Charles R. Pierce
Regulatory Affairs Director

Southern Nuclear
Operating Company, Inc.
40 Inverness Center Parkway
Post Office Box 1295
Birmingham, AL 35242

Tel 205.992.7872
Fax 205.992.7601

SOUTHERN COMPANY

MAY 1 5 2015

Docket Nos.: 50-321 50-348 50-424
50-366 50-364 50-425

NL-15-0877

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

Edwin I. Hatch Nuclear Plant – Units 1 & 2
Joseph M. Farley Nuclear Plant– Units 1 & 2
Vogtle Electric Generating Plant– Units 1 & 2
Annual Radiological Environmental Operating Reports for 2014

Ladies and Gentlemen:

In accordance with section 5.6.2 of the referenced plants' Technical Specifications, Southern Nuclear Operating Company hereby submits the Annual Radiological Environmental Operating Reports for 2014.

This letter contains no NRC commitments. If you have any questions, please contact Ken McElroy at (205) 992-7369.

Respectfully submitted,

C. R. Pierce

C. R. Pierce
Regulatory Affairs Director

CRP/RMJ

Enclosures: 1. Hatch Annual Radiological Environmental Operating Report for 2014
2. Farley Annual Radiological Environmental Operating Report for 2014
3. Vogtle Annual Radiological Environmental Operating Report for 2014

cc: Southern Nuclear Operating Company
Mr. S. E. Kuczynski, Chairman, President & CEO
Mr. D. G. Bost, Executive Vice President & Chief Nuclear Officer
Ms. C. A. Gayheart, Vice President - Farley
Mr. D. R. Vineyard, Vice President – Hatch
Mr. D. R. Madison, Vice President – Fleet Operations
Mr. B. K. Taber, Vice President – Vogtle 1 & 2
Mr. M. D. Meier, Vice President – Regulatory Affairs
Mr. B. J. Adams, Vice President – Engineering
Ms. B. L. Taylor, Regulatory Affairs Manager – Farley
Mr. G. L. Johnson, Regulatory Affairs Manager – Hatch
Mr. G. W. Gunn, Regulatory Affairs Manager – Vogtle 1 & 2
RType: Farley=CFA04.054; Hatch=CHA02.004; Vogtle=CVC7000

U. S. Nuclear Regulatory Commission
Mr. V. M. McCree, Regional Administrator
Mr. S. A. Williams, NRR Project Manager – Farley
Mr. D. H. Hardage, Senior Resident Inspector – Hatch
Mr. L. M. Cain, Senior Resident Inspector – Vogtle 1 & 2
Mr. P. K. Niebaum, Senior Resident Inspector - Farley
Mr. R.E. Martin, NRR Project Manager – Hatch, Vogtle 1 & 2

State of Alabama
Mr. D. K. Walter, Department of Public Health, Office of Radiation Control

State of Georgia
Mr. M. Williams, Department of Natural Resources

American Nuclear Insurers
Mr. R. A. Oliveira

Edwin I. Hatch Nuclear Plant – Units 1 & 2
Joseph M. Farley Nuclear Plant– Units 1 & 2
Vogtle Electric Generating Plant– Units 1 & 2
Annual Radiological Environmental Operating Reports for 2014

Enclosure 1

Hatch Annual Radiological Environmental Operating Report for 2014

EDWIN I. HATCH NUCLEAR PLANT

2014 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

SOUTHERN COMPANY

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EDWIN I. HATCH NUCLEAR PLANT

2014 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

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Appendix – Maps

A-1 – REMP Stations in Plant Vicinity
A-2 – REMP Stations within 5 Miles
A-3 – Facility Groundwater Wells

LIST OF ACRONYMS

AREOR	Annual Radiological Environmental Operating Report
ASTM	American Society for Testing and Materials
BWR	Boiling Water Reactor
CL	Confidence Level
EPA	Environmental Protection Agency
GPC	Georgia Power Company
GPCEL	Georgia Power Company Environmental Laboratory
HNP	Edwin I. Hatch Nuclear Plant
ICP	Interlaboratory Comparison Program
MDC	Minimum Detectable Concentration
MDD	Minimum Detectable Difference
MWe	MegaWatts Electric
NA	Not Applicable
NDM	No Detectable Measurement(s)
NEI	Nuclear Energy Institute
NRC	Nuclear Regulatory Commission
ODCM	Offsite Dose Calculation Manual
OSL	Optically Stimulated Luminescence
Po	Preoperation
REMP	Radiological Environmental Monitoring Program
RL	Reporting Level
RM	River Mile
SNC	Southern Nuclear Operating Company
TLD	Thermoluminescent Dosimeter
TS	Technical Specification

1 INTRODUCTION

The Radiological Environmental Monitoring Program (REMP) is conducted in accordance with Chapter 4 of the Offsite Dose Calculation Manual (ODCM). REMP activities for 2014 are reported herein in accordance with Technical Specification (TS) 5.6.2 and ODCM 7.1.

The objectives of the REMP are to:
1) Determine the levels of radiation and the concentrations of radioactivity in the environs and;
2) Assess the radiological impact (if any) to the environment due to the operation of the Edwin I. Hatch Nuclear Plant (HNP).

The assessments include comparisons between the results of analyses of samples obtained at locations where radiological levels are not expected to be affected by plant operation (control stations), areas of higher population (community stations), and at locations where radiological levels are more likely to be affected by plant operation (indicator stations), as well as comparisons between preoperational and operational sample results.

The pre-operational stage of the REMP began with the establishment and activation of the environmental monitoring stations in January of 1972. The operational stage of the REMP began on September 12, 1974 with Unit 1 initial criticality.

- A description of the REMP is provided in Section 2 of this report
- Section 3 provides a summary of the results and an assessment of any radiological impacts to the environment
- A summary of the land use census and the river survey are included in Section 4
- Conclusions are included in Section 5

2 REMP DESCRIPTION

The following section provides a description of the sampling and laboratory protocols associated with the REMP. Table 2-1 provides a summary of the sample types to be collected and the analyses to be performed in order to monitor the airborne, direct radiation, waterborne and ingestion pathways, and also summarizes the collection and analysis frequencies (in accordance with ODCM Section 4.2). Table 2-2 provides specific information regarding the station locations, their proximity to the plant, and exposure pathways. Additionally, the locations of the sampling stations are depicted on Maps A-1 through A-3 of the georeferenced data included in the appendix of this report.

Georgia Power Company's Environmental Laboratory (GPCEL), located in Smyrna, Georgia collects and analyzes REMP samples.

Table 2-1. Summary Description of Radiological Environmental Monitoring Program

Exposure Pathway and/or Sample	Approximate Number of Sample Locations	Sampling/Collection Frequency	Type/Frequency of Analysis
Direct Radiation	37 routine monitoring stations	Quarterly	Gamma dose, quarterly
Airborne Radioiodine and Particulates	Samples from six locations:	Continuous sampler operation with sample collection weekly	Radioiodine canister: I-131 analysis, weekly Particulate sampler: analyze for gross beta radioactivity not less than 24 hours following filter change, weekly; perform gamma isotopic analysis on affected sample when gross beta activity is 10 times the yearly mean of control samples; and composite (by location) for gamma isotopic analysis, quarterly.
Waterborne			
Surface	One sample upriver One sample downriver	Composite sample over one month period[1]	Gamma isotopic analysis[2], monthly Composite for tritium analysis, quarterly
Drinking[3,4]	One sample of river water near the intake and one sample of finished water from each of one to three of the nearest water supplies which could be affected by HNP discharges.	River water collected near the intake will be a composite sample; the finished water will be a grab sample. These samples will be collected monthly unless the calculated dose due to consumption of the water is greater than 1 mrem/year; then the collection will be biweekly. The collections may revert to monthly should the calculated doses become less than 1 mrem/year.	I-131 analysis on each sample when biweekly collections are required. Gross beta and gamma isotopic analysis on each sample; composite (by location) for tritium analysis, quarterly.

Table 2-1. Summary Description of Radiological Environmental Monitoring Program

Exposure Pathway and/or Sample	Approximate Number of Sample Locations	Sampling/Collection Frequency	Type/Frequency of Analysis
Groundwater	See Table 3-8 and Map A-3 for well locations	Quarterly sample; pump used to sample GW wells; grab sample from yard drains and ponds	Tritium, gamma isotopic, and field parameters (pH, temperature, conductivity, dissolved oxygen, oxidation/reduction potential, and turbidity) of each sample quarterly; Hard to detect radionuclides as necessary based on results of tritium and gamma.
Shoreline Sediment	Two	Semiannually	Gamma isotopic analysis[2], semiannually
Ingestion			
Milk[5]	One	Bimonthly	Gamma isotopic analysis[2,7], bimonthly
Fish or Clams[6]	Two	Semiannually	Gamma isotopic analysis[2] on edible portions, semiannually
Grass or Leafy Vegetation	Three	Monthly during growing season	Gamma isotopic analysis[2,7], monthly

Notes:
[1]Composite sample aliquots shall be collected at time intervals that are very short (e.g., hourly) relative to the compositing period (e.g., monthly) to assure obtaining a representative sample.
[2]Gamma isotopic analysis means the identification and quantification of gamma-emitting radionuclides that may be attributable to the effluents from the facility.
[3]If it is found that river water downstream of the plant is used for drinking, drinking water samples will be collected and analyzed as specified herein.
[4]A survey shall be conducted annually at least 50 river miles downstream of the plant to identify those who use water from the Altamaha River for drinking.
[5]Up to three sampling locations within five miles and in different sectors will be used as available. In addition, one or more control locations beyond 10 miles will be used.
[6]Commercially or recreationally important fish may be sampled. Clams may be sampled if difficulties are encountered in obtaining sufficient fish samples.
[7]If the gamma isotopic analysis is not sensitive enough to meet the Minimum Detectable Concentration (MDC) for I-131, a separate analysis for I-131 may be performed.

Table 2-2. Radiological Environmental Sampling Locations

Station Number	Station Type	Descriptive Location	Direction[1]	Distance (miles)[1]	Radiation Sample Type
064	Other	Roadside Park	WNW	0.8	Direct
101	Indicator	Inner Ring	N	1.9	Direct
102	Indicator	Inner Ring	NNE	2.5	Direct
103	Indicator	Inner Ring	NE	1.8	Airborne, Direct
104	Indicator	Inner Ring	ENE	1.6	Direct
105	Indicator	Inner Ring	E	3.7	Direct
106	Indicator	Inner Ring	ESE	1.1	Direct, Vegetation
107	Indicator	Inner Ring	SE	1.2	Airborne, Direct
108	Indicator	Inner Ring	SSE	1.6	Direct
109	Indicator	Inner Ring	S	0.9	Direct
110	Indicator	Inner Ring	SSW	1.0	Direct
111	Indicator	Inner Ring	SW	0.9	Direct
112	Indicator	Inner Ring	WSW	1.0	Airborne, Direct, Vegetation
113	Indicator	Inner Ring	W	1.1	Direct
114	Indicator	Inner Ring	WNW	1.2	Direct
115	Indicator	Inner Ring	NW	1.1	Direct
116	Indicator	Inner Ring	NNW	1.6	Airborne, Direct
170	Control	Upstream	WNW	[2]	River[3]
172	Indicator	Downstream	E	[2]	River[3]
201	Other	Outer Ring	N	5.0	Direct
202	Other	Outer Ring	NNE	4.9	Direct
203	Other	Outer Ring	NE	5.0	Direct
204	Other	Outer Ring	ENE	5.0	Direct
205	Other	Outer Ring	E	7.2	Direct
206	Other	Outer Ring	ESE	4.8	Direct
207	Other	Outer Ring	SE	4.3	Direct
208	Other	Outer Ring	SSE	4.8	Direct
209	Other	Outer Ring	S	4.4	Direct
210	Other	Outer Ring	SSW	4.3	Direct
211	Other	Outer Ring	SW	4.7	Direct
212	Other	Outer Ring	WSW	4.4	Direct
213	Other	Outer Ring	W	4.3	Direct
214	Other	Outer Ring	WNW	5.4	Direct
215	Other	Outer Ring	NW	4.4	Direct
216	Other	Outer Ring	NNW	4.8	Direct

Table 2-2. Radiological Environmental Sampling Locations

Station Number	Station Type	Descriptive Location	Direction[1]	Distance (miles)[1]	Radiation Sample Type
301	Other	Toombs Central School	N	8.0	Direct
304	Control	State Prison	ENE	11.2	Airborne, Direct
304	Control	State Prison	ENE	10.3	Milk
309	Control	Baxley Substation	S	10.0	Airborne, Direct
416	Control	Emergency News Center	NNW	21.0	Direct, Vegetation

Notes:
[1]Direction and distance are determined from the main stack.

[2]Station 170 is located approximately 0.6 river miles upstream of the intake structure for river water, 1.1 river miles for sediment and clams, and 1.5 river miles for fish.

Station 172 is located approximately 3.0 river miles downstream of the discharge structure for river water, sediment and clams, and 1.7 river miles for fish.

The locations from which river water and sediment may be taken can be sharply defined. However, the sampling locations for clams often have to be extended over a wide area to obtain a sufficient quantity. High water adds to the difficulty in obtaining clam samples and may also make an otherwise suitable location for sediment sampling unavailable. A stretch of the river of a few miles or so is generally needed to obtain adequate fish samples. The mile locations given above represent approximations of the locations where samples are collected.

[3]River (fish or clams, shoreline sediment, and surface water)

3 RESULTS SUMMARY

Included in this section are statistical evaluations of the laboratory results, comparison of the results by media, and a summary of the anomalies and deviations. Overall, 855 analyses were performed across nine exposure pathways. Tables and figures are provided throughout this section to provide an enhanced presentation of the information.

In recent history, man-made nuclides have been released into the environment and have resulted in wide spread distribution of radionuclides across the globe. For example, atmospheric nuclear weapons tests from the mid-1940s through 1980 distributed man-made nuclides around the world. The most recent atmospheric tests in the 1970s and in 1980 had a significant impact upon the radiological concentrations found in the environment prior to and during pre-operation, and through early operation. Some long-lived radionuclides, such as Cs-137, continue to be detected and a portion of these detections are believed to be attributed to the nuclear weapons tests.

Additionally, data associated with certain radiological effects created by off-site events have been removed from the historical evaluation, this includes: the nuclear atmospheric weapon test in the fall of 1980 and the Chernobyl incident in the spring of 1986.

As indicated in ODCM 7.1.2.1, the results for naturally occurring radionuclides that are also found in plant effluents must be reported along with man-made radionuclides. Historically, the radionuclide Be-7, which occurs abundantly in nature, is often detected in REMP samples, and occasionally detected in the plant's liquid and gaseous effluents. When it is detected in effluents and REMP samples, it is also included in the REMP results. In 2014, Be-7 was not detected in any plant effluents and is therefore not included in this report. The Be-7 detected in select REMP samples likely represents naturally occurring and/or background conditions.

As part of the data evaluation process, SNC considered the impact of the non-plant associated nuclides along with a statistical evaluation of the REMP data. The statistical evaluations included within this report include the Minimum Detectable Concentration (MDC), the Minimum Detectable Difference (MDD), and Chauvenet's Criterion as described below.

Minimum Detectable Concentration

The minimum detectable concentration is defined as an estimate of the true concentration of an analyte required to give a specified high probability that the measured response will be greater than the critical value.

Minimum Detectable Difference

The Minimum Detectable Difference (MDD) compares the lowest significant difference (between the means) of a control station, versus an indicator station or a community station, that can be determined statistically at the 99% Confidence Level (CL). A difference in mean values which was less than the MDD was considered to be statistically indiscernible.

Chauvenet's Criterion

All results were tested for conformance with Chauvenet's criterion (G. D. Chase and J. L. Rabinowitz, Principles of Radioisotope Methodology, Burgess Publishing Company, 1962, pages 87-90) to identify values which differed from the mean of a set by a statistically significant amount. Identified outliers were investigated to determine the reason(s) for the difference. If equipment malfunction or other valid physical reasons were identified as causing the variation, the anomalous result was excluded from the data set as non-representative.

The 2014 results were compared with past results, including those obtained during pre-operation. As appropriate, results were compared with their MDC (listed in Table 3-1) and RL which is listed in Table 3-2. The required MDCs were achieved during laboratory sample analysis. No data points were excluded for violating Chauvenet's criterion.

Table 3-1. Radiological Environmental Monitoring Program Annual Summary

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Minimum Detectable Concentration (MDC) (a)	Indicator Locations Mean (b), Range (Fraction)	Location with the Highest Annual Mean		Other Stations (f) Mean (b), Range (Fraction)	Control Locations Mean (b), Range (Fraction)
				Name Distance and Direction	Mean (b), Range (Fraction)		
Airborne Particulates (fCi/m3)	Gross Beta 310	10	22 6.2-38.3 (207/207)	Baxley Substation, S, 10 mi.	22.7 6.6-38.2 (52/52)		22.3 9.5-36.6 (103/103)
	Gamma Isotopic 24						
	I-131	70	NDM(c)		NDM		NDM
	Cs-134	50	NDM		NDM		NDM
	Cs-137	60	NDM		NDM		NDM
Airborne Radioiodine (fCi/m3)	I-131 306	70	NDM		NDM	NDM	NDM
Direct Radiation (mR/91 days)	Gamma Dose 148		12.0 8.8-18.4 (64/64)	Inner Ring NW 1.1 mi.	16.4 13.5-18.4 (4/4)	11.8 8.1-16.6 (72/72)	11.7 10.5-13.2 (12/12)
Milk (pCi/l)	Gamma Isotopic 24						
	I-131	1	NDM		NDM		NDM
	Cs-134	15	NDM		NDM		NDM
	Cs-137	18	NDM		NDM		NDM
	Ba-140	60	NDM		NDM		NDM
	La-140	15	NDM		NDM		NDM
Vegetation (pCi/kg-wet)	Gamma Isotopic 36						
	I-131	60	NDM				

Table 3-1. Radiological Environmental Monitoring Program Annual Summary

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Minimum Detectable Concentration (MDC) (a)	Indicator Locations Mean (b), Range (Fraction)	Location with the Highest Annual Mean		Other Stations (f) Mean (b), Range (Fraction)	Control Locations Mean (b), Range (Fraction)
				Name Distance and Direction	Mean (b), Range (Fraction)		
	Cs-134	60	NDM				
	Cs-137	80	69.8 0-508.5 (7/24)	Inner Ring ESE 1.1 mi.	123.0 0-508.5 (7/12)		
River Water (pCi/l)	Gamma Isotopic 13						
	Mn-54	15	NDM		NDM		NDM
	Fe-59	30	NDM		NDM		NDM
	Co-58	15	NDM		NDM		NDM
	Co-60	15	NDM		NDM		NDM
	Zn-65	30	NDM		NDM		NDM
	Zr-95	30	NDM		NDM		NDM
	Nb-95	15	NDM		NDM		NDM
	I-131	15(d)	NDM		NDM		NDM
	Cs-134	15	NDM		NDM		NDM
	Cs-137	18	NDM		NDM		NDM
	Ba-140	60	NDM		NDM		NDM
	La-140	15	NDM		NDM		NDM
	Tritium 8	3000 (e)	141.9 2.4-370 (3/3)	Upstream WNW 0.6 RM from intake	250.5 139-362 (2/2)		250.5 139-362 (2/2)
Fish (pCi/kg-wet)	Gamma Isotopic 4						

Table 3-1. Radiological Environmental Monitoring Program Annual Summary

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Minimum Detectable Concentration (MDC) (a)	Indicator Locations Mean (b), Range (Fraction)	Location with the Highest Annual Mean		Other Stations (f) Mean (b), Range (Fraction)	Control Locations Mean (b), Range (Fraction)
				Name Distance and Direction	Mean (b), Range (Fraction)		
	Be-7	655(d)	NDM				NDM
	Mn-54	130	NDM				NDM
	Fe-59	260	NDM				NDM
	Co-58	130	NDM				NDM
	Co-60	130	NDM				NDM
	Zn-65	260	NDM				NDM
	Cs-134	130	NDM				NDM
	Cs-137	150	12.8 0-12.8 (1/2)	Downstream E ~3.0 RM from intake	12.8 0-12.8 (1/2)		NDM NDM (0/2)
Sediment (pCi/kg-dry)	Gamma Isotopic 8						
	Cs-134	150	NDM				NDM
	Cs-137	180	14.4 0-57.6 (1/4)	Upstream WNW 1.1 RM from intake	19.8 0-79.2 (1/4)		19.8 0-79.2 (1/4)

Notes:
(a)The MDC is defined in ODCM 10.1. Except as noted otherwise, the values listed in this column are the detection capabilities required by ODCM Table 4-3. The values listed in this column are a priori (before the fact) MDCs. In practice, the a posteriori (after the fact) MDCs are generally lower than the values listed.
(b) Mean and range are based upon detectable measurements only. The fraction of all measurements at a specified location that are detectable is placed in parenthesis.
(c) No Detectable Measurement(s) (NDM).
(d) If a drinking water pathway were to exist, a MDC of 1pCi/L would have been used.
(e) If a drinking water pathway were to exist, a MDC of 2000pCi/L would have been used.

Not Applicable (sample not required)

Table 3-2. Reporting Levels (RL)

Analysis	Water (pCi/l)	Airborne Particulate or Gases (fCi/m3)	Fish (pCi/kg-wet)	Milk (pCi/l)	Grass or Leafy Vegetation (pCi/kg-wet)
H-3	20,000[a]				
Mn-54	1000		30,000		
Fe-59	400		10,000		
Co-58	1000		30,000		
Co-60	300		10,000		
Zn-65	300		20,000		
Zr-95	400				
Nb-95	700				
I-131	2[b]	900		3	100
Cs-134	30	10,000	1000	60	1000
Cs-137	50	20,000	2000	70	2000
Ba-140	200			300	
La-140	100			400	

[a] This is the 40 CFR 141 value for drinking water samples. If no drinking water pathway exists, a value of 30,000 may be used.
[b] If no drinking water pathway exists, a value of 20 pCi/l may be used.

In accordance with ODCM 4.1.1.2.1, deviations from the required sampling schedule are permitted, if samples are unobtainable due to hazardous conditions, unavailability, inclement weather, equipment malfunction or other just reasons. Deviations from conducting the REMP sampling (as described in Table 2-1) are summarized in Table 3-3 along with their causes and resolution.

Table 3-3. Anomalies and Deviations from Radiological Environmental Monitoring Program

Collection Period	Affected Samples	Anolmaly (A)* or Deviation (D)**	Cause	Resolution
12/30/14-01/06/14	River Water Gamma Station 170	(A) Grab sample obtained rather than composite	Grab sample was obtained instead of a composite, which was previously allowed per procedure.	GPCEL sampling procedure updated to reflect this requirement. Sample was analyzed as usual.
12/30/13-01/06/14 CR 753916	Air I, Air Part. Station #116	(D) Sample not obtained	Sampler found damaged during weekly change-out.	No sample obtained.
01/06/14-01/13/14 CR 753916	Air I, Air Part. Station #116	(A) Low sample volume	Sampler found damaged during weekly change-out.	Sample volume was low, but still acceptable per GPCEL sampling procedure.
05/12/14-05/19/14	Air I, Air Part. Station #309	(D) Sample not obtained	Sample motor was not started after changing filter.	Discussed expectations with GPCEL personnel.

* An anomaly is considered a non-standard sample that still meets sampling criteria outlined in SNC and Georgia Power Lab procedures.
** A deviation is a sample result that is not recorded due to not meeting scheduling and/or procedural requirements as outlined by SNC and Georgia Power Lab

3.1 Airborne Particulates

As specified in Table 2-1, airborne particulate filters and charcoal canisters are collected weekly at four indicator stations (Stations 103, 107, 112 and 116) which encircle the plant at the site periphery, and at two control stations (Station 304 and 309) which is approximately 10 miles from the main stack. At each location, air is continuously drawn through a glass fiber filter to retain airborne particulate and an activated charcoal canister is placed in series with the filter to adsorb radioiodine.

3.1.1 Gross Beta

As provided in Table 3-1, the 2014 annual average weekly gross beta activity was 22 fCi/m3 for the indicator stations. It was 0.3 fCi/m3 less than the control station average of 22.3 fCi/m3 for the year. This difference is not statistically discernible, since it is less than the calculated MDD of 4.6 fCi/m3.

Average Air Gross Beta historical data (Table 3-4) is graphed to show trends associated with a prevalent exposure pathway (Figure 3-1). In general, there is close agreement between the results for the indicator, control and community stations. This close agreement supports the position that the plant is not contributing significantly to the gross beta concentrations in air.

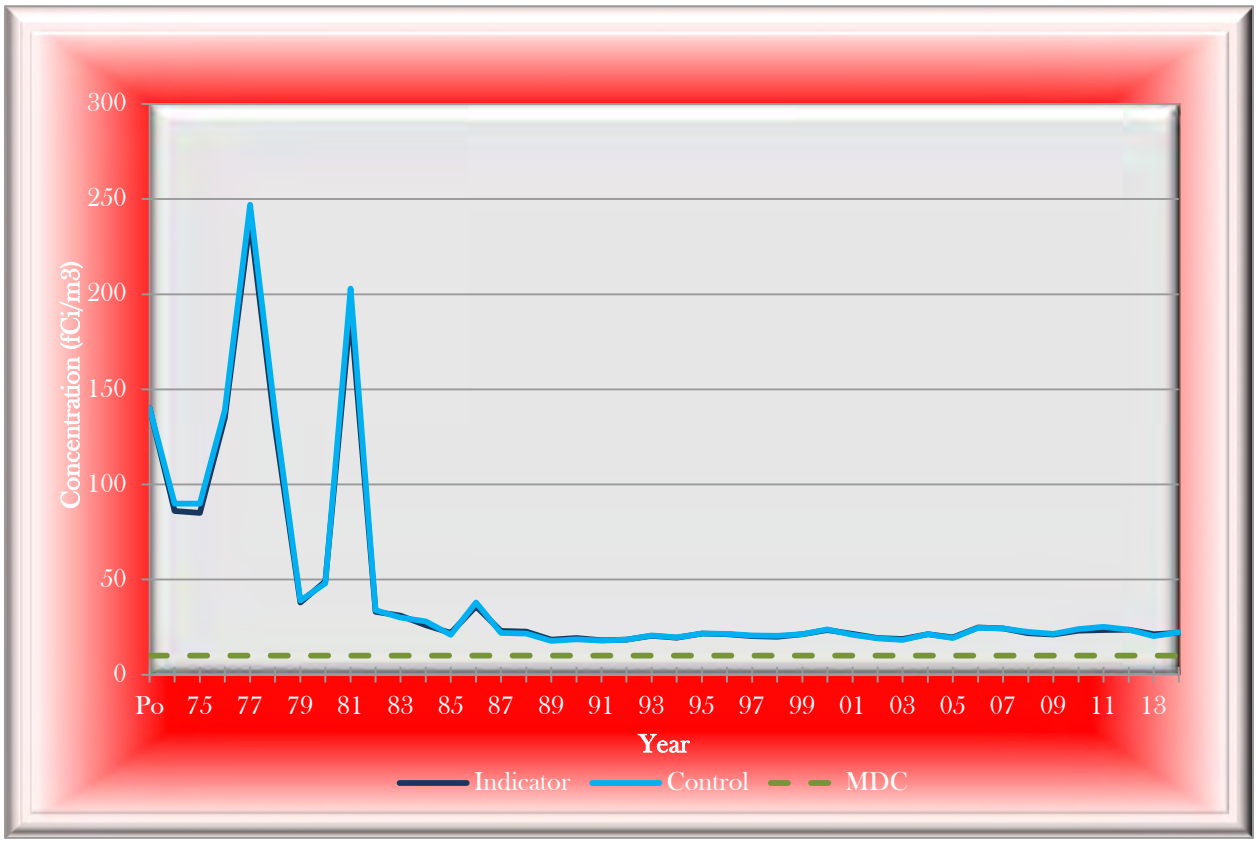
Table 3-4. Average Weekly Gross Beta Air Concentration

Period	Indicator (fCi/m3)	Control (fCi/m3)
Pre-op	140	140
1974	87	90
1975	85	90
1976	135	139
1977	239	247
1978	130	137
1979	38	39
1980	49	48
1981	191	203
1982	33	34
1983	31	30
1984	26	28
1985	22	21
1986	36	38
1987	23	22
1988	22.6	21.7
1989	18.4	17.8
1990	19.3	18.7
1991	18.1	18

Table 3-4. Average Weekly Gross Beta Air Concentration

Period	Indicator (fCi/m3)	Control (fCi/m3)
1992	18.5	18.4
1993	20.4	20.7
1994	19.5	19.7
1995	21.7	21.7
1996	21.3	21.4
1997	20.3	20.7
1998	20.0	20.5
1999	21.3	21.3
2000	23.6	23.9
2001	21.5	21.0
2002	19.3	19.2
2003	18.8	18.2
2004	21.4	21.3
2005	19.7	19.4
2006	24.9	24.7
2007	24.4	24.3
2008	21.8	22.5
2009	21.2	21.4
2010	23.1	24.0
2011	23.5	25.1
2012	23.7	22.7
2013	21.3	20.3
2014	22.0	22.3

Figure 3-1. Average Weekly Gross Beta Air Concentration



3.1.2 Gamma Particulates

During 2014, no man-made radionuclides were detected from the gamma isotopic analysis of the quarterly composites of the air particulate filters.

On only one occasion since 1986, has a man-made radionuclide been detected in a quarterly composite. A small amount of Cs-137 (1.7 fCi/m3) was identified in the first quarter of 1991 at Station 304. The MDC and RL for Cs-137 in air are 60 and 20,000 fCi/m3, respectively.

3.2 Direct Radiation

In 2014, direct (external) radiation was measured with Optically Stimulated Luminescent (OSL) dosimeters by placing two OSL badges at each station. The gamma dose at each station is reported as the average reading of the two badges. The badges are analyzed on a quarterly basis. An inspection is performed near mid-quarter for offsite badges to assure that the badges are on-station and to replace any missing or damaged badges.

Two direct radiation stations are established in each of the 16 compass sectors, to form two concentric rings. The inner ring stations (Nos. 101 through 116) are located near the plant perimeter as shown in Map A-1 in the appendix and the outer ring stations (Nos. 201 through 216) are located at distances of four to five miles from the plant as shown in Map A-2 in the appendix. The stations in the East sector are a few additional miles away with regard to the other stations in their respective rings due to large swamps making normal access extremely difficult. The 16 stations forming the inner ring are designated as the indicator stations. The two ring configuration of stations was established in accordance with NRC Branch Technical Position "An Acceptable Radiological Environmental Monitoring Program", Revision 1, November 1979. The three control stations (Nos. 304, 309 and 416) are located at distances greater than 10 miles from the plant as shown in Map A-2. The mean and range values presented in the "Other" column in Table 3-1 includes the outer ring stations (stations 201 through 216) as well as stations 064 and 301, which monitor special interest areas. Station 064 is located at the onsite roadside park, while Station 301 is located near the Toombs Central School. Station 210, in the outer ring, is located near the Altamaha School (the only other nearby school).

As provided in Table 3-1, the 2014 average quarterly exposure at the indicator stations (inner ring) was 12.0 mR with a range of 8.8-18.4 mR. The indicator station average was 0.3 mR more than the control station average (11.7 mR). This difference is not considered statistically discernible since it is less than the MDD of 1.3 mR.

The quarterly exposures acquired at the community/other (outer ring) stations during 2014 ranged from 8.1 to 16.6 mR with an average of 11.8 mR which was 0.1 mR more than that for the control stations. However, this difference is not discernible since it is less than the MDD of 0.6 mR.

Average Direct Radiation historical data (Table 3-5) is graphed to show trends associated with a prevalent exposure pathway (Figure 3-2). The decrease between 1991 and 1992 values is attributed to a change in TLDs from Teledyne to Panasonic. It should be noted however that the differences between indicator and control and outer ring values did not change.

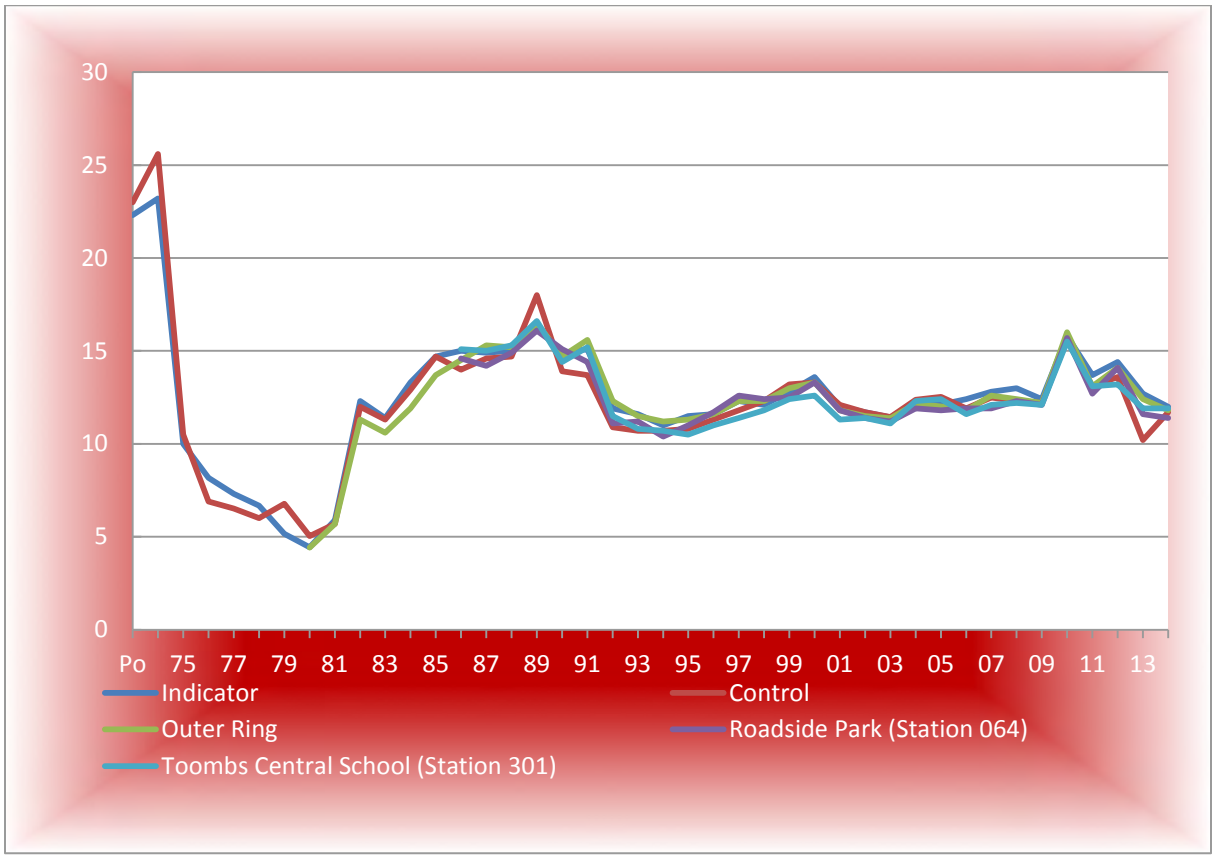
Table 3-5. Average Quarterly Exposure from Direct Radiation

Period	Indicator (mR)	Control (mR)	Outer Ring (mR)
Pre-op	22.3	23.0	NA
1974	23.2	25.6	NA
1975	10.0	10.5	NA
1976	8.18	6.90	NA
1977	7.31	6.52	NA
1978	6.67	6.01	NA

Table 3-5. Average Quarterly Exposure from Direct Radiation

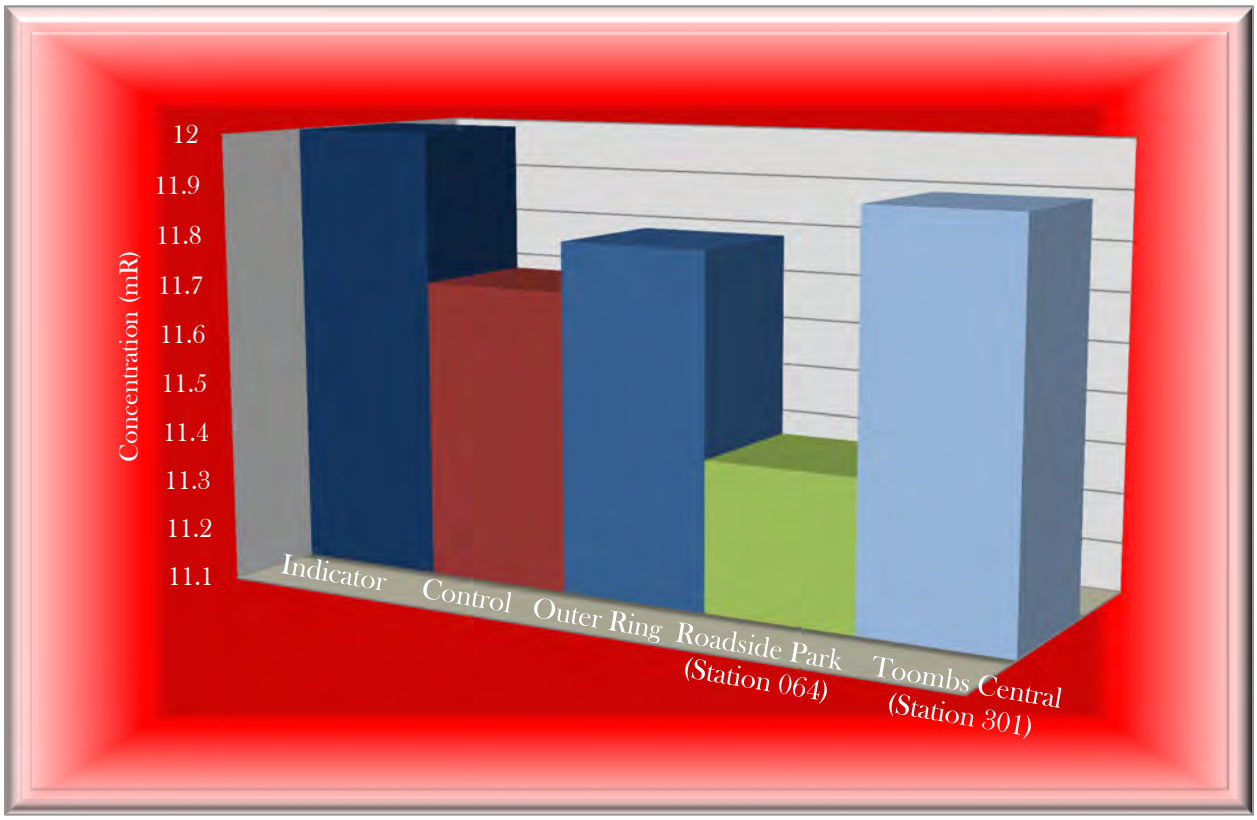
Period	Indicator (mR)	Control (mR)	Outer Ring (mR)
1979	5.16	6.77	NA
1980	4.44	5.04	4.42
1981	5.90	5.70	5.70
1982	12.3	12.0	11.3
1983	11.4	11.3	10.6
1984	13.3	12.9	11.9
1985	14.7	14.7	13.7
1986	15.0	14.0	14.5
1987	14.9	14.6	15.3
1988	15.0	14.7	15.2
1989	16.4	18.0	16.5
1990	14.9	13.9	14.7
1991	15.1	13.7	15.6
1992	11.9	10.9	12.3
1993	11.6	10.7	11.5
1994	11.0	10.7	11.2
1995	11.5	10.8	11.3
1996	11.6	11.3	11.6
1997	12.3	11.8	12.3
1998	12.1	12.3	12.3
1999	12.8	13.2	13.0
2000	13.6	13.3	13.3
2001	12.0	12.1	11.8
2002	11.7	11.7	11.5
2003	11.4	11.4	11.4
2004	12.2	12.4	12.2
2005	12.1	12.5	12.0
2006	12.4	11.9	11.8
2007	12.8	12.5	12.6
2008	13.0	12.3	12.4
2009	12.4	12.2	12.2
2010	15.8	15.6	16.0
2011	19.7	19.1	19.2
2012	14.4	13.6	14.1
2013	12.7	10.2	12.4
2014	12.0	11.7	11.8

Figure 3-2. Average Quarterly Exposure from Direct Radiation



The increase shown in 2010 reflects issues with the aging Panasonic TLD reader. The close agreement between the station groups supports the position that the plant is not contributing significantly to direct radiation in the environment. Figure 3-3 below provides a more detailed view of the 2014 values. The values for the special interest areas detailed below, indicate that Plant Hatch did not significantly contribute to direct radiation at those areas.

Figure 3-3. 2014 Average Exposure from Direct Radiation



3.3 Biological Media

Cs-137 was the only radionuclide analyzed across all three biological mediums. As indicated in Figure 3-4, the Cs-137 activity levels are below the respective MDCs and well below that of the respective RLs for each sample media for both the indicator and control stations.

3.3.1 Milk

In accordance with Tables 2-1 and 2-2, milk samples are collected bimonthly from Station 304 (the state prison dairy) which is a control station located more than 10 miles from the plant. Since 1989, efforts to locate a reliable milk sample source within five miles of the plant have been unsuccessful and the 2014 land census did not identify a milk animal within five miles of the plant.

Gamma isotopic (including I-131 and Cs-137) analyses were performed on each collected milk sample and there were no detectable results for gamma isotopes. Figure 3-4 provides the 2014 Cs-137 concentration in milk.

3.3.2 Vegetation

In accordance with Tables 2-1 and 2-2, vegetation samples are collected monthly for gamma isotopic analyses at two indicator locations near the site boundary (Stations 106 and 112) and at one control station located about 21 miles from the plant (Station 416). Cesium-137 was detected in seven samples (Station 106 and Station 112 did not return any activity) of the 24 samples collected at the indicator stations. The average of the samples was 69.8 pCi/kg-wet. Cesium-137 was not detected in any control station samples. Due to the low number of samples, MDD was not able to be used to evaluate the data. The man-made radionuclide Cs-137 is periodically identified in vegetation samples, and is generally attributed to offsite sources (such as weapons testing, Chernobyl, and Fukushima).

While Cs-137 and I-131 were periodically found in vegetation samples during pre-operation, the historical trends and the relationship between the indicator and control stations demonstrate that plant operations are having no adverse impact to the environment. The sample results have consistently been well below the MDC and the RL for Cs-137 (80 and 2000 pCi/kg-wet, respectively).

During 2014, no other gamma isotopes were detected in any Vogtle REMP vegetation samples.

3.3.3 Fish

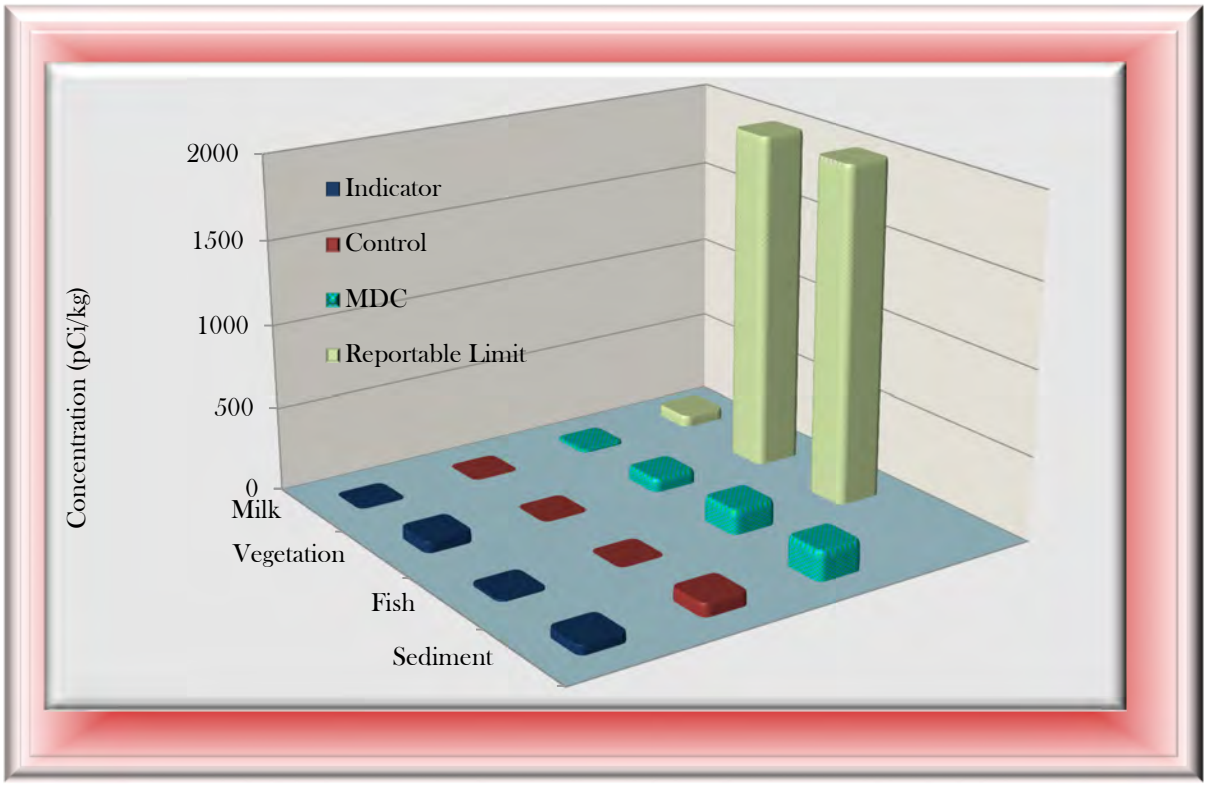
Fish samples were collected in accordance with the ODCM (as indicated in Table 2-1). For the semiannual collections, the control location (Station 170) is located upriver of the plant intake structure, and the indicator location (Station 172) is located downriver of the plant discharge structure.

Cs-137 was detected in the indicator and control locations, which is consistent with historical results.

3.3.4 Biological Media Summary

There were no statistical differences, trends, or anomalies associated with the 2014 biological media samples when compared to historical data. Figure 3-4 below, details the 2014 Cs-137 concentration compared to the Reportable Limits.

Figure 3-4. 2014 Biological Media Average Concentrations

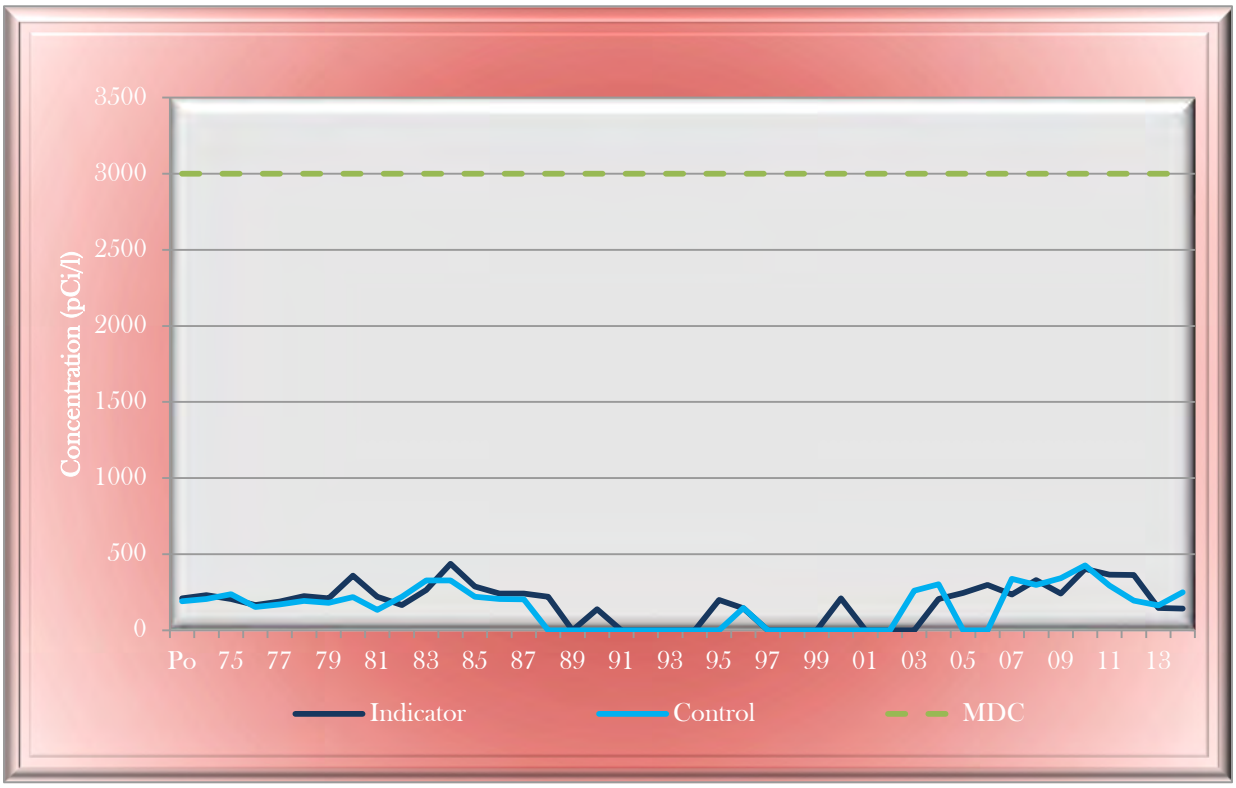


3.4 Surface Water

Composite river water samples are collected monthly at an upstream control location and at a downstream indicator location (shown on Map A-3 in the appendix). The details of the sampling protocols are outlined in Tables 2-1 and Table 2-2. A gamma isotopic analysis is conducted on each monthly sample and the monthly aliquots are combined to form quarterly composite samples, which are analyzed for tritium.

As provided in Table 3-1, there were no positive results during 2014 from the gamma isotopic analysis of the river water samples. Also indicated in Table 3-1, the average tritium concentration found at the indicator station was 141.9 pCi/l which was 108.6 pCi/l less than the average at the control station (250.5 pCi/l). No MDD was calculated because the indicator station average was below the control station. Historically, the relationship between the indicator and control stations has remained consistent. Figure 3-5 below details the 2014 historical average tritium concentrations in river water.

Figure 3-5. Average Annual Tritium Concentrations in River Water



3.5 Sediment

Sediment was collected along the shoreline of the Altamaha River in the spring and fall, at the upstream control station (No. 170) and the downstream indicator station (No. 172). A gamma isotopic analysis was performed on each sample. There were no man-made radionuclides detected in sediment samples, with the exception of Cs-137 (below the control average), which is previously plotted along with biological media (Cs-137 across all detected mediums) in Section 3.3.4, and Figure 3-4.

3.6 Interlaboratory Comparison Program

In accordance with ODCM 4.1.3, GPCEL participates in an Interlaboratory Comparison Program (ICP) that satisfies the requirements of Regulatory Guide 4.15, Revision 1, "Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment", February 1979. The ICP includes the required determinations (sample medium/radionuclide combinations) included in the REMP.

The ICP was conducted by Eckert & Ziegler Analytics, Inc. (EZA) of Atlanta, Georgia. EZA has a documented Quality Assurance (QA) program and the capability to prepare Quality Control (QC) materials traceable to the National Institute of Standards and Technology. The ICP is a third party blind testing program which provides a means to ensure independent checks are performed on the accuracy and precision of the measurements of radioactive materials in environmental sample matrices. EZA supplies the crosscheck samples to GPCEL which performs routine laboratory analyses. Each of the specified analyses is performed three times.

The accuracy of each result is measured by the normalized deviation, which is the ratio of the reported average less the known value to the total error. An investigation is undertaken whenever the absolute value of the normalized deviation is greater than three or whenever the coefficient of variation is greater than 15% for all radionuclides other than Cr-51 and Fe-59. For Cr-51 and Fe-59, an investigation is undertaken when the coefficient of variation exceeds the values shown on Table 3-6 below:

Table 3-6. Interlaboratory Comparison Limits

Nuclide	Concentration *	Total Sample Activity (pCi)	Percent Coefficient of Variation
Cr-51	<300	NA	25
	NA	>1000	25
	>300	<1000	15
Fe-59	<80	NA	25
	>80	NA	15
* For air filters, concentration units are pCi/filter. For all other media, concentration units are pCi/liter (pCi/l).			

As required by ODCM 4.1.3.3 and 7.1.2.3, a summary of the results of the GPCEL's participation in the ICP is provided in Table 3-7 for:

- gross beta and gamma isotopic analyses of an air filter
- gamma isotopic analyses of milk samples
- gross beta, tritium and gamma isotopic analyses of water samples

The 2014 analyses included tritium, gross beta and gamma emitting radio-nuclides in different matrices. The attached results for all analyses were within acceptable limits for accuracy (less than 15% coefficient of variation and less than 3.0 normalized deviations, except for Cr-51 and Fe-59, which are outlined in Table 3-6).

Table 3-7. Interlaboratory Comparison Summary

Analysis or Radionuclide	Date Prepared	Reported Average	Known Value	Standard Deviation EL	Uncertainty Analytics (3S)	Percent Coef of Variation	Normalized Deviation
I-131 ANALYSIS OF AN AIR CARTRIDGE (pCi/cartridge)							
I-131	12/4/2014	102.5	98.4	1.8	1.64	5.05	0.8
GAMMA ISOTOPIC ANALYSIS OF AN AIR FILTER (pCi/filter)							
Ce-141	12/4/2014	108	103	9	1.73	9.61	0.5
Co-58	12/4/2014	66	61.4	4.76	1.02	9	0.77
Co-60	12/4/2014	113	111	5.96	1.85	6.82	0.25
Cr-51	12/4/2014	200	192	9.22	3.2	8.42	0.48
Cs-134	12/4/2014	74.5	77.6	4.51	1.3	7.46	-0.55
Cs-137	12/4/2014	97.4	93.5	10.7	1.56	12.04	0.33
Fe-59	12/4/2014	83.3	82.4	8.01	1.38	11.41	0.09
Mn-54	12/4/2014	114	106	7.97	1.78	8.5	0.82
Zn-65	12/4/2014	153	140	18.4	2.34	13.25	0.62
GROSS BETA ANALYSIS OF AN AIR FILTER (PCI/FILTER)							
Gross Beta	09/12/13	58.30	58.70	0.79	0.98	5.08	-0.14
GAMMA ISOTOPIC ANALYSIS OF A MILK SAMPLE (PCI/LITER)							
Ce-141	6/12/2014	132	124	3.53	2.07	6.43	0.93
Co-58	6/12/2014	120	112	6.8	1.88	8.11	0.84
Co-60	6/12/2014	240	224	2.91	3.74	4.32	1.53
Cr-51	6/12/2014	269	253	13.3	4.23	12.91	0.47
Cs-134	6/12/2014	181	162	9.8	2.71	6.74	1.52
Cs-137	6/12/2014	130	120	4.6	2	7.09	1.06
Fe-59	6/12/2014	108	102	5.79	1.71	9.4	0.56
I-131	6/12/2014	99.2	90.9	4.25	1.52	7.58	1.1
Mn-54	6/12/2014	175	156	4.41	2.6	5.7	1.9

Table 3-7. Interlaboratory Comparison Summary

Analysis or Radionuclide	Date Prepared	Reported Average	Known Value	Standard Deviation EL	Uncertainty Analytics (3S)	Percent Coef of Variation	Normalized Deviation
Zn-65	6/12/2014	299	252	14.8	4.22	7.56	2.09
GROSS BETA ANALYSIS OF WATER SAMPLE (PCI/LITER)							
Gross Beta	3/20/2014	309	279	12.35	1.79	6.32	1.54
	12/4/2014	339	299	11.94	4.99	5.42	2.2
GAMMA ISOTOPIC ANALYSIS OF WATER SAMPLES (PCI/LITER)							
Ce-141	3/20/2014	74.9	77.1	6.05	1.29	11.96	-0.24
Co-58	3/20/2014	173	174	7.87	2.9	7.03	-0.12
Co-60	3/20/2014	221	219	6.12	3.65	5.22	0.15
Cr-51	3/20/2014	334	319	17.7	5.32	12.47	0.36
Cs-134	3/20/2014	142	136	5.6	2.28	6	0.7
Cs-137	3/20/2014	169	164	11.1	2.74	8.52	0.35
Fe-59	3/20/2014	142	142	7.55	2.37	8.64	-0.02
I-131	3/20/2014	91.8	89.9	3.86	1.5	8.34	0.25
Mn-54	3/20/2014	202	193	11.7	3.22	7.61	0.56
Zn-65	3/20/2014	221	210	10.1	3.5	8.06	0.61
TRITIUM ANALYSIS OF WATER SAMPLES (PCI/LITER)							
H-3	3/20/2014	9820	10000	157.6	167	2.71	-0.69
	12/4/2014	14800	14900	127.53	249	2.18	-0.46

3.7 Groundwater

To ensure compliance with NEI 07-07 (Industry Ground Water Protection Initiative – Final Guidance Document), Southern Nuclear developed the Nuclear Management Procedure, Radiological Groundwater Protection Program. The procedure contains detailed site-specific monitoring plans, program technical bases, and communications protocol (to ensure that radioactive leaks and spills are addressed and communicated appropriately). In an effort to prevent future leaks of radioactive material to groundwater, SNC plants have established robust buried piping and tanks inspection programs.

Plant Hatch maintains the following wells (Table 3-8), which are sampled at a frequency that satisfies the requirements of NEI 07-07. The analytical results for 2014 were all within regulatory limits specified within this report. See Map A-4 in the appendix for well locations.

Table 3-8. Groundwater Monitoring Locations

Well	Depth (Feet)	Monitoring Purpose
R1	82.9	Confined Aquifer Upgradient
R2	82.7	Confined Aquifer Near Diesel Generator Bldg.
R3	89.2	Confined Aquifer Near CST-1
R4	41	Dilution Line Near River Water Discharge Structure
R5	33.6	Between Subsurface Drain Lines Downgradient
R6	38.2	Between Subsurface Drain Lines Downgradient
NW2A	27	Water Table Near CST-2 Inside of Subsurface Drain
NW2B	27	Water Table Outside of Subsurface Drain
NW3A	26.5	Water Table Inside of Subsurface Drain
NW3B	25.3	Water Table Outside of Subsurface Drain
NW4A	27	Water Table Upgradient Inside of Subsurface Drain
NW5A	26.7	Water Table Upgradient Inside of Subsurface Drain
NW5B	26.3	Water Table Upgradient Outside of Subsurface Drain
NW6	27	Water Table Near Diesel Generator Bldg.
NW8	23	Water Table Near Diesel Generator Bldg.
NW9	26.1	Water Table Downgradient Inside of Subsurface Drain
NW10	26.2	Water Table Near CST-2
T3	18	Water Table Near Turbine Bldg.
T7	21.4	Water Table Near Diesel Generator Bldg.
T10	18.8	Water Table Near CST-1
T12	23.2	Water Table Near CST-1
T15	27.4	Water Table Near CST-1

Table 3-8. Groundwater Monitoring Locations

Well	Depth (Feet)	Monitoring Purpose
P15A*	74.5	Confined Aquifer Near Turbine Bldg.
P15B	18	Water Table Near Turbine Bldg.
P17A*	77	Confined Aquifer Near Diesel Generator Bldg.
P17B	14.8	Water Table Near Diesel Generator Bldg.
Deep Well 1	680	Backup Supply for Potable Water (infrequently used)
Deep Well 2	711	Plant Potable Water Supply
Deep Well 3	710	Potable Water Supply – Rec. Center, Firing Range, and Garage
* Water Level Only		

4 SURVEY SUMMARIES

4.1 Land Use Census

In accordance with ODCM 4.1.2, a land use census was conducted on November 24, 2014 to verify the locations of the nearest radiological receptor within five miles. The census results, shown in Table 4-1, indicated no changes from 2013; therefore, no changes to the ODCM are required.

Table 4-1. Land Use Census Results

Sector	Residence	Milk Animal	Beef Cattle	Fruit/Nut Tree	Garden
Distance in Miles to the Nearest Location in Each Sector					
N	2.8	None	None	4.2	3.8
NNE	2.9	None	None	4.7	None
NE	3.3	None	4.1	None	None
ENE	4.2	None	None	None	None
E	3.0	None	None	None	None
ESE	3.8	None	None	None	None
SE	1.8	None	2.4	None	None
SSE	2.0	None	3.6	None	4.5
S	1.1	None	2.5	None	1.0
SSW	1.3	None	2.8	1.4	3.0
SW	1.1	None	4.7	1.6	1.6
WSW	1.0	None	3.6	1.5	None
W	1.1	None	None	2.8	2.0
WNW	1.1	None	None	None	None
NW	3.6	None	4.5	None	None
NNW	1.8	None	2.8	None	2.9

4.2 Altamaha River Survey

A survey of the Altamaha River downstream of the plant for approximately 50 miles (approximately river miles 66.5 to 117.0) was conducted on October 21, 2014 to identify any new withdrawal of water from the river for drinking, irrigation, or construction purposes.

Irrigation equipment was identified at Clarke's Farm about ¾ mile downstream of Station #172 river water sampling station. The equipment is potentially used to irrigate crops. Mr. Clarke was contacted on October 22, 2014 and he stated that he had used river water to irrigate corn in 2014. SNC will implement steps to insure that this vegetation is collected in 2015 and included in that AREOR.

5 CONCLUSIONS

This report confirms SNCs conformance with the requirements of Chapter 4 of the ODCM and the objectives were to:

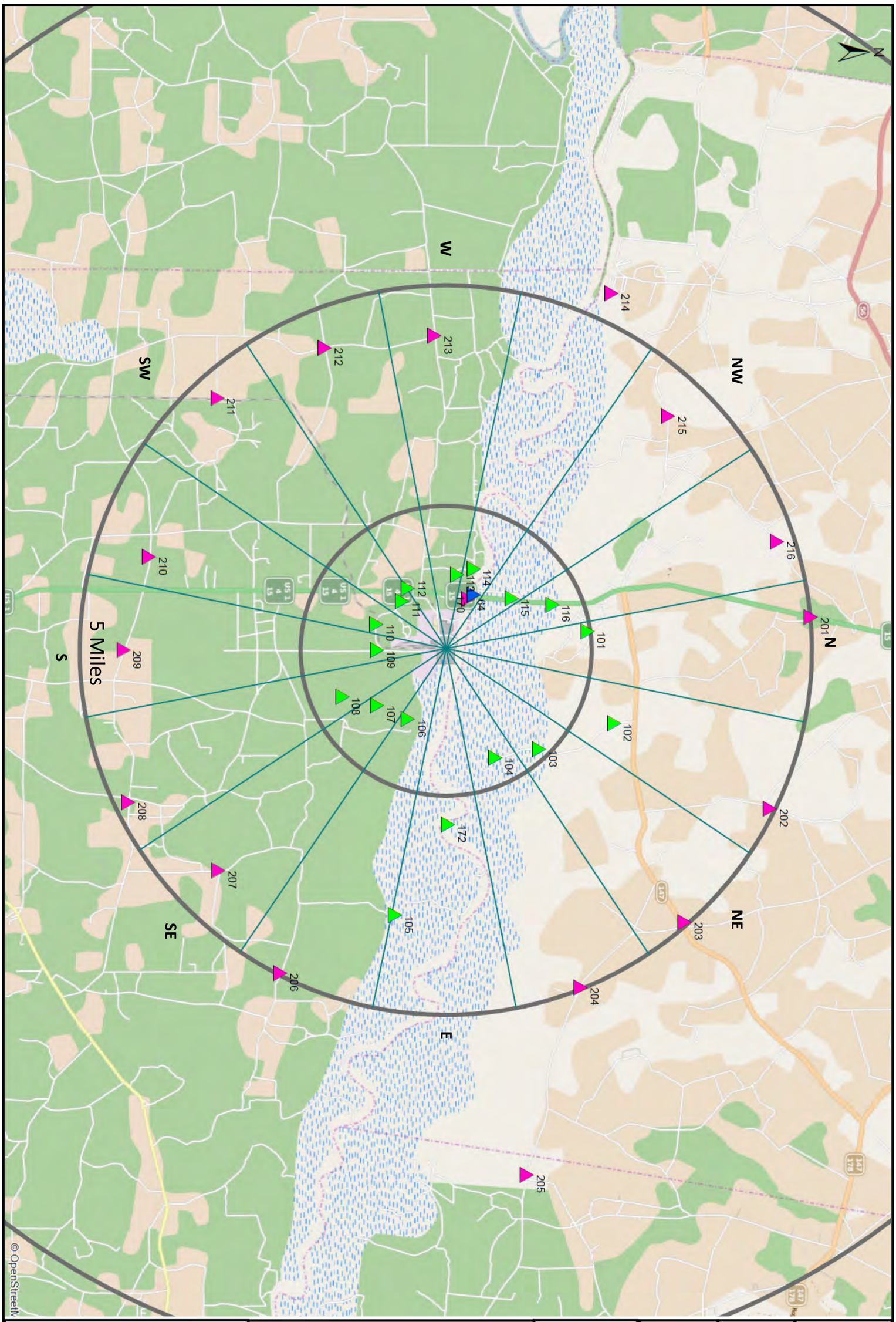
1) Determine the levels of radiation and the concentrations of radioactivity in the environs and;
2) Assess the radiological impact (if any) to the environment due to the operation of the HNP.

Based on the 2014 activities associated with the REMP, SNC offers the following conclusions:

- Samples were collected and there were no deviations or anomalies that negatively affected the quality of the REMP
- Land use census and river survey did not reveal any changes
- Analytical results were below reporting levels
- These values are consistent with historical results, indicating no adverse radiological environmental impacts associated with the operation of HNP

APPENDIX

Maps



Legend:

Indicator Stations -

Control Stations -

Other Stations -

Edwin I. Hatch Nuclear Plant

2014 Annual Radiological Environmental Report

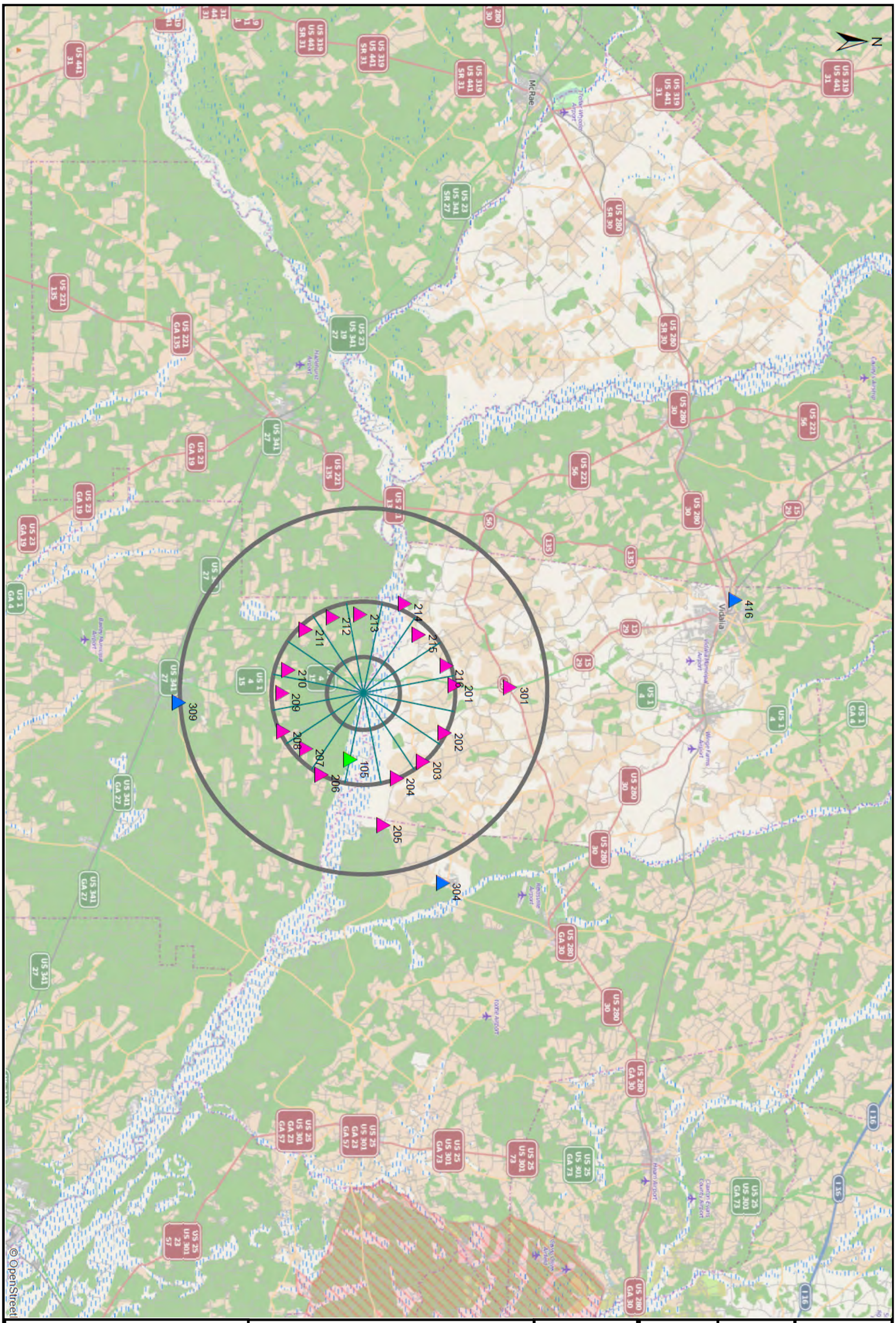
REMP Stations in Plant Vicinity

Drawn by: C. Groce

April 30, 2015

Appendix A

Map A-1



Legend:

Indicator Stations -

Control Stations -

Other Stations -

Edwin I. Hatch Nuclear Plant

2014 Annual Radiological Environmental Report

REMP Stations within 10 miles

Drawn by: C. Groce

April 30, 2015

Appendix A

Map A-2

Appendix A
Map A-3

Drawn by: C. Groce

April 30, 2015

Edwin I. Hatch Nuclear Plant
2014 Annual Radiological Environmental Report
Facility Groundwater Wells

Legend:
Upper Perched Aquifer -
Minor Confined Aquifer -

Edwin I. Hatch Nuclear Plant – Units 1 & 2
Joseph M. Farley Nuclear Plant– Units 1 & 2
Vogtle Electric Generating Plant– Units 1 & 2
Annual Radiological Environmental Operating Reports for 2014

Enclosure 2

Farley Annual Radiological Environmental Operating Report for 2014

JOSEPH M. FARLEY NUCLEAR PLANT

2014 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

SOUTHERN COMPANY

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JOSEPH M. FARLEY NUCLEAR PLANT

2014 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

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Appendix – Maps

A-1 – REMP Stations in Plant Vicinity
A-2 – REMP Stations within 5 Miles
A-3 – Extended REMP Stations
A-4 – Facility Groundwater Wells

LIST OF ACRONYMS

APC	Alabama Power Company
AREOR	Annual Radiological Environmental Operating Report
ASTM	American Society for Testing and Materials
CL	Confidence Level
EPA	Environmental Protection Agency
FNP	Joseph M. Farley Nuclear Plant
GPCEL	Georgia Power Company Environmental Laboratory
ICP	Interlaboratory Comparison Program
MDC	Minimum Detectable Concentration
MDD	Minimum Detectable Difference
MWe	MegaWatts Electric
NA	Not Applicable
NDM	No Detectable Measurement(s)
NEI	Nuclear Energy Institute
NRC	Nuclear Regulatory Commission
ODCM	Offsite Dose Calculation Manual
OSL	Optically Stimulated Luminescence
Po	Preoperation
PWR	Pressurized Water Reactor
REMP	Radiological Environmental Monitoring Program
RL	Reporting Level
RM	River Mile
SNC	Southern Nuclear Operating Company
SRS	ChattahoocheeRiver Site
TLD	Thermoluminescent Dosimeter
TS	Technical Specification

1 INTRODUCTION

The Radiological Environmental Monitoring Program (REMP) is conducted in accordance with Chapter 4 of the Offsite Dose Calculation Manual (ODCM). The REMP activities for 2014 are reported herein in accordance with Technical Specification (TS) 5.6.2 and ODCM 7.1.

The objectives of the REMP are to:

1) Determine the levels of radiation and the concentrations of radioactivity in the environs and;
2) Assess the radiological impact (if any) to the environment due to the operation of the Joseph M. Farley Nuclear Plant (FNP).

The assessments include comparisons between results of analyses of samples obtained at locations where radiological levels are not expected to be affected by plant operation (control stations), areas of higher population (community stations), and at locations where radiological levels are more likely to be affected by plant operation (indicator stations), as well as comparisons between preoperational and operational sample results.

FNP is owned by Alabama Power Company (APC) and operated by Southern Nuclear Operating Company (SNOC). It is located in Houston County, Alabama approximately fifteen miles east of Dothan, Alabama on the west bank of the Chattahoochee River. Unit 1, a Westinghouse Electric Corporation Pressurized Water Reactor (PWR) with a licensed core thermal power output of 2775 MegaWatts thermal (MWt), achieved initial criticality on August 9, 1977 and was declared "commercial" on December 1, 1977. Unit 2, also a 2775 MWt Westinghouse PWR, achieved initial criticality on May 8, 1981 and was declared "commercial" on July 30, 1981.

The preoperational stage of the REMP began with initial sample collections in January of 1975. The transition from the preoperational to the operational stage of the REMP was marked by Unit 1 initial criticality.

- A description of the REMP is provided in Section 2 of this report
- Section 3 provides a summary of the results and an assessment of any radiological impacts to the environment
- A summary of the land use census and the river survey are included in Section 4
- Conclusions are included in Section 5

2 REMP DESCRIPTION

The following section provides a description of the sampling and laboratory protocols associated with the REMP. Table 2-1 provides a summary of the sample types to be collected and the analyses to be performed in order to monitor the airborne, direct radiation, waterborne and ingestion pathways, and also summarizes the collection and analysis frequencies (in accordance with ODCM Section 4.2). Table 2-2 provides specific information regarding the station locations, their proximity to the plant, and exposure pathways. Additionally, the locations of the sampling stations are depicted on Maps A-1 through A-3 of the station locations included in the appendix of this report.

Georgia Power Company's Environmental Laboratory (GPCEL), located in Smyrna, Georgia collects and analyzes REMP samples.

Table 2-1. Summary Description of Radiological Environmental Monitoring Program

Exposure Pathway and/or	Number of Representative Samples and Sample Locations	Sampling/Collection Frequency	Type/Frequency of Analysis
Direct Radiation	Forty routine monitoring stations with two or more dosimeters placed as follows: An inner ring of stations, one in each compass sector in the general area of the site boundary; An outer ring of stations, one in each compass sector at approximately 5 miles from the site; and Special interest areas, such as population centers, nearby recreation areas, and control stations	Quarterly	Gamma dose, quarterly
Airborne Radioiodine and Particulates	Samples from nine locations: Four locations close to the site boundary in different sectors; Three community stations; within 8 miles Two control locations near population centers, approximately 15 and 18 miles away	Continuous sampler operation with sample collection weekly	Particulate sampler: Analyze for gross beta radioactivity ≥ 24 hours following filter change. Perform gamma isotopic analysis on each sample when gross beta activity is > 10 times the yearly mean of control samples. Perform gamma isotopic analysis on composite sample (by location) quarterly. Radioiodine canister: I-131 analysis, weekly (One community station)
Waterborne			
Surface[3]	One sample upriver One sample downriver	Composite sample over one month period[4]	Gamma isotopic analysis[2], monthly Composite for tritium analysis, quarterly

Table 2-1. Summary Description of Radiological Environmental Monitoring Program

Exposure Pathway and/or	Number of Representative Samples and Sample Locations	Sampling/Collection Frequency	Type/Frequency of Analysis
Drinking	Two samples at each of the three nearest water treatment plants that could be affected by plant discharges Two samples at a control location	Composite sample of river water near the intake of each water treatment plant over two week period[4] when I-131 analysis is required for each sample; monthly composite otherwise; and grab sample of finished water at each water treatment plant every two weeks or monthly, as appropriate	I-131 analysis on each sample when the dose calculated for the consumption of the water is greater than 1 mrem per year[5]. Composite for gross beta and gamma isotopic analysis[2] on raw water, monthly. Gross beta, gamma isotopic and I-131 analyses on grab sample of finished water, monthly. Composite for tritium analysis on raw and finished water, quarterly
Groundwater	See Table 3-8 and Map A-4 in the appendix for well locations Off-site monitoring includes one indicator station and one control station	Quarterly sample; pump used to sample GW wells; grab sample from yard drains and ponds	Tritium, gamma isotopic, and field parameters (pH, temperature, conductivity, dissolved oxygen, oxidation/reduction potential, and turbidity) of each sample quarterly; Hard to detect radionuclides as necessary based on results of tritium and gamma (Off-site wells are analyzed only for Gamma Isotopic, I-131, & tritium
Shoreline Sediment[8]	• One sample from downriver area with existing or potential recreational value • One sample from upriver area with existing or potential recreational value	Semiannually	Gamma isotopic analysis[2], semiannually
Ingestion			
Milk	Two samples from milking animals[6] at control locations at a distance of about 10 miles or more	Bimonthly	Gamma isotopic analysis[2,7], bimonthly

Table 2-1. Summary Description of Radiological Environmental Monitoring Program

Exposure Pathway and/or	Number of Representative Samples and Sample Locations	Sampling/Collection Frequency	Type/Frequency of Analysis
Fish[9]	• One bottom feeding fish and one game fish both upstream and downstream	Semiannually During spring spawning season	Gamma isotopic analysis[2] on edible portions, semiannually Gamma isotopic analysis[2] on edible portions, annually.
Grass or Leafy Vegetation	• One sample from two onsite locations near the site boundary in different sectors • One sample from a control location at a distance of about 18 miles	Monthly during growing season	Gamma isotopic analysis[2,7], monthly

Notes:
[1]Airborne particulate sample filters shall be analyzed for gross beta radioactivity 24 hours or more after sampling to allow for radon and thoron daughter decay. If gross beta activity in air particulate samples is greater than 10 times the yearly mean of control samples, gamma isotopic analysis shall be performed on the individual samples.
[2]Gamma isotopic analysis means the identification and quantification of gamma-emitting radionuclides that may be attributable to the effluents from the facility.
[3]Upriver sample is taken at a distance beyond significant influence of the discharge. Downriver samples are taken beyond but near the mixing zone.
[4]Composite sample aliquots shall be collected at time intervals that are very short (e.g., hourly) relative to the compositing period (e.g., monthly) to assure obtaining a representative sample.
[5]The dose shall be calculated for the maximum organ and age group, using the methodology and parameters in the ODCM.
[6]A milking animal is a cow or goat producing milk for human consumption, no milk animals were found within five miles of the plant.
[7]If the gamma isotopic analysis is not sensitive enough to meet the Minimum Detectable Concentration (MDC) for I-131, a separate analysis for I-131 may be performed.
[8]These collections are normally made at river mile 41.3 for the indicator station and river mile 47.8 for the control station; however, due to river bottom sediment shifting caused by high flows, dredging, etc., collections may be made from river mile 40 to 42 for the indicator station and from river mile 47 to 49 for the control station.
[9] Since several miles of river water may be needed to obtain adequate fish samples, these river mile positions represent the approximate locations from which the fish are taken. Collections for the indicator station should be from river mile 37.5 to 42.5 and for the control station from river mile 47 to 52.

Table 2-2. Radiological Environmental Sampling Locations

Station Number	Station Type	Descriptive Location	Direction[1]	Distance (miles)[1]	Radiation Sample Type
0501	Indicator	River Intake Structure	ESE	0.8	Airborne
0701	Indicator	South Perimeter	SSE	1.0	Airborne
1101	Indicator	Plant Entrance	WSW	0.9	Airborne
1601	Indicator	North Perimeter	N	0.8	Airborne
0215	Control	Blakely GA	NE	15	Airborne, Direct
0718	Control	Neals Landing, FL	SSE	18	Airborne, Direct
1218	Control	Dothan, AL	W	18	Airborne, Direct, Vegetation
0703	Community	GA Pacific Paper Co.	SSE	3	Airborne
1108	Community	Ashford, AL	WSW	8	Airborne
1605	Community	Columbia, AL	N	5	Airborne
0101	Indicator	Plant Perimeter	NNE	0.9	Direct
0201	Indicator	Plant Perimeter	NE	1.0	Direct
0301	Indicator	Plant Perimeter	ENE	0.9	Direct
0401	Indicator	Plant Perimeter	E	0.8	Direct
0501	Indicator	Plant Perimeter	ESE	0.8	Direct
0601	Indicator	Plant Perimeter	SE	1.1	Direct
0701	Indicator	Plant Perimeter	SSE	1.0	Direct, Vegetation
0801	Indicator	Plant Perimeter	S	1.0	Direct
0901	Indicator	Plant Perimeter	SSW	1.0	Direct
1001	Indicator	Plant Perimeter	SW	0.9	Direct
1101	Indicator	Plant Perimeter	WSW	0.9	Direct
1201	Indicator	Plant Perimeter	W	0.8	Direct
1301	Indicator	Plant Perimeter	WNW	0.8	Direct
1401	Indicator	Plant Perimeter	NW	1.1	Direct
1501	Indicator	Plant Perimeter	NNW	0.9	Direct
1601	Indicator	Plant Perimeter	N	0.8	Direct, Vegetation
1215	Control	Dothan, AL	W	15	Direct
1311	Control	Webb, AL	W	11	Direct
1612	Control	Haleburg, AL	WNW	12	Direct
1001	Community	Nearest Residence	SW	12	Direct
1108	Community	Ashford, AL	WSW	8.0	Direct
WRI	Indicator	Downstream of plant discharge, approximately RM 40	S	3.0	River Water
WRB	Control	Upstream of plant intake, approximately RM 47	NNE	3.0	River Water
WGI-07	Indicator	Paper Mill Well	SSE	4.0	Groundwater

Table 2-2. Radiological Environmental Sampling Locations

Station Number	Station Type	Descriptive Location	Direction[1]	Distance (miles)[1]	Radiation Sample Type
WGB-10	Control	Whatley Residence	SW	1.2	Groundwater
RSI	Indicator	Downstream of plant discharge at Smith's Bend (RM 41)	S	4.0	Sediment
RSB	Control	Upstream of plant intake at Andrews Lock and Dam (RM 48)	N	4.0	Sediment
MB-0714	Control[2]	Robert Weir Dairy, Donaldsonville, GA	SSE	14	Milk
FGI & FGB	Indicator	Downstream of plant discharge at Smith's Bend (RM 41)	S	4.0	Fish
FGB & FBB	Control	Upstream of plant intake at Andrews Lock and Dam (RM 48)	N	4.0	Fish

Notes:
[1]Direction and distance are determined from the main stack.
[2] No milk animals were found within five miles of the plant, control sample not collected since 2009.

3 RESULTS SUMMARY

Included in this section are statistical evaluations of the laboratory results, comparison of the results by media, and a summary of the anomalies and deviations. Overall, 1,102 analyses were performed across nine exposure pathways. Tables and figures are provided throughout this section to provide an enhanced presentation of the information.

In recent history, man-made nuclides have been released into the environment and have resulted in wide spread distribution of radionuclides across the globe. For example, atmospheric nuclear weapons tests from the mid-1940s through 1980 distributed man-made nuclides around the world. The most recent atmospheric tests in the 1970s and in 1980 had a significant impact upon the radiological concentrations found in the environment prior to and during pre-operation, and through early operation. Some long-lived radionuclides, such as Cs-137, continue to be detected and a portion of these detections are believed to be attributed to the nuclear weapons tests.

Additionally, data associated with certain radiological effects created by off-site events have been removed from the historical evaluation, this includes: the nuclear atmospheric weapon test in the fall of 1980 and the Chernobyl incident in the spring of 1986.

As indicated in ODCM 7.1.2.1, the results for naturally occurring radionuclides that are also found in plant effluents must be reported along with man-made radionuclides. Historically, the radionuclide Be-7, which occurs abundantly in nature, is often detected in REMP samples, and occasionally detected in the plant's liquid and gaseous effluents. When it is detected in effluents and REMP samples, it is also included in the REMP results. In 2014, Be-7 was not detected in any plant effluents and therefore is not included in this report. The Be-7 detected in select REMP samples likely represents naturally occurring and/or background conditions.

As part of the data evaluation process, SNC considered the impact of the non-plant associated nuclides along with a statistical evaluation of the REMP data. The statistical evaluations included within this report include the Minimum Detectable Concentration (MDC), the Minimum Detectable Difference (MDD), and Chauvenet's Criterion as described below.

Minimum Detectable Concentration

The minimum detectable concentration is defined as an estimate of the true concentration of an analyte required to give a specified high probability that the measured response will be greater than the critical value.

Minimum Detectable Difference

The Minimum Detectable Difference (MDD) compares the lowest significant difference (between the means) of a control station, versus an indicator station or a community station, that can be determined statistically at the 99% Confidence Level (CL). A difference in mean values which was less than the MDD was considered to be statistically indiscernible.

Chauvenet's Criterion

All results were tested for conformance with Chauvenet's criterion (G. D. Chase and J. L. Rabinowitz, Principles of Radioisotope Methodology, Burgess Publishing Company, 1962, pages 87-90) to identify values which differed from the mean of a set by a statistically significant amount. Identified outliers were investigated to determine the reason(s) for the difference. If equipment malfunction or other valid physical reasons were identified as causing the variation, the anomalous result was excluded from the data set as non-representative.

The 2014 results were compared with past results, including those obtained during pre-operation. As appropriate, results were compared with their MDC (listed in Table 3-1) and RL which is listed in Table 3-2. The required MDCs were achieved during laboratory sample analysis. No data points were excluded for violating Chauvenet's criterion.

Table 3-1. Radiological Environmental Monitoring Program Annual Summary

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Minimum Detectable Concentration (MDC) (a)	Indicator Locations Mean (b), Range (Fraction)	Location with the Highest Annual Mean		Other Stations (f) Mean (b), Range (Fraction)	Control Locations Mean (b), Range (Fraction)
				Name Distance and Direction	Mean (b), Range (Fraction)		
Airborne Particulates (fCi/m3)	Gross Beta 413	10	17.7 1.8-51.7 (189/189)	Plant Entrance, WSW 0.9 mi.	24.6 3.4-51.7 (52/52)	18.5 3.8-50 (120/120)	19.1 4.1-37..1 (104/104)
	Gamma Isotopic 36						
	I-131	70	NDM(c)		NDM	NDM	NDM
	Cs-134	50	NDM		NDM	NDM	NDM
	Cs-137	60	NDM		NDM	NDM	NDM
Airborne Radioiodine (fCi/m3)	I-131 352	70	NDM		NDM	NDM	NDM
Direct Radiation (mR/91 days)	Gamma Dose 159		16.7 11.4-26.2 (63/63)	Plant Perimeter, E 0.8	25.2 23.7-26.2 (4/4)	14.1 11.5-17.1 (72/72)	15.7 12.7-19.2 (24/24)
Milk (pCi/l)	Gamma Isotopic 0						
	I-131	1					
	Cs-134	15					
	Cs-137	18					
	Ba-140	60					
	La-140	15					
Vegetation (pCi/kg-wet)	Gamma Isotopic 36						

Table 3-1. Radiological Environmental Monitoring Program Annual Summary

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Minimum Detectable Concentration (MDC) (a)	Indicator Locations Mean (b), Range (Fraction)	Location with the Highest Annual Mean		Other Stations (f) Mean (b), Range (Fraction)	Control Locations Mean (b), Range (Fraction)
				Name Distance and Direction	Mean (b), Range (Fraction)		
	I-131	60	NDM				NDM
	Cs-134	60	NDM				NDM
	Cs-137	80	NDM				NDM
River Water (pCi/l)	Gamma Isotopic 22						
	Mn-54	15	NDM		NDM	NDM	NDM
	Fe-59	30	NDM		NDM	NDM	NDM
	Co-58	15	NDM		NDM	NDM	NDM
	Co-60	15	NDM		NDM	NDM	NDM
	Zn-65	30	NDM		NDM	NDM	NDM
	Zr-95	30	NDM		NDM	NDM	NDM
	Nb-95	15	NDM		NDM	NDM	NDM
	I-131	15	NDM		NDM	NDM	NDM
	Cs-134	15	NDM		NDM	NDM	NDM
	Cs-137	18	NDM		NDM		
	Ba-140	60	NDM		NDM		
	La-140	15	NDM		NDM		
	Tritium 3	3000	69 29.7-109 (2/2)	Upstream of plant discharge (RM 48)	96.3 96.3 (1/1)		96.3 96.3 (1/1)
Off-site Groundwater	Gamma Isotopic 6						
	Mn-54	15	NDM		NDM		NDM
	Fe-59	30	NDM		NDM		NDM
	Co-58	15	NDM		NDM		NDM

Table 3-1. Radiological Environmental Monitoring Program Annual Summary

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Minimum Detectable Concentration (MDC) (a)	Indicator Locations Mean (b), Range (Fraction)	Location with the Highest Annual Mean		Other Stations (f) Mean (b), Range (Fraction)	Control Locations Mean (b), Range (Fraction)
				Name Distance and Direction	Mean (b), Range (Fraction)		
	Co-60	15	NDM		NDM		NDM
	Zn-65	30	NDM		NDM		NDM
	Zr-95	30	NDM		NDM		NDM
	Nb-95	15	NDM		NDM		NDM
	I-131 6	15	NDM		NDM		NDM
	Cs-134	15	NDM		NDM		NDM
	Cs-137	18	NDM		NDM		NDM
	Ba-140	60	NDM		NDM		NDM
	La-140	15	NDM		NDM		NDM
	Tritium 3	2000	30.8 17.3-44.2 (2/2)	Whatley Residence Well, SW, 1.2 mi.	37.3 37.3 (1/1)		37.3 37.3 (1/1)
Bottom Feeding Fish (pCi/kg-wet)	Gamma Isotopic 2						
	Mn-54	130			NDM		NDM
	Fe-59	260			NDM		NDM
	Co-58	130			NDM		NDM
	Co-60	130			NDM		NDM
	Zn-65	260			NDM		NDM
	Cs-134	130			NDM		NDM
	Cs-137	150			NDM		NDM
Game Fish (pCi/kg-wet)	Gamma Isotopic 4						
	Mn-54	130	NDM		NDM		NDM

Table 3-1. Radiological Environmental Monitoring Program Annual Summary

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Minimum Detectable Concentration (MDC) (a)	Indicator Locations Mean (b), Range (Fraction)	Location with the Highest Annual Mean		Other Stations (f) Mean (b), Range (Fraction)	Control Locations Mean (b), Range (Fraction)
				Name Distance and Direction	Mean (b), Range (Fraction)		
	Fe-59	260	NDM		NDM		NDM
	Co-58	130	NDM		NDM		NDM
	Co-60	130	NDM		NDM		NDM
	Zn-65	260	NDM		NDM		NDM
	Cs-134	130	NDM		NDM		NDM
	Cs-137	150	NDM		NDM		NDM
Sediment (pCi/kg-dry)	Gamma Isotopic 4						
	Co-60	70(e)	NDM		NDM		NDM
	Cs-134	150	NDM		NDM		NDM
	Cs-137	180	NDM		NDM		NDM

Notes:
(a)The MDC is defined in ODCM 10.1. Except as noted otherwise, the values listed in this column are the detection capabilities required by ODCM Table 4-3. The values listed in this column are a priori (before the fact) MDCs. In practice, the a posteriori (after the fact) MDCs are generally lower than the values listed.
(b) Mean and range are based upon detectable measurements only. The fraction of all measurements at a specified location that are detectable is placed in parenthesis.
(c) No Detectable Measurement(s) (NDM).
(d) The Georgia Power Company Environmental Laboratory has determined that this value may be routinely attained under normal conditions. No value is provided in ODCM Table 4-3.
(e) Item 3 of ODCM Table 4-1 implies that an I-131 analysis is not required to be performed on water samples when the dose calculated from the consumption of water is less then 1 mrem per year. However, I-131 analyses have been performed on the finished drinking water samples.
(f) "Other" stations, as identified in the "Station Type" column of Table 2-2, are "Community" and/or "Special" stations.
Not Applicable (sample not required)

Table 3-2. Reporting Levels (RL)

Analysis	Water (pCi/l)	Airborne Particulate or Gases (fCi/m3)	Fish (pCi/kg-wet)	Milk (pCi/l)	Grass or Leafy Vegetation (pCi/kg-wet)
H-3	20,000[a]				
Mn-54	1000		30,000		
Fe-59	400		10,000		
Co-58	1000		30,000		
Co-60	300		10,000		
Zn-65	300		20,000		
Zr-95	400				
Nb-95	700				
I-131	2[b]	900		3	100
Cs-134	30	10,000	1000	60	1000
Cs-137	50	20,000	2000	70	2000
Ba-140	200			300	
La-140	100			400	

[a] This is the 40 CFR 141 value for drinking water samples. If no drinking water pathway exists, a value of 30,000 may be used.
[b] If no drinking water pathway exists, a value of 20 pCi/l may be used.

In accordance with ODCM 4.1.1.2.1, deviations from the required sampling schedule are permitted, if samples are unobtainable due to hazardous conditions, unavailability, inclement weather, equipment malfunction or other just reasons. Deviations from conducting the REMP sampling (as described in Table 2-1) are summarized in Table 3-3 along with their causes and resolution.

Table 3-3. Anomalies and Deviations from Radiological Environmental Monitoring Program

Collection Period	Affected Samples	Anomaly (A)* or Deviation (D)**	Cause	Resolution
01/21/14-01/28/14 CR 760966	Air I, Air Part. N Perimeter Cabinet	(A) Low sample volume	Loss of power for approximately 72 hours.	Power restored to cabinet.
First quarter 2014 CR 773511	Groundwater Tritium PW#3, CW#1	(D) Samples not obtained	PW#3 pump was danger tagged out; CW#1 pump was inoperable	Samples were not obtained.
04/29/14-05/06/14 CR 809561	Air I, Air Part. GP Paper Mill Sampler	(A) Low sample volume	Loss of power for approximately 6 days, due to electrical storm.	Power restored to cabinet.
Second quarter 2014 CR 811754	Groundwater Tritium PW#3, CW#1	(D) Samples not obtained	PW#3 pump was danger tagged out; CW#1 pump was inoperable	Samples were not obtained.
08/19/14-08/26/14 CR 857395	Air I, Air Part. N Perimeter Cabinet	(A) Low sample volume	Loss of power for approximately 5 days, due to storm.	Power restored to cabinet.
08/19/14-08/26/14 CR 857681	Air I, Ari Part. SSE Perimeter Station	(A) Low sample volume	Loss of power for approximately 15.5 hrs, due to birds contacting 12KV power lines.	Equipment repaired and power restored to cabinet.
09/02/14-09/09/14 CR 863951	Air I, Ari Part. SSE Perimeter Station	(A) Low sample volume	Loss of power for approximately 65 hrs, due to electrical storm	Power restored to cabinet.
Third quarter 2014 CR 875393	Gamma OSLD Station 0501	(D) OSLD missing from station	Cause attributed to wildlife activity.	New OSLD placed at station to replace old dosimeter.
12/22/14-12/29/14 CR 10005467	Air I, Ari Part. SSE Perimeter Station	(A) Low sample volume	Loss of power for approximately 10.25 hrs, due to electrical storm	Power restored to cabinet.
Third and Fourth quarter 2014 CR 811754	Groundwater Tritium PW#3, CW#1	(D)Samples not obtained	PW#3 pump was danger tagged out; CW#1 pump was inoperable	Samples were not obtained. CW#1 pump operability restored and sampled in First quarter 2015.

* An anomaly is considered a non-standard sample that still meets sampling criteria outlined in SNC and Georgia Power Labs procedures.
** A deviation is a sample result that is not recorded due to not meeting scheduling and/or procedural requirements as outlined by SNC and Georgia Power Labs

3.1 Airborne Particulates

As specified in Table 2-1, airborne particulate filters and charcoal canisters are collected weekly at four indicator stations (Stations 0501, 0701, 1101, and 1601) which encircle the plant at the site periphery, at three community station (0703, 1108, and 1605) approximately three to eight miles from the plant, and at three control stations (0215, 0718, and 1218) which are range from approximately 15 to 18 miles from the plant. At each location, air is continuously drawn through a glass fiber filter to retain airborne particulate and an activated charcoal canister is placed in series with the filter to adsorb radioiodine.

3.1.1 Gross Beta

As provided in Table 3-1, the 2014 annual average weekly gross beta activity was 17.7 fCi/m3 for the indicator stations. It was 1.4 fCi/m3 less than the control station average of 19.1 fCi/m3 for the year. This difference is not statistically discernible, since it is less than the calculated MDD of 3.0 fCi/m3.

The 2014 annual average weekly gross beta activity at the community stations was 18.5 fCi/m3 which was 0.6 fCi/m3 less than the control station average. This difference is not statistically discernible since it is less than the calculated MDD of 2.9 fCi/m3.

Average Air Gross Beta historical data (Table 3-4) is graphed to show trends associated with a prevalent exposure pathway (Figure 3-1). In general, there is close agreement between the results for the indicator, control and community stations. This close agreement supports the position that the plant is not contributing significantly to the gross beta concentrations in air.

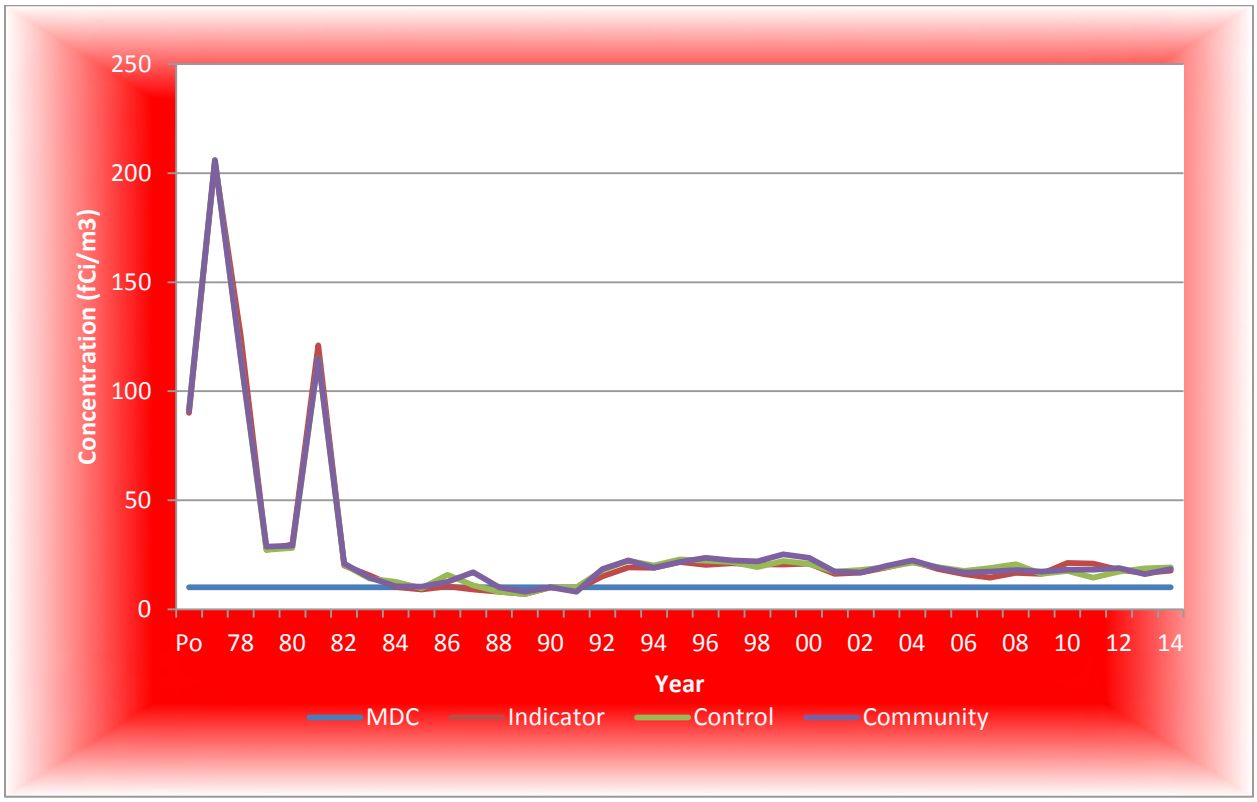
Table 3-4. Average Weekly Gross Beta Air Concentration

Period	Indicator (fCi/m3)	Control (fCi/m3)	Community (fCi/m3)
Pre-op	90	92	91
1977	205	206	206
1978	125	115	115
1979	27.3	27.3	28.7
1980	29.7	28.1	29.2
1981	121	115	115
1982	20.0	20.4	21.0
1983	15.5	14.1	14.5
1984	10.2	12.6	10.5
1985	9.0	9.6	10.3
1986	10.5	15.8	12.5
1987	9.0	11.0	17.0

Table 3-4. Average Weekly Gross Beta Air Concentration

Period	Indicator (fCi/m3)	Control (fCi/m3)	Community (fCi/m3)
1988	8	8	10
1989	7	7	8
1990	10	10	10
1991	9	10	8
1992	15	17.9	18.5
1993	19.1	22.3	22.4
1994	19.0	20.0	19.0
1995	21.7	22.9	21.6
1996	20.3	22.3	23.5
1997	21.1	21.6	22.4
1998	20.6	19.3	22.0
1999	20.5	22.1	25.2
2000	20.9	20.8	23.6
2001	16.3	17.2	17.3
2002	16.8	18	16.8
2003	19.1	19.3	19.9
2004	22.0	21.3	22.4
2005	18.4	19.3	19.0
2006	16.1	17.5	16.8
2007	14.5	18.9	17.3
2008	16.7	20.6	18.0
2009	16.2	16.3	17.3
2010	21.2	17.5	18.2
2011	20.9	14.5	18.2
2012	18.0	17.3	18.9
2013	16.7	18.7	16.1
2014	17.7	19.1	18.5

Figure 3-1. Average Weekly Gross Beta Air Concentration



3.1.2 Gamma Particulates

During 2014, no man-made radionuclides were detected from the gamma isotopic analysis of the quarterly composites of the air particulate filters.

Historically, gamma isotopes have been detected as a result of offsite events. During pre-operation Cs-137 was occasionally detected.

3.2 Direct Radiation

In 2014, direct (external) radiation was measured with Optically Stimulated Luminescent (OSL) dosimeters by placing two OSL badges at each station. The gamma dose at each station is reported as the average reading of the two badges. The badges are analyzed on a quarterly basis. An inspection is performed near mid-quarter for offsite badges to assure that the badges are on-station and to replace any missing or damaged badges.

Two direct radiation stations are established in each of the 16 compass sectors, to form two concentric rings. The inner ring (Stations 0101 through 1601) is located near the plant perimeter as shown in Map A-1 in the appendix and the outer ring (Stations 1701 through 3201) is located at a distance of approximately 5 miles from the plant as shown in Map A-2 in the appendix. The 16 stations forming the inner ring are designated as the indicator stations. The two ring configuration of stations was established in accordance with NRC Branch Technical Position "An Acceptable Radiological Environmental Monitoring Program", Revision 1, November 1979. The six control stations (Stations 0215, 0718, 1215, 1218, 1311 and 1612) are located at distances greater than 10 miles from the plant as shown in Map A-3 in the appendix. Monitored special interest areas consist of the following: Station 1001 which is the nearest residence to the plant, and Station 1108 in the town of Ashford, Alabama. The mean and range values presented in the "Other" column in Table 3-1 includes the outer ring stations (stations 1701 through 3201) as well as stations 1101 and 1108.

As provided in Table 3-1, the 2014 average quarterly exposure at the indicator stations (inner ring) was 16.7 mR with a range of 11.4 to 26.2 mR. The indicator station average was 1.0 mR more than the control station average (15.7 mR). This difference is not statistically discernible since it is less than the MDD of 1.4 mR.

The quarterly exposures acquired at the community/other (outer ring) stations during 2014 ranged from 11.5 to 17.1 mR with an average of 14.1 mR which was 1.6 mR less than that for the control stations.

Average Direct Radiation historical data (Table 3-5) is graphed to show trends associated with a prevalent exposure pathway (Figure 3-2). The decrease between 1991 and 1992 values is attributed to a change in TLDs from Teledyne to Panasonic. It should be noted however that the differences between indicator and control and outer ring values did not change.

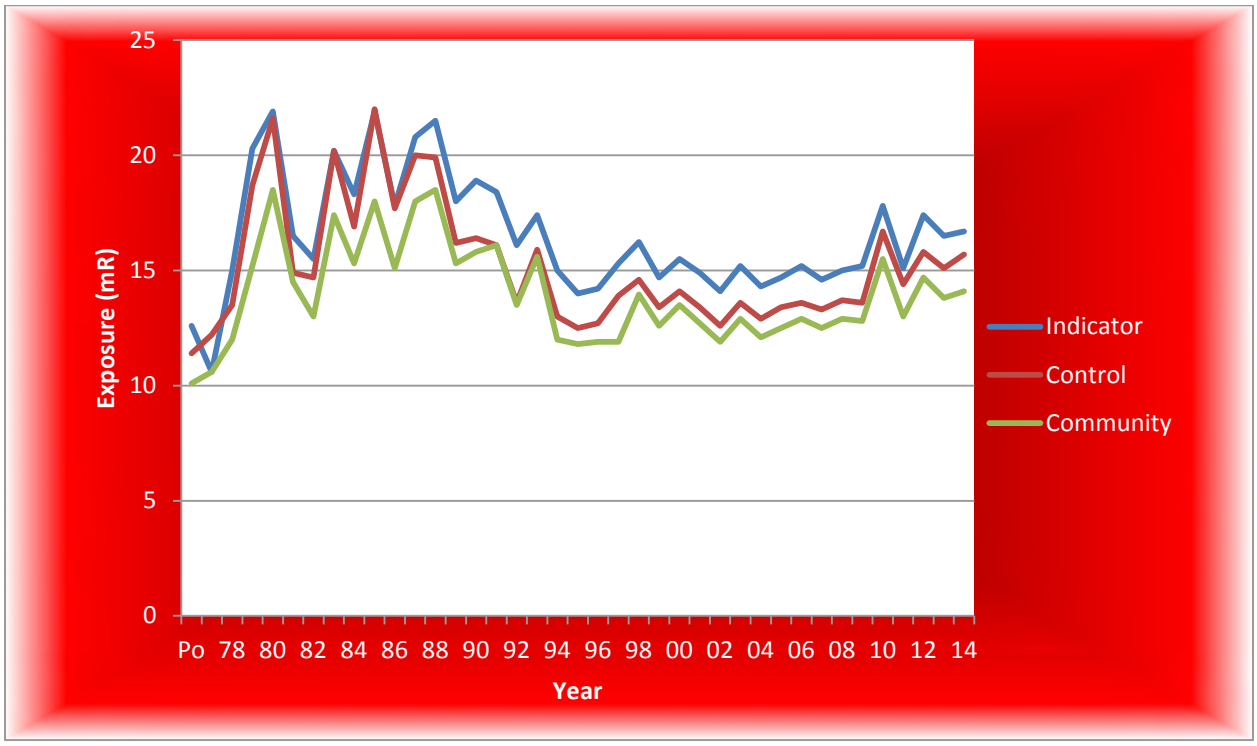
Table 3-5. Average Quarterly Exposure from Direct Radiation

Period	Indicator (mR)	Control (mR)	Outer Ring (mR)
Pre-op	12.6	11.4	10.1
1977	10.6	12.2	10.6
1978	15	13.5	12
1979	20.3	18.7	15.2
1980	21.9	21.6	18.5
1981	16.5	14.9	14.5
1982	15.5	14.7	13
1983	20.2	20.2	17.4
1984	18.3	16.9	15.3
1985	21.9	22	18
1986	17.8	17.7	15.1

Table 3-5. Average Quarterly Exposure from Direct Radiation

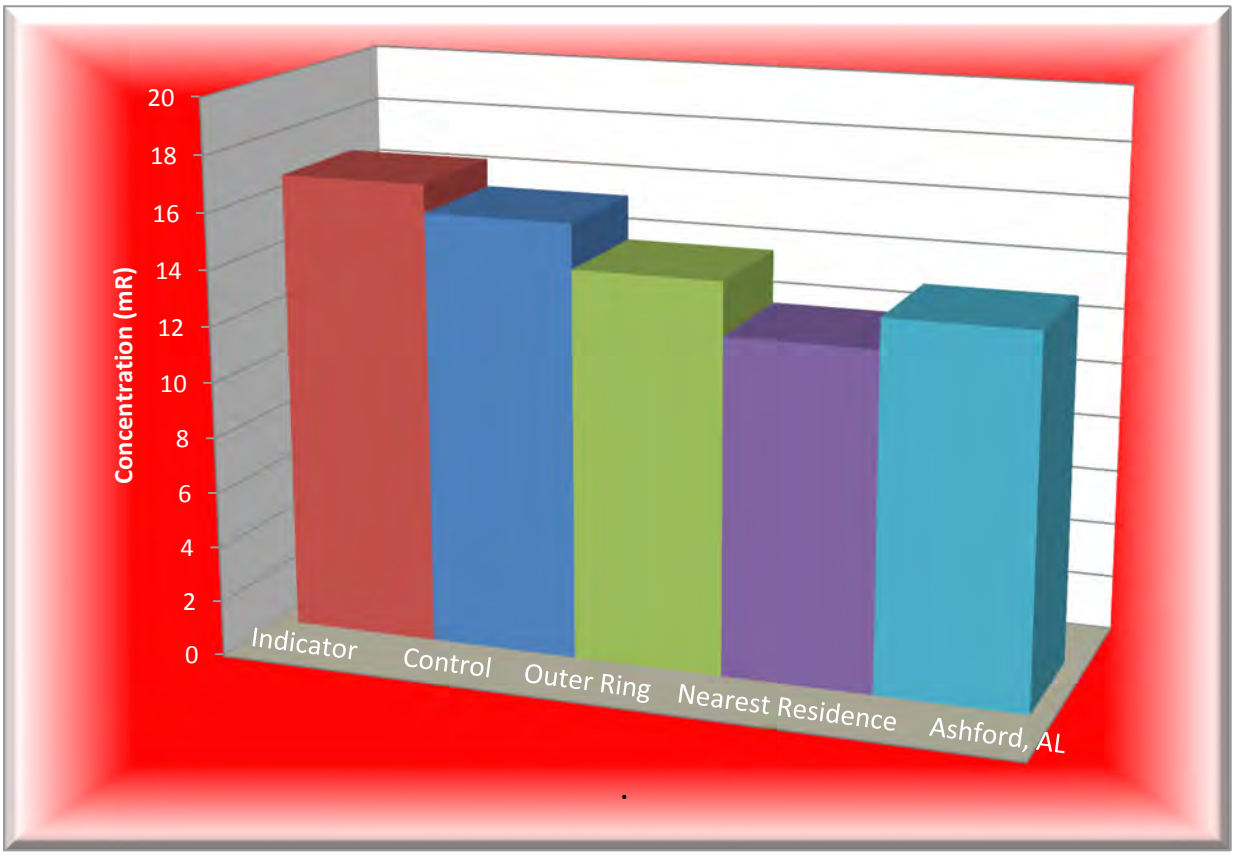
Period	Indicator (mR)	Control (mR)	Outer Ring (mR)
1987	20.8	20.0	18.0
1988	21.5	19.9	18.5
1989	18.0	16.2	15.3
1990	18.9	16.4	15.8
1991	18.4	16.1	16.1
1992	16.1	13.6	13.5
1993	17.4	15.9	15.6
1994	15.0	13.0	12.0
1995	14.0	12.5	11.8
1996	14.2	12.7	11.9
1997	15.3	13.9	11.9
1998	16.2	14.6	13.9
1999	14.7	13.4	12.6
2000	15.5	14.1	13.5
2001	14.9	13.4	12.7
2002	14.1	12.6	11.9
2003	15.2	13.6	12.9
2004	14.3	12.9	12.1
2005	14.7	13.4	12.5
2006	15.2	13.6	12.9
2007	14.6	13.3	12.5
2008	15.0	13.7	12.9
2009	15.2	13.6	12.8
2010	17.8	16.7	15.5
2011	21.0	19.9	18.4
2012	17.4	15.8	14.7
2013	16.5	15.1	13.8
2014	16.7	15.7	14.1

Figure 3-2. Average Quarterly Exposure from Direct Radiation



The increase shown in 2010 reflects issues with the aging Panasonic TLD reader. The close agreement between the station groups supports the position that the plant is not contributing significantly to direct radiation in the environment. Figure 3-3 provides a more detailed view of the 2014 values. The values for the special interest areas detailed below indicate that Plant Farley did not significantly contribute to direct radiation at those areas.

Figure 3-3. 2014 Average Exposure from Direct Radiation



3.3 Biological Media

Cs-137 was the only radionuclide detected in two of the three biological media. As indicated in Figure 3-4, the Cs-137 activity levels are below the respective MDCs and well below that of the respective RLs for each sample media for both the indicator and control stations.

3.3.1 Milk

Milk samples had been collected biweekly from a control location until the end of 2009 when the dairy would no longer provide samples. No indicator station (a location within five miles of the plant) has been available for milk sampling since 1987. As discussed in Section 4.0, no milk animals were found within five miles of the plant during the 2014 land use census therefore no milk sampling was performed during the reporting year.

3.3.2 Vegetation

In accordance with Table 2-1 and 2-2, forage samples are collected every four weeks at two indicator stations on the plant perimeter, and at one control station located approximately 18 miles west of the plant, in Dothan. The man-made radionuclide Cs-137 is periodically identified in vegetation samples, and is generally attributed to offsite sources (such as weapons testing, Chernobyl, and Fukushima).

During 2014, no gamma isotopes were detected in any Farley REMP vegetation samples.

3.3.3 Fish

Two types of fish (bottom feeding and game) are collected semiannually from the Chattahoochee River at a control station several miles upstream of the plant intake structure and at an indicator station a few miles downstream of the plant discharge structure. These locations are shown in Map A-3 in appendix.

3.3.3.1 Bottom Feeding Species

For bottom-feeding species, all fish sampled are considered indicator stations. No radionuclides were detected in the 2014 analyses, which is consistent with historical data.

3.3.3.2 Game Species

For game species, all fish sampled are considered indicator stations. No radionuclides were detected in the 2014 analyses, which is consistent with historical data.

3.3.4 Biological Media Summary

There were no statistical differences, trends, or anomalies associated with the 2014 biological media samples when compared to historical data. As shown in Table 3-1, no radionuclides were found from the gamma isotopic analysis of biological media samples in 2014.

3.4 Off-site Groundwater

There are no true indicator sources of ground water offsite of Plant Farley. A well, located approximately four miles south-southeast of the plant on the east bank of the Chattahoochee River, serves Georgia Pacific Paper Company as a source of potable water and is designated as the indicator station. A deep well located about 1.2 miles southwest of the plant, which supplies water to the Whatley residence, is designated as the control station. Samples are collected quarterly and analyzed for gamma isotopic, I-131 and tritium as specified in Table 2-1.

In 2014, there were no radionuclides detected in any of the ground water samples from either sample station, with the exception of tritium.

Since 2004, tritium has been detected at very low concentrations (near the instrument detection level) and close to environmental background levels in off-site groundwater. In 2014, tritium was detected with an average of 30.8 pCi/l at the indicator station, and 37.3 pCi/l at the control station (one sample). Typically the positive results are at concentrations well below the MDC and RL for tritium (2,000 and 20,000 pCi/l, respectively).

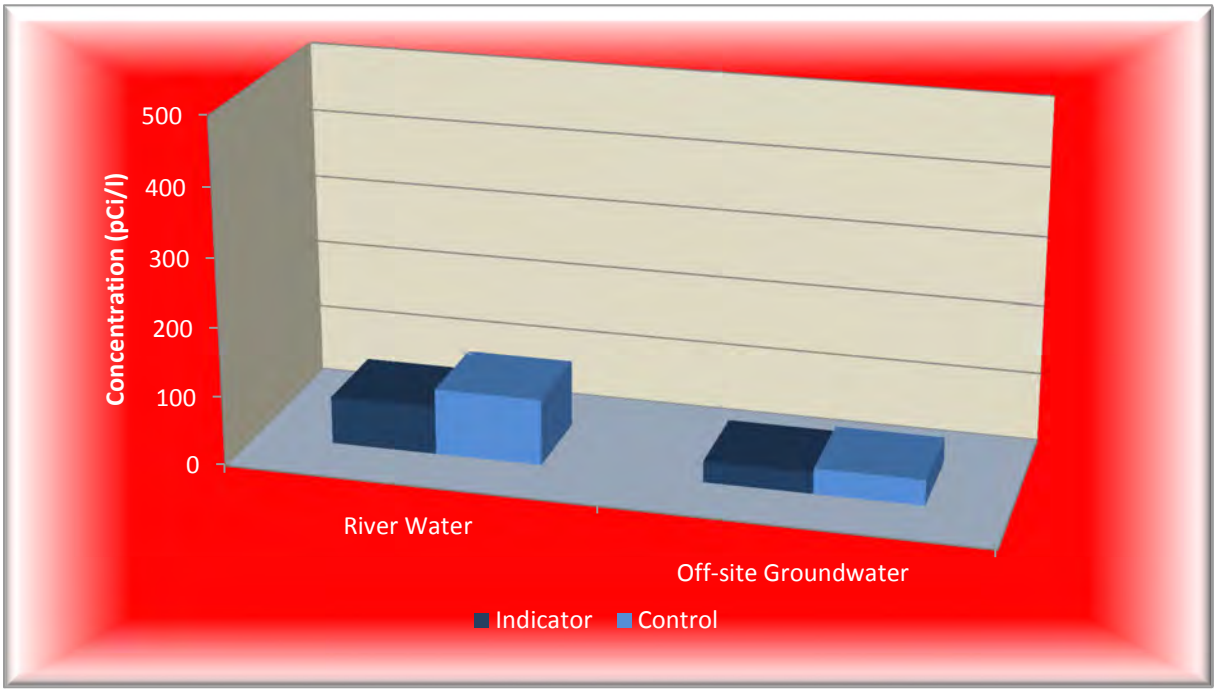
3.5 River Water

Composite river water samples are collected monthly at an upstream control location and at two downstream indicator locations (shown on Figure 2). The details of the sampling protocols are outlined in Tables 2-1 and Table 2-2. A gamma isotopic analysis is conducted on each monthly sample and the monthly aliquots are combined to form quarterly composite samples, which are analyzed for tritium.

As provided in Table 3-1, there were no positive results during 2014 from the gamma isotopic analysis of the river water samples. Also indicated in Table 3-1, the average tritium concentration found at the indicator station was 69.0 pCi/l which was 27.3 pCi/l less than the average (one sample) at the control station (96.3 pCi/l). The MDC for tritium in river water used to supply drinking water is 2000 pCi/l and the RL is 20000 pCi/l.

Figure 3-4 below details the 2014 average tritium concentrations across both water mediums.

Figure 3-4. 2014 Average Tritium Concentrations in River and Off-site Groundwater



3.6 Sediment

Sediment was collected along the shoreline of the Chattahoochee River in the spring and fall at a control station which is approximately four miles upstream of the intake structure and at an indicator station which is approximately two miles downstream of the discharge structure as shown in Map A-3. A gamma isotopic analysis was performed on each sample. There were no radionuclides detected in sediment samples in 2014.

3.7 Interlaboratory Comparison Program

In accordance with ODCM 4.1.3, GPCEL participates in an Interlaboratory Comparison Program (ICP) that satisfies the requirements of Regulatory Guide 4.15, Revision 1, "Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment", February 1979. The ICP includes the required determinations (sample medium/radionuclide combinations) included in the REMP.

The ICP was conducted by Eckert & Ziegler Analytics, Inc. (EZA) of Atlanta, Georgia. EZA has a documented Quality Assurance (QA) program and the capability to prepare Quality Control (QC) materials traceable to the National Institute of Standards and Technology. The ICP is a third

party blind testing program which provides a means to ensure independent checks are performed on the accuracy and precision of the measurements of radioactive materials in environmental sample matrices. EZA supplies the crosscheck samples to GPCEL which performs routine laboratory analyses. Each of the specified analyses is performed three times.

The accuracy of each result is measured by the normalized deviation, which is the ratio of the reported average less the known value to the total error. An investigation is undertaken whenever the absolute value of the normalized deviation is greater than three or whenever the coefficient of variation is greater than 15% for all radionuclides other than Cr-51 and Fe-59. For Cr-51 and Fe-59, an investigation is undertaken when the coefficient of variation exceeds the values shown on Table 3-6 below:

Table 3-6. Interlaboratory Comparison Limits

Nuclide	Concentration *	Total Sample Activity (pCi)	Percent Coefficient of Variation
Cr-51	<300	NA	25
	NA	>1000	25
	>300	<1000	15
Fe-59	<80	NA	25
	>80	NA	15
* For air filters, concentration units are pCi/filter. For all other media, concentration units are pCi/liter (pCi/l).			

As required by ODCM 4.1.3.3 and 7.1.2.3, a summary of the results of the GPCEL's participation in the ICP is provided in Table 3-7 for:

- gross beta and gamma isotopic analyses of an air filter
- gamma isotopic analyses of milk samples
- gross beta, tritium and gamma isotopic analyses of water samples

The 2014 analyses included tritium, gross beta and gamma emitting radio-nuclides in different matrices. The attached results for all analyses were within acceptable limits for accuracy (less than 15% coefficient of variation and less than 3.0 normalized deviations, except for Cr-51 and Fe-59, which are outlined in Table 3-6).

The 2014 analyses included tritium, gross beta and gamma emitting radio-nuclides in different matrices. The attached results for all analyses were within acceptable limits for accuracy.

Table 3-7. Interlaboratory Comparison Summary

Analysis or Radionuclide	Date Prepared	Reported Average	Known Value	Standard Deviation EL	Uncertainty Analytics (3S)	Percent Coef of Variation	Normalized Deviation
I-131 ANALYSIS OF AN AIR CARTRIDGE (pCi/cartridge)							
I-131	12/4/2014	102.5	98.4	1.8	1.64	5.05	0.8
GAMMA ISOTOPIC ANALYSIS OF AN AIR FILTER (pCi/filter)							
Ce-141	12/4/2014	108	103	9	1.73	9.61	0.5
Co-58	12/4/2014	66	61.4	4.76	1.02	9	0.77
Co-60	12/4/2014	113	111	5.96	1.85	6.82	0.25
Cr-51	12/4/2014	200	192	9.22	3.2	8.42	0.48
Cs-134	12/4/2014	74.5	77.6	4.51	1.3	7.46	-0.55
Cs-137	12/4/2014	97.4	93.5	10.7	1.56	12.04	0.33
Fe-59	12/4/2014	83.3	82.4	8.01	1.38	11.41	0.09
Mn-54	12/4/2014	114	106	7.97	1.78	8.5	0.82
Zn-65	12/4/2014	153	140	18.4	2.34	13.25	0.62
GROSS BETA ANALYSIS OF AN AIR FILTER (PCI/FILTER)							
Gross Beta	09/12/13	58.30	58.70	0.79	0.98	5.08	-0.14
GAMMA ISOTOPIC ANALYSIS OF A MILK SAMPLE (PCI/LITER)							
Ce-141	6/12/2014	132	124	3.53	2.07	6.43	0.93
Co-58	6/12/2014	120	112	6.8	1.88	8.11	0.84
Co-60	6/12/2014	240	224	2.91	3.74	4.32	1.53
Cr-51	6/12/2014	269	253	13.3	4.23	12.91	0.47
Cs-134	6/12/2014	181	162	9.8	2.71	6.74	1.52
Cs-137	6/12/2014	130	120	4.6	2	7.09	1.06
Fe-59	6/12/2014	108	102	5.79	1.71	9.4	0.56
I-131	6/12/2014	99.2	90.9	4.25	1.52	7.58	1.1
Mn-54	6/12/2014	175	156	4.41	2.6	5.7	1.9

Table 3-7. Interlaboratory Comparison Summary

Analysis or Radionuclide	Date Prepared	Reported Average	Known Value	Standard Deviation EL	Uncertainty Analytics (3S)	Percent Coef of Variation	Normalized Deviation
Zn-65	6/12/2014	299	252	14.8	4.22	7.56	2.09
GROSS BETA ANALYSIS OF WATER SAMPLE (PCI/LITER)							
Gross Beta	3/20/2014	309	279	12.35	1.79	6.32	1.54
	12/4/2014	339	299	11.94	4.99	5.42	2.2
GAMMA ISOTOPIC ANALYSIS OF WATER SAMPLES (PCI/LITER)							
Ce-141	3/20/2014	74.9	77.1	6.05	1.29	11.96	-0.24
Co-58	3/20/2014	173	174	7.87	2.9	7.03	-0.12
Co-60	3/20/2014	221	219	6.12	3.65	5.22	0.15
Cr-51	3/20/2014	334	319	17.7	5.32	12.47	0.36
Cs-134	3/20/2014	142	136	5.6	2.28	6	0.7
Cs-137	3/20/2014	169	164	11.1	2.74	8.52	0.35
Fe-59	3/20/2014	142	142	7.55	2.37	8.64	-0.02
I-131	3/20/2014	91.8	89.9	3.86	1.5	8.34	0.25
Mn-54	3/20/2014	202	193	11.7	3.22	7.61	0.56
Zn-65	3/20/2014	221	210	10.1	3.5	8.06	0.61
TRITIUM ANALYSIS OF WATER SAMPLES (PCI/LITER)							
H-3	3/20/2014	9820	10000	157.6	167	2.71	-0.69
	12/4/2014	14800	14900	127.53	249	2.18	-0.46

3.8 Groundwater

To ensure compliance with NEI 07-07, Southern Nuclear developed the Nuclear Management Procedure, Radiological Groundwater Protection Program. The procedure contains detailed site-specific monitoring plans, program technical bases, and communications protocol (to ensure that radioactive leaks and spills are addressed and communicated appropriately). In an effort to prevent future leaks of radioactive material to groundwater, SNC plants have established robust buried piping and tanks inspection programs.

Plant Farley maintains the following wells (Table 3-8), which are sampled at a frequency that satisfies the requirements of NEI 07-07. The analytical results for 2014 were all within regulatory limits specified within this report.

Table 3-8. Groundwater Monitoring Locations

Well	Aquifer	Monitoring Purpose
R1	Major Shallow aquifer	Dilution line
R2	Major Shallow aquifer	Dilution line
R3	Major Shallow aquifer	Unit 2 RWST
R4	Major Shallow aquifer	Unit 1 RWST
R5	Major Shallow aquifer	Dilution line
R6	Major Shallow aquifer	Dilution line
R7	Major Shallow aquifer	Dilution line
R8	Major Shallow aquifer	Dilution line
R9	Major Shallow aquifer	Dilution line
R10	Major Shallow aquifer	Dilution line
R11	Major Shallow aquifer	Background 1
R13	Major Shallow aquifer	Dilution line
R14	Major Shallow aquifer	Background 2
PW#2	Drinking water	Production Well #2 Supply
PW#3	Drinking water	Production Well #3 Supply
PW#4	Drinking water	Production Well #4 Supply
CW West	Drinking water	Construction Well West Supply
CW East	Drinking water	Construction Well East Supply
FRW	Drinking water	Firing Range Well Supply
SW-1	N/A	Background 3, Service Water Pond

4 SURVEY SUMMARIES

4.1 Land Use Census

In accordance with ODCM 4.1.2, a land use census was conducted on November 25, 2014 to determine the locations of the nearest permanent residence, milk animal, and garden of greater than 500 square feet producing broad leaf vegetation, in each of the 16 compass sectors within a distance of five miles; the locations of the nearest beef cattle in each sector were also determined. A milk animal is a cow or goat producing milk for human consumption. Land within SRS was excluded from the census. The census results are tabulated in Table 4.1-1. The 2014 census indicated that there were no changes to the nearest location for any of the categories in any of the sectors when compared to the 2013 census.

In accordance with ODCM 4.1.2, a land use census was conducted on November 25, 2014 to verify the locations of the nearest radiological receptor within five miles. The census results, shown in Table 4-1 indicated one change from 2013; a new permanent resident was identified in the western sector (12); now located 1.0 mile from the plant (a change of 0.3 miles). This location will be evaluated within the 2015 AREOR in accordance with ODCM 4.1.2.2.1.

Table 4-1. Land Use Census Results

Sector	Residence	Milk Animal
Distance in Miles to the Nearest Location in Each Sector		
N	2.6	None
NNE	2.5	None
NE	2.4	None
ENE	2.4	None
E	2.8	None
ESE	3.0	None
SE	3.4	None
SSE	None	None
S	4.3	None
SSW	2.9	None
SW	1.2	None
WSW	2.4	None
W	1.0	None
WNW	2.1	None
NW	1.5	None
NNW	3.4	None

4.2 Chattahoochee River Survey

A river survey performed for Plant Farley in early 2014 identified a potential use of water from the Chattahoochee River, downstream of the plant discharge at a distance of approximately 2 miles. In July 2013, the Georgia Department of Natural Resources issued a farm use permit to withdraw from the Chattahoochee River to the Nature Conservancy of Georgia. The Nature Conservancy of Georgia leases property along the river for agricultural and grazing purposes to a private farm family, and water from the river could potentially be used for crop irrigation.

It is not known, at the time of this report, if the property lessee (farmer) has exercised permit rights to withdraw from the river. Plant Farley is pursuing this information from the farmer and will request future crop samples from the farmer if, and when, water is withdrawn from the river for irrigation of crops.

5 CONCLUSIONS

This report confirms SNCs conformance with the requirements of Chapter 4 of the ODCM and the objectives were to:

1) Determine the levels of radiation and the concentrations of radioactivity in the environs and;
2) Assess the radiological impact (if any) to the environment due to the operation of the FNP.

Based on the 2014 activities associated with the REMP, SNC offers the following conclusions:

- Samples were collected and there were no deviations or anomalies that negatively affected the quality of the REMP
- Land use census and river survey did not reveal any changes
- Analytical results were below reporting levels
- These values are consistent with historical results, indicating no adverse radiological environmental impacts associated with the operation of FNP

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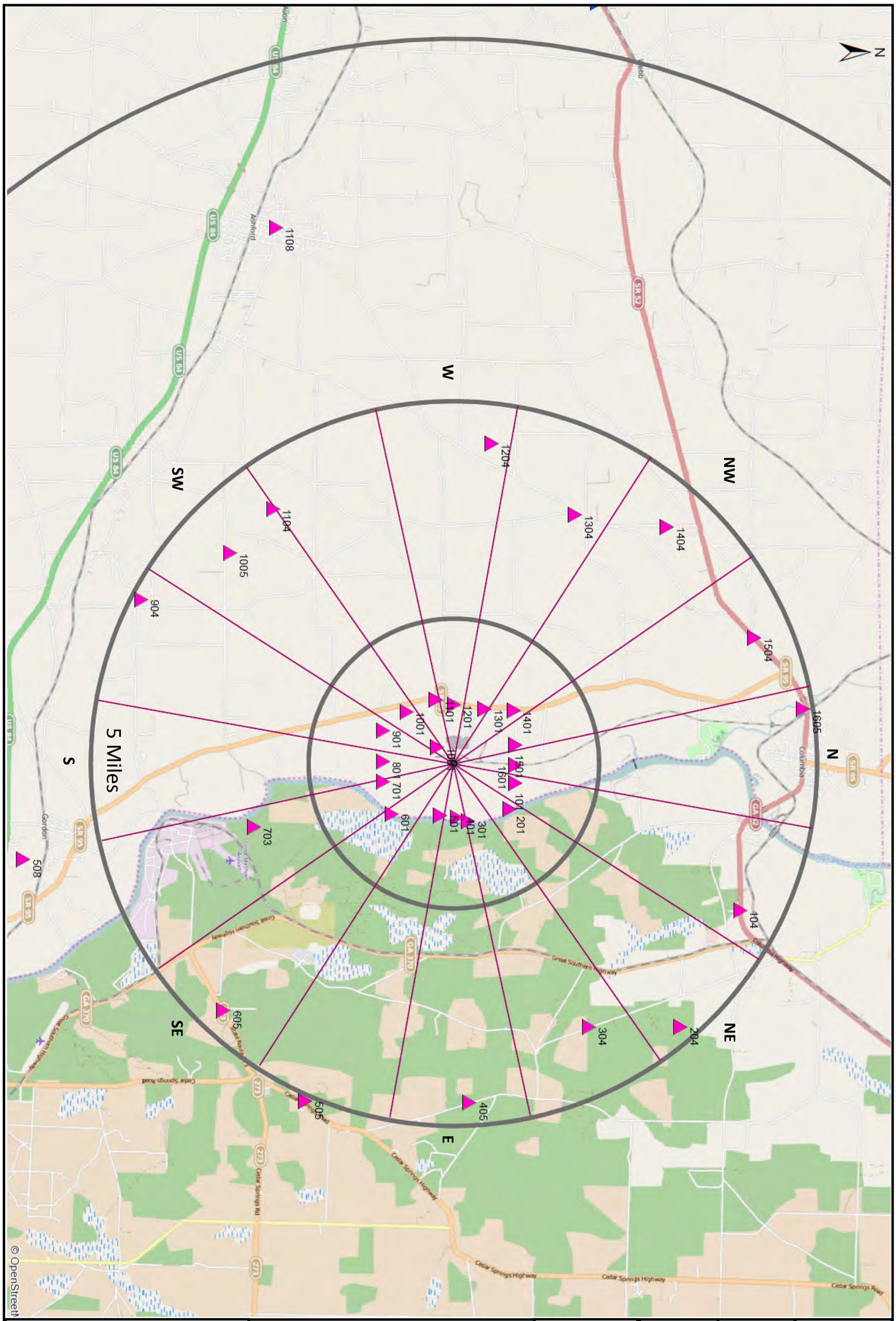
APPENDIX

Maps



Legend:

Indicator Stations - ▲

Joseph M. Farley Nuclear Plant

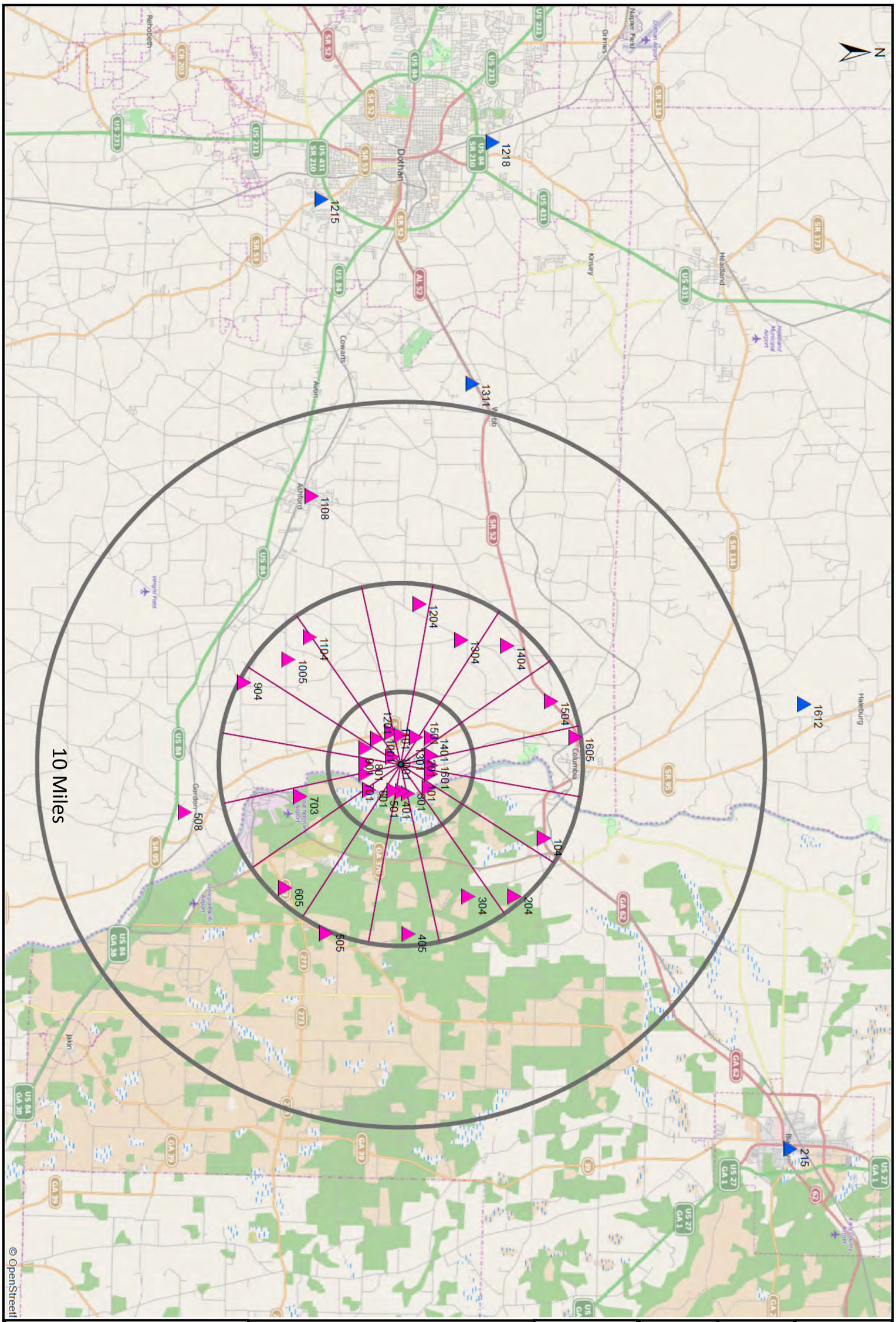
2014 Annual Radiological Environmental Report

REMP Stations in Plant Vicinity

Drawn by:	C. Groce
April 30, 2015	

Appendix A

Map A-1



Legend:

Indicator Stations -

Control Stations -

Joseph M. Farley Nuclear Plant

2014 Annual Radiological Environmental Report

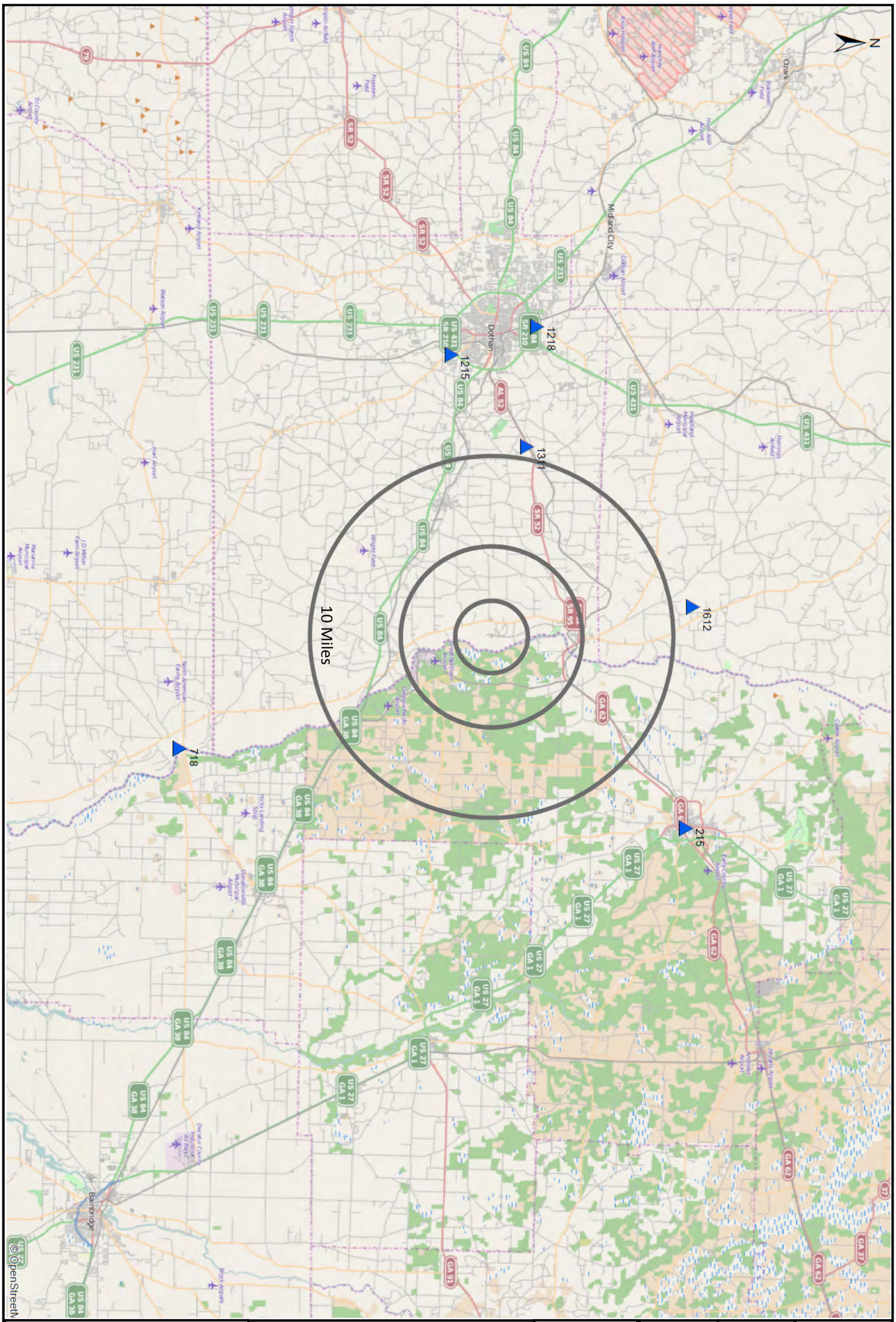
REMP Stations within 10 miles

Drawn by: C. Groce

April 30, 2015

Appendix A

Map A-2



Legend:

Control Stations - ▲

Joseph M. Farley Nuclear Plant

2014 Annual Radiological Environmental Report

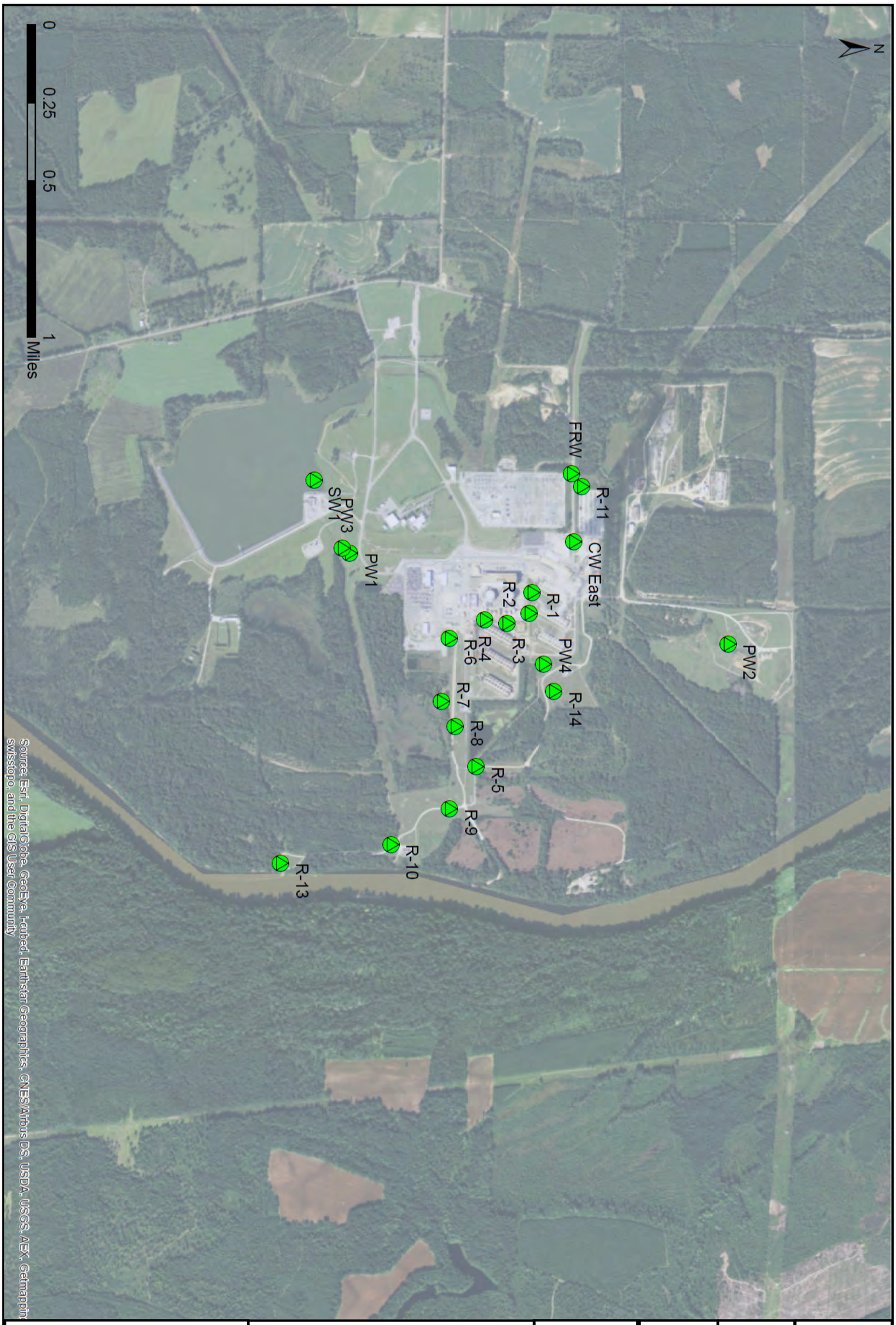
Extended REMP Stations

Drawn by: C. Groce

April 30, 2015

Appendix A

Map A-3



Legend:

Groundwater Wells -

Joseph M. Farley Nuclear Plant

2014 Annual Radiological Environmental Report

Facility Groundwater Wells

Drawn by: C. Groce

April 30, 2015

Appendix A

Map A-4

Edwin I. Hatch Nuclear Plant – Units 1 & 2
Joseph M. Farley Nuclear Plant– Units 1 & 2
Vogtle Electric Generating Plant– Units 1 & 2
Annual Radiological Environmental Operating Reports for 2014

Enclosure 3

Vogtle Annual Radiological Environmental Operating Report for 2014

VOGTLE ELECTRIC GENERATING PLANT

2014 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

SOUTHERN COMPANY

VOGTLE ELECTRIC GENERATING PLANT

2014 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

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Appendix – Maps

A-1 – REMP Stations in Plant Vicinity
A-2 – REMP Stations within 5 Miles
A-3 – Extended REMP Stations
A-4 – Facility Groundwater Wells

LIST OF ACRONYMS

AREOR	Annual Radiological Environmental Operating Report
ASTM	American Society for Testing and Materials
CL	Confidence Level
EPA	Environmental Protection Agency
GPC	Georgia Power Company
GPCEL	Georgia Power Company Environmental Laboratory
ICP	Interlaboratory Comparison Program
MDC	Minimum Detectable Concentration
MDD	Minimum Detectable Difference
MWe	MegaWatts Electric
NA	Not Applicable
NDM	No Detectable Measurement(s)
NEI	Nuclear Energy Institute
NRC	Nuclear Regulatory Commission
ODCM	Offsite Dose Calculation Manual
OSL	Optically Stimulated Luminescence
Po	Preoperation
PWR	Pressurized Water Reactor
REMP	Radiological Environmental Monitoring Program
RL	Reporting Level
RM	River Mile
SNC	Southern Nuclear Operating Company
SRS	Savannah River Site
TLD	Thermoluminescent Dosimeter
TS	Technical Specification
VEGP	Alvin W. Vogtle Electric Generating Plant

1 INTRODUCTION

The Radiological Environmental Monitoring Program (REMP) is conducted in accordance with Chapter 4 of the Offsite Dose Calculation Manual (ODCM). The REMP activities for 2014 are reported herein in accordance with Technical Specification (TS) 5.6.2 and ODCM 7.1.

The objectives of the REMP are to:

1) Determine the levels of radiation and the concentrations of radioactivity in the environs and;
2) Assess the radiological impact (if any) to the environment due to the operation of the Alvin W. Vogtle Electric Generating Plant (VEGP).

The assessments include comparisons between results of analyses of samples obtained at locations where radiological levels are not expected to be affected by plant operation (control stations), areas of higher population (community stations), and at locations where radiological levels are more likely to be affected by plant operation (indicator stations), as well as comparisons between preoperational and operational sample results.

VEGP is owned by Georgia Power Company (GPC), Oglethorpe Power Corporation, the Municipal Electric Authority of Georgia, and the City of Dalton, Georgia. It is located on the southwest side of the Savannah River approximately 23 river miles upstream from the intersection of the Savannah River and U.S. Highway 301. The site is in the eastern sector of Burke County, Georgia, and across the river from Barnwell County, South Carolina. The VEGP site is directly across the Savannah River from the Department of Energy Savannah River Site (SRS). Unit 1, a Westinghouse Electric Corporation Pressurized Water Reactor (PWR), with a licensed core thermal power of 3626 MegaWatts (MWt), received its operating license on January 16, 1987 and commercial operation started on May 31, 1987. Unit 2, also a Westinghouse PWR rated for 3626 MWt, received its operating license on February 9, 1989 and began commercial operation on May 19, 1989. Both units were relicensed on June 3, 2009.

The pre-operational stage of the REMP began with initial sample collections in August of 1981. The transition from the pre-operational to the operational stage of the REMP occurred as Unit 1 reached initial criticality on March 9, 1987.

- A description of the REMP is provided in Section 2 of this report
- Section 3 provides a summary of the results and an assessment of any radiological impacts to the environment
- A summary of the land use census and the river survey are included in Section 4
- Conclusions are included in Section 5

2 REMP DESCRIPTION

The following section provides a description of the sampling and laboratory protocols associated with the REMP. Table 2-1 provides a summary of the sample types to be collected and the analyses to be performed in order to monitor the airborne, direct radiation, waterborne and ingestion pathways, and also summarizes the collection and analysis frequencies (in accordance with ODCM Section 4.2). Table 2-2 provides specific information regarding the station locations, their proximity to the plant, and exposure pathways. Additionally, the locations of the sampling stations are depicted on Maps A-1 through A-4 of the station locations included in the appendix of this report.

Georgia Power Company's Environmental Laboratory (GPCEL), located in Smyrna, Georgia collects and analyzes REMP samples.

Table 2-1. Summary Description of Radiological Environmental Monitoring Program

Exposure Pathway and/or	Number of Representative Samples and Sample Locations	Sampling/Collection Frequency	Type/Frequency of Analysis
Direct Radiation	40 routine monitoring stations with two or more dosimeters placed as follows: An inner ring of stations, one in each compass sector in the general area of the site boundary; An outer ring of stations, one in each compass sector at approximately five miles from the site; and Special interest areas, such as population centers, nearby recreation areas, and control stations	Quarterly	Gamma dose, quarterly
Airborne Radioiodine and Particulates	Samples from seven locations: Five locations close to the site boundary in different sectors; A community having the highest calculated annual average ground level D/Q; A control location near a population center at a distance of about 14 miles	Continuous sampler operation with sample collection weekly, or more frequently if required by dust loading	Radioiodine canister: I-131 analysis, weekly Particulate sampler: Gross beta analysis[1] following filter change and gamma isotopic analysis[2] of composite (by location), quarterly
Waterborne			
Surface[3]	One sample upriver Two samples downriver	Composite sample over one month period[4]	Gamma isotopic analysis[2], monthly Composite for tritium analysis, quarterly

Table 2-1. Summary Description of Radiological Environmental Monitoring Program

Exposure Pathway and/or	Number of Representative Samples and Sample Locations	Sampling/Collection Frequency	Type/Frequency of Analysis
Drinking	Two samples at each of the three nearest water treatment plants that could be affected by plant discharges Two samples at a control location	Composite sample of river water near the intake of each water treatment plant over two week period[4] when I-131 analysis is required for each sample; monthly composite otherwise; and grab sample of finished water at each water treatment plant every two weeks or monthly, as appropriate	I-131 analysis on each sample when the dose calculated for the consumption of the water is greater than 1 mrem per year[5]. Composite for gross beta and gamma isotopic analysis[2] on raw water, monthly. Gross beta, gamma isotopic and I-131 analyses on grab sample of finished water, monthly. Composite for tritium analysis on raw and finished water, quarterly
Groundwater	See Table 3-8 and Map A-4 for well locations	See Table 3-8 and Map A-4 for well locations. Quarterly sample; pump used to sample GW wells; grab sample from yard drains and ponds	Tritium, gamma isotopic, and field parameters (pH, temperature, conductivity, dissolved oxygen, oxidation/reduction potential, and turbidity) of each sample quarterly; Hard to detect radionuclides as necessary based on results of tritium and gamma
Shoreline Sediment	• One sample from downriver area with existing or potential recreational value • One sample from upriver area with existing or potential recreational value	Semiannually	Gamma isotopic analysis[2], semiannually
Ingestion			
Milk	Two samples from milking animals[6] at control locations at a distance of about 10 miles or more	Bimonthly	Gamma isotopic analysis[2,7], bimonthly

Table 2-1. Summary Description of Radiological Environmental Monitoring Program

Exposure Pathway and/or	Number of Representative Samples and Sample Locations	Sampling/Collection Frequency	Type/Frequency of Analysis
Fish	• At least one sample of any commercially or recreationally important species near the plant discharge • At least one sample of any commercially or recreationally important species in an area not influenced by plant discharges • At least one sample of any anadromous species near the plant discharge	Semiannually During spring spawning season	Gamma isotopic analysis[2] on edible portions, semiannually Gamma isotopic analysis[2] on edible portions, annually.
Grass or Leafy Vegetation	• One sample from two onsite locations near the site boundary in different sectors • One sample from a control location at a distance of about 17 miles	Monthly during growing season	Gamma isotopic analysis[2,7], monthly

Notes:
[1]Airborne particulate sample filters shall be analyzed for gross beta radioactivity 24 hours or more after sampling to allow for radon and thoron daughter decay. If gross beta activity in air particulate samples is greater than 10 times the yearly mean of control samples, gamma isotopic analysis shall be performed on the individual samples.
[2]Gamma isotopic analysis means the identification and quantification of gamma-emitting radionuclides that may be attributable to the effluents from the facility.
[3]Upriver sample is taken at a distance beyond significant influence of the discharge. Downriver samples are taken beyond but near the mixing zone.
[4]Composite sample aliquots shall be collected at time intervals that are very short (e.g., hourly) relative to the compositing period (e.g., monthly) to assure obtaining a representative sample.
[5]The dose shall be calculated for the maximum organ and age group, using the methodology and parameters in the ODCM.
[6]A milking animal is a cow or goat producing milk for human consumption.
[7]If the gamma isotopic analysis is not sensitive enough to meet the Minimum Detectable Concentration (MDC) for I-131, a separate analysis for I-131 may be performed.

Table 2-2. Radiological Environmental Sampling Locations

Station Number	Station Type	Descriptive Location	Direction[1]	Distance (miles)[1]	Radiation Sample Type
1	Indicator	River Bank	N	1.1	Direct
2	Indicator	River Bank	NNE	0.8	Direct
3	Indicator	Discharge Area	NE	0.6	Airborne
3	Indicator	River Bank	NE	0.7	Direct
4	Indicator	River Bank	ENE	0.8	Direct
5	Indicator	River Bank	E	1.0	Direct
6	Indicator	Plant Wilson	ESE	1.1	Direct
7	Indicator	Simulator Building	SE	1.7	Airborne, Direct, Vegetation
8	Indicator	River Road	SSE	1.1	Direct
9	Indicator	River Road	S	1.1	Direct
10	Indicator	Met Tower	SSW	0.9	Airborne
10	Indicator	River Road	SSW	1.1	Direct
11	Indicator	River Road	SW	1.2	Direct
12	Indicator	River Road	WSW	1.2	Airborne, Direct
13	Indicator	River Road	W	1.3	Direct
14	Indicator	River Road	WNW	1.8	Direct
15	Indicator	Hancock Landing Road	NW	1.5	Direct, Vegetation
16	Indicator	Hancock Landing Road	NNW	1.4	Airborne, Direct
17	Other	Sav. River Site (SRS), River Road	N	5.4	Direct
18	Other	SRS, D Area	NNE	5.0	Direct
19	Other	SRS, Road A.13	NE	4.6	Direct
20	Other	SRS, Road A.13.1	ENE	4.8	Direct
21	Other	SRS, Road A.17	E	5.3	Direct

Table 2-2. Radiological Environmental Sampling Locations

Station Number	Station Type	Descriptive Location	Direction[1]	Distance (miles)[1]	Radiation Sample Type
22	Other	River Bank	ESE	5.2	Direct
23	Other	River Road	SE	4.6	Direct
24	Other	Chance Road	SSE	4.9	Direct
25	Other	Chance Road near Highway 23	S	5.2	Direct
26	Other	Highway 23 and Ebenezer Church Road	SSW	4.6	Direct
27	Other	Highway 23 opposite Boll Weevil Road	SW	4.7	Direct
28	Other	Thomas Road	WSW	5.0	Direct
29	Other	Claxton-Lively Road	W	5.1	Direct
30	Other	Nathaniel Howard Road	WNW	5.0	Direct
31	Other	River Road at Allen's Chapel Fork	NW	5.0	Direct
32	Other	River Bank	NNW	4.7	Direct
35	Other	Girard	SSE	6.6	Airborne, Direct
36	Control	GPC Waynesboro Op. HQ	WSW	13.9	Airborne, Direct
37	Control	Substation, Waynesboro, GA	WSW	16.7	Direct, Vegetation
43	Other	Employee's Rec. Center	SW	2.2	Direct
47	Control	Oak Grove Church	SE	10.4	Direct
48	Control	McBean Cemetery	NW	10.2	Direct
51	Control	SGA School, Sardis, GA	S	11.0	Direct
52	Control	Oglethorpe Substation; Alexander, GA	SW	10.7	Direct
80	Control	Augusta Water Treatment Plant	NNW	29.0	Drinking Water[2]
81	Control	Sav. River	N	2.5	Fish[3] Sediment[4]
82	Control	Sav. River (RM 151.2)	NNE	0.8	River Water
83	Indicator	Sav. River (RM 150.4)	ENE	0.8	River Water Sediment[4]

Table 2-2. Radiological Environmental Sampling Locations

Station Number	Station Type	Descriptive Location	Direction[1]	Distance (miles)[1]	Radiation Sample Type
84	Other	Sav. River (RM 149.5)	ESE	1.6	River Water
85	Indicator	Sav. River	ESE	4.3	Fish[3]
87	Indicator	Beaufort-Jasper County Water Treatment Plant	SE	76	Drinking Water[5]
88	Indicator	Cherokee Hill Water Treatment Plant, Port Wentworth, GA	SSE	72	Drinking Water[6]
89	Indicator	Purrysburg Water Treatment Plant; Purrysburg, SC	SSE	76	Drinking Water[7]
98	Control	W.C. Dixon Dairy	SE	9.8	Milk[8]
101	Indicator	Girard Dairy	S	5.5	Milk[8]
102	Control	Seven Oaks Dairy	W	7.5	Milk[8]

Notes:

[1]Direction and distance are determined from a point midway between the two reactors.

[2]The intake for the Augusta Water Treatment Plant is located on the Augusta Canal. The entrance to the canal is at River Mile (RM) 207 on the Savannah River. The canal effectively parallels the river. The intake to the pumping station is about 4 miles down the canal.

[3]A 5-mile stretch of the river is generally needed to obtain adequate fish samples. Samples are normally gathered between RM 153 and 158 for upriver collections and between RM 144 and 149.4 for downriver collections.

[4]Sediment is collected at locations with existing or potential recreational value. Because high water, shifting of the river bottom, or other reasons could cause a suitable location for sediment collections to become unavailable or unsuitable, a stretch of the river between RM 148.5 and 150.5 was designated for downriver collections while a stretch between RM 153 and 154 was designated for upriver collections. In practice, collections are normally made at RM 150.2 for downriver collections and RM 153.3 for upriver collections.

[5]The intake for the Beaufort-Jasper County Water Treatment Plant is located at the end of canal that begins at RM 39.3 on the Savannah River. This intake is about 16 miles by line of sight down the canal from its beginning on the Savannah River.

[6]The intake for the Cherokee Hill Water Treatment Plant is located on Abercorn Creek which is about one and a quarter creek miles from its mouth on the Savannah River at RM 29.

[7]The intake for the Purrysburg Water Treatment Plant is located on the same canal as the Beaufort-Jasper Water Treatment Plant. The Purrysburg intake is closer to the Savannah River at the beginning of the canal.

[8]Girard Dairy is considered an indicator station since it is the closest dairy to the plant (~5.5 miles). Dixon Dairy went out of business in June 2009 and Seven Oaks Dairy (~7.5 miles) was added as a replacement and is considered a control station even though a control station is typically 10 miles or greater.

3 RESULTS SUMMARY

Included in this section are statistical evaluations of the laboratory results, comparison of the results by media, and a summary of the anomalies and deviations. Overall, 964 analyses were performed across nine exposure pathways. Tables and figures are provided throughout this section to provide an enhanced presentation of the information.

In recent history, man-made nuclides have been released into the environment and have resulted in wide spread distribution of radionuclides across the globe. For example, atmospheric nuclear weapons tests from the mid-1940s through 1980 distributed man-made nuclides around the world. The most recent atmospheric tests in the 1970s and in 1980 had a significant impact upon the radiological concentrations found in the environment prior to and during pre-operation, and through early operation. Some long lived radionuclides, such as Cs-137, continue to be detected and a portion of these detections are believed to be attributed to the nuclear weapons tests.

Additionally, data associated with certain radiological effects created by off-site events have been removed from the historical evaluation, this includes: the nuclear atmospheric weapon test in the fall of 1980; the Chernobyl incident in the spring of 1986; and abnormal releases from the Savannah River Site (SRS) during 1987 and 1991.

As indicated in ODCM 7.1.2.1, the results for naturally occurring radionuclides that are also found in plant effluents must be reported along with man-made radionuclides. Historically, the radionuclide Be-7, which occurs abundantly in nature, is often detected in REMP samples, and occasionally detected in the plant's liquid and gaseous effluents. When it is detected in effluents and REMP samples, it is also included in the REMP results. In 2014, Be-7 was not detected in any plant effluents and therefore is not included in this report. The Be-7 detected in select REMP samples likely represents naturally occurring and/or background conditions.

As part of the data evaluation process, SNC considered the impact of the non-plant associated nuclides along with a statistical evaluation of the REMP data. The statistical evaluations included within this report include the Minimum Detectable Concentration (MDC), the Minimum Detectable Difference (MDD), and Chauvenet's Criterion as described below.

Minimum Detectable Concentration

The minimum detectable concentration is defined as an estimate of the true concentration of an analyte required to give a specified high probability that the measured response will be greater than the critical value.

Minimum Detectable Difference

The Minimum Detectable Difference (MDD) compares the lowest significant difference (between the means) of a control station, versus an indicator station or a community station, that can be determined statistically at the 99% Confidence Level (CL). A difference in mean values which was less than the MDD was considered to be statistically indiscernible.

Chauvenet's Criterion

All results were tested for conformance with Chauvenet's criterion (G. D. Chase and J. L. Rabinowitz, Principles of Radioisotope Methodology, Burgess Publishing Company, 1962, pages 87-90) to identify values which differed from the mean of a set by a statistically significant amount. Identified outliers were investigated to determine the reason(s) for the difference. If equipment malfunction or other valid physical reasons were identified as causing the variation, the anomalous result was excluded from the data set as non-representative.

The 2014 results were compared with past results, including those obtained during pre-operation. As appropriate, results were compared with their MDC (listed in Table 3-1) and RL which is listed in Table 3-2. The required MDCs were achieved during laboratory sample analysis. No data points were excluded for violating Chauvenet's criterion.

Table 3-1. Radiological Environmental Monitoring Program Annual Summary

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Minimum Detectable Concentration (MDC) (a)	Indicator Locations Mean (b), Range (Fraction)	Location with the Highest Annual Mean		Other Stations (f) Mean (b), Range (Fraction)	Control Locations Mean (b), Range (Fraction)
				Name Distance and Direction	Mean (b), Range (Fraction)		
Airborne Particulates (fCi/m3)	Gross Beta 356	10	24.1 4.2-42.9 (254/254)	Hancock Landing Road NNW 1.4 mi.	25.3 7.0-42.9 (51/51)	23.5 7.3-39.9 (51/51)	23.4 12.4-39 (51/51)
	Gamma Isotopic 28						
	I-131	70	NDM(c)		NDM	NDM	NDM
	Cs-134	50	NDM		NDM	NDM	NDM
	Cs-137	60	NDM		NDM	NDM	NDM
Airborne Radioiodine (fCi/m3)	I-131 98	70	NDM		NDM	NDM	NDM
Direct Radiation (mR/91 days)	Gamma Dose 160		13.1 8.1-18 (64/64)	SRS, Road A.13.1 ENE 4.8 mi.	17.3 16.3-19.6 (4/4)	13.6 10.8-16.8 (72/72)	13.2 8.4-19.6 (24/24)
Milk (pCi/l)	Gamma Isotopic 14						
	I-131	1	NDM		NDM		NDM
	Cs-134	15	NDM		NDM		NDM
	Cs-137	18	NDM		NDM		NDM
	Ba-140	60	NDM		NDM		NDM
	La-140	15	NDM		NDM		NDM
Vegetation (pCi/kg-wet)	Gamma Isotopic 37						

Table 3-1. Radiological Environmental Monitoring Program Annual Summary

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Minimum Detectable Concentration (MDC) (a)	Indicator Locations Mean (b), Range (Fraction)	Location with the Highest Annual Mean		Other Stations (f) Mean (b), Range (Fraction)	Control Locations Mean (b), Range (Fraction)
				Name Distance and Direction	Mean (b), Range (Fraction)		
	I-131	60	NDM				NDM
	Cs-134	60	NDM				NDM
	Cs-137	80	0-14.9 (1/24)	Simulator Building SE, 1.7 miles	0-14.9 (1/24)		NDM
River Water (pCi/l)	Gamma Isotopic 36						
	Be-7	124(d)	NDM		NDM	NDM	NDM
	Mn-54	15	NDM		NDM	NDM	NDM
	Fe-59	30	NDM		NDM	NDM	NDM
	Co-58	15	NDM		NDM	NDM	NDM
	Co-60	15	NDM		NDM	NDM	NDM
	Zn-65	30	NDM		NDM	NDM	NDM
	Zr-95	30	NDM		NDM	NDM	NDM
	Nb-95	15	NDM		NDM	NDM	NDM
	I-131	15	NDM		NDM	NDM	NDM
	Cs-134	15	NDM		NDM	NDM	NDM
	Cs-137	18	NDM		NDM		
	Ba-140	60	NDM		NDM		
	La-140	15	NDM		NDM		
	Tritium 12	2000	1399 790-2700 (4/4)	Savannah River (RM 150.4)	1399 790-2700 (4/4)	606 377-940 (4/4)	152 80.7-286 (3/4)

Table 3-1. Radiological Environmental Monitoring Program Annual Summary

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Minimum Detectable Concentration (MDC) (a)	Indicator Locations Mean (b), Range (Fraction)	Location with the Highest Annual Mean		Other Stations (f) Mean (b), Range (Fraction)	Control Locations Mean (b), Range (Fraction)
				Name Distance and Direction	Mean (b), Range (Fraction)		
Water Near Intakes to Water Treatment Plants (pCi/l)	Gross Beta 43	4	2.8 0-7.9 (33/36)	Purrysburg Water Treatment Plant, Purrysburg, SC, SSE, 76 miles	3.8 0-7.9 (11/12)		1.9 0-3.7 (10/12)
	Gamma Isotopic 48						
	Be-7	124(d)	NDM		NDM		NDM
	Mn-54	15	NDM		NDM		NDM
	Fe-59	30	NDM		NDM		NDM
	Co-58	15	NDM		NDM		NDM
	Co-60	15	NDM		NDM		NDM
	Zn-65	30	NDM		NDM		NDM
	Zr-95	30	NDM		NDM		NDM
	Nb-95	15	NDM		NDM		NDM
	I-131	15	NDM		NDM		NDM
	Cs-134	15	NDM		NDM		NDM
	Cs-137	18	NDM		NDM		NDM
	Ba-140	60	NDM		NDM		NDM
	La-140	15	NDM		NDM		NDM
	Tritium 16	2000	370.8 170-520 (12/12)	Purrysburg Water Treatment Plant, Purrysburg, SC, SSE, 76 miles	396.8 245-520 (4/4)		137 78.9-174 (4/4)

Table 3-1. Radiological Environmental Monitoring Program Annual Summary

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Minimum Detectable Concentration (MDC) (a)	Indicator Locations Mean (b), Range (Fraction)	Location with the Highest Annual Mean		Other Stations (f) Mean (b), Range (Fraction)	Control Locations Mean (b), Range (Fraction)
				Name Distance and Direction	Mean (b), Range (Fraction)		
Finished Water at Water Treatment Plants (pCi/l)	Gross Beta 48	4	2.2 0-5.3 (33/36)	Augusta Water Treatment Plant, NNW, 29 mi.	5.7 0-9.6 (11/12)		5.7 0-9.6 (11/12)
	Gamma Isotopic 48						
	Be-7	124(d)	NDM		NDM		NDM
	Mn-54	15	NDM		NDM		NDM
	Fe-59	30	NDM		NDM		NDM
	Co-58	15	NDM		NDM		NDM
	Co-60	15	NDM		NDM		NDM
	Zn-65	30	NDM		NDM		NDM
	Zr-95	30	NDM		NDM		NDM
	Nb-95	15	NDM		NDM		NDM
	I-131	15	NDM		NDM		NDM
	Cs-134	15	NDM		NDM		NDM
	Cs-137	18	NDM		NDM		NDM
	Ba-140	60	NDM		NDM		NDM
	La-140	15	NDM		NDM		NDM
	Tritium 16	2000	380.1 192-701 (12/12)	Beaufort-Jasper County Water Treatment Plant, SE, 76 miles	444.5 212-530 (4/4)		136.1 51.4-190 (3/4)
Anadromous Fish (pCi/kg-wet)	Gamma Isotopic 1						
	Be-7	655(d)			NDM		NDM

Table 3-1. Radiological Environmental Monitoring Program Annual Summary

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Minimum Detectable Concentration (MDC) (a)	Indicator Locations Mean (b), Range (Fraction)	Location with the Highest Annual Mean		Other Stations (f) Mean (b), Range (Fraction)	Control Locations Mean (b), Range (Fraction)
				Name Distance and Direction	Mean (b), Range (Fraction)		
	Mn-54	130			NDM		NDM
	Fe-59	260			NDM		NDM
	Co-58	130			NDM		NDM
	Co-60	130			NDM		NDM
	Zn-65	260			NDM		NDM
	Cs-134	130			NDM		NDM
	Cs-137	150			NDM		NDM
Fish (pCi/kg-wet)	Gamma Isotopic 4						
	Be-7	655(d)	NDM				NDM
	Mn-54	130	NDM				NDM
	Fe-59	260	NDM				NDM
	Co-58	130	NDM				NDM
	Co-60	130	NDM				NDM
	Zn-65	260	NDM				NDM
	Cs-134	130	NDM				NDM
	Cs-137	150	32.7 27.8-37.7 (2/3)	Savannah River, N, 2.5 Miles	13.9 0-41.6 (1/3)		13.9 0-41.6 (1/3)
Sediment (pCi/kg-dry)	Gamma Isotopic 4						
	Co-60	70(e)	NDM				NDM
	Cs-134	150	NDM				NDM

Table 3-1. Radiological Environmental Monitoring Program Annual Summary

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Minimum Detectable Concentration (MDC) (a)	Indicator Locations Mean (b), Range (Fraction)	Location with the Highest Annual Mean		Other Stations (f) Mean (b), Range (Fraction)	Control Locations Mean (b), Range (Fraction)
				Name Distance and Direction	Mean (b), Range (Fraction)		
	Cs-137	180	114.6 86.8-154.5 (3/3)	Savannah River (RM 150.4), ENE, 0.8 miles	114.6 86.8-154.5 (3/3)		77.1 65.9-88.3 (2/2)

Notes:
(a)The MDC is defined in ODCM 10.1. Except as noted otherwise, the values listed in this column are the detection capabilities required by ODCM Table 4-3. The values listed in this column are a priori (before the fact) MDCs. In practice, the a posteriori (after the fact) MDCs are generally lower than the values listed.
(b) Mean and range are based upon detectable measurements only. The fraction of all measurements at a specified location that are detectable is placed in parenthesis.
(c) No Detectable Measurement(s) (NDM).
(d) The Georgia Power Company Environmental Laboratory has determined that this value may be routinely attained under normal conditions. No value is provided in ODCM Table 4-3.
(e) Item 3 of ODCM Table 4-1 implies that an I-131 analysis is not required to be performed on water samples when the dose calculated from the consumption of water is less then 1 mrem per year. However, I-131 analyses have been performed on the finished drinking water samples.
(f) "Other" stations, as identified in the "Station Type" column of Table 2-2, are "Community" and/or "Special" stations.
Not Applicable (sample not required)

Table 3-2. Reporting Levels (RL)

Analysis	Water (pCi/l)	Airborne Particulate or Gases (fCi/m3)	Fish (pCi/kg-wet)	Milk (pCi/l)	Grass or Leafy Vegetation (pCi/kg-wet)
H-3	20000[a]				
Mn-54	1000		30,000		
Fe-59	400		10,000		
Co-58	1000		30,000		
Co-60	300		10,000		
Zn-65	300		20000		
Zr-95	400				
Nb-95	700				
I-131	2[b]	900		3	100
Cs-134	30	10,000	1000	60	1000
Cs-137	50	20000	2000	70	2000
Ba-140	200			300	
La-140	100			400	

[a] This is the 40 CFR 141 value for drinking water samples. If no drinking water pathway exists, a value of 30,000 may be used.
[b] If no drinking water pathway exists, a value of 20 pCi/l may be used.

In accordance with ODCM 4.1.1.2.1, deviations from the required sampling schedule are permitted, if samples are unobtainable due to hazardous conditions, unavailability, inclement weather, equipment malfunction or other just reasons. Deviations from conducting the REMP sampling (as described in Table 2-1) are summarized in Table 3-3 along with their causes and resolution.

Table 3-3. Anomalies and Deviations from Radiological Environmental Monitoring Program

Collection Period	Affected Samples	Anolmaly (A)* or Deviation (D)**	Cause	Resolution
01/14/14-01/28/14 CR 768165	Milk Station 102 (Seven Oaks)	(D) Milk sample failed to meet MDC	Ice storm caused GPC lab to close for several days. Milk sample hold time is typically <2 days.	Milk was resampled on 02/04/14 from Seven Oaks to replace sample.
02/11/14-02/18/14 CR 775962	Air I, Air Part. Stations 3 (Discharge), 7 (Simulator), 12 (River Road), 35 (Girard), 36 (Waynesboro)	(A) Low sample volume	Loss of power to entire area due to ice storm.	Power restored to all stations. Sample volumes were low but acceptable per GPCEL sampling procedure.
02/11/14-02/18/14 CR 775962	Air I, Air Part. Stations 16 (Hancock)	(D) No sample obtained	Loss of power to entire area due to ice storm.	Power was not restored to this station by the end of the sampling period. No sample obtained.
First half of 2014 CR 826087	Sediment River Station 1502	(A) Unexpected isotope present in sample	No apparent cause to presence of Co-58 in sediment.	Very low levels; future samples observed closely for presence of this isotope.
07/29/14-08/12/14	Milk Station 101 (Girard), 102 (Seven Oaks)	(D) No samples obtained	Milk trucks had completely drained the milk tanks prior to arrival to collect the samples.	No milk samples were obtained for this sampling period.

* An anomaly is considered a non-standard sample that still meets sampling criteria outlined in SNC and Georgia Power Labs procedures.
** A deviation is a sample result that is not recorded due to not meeting scheduling and/or procedural requirements as outlined by SNC and Georgia Power Labs

3.1 Airborne Particulates

As specified in Table 2-1, airborne particulate filters and charcoal canisters are collected weekly at five indicator stations (Stations 3, 7, 10, 12 and 16) which encircle the plant at the site periphery, at a nearby community station (Station 35) approximately seven miles from the plant, and at a control station (Station 36) which is approximately 14 miles from the plant. At each location, air is continuously drawn through a glass fiber filter to retain airborne particulate and an activated charcoal canister is placed in series with the filter to adsorb radioiodine.

3.1.1 Gross Beta

As provided in Table 3-1, the 2014 annual average weekly gross beta activity was 24.1 fCi/m3 for the indicator stations. It was 0.7 fCi/m3 more than the control station average of 23.4 fCi/m3 for the year. This difference is not statistically discernible, since it is less than the calculated MDD of 3.6 fCi/m3.

The 2014 annual average weekly gross beta activity at the Girard community station was 23.5 fCi/m3 which was 0.1 fCi/m3 more than the control station average. This difference is not statistically discernible since it is less than the calculated MDD of 8.7 fCi/m3.

Average Air Gross Beta historical data (Table 3-4) is graphed to show trends associated with a prevalent exposure pathway (Figure 3-1). In general, there is close agreement between the results for the indicator, control and community stations. This close agreement supports the position that the plant is not contributing significantly to the gross beta concentrations in air.

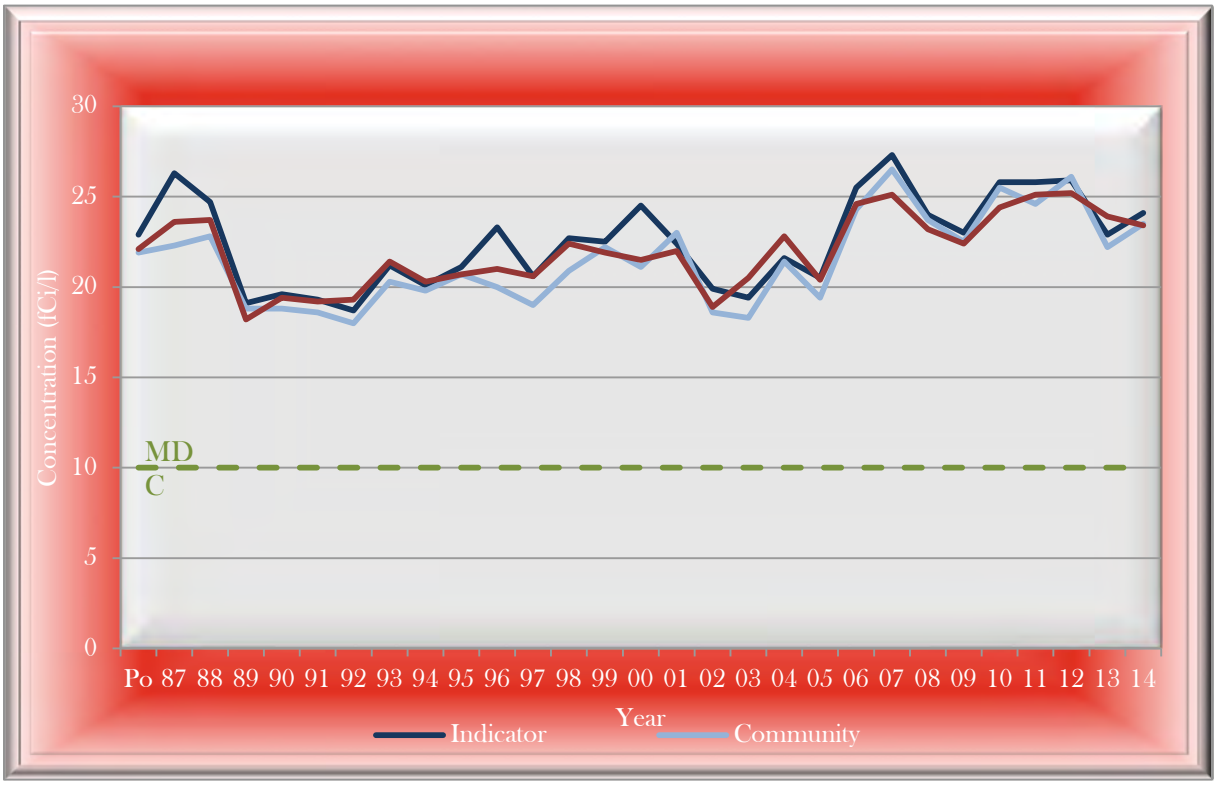
Table 3-4. Average Weekly Gross Beta Air Concentration

Period	Indicator (fCi/m3)	Control (fCi/m3)	Community (fCi/m3)
Pre-op	22.9	22.1	21.9
1987	26.3	23.6	22.3
1988	24.7	23.7	22.8
1989	19.1	18.2	18.8
1990	19.6	19.4	18.8
1991	19.3	19.2	18.6
1992	18.7	19.3	18.0
1993	21.2	21.4	20.3
1994	20.1	20.3	19.8
1995	21.1	20.7	20.7
1996	23.3	21.0	20.0
1997	20.6	20.6	19.0
1998	22.7	22.4	20.9

Table 3-4. Average Weekly Gross Beta Air Concentration

Period	Indicator (fCi/m3)	Control (fCi/m3)	Community (fCi/m3)
1999	22.5	21.9	22.2
2000	24.5	21.5	21.1
2001	22.4	22.0	22.7
2002	19.9	18.9	18.6
2003	19.4	20.5	18.3
2004	21.6	22.8	21.4
2005	20.5	20.4	19.4
2006	25.5	24.6	24.3
2007	27.3	25.1	26.5
2008	24.0	23.2	23.7
2009	23.0	22.4	22.5
2010	25.8	24.4	25.5
2011	25.8	25.1	24.6
2012	25.9	25.2	26.1
2013	22.9	23.9	22.2
2014	24.1	23.4	23.5

Figure 3-1. Average Weekly Gross Beta Air Concentration



3.1.2 Gamma Particulates

During 2014, no man-made radionuclides were detected from the gamma isotopic analysis of the quarterly composites of the air particulate filters.

Historically, gamma isotopes have been detected as a result of offsite events. During pre-operation, Cs-134, Cs-137 and I-131 were occasionally detected. In 1987, Cs-137 was found in one indicator composite at a concentration of 1.7 fCi/m3. Additionally, I-131 was also detected after the Fukushima incident in 2011, the highest I-131 result in 2011 was 93.8 fCi/m3, which is approximately 10% of the RL.

3.2 Direct Radiation

In 2014, direct (external) radiation was measured with Optically Stimulated Luminescent (OSL) dosimeters by placing two OSL badges at each station. The gamma dose at each station is reported as the average reading of the two badges. The badges are analyzed on a quarterly basis. An inspection is performed near mid-quarter for offsite badges to assure that the badges are on-station and to replace any missing or damaged badges.

Two direct radiation stations are established in each of the 16 compass sectors, to form two concentric rings. The inner ring (Stations 1 through 16) is located near the plant perimeter as shown in Map A-1 in the appendix and the outer ring (Stations 17 through 32) is located at a distance of approximately five miles from the plant as shown in Map A-2 in the appendix. The 16 stations forming the inner ring are designated as the indicator stations. The two ring configuration of stations was established in accordance with NRC Branch Technical Position “An Acceptable Radiological Environmental Monitoring Program”, Revision 1, November 1979. The six control stations (Stations 36, 37, 47, 48, 51 and 52) are located at distances greater than 10 miles from the plant as shown in Map A-3 in the appendix. Monitored special interest areas include Station 35 at the town of Girard and Station 43 at the employee recreational area. The mean and range values presented in the “Other” column in Table 3-1 includes the outer ring stations (stations 17 through 32) as well as stations 35 and 43.

As provided in Table 3-1, the 2014 average quarterly exposure at the indicator stations (inner ring) was 11.6 mR with a range of 5.6 to 17.7 mR. The indicator station average was 0.7 mR less than the control station average (12.3 mR). This difference is not statistically discernible since it is less than the MDD of 1.3 mR. Over the operational history, the annual average quarterly exposures shows a variation of no more than 0.7 mR between the indicator and control stations.

The quarterly exposures acquired at the community/other (outer ring) stations during 2014 ranged from 8.5 to 17.3 mR with an average of 12.0 mR which was 0.3 mR less than that for the

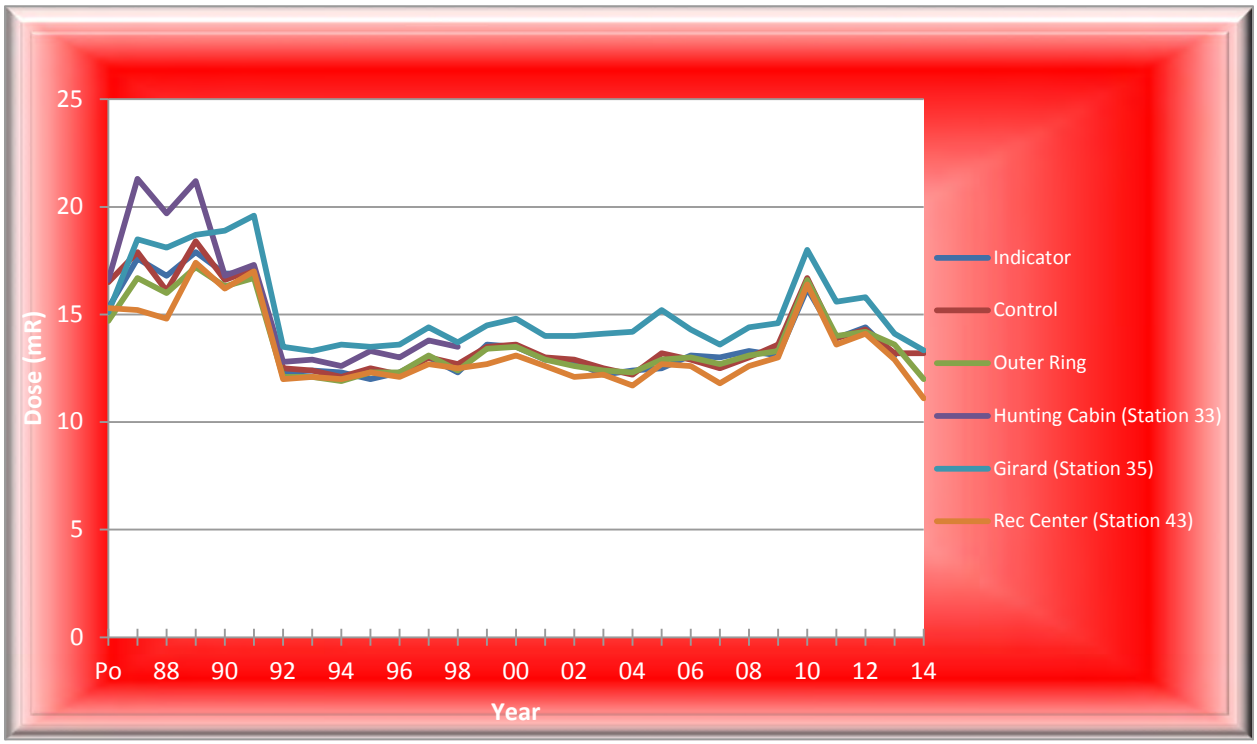
control stations. However, this difference is not discernible since it is less than the MDD of 1.1 mR. For the entire period of operation, the annual average quarterly exposures at the outer ring stations vary by no more than 1.2 mR from those at the control stations.

Average Direct Radiation historical data (Table 3-5) is graphed to show trends associated with a prevalent exposure pathway (Figure 3-2). The decrease between 1991 and 1992 values is attributed to a change in TLDs from Teledyne to Panasonic. It should be noted however that the differences between indicator and control and outer ring values did not change.

Table 3-5. Average Quarterly Exposure from Direct Radiation

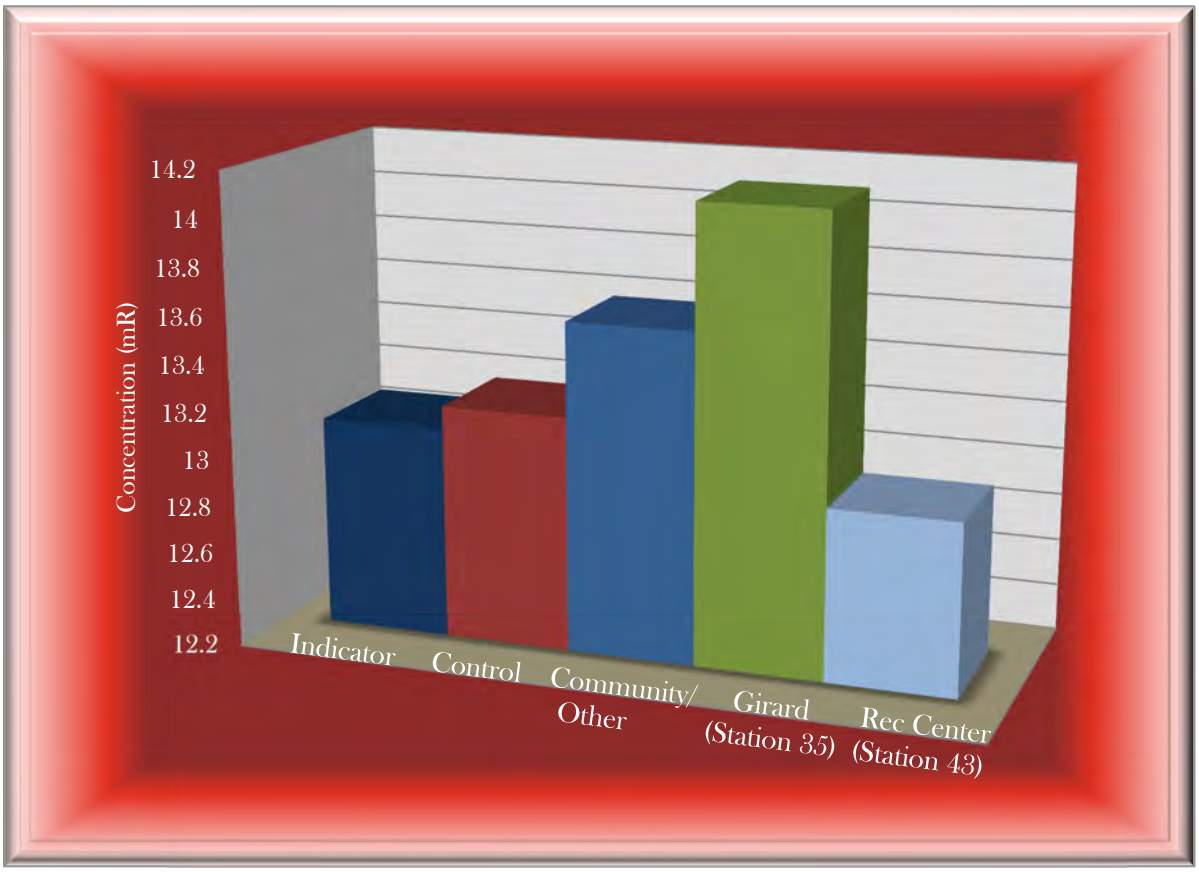
Period	Indicator (mR)	Control (mR)	Outer Ring (mR)
Pre-op	15.3	16.5	14.7
1987	17.6	17.9	16.7
1988	16.8	16.1	16.0
1989	17.9	18.4	17.2
1990	16.9	16.6	16.3
1991	16.9	17.1	16.7
1992	12.3	12.5	12.1
1993	12.4	12.4	12.1
1994	12.3	12.1	11.9
1995	12.0	12.5	12.3
1996	12.3	12.2	12.3
1997	13.0	13.0	13.1
1998	12.3	12.7	12.4
1999	13.6	13.5	13.4
2000	13.5	13.6	13.5
2001	12.9	13.0	12.9
2002	12.8	12.9	12.6
2003	12.2	12.5	12.4
2004	12.4	12.2	12.3
2005	12.5	13.2	12.9
2006	13.1	12.9	13.0
2007	13.0	12.5	12.7
2008	13.3	13.0	13.1
2009	13.1	13.6	13.3
2010	16.2	16.7	16.6
2011	13.9	13.9	14.0
2012	14.4	14.3	14.2
2013	13.1	13.2	13.6
2014	11.6	12.3	12.0

Figure 3-2. Average Quarterly Exposure from Direct Radiation



The increase shown in 2010 reflects issues with the aging Panasonic TLD reader. The close agreement between the station groups supports the position that the plant is not contributing significantly to direct radiation in the environment. Figure 3-3 provides a more detailed view of the 2014 values. The values for the special interest areas detailed below indicate that Plant Vogtle did not significantly contribute to direct radiation at those areas.

Figure 3-3. 2014 Average Exposure from Direct Radiation



3.3 Biological Media

Cs-137 was the only radionuclide detected in two of the three biological media. As indicated in Figure 3-4, the Cs-137 activity levels are below the respective MDCs and well below that of the respective RLs for each sample media for both the indicator and control stations.

3.3.1 Milk

In accordance with Tables 2-1 and 2-2, milk samples are collected bimonthly from two locations, the Girard Dairy (Station 101) which is considered an indicator station because it is approximately 5.5 miles from Vogtle (ideally a milk indicator station is less than 5 miles from the plant), and the Seven Oaks Dairy (Station 102) at 7.5 miles from Vogtle is the control location (ideally control locations are greater than 10 miles from the plant). SNC identified Milky Way Dairy as a replacement control location. The ODCM is in the process of being revised

to include the Milky Way Dairy for sampling. No milk animal was found within five miles of Plant Vogtle during the 2014 land use census.

Gamma isotopic (including I-131 and Cs-137) analyses were performed on each collected milk sample and there were no detectable results for gamma isotopes. Figure 3-4 provides the 2014 Cs-137 concentration in milk.

3.3.2 Vegetation

In accordance with Tables 2-1 and 2-2, vegetation samples are collected monthly for gamma isotopic analyses at two indicator locations near the site boundary (Stations 7 and 15) and at one control station located about 17 miles WSW from the plant (Station 37). Cs-137 was detected (14.8 pCi/kg-wet) in a sample collected from the Simulator Building (Station 7). The man-made radionuclide Cs-137 is periodically identified in vegetation samples, and is generally attributed to offsite sources (such as weapons testing, Chernobyl, and Fukushima).

While Cs-137 and I-131 were periodically found and Co-60 was discovered once in vegetation samples during pre-operation, the historical trends and the relationship between the indicator and control stations demonstrate that plant operations are having no adverse impact to the environment. The sample results have consistently been well below the MDC and the RL for Cs-137 (80 and 2000 pCi/kg-wet, respectively).

During 2014, no other gamma isotopes were detected in any Vogtle REMP vegetation samples.

3.3.3 Fish

Fish samples were collected in accordance with the ODCM (as indicated in Table 2-1). For the semiannual collections, the control location (Station 81) extends from approximately two to seven miles upriver of the plant intake structure, and the indicator location (Station 85) extends from about 1.4 to seven miles downriver of the plant discharge structure.

3.3.3.1 Anadromous Species

For anadromous species, all fish sampled are considered indicator stations. Anadromous fish were sampled twice during 2014, on May 22 and December 5. No radionuclides were detected in the 2014 analyses, which is consistent with historical data.

3.3.3.2 Commercially or Recreationally Important Species

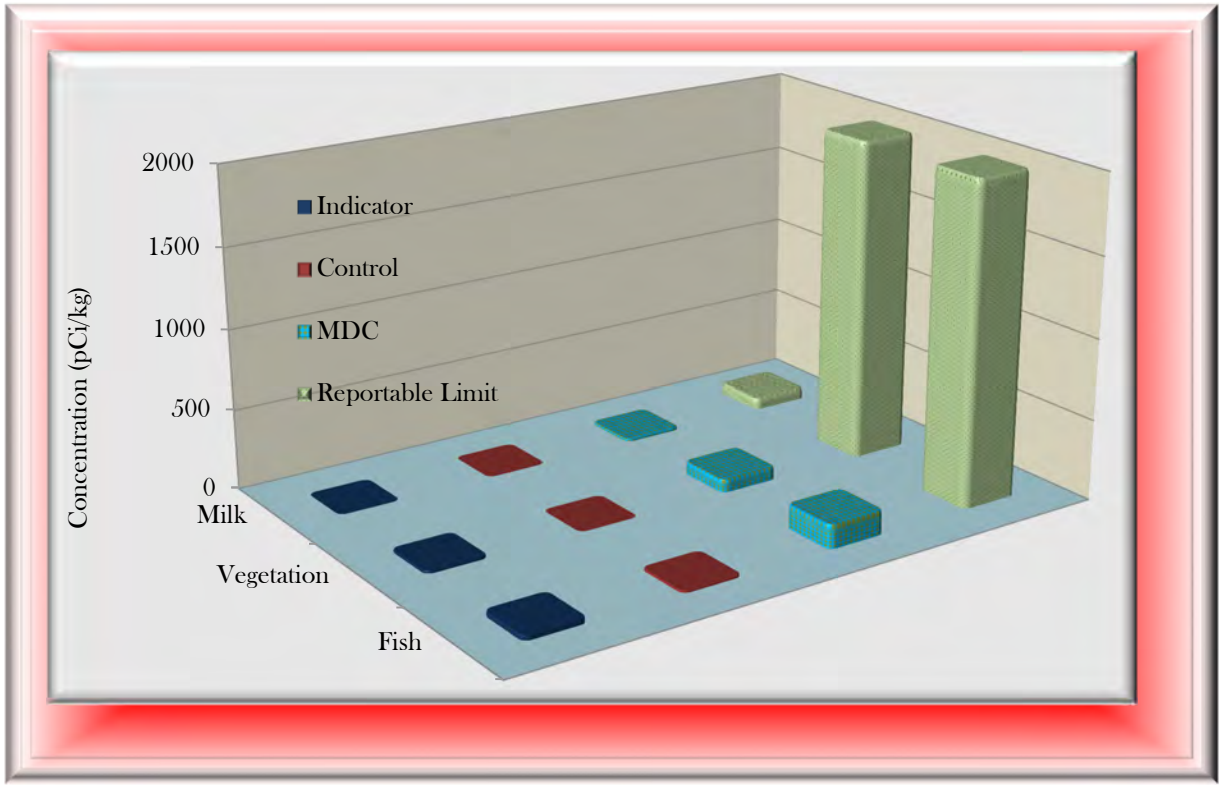
For this year, as provided in Table 3-1, Cs-137 was found in the semiannual collections of commercially or recreationally important species of fish (indicator and control). The indicator station averaged a Cs-137 concentration of 32.7 pCi/kg-wet, and 13.9 pCi/kg-wet was the

average Cs-137 detected at the control station. The difference of 18.8 pCi/kg-wet between the indicator and control stations is not statistically significant since it is less than the MDD of 41.1 pCi/kg-wet. No discernible difference between the indicator and control stations has occurred for any year of operation or during pre-operation. No other gamma nuclides were discovered in 2014.

3.3.4 Biological Media Summary

There were no statistical differences, trends, or anomalies associated with the 2014 biological media samples when compared to historical data. Figure 3-4 below, details the 2014 Cs-137 concentration compared to the Reportable Limits.

Figure 3-4. 2014 Biological Media Average Concentrations



3.4 Drinking Water

Samples are collected at an upstream control location and at three downstream indicator locations (shown on Map A-3) and further described in Table 2-2.

Water samples are taken near the intake of each water treatment plant (raw drinking water) using automatic composite samplers, which are collected monthly. Additionally, monthly grab samples of the processed water effluent from the treatment plants (finished drinking water) are collected. Monthly aliquots from the raw and processed drinking water are analyzed for gross beta and gamma isotopic activity. The monthly aliquots are also combined to form quarterly composites, which are analyzed for tritium.

For 2014, the indicator station average gross beta concentration in the raw drinking water was 2.77 pCi/l which was 0.87 pCi/l greater than the average gross beta concentration at the control station (1.90 pCi/l). This difference is not statistically discernible since it is less than the calculated MDD of 1.09 pCi/l. Historically, there has been close agreement between the gross beta values at the indicator stations and the control station which supports that there is no significant gross beta contribution from the plant effluents. The required MDC for gross beta in water is 4.0 pCi/l. There is no RL for gross beta in water.

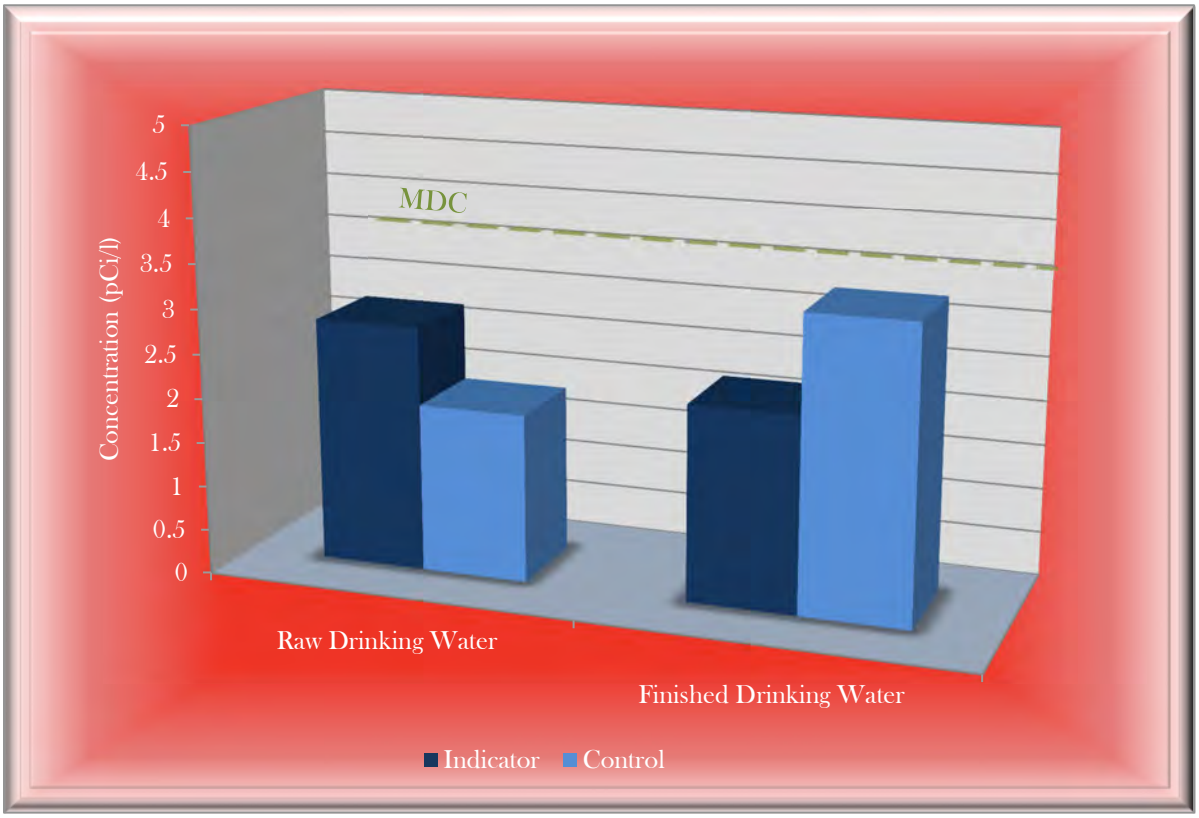
For 2014, the indicator station average gross beta concentration in the finished drinking water was 2.21 pCi/l which was 1.09 pCi/l less than the average gross beta concentration at the control station (3.30 pCi/l). The MDD was not calculated because the control station was higher than the indicator station. Figure 3-5 show the relationship between the average indicator station and average control station for 2014 and the comparison to the MDC.

As provided in Table 3-1, there were no positive results during 2014 from the gamma isotopic analysis of the raw and finished drinking water samples. The 2014 raw drinking water indicator stations average tritium concentration was 371 pCi/l which was 234 pCi/l greater than the average concentration found at the control station (137 pCi/l). The difference between the station averages was greater than the MDD (156 pCi/l), which indicates a statistically discernible difference. However, given the small difference, historical trends, and the concentrations being less than the MDC and RL (2000 pCi/l and 20000 pCi/l, respectively), no adverse environmental impact is evident.

A statistically significant increase in the concentrations found in samples collected at the indicator station compared to those collected at the control station could be indicative of plant releases. Concentrations found at the special station are more likely to represent the activity in the river as a whole, which might include plant releases combined with those from other sources along the river.

The finished drinking water average tritium concentration at the indicator stations during 2014 was 381 pCi/l which was 245 pCi/l greater than the average concentration found at the control station (136 pCi/l). MDD was calculated as 229 pCi/l between the indicator and control stations, indicating a statistically significant difference. However the small difference and historical trends do not indicate environmental impact.

Figure 3-5. 2014 Average Gross Beta Concentration in Raw and Finished Drinking Water



3.5 River Water

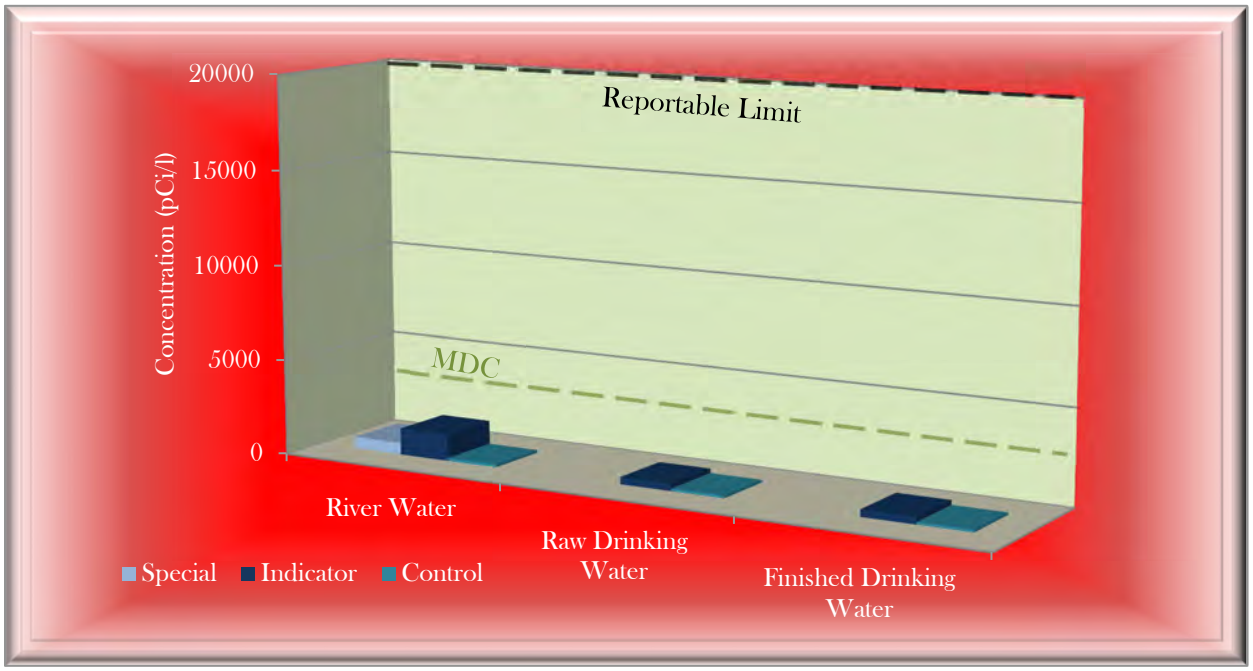
Composite river water samples are collected monthly at an upstream control location and at two downstream indicator locations (shown on Map A-3). The details of the sampling protocols are outlined in Tables 2-1 and Table 2-2. A gamma isotopic analysis is conducted on each monthly sample and the monthly aliquots are combined to form quarterly composite samples, which are analyzed for tritium.

As provided in Table 3-1, there were no positive results during 2014 from the gamma isotopic analysis of the river water samples. Also indicated in Table 3-1, the average tritium concentration found at the indicator station was 1399 pCi/l which was 1247 pCi/l greater than the average at the control station (152 pCi/l). The River Water tritium MDD was calculated to be 1195 pCi/l, which would indicate a value that is statistically discernible. Since the value is slightly above the MDD and below the MDC and the RL, no adverse environmental impact

exists. The MDC for tritium in river water used to supply drinking water is 2000 pCi/l and the RL is 20000 pCi/l.

At the "Other" river water sampling station (Station 84), the results ranged from 377 pCi/l to 940 pCi/l with an average of 607 pCi/l. The difference between the Station 84 and the control station was 521 pCi/l. The MDD was calculated to be 361 pCi/l, which would indicate a value that is statistically discernible. Since the value is slightly above the MDD and below the MDC and the RL, no adverse environmental impact exists. Historically, the relationship between the indicator and control stations, and Station 84 has remained consistent. Figure 3-6 below details the 2014 average tritium concentrations across the three water mediums.

Figure 3-6. 2014 Average Tritium Concentrations in River, Raw Drinking, and Finished Drinking Water



3.6 Sediment

Sediment was collected along the shoreline of the Savannah River in the spring and fall at Stations 81 and 83. Station 81 is a control station located about 2.5 miles upriver of the plant intake structure while Station 83 is an indicator station located about 0.6 miles downriver of the plant discharge structure. A gamma isotopic analysis was performed on each sample. The radionuclides detected in 2014 samples were Be-7 and Cs-137. Even though Be-7 was detected in sediment, it has not been discussed within this report, because it was not detected in any plant effluents and likely represents naturally occurring and/or background conditions.

For Cs-137, the average concentration at the indicator station during 2014 was 114.6 pCi/kg-dry which was 37.5 pCi/kg-dry greater than that at the control station (77.1 pCi/kg-dry). The difference between the average value at the indicator station and the average value at the control station is not statistically discernible since it is less than the calculated MDD of 66.6 pCi/kg-dry. However, the concentration of Cs-137 found at the indicator station could be attributed to plant effluents or to other facilities that release radioactive effluents in the vicinity of the plant.

Co-58 was detected at a very low level (46.3 pCi/kg) in a sediment sample collected in May, 2014, from station 83 (approximately 0.8 miles downstream of the plant discharge) and will be monitored in the future. A review of plant effluents indicates that Co-58 is regularly released at very low levels. Co-58 is currently measured in both water and fish samples; however, if this isotope is consistently observed in subsequent sediment samples, it will be added to the Vogtle ODCM for future inclusion on the REMP. There are no reporting levels for sediment results.

3.7 Interlaboratory Comparison Program

In accordance with ODCM 4.1.3, GPCEL participates in an Interlaboratory Comparison Program (ICP) that satisfies the requirements of Regulatory Guide 4.15, Revision 1, "Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment", February 1979. The ICP includes the required determinations (sample medium/radionuclide combinations) included in the REMP.

The ICP was conducted by Eckert & Ziegler Analytics, Inc. (EZA) of Atlanta, Georgia. EZA has a documented Quality Assurance (QA) program and the capability to prepare Quality Control (QC) materials traceable to the National Institute of Standards and Technology. The ICP is a third party blind testing program which provides a means to ensure independent checks are performed on the accuracy and precision of the measurements of radioactive materials in environmental sample matrices. EZA supplies the crosscheck samples to GPCEL which performs routine laboratory analyses. Each of the specified analyses is performed three times.

The accuracy of each result is measured by the normalized deviation, which is the ratio of the reported average less the known value to the total error. An investigation is undertaken whenever the absolute value of the normalized deviation is greater than three or whenever the coefficient of variation is greater than 15% for all radionuclides other than Cr-51 and Fe-59. For Cr-51 and Fe-59, an investigation is undertaken when the coefficient of variation exceeds the values shown on Table 3-6 below:

Table 3-6. Interlaboratory Comparison Limits

Nuclide	Concentration *	Total Sample Activity (pCi)	Percent Coefficient of Variation
Cr-51	<300	NA	25
	NA	>1000	25
	>300	<1000	15
Fe-59	<80	NA	25
	>80	NA	15
* For air filters, concentration units are pCi/filter. For all other media, concentration units are pCi/liter (pCi/l).			

As required by ODCM 4.1.3.3 and 7.1.2.3, a summary of the results of the GPCEL's participation in the ICP is provided in Table 3-7 for:

- gross beta and gamma isotopic analyses of an air filter
- gamma isotopic analyses of milk samples
- gross beta, tritium and gamma isotopic analyses of water samples

The 2014 analyses included tritium, gross beta and gamma emitting radio-nuclides in different matrices. The attached results for all analyses were within acceptable limits for accuracy (less than 15% coefficient of variation and less than 3.0 normalized deviations, except for Cr-51 and Fe-59, which are outlined in Table 3-6).

Table 3-7. Interlaboratory Comparison Summary

Analysis or Radionuclide	Date Prepared	Reported Average	Known Value	Standard Deviation EL	Uncertainty Analytics (3S)	Percent Coef of Variation	Normalized Deviation
I-131 ANALYSIS OF AN AIR CARTRIDGE (pCi/cartridge)							
I-131	12/4/2014	102.5	98.4	1.8	1.64	5.05	0.8
GAMMA ISOTOPIC ANALYSIS OF AN AIR FILTER (pCi/filter)							
Ce-141	12/4/2014	108	103	9	1.73	9.61	0.5
Co-58	12/4/2014	66	61.4	4.76	1.02	9.00	0.77
Co-60	12/4/2014	113	111	5.96	1.85	6.82	0.25
Cr-51	12/4/2014	200	192	9.22	3.2	8.42	0.48
Cs-134	12/4/2014	74.5	77.6	4.51	1.3	7.46	-0.55
Cs-137	12/4/2014	97.4	93.5	10.7	1.56	12.04	0.33
Fe-59	12/4/2014	83.3	82.4	8.01	1.38	11.41	0.09
Mn-54	12/4/2014	114	106	7.97	1.78	8.5	0.82
Zn-65	12/4/2014	153	140	18.4	2.34	13.25	0.62
GROSS BETA ANALYSIS OF AN AIR FILTER (PCI/FILTER)							
Gross Beta	09/12/13	58.30	58.70	0.79	0.98	5.08	-0.14
GAMMA ISOTOPIC ANALYSIS OF A MILK SAMPLE (PCI/LITER)							
Ce-141	6/12/2014	132	124	3.53	2.07	6.43	0.93
Co-58	6/12/2014	120	112	6.8	1.88	8.11	0.84
Co-60	6/12/2014	240	224	2.91	3.74	4.32	1.53
Cr-51	6/12/2014	269	253	13.3	4.23	12.91	0.47
Cs-134	6/12/2014	181	162	9.8	2.71	6.74	1.52
Cs-137	6/12/2014	130	120	4.6	2.00	7.09	1.06
Fe-59	6/12/2014	108	102	5.79	1.71	9.4	0.56
I-131	6/12/2014	99.2	90.9	4.25	1.52	7.58	1.10
Mn-54	6/12/2014	175	156	4.41	2.60	5.70	1.90

Table 3-7. Interlaboratory Comparison Summary

Analysis or Radionuclide	Date Prepared	Reported Average	Known Value	Standard Deviation EL	Uncertainty Analytics (3S)	Percent Coef of Variation	Normalized Deviation
Zn-65	6/12/2014	299	252	14.8	4.22	7.56	2.09
GROSS BETA ANALYSIS OF WATER SAMPLE (PCI/LITER)							
Gross Beta	3/20/2014	309	279	12.35	1.79	6.32	1.54
	12/4/2014	339	299	11.94	4.99	5.42	2.20
GAMMA ISOTOPIC ANALYSIS OF WATER SAMPLES (PCI/LITER)							
Ce-141	3/20/2014	74.9	77.1	6.05	1.29	11.96	-0.24
Co-58	3/20/2014	173	174	7.87	2.9	7.03	-0.12
Co-60	3/20/2014	221	219	6.12	3.65	5.22	0.15
Cr-51	3/20/2014	334	319	17.7	5.32	12.47	0.36
Cs-134	3/20/2014	142	136	5.6	2.28	6.00	0.70
Cs-137	3/20/2014	169	164	11.1	2.74	8.52	0.35
Fe-59	3/20/2014	142	142	7.55	2.37	8.64	-0.02
I-131	3/20/2014	91.8	89.9	3.86	1.5	8.34	0.25
Mn-54	3/20/2014	202	193	11.7	3.22	7.61	0.56
Zn-65	3/20/2014	221	210	10.1	3.5	8.06	0.61
TRITIUM ANALYSIS OF WATER SAMPLES (PCI/LITER)							
H-3	3/20/2014	9820	10000	157.6	167	2.71	-0.69
	12/4/2014	14800	14900	127.53	249	2.18	-0.46

3.8 Groundwater

To ensure compliance with NEI 07-07 (Industry Ground Water Protection Initiative – Final Guidance Document), Southern Nuclear developed the Nuclear Management Procedure, Radiological Groundwater Protection Program. The procedure contains detailed site-specific monitoring plans, program technical bases, and communications protocol (to ensure that radioactive leaks and spills are addressed and communicated appropriately). In an effort to prevent future leaks of radioactive material to groundwater, SNC plants have established robust buried piping and tanks inspection programs.

Plant Vogtle maintains the following wells (Table 3-8), which are sampled at a frequency that satisfies the requirements of NEI 07-07. The analytical results for 2014 were all within regulatory limits specified within this report.

Table 3-8. Groundwater Monitoring Locations

Well	Aquifer	Monitoring Purpose
LT-1B	Water Table	NSCW related tank
LT-7A	Water Table	NSCW related tank
LT-12	Water Table	NSCW related tank
LT-13	Water Table	NSCW related tank
802A	Water Table	Southeastern potential leakage
803A*	Water Table	Up gradient to rad waste building
805A**	Water Table	Down gradient from rad waste building and NSCW related facilities
806B	Water Table	Dilution line
808	Water Table	Up gradient; along Pen Branch Fault
R1	Water Table	NSCW related tank; western potential leakage
R2	Water Table	Southern potential leakage
R3	Water Table	Eastern potential leakage
R4	Water Table	Dilution line
R5	Water Table	Dilution line
R6	Water Table	Dilution line
R7	Water Table	Dilution line
R8	Water Table within Sav. River sediments	Dilution line
1013*	Water Table	Low level rad waste storage
1014	Tertiary	Up gradient
1015	Water Table	Vertically up gradient
1003*	Tertiary	Up gradient
1004*	Water Table	Vertically up gradient

Table 3-8. Groundwater Monitoring Locations

Well	Aquifer	Monitoring Purpose
27**	Tertiary	Down gradient tertiary
29**	Tertiary	Down gradient tertiary
MU-1	Tertiary/Cretaceous	Facility water supply
River	N/A	Surface water

NSCW – Nuclear service cooling water
* Well abandoned due to construction activities with Vogtle Units 3&4
** Well no longer sampled due to structural issues

4 SURVEY SUMMARIES

4.1 Land Use Census

In accordance with ODCM 4.1.2, a land use census was conducted on November 25, 2014 to verify the locations of the nearest radiological receptor within five miles. The census results, shown in Table 4-1, indicated no changes from 2013; therefore, no changes to the ODCM are required.

Table 4-1. Land Use Census Results

Sector	Residence	Milk Animal*	Beef Cattle	Garden**
Distance in Miles to the Nearest Location in Each Sector				
N	1.4	None	None	None
NNE	None	None	None	None
NE	None	None	None	None
ENE	None	None	None	None
E	None	None	None	None
ESE	4.2	None	None	None
SE	4.3	None	4.9	None
SSE	4.7	None	4.7	None
S	4.4	None	4.3	None
SSW	4.7	None	4.6	None
SW	3.1	None	None	None
WSW	2.6	None	2.7	None
W	3.4	None	4.4	None
WNW	1.9	None	None	None
NW	1.5	None	None	None
NNW	1.5	None	None	None

*A milk animal is a cow or goat producing milk for human consumption.
**A garden of greater than 500 square feet producing broad leaf vegetation.
Note: Land within SRS was excluded from the census.

4.2 Savannah River Survey

A survey of the Savannah River downstream of the plant for approximately 100 miles (approximately river miles 44.7 to 151.2) was conducted on September 16, 2014 to identify any new withdrawal of water from the river for drinking, irrigation, or construction purposes. No

new usage was visually identified. These results were verified with the South Carolina Department of Health and Environmental Control on October 2, 2014, and the Georgia Department of Natural Resources on October 6, 2014. Each of these agencies confirmed that no water withdrawal permits for drinking, irrigation, or construction purposes had been issued for this stretch of the Savannah River. It should be noted that Vogtle Units 3 and 4 received a surface water withdrawal permit in December of 2014.

5 CONCLUSIONS

This report confirms SNCs conformance with the requirements of Chapter 4 of the ODCM and the objectives were to:

1) Determine the levels of radiation and the concentrations of radioactivity in the environs and;
2) Assess the radiological impact (if any) to the environment due to the operation of the VEGP.

Based on the 2014 activities associated with the REMP, SNC offers the following conclusions:

- Samples were collected and there were no deviations or anomalies that negatively affected the quality of the REMP
- Land use census and river survey did not reveal any changes
- Analytical results were below reporting levels
- These values are consistent with historical results, indicating no adverse radiological environmental impacts associated with the operation of VEGP

APPENDIX

Maps

Appendix A
Map A-1

Drawn by: C. Groce

April 30, 2015

Vogtle Electric Generating Plant
2014 Annual Radiological Environmental Report
REMP Stations in Plant Vicinity

Legend:

Indicator Stations -

Control Stations -

Other Stations -

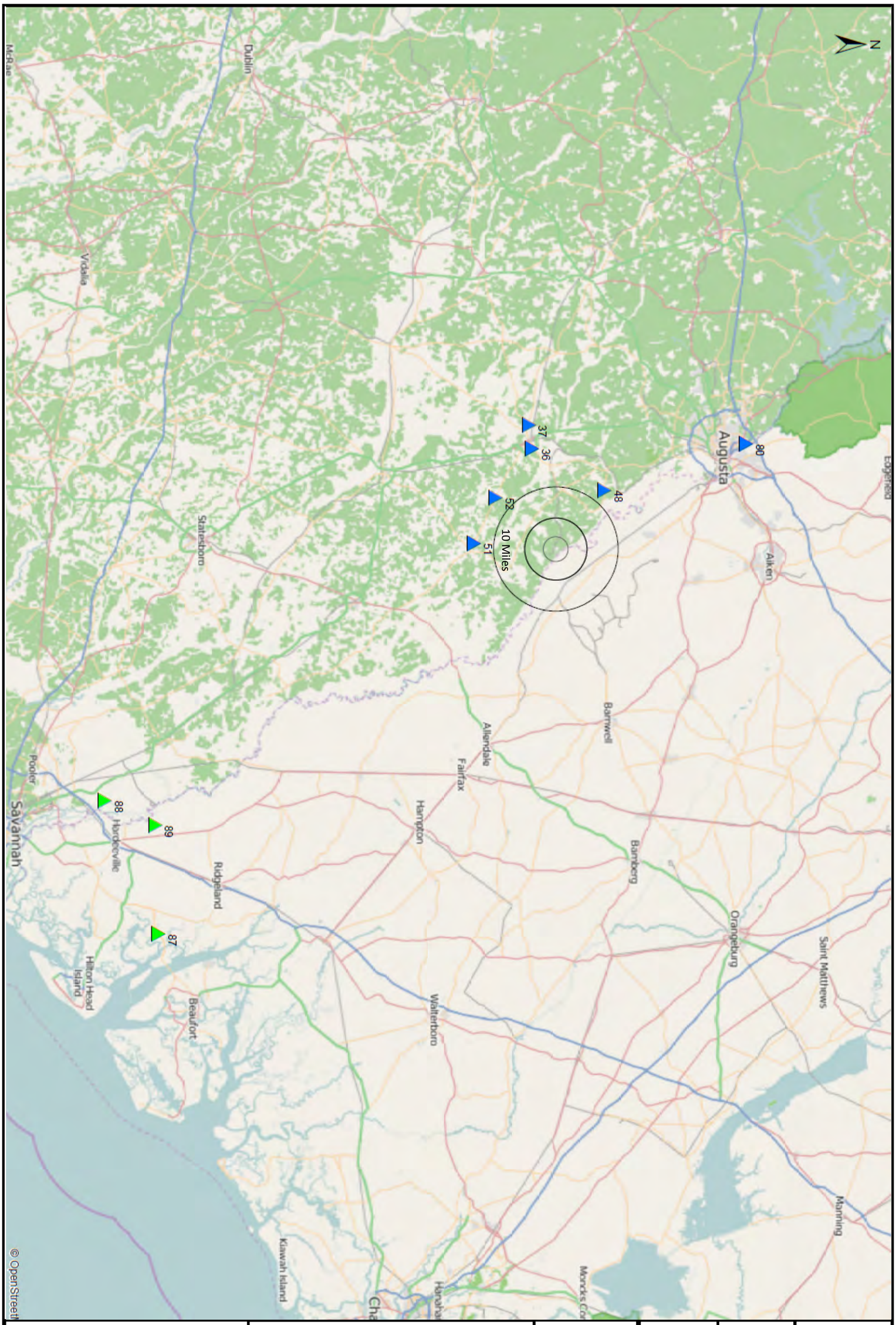
Appendix A
Map A-2

Drawn by: C. Groce

April 30, 2015

Vogtle Electric Generating Plant
2014 Annual Radiological Environmental Report
REMP Stations within 10 miles

Legend:
Indicator Stations -
Control Stations -
Other Stations -



Legend:

Indicator Stations -

Control Stations -

Other Stations -

Vogtle Electric Generating Plant

2014 Annual Radiological Environmental Report

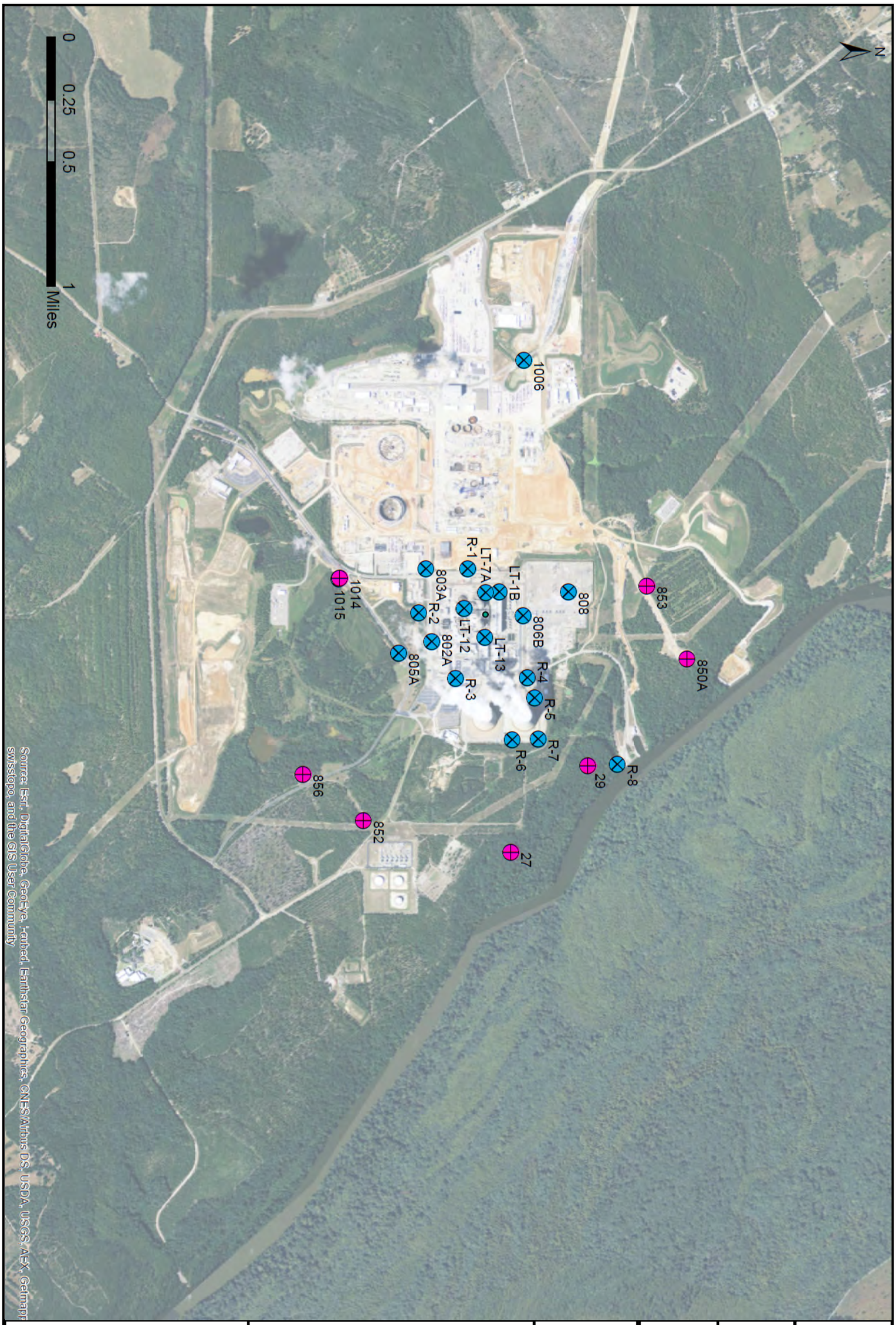
Extended REMP Stations

Drawn by: C. Groce

April 30, 2015

Appendix A

Map A-3



Legend:

Surficial Aquifer -

Tertiary Aquifer -

Vogtle Electric Generating Plant

2014 Annual Radiological Environmental Report

Facility Groundwater Wells

Drawn by: C. Groce

April 30, 2015

Appendix A

Map A-4