± 21.1	-9.83 ± 21.4
April 09	-11.0 ± 22.3	-10.8 ± 21.9	-10.9 ± 22.1	-10.7 ± 21.7	9.82 ± 22.3	9.67 ± 23.0	9.81 ± 23.3	9.79 ± 23.2
April 16	-4.35 ± 12.5	-4.32 ± 12.4	-4.31 ± 12.4	-4.24 ± 12.2	0.84 ± 13.2	0.85 ± 13.3	0.85 ± 13.3	0.87 ± 13.7
April 23	-8.47 ± 20.9	-8.35 ± 20.6	-8.46 ± 20.9	-8.26 ± 20.4	14.3 ± 17.9	14.1 ± 17.7	14.3 ± 17.9	14.5 ± 18.2
April 30	-4.19 ± 18.6	-4.14 ± 18.3	-4.20 ± 18.6	-4.08 ± 18.1	-6.30 ± 16.8	-6.19 ± 16.5	-6.28 ± 16.8	-6.42 ± 17.1
May 07	9.96 ± 10.4	9.78 ± 10.2	9.98 ± 10.4	9.68 ± 10.1	-0.27 ± 10.5	-0.27 ± 10.5	-0.28 ± 10.7	-0.28 ± 10.7
May 14	-8.22 ± 12.2	-8.07 ± 12.0	-8.28 ± 12.3	-8.05 ± 12.0	-6.91 ± 15.2	-6.79 ± 14.9	-6.90 ± 15.2	-7.40 ± 15.5
May 21	-6.95 ± 22.9	-6.82 ± 22.5	-6.92 ± 22.9	-6.77 ± 22.3	4.54 ± 21.8	4.50 ± 21.6	4.55 ± 21.9	4.56 ± 21.9
May 28	-10.7 ± 22.2	-10.5 ± 21.9	-10.7 ± 22.2	-10.5 ± 21.9	16.0 ± 21.0	16.0 ± 21.0	16.1 ± 21.2	16.3 ± 21.4
June 05	-9.68 ± 15.9	-9.45 ± 15.5	-9.62 ± 15.8	-9.52 ± 15.6	-1.98 ± 11.7	-1.95 ± 11.5	-1.98 ± 11.7	-1.97 ± 11.7
June 10	10.2 ± 24.2	10.5 ± 23.7	-8.00 ± 28.9	10.4 ± 23.5	-7.03 ± 24.0	-6.76 ± 23.1	-6.97 ± 23.8	-6.96 ± 23.8
June 17	-0.08 ± 12.6	-0.08 ± 12.4	-0.08 ± 12.0	-0.08 ± 11.6	5.10 ± 15.5	4.18 ± 12.7	4.31 ± 13.1	4.23 ± 12.9
June 24	-7.35 ± 15.3	-7.19 ± 14.9	-7.36 ± 15.3	-7.16 ± 14.9	6.09 ± 13.9	5.94 ± 13.5	6.09 ± 13.9	6.09 ± 13.9

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

Surry Power Station, Surry County, Virginia - 2013

1.0E-3 pCi/m3 ± 2 Sigma

COLLECTION DATE	SAMPLING LOCATIONS							
	SS	HIR	BC	ALL	CP	BASF	FE	NN-C
July 02	11.1 ± 23.7	11.4 ± 24.3	11.6 ± 24.8	11.3 ± 24.2	4.60 ± 29.6	4.48 ± 28.8	4.56 ± 29.2	4.58 ± 29.5
July 09	-8.65 ± 25.8	-8.27 ± 24.7	-8.42 ± 25.1	-8.21 ± 24.5	-0.50 ± 23.9	-0.50 ± 23.6	-0.50 ± 23.9	-0.50 ± 24.0
July 15	-1.57 ± 14.4	-1.55 ± 14.3	-1.57 ± 14.4	-1.53 ± 14.1	-9.03 ± 14.1	-8.93 ± 14.0	-9.06 ± 14.1	-8.92 ± 13.9
July 23	6.48 ± 13.8	6.32 ± 13.5	6.39 ± 13.6	6.23 ± 13.3	-2.91 ± 14.5	-2.90 ± 14.4	-2.93 ± 14.6	-2.90 ± 14.4
July 30	-9.09 ± 32.1	-8.86 ± 31.3	-8.99 ± 31.8	-8.83 ± 31.2	10.7 ± 22.0	10.6 ± 21.8	10.7 ± 22.0	10.6 ± 21.8
August 06	-14.8 ± 24.1	-14.5 ± 23.6	-14.7 ± 23.9	-14.5 ± 23.6	15.4 ± 20.3	15.3 ± 20.1	15.4 ± 20.2	15.1 ± 19.8
August 13	-15.4 ± 16.6	-15.1 ± 16.3	-15.8 ± 17.0	-15.4 ± 16.6	2.44 ± 18.2	2.44 ± 18.2	2.44 ± 18.2	2.49 ± 18.5
August 20	-12.7 ± 16.0	-12.4 ± 15.6	-12.5 ± 15.7	-12.3 ± 15.5	-8.13 ± 18.4	-8.08 ± 18.3	-8.14 ± 18.5	-8.06 ± 18.3
August 26	-2.12 ± 18.5	-2.05 ± 17.9	-2.09 ± 18.2	-2.04 ± 17.8	8.35 ± 17.7	8.30 ± 17.6	8.36 ± 17.7	8.23 ± 17.5
September 03	17.5 ± 22.9	17 ± 22.3	17.3 ± 22.7	16.9 ± 22.1	-4.87 ± 20.2	-4.83 ± 20.1	-4.86 ± 20.2	-4.77 ± 19.8
September 10	19.4 ± 25.1	18.9 ± 24.5	19.2 ± 24.8	18.9 ± 24.4	31.5 ± 30.4	31.3 ± 30.2	31.5 ± 30.4	30.9 ± 29.8
September 17	-0.75 ± 16.8	-0.73 ± 16.4	-0.74 ± 16.6	-0.72 ± 16.3	1.40 ± 15.9	1.37 ± 15.6	1.39 ± 15.8	1.37 ± 15.5
September 24	6.57 ± 22.7	6.37 ± 22.1	6.47 ± 22.4	6.35 ± 22.0	-20.5 ± 22.2	-20.1 ± 21.8	-20.4 ± 22.2	-20.0 ± 21.8
October 01	14.9 ± 28.3	14.4 ± 27.4	14.6 ± 27.9	14.3 ± 27.3	-8.57 ± 29.0	-8.46 ± 28.6	-8.56 ± 28.9	-8.28 ± 28.0
October 08	24.2 ± 24.2	23.5 ± 23.4	23.9 ± 23.9	23.7 ± 23.6	-5.99 ± 24.3	-5.90 ± 23.9	-5.94 ± 24.0	-5.84 ± 23.6
October 15	-2.11 ± 11.2	-2.05 ± 10.9	-2.01 ± 10.7	-1.99 ± 10.6	-5.18 ± 10.7	-5.13 ± 10.6	-5.21 ± 10.8	-5.00 ± 10.3
October 22	22.4 ± 20.4	21.8 ± 19.8	22.2 ± 20.2	22.0 ± 20.0	12.5 ± 18.0	12.3 ± 17.8	12.4 ± 18.0	12.4 ± 17.9
October 29	-18.4 ± 39.6	-18 ± 38.6	-18.2 ± 39.2	-18.2 ± 39.0	-0.85 ± 36.3	-0.84 ± 35.7	-0.85 ± 36.3	-0.84 ± 35.6
November 05	-22.8 ± 35.1	-22.4 ± 34.5	-22.9 ± 35.3	-22.5 ± 34.6	-3.72 ± 40.1	-3.69 ± 39.9	-3.72 ± 40.2	-3.57 ± 38.6
November 12	1.30 ± 20.4	1.28 ± 20.0	1.30 ± 20.4	1.28 ± 20.2	0.73 ± 20.1	0.72 ± 19.9	0.72 ± 19.9	0.72 ± 19.8
November 19	-3.68 ± 18.1	-3.57 ± 17.5	-3.63 ± 17.8	-3.62 ± 17.8	-5.05 ± 21.8	-5.04 ± 21.7	-5.08 ± 21.9	-4.92 ± 21.2
November 26	-5.84 ± 39.0	-5.67 ± 37.8	-5.77 ± 38.5	-5.70 ± 38.0	-0.67 ± 41.0	-0.66 ± 40.8	-0.67 ± 41.1	-0.65 ± 40.3
December 03	4.55 ± 32.9	4.43 ± 32.0	4.49 ± 32.4	4.42 ± 31.9	-7.08 ± 33.4	-7.01 ± 33.0	-7.08 ± 33.3	-6.99 ± 32.9
December 10	-14.0 ± 25.7	-13.6 ± 24.9	-13.8 ± 25.5	-13.7 ± 25.2	-16.1 ± 20.0	-15.9 ± 19.8	-16.2 ± 20.0	-15.7 ± 19.5
December 16	-28.4 ± 29.8	-27.6 ± 29.0	-28.1 ± 29.5	-27.6 ± 29.0	-19.7 ± 28.8	-19.4 ± 28.4	-19.6 ± 28.7	-19.3 ± 28.2
December 24	17.0 ± 30.4	16.6 ± 29.7	17.5 ± 31.3	17.3 ± 30.8	-10.3 ± 28.5	-10.2 ± 28.1	-10.3 ± 28.4	-10.1 ± 27.9
December 31	-30.8 ± 43.0	-30.2 ± 42.3	-30.2 ± 42.1	-29.8 ± 41.6	-25.9 ± 33.4	-25.6 ± 33.0	-25.8 ± 33.3	-25.3 ± 32.7