

**Moanica M. Caston**  
Vice President,  
General Counsel and  
Corporate Secretary

**Southern Nuclear  
Operating Company, Inc.**  
40 Inverness Center Parkway  
Post Office Box 1295  
Birmingham, Alabama 35201-1295  
Tel 205.992.5316



May 14, 2009

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

*Energy to Serve Your World*<sup>SM</sup>

NL-09-0775

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

Edwin I. Hatch Nuclear Plant  
Joseph M. Farley Nuclear Plant  
Vogtle Electric Generating Plant  
Annual Radiological Environmental Operating Reports for 2008

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 2008.

This letter contains no NRC commitments. If you have any questions, please advise.

Sincerely,

A handwritten signature in black ink, appearing to read "Moanica M. Caston".

M. Caston  
Vice President, External Affairs and General Counsel

MC/TWS/daj

- Enclosures:
1. Hatch Annual Radiological Environmental Operating Report for 2008
  2. Farley Annual Radiological Environmental Operating Report for 2008
  3. Vogtle Annual Radiological Environmental Operating Report for 2008

1025  
NRR

U. S. Nuclear Regulatory Commission

NL-09-0775

Page 2

cc: Southern Nuclear Operating Company  
Mr. J. T. Gasser, Executive Vice President  
Mr. J. R. Johnson, Vice President – Farley  
Mr. D. R. Madison, Vice President – Hatch  
Mr. T. E. Tynan, Vice President – Vogtle  
Ms. P. M. Marino, Vice President – Engineering  
RTYPE: CFA04.054; CHA02.004; CVC7000

U. S. Nuclear Regulatory Commission  
Mr. L. A. Reyes, Regional Administrator  
Mr. R. E. Martin, NRR Project Manager – Farley  
Ms. D. N. Wright, NRR Project Manager – Hatch  
Ms. D. N. Wright, NRR Project Manager – Vogtle  
Mr. E. L. Crowe, Senior Resident Inspector – Farley  
Mr. J. A. Hickey, Senior Resident Inspector – Hatch  
Mr. M. Cain, Senior Resident Inspector – Vogtle

State of Alabama  
Mr. K. E. Whatley, Department of Public Health, Division of Radiation  
Control

State of Georgia  
Mr. T. V. Jackson, Department of Natural Resources

Georgia Power Company  
Ms. M. A. Heilbron

American Nuclear Insurers  
Mr. R. A. Oliveira

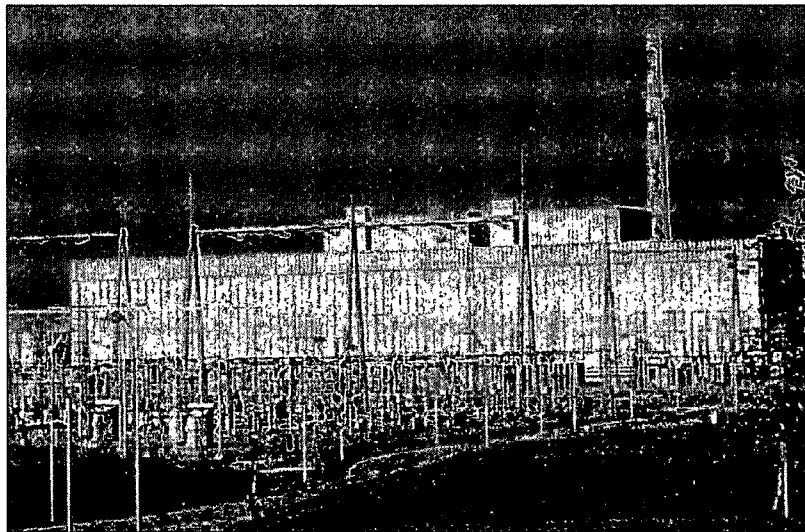


**Edwin I. Hatch Nuclear Plant  
Joseph M. Farley Nuclear Plant  
Vogtle Electric Generating Plant  
Annual Radiological Environmental Operating Reports for 2008**

**Enclosure 1**

**Hatch Annual Radiological Environmental Operating Report for 2008**

**EDWIN I. HATCH NUCLEAR PLANT  
ANNUAL RADIOLOGICAL ENVIRONMENTAL  
OPERATING REPORT FOR 2008**



**SOUTHERN**   
**COMPANY**  
*Energy to Serve Your World™*

# **TABLE OF CONTENTS**

<b>Title and/or Section</b>	<b>Subsection</b>	<b>Page</b>
List of Figures		ii
List of Tables		iii
List of Acronyms		iv
1.0 Introduction		1-1
2.0 REMP Description		2-1
3.0 Results Summary		3-1
4.0 Discussion of Results		4-1
	4.1 Land Use Census and River Survey	4-5
	4.2 Airborne	4-7
	4.3 Direct Radiation	4-12
	4.4 Milk	4-18
	4.5 Vegetation	4-22
	4.6 River Water	4-25
	4.7 Fish	4-28
	4.8 Sediment	4-32
	4.9 Groundwater	4-38
5.0 Interlaboratory Comparison Program		5-1
6.0 Conclusions		6-1

## LIST OF FIGURES

<b>Figure Number</b>	<b>Title</b>	<b>Page</b>
Figure 2-1	REMP Stations Near the Plant	2-8
Figure 2-2	REMP Stations Beyond Six Miles from the Plant	2-9
Figure 2-3	Groundwater Monitoring Locations	2-10
Figure 2-4	Deep Wells	2-11
Figure 4.2-1	Average Weekly Gross Beta Air Concentration	4-7
Figure 4.2-2	Average Annual Cs-137 Concentration in Air	4-9
Figure 4.3-1	Average Quarterly Exposure from Direct Radiation	4-13
Figure 4.3-2	Average Quarterly Exposure from Direct Radiation at Special Interest Areas	4-15
Figure 4.4-1	Average Annual Cs-137 Concentration in Milk	4-18
Figure 4.4-2	Average Annual I-131 Concentration in Milk	4-20
Figure 4.5-1	Average Annual Cs-137 Concentration in Vegetation	4-23
Figure 4.6-1	Average Annual H-3 Concentration in River Water	4-26
Figure 4.7-1	Average Annual Cs-137 Concentration in Fish	4-28
Figure 4.7-2	Average Annual Cs-134 Concentration in Fish	4-30
Figure 4.8-1	Average Annual Co-60 Concentration in Sediment	4-32
Figure 4.8-2	Average Annual Cs-137 Concentration in Sediment	4-34
Figure 4.8-3	Average Annual Indicator Station Concentrations of Select Nuclides in Sediment	4-36
Figure 4.9-1	Plant Hatch Tritium Concentration Levels October 2008	4-41

## LIST OF TABLES

<b>Table Number</b>	<b>Title</b>	<b>Page</b>
Table 2-1	Summary Description of Radiological Environmental Monitoring Program	2-2
Table 2-2	Radiological Environmental Sampling Locations	2-5
Table 2-3	Groundwater Sampling Locations	2-7
Table 3-1	Radiological Environmental Monitoring Program Annual Summary	3-2
Table 4-1	Minimum Detectable Concentrations (MDC)	4-1
Table 4-2	Reporting Levels (RL)	4-2
Table 4-3	Deviations from Radiological Environmental Monitoring Program	4-4
Table 4.1-1	Land Use Census Results	4-5
Table 4.2-1	Average Weekly Gross Beta Air Concentration	4-8
Table 4.2-2	Average Annual Cs-137 Concentration in Air	4-10
Table 4.3-1	Average Quarterly Exposure from Direct Radiation	4-14
Table 4.3-2	Average Quarterly Exposure from Direct Radiation at Special Interest Areas	4-16
Table 4.4-1	Average Annual Cs-137 Concentration in Milk	4-19
Table 4.4-2	Average Annual I-131 Concentration in Milk	4-21
Table 4.5-1	Average Annual Cs-137 Concentration in Vegetation	4-24
Table 4.6-1	Average Annual H-3 Concentration in River Water	4-27
Table 4.7-1	Average Annual Cs-137 Concentration in Fish	4-29
Table 4.7-2	Average Annual Cs-134 Concentration in Fish	4-31
Table 4.8-1	Average Annual Co-60 Concentration in Sediment	4-33
Table 4.8-2	Average Annual Cs-137 Concentration in Sediment	4-35
Table 4.8-3	Sediment Nuclide Concentrations Other Than Co-60 & Cs-137	4-37
Table 5-1	Interlaboratory Comparison Results	5-3

## **LIST OF ACRONYMS**

Acronyms presented in alphabetical order.

<b>Acronym</b>	<b>Definition</b>
ASTM	American Society for Testing and Materials
CL	Confidence Level
EL	Georgia Power Company Environmental Laboratory
EPA	Environmental Protection Agency
GPC	Georgia Power Company
HNP	Edwin I. Hatch Nuclear Plant
ICP	Interlaboratory Comparison Program
MDC	Minimum Detectable Concentration
MDD	Minimum Detectable Difference
NA	Not Applicable
NDM	No Detectable Measurement(s)
NRC	Nuclear Regulatory Commission
ODCM	Offsite Dose Calculation Manual
Po	Preoperation
REMP	Radiological Environmental Monitoring Program
RL	Reporting Level
TLD	Thermoluminescent Dosimeter
TS	Technical Specification

## 1.0 INTRODUCTION

The Radiological Environmental Monitoring Program (REMP) is conducted in accordance with Chapter 4 of the Offsite Dose Calculation Manual (ODCM). REMP activities for 2008 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) 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. An annual summary of the results of the analyses of REMP samples is provided in Section 3. A discussion of the results, including assessments of any radiological impacts upon the environment, and the results of the land use census and the river survey, are provided in Section 4. The results of the Interlaboratory Comparison Program (ICP) are provided in Section 5. Conclusions are provided in Section 6.

## **2.0 REMP DESCRIPTION**

A summary description of the REMP is provided in Table 2-1. This table summarizes the program as it meets the requirements outlined in ODCM Table 4-1. It details 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 delineates the collection and analysis frequencies. The sampling locations (stations) specified by ODCM 4.2 are depicted on maps in Figures 2-1 and 2-2. These maps are keyed to Table 2-2 which delineates the direction and distance of each station from the main stack.

REMP samples are collected by Georgia Power Company's (GPC) Environmental Laboratory (EL) personnel. The same lab performs all the laboratory analyses at their headquarters in Smyrna, Georgia.



TABLE 2-1 (SHEET 1 of 3)

SUMMARY DESCRIPTION OF RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Approximate Number of Sample Locations	Sampling and Collection Frequency	Type of Analysis and Frequency
1. Airborne Radioiodine and Particulates	6	Continuous operation of the sampler 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.
2. Direct Radiation	37	Quarterly	Gamma dose, quarterly.
3. Ingestion			
Milk (a)	1	Biweekly	Gamma isotopic and I-131 analysis, biweekly.
Fish or Clams (b)	2	Semiannually	Gamma isotopic analysis on edible portions, semiannually.
Grass or Leafy Vegetation	3	Monthly during growing season.	Gamma isotopic analysis, monthly. (c)
4. Waterborne			
Surface	2	Composite sample collected monthly. (d)	Gamma isotopic analysis, monthly. Composite (by location) for tritium analysis, quarterly.
Sediment	2	Semiannually.	Gamma isotopic analysis, semiannually.

TABLE 2-1 (SHEET 2 of 3)

SUMMARY DESCRIPTION OF RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Approximate Number of Sample Locations	Sampling and Collection Frequency	Type of Analysis and Frequency
Drinking Water (e & f)	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.
Groundwater	See Table 2-3, Figure 2-3, and Figure 2-4	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

**TABLE 2-1 (SHEET 3 of 3)**

**SUMMARY DESCRIPTION OF RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM**

Notes:

- a. Up to three sampling locations within 5 miles and in different sectors will be used as available. In addition, one or more control locations beyond 10 miles will be used.
- b. Commercially or recreationally important fish may be sampled. Clams may be sampled if difficulties are encountered in obtaining sufficient fish samples.
- c. If gamma isotopic analysis is not sensitive enough to meet the Minimum Detectable Concentration (MDC), a separate analysis for I-131 may be performed.
- d. The composite samples shall be composed of a series of aliquots collected at intervals not exceeding a few hours.
- e. 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.
- f. 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.

TABLE 2-2 (SHEET 1 of 2)

RADIOLOGICAL ENVIRONMENTAL SAMPLING LOCATIONS

Station Number	Station Type	Descriptive Location	Direction (a)	Distance (a) (miles)	Sample Type
064	Other	Roadside Park	WNW	0.8	Direct Rad
101	Indicator	Inner Ring	N	1.9	Direct Rad
102	Indicator	Inner Ring	NNE	2.5	Direct Rad
103	Indicator	Inner Ring	NE	1.8	Airborne Rad Direct Rad
104	Indicator	Inner Ring	ENE	1.6	Direct Rad
105	Indicator	Inner Ring	E	3.7	Direct Rad
106	Indicator	Inner Ring	ESE	1.1	Direct Rad Vegetation
107	Indicator	Inner Ring	SE	1.2	Airborne Rad Direct Rad
108	Indicator	Inner Ring	SSE	1.6	Direct Rad
109	Indicator	Inner Ring	S	0.9	Direct Rad
110	Indicator	Inner Ring	SSW	1.0	Direct Rad
111	Indicator	Inner Ring	SW	0.9	Direct Rad
112	Indicator	Inner Ring	WSW	1.0	Airborne Rad Direct Rad Vegetation
113	Indicator	Inner Ring	W	1.1	Direct Rad
114	Indicator	Inner Ring	WNW	1.2	Direct Rad
115	Indicator	Inner Ring	NW	1.1	Direct Rad
116	Indicator	Inner Ring	NNW	1.6	Airborne Rad Direct Rad
170	Control	Upstream	WNW	(c)	River (b)
172	Indicator	Downstream	E	(c)	River (b)
201	Other	Outer Ring	N	5.0	Direct Rad
202	Other	Outer Ring	NNE	4.9	Direct Rad
203	Other	Outer Ring	NE	5.0	Direct Rad
204	Other	Outer Ring	ENE	5.0	Direct Rad
205	Other	Outer Ring	E	7.2	Direct Rad
206	Other	Outer Ring	ESE	4.8	Direct Rad
207	Other	Outer Ring	SE	4.3	Direct Rad
208	Other	Outer Ring	SSE	4.8	Direct Rad
209	Other	Outer Ring	S	4.4	Direct Rad
210	Other	Outer Ring	SSW	4.3	Direct Rad
211	Other	Outer Ring	SW	4.7	Direct Rad
212	Other	Outer Ring	WSW	4.4	Direct Rad
213	Other	Outer Ring	W	4.3	Direct Rad
214	Other	Outer Ring	WNW	5.4	Direct Rad
215	Other	Outer Ring	NW	4.4	Direct Rad
216	Other	Outer Ring	NNW	4.8	Direct Rad
301	Other	Toombs Central School	N	8.0	Direct Rad
304	Control	State Prison	ENE	11.2	Airborne Rad Direct Rad
304	Control	State Prison	ENE	10.3	Milk
309	Control	Baxley Substation	S	10.0	Airborne Rad Direct Rad
416	Control	Emergency News Center	NNW	21.0	Direct Rad Vegetation

**TABLE 2-2 (SHEET 2 of 2)**

**RADIOLOGICAL ENVIRONMENTAL SAMPLING LOCATIONS**

Notes:

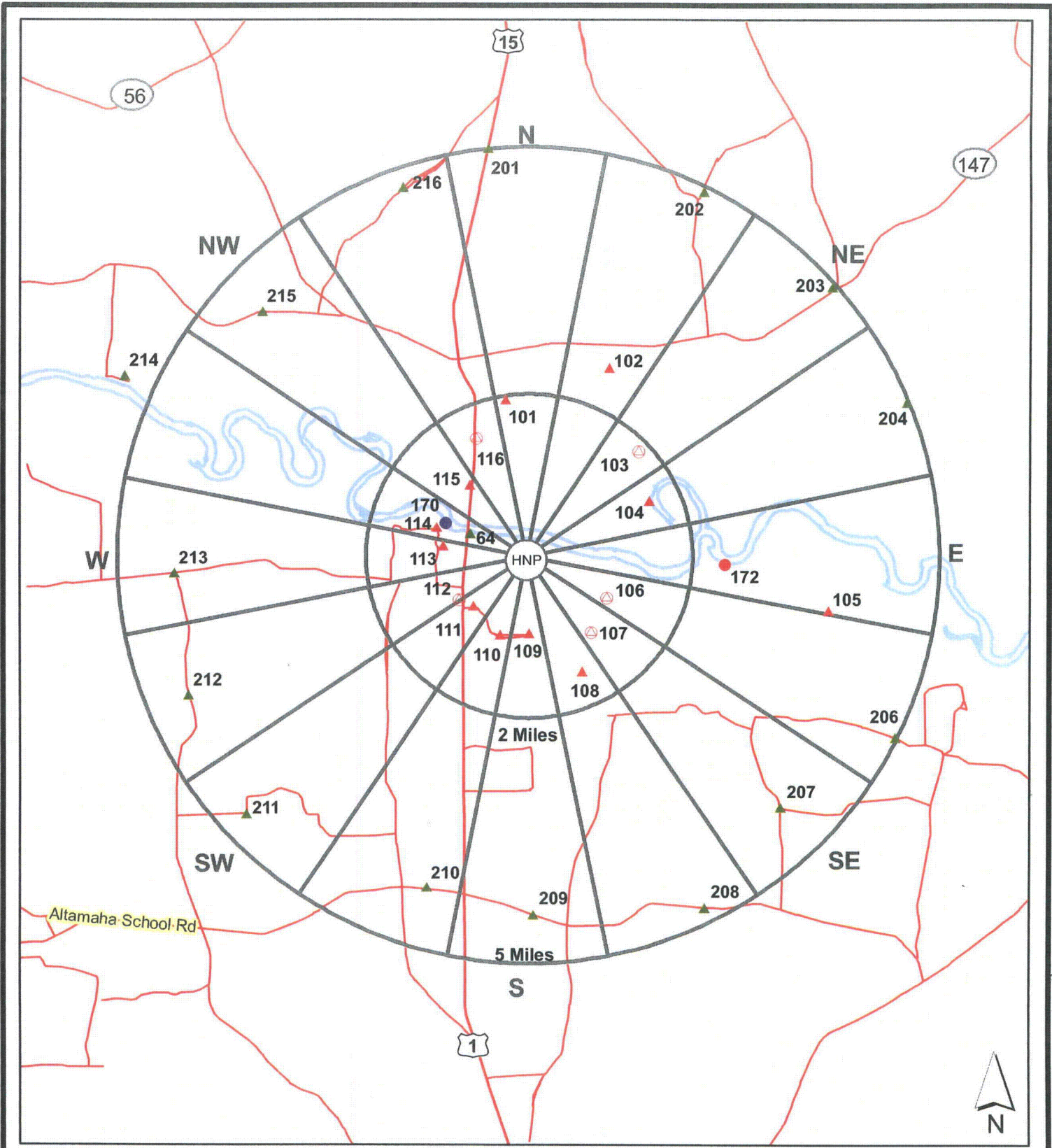
- a. Direction and distance are determined from the main stack.
- b. River (fish or clams, shoreline sediment, and surface water)
- c. Station 170 is located approximately 0.6 river miles upstream of the intake structure for river water, 1.1 river miles for sediment and clams, and 1.5 river miles for 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.

Table 2-3  
Groundwater Monitoring Locations

<b>WELL</b>	<b>DEPTH (ft)</b>	<b>MONITORING PURPOSE</b>
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
T2	21.9	Water Table Near Recombiner Bldg.
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
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



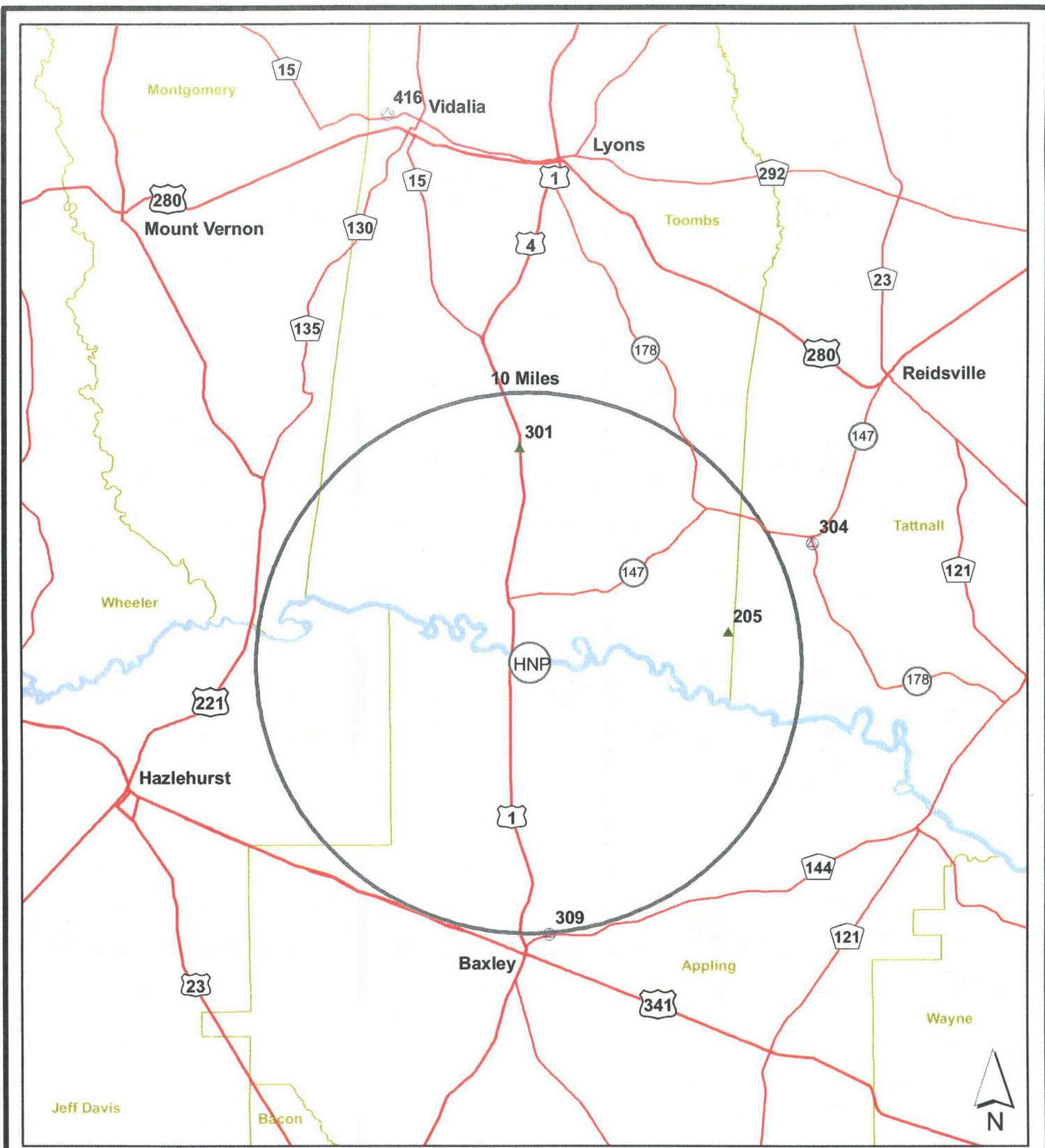
**Radiological Environmental Sampling Locations**

	Indicator	Control	Additional
TLD	▲	▲	▲
Other	●	●	●
TLD & Other	⊕	⊕	⊕

**REMP Stations Near the Plant**

**Figure 2-1**





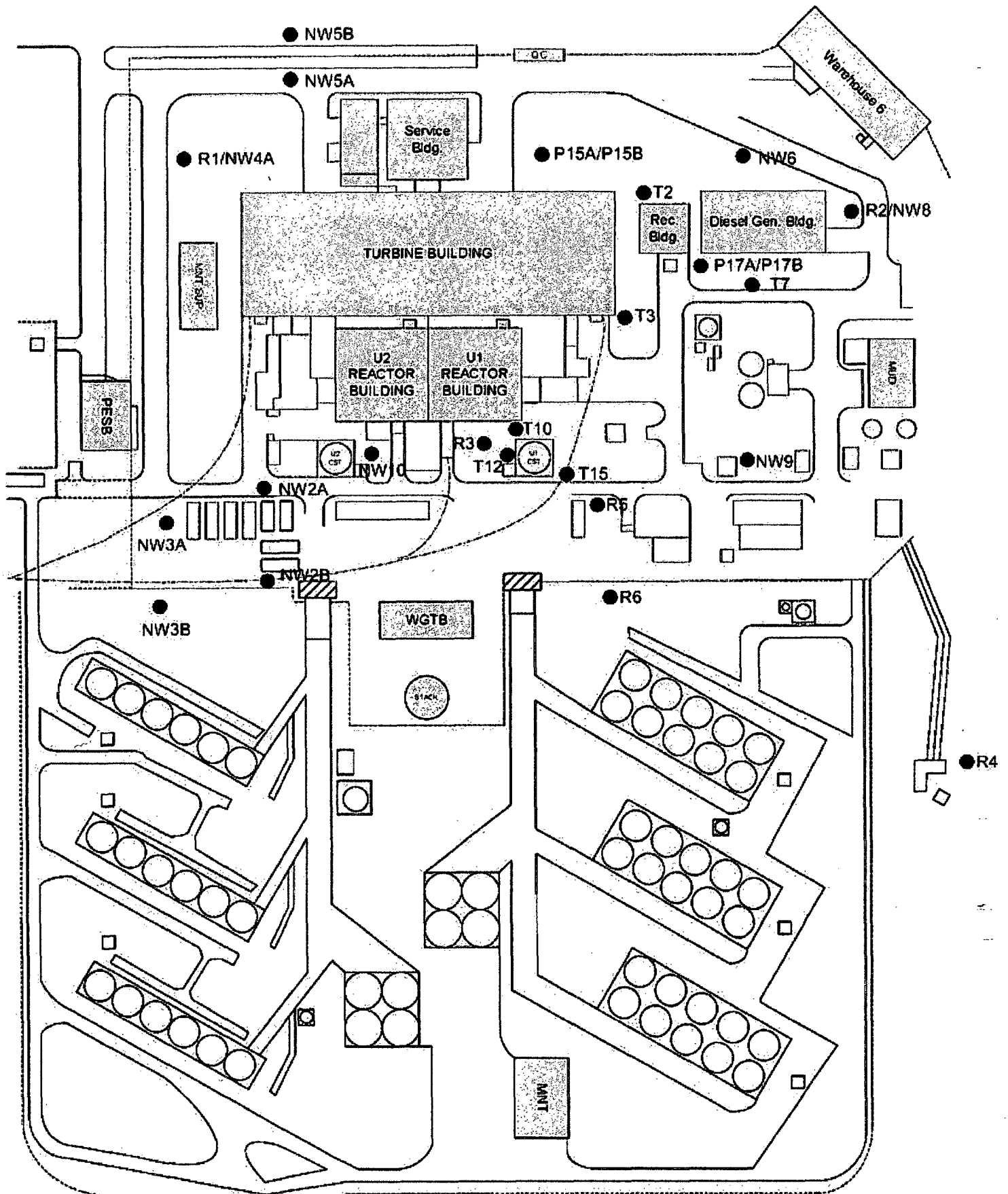
**Radiological Environmental Sampling Locations**

	Indicator	Control	Additional
TLD	▲	▲	▲
Other	●	●	●
TLD & Other	⊕	⊕	⊕

**REMP Stations Beyond Five Miles from the Plant**

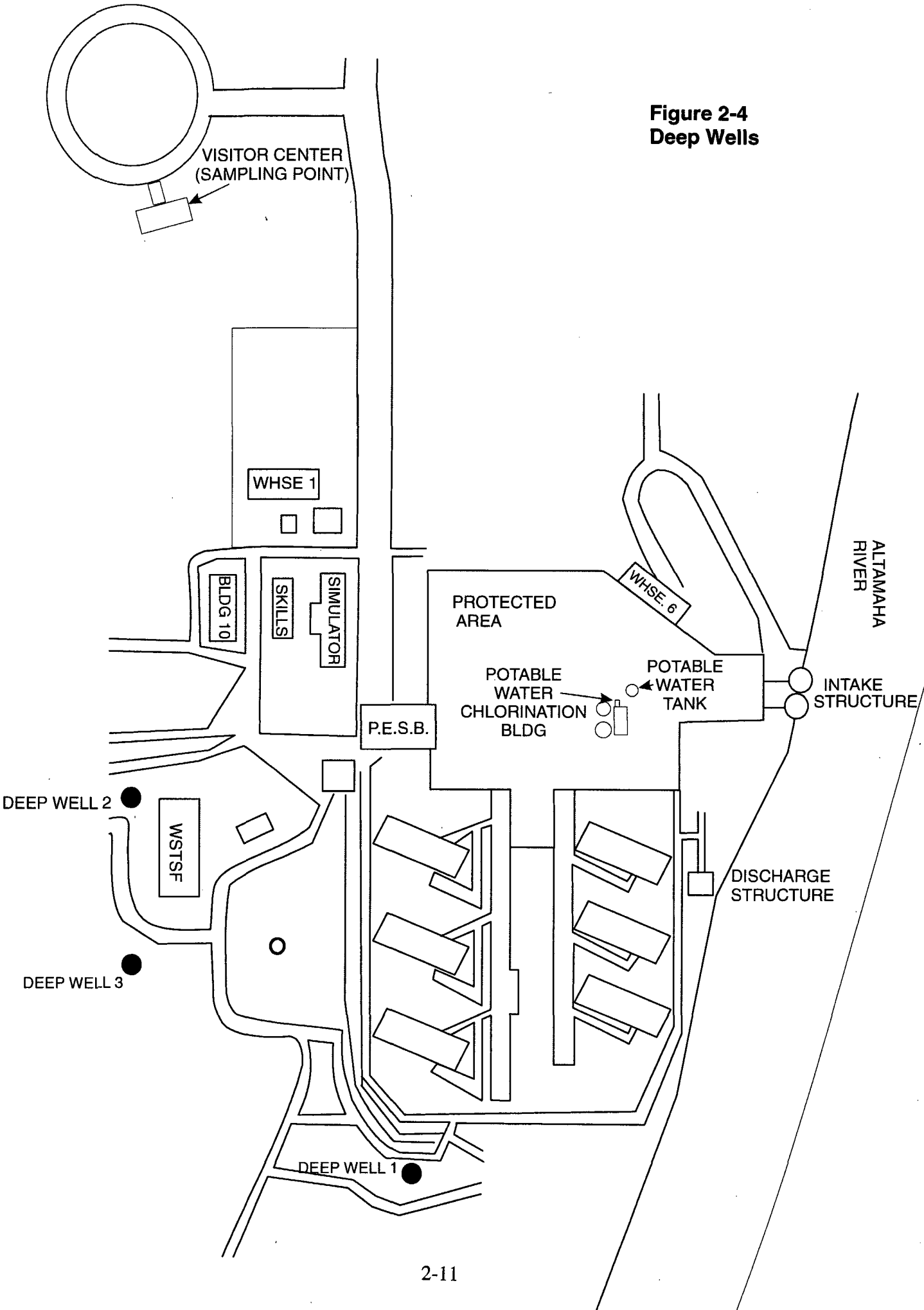
**Figure 2-2**





**Figure 2-3  
Groundwater Monitoring Locations**

**Figure 2-4  
Deep Wells**



### **3.0 RESULTS SUMMARY**

In accordance with ODCM 7.1.2.1, the summarized and tabulated results for all of the regular samples collected for the year at the designated indicator and control stations are presented in Table 3-1. The format of Table 3-1 is similar to Table 3 of the Nuclear Regulatory Commission (NRC) Branch Technical Position, "An Acceptable Radiological Environmental Monitoring Program", Revision 1, November 1979. Since no naturally occurring radionuclides were found in the plant's effluent releases, only man-made radionuclides are reported as permitted by ODCM 7.1.2.1. Results for samples collected at locations other than control or indicator stations are discussed in Section 4 under the particular sample type.

TABLE 3-1 (SHEET 1 of 4)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY

Edwin I. Hatch Nuclear Plant, Docket Nos. 50-321 and 50-366

Appling County, Georgia

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(g) Mean (b), Range (Fraction)	Control Locations Mean (b), Range (Fraction)
				Name Distance & Direction (Fraction)	Mean (b), Range		
Airborne Particulates (fCi/m3)	Gross Beta 311	10	21.8 7.6-39.1 (208/208)	No. 309 Baxley Substation 10.0 miles, S	22.5 11.8-40.8 (52/52)	NA	22.5 8.3-40.8 (103/103)
	Gamma Isotopic 24 Cs-134 Cs-137	50 60	NDM (c) NDM		NDM NDM		NDM NDM
Airborne Radioiodine (fCi/m3)	I-131 311	70	NDM		NDM	NA	NDM
Direct Radiation (mR/91 days)	Gamma Dose 147	NA (d)	13.0 10.0-19.3 (63/63)	No. 104 Inner Ring 1.6 miles, ENE	16.5 14.7-18.6 (3/3)	12.4 9.3-18.3 (72/72)	12.3 10.1-14.8 (12/12)
Milk (pCi/l)	Gamma Isotopic 26					NA	
	Cs-134	15	NA		NDM		NDM
	Cs-137	18	NA		NDM		NDM
	Ba-140	60	NA		NDM		NDM
	La-140	15	NA		NDM		NDM
	I-131 26	1	NA		NDM		NDM

3-2

TABLE 3-1 (SHEET 2 of 4)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY

Edwin I. Hatch Nuclear Plant, Docket Nos. 50-321 and 50-366

Appling County, Georgia

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		Control Locations Mean (b), Range (Fraction)
				Name Distance & Direction	Mean (b), Range (Fraction)	
Vegetation (pCi/kg-wet)	Gamma Isotopic 36 I-131 Cs-134 Cs-137	60 60 80	NDM NDM 41.8 15.9-85.4 (7/24)	Station 106 Inner Ring 1.1 miles; ESE	NDM NDM 48.2 15.9-85.4 (5/12)	NDM NDM 38.1 (1/12)
River Water (pCi/l)	Gamma Isotopic 24 Mn-54 Fe-59 Co-58 Co-60 Zn-65 Zr-95 Nb-95 I-131 Cs-134 Cs-137 Ba-140 La-140	15 30 15 15 30 30 15 15 (e) 15 18 60 15	NDM NDM NDM NDM NDM NDM NDM NDM NDM NDM NDM NDM		NDM NDM NDM NDM NDM NDM NDM NDM NDM NDM NDM	NDM NDM NDM NDM NDM NDM NDM NDM NDM NDM NDM
	Tritium 8	3000 (f)	329 284-373 (2/4)	No. 170 0.6 miles Upstream	329 284-373 (2/4)	298 (1/4)

TABLE 3-1 (SHEET 3 of 4)

**RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY**  
 Edwin I. Hatch Nuclear Plant, Docket Nos. 50-321 and 50-366  
 Appling County, Georgia

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		Control Locations Mean (b), Range (Fraction)
				Name Distance & Direction	Mean (b), Range (Fraction)	
Fish (pCi/kg-wet)	Gamma Isotopic 6					
	Mn-54	130	NDM		NDM	NDM
	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	19.9 18.5-21.2 (3/3)	No. 172 3.0 miles Downstream	19.9 18.5-21.2 (3/3)	8.4 7.5-9.3 (2/3)
Sediment (pCi/kg-dry)	Gamma Isotopic 4					
	Cs-134	150	NDM		NDM	NDM
	Cs-137	180	112.7 103.9-121.4 (2/2)	No. 172 3.0 miles Downstream	112.7 103.9-121.4 (2/2)	61.9 (1/2)

**TABLE 3-1 (SHEET 4 of 4)**

**RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY**

**Edwin I. Hatch Nuclear Plant, Docket Nos. 50-321 and 50-366**

**Appling County, Georgia**

**NOTATIONS**

- 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. Any a posteriori MDC greater than the value listed in this column is discussed in Section 4.
- b. Mean and range are based upon detectable measurements only. The fraction of all measurements at specified locations that are detectable is placed in parenthesis.
- c. No Detectable Measurement(s).
- d. Not Applicable.
- e. If a drinking water pathway were to exist, a MDC of 1 pCi/l would have been used (see Table 4-1 of this report).
- f. If a drinking water pathway were to exist, a MDC of 2000 pCi/l would have been used (see Table 4-1 of this report).
- g. "Other" stations, identified in the "station type" column of Table 2-2, include community and special stations.

## 4.0 DISCUSSION OF RESULTS

Included in this section are evaluations of the laboratory results for the various sample types. Comparisons were made between the difference in mean values for pairs of station groups (e.g., indicator and control stations) and the calculated Minimum Detectable Difference (MDD) between these pairs at the 99% Confidence Level (CL). The MDD was determined using the standard Student's t-test. A difference in the mean values which was less than the MDD was considered to be statistically indiscernible.

The 2008 results were compared with past results, including those obtained during pre-operation. As appropriate, results were compared with their Minimum Detectable Concentrations (MDC) and Reporting Levels (RL) which are listed in Tables 4-1 and 4-2 of this report, respectively. The required MDCs were achieved during laboratory sample analyses. Any anomalous results are explained within this report.

Results of interest are graphed to show historical trends. The data points are tabulated and included in this report. The points plotted and provided in the tables represent mean values of only detectable results. Periods for which no detectable measurements (NDM) were observed or periods for which values were not applicable (e.g., milk indicator, etc.) are plotted as 0's and listed in the tables as NDM.

**Table 4-1**

### Minimum Detectable Concentrations (MDC)

Analysis	Water (pCi/l)	Airborne Particulate or Gases (fCi/m <sup>3</sup> )	Fish (pCi/kg- wet)	Milk (pCi/l)	Grass or Leafy Vegetation (pCi/kg-wet)	Sediment (pCi/kg- dry)
Gross Beta	4	10				
H-3	2000 (a)					
Mn-54	15		130			
Fe-59	30		260			
Co-58	15		130			
Co-60	15		130			
Zn-65	30		260			
Zr-95	30					
Nb-95	15					
I-131	1 (b)	70		1	60	
Cs-134	15	50	130	15	60	150
Cs-137	18	60	150	18	80	180
Ba-140	60			60		
La-140	15			15		

(a) If no drinking water pathway exists, a value of 3000 pCi/l may be used.

(b) If no drinking water pathway exists, a value of 15 pCi/l may be used.



**Table 4-2**

**Reporting Levels (RL)**

<b>Analysis</b>	<b>Water (pCi/l)</b>	<b>Airborne Particulate or Gases (fCi/m3)</b>	<b>Fish (pCi/kg-wet)</b>	<b>Milk (pCi/l)</b>	<b>Grass or Leafy Vegetation (pCi/kg-wet)</b>
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.

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 preoperation, and the earlier years of operation. Some long lived radionuclides, such as Cs-137, continue to be detectable.

Significant upward trends also followed the Chernobyl incident which began on April 26, 1986.

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 as described in Table 2-1 are summarized in Table 4-3 along with their causes and resolutions.

All results were tested for conformance to 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. No data were excluded exclusively for failing Chauvenet's criterion. Data exclusions are discussed in this section under the appropriate sample type.

**TABLE 4-3  
DEVIATIONS FROM RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM**

<b>COLLECTION PERIOD</b>	<b>AFFECTED SAMPLES</b>	<b>DEVIATION</b>	<b>CAUSE</b>	<b>RESOLUTION</b>
01/28/08-02/04/08 CR2008111149	AF/AC Station 309 10.0 miles S	Non-representative sample of airborne particulates.	Power loss during rewiring work in area; lost ~100 hours sample time.	Station operated satisfactorily after power restored.
1 <sup>st</sup> Quarter CR2008111151	TLD Station 110 1.0 mile SSW	Non-representative direct radiation data.	TLDs destroyed in a fire.	Replaced TLDs at beginning of quarter.
06/23/08-06/30/08 CR2008111152 EXCLUDED	AF/AC Station 304 11.2 miles ENE	Non-representative sample of airborne particulates.	Breaker on power pole tripped; lost ~116.4 hours of sample time.	GPC trouble man contacted. Sample station operated satisfactorily after power restored.
07/28/08-08/04/08 CR2008111153	AF/AC Station 304 11.2 miles ENE	Non-representative sample of airborne particulates.	Fuse on power pole tripped; lost ~69.2 hours of sample time.	Station operated satisfactorily after power restored.
3 <sup>rd</sup> Quarter CR2009104826 EXCLUDED	TLD Station 104 1.6 miles ENE	No direct radiation data available.	TLDs missing at mid-quarter checks.	Replaced TLDs at beginning of quarter.
Second Semi-Annual Collection Period CR2009101127	Fish	Fall fish collection postponed.	Unable to do electrofishing due to low river water level during the fall.	Fish was collected on 01/06/09.

## 4.1 Land Use Census and River Survey

In accordance with ODCM 4.1.2, a land use census was conducted on November 10, 2008, to determine the locations of the nearest permanent residence and milk animal in each of the 16 compass sectors within a distance of 5 miles, and the locations of all milk animals within a distance of 3 miles. A milk animal is defined as a cow or goat producing milk for human consumption. The locations of beef cattle and of gardens greater than 500 square feet producing broad leaf vegetation were also included in the census. The census results are tabulated in the Table 4.1-1.

**Table 4.1-1**

### LAND USE CENSUS RESULTS

Distance in Miles to Nearest Location in Each Sector

SECTOR	RESIDENCE	MILK ANIMAL	BEEF CATTLE	GARDEN
N	2.1	None	None	None
NNE	2.9	None	None	None
NE	3.3	None	3.5	3.5
ENE	4.2	None	4.1	None
E	3.0	None	None	None
ESE	3.8	None	None	None
SE	1.8	None	2.3	4.4
SSE	2.0	None	3.6	4.5
S	1.1	None	2.3	2.3
SSW	1.5	None	2.0	None
SW	1.1	None	2.3	1.6
WSW	1.0	None	4.8	1.6
W	1.1	None	2.8	None
WNW	1.1	None	None	None
NW	3.6	None	3.2	None
NNW	1.9	None	2.8	2.8

ODCM 4.1.2.2.1 requires a new controlling receptor to be identified if the land use census identifies a location that yields a calculated receptor dose greater than the one in current use. No change in the controlling receptor was required as a result of the 2008 land use census. The current controlling receptor as described in ODCM Table 3-7 is a child in the WSW Sector at 1.2 miles

ODCM 4.1.2.2.2 requires that whenever the land use census identifies a location which would yield a calculated dose (via the same ingestion pathway) 20% greater than that of a current indicator station, the new location must become a REMP station (if samples are available). The 2008 land use census did not identify a garden which yielded a calculated dose 20% greater than that for any of the current indicator stations for vegetation. The results of the census were corroborated by inquiries to the county extension agents in the 5 counties in the vicinity of the plant.

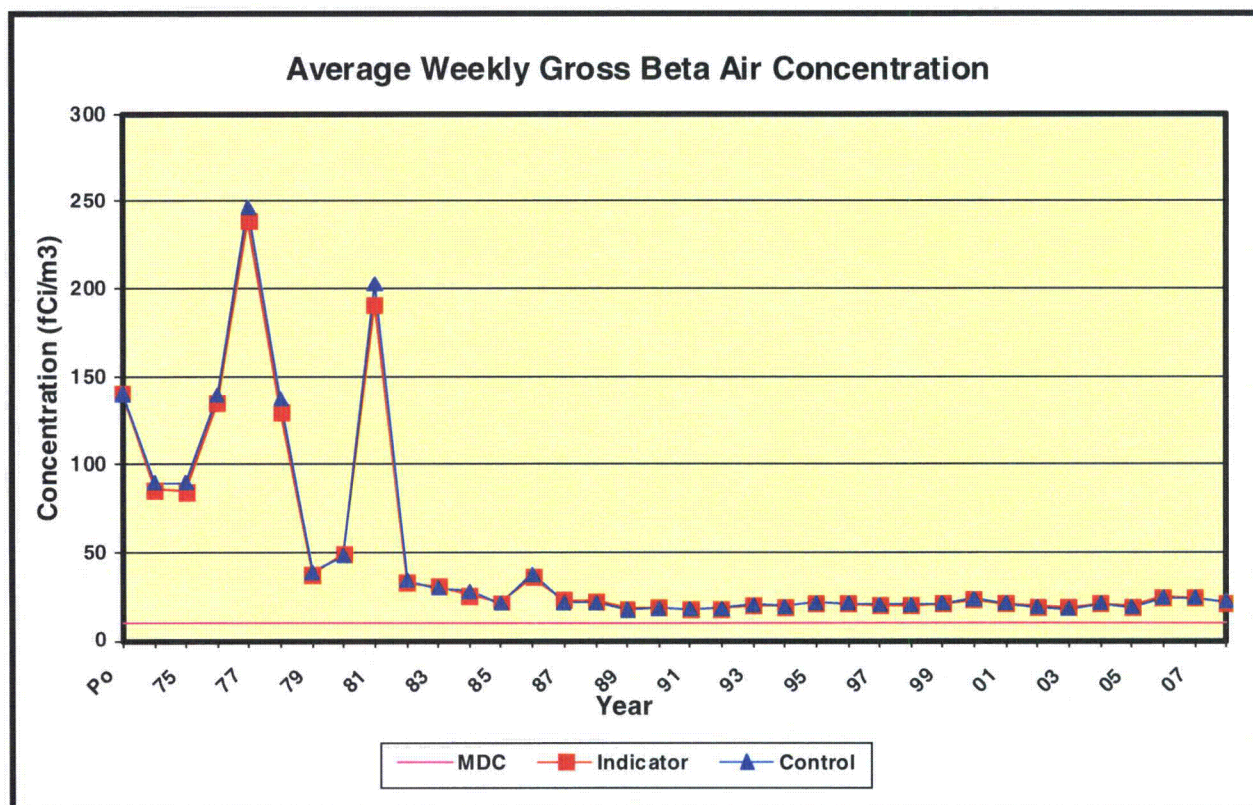
As required by Note f of Table 2-1, the annual survey of the Altamaha River for 50 miles downstream of the plant was conducted on September 22, 2008 to identify any withdrawal of river water for drinking purposes. No sources of withdrawal for drinking water purposes were identified. One irrigation source was noted about  $\frac{3}{4}$  miles downriver from river water Station #172 belonging to Clarke Farms who informed GPC that peanuts were being irrigated. Information obtained from the Georgia Department of Natural Resources on October 2, 2008 indicated that no surface water withdrawal permits for agricultural or drinking purposes had been issued for this stretch of the Altamaha River between the 2007 survey and the 2008 survey. Should it be determined that river water downstream of the plant is being used for drinking, the sampling and analysis requirements for drinking water found in Table 2-1 would be implemented.

## 4.2 Airborne

As indicated in Table 2-2 and Figures 2-1 and 2-2, airborne particulates and airborne radioiodine are collected at 4 indicator stations (Nos. 103, 107, 112 and 116) which encircle the plant near the site periphery and at 2 control stations (Nos. 304 and 309) which are located approximately 10 miles from the main stack. At each location, air is continuously drawn through a glass fiber filter and a charcoal canister placed in series to collect airborne particulates and radioiodine. The filters and canisters are collected weekly and analyzed for gross beta and I-131, respectively. A gamma isotopic analysis is performed quarterly on a composite of the filters for each station.

The 2008 annual average weekly gross beta concentration of 21.8 fCi/m<sup>3</sup> for the indicator stations was 0.7 fCi/m<sup>3</sup> less than that for the control stations (22.5 fCi/m<sup>3</sup>). This difference is not statistically discernible, since it is less than the calculated MDD of 1.8 fCi/m<sup>3</sup>. Figure 4.2-1 and Table 4.2-1 provide the historical trending of the average weekly gross beta concentrations in air. In general, there is close agreement between the results for the indicator and control stations. This close agreement supports the position that the plant is not contributing significantly to the gross beta concentration in air.

Figure 4.2-1



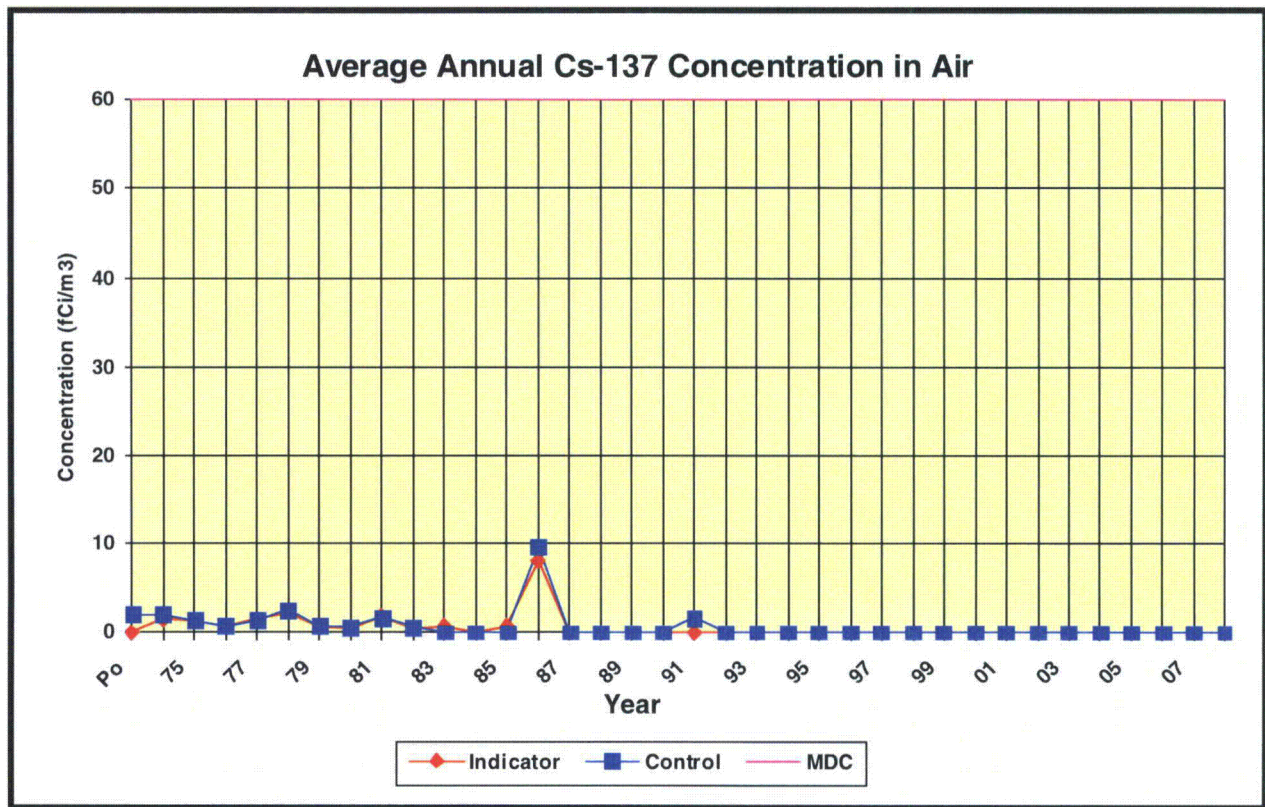
**Table 4.2-1****Average Weekly Gross Beta Air Concentration**

<b>Year</b>	<b>Indicator (fCi/m<sup>3</sup>)</b>	<b>Control (fCi/m<sup>3</sup>)</b>
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
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



During 2008, no man-made radionuclides were detected from the gamma isotopic analysis of the quarterly composites of the particulate air filters. During preoperation and during operation through 1986, a number of fission products and activation products were detected. These were generally attributed to the nuclear weapons tests and to the Chernobyl incident. 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/m<sup>3</sup>) 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/m<sup>3</sup>, respectively. The historical trending of the average annual concentrations of detectable Cs-137 from quarterly air filter composites is provided in Figure 4.2-2 and Table 4.2-2.

**Figure 4.2-2**





**Table 4.2-2****Average Annual Cs-137 Concentration In Air**

<b>Year</b>	<b>Indicator (fCi/m3)</b>	<b>Control (fCi/m3)</b>
Pre-op	NDM	2.0
1974	1.5	2.0
1975	1.4	1.4
1976	0.6	0.7
1977	1.5	1.4
1978	2.3	2.6
1979	0.8	0.8
1980	0.4	0.6
1981	1.8	1.7
1982	0.5	0.6
1983	0.7	NDM
1984	NDM	NDM
1985	0.7	NDM
1986	8.1	9.6
1987	NDM	NDM
1988	NDM	NDM
1989	NDM	NDM
1990	NDM	NDM
1991	NDM	1.7
1992	NDM	NDM
1993	NDM	NDM
1994	NDM	NDM
1995	NDM	NDM
1996	NDM	NDM
1997	NDM	NDM
1998	NDM	NDM
1999	NDM	NDM
2000	NDM	NDM
2001	NDM	NDM
2002	NDM	NDM
2003	NDM	NDM
2004	NDM	NDM
2005	NDM	NDM
2006	NDM	NDM
2007	NDM	NDM
2008	NDM	NDM

No airborne I-131 was detected in the charcoal canisters in 2008. During 1976, 1977, and 1978, positive levels of I-131 were found in nearly all of the samples collected for a period of a few weeks following atmospheric nuclear weapons tests. Some of the concentrations were on the order of 70 fCi/m<sup>3</sup>. In 1986, the same phenomenon occurred following the Chernobyl incident. The highest airborne I-131 concentration found to date in an individual charcoal canister was 217 fCi/m<sup>3</sup> in 1977. The MDC and RL for airborne I-131 are 70 fCi/m<sup>3</sup> and 900 fCi/m<sup>3</sup>, respectively.

Table 4-3 lists REMP deviations that occurred in 2008. Three deviations involved air sampling; one at Station #309 and two at Station #304. All three were related to power interruptions. Only one resulted in data exclusion. The results from the other two passed Chauvenet's Criterion and were included in the data set.

## 4.3 Direct Radiation

Direct (external) radiation is measured with thermoluminescent dosimeters (TLDs). Two Panasonic UD-814 TLD badges are placed at each station. Each badge contains three phosphors composed of calcium sulfate crystals (with thulium impurity). The gamma dose at each station is based upon the average readings of the phosphors from the two badges. The badges for each station are placed in thin plastic bags for protection from moisture while in the field. The badges are nominally exposed for periods of a quarter of a year (91 days). An inspection is performed near mid-quarter to assure that all badges are on-station and to replace any missing or damaged badges.

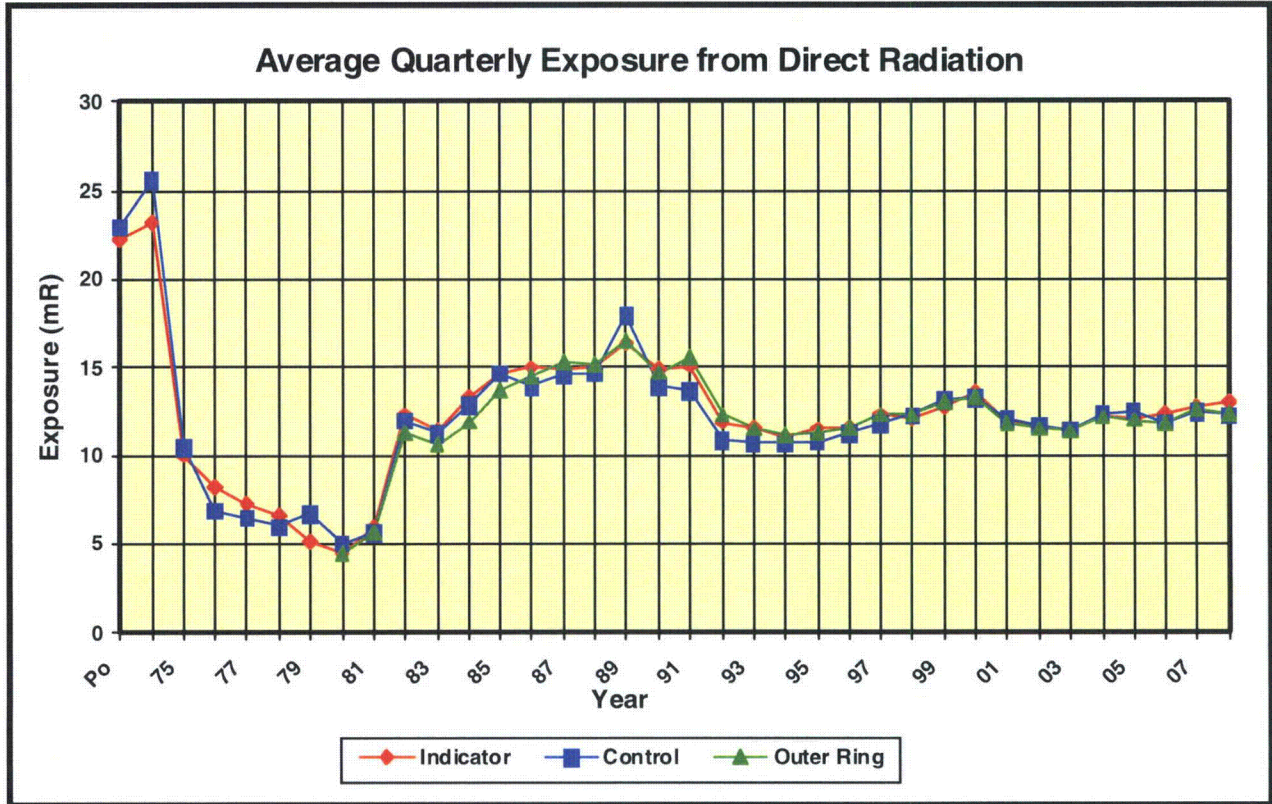
Two TLD stations are established in each of the 16 compass sectors around the plant to form 2 concentric rings, as seen in Figures 2-1 and 2-2. The two ring configuration of stations was established in 1980, in accordance with NRC Branch Technical Position "An Acceptable Radiological Environmental Monitoring Program", Revision 1, 1979. With the exception of the East sector, the inner ring stations (Nos. 101 through 116) are located near the site boundary and the outer ring stations (Nos. 201 through 216) are located at distances of 4 to 5 miles from the plant. The stations in the East sector are a few miles farther out than 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 3 control stations (Nos. 304, 309 and 416) are located 10 miles or more from the plant. Stations 064 and 301 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 average quarterly exposure measured at the indicator stations (inner ring) during 2008 was 13.0 mR. At the control stations, the average quarterly exposure was 12.3 mR. This difference (0.7 mR) is not statistically discernible since it is less than the MDD of 1.5 mR.

The quarterly exposures acquired at the outer ring stations during 2008 ranged from 9.3 to 18.3 mR, with an average of 12.4 mR. The average for the outer ring stations was 0.1 mR more than the average for the control stations. Since the results for the outer ring stations and the control stations differ by less than the MDD of 1.5 mR, there is no discernible difference between outer ring and control station results for 2008.

The historical trending of the average quarterly exposures for the indicator inner ring, outer ring, and the control stations are plotted in Figure 4.3-1 and listed in Table 4.3-1. 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. The close agreement between the station groups supports the position that the plant is not contributing significantly to direct radiation in the environment.

Figure 4.3-1

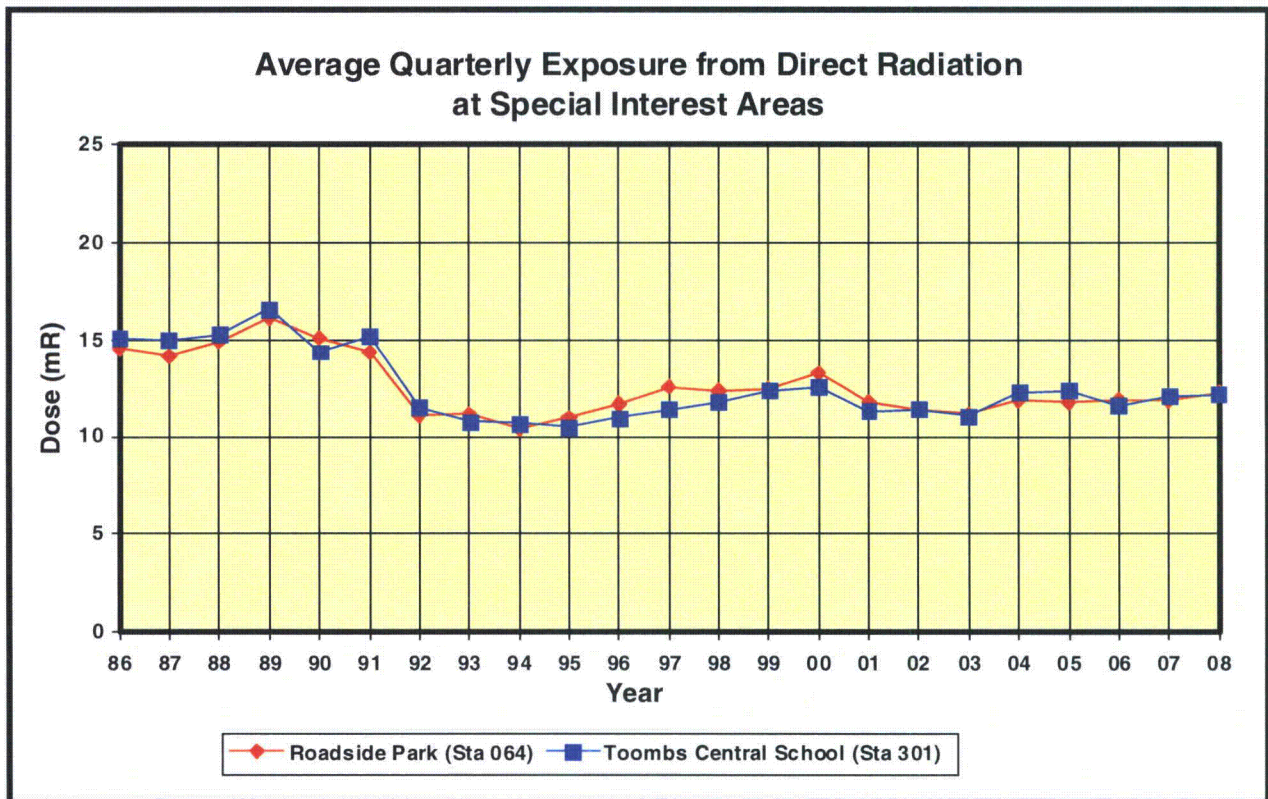


**Table 4.3-1****Average Quarterly Exposure from Direct Radiation**

<b>Year</b>	<b>Indicator (mR)</b>	<b>Control (mR)</b>	<b>Outer Ring (mR)</b>
Pre-op	22.3	23	NA
1974	23.2	25.6	NA
1975	10.0	10.5	NA
1976	8.18	6.9	NA
1977	7.31	6.52	NA
1978	6.67	6.01	NA
1979	5.16	6.77	NA
1980	4.44	5.04	4.42
1981	5.9	5.7	5.7
1982	12.3	12	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	14	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	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

The historical trending of the average quarterly exposures at the special interest areas for the past 19 years is provided in Figure 4.3-2 and listed in Table 4.3-2. These exposures are within the range of those acquired at the other stations. They too, show that the plant is not contributing significantly to direct radiation at the special interest areas.

Figure 4.3-2



**Table 4.3-2**

**Average Quarterly Exposure from Direct Radiation  
at Special Interest Areas**

Period	Station 064 (mR)	Station 301 (mR)
1986	14.6	15.1
1987	14.2	15.0
1988	14.9	15.3
1989	16.1	16.6
1990	15.1	14.4
1991	14.4	15.2
1992	11.1	11.5
1993	11.2	10.8
1994	10.4	10.7
1995	11.0	10.5
1996	11.7	11.0
1997	12.6	11.4
1998	12.4	11.8
1999	12.5	12.4
2000	13.3	12.6
2001	11.8	11.3
2002	11.4	11.4
2003	11.2	11.1
2004	11.9	12.3
2005	11.8	12.4
2006	11.9	11.6
2007	11.9	12.1
2008	12.3	12.2

In 2008, there were two deviations involving direct radiation measurements. In the first quarter, the TLDs at Station 110 were destroyed in a fire. In the third quarter, the TLDs at Station 104 were missing at mid-quarter. Blanks were put in place at mid-quarter for both of these stations. The results passed Chauvenet's Criterion at Station 110 and were retained in the data set. The results failed Chauvenet's Criterion at Station 104 and were excluded from the data set.

The standard deviation for the quarterly result for each badge was subjected to a self-imposed limit of 1.4. This limit is based upon the standard deviations obtained with the Panasonic UD-814 badges during 1992 and is calculated using a method developed by the American Society of Testing and Materials (ASTM

Special Technical Publication 15D, ASTM Manual on Presentation of Data and Control Chart Analysis, Fourth Revision, Philadelphia, PA, October 1976).

The limit serves as a flag to initiate an investigation. To be conservative, readings with a standard deviation greater than 1.4 are excluded from the data set since the high standard deviation is interpreted as an indication of unacceptable variation in TLD response. In 2008, the following TLD results were excluded from the data set because their standard deviations were greater than 1.4:

First Quarter	113B
Second Quarter	None
Third Quarter	416A
Fourth Quarter	114A

For the stations listed above, where one badge at a station exhibited a standard deviation greater than 1.4, the reading of the companion badge at each location was used to determine the quarterly exposure. A deviation occurred in the first quarter that involved a large number of TLD results which had high standard deviations. To minimize data loss, only the results from elements 3 and 4 were used to determine dose. The badges exceeding the self-imposed limit were visually inspected under a microscope and the glow curve and test results for the anneal data and the element correction factors were reviewed. No reason was evident for the high standard deviation.



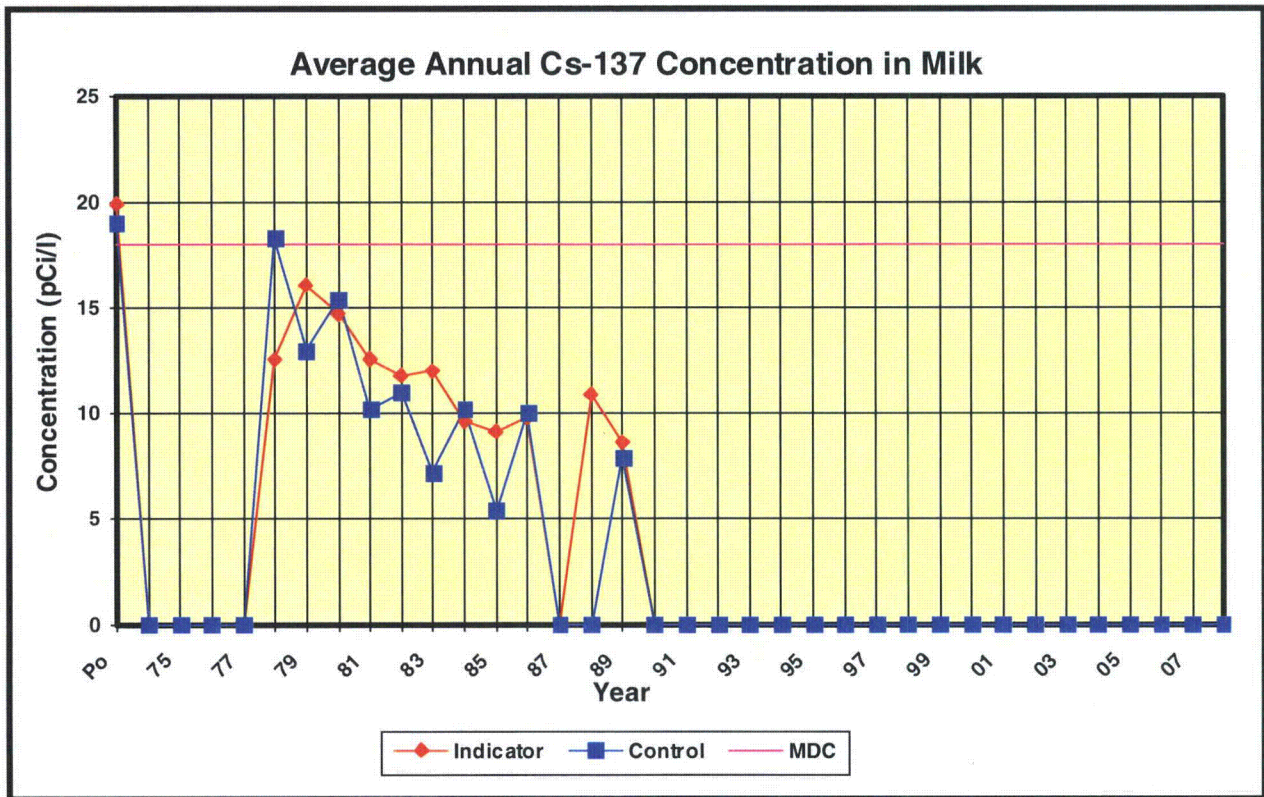
## 4.4 Milk

Milk samples are obtained biweekly from Station 304 (the state prison dairy) which is a control station located more than 10 miles from the plant. Gamma isotopic and I-131 analyses are performed on each sample as specified in Tables 2-1 and 2-2. Since 1989, efforts to locate a reliable milk sample source within 5 miles of the plant have been unsuccessful.

During 2008, no man-made radionuclides were detected from the gamma isotopic analysis of the milk samples. Cesium-137 was found in most of the samples each year from 1978 (when this analysis became a requirement) through 1989. No other man-made radionuclides have been detected by this analysis.

The MDC and RL for Cs-137 in milk are 18 and 70 pCi/l, respectively. The historical trending of the average annual detectable Cs-137 concentration in milk is provided in Figure 4.4-1 and Table 4.4-1.

Figure 4.4-1



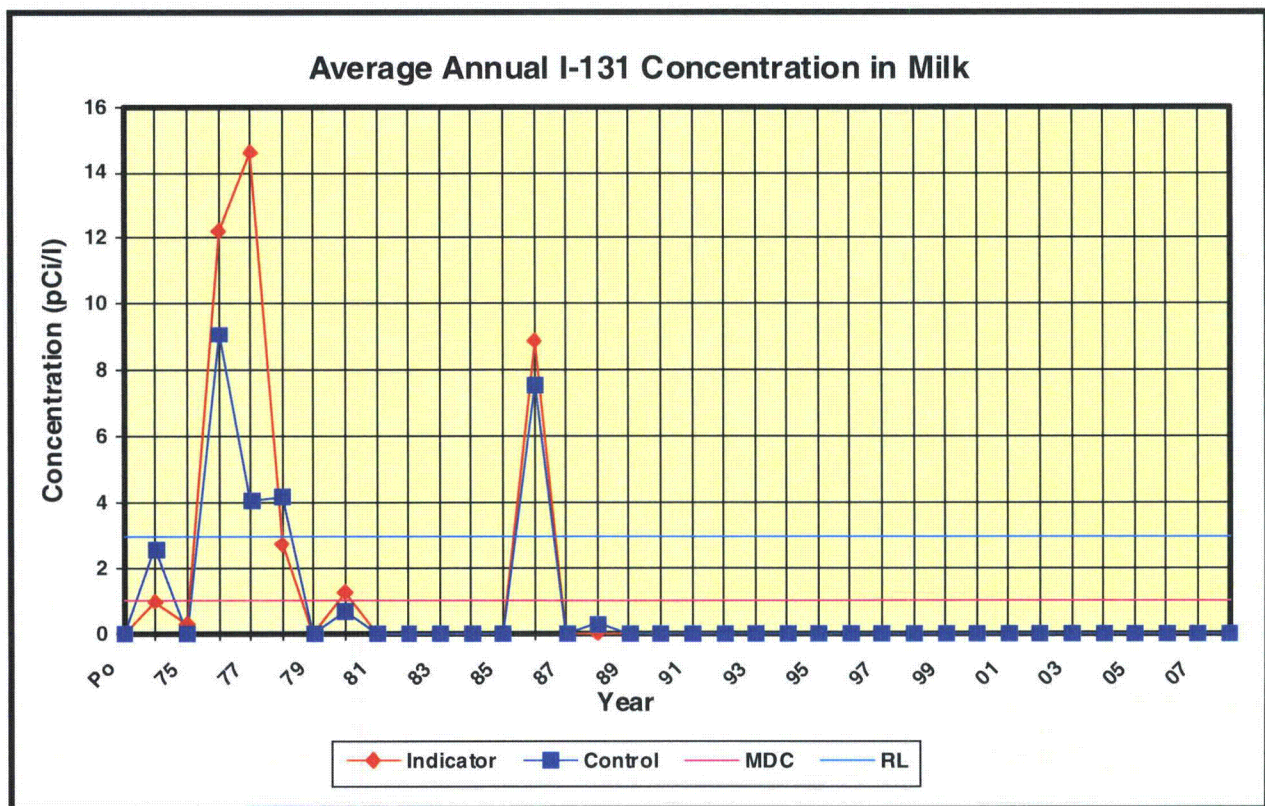
**Table 4.4-1****Average Annual Cs-137 Concentration in Milk**

<b>Year</b>	<b>Indicator (pCi/l)</b>	<b>Control (pCi/l)</b>
Pre-op	19.9	19.4
1974	NDM	NDM
1975	NDM	NDM
1976	NDM	NDM
1977	NDM	NDM
1978	12.1	18.3
1979	16.1	13
1980	14.7	15.4
1981	12.57	10.2
1982	11.8	11
1983	12	7.2
1984	9.6	10.2
1985	9.14	5.35
1986	9.8	10
1987	NDM	NDM
1988	10.9	NDM
1989	8.6	7.9
1990	NDM	NDM
1991	NDM	NDM
1992	NDM	NDM
1993	NDM	NDM
1994	NDM	NDM
1995	NDM	NDM
1996	NDM	NDM
1997	NDM	NDM
1998	NDM	NDM
1999	NDM	NDM
2000	NDM	NDM
2001	NDM	NDM
2002	NDM	NDM
2003	NDM	NDM
2004	NDM	NDM
2005	NDM	NDM
2006	NDM	NDM
2007	NDM	NDM
2008	NDM	NDM

During 2008, I-131 was not detected in any of the milk samples. During preoperation, all readings were less than 2 pCi/l which was the allowed MDC at that time. Figure 4.4-2 and Table 4.4-2 provide the historical trending of the average annual detectable concentration of I-131 in milk. In 1988, a single reading of 0.32 pCi/l, which was believed to have resulted from a procedural deficiency, was reported. The MDC and RL for I-131 in milk are 1 and 3 pCi/l, respectively.

All the detectable results for Cs-137 and I-131 are attributed to fallout from the nuclear weapons tests and the Chernobyl incident.

**Figure 4.4-2**



**Table 4.4-2****Average Annual I-131 Concentration in Milk**

<b>Year</b>	<b>Indicator (pCi/l)</b>	<b>Control (pCi/l)</b>
Pre-op	NDM	NDM
1974	0.98	2.6
1975	0.3	NDM
1976	12.23	9.1
1977	14.61	4.08
1978	2.72	4.18
1979	NDM	NDM
1980	1.26	0.69
1981	NDM	NDM
1982	NDM	NDM
1983	NDM	NDM
1984	NDM	NDM
1985	NDM	NDM
1986	8.9	7.6
1987	NDM	NDM
1988	NDM	0.32
1989	NDM	NDM
1990	NDM	NDM
1991	NDM	NDM
1992	NDM	NDM
1993	NDM	NDM
1994	NDM	NDM
1995	NDM	NDM
1996	NDM	NDM
1997	NDM	NDM
1998	NDM	NDM
1999	NDM	NDM
2000	NDM	NDM
2001	NDM	NDM
2002	NDM	NDM
2003	NDM	NDM
2004	NDM	NDM
2005	NDM	NDM
2006	NDM	NDM
2007	NDM	NDM
2008	NDM	NDM

## 4.5 Vegetation

In accordance with Tables 2-1 and 2-2, grass samples are collected monthly from two indicator stations near the site boundary (Nos. 106 and 112) and at one control station located about 21 miles from the plant (No. 416). Gamma isotopic analyses are performed on each sample. Gamma isotopic analysis on vegetation samples began in 1978 when the analysis became a TS requirement.

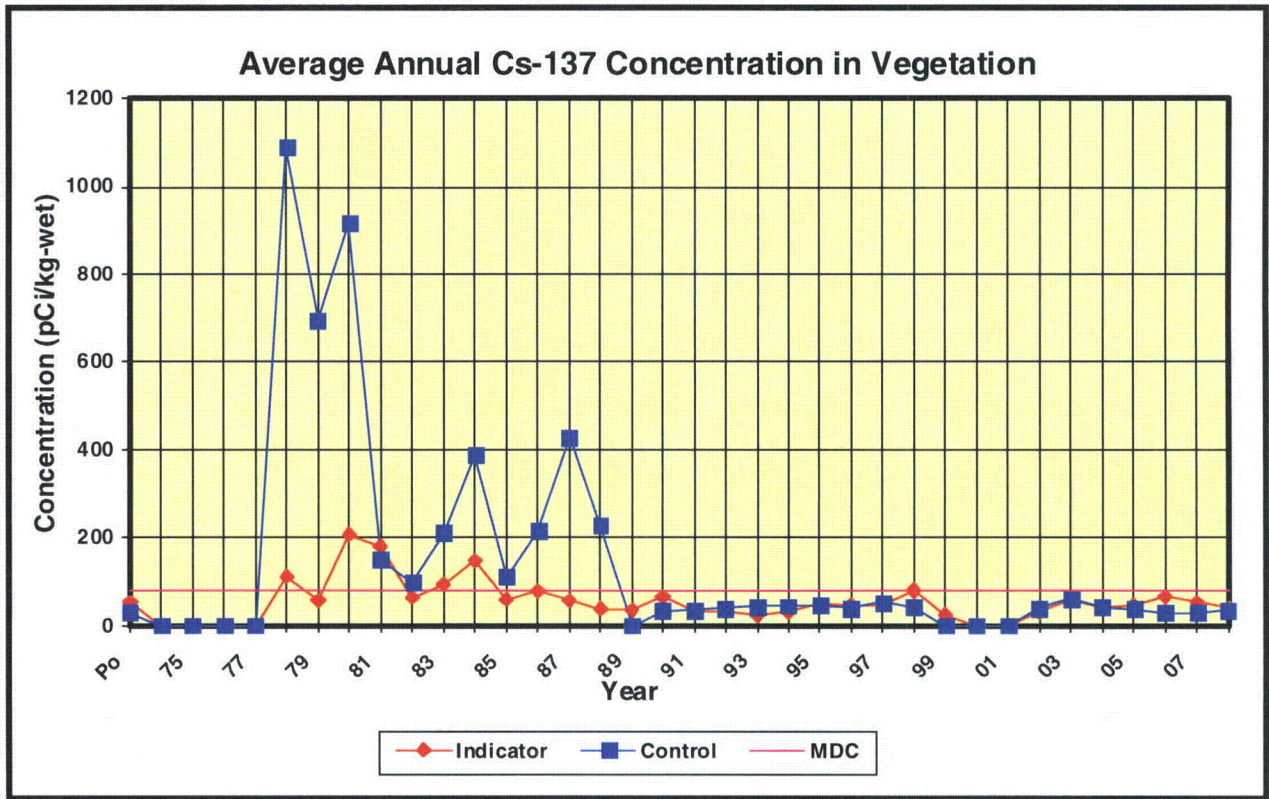
The results presented in Table 3-1 show that Cs-137 was the only man-made radionuclide detected in vegetation samples during 2008. Cs-137 was detected in seven samples collected at the indicator stations at an average value of 41.8 pCi/kg-wet. One samples collected at the control station had detectable Cs-137 at 38.1 pCi/kg-wet. Application of the modified Student's t-test shows that the difference of 3.7 pCi/kg-wet between the control and the indicator stations is not statistically discernible. The Cs-137 seen at the indicator stations could potentially be attributed to plant effluents.

Since 1986, Cs-137 has been the only man-made radionuclide found in vegetation samples. The MDC and RL for Cs-137 in vegetation samples are 80 pCi/kg-wet and 2000 pCi/kg-wet, respectively. The occasional presence of Cs-137 in vegetation samples is attributed primarily to fallout from nuclear weapons tests and the Chernobyl incident.

Figure 4.5-1 and Table 4.5-1 provide the historical trending of the average annual detectable Cs-137 concentration found in vegetation. Since 1978, the Cs-137 concentration has been on a decline, and since about 1989, generally occurring below the required MDC.



Figure 4.5-1



**Table 4.5-1****Average Annual Cs-137 Concentration in Vegetation**

<b>Year</b>	<b>Indicator (pCi/kg-wet)</b>	<b>Control (pCi/kg-wet)</b>
Pre-op	55	30
1974	NDM	NDM
1975	NDM	NDM
1976	NDM	NDM
1977	NDM	NDM
1978	112	1089
1979	59	695
1980	208	916
1981	182	152
1982	65	99
1983	95	211
1984	149	388
1985	60.9	113.3
1986	80	215
1987	60	428
1988	40.1	228.8
1989	37	NDM
1990	66.7	34.5
1991	34.1	36.1
1992	35.2	41.3
1993	24.7	45.8
1994	32.2	46.6
1995	49.8	47.6
1996	47.2	41.1
1997	48.4	54.9
1998	81.4	44.1
1999	26.9	NDM
2000	NDM	NDM
2001	NDM	NDM
2002	33.7	41.1
2003	61.0	62.8
2004	41.6	43.5
2005	47.7	39.8
2006	66.8	29.6
2007	55.7	31.1
2008	41.8	38.1

## 4.6 River Water

Surface water from the Altamaha River is obtained at an upstream location (Station 170) and at a downstream location (Station 172) using automatic samplers. Small quantities are drawn at intervals not exceeding a few hours. The samples drawn are collected monthly and quarterly composites are produced from the monthly collections.

As specified in Table 2-1, a gamma isotopic analysis is conducted on each monthly sample. No man-made gamma emitters were detected during 2008. The only man-made gamma emitters previously detected are presented in the table below.

Year	Quarter	Station	Radionuclide	Level (pCi/l)
1975	4th	172	Ce-141	78.2
1986	2nd	170	La-140	18.0
1986	2nd	172	Cs-137	12.0
1988	2nd	170	Cs-137	6.8

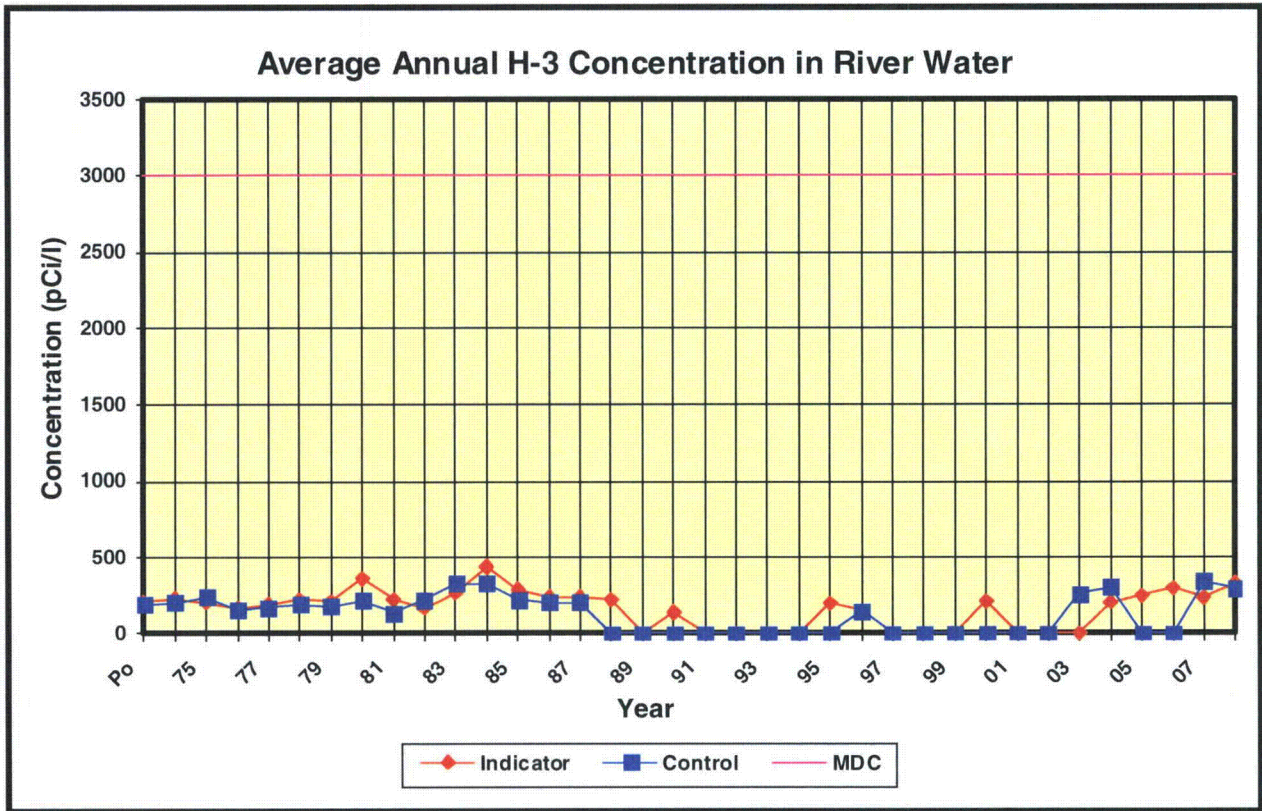
A tritium analysis is performed on the quarterly composite. Prior to 1986, positive results were usually found in each quarterly composite at levels generally ranging from 200 and 350 pCi/l which is approximately background environmental levels. Subsequently, the number of positive results have diminished.

In 2008, tritium was detected in one of the four quarterly samples at the upstream (control) location and in two of the four quarterly samples at the downstream (indicator) location. The average of the two indicator samples was 329 pCi/l (the range was 284-373 pCi/l). The single positive value at the control station was 298 pCi/l. Application of the modified Student's t-test shows that the difference between the two stations is not statistically discernible. These low levels are essentially background environmental levels. The MDC and RL for tritium in river water are 3000 and 30,000 pCi/l, respectively. Figure 4.6-1 and Table 4.6-1 provide the historical trending of the annual average detectable tritium concentration in river water.

The annual 50 mile downstream survey of the Altamaha River to determine if river water is being withdrawn for drinking purposes is discussed in Section 4.1.



Figure 4.6-1



**Table 4.6-1****Average Annual H-3 Concentration in River Water**

<b>Year</b>	<b>Indicator (pCi/l)</b>	<b>Control (pCi/l)</b>
Pre-op	210	191
1974	230	205
1975	205	238
1976	165	153
1977	189	170
1978	224	193
1979	210	180
1980	358	218
1981	220	135
1982	165	220
1983	265	328
1984	437	327
1985	288	220
1986	242	206
1987	241	204
1988	220	NDM
1989	NDM	NDM
1990	139	NDM
1991	NDM	NDM
1992	NDM	NDM
1993	NDM	NDM
1994	NDM	NDM
1995	200	NDM
1996	144	147
1997	NDM	NDM
1998	NDM	NDM
1999	NDM	NDM
2000	209	NDM
2001	NDM	NDM
2002	NDM	NDM
2003	NDM	261
2004	206	302
2005	245	NDM
2006	299	NDM
2007	235	338
2008	329	298

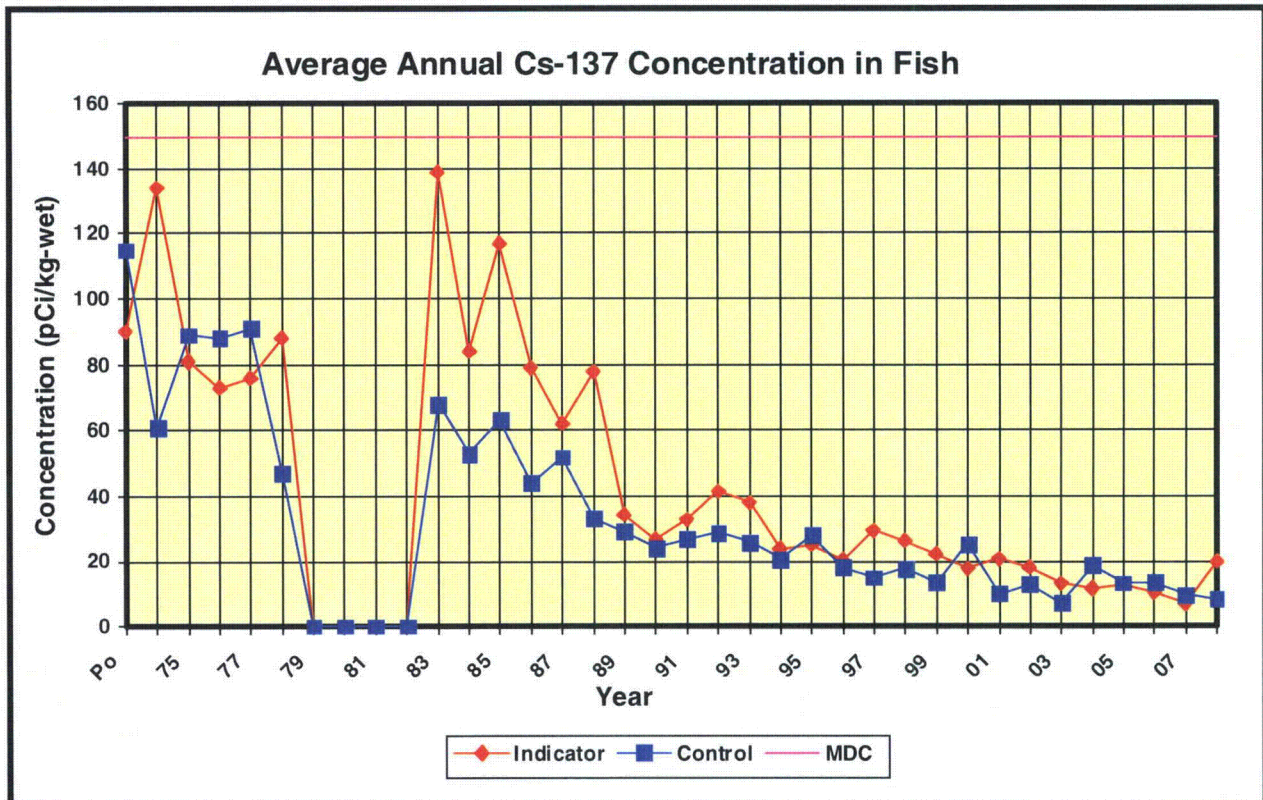
## 4.7 Fish

Gamma isotopic analyses were performed on the edible portion of the fish samples collected at the river stations on April 14, 2008 and January 6, 2009 (the fall collection was delayed due to low river water level). The control station (No. 170) is located upstream of the plant while the indicator station (No. 172) is located downstream.

As shown in Table 3-1, Cs-137 was the only man-made radionuclide detected in fish during 2008. The average concentration of 19.9 pCi/kg-wet at the indicator station was 11.5 pCi/kg-wet more than the average concentration found at the control station (8.4 pCi/kg-wet). This difference is statistically discernible since it is more than the calculated MDD of 5.4 pCi/kg-wet. Cs-137 in fish samples is attributed primarily to weapons testing and the Chernobyl incident. However, the Cs-137 seen in the fish samples at the indicator station could be attributed to plant effluents. The MDC and RL for Cs-137 in fish are 150 and 2000 pCi/kg-wet, respectively.

The historical trending of the average annual detectable Cs-137 concentration in fish is provided in Figure 4.7-1 and Table 4.7-1. Figure 4.7-1 indicates, in general, a decline in the Cs-137 levels after 1983. (Note: From 1979 through 1982, clams were collected rather than fish.)

Figure 4.7-1



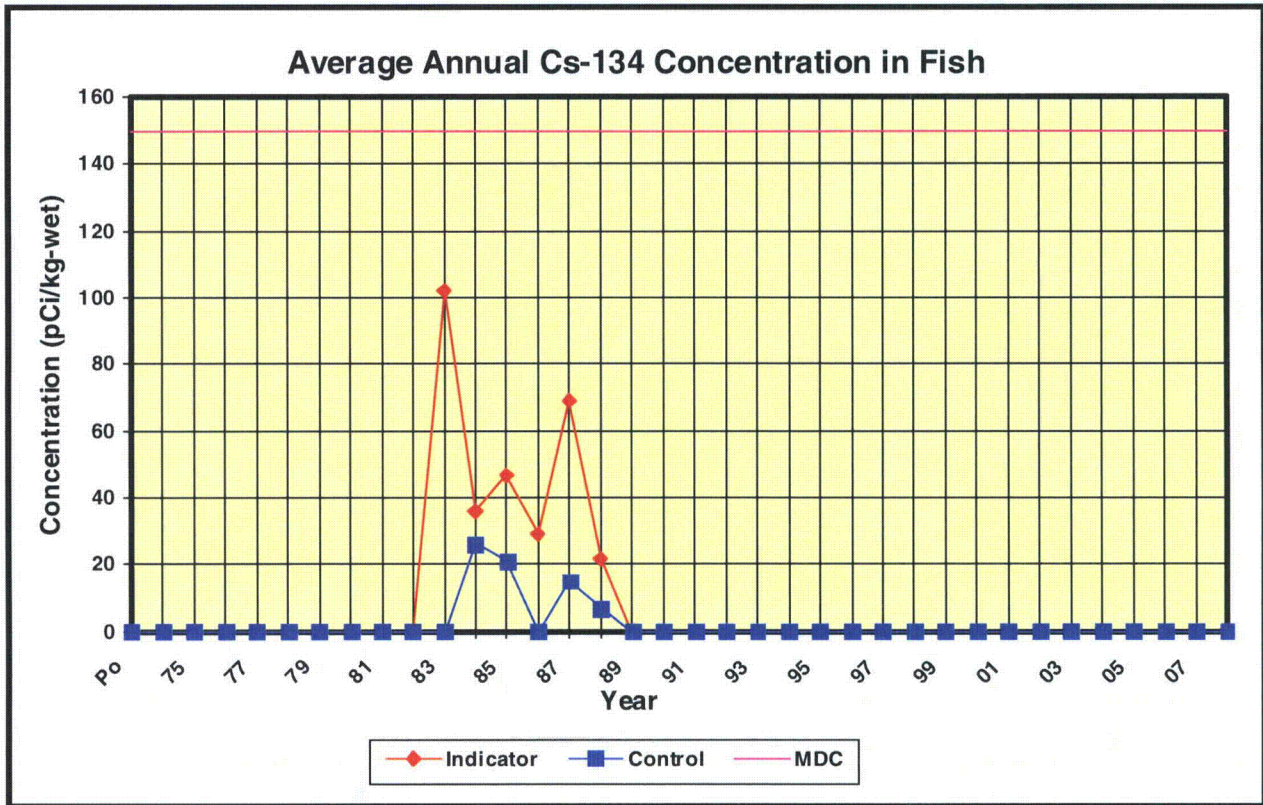
**Table 4.7-1****Average Annual Cs-137 Concentration in Fish**

<b>Year</b>	<b>Indicator (pCi/kg-wet)</b>	<b>Control (pCi/kg-wet)</b>
Pre-op	90	115
1974	134	61
1975	80.6	89.4
1976	73	88
1977	76	91
1978	88	47
1979	NDM	NDM
1980	NDM	NDM
1981	NDM	NDM
1982	NDM	NDM
1983	138.6	67.5
1984	84	53
1985	117	63.3
1986	79	44
1987	62	52
1988	77.8	33.3
1989	34.3	28.9
1990	26.7	24.2
1991	32.9	26.9
1992	41.6	28.8
1993	38.0	25.9
1994	23.8	20.7
1995	25.0	27.9
1996	20.4	18.0
1997	29.4	15.1
1998	26.1	17.7
1999	22.3	13.5
2000	17.9	25.3
2001	20.8	10.2
2002	18.2	13.0
2003	13.1	7.1
2004	11.6	18.8
2005	13.0	13.3
2006	10.4	13.5
2007	6.8	9.8
2008	19.9	8.4



In the past, the only other man-made radionuclides detected in fish samples were Co-60 and Cs-134. During preoperation, Co-60 was detected in one fish sample at a very low concentration. During the period of 1983 through 1988, Cs-134 was found in about half of the samples at concentrations of the same order of magnitude as those found for Cs-137. The Co-60 and Cs-134 levels found in these samples are attributed to the nuclear weapons tests and the Chernobyl incident. Figure 4.7-2 and Table 4.7-2 show the historical trending of the annual average detectable concentration of Cs-134 in fish.

**Figure 4.7-2**



**Table 4.7-2****Average Annual Cs-134 Concentration in Fish**

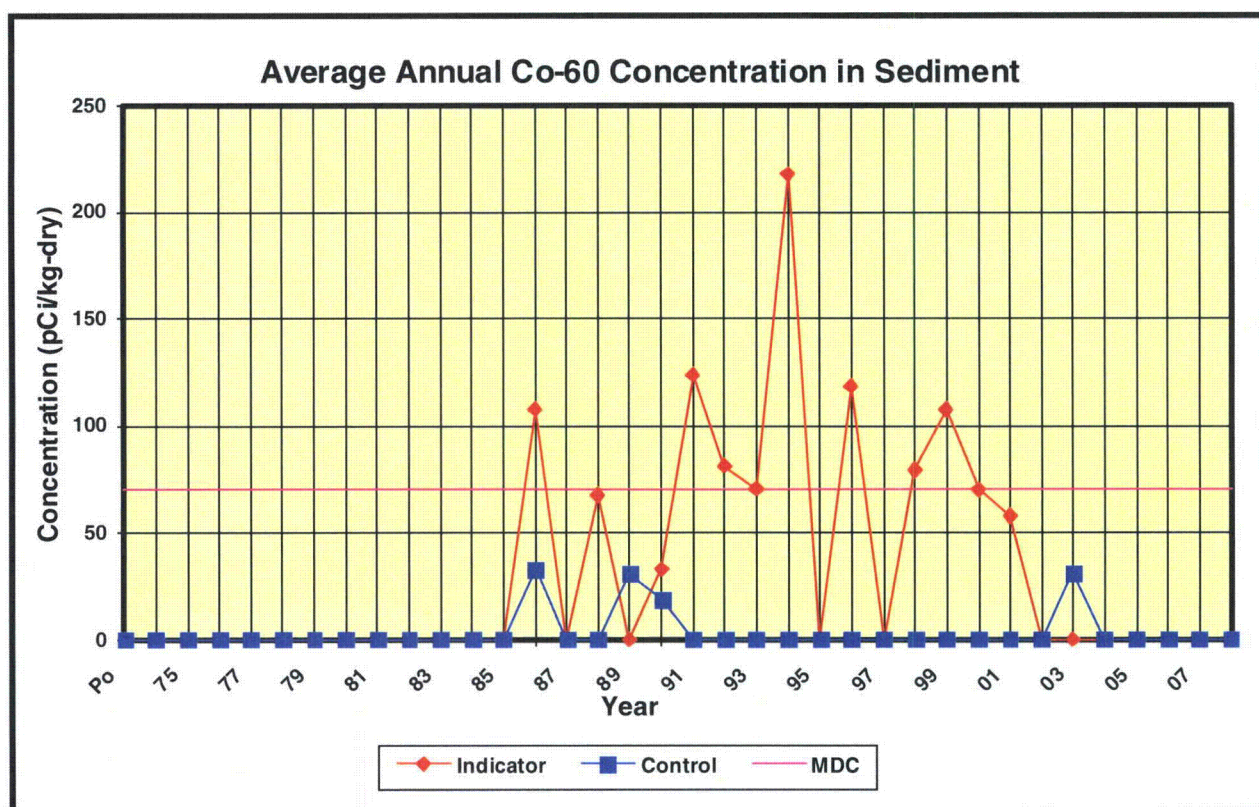
<b>Year</b>	<b>Indicator (pCi/kg-wet)</b>	<b>Control (pCi/kg-wet)</b>
Pre-op	NDM	NDM
1974	NDM	NDM
1975	NDM	NDM
1976	NDM	NDM
1977	NDM	NDM
1978	NDM	NDM
1979	NDM	NDM
1980	NDM	NDM
1981	NDM	NDM
1982	NDM	NDM
1983	101.8	NDM
1984	35.8	26.3
1985	46.7	21.1
1986	29	NDM
1987	69	15
1988	21.7	6.9
1989	NDM	NDM
1990	NDM	NDM
1991	NDM	NDM
1992	NDM	NDM
1993	NDM	NDM
1994	NDM	NDM
1995	NDM	NDM
1996	NDM	NDM
1997	NDM	NDM
1998	NDM	NDM
1999	NDM	NDM
2000	NDM	NDM
2001	NDM	NDM
2002	NDM	NDM
2003	NDM	NDM
2004	NDM	NDM
2005	NDM	NDM
2006	NDM	NDM
2007	NDM	NDM
2008	NDM	NDM

## 4.8 Sediment

Sediment was collected along the shoreline of the Altamaha River on May 5 and November 3, 2008, at the upstream control station (No. 170) and the downstream indicator station (No. 172). A gamma isotopic analysis was performed on each sample.

Co-60 was not found in sediment samples in 2008. With the exception of a few years, Co-60 has been found at either the indicator or the control station every year since 1986. There is no RL or MDC assigned to Co-60 in sediment in ODCM Tables 4-2 and 4-3 (Tables 4-2 and 4-1 of this report). The MDC assigned by the EL for Co-60 in sediment is 70 pCi/kg-dry. The historical trending of the average annual detectable Co-60 concentration in sediment is provided in Figure 4.8-1 and Table 4.8-1.

Figure 4.8-1



**Table 4.8-1****Average Annual Co-60 Concentration in Sediment**

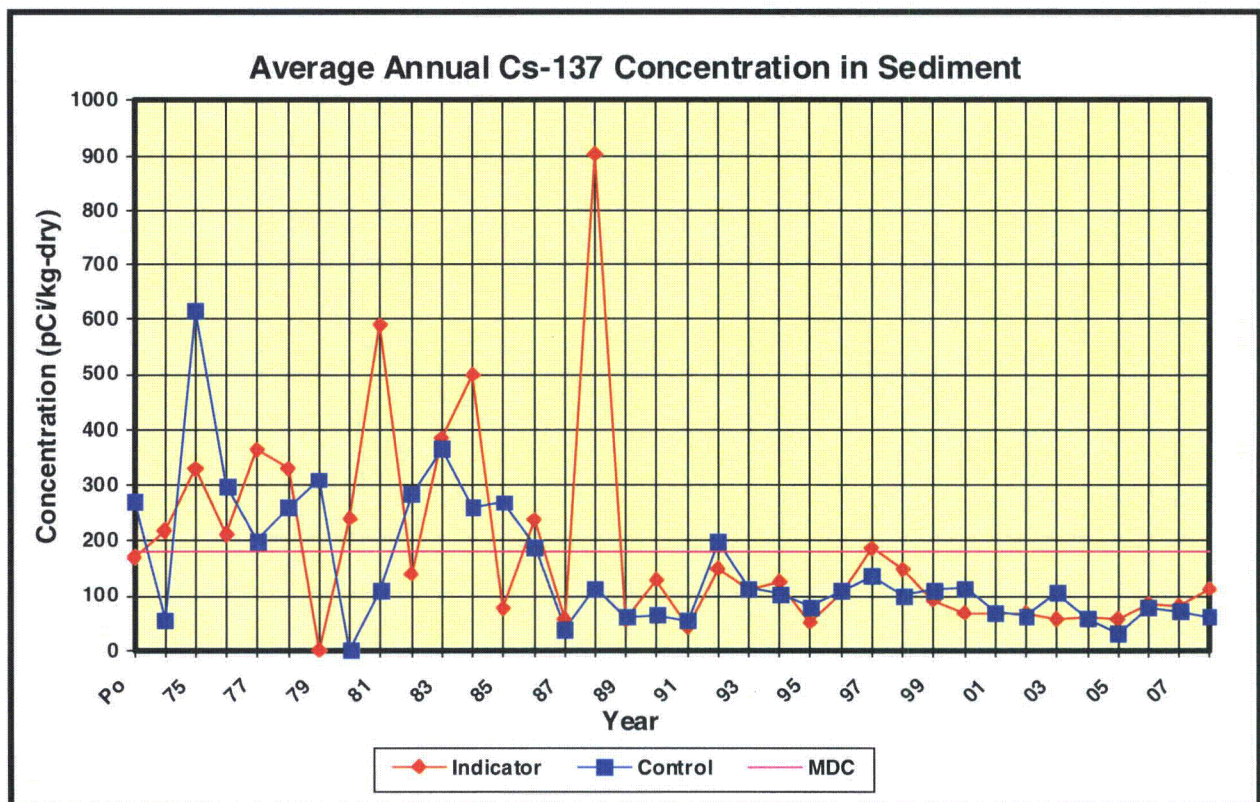
<b>Year</b>	<b>Indicator (pCi/kg-dry)</b>	<b>Control (pCi/kg-dry)</b>
Pre-op	NDM	NDM
1974	NDM	NDM
1975	NDM	NDM
1976	NDM	NDM
1977	NDM	NDM
1978	NDM	NDM
1979	NDM	NDM
1980	NDM	NDM
1981	NDM	NDM
1982	NDM	NDM
1983	NDM	NDM
1984	NDM	NDM
1985	NDM	NDM
1986	108	33
1987	NDM	NDM
1988	67.8	NDM
1989	NDM	31
1990	33	19
1991	123.6	NDM
1992	81.4	NDM
1993	70.7	NDM
1994	218	NDM
1995	NDM	NDM
1996	118.5	NDM
1997	NDM	NDM
1998	79.4	NDM
1999	107.7	NDM
2000	70.0	NDM
2001	58.1	NDM
2002	NDM	NDM
2003	NDM	31.5
2004	NDM	NDM
2005	NDM	NDM
2006	NDM	NDM
2007	NDM	NDM
2008	NDM	NDM



Co-60 was not detected in sediment samples near the plant until 1986, the year of the Chernobyl incident. However, because Co-60 was detected in indicator station samples more often than in control station samples during the years 1986 through 2002, some contribution from plant effluents cannot be ruled out. Co-60 has not been detected in either control or indicator station samples since 2004.

In 2008, Cs-137 was detected in both indicator and control station sediment samples. It has been found in over 95% of all of the sediment samples collected back through preoperation, and is generally attributed to the atmospheric nuclear weapons tests or to the Chernobyl incident. As shown in Table 3-1, the average at the indicator station was 112.7 pCi/kg-dry and at the control station the single positive value was 61.9 pCi/kg-dry. Application of the modified Student's t-test shows that the difference (50.8 pCi/kg-dry) between the stations is not statistically discernible. The MDC for Cs-137 in sediment is 180 pCi/kg-dry. The historical trending of the average annual detectable Cs-137 concentration in sediment is provided in Figure 4.8-2 and Table 4.8-2.

**Figure 4.8-2**

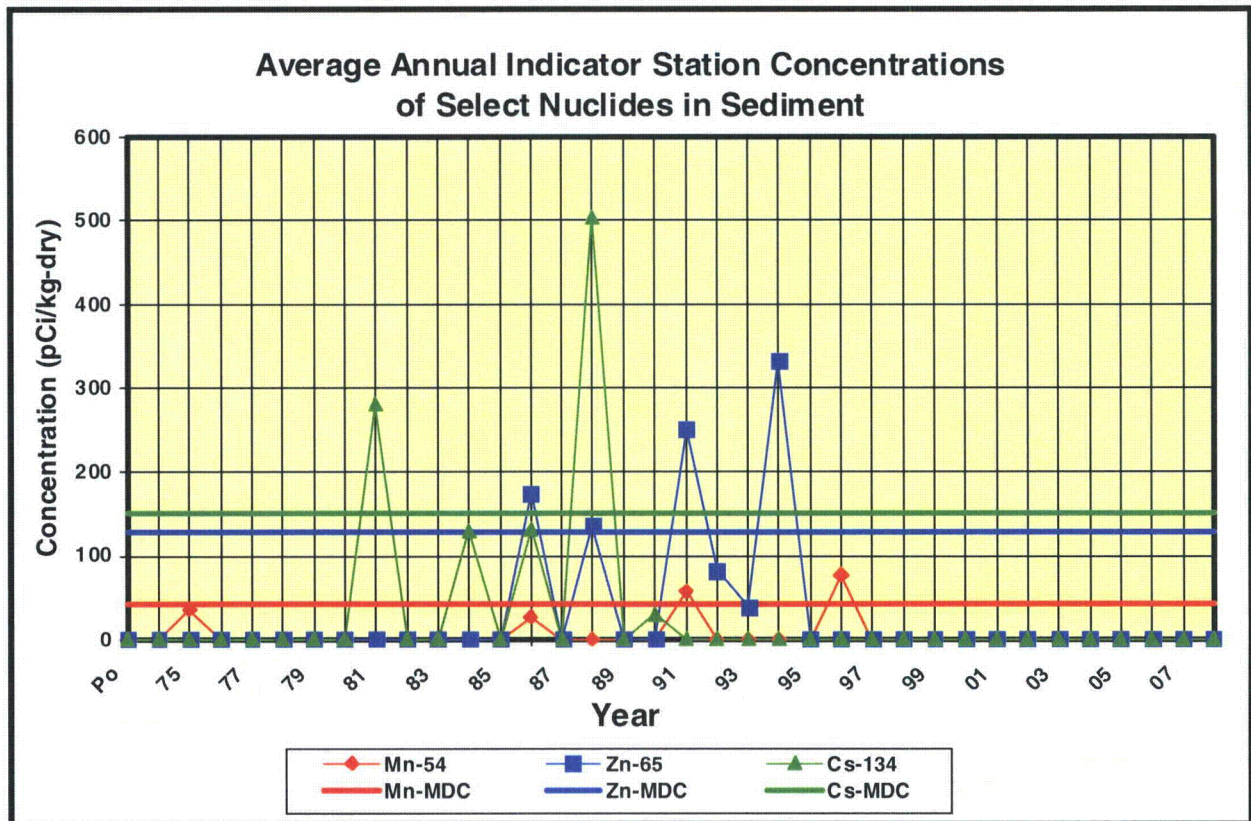


**Table 4.8-2****Average Annual Cs-137 Concentration in Sediment**

<b>Year</b>	<b>Indicator (pCi/kg-dry)</b>	<b>Control (pCi/kg-dry)</b>
Pre-op	170	270
1974	218	57
1975	330	615
1976	211	300
1977	364	200
1978	330	260
1979	NDM	310
1980	240	NDM
1981	590	110
1982	141	285
1983	384	365
1984	500	260
1985	76.5	269
1986	238	190
1987	59	39
1988	903	114
1989	56	62
1990	130.5	66
1991	43.1	54.5
1992	151	198.5
1993	113	115
1994	127	104
1995	52.3	80.6
1996	106	110
1997	186	137
1998	148.5	101.4
1999	92	111.8
2000	68.1	114.5
2001	68.7	69.6
2002	68.1	62.8
2003	57.3	106
2004	59.5	57.1
2005	57.2	30.3
2006	85.2	79.2
2007	82.1	71.6
2008	112.7	61.9

Other man-made nuclides, besides Co-60 and Cs-137, were occasionally found in past years. Their presence was generally attributed to the nuclear weapons tests or to the Chernobyl incident, although plant releases were not ruled out. Mn-54, Co-58, and Zn-65, which have relatively short half-lives, are most likely a result of plant releases and have been plotted in Figure 4.8-3 along with their MDCs. All the man-made nuclides detected in sediment except for Co-60 and Cs-137 have been listed in Table 4.8-3. The Cs-134 MDC (150 pCi/kg-dry) is defined in ODCM Table 4-3 (Table 4-1 of this report). The MDCs for Mn-54 (42 pCi/kg-dry) and Zn-65 (129 pCi/kg-dry) were determined by the EL since no values are provided in ODCM Table 4-3.

Figure 4.8-3



**Table 4.8-3**

**Sediment Nuclide Concentrations Other Than Co-60 & Cs-137**

<b>Nuclide</b>	<b>YEAR</b>	<b>Indicator (pCi/kg-dry)</b>	<b>Control (pCi/kg-dry)</b>
Ce-141	1976	340	254
	1977	141	
Ce-144	Preop		720
	1974	363	
	1975	342	389
	1978	700	
	1981	1290	
Co-58	1994	22.2	
Cs-134	Preop		40
	1981	280	
	1984	130	40
	1986	132	
	1988	505	
	1990	31	
Mn-54	1975	36.1	
	1986	28	26
	1991	57.2	
	1996	77.7	
Ru-103	1974	81	
	1976	158	
	1977	195	
	1981	220	
Zn-65	1986	175	
	1988	136	
	1991	250.5	
	1992	83	
	1993	39.9	
	1994	332	
Zr-95	Preop		180
	1974	138	
	1976	427	170
	1977	349	294
	1978	220	230
	1981	860	280



## 4.9 Groundwater

As nuclear plants began to undergo decommissioning in the late 1990's to early 2000s, instances of subsurface and/or groundwater contamination were identified. In addition, several operating facilities also identified groundwater contamination resulting from spills and leaks or equipment failure. In one instance, low levels of licensed material were detected in a private well located on property adjacent to a nuclear power plant.

In 2006, NEI (Nuclear Energy Institute) formed a task force to address monitoring onsite groundwater for radionuclides at nuclear facilities. A Groundwater Protection Initiative was developed which was adopted by all U.S. commercial operating nuclear plants.

The NRC also formed a task force to study the groundwater issues and released Information Notice 2006-13 "Ground-water Contamination due to Undetected Leakage of Radioactive Water" which summarized its review of radioactive contamination of ground water at multiple facilities as a result of undetected leakage from structures, systems, or components that contain or transport radioactive fluids. Licensees were instructed to review the information for applicability and to consider appropriate actions to avoid similar problems.

The NEI task force felt it was prudent for the industry to update site hydrology information and to develop radiological groundwater monitoring plans at each site. These groundwater protection plans would ensure that underground leaks and spills would be addressed promptly. Additionally, the task force recommended developing a communications protocol to report radioactive leaks or spills that entered groundwater (or might eventually enter groundwater) to the NRC and State and Local government officials as needed.

Southern Nuclear developed a company-wide communications protocol which is contained in the Nuclear Management Procedure, *Actions for Potential Groundwater Contamination Events*, to ensure radioactive leaks and spills would be addressed and communicated appropriately. The guidance in this procedure is used to informally update both the NRC and the State of Georgia regarding the changes in Hatch's groundwater tritium concentrations.

Plant Hatch has monitored onsite groundwater since preoperation. Initially piezometers, which were installed prior to plant construction, were used to monitor groundwater. In the late 1970s to the early 1980s timeframe, a hydrological engineering consultant was hired to evaluate several areas where leaks had occurred and tritium had been detected in onsite wells. The consultant recommended drilling additional monitoring wells to study the groundwater movement, to determine the source of the leaks, and to track the tritium concentrations in groundwater.

In the late 1970s through the mid 1980s, Hatch reported groundwater results to the NRC. The reporting frequency was decreased for several reasons – the areas where the groundwater showed tritium were all onsite and the movement of groundwater was extremely slow and in a direction (towards the river) that was not expected to impact the public. Although the reports are no longer made on a routine basis, Plant Hatch has continued to monitor onsite groundwater wells for tritium on a scheduled frequency.

In 2006 as the nuclear industry was moving towards establishing groundwater monitoring programs, Plant Hatch hired a hydrological engineering consultant to re-evaluate the groundwater study which had been done previously. The key purpose of the new study was to evaluate the adequacy of the current monitoring program and to diagram the existing groundwater tritium plume to ensure that the plume had not migrated offsite. The consultant concluded that tritium was not leaving the site through the groundwater. The consultant recommended installing additional monitoring wells to better characterize the groundwater plume in areas of the site where there were no existing wells.

During the course of Plant Hatch's groundwater evaluation in 2006, some leaks were discovered which explained why the levels of tritium around CST-1 (Unit 1 Condensate Storage Tank) were not decreasing. Underground piping which carried radioactive liquids was evaluated over the plant site and replaced in some areas around CST-1. Both CST tank/pump moats (Unit 1 and Unit 2) were coated and sealed to ensure that moats would not leak in the event of transfer pump or tank leaks.

In 2006, Plant Hatch's groundwater monitoring program included over 50 location points which were sampled on weekly, monthly, quarterly, or annual frequencies (see maps at the end of this section). Included in these sample points were the onsite drinking water wells. They did not contain detectable amounts of radioactivity. Surface drains or outfalls were also included as sample points. Tritium was detected in two of the outfalls which discharged to the river. These outfalls were added to the Hatch ODCM as radiological effluent release points. Permitted release point Y22N008A (by design) discharges groundwater from the site subsurface drainage system which includes the tritiated groundwater around the CST-1. The other permitted release point, Y22N003A, discharges runoff from the roof drains. The source of tritium in this outfall is believed to be from rain washout of the gaseous plant effluents. Plant Hatch sampled rainfall during two rain events in 2006 and found tritium levels as high as  $4.58E5$  pCi/l on the reactor building roof. Two other outfalls, Y22N024A and Y22N025A, which discharge into the onsite swamp show sporadic levels of tritium. The source of tritium in these outfalls is also believed to be from rain washout.

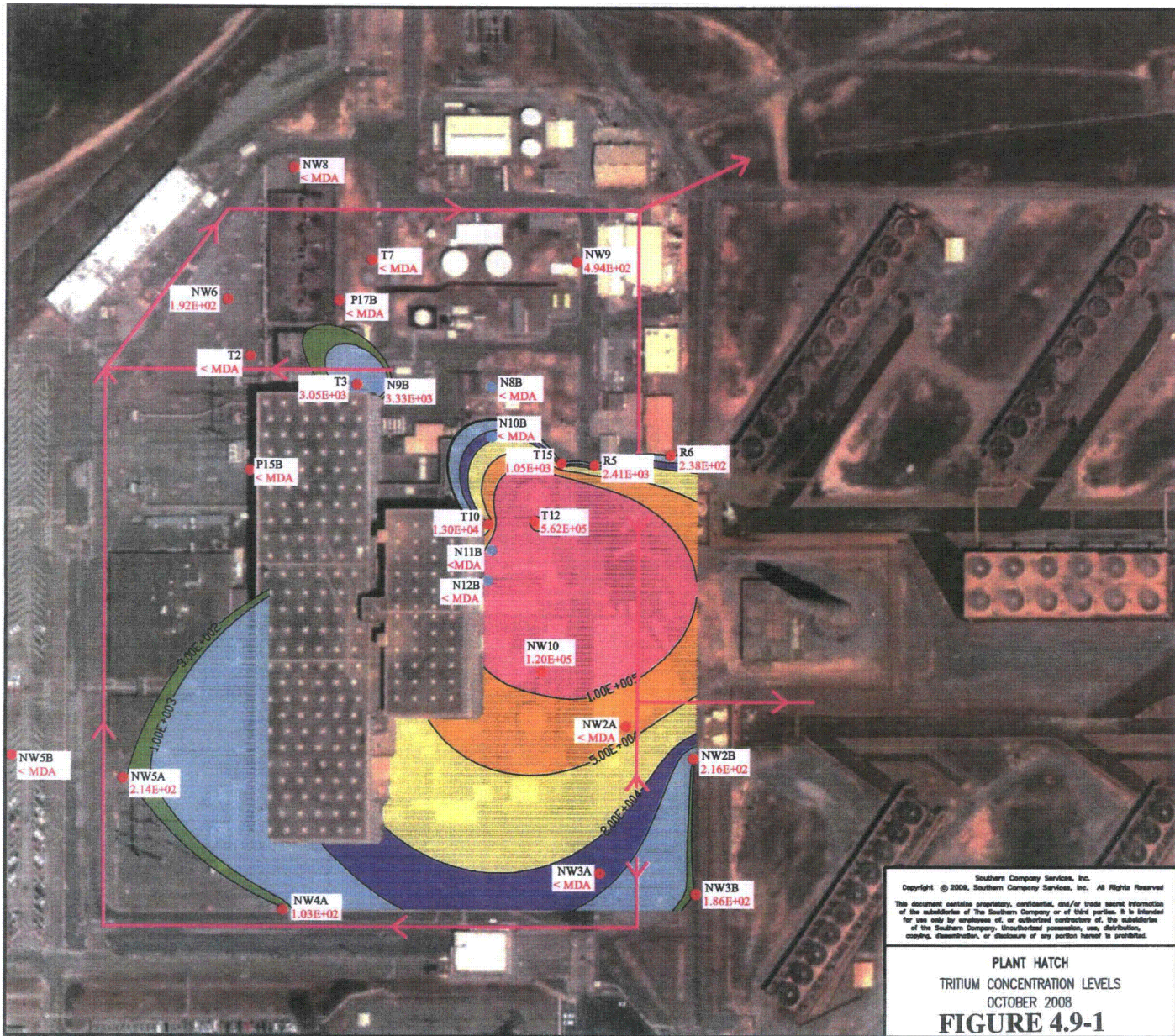
In 2007, Hatch continued to aggressively monitor the groundwater tritium plume especially in two areas of higher activity around CST-1 and CST-2. The amount of seasonal rainfall during 2007 seems to have had some correlation with the tritium concentrations in the T-12 well near CST-1. During early spring and late fall rainy seasons, the concentrations of tritium were at their highest levels, whereas, during the summer and early fall drought season the tritium concentrations decreased significantly. This is indicative of water table level fluctuations.

However, this same seasonal affect was not observed in the newer NW10 monitoring well installed in 2006 near CST-2. The tritium concentration in NW10 increased from February 2007 through September 2007 by a factor of 2.5. Events which could have contributed to the increase were a CST-2 transfer pump leak (in November 2006) which led to an accumulation of a couple feet of CST-2 water in the pump moat. Although the moat had been sealed earlier in 2006, there was a possibility that some of the contaminated water seeped through the concrete moat and gradually seeped through the ground to NW10. In addition, there was a deep hole dug (in January 2007) near the CST-2 (and NW10) to replace some CST-2 piping. The hole may have altered groundwater flow toward NW10 from the CST-1 groundwater plume and resulted in higher concentrations of tritium being drawn to NW10.

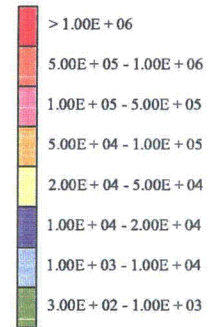
In 2008, Hatch made further enhancements to the groundwater tritium monitoring program. Three additional shallow wells and three additional deep wells were installed ("R" series wells). One of the deep wells was a replacement well for the deep well N7A. The integrity of N7A was questioned due to the high level of tritium (~211,000 pCi/l) seen in this well which should have been protected from contamination by a confining layer. The well was retired and a new well (R-3) was placed in the same vicinity. The newer well showed much smaller amounts of tritium activity (average of 2180 pCi/l for the last three quarters of 2008).

In addition, two other groups within Southern Company are now utilized to conduct an improved sampling program and to provide additional expertise in characterizing groundwater quality and flow. The sampling frequency for radiological groundwater monitoring was officially changed to quarterly starting in second quarter of 2008 with SCS Civil Field Services performing the sampling and Georgia Power Environmental Laboratory continuing to analyze the samples. The latest groundwater tritium plume map (generated from the 2008 SCS sampling data) is shown on the following page. It is a representation of the current groundwater conditions at Plant Hatch. The wells of interest around the CSTs had the following average tritium concentrations from the 3 quarters of sampling: T-12, near CST-1, averaged approximately 650,000 pCi/l of tritium and NW10, near CST-2, averaged 116,000 pCi/l of tritium. No tritium activity was seen in the Deep Wells 2 and 3 which are used for drinking water at the plant. The plant staff continues to sample and monitor strategically located wells on a more frequent basis than quarterly to ensure that radiological leaks have not occurred. In addition, outfalls, pull boxes, manholes, and the sewage treatment plant effluent are sampled by the plant staff on a periodic basis.





**CONCENTRATION DATA PC/L**



**LEGEND:**

- NW9 ● Unconfined Perched Aquifer Tritium Source Detection Monitoring Well
- N8B ● Tritium Attenuation Monitoring Wells (not part of groundwater source detection program)
- ➔ Approximately Located French Drain & Flow Direction
- < MDA Less Than Minimum Detectable Activity

Southern Company Services, Inc.  
 Copyright © 2008, Southern Company Services, Inc. All Rights Reserved  
 This document contains proprietary, confidential, and/or trade secret information of the subsidiaries of The Southern Company or of third parties. It is intended for use only by employees of, or authorized contractors of, the subsidiaries of the Southern Company. Unauthorized possession, use, distribution, copying, dissemination, or disclosure of any portion hereof is prohibited.

**Southern Company Generation  
 Engineering and Construction Services**  
 FOR

PLANT HATCH  
 TRITIUM CONCENTRATION LEVELS  
 OCTOBER 2008  
**FIGURE 4.9-1**

**Southern Nuclear**

SCALE	PROJ. I.D.	DRAWING NUMBER	SHEET	CONT'D	REV
			1	FINAL	0

ANSI B: 17x11

Acad2008



## 5.0 INTERLABORATORY COMPARISON PROGRAM

In accordance with ODCM 4.1.3, the EL participates in an 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 guide indicates the ICP is to be conducted with the Environmental Protection Agency (EPA) Environmental Radioactivity Laboratory Intercomparison Studies (Cross-check) Program or an equivalent program, and the ICP should include all of the determinations (sample medium/radionuclide combinations) that are offered by the EPA and included in the REMP.

The ICP is conducted by Analytics, Inc. of Atlanta, Georgia. Analytics 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. Analytics supplies the crosscheck samples to the EL which performs the laboratory analyses in a normal manner. Each of the specified analyses is performed three times. The results are then sent to Analytics who performs an evaluation which may be helpful to the EL in the identification of instrument or procedural problems.

The samples offered by Analytics and included in the EL analyses are gross beta and gamma isotopic analyses of an air filter; gamma isotopic analyses of milk samples; and gross beta, tritium and gamma isotopic analyses of water samples.

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. The total error is the square root of the sum of the squares of the uncertainties of the known value and of the reported average. The uncertainty of the known value includes all analytical uncertainties as reported by Analytics. The uncertainty of the reported average is the propagated error of the values in the reported average by the EL. The precision of each result is measured by the coefficient of variation, which is defined as the standard deviation of the reported result divided by the reported average. 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 as follows:

Nuclide	Concentration *	Total Sample Activity (pCi)	Percent Coefficient of Variation
Cr-51	<300	NA	25
Cr-51	NA	>1000	25
Cr-51	>300	<1000	15
Fe-59	<80	NA	25
Fe-59	>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 EL's participation in the ICP is provided in Table 5-1 for: the gross beta and gamma isotopic analyses of an air filter; gamma isotopic analyses of milk samples; and gross beta, tritium and gamma isotopic analyses of water samples. Delineated in this table for each of the media/analysis combinations, are: the specific radionuclides; Analytics' preparation dates; the known values with their uncertainties supplied by Analytics; the reported averages with their standard deviations; and the resultant normalized deviations and coefficients of variation expressed as a percentage.

The GPC EL analyzed 13 samples for 43 parameters in 2008. The analyses included tritium, gross beta, Fe-55, Sr-89/90 and gamma emitting radio-nuclides in milk, water, air cartridge and air filter matrices. The attached results indicate three analyses outside the three sigma control limits. They were the following:

- 1) Mn-54 in air filter (Environmental Program) for accuracy.
- 2) Co-58 in water (Environmental Program) for precision
- 3) Gross alpha in water (Effluent Program) for accuracy.

The first quarter effluent water sample analyzed for gross alpha had a low activity recovery. The gross alpha in water self absorption curve was evaluated and updated. The second quarter alpha sample was in control for both accuracy and precision. A known alpha activity sample will be processed with the blind samples in the future to assure accurate results.

The third quarter environmental air filter sample was analyzed by gamma spectroscopy and had a high activity recovery for Mn-54. The sample was analyzed by three detectors and a weighted average reported. A small range from the three detectors produced an elevated normalized deviation result. The value was above the three sigma control limit, however the recovery of the Mn-54 activity is 114% and is acceptable.

The precision failure was in the first quarter water sample analyzed by gamma spectroscopy. The %CV for Co-58 was above the control limit. The sample was analyzed on three detectors with an error weighted average reported. An elevated range of values in the analysis is due to one of the detectors measuring a higher activity. No inconsistencies were found in the detector shaping or analysis of the 810 keV gamma peak. No further investigation will be performed.

In 2009 the Environmental Laboratory will adopt the NRC Inspection Procedure's guidance for acceptance criteria in performance sample testing. The adoption of the NRC Inspection Procedure 84750 will keep the lab consistent with the nuclear industry.

TABLE 5-1 (SHEET 1 of 3)

INTERLABORATORY COMPARISON PROGRAM RESULTS

GROSS BETA ANALYSIS OF AN AIR FILTER (pCi/filter)

Analysis or Radionuclide	Date Prepared	Reported Average	Known Value	Standard Deviation EL	Uncertainty Analytics (3S)	Percent Coef of Variation	Normalized Deviation
Gross Beta	09/18/08	128.00	121.00	4.82	2.03	5.43	1.01

GAMMA ISOTOPIC ANALYSIS OF AN AIR FILTER (pCi/filter)

Analysis or Radionuclide	Date Prepared	Reported Average	Known Value	Standard Deviation EL	Uncertainty Analytics (3S)	Percent Coef of Variation	Normalized Deviation
Ce-141	09/18/08	134.00	132.00	6.74	0.74	5.81	0.25
Co-58	09/18/08	149.70	146.00	6.7	0.81	3.84	0.61
Co-60	09/18/08	197.10	192.00	7.81	1.07	3.22	0.74
Cr-51	09/18/08	390.10	345.00	14.59	1.92	6.74	1.69
Cs-134	09/18/08	186.90	190.00	6.88	1.06	4.54	-0.35
Cs-137	09/18/08	143.20	133.00	5.23	0.74	4.92	1.40
Fe-59	09/18/08	140.60	118.00	2.99	0.66	4.58	3.40
Mn-54	09/18/08	154.60	136.00	1.14	0.76	3.42	3.30
Zn-65	09/18/08	295.40	262.00	13.08	1.46	5.70	1.93

GAMMA ISOTOPIC ANALYSIS OF A MILK SAMPLE (pCi/liter)

Analysis or Radionuclide	Date Prepared	Reported Average	Known Value	Standard Deviation EL	Uncertainty Analytics (3S)	Percent Coef of Variation	Normalized Deviation
Ce-141	06/19/08	180.10	174.00	13.17	0.97	8.56	0.39
Co-58	06/19/08	68.90	61.90	4.77	0.34	0.65	0.96
Co-60	06/19/08	112.60	104.00	5.69	0.58	6.87	1.10
Cr-51	06/19/08	146.70	138.00	23.39	0.77	25.12	0.24
Cs-134	06/19/08	74.70	76.70	2.67	0.43	7.18	-0.36
Cs-137	06/19/08	118.20	116.00	5.44	0.65	7.27	0.25

TABLE 5-1 (SHEET 2 of 3)

INTERLABORATORY COMPARISON PROGRAM RESULTS

GAMMA ISOTOPIC ANALYSIS OF A MILK SAMPLE (pCi/liter)

Analysis or Radionuclide	Date Prepared	Reported Average	Known Value	Standard Deviation EL	Uncertainty Analytics (3S)	Percent Coef of Variation	Normalized Deviation
Fe-59	06/19/08	109.40	91.70	13.67	0.51	14.96	1.08
I-131	06/19/08	88.90	71.40	9.9	0.40	12.83	1.53
Mn-54	06/19/08	152.00	135.00	4.56	0.75	5.68	1.92
Zn-65	06/19/08	135.40	127.00	8.19	0.71	10.23	0.60

GROSS BETA ANALYSIS OF WATER SAMPLE (pCi/liter)

Analysis or Radionuclide	Date Prepared	Reported Average	Known Value	Standard Deviation EL	Uncertainty Analytics (3S)	Percent Coef of Variation	Normalized Deviation
Gross Beta	03/20/08	182.00	209.00	11.15	1.16	8.57	-1.73
	06/19/08	151.10	169.00	6.13	0.94	5.61	-2.10

GAMMA ISOTOPIC ANALYSIS OF WATER SAMPLES (pCi/liter)

Analysis or Radionuclide	Date Prepared	Reported Average	Known Value	Standard Deviation EL	Uncertainty Analytics (3S)	Percent Coef of Variation	Normalized Deviation
Ce-141	03/20/08	204.60	198.00	8.08	2.21	5.87	0.55
Co-58	03/20/08	58.50	56.40	9.22	0.63	15.77	0.23
Co-60	03/20/08	188.90	189.00	9.74	2.09	6.57	0.06
Cr-51	03/20/08	356.30	286.00	21.56	2.85	12.23	1.61
Cs-134	03/20/08	99.90	99.70	2.29	1.11	5.91	0.03

TABLE 5-1 (SHEET 3 of 3)

INTERLABORATORY COMPARISON PROGRAM RESULTS

GAMMA ISOTOPIC ANALYSIS OF WATER SAMPLES (pCi/liter)

Analysis or Radionuclide	Date Prepared	Reported Average	Known Value	Standard Deviation EL	Uncertainty Analytics (3S)	Percent Coef of Variation	Normalized Deviation
Cs-137	03/20/08	121.50	116.00	9.85	1.29	10.22	0.45
Fe-59	03/20/08	92.60	81.40	7.75	0.91	12.21	0.99
I-131	03/20/08	68.90	70.40	0.98	0.79	8.64	-0.25
Mn-54	03/20/08	83.20	75.00	4.32	0.83	8.84	1.11
Zn-65	03/20/08	119.90	109.00	6.41	1.21	11.03	0.83

TRITIUM ANALYSIS OF WATER SAMPLES (pCi/liter)

Analysis or Radionuclide	Date Prepared	Reported Average	Known Value	Standard Deviation EL	Uncertainty Analytics (3S)	Percent Coef of Variation	Normalized Deviation
H-3	03/20/08	3988.70	4010.00	87.41	22.33	4.28	-0.13
	06/19/08	12,900.00	13,000.00	44.32	72.33	2.16	-0.48

I-131 ANALYSIS OF AN AIR CARTRIDGE (pCi/cartridge)

Analysis or Radionuclide	Date Prepared	Reported Average	Known Value	Standard Deviation EL	Uncertainty Analytics (3S)	Percent Coef of Variation	Normalized Deviation
I-131	12/11/08	51.30	54.80	0.22	0.31	3.83	-1.75

5-5

## 6.0 CONCLUSIONS

This report confirms the licensee's conformance with the requirements of Chapter 4 of the ODCM. It provides a summary and discussion of the results of the laboratory analyses for each type of sample.

In 2008, there was one instance where the indicator station results were statistically discernible from the control station results. This is discussed below. No discernible radiological impact upon the environment or the public as a consequence of plant discharges to the atmosphere and to the river was established for any other REMP samples.

Cesium-137 was identified in both of the fish collections (spring and winter) at the indicator station and at the control station. The average of the samples at the indicator station was 19.9 pCi/kg-wet and the average at the control station was 8.4 pCi/kg-wet. The potential dose to a member of the public who would receive the highest dose (an adult) due to regular consumption of fish containing Cs-137 would be 1.72E-2 mrem in a year. This dose is approximately 0.6% of the regulatory limit of 3 mrem per year due to liquid effluents. Low levels of Cs-137 in the environment are attributed primarily to fallout from nuclear weapons testing and from the Chernobyl incident. However, the level of Cs-137 seen at the indicator station could potentially be attributed to plant effluents.

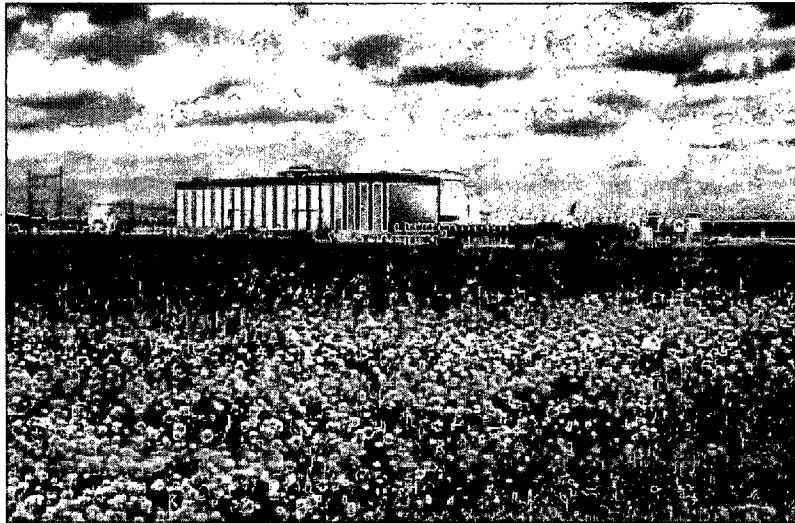
The radiological levels reported in 2008 were low and are generally trending downward. The REMP trends over the course of time from preoperation to the present are decreasing or have remained fairly constant. This supports the conclusion that there is no adverse radiological impact on the environment or to the public as a result of the operation of Hatch Nuclear Plant.

**Edwin I. Hatch Nuclear Plant  
Joseph M. Farley Nuclear Plant  
Vogtle Electric Generating Plant  
Annual Radiological Environmental Operating Reports for 2008**

**Enclosure 2**

**Farley Annual Radiological Environmental Operating Report for 2008**

**JOSEPH M. FARLEY NUCLEAR PLANT  
ANNUAL RADIOLOGICAL ENVIRONMENTAL  
OPERATING REPORT FOR 2008**



**SOUTHERN**   
**COMPANY**  
*Energy to Serve Your World™*



## **TABLE OF CONTENTS**

<b>Section and/or Title</b>	<b>Subsection</b>	<b>Page</b>
List of Figures		ii
List of Tables		iii
List of Acronyms		iv
1.0 Introduction		1-1
2.0 REMP Description		2-1
3.0 Results Summary		3-1
4.0 Discussion of Results		4-1
	4.1 Land Use Census	4-6
	4.2 Airborne	4-7
	4.3 Direct Radiation	4-13
	4.4 Milk	4-17
	4.5 Forage	4-21
	4.6 Ground Water	4-27
	4.7 Surface Water	4-32
	4.8 Fish	4-35
	4.9 Sediment	4-41
5.0 Interlaboratory Comparison Program		5-1
6.0 Conclusions		6-1

## **LIST OF FIGURES**

<b>Figure Number</b>	<b>Title</b>	<b>Page</b>
Figure 2-1	REMP Stations Near the Plant Perimeter	2-10
Figure 2-2	REMP Stations 2 to 5 Miles from the Plant	2-11
Figure 2-3	REMP Stations Beyond 5 Miles from the Plant	2-12
Figure 2-4	Onsite Ground Water Locations	2-13
Figure 4.2-1	Average Weekly Gross Beta Air Concentration	4-8
Figure 4.2-2	Average Annual Cs-137 Concentration in Air	4-10
Figure 4.3-1	Average Quarterly Exposure from Direct Radiation	4-14
Figure 4.4-1	Average Annual Cs-137 Concentration in Milk	4-17
Figure 4.4-2	Average Annual I-131 Concentration in Milk	4-19
Figure 4.5-1	Average Annual Cs-137 Concentration in Forage	4-22
Figure 4.5-2	Average Annual I-131 Concentration in Forage	4-24
Figure 4.6-1	Average Annual H-3 Concentration in Offsite Ground Water	4-28
Figure 4.6-2	H-3 Concentration in Onsite Ground Water Well R-3	4-31
Figure 4.7-1	Average Annual H-3 Concentration in Surface Water	4-33
Figure 4.8-1	Average Annual Cs-137 Concentration in Bottom Feeding Fish	4-36
Figure 4.8-2	Average Annual Cs-137 Concentration in Game Fish	4-38
Figure 4.9-1	Average Annual Cs-134 Concentration in Sediment	4-42
Figure 4.9-2	Average Annual Cs-137 Concentration in Sediment	4-43

## LIST OF TABLES

<b>Table Number</b>	<b>Title</b>	<b>Page</b>
Table 2-1	Summary Description of Radiological Environmental Monitoring Program	2-2
Table 2-2	Groundwater Monitoring Locations	2-9
Table 3-1	Radiological Environmental Monitoring Program Annual Summary	3-2
Table 4-1	Minimum Detectable Concentrations (MDC)	4-1
Table 4-2	Reporting Levels (RL)	4-2
Table 4-3	Deviations from Radiological Environmental Monitoring Program	4-4
Table 4.1-1	Land Use Census Results	4-6
Table 4.2-1	Average Weekly Gross Beta Air Concentration	4-9
Table 4.2-2	Average Annual Cs-137 Concentration in Air	4-11
Table 4.3-1	Average Quarterly Exposure from Direct Radiation	4-15
Table 4.4-1	Average Annual Cs-137 Concentration in Milk	4-18
Table 4.4-2	Average Annual I-131 Concentration in Milk	4-20
Table 4.5-1	Average Annual Cs-137 Concentration in Forage	4-23
Table 4.5-2	Average Annual I-131 Concentration in Forage	4-25
Table 4.6-1	Average Annual H-3 Concentration in Ground Water	4-29
Table 4.7-1	Average Annual H-3 Concentration in Surface Water	4-34
Table 4.8-1	Average Annual Cs-137 Concentration in Bottom Feeding Fish	4-37
Table 4.8-2	Average Annual Cs-137 Concentration in Game Fish	4-39
Table 4.9	Sediment Nuclide Concentrations	4-41
Table 5-1	Interlaboratory Comparison Program Results	5-3

## LIST OF ACRONYMS

Acronyms presented in alphabetical order

<b>Acronym</b>	<b>Definition</b>
APCo	Alabama Power Company
ASTM	American Society for Testing and Materials
CL	Confidence Level
EL	Georgia Power Company Environmental Laboratory
EPA	Environmental Protection Agency
FNP	Joseph M. Farley 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)
NRC	Nuclear Regulatory Commission
ODCM	Offsite Dose Calculation Manual
Po	Preoperation
PWR	Pressurized Water Reactor
REMP	Radiological Environmental Monitoring Program
RL	Reporting Level
RM	River Mile
TLD	Thermoluminescent Dosimeter
TS	Technical Specification

## 1.0 INTRODUCTION

The Radiological Environmental Monitoring Program (REMP) for 2008 was conducted in accordance with Chapter 4 of the Offsite Dose Calculation Manual (ODCM). The REMP activities for 2008 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) 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 (APCo) and operated by Southern Nuclear Operating Company. 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. An annual summary of the results of the analyses of REMP samples is provided in Section 3. A discussion of the results, including assessments of any radiological impacts upon the environment and the results of the land use census are provided in Section 4. The results of the Interlaboratory Comparison Program (ICP) are provided in Section 5. Conclusions are provided in Section 6.

## 2.0 REMP DESCRIPTION

A summary description of the REMP is provided in Table 2-1. This table summarizes the program as it meets the requirements outlined in ODCM Table 4-1. It details 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 delineates the collection and analysis frequencies. In addition, Table 2-1 describes the locations of the indicator, community and control stations as described in ODCM Table 4-4 and the identification of each sample according to station location and analysis type. The stations are also depicted on maps in Figures 2-1 through 2-3.

The location of each REMP station for gaseous releases is described by its direction and distance from a point midway between the Unit 1 and Unit 2 plant vent stacks. The surrounding area is divided into 16 azimuthal sectors which are centered on the major compass points; each sector is numbered sequentially clockwise and oriented so that the centerline of sector 16 is due north. Each sampling station is identified by a four digit number. The first two digits indicate the sector number, and the last two digits indicate the distance from the origin to the nearest mile. For example, air monitoring station 0215 is located approximately 15 miles northeast of the origin. The locations for the sampling stations along the river are identified by the nearest River Mile (RM) which is the distance along the navigable portion of the Chattahoochee River upstream of the Jim Woodruff Dam near Chattahoochee, Florida. The approximate locations of the plant discharge and intake structures are at RM 43.5 and 43.8, respectively.

The samples are collected by the plant's technical staff, except for fish and river sediment samples which are collected by APCo Environmental Field Services personnel.

All laboratory analyses were performed by Georgia Power Company's Environmental Laboratory (EL) in Smyrna, Georgia.

TABLE 2-1 (SHEET 1 of 7)

SUMMARY DESCRIPTION OF RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway with Sample Types and Locations (sector-miles)	Sample Identification	Sampling and Collection Frequency	Type and Frequency of Analysis
AIRBORNE <u>Particulates</u>		Continuous sampler operation with sample collection weekly.	Particulate sampler: Analyze for gross beta radioactivity $\geq$ 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.
Indicator Stations: River Intake Structure (ESE-0.8) South Perimeter (SSE-1.0) Plant Entrance (WSW-0.9) North Perimeter (N-0.8)	PI-0501 PI-0701 PI-1101 PI-1601		
Control Stations: Blakely GA (NE-15) Neals Landing, FL (SSE-18) Dothan, AL (W-18)	PB-0215 PB-0718 (spare station, not in service) PB-1218		
Community Stations: GA Pacific Paper Co. (SSE-3) Ashford, AL (WSW-8) Columbia, AL (N-5)	PC-0703 PC-1108 PC-1605		

TABLE 2-1 (SHEET 2 of 7)

SUMMARY DESCRIPTION OF RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway with Sample Types and Locations (sector-miles)	Sample Identification	Sampling and Collection Frequency	Type and Frequency of Analysis
<u>Iodine</u>		Continuous sampler operation with sample collection weekly	Radioiodine canister: Analyze each sample for I-131 weekly.
Indicator Stations: River Intake Structure (ESE-0.8) South Perimeter (SSE-1.0) Plant Entrance (WSW-0.9) North Perimeter (N-0.8)	II-0501 II-0701 II-1101 II-1601		
Control Station: Blakely, GA (NE-15) Neals Landing, FL (SSE-18) Dothan, AL (W-18)	IB-0215 IB-0718 (spare station, not in service) IB-1218		
Community Station: GA Pacific Paper Co. (SSE-3)	IC-0703		
<u>DIRECT RADIATION TLD</u>		Quarterly	Gamma dose: Read each badge quarterly
Indicator Stations: Plant Perimeter (NNE-0.9) (NE-1.0) (ENE-0.9) (E-0.8) (ESE-0.8)	RI-0101 RI-0201 RI-0301 RI-0401 RI-0501		



TABLE 2-1 (SHEET 3 of 7)

SUMMARY DESCRIPTION OF RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway with Sample Types and Locations (sector-miles)	Sample Identification	Sampling and Collection Frequency	Type and Frequency of Analysis
(SE-1.1) (SSE-1.0) (S-1.0) (SSW-1.0) (SW-0.9) (WSW-0.9) (W-0.8) (WNW-0.8) (NW-1.1) (NNW-0.9) (N-0.8)	RI-0601 RI-0701 RI-0801 RI-0901 RI-1001 RI-1101 RI-1201 RI-1301 RI-1401 RI-1501 RI-1601		
Control Stations: Blakely, GA (NE-15) Neals Landing, FL (SSE-18) Dothan, AL (W-15) Dothan, AL (W-18) Webb, AL (WNW-11) Haleburg, AL (N-12)	RB-0215 RB-0718 RB-1215 RB-1218 RB-1311 RB-1612		
Community Station By sector (NNE-4) (NE-4) (ENE-4) (E-5) (ESE-5) (SE-5) (SSE-3)	RC-0104 RC-0204 RC-0304 RC-0405 RC-0505 RC-0605 RC-0703		

TABLE 2-1 (SHEET 4 of 7)

SUMMARY DESCRIPTION OF RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway with Sample Types and Locations (sector-miles)	Sample Identification	Sampling and Collection Frequency	Type and Frequency of Analysis
(S-5) (SSW-4) (SW-5) (WSW-4) (W-4) (WNW-4) (NW-4) (NNW-4) (N-5)  Of Special Interest: Nearest Residence (SW-1.2) City of Ashford, AL (WSW-8.0)	RC-0805 RC-0904 RC-1005 RC-1104 RC-1204 RC-1304 RC-1404 RC-1504 RC-1605  RC-1001 RC-1108		
<u>WATERBORNE Surface Water</u>		Aliquots taken with proportional semi-continuous sampler, having a minimum sampling frequency not exceeding two hours, collected weekly for 4 week composites and quarterly composites	Gamma isotopic analysis of each 4 week composite sample. Tritium analysis for each quarterly composite.
Indicator Station: Paper Mill, (~3 miles downstream of plant discharge, RM 40)	WRI		
Control Station: Upstream of Andrews Lock and dam (~3 miles upstream of the plant intake, RM 47)	WRB		

TABLE 2-1 (SHEET 5 of 7)

SUMMARY DESCRIPTION OF RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway with Sample Types and Locations (sector-miles)	Sample Identification	Sampling and Collection Frequency	Type and Frequency of Analysis
<u>Offsite Ground Water</u>		Grab sample quarterly	Gamma isotopic, I-131, and tritium analyses of each sample quarterly
Indicator Station: Paper Mill Well (SSE-4)	WGI-07		
Control Station: Whatley Residence Well (SW-1.2)	WGB-10		
<u>Onsite Ground Water</u>	See Table 2-2	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
<u>River Sediment</u>		Grab sample semiannually	Gamma isotopic analysis of each sample semiannually
Indicator Station: Downstream of plant discharge at Smith's Bend (RM 41) <sup>a</sup>	RSI		
Control Station: Upstream of plant discharge at Andrews Lock & Dam Reservoir (RM 48) <sup>a</sup>	RSB		

TABLE 2-1 (SHEET 6 of 7)

SUMMARY DESCRIPTION OF RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway with Sample Types and Locations (sector-miles)	Sample Identification	Sampling and Collection Frequency	Type and Frequency of Analysis
<u>INGESTION</u> <u>Milk</u>		Grab sample biweekly	Gamma isotopic and I-131 analyses of each sample biweekly
Control Station: Robert Weir Dairy Donaldsonville, GA (SSE - 14)	MB-0714		
<u>Fish</u>		Grab sample semiannually for Game Fish and Bottom Feeding Fish	Gamma isotopic analysis on the edible portions of each sample semiannually
Indicator Stations: Downstream of plant discharge in vicinity of Smith's Bend (RM 41) <sup>b</sup>	FGI & FBI		
Control Station: Upstream of plant discharge in Andrews Lock & Dam Reservoir (RM 48) <sup>b</sup>	FGB & FBB		
<u>Forage</u>		Grab sample from forage every 4 weeks.	Gamma isotopic analysis of each sample every 4 weeks.
Indicator Station: South Southeast Perimeter (SSE-1.0) North Perimeter (N-0.8)	FI-0701 FI-1601		
Control Station: Dothan, AL (W-18)	FB-1218		

**TABLE 2-1 (SHEET 7 of 7)**

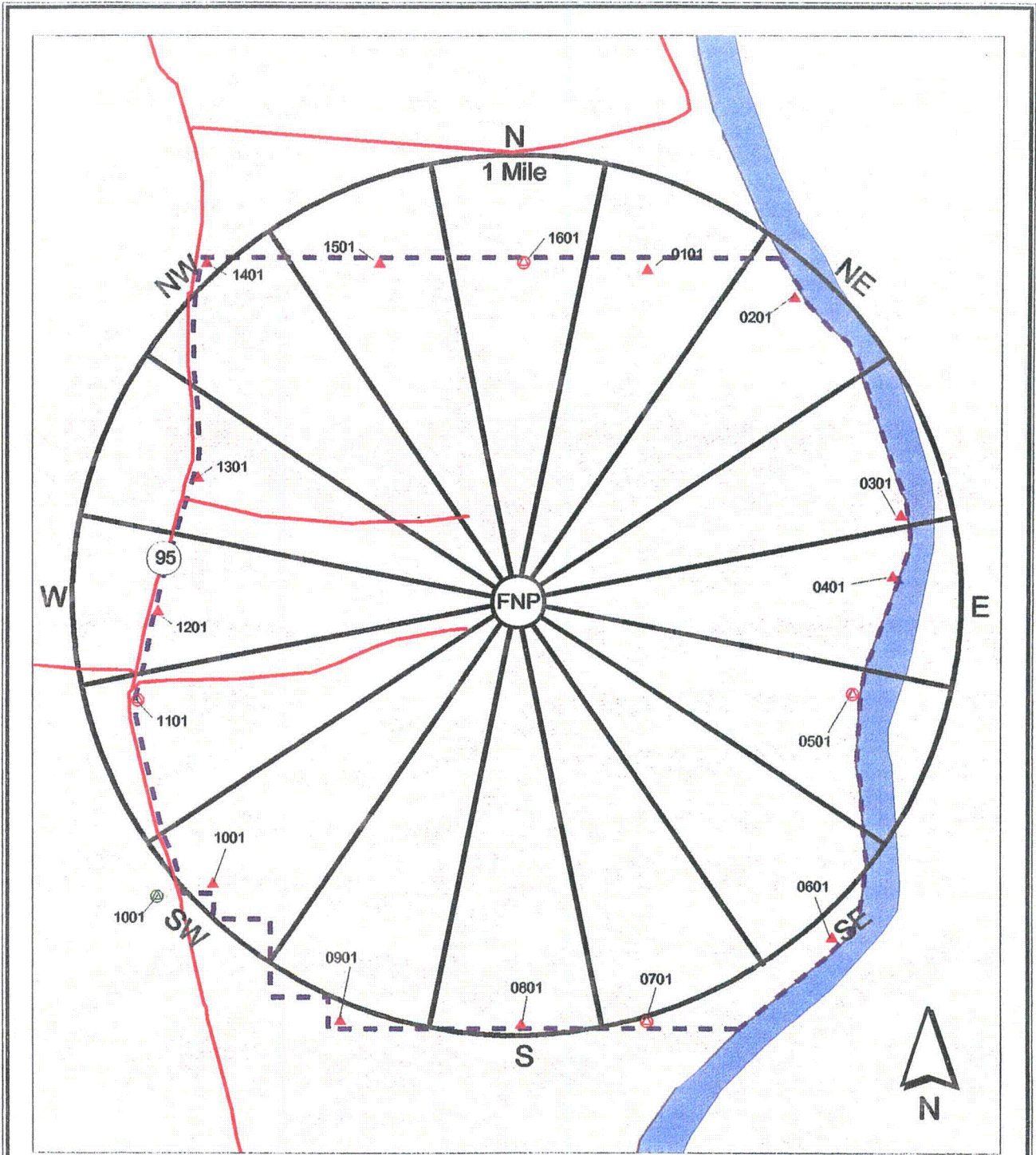
**SUMMARY DESCRIPTION OF RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM**

NOTATIONS

- a. *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.*
- b. *Since a few miles of river water may be needed to obtain adequate fish samples, these river mile positions represent the approximate locations about which the catches 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  
Onsite Groundwater Monitoring Locations**

<b>WELL</b>	<b>ACQUIFER</b>	<b>MONITORING PURPOSE</b>
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
CW#1	Drinking water	Construction Well West Supply
CW#2	Drinking water	Construction Well East Supply
FRW	Drinking water	Firing Range Well Supply
SW-1	N/A	Background 3 Service Water Pond
East YD	N/A	Plant outfall East Yard Drain
SE YD	N/A	Plant outfall Southeast Yard Drain



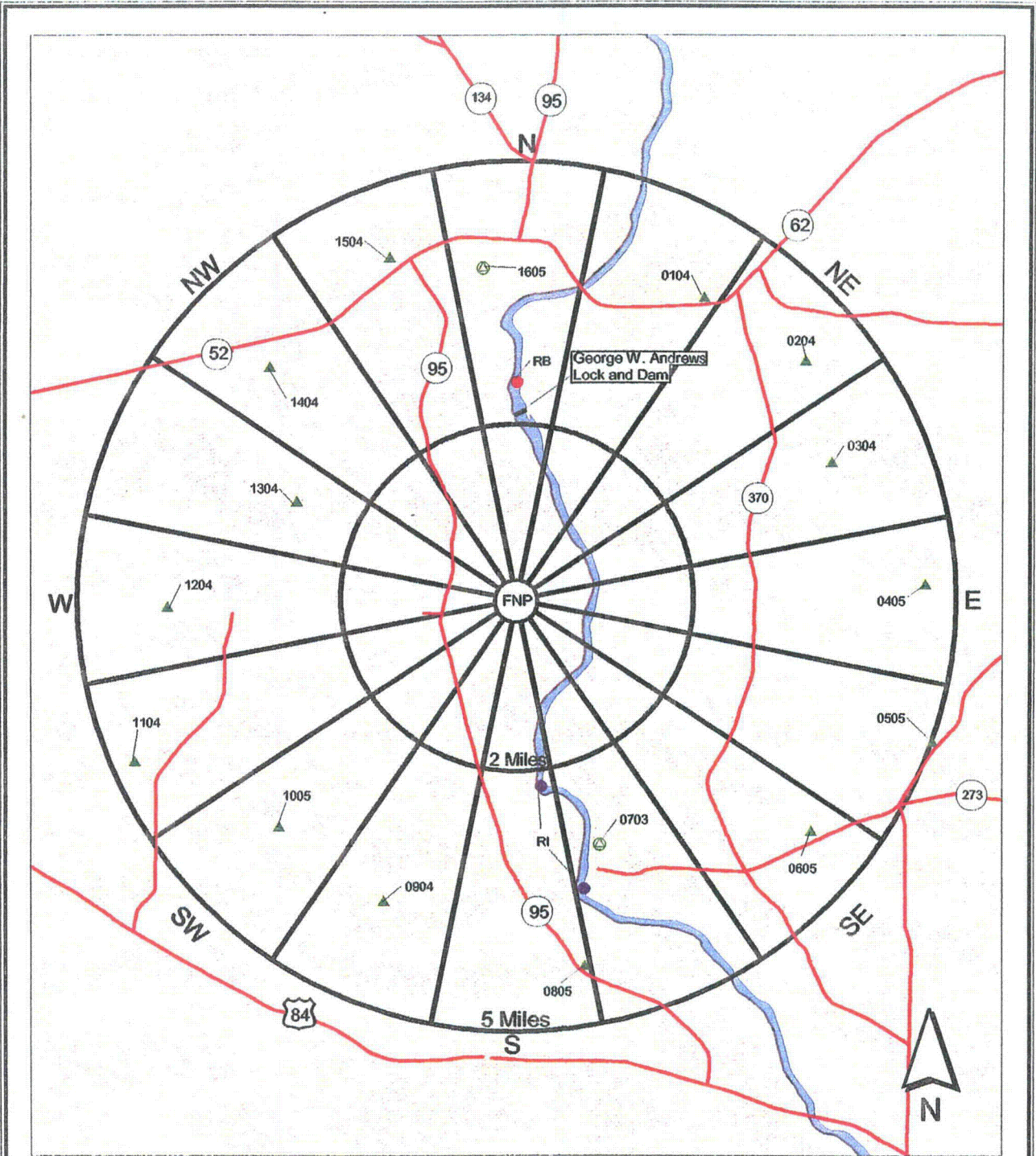
**Radiological Environmental Sampling Locations**

	Indicator	Control	Community
TLD	▲	▲	▲
Other	●	●	●
TLD & Other	⊗	⊗	⊗

**REMP Stations Near the Plant Perimeter**

Figure 2-1





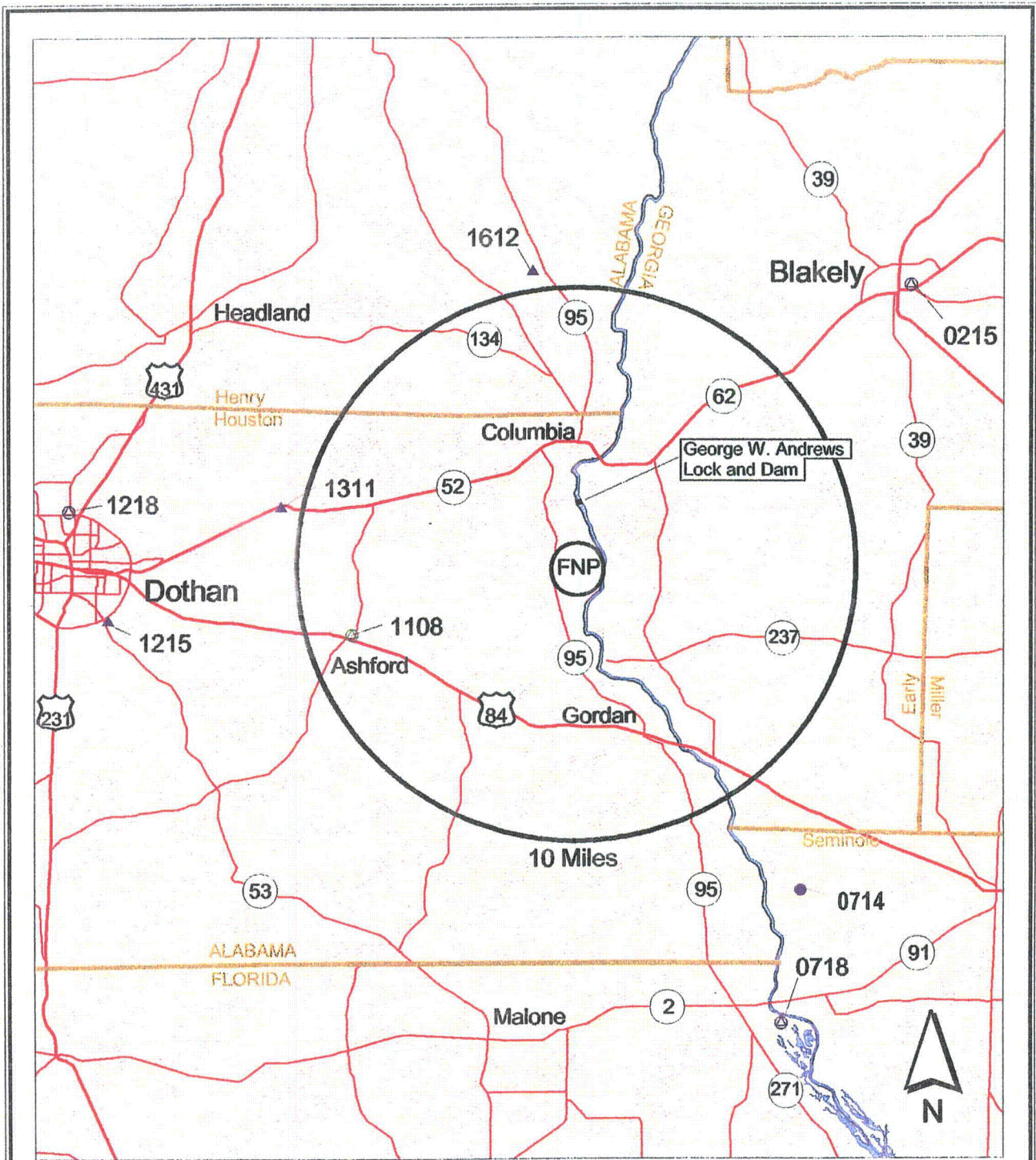
**Radiological Environmental Sampling Locations**

	Indicator	Control	Community
TLD	▲	▲	▲
Other	●	●	●
TLD & Other	⊗	⊗	⊗

**REMP Stations 2 to 5 Miles From the Plant**

Figure 2-2





**Radiological Environmental Sampling Locations**

	Indicator	Control	Community
TLD	▲	▲	▲
Other	●	●	●
TLD & Other	⊕	⊕	⊕

**REMP Stations Beyond  
5 Miles From the Plant**

Figure 2-3

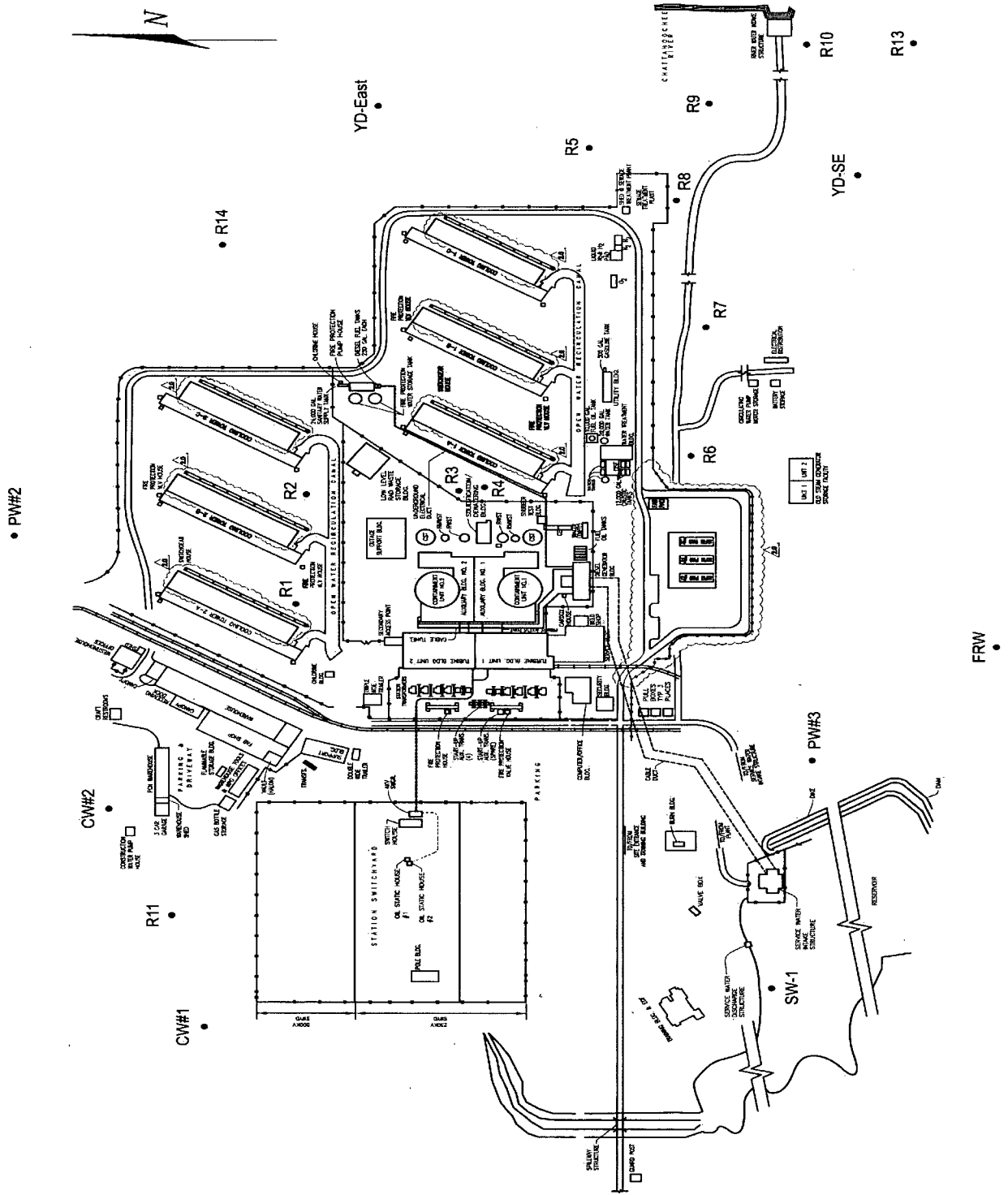


Figure 2-4 Onsite Groundwater Monitoring Location

### 3.0 RESULTS SUMMARY

In accordance with ODCM 7.1.2.1, the summarized and tabulated results for all of the regular samples collected for the year at the designated indicator, community and control stations are presented in Table 3-1. The format of Table 3-1 is similar to Table 3 of the Nuclear Regulatory Commission (NRC) Branch Technical Position, "An Acceptable Radiological Environmental Monitoring Program" Revision 1, November 1979. Results for samples collected at locations other than those listed in Table 2-1 are discussed in Section 4 under the particular sample type.

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. The radionuclide Be-7, which occurs abundantly in nature, is often detected in REMP samples. It is occasionally detected in the plant's liquid and gaseous effluents. When it is detected in effluents, it is also included in the REMP results. In 2008, Be-7 was detected in Farley's liquid effluents but not in the gaseous effluents.

TABLE 3-1 (SHEET 1 of 6)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY

Farley Nuclear Plant, Docket Nos. 50-348 and 50-364

Houston County, Alabama

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		Community Locations Mean (b), Range (Fraction)	Control Locations Mean(b), Range (Fraction)
				Name Distance & Direction	Mean (b), Range (Fraction)		
Airborne Particulates (fCi/m3)	Gross Beta 476	10	16.7 2.7-33.8 (212/212)	PB-0215 Blakely, GA 15 miles, NE	21.1 7.8-39.6 (53/53)	18.0 4.4-36.1 (158/159)	20.6 5.6-39.6 (106/106)
	Gamma Isotopic 36						
	I-131	70	NDM(c) (0/16)	NA(d)		NDM (0/12)	NDM (0/8)
	Cs-134	50	NDM (0/16)	NA		NDM (0/12)	NDM (0/8)
	Cs-137	60	NDM (0/16)	NA		NDM (0/12)	NDM (0/8)
Airborne Radioiodine (fCi/m3)	I-131 371	70	NDM (0/212)	NA		NDM (0/53)	NDM (0/106)
Direct Radiation (mR/91 days)	Gamma Dose 158	NA	15.0 11.0-22.6 (63/63)	RI-0401 Plt. Perimeter 0.8 miles, E	22.2 21.7-22.6 (4/4)	12.9 10.4-16.1 (71/71)	13.7 10.9-17.5 (24/24)
Milk (pCi/l)	Gamma Isotopic 27						
	Cs-134	15	NA	NA		NA	NDM (0/27)
	Cs-137	18	NA	NA		NA	NDM (0/27)
	Ba-140	60	NA	NA		NA	NDM (0/27)
	La-140	15	NA	NA	NA	NA	NDM (0/27)
	I-131 27	1	NA	NA		NA	NDM (0/27)

TABLE 3-1 (SHEET 2 of 6)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY

Farley Nuclear Plant, Docket Nos. 50-348 and 50-364

Houston County, Alabama

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		Community Locations Mean (b), Range (Fraction)	Control Locations Mean(b), Range (Fraction)
				Name Distance & Direction	Mean (b), Range (Fraction)		
Forage (pCi/kg wet)	Gamma Isotopic 39 I-131	60	NDM (0/26)	NA		NA	NDM (0/13)
	Cs-134	60	NDM (0/26)	NA		NA	NDM (0/13)
	Cs-137	80	10.1 (1/26)	FI-0701 Plt. Perimeter 1.0 mile, SSE	10.1 (1/26)	NA	NDM (0/13)
Offsite Ground Water (g) (pCi/l)	H-3 8	2000	196 (1/4)	WGB-10 Whatley Res. 1.2 miles, SW	237 234-240 (2/4)	NA	237 234-240 (2/4)
	I-131 8	1	NDM (0/4)	NA		NA	NDM (0/4)
	Gamma Isotopic 8 Mn-54	15	NDM (0/4)	NA		NA	NDM (0/4)
	Fe-59	30	NDM (0/4)	NA		NA	NDM (0/4)
	Co-58	15	NDM (0/4)	NA		NA	NDM (0/4)
	Co-60	15	NDM (0/4)	NA		NA	NDM (0/4)
	Zn-65	30	NDM (0/4)	NA		NA	NDM (0/4)
	Zr-95	30	NDM (0/4)	NA		NA	NDM (0/4)
	Nb-95	15	NDM (0/4)	NA		NA	NDM (0/4)

TABLE 3-1 (SHEET 3 of 6)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY

Farley Nuclear Plant, Docket Nos. 50-348 and 50-364

Houston County, Alabama

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		Community Locations Mean (b), Range (Fraction)	Control Locations Mean(b), Range (Fraction)
				Name Distance & Direction	Mean (b), Range (Fraction)		
	Cs-134	15	NDM (0/4)	NA		NA	NDM (0/4)
	Cs-137	18	NDM (0/4)	NA		NA	NDM (0/4)
	Ba-140	60	NDM (0/4)	NA		NA	NDM (0/4)
	La-140	15	NDM (0/4)	NA		NA	NDM (0/4)
Surface Water (pCi/l)	H-3 8	3000	644 412-875 (2/4)	Ga Pacific Paper Mill RM 40	644 412-875 (2/4)	NA	NDM (0/4)
	Gamma Isotopic 28 Be-7	124 (e)	NDM (0/14)	NA		NA	NDM (0/14)
	Mn-54	15	NDM (0/14)	NA		NA	NDM (0/14)
	Fe-59	30	NDM (0/14)	NA		NA	NDM (0/14)
	Co-58	15	NDM (0/14)	NA		NA	NDM (0/14)
	Co-60	15	NDM (0/14)	NA		NA	NDM (0/14)
	Zn-65	30	NDM (0/14)	NA		NA	NDM (0/14)
	Zr-95	30	NDM (0/14)	NA		NA	NDM (0/14)
	Nb-95	15	NDM (0/14)	NA		NA	NDM (0/14)

TABLE 3-1 (SHEET 4 of 6)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY

Farley Nuclear Plant, Docket Nos. 50-348 and 50-364

Houston County, Alabama

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		Community Locations Mean (b), Range (Fraction)	Control Locations Mean(b), Range (Fraction)
				Name Distance & Direction	Mean (b), Range (Fraction)		
	I-131	15 (f)	NDM (0/14)	NA		NA	NDM (0/14)
	Cs-134	15	NDM (0/14)	NA		NA	NDM (0/14)
	Cs-137	18	NDM (0/14)	NA		NA	NDM (0/14)
	Ba-140	60	NDM (0/14)	NA		NA	NDM (0/14)
	La-140	15	NDM (0/14)	NA		NA	NDM (0/14)
Bottom Feeding Fish (pCi/kg wet)	Gamma Isotopic 4						
	Be-7	655 (e)	NDM (0/2)	NA		NA	NDM (0/2)
	Mn-54	130	NDM (0/2)	NA		NA	NDM (0/2)
	Fe-59	260	NDM (0/2)	NA		NA	NDM (0/2)
	Co-58	130	NDM (0/2)	NA		NA	NDM (0/2)
	Co-60	130	NDM (0/2)	NA		NA	NDM (0/2)
	Zn-65	260	NDM (0/2)	NA		NA	NDM (0/2)
	Cs-134	130	NDM (0/2)	NA		NA	NDM (0/2)
	Cs-137	150	11.4 9.8-13.0 (2/2)	Downstream, near Smith's Bend (RM 41)	11.4 9.8-13.0 (2/2)	NA	7.7 (1/2)

TABLE 3-1 (SHEET 5 of 6)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY

Farley Nuclear Plant, Docket Nos. 50-348 and 50-364

Houston County, Alabama

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		Community Locations Mean (b), Range (Fraction)	Control Locations Mean(b), Range (Fraction)
				Name Distance & Direction	Mean (b), Range (Fraction)		
Game Fish (pCi/kg wet)	Gamma Isotopic 4						
	Be-7	655 (e)	NDM (0/2)	NA		NA	NDM (0/2)
	Mn-54	130	NDM (0/2)	NA		NA	NDM (0/2)
	Fe-59	260	NDM (0/2)	NA		NA	NDM (0/2)
	Co-58	130	NDM (0/2)	NA		NA	NDM (0/2)
	Co-60	130	NDM (0/2)	NA		NA	NDM (0/2)
	Zn-65	260	NDM (0/2)	NA		NA	NDM (0/2)
	Cs-134	130	NDM (0/2)	NA		NA	NDM (0/2)
Cs-137	150	16.6 15.5-17.7 (2/2)	16.6 15.5-17.7 (2/2)	Upstream, at Andrews Dam (RM 48)	23.2 (1/2)	NA	23.2 (1/2)
River Shoreline Sediment (pCi/kg dry)	Gamma Isotopic 4						
	Be-7	655 (e)	NDM (0/2)	NA		NA	NDM (0/2)
	Cs-134	150	NDM (0/2)	NA		NA	NDM (0/2)
Cs-137	180	NDM (0/2)	NDM (0/2)	NA		NA	NDM (0/2)



**TABLE 3-1 (SHEET 6 of 6)**

**RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY**

**Farley Nuclear Plant, Docket Nos. 50-348 and 50-364**

**Houston County, Alabama**

**NOTATIONS**

- 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 (Table 4-1 of this report). 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. Any a posteriori MDC greater than the value listed in this column is discussed in Section 4.
- 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 parentheses.
- c. No Detectable Measurement(s).
- d. Not Applicable.
- e. The EL has determined that this value may be routinely attained under normal conditions. No value is provided in Table 4-1 of this report.
- f. If a drinking water pathway exists, a value of 1 pCi/l would be used. See note b of Table 4-1 of this report.
- g. Onsite groundwater results are discussed in Section 4.6.

## 4.0 DISCUSSION OF RESULTS

Included in this section are evaluations of the laboratory results for the various sample types. Comparisons were made between the difference in mean values for pairs of station groups (e.g., indicator and control stations, or, community and control stations) and the calculated Minimum Detectable Difference (MDD) between these pairs, at the 99% Confidence Level (CL). The MDD was determined using the standard Student's t-test. A difference in the mean values which was less than the MDD was considered to be statistically indiscernible.

The 2008 results were compared with past results, including those obtained during preoperation. As appropriate, results were compared with their Minimum Detectable Concentrations (MDC) and Reporting Levels (RL) which are listed in Tables 4-1 and 4-2 of this report, respectively. The required MDCs were achieved during laboratory sample analysis. Any anomalous results are explained within this report.

Results of interest are graphed to show historical trends. The data points are tabulated and included in this report. The points plotted and provided in the tables represent mean values of only detectable results. Periods for which no detectable measurements (NDM) were observed, or periods for which values were not applicable (e.g., milk indicator, etc.), are plotted as 0's and listed in the tables as NDM.

**Table 4-1**

### Minimum Detectable Concentrations (MDC)

Analysis	Water (pCi/l)	Airborne Particulate or Gases (fCi/m <sup>3</sup> )	Fish (pCi/kg) wet	Milk (pCi/l)	Grass or Leafy Vegetation (pCi/kg) wet	Sediment (pCi/kg) dry
Gross Beta	4	10				
H-3	2000 (a)					
Mn-54	15		130			
Fe-59	30		260			
Co-58	15		130			
Co-60	15		130			
Zn-65	30		260			
Zr-95	30					
Nb-95	15					
I-131	1 (b)	70		1	60	
Cs-134	15	50	130	15	60	150
Cs-137	18	60	150	18	80	180
Ba-140	60			60		
La-140	15			15		

(a) If no drinking water pathway exists, a value of 3000 pCi/l may be used.

(b) If no drinking water pathway exists, a value of 15 pCi/l may be used.

**Table 4-2**  
**Reporting Levels (RL)**

Analysis	Water (pCi/l)	Airborne Particulate or Gases (fCi/m <sup>3</sup> )	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.

Atmospheric nuclear weapons tests from the mid 1940's through 1980 distributed man-made nuclides around the world. The most recent atmospheric tests in the 1970's and in 1980 had a significant impact upon the radiological concentrations found in the environment prior to and during preoperation, and the earlier years of operation. Some long-lived radionuclides, such as Cs-137, continue to have some impact.

Significant upward trends also followed the Chernobyl incident, which began on April 26, 1986.

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 as described in Table 2-1 are summarized in Table 4-3 along with their causes and resolutions.

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 variation. 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. No data were excluded exclusively for failing Chauvenet's criterion. Data exclusions are discussed in this section under the appropriate sample type.

TABLE 4-3 (SHEET 1 of 2)

DEVIATIONS FROM RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

COLLECTION PERIOD	AFFECTED SAMPLE(S)	DEVIATION	CAUSE	RESOLUTION
04/01/08-04/08/08 CR2008103522	PB-0215/IB-0215 Blakely, GA`	Non-representative sample of airborne particulates.	Sample time short about 1 hour. Possible power loss due to inclement weather.	Station operation satisfactory after sample change out.
04/22/08-04/29/08 CR2008104250	PI-1601/II-1601 North Perimeter	Non-representative sample of airborne particulates.	Sample time short about 2 hours. Reason unknown.	Station operation satisfactory after sample change out.
04/22/08-04/29/08 CR2008104250	PC-1605 Columbia	Non-representative sample of airborne particulates.	Sample time short about 2 hours. Reason unknown.	Station operation satisfactory after sample change out.
04/22/08-04/29/08 CR2008104250	PC-1108 Ashford	Non-representative sample of airborne particulates.	Sample time short about 1.25 hours. Reason unknown.	Station operation satisfactory after sample change out.
05/13/08-05/20/08 CR2008105037	PC-0703/IC-0703 GA Pacific	Non-representative sample of airborne particulates.	Sample time short about 1 hour. Possible power loss due to inclement weather.	Station operation satisfactory after sample change out.
04/22/08-05/20/08 CR2008104736	WRI Paper Mill	Non-representative sample of surface water.	Sample supply valve found isolated during 3 <sup>rd</sup> week collection. Reason unknown. Enough sample in collection container to use for weekly portion of monthly composite.	Temporary signage added to alert paper mill employees not to operate valve without notifying Farley personnel.
05/27/08-06/03/08 CR2008105635	PI-1601/II-1601 North Perimeter	Non-representative sample of airborne particulates.	Sample time short about 23 hours. Reason unknown.	Station operation satisfactory after sample change out.
06/03/08-06/10/08 CR2008105891	PC-0703/IC-0703 GA Pacific	Non-representative sample of airborne particulates.	Sample time short about 2 hours. Possible power loss due to inclement weather.	Station operation satisfactory after sample change out.
05/20/08-06/17/08 CR2008106134	WRI Paper Mill	Non-representative sample of surface water.	Cold shutdown at paper mill for maintenance. No flow available for river water autosampler on 06/13/08-06/24/08.	Autosampler put back in operation when sample flow resumed.
06/24/08-07/01/08 CR2008106602	PI-0701/II-0701 South Perimeter	Non-representative sample of airborne particulates.	Sample time short about 2 hours. Possible power loss due to inclement weather.	Station operation satisfactory after sample change out.

TABLE 4-3 (SHEET 2 of 2)

DEVIATIONS FROM RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

COLLECTION PERIOD	AFFECTED SAMPLE(S)	DEVIATION	CAUSE	RESOLUTION
06/17/08-07/15/08 CR2008106134	WRI Paper Mill	Non-representative sample of surface water.	Cold shutdown at paper mill for maintenance. No flow available for river water autosampler from 06/13/08-06/24/08.	Autosampler put back in operation when sample flow resumed.
06/17/08-07/15/08 CR2008106857	WRI Paper Mill	Non-representative sample of surface water.	Sample supply valve found isolated during 3 <sup>rd</sup> week collection. Reason unknown. Enough sample in collection container to use for weekly portion of monthly composite.	Permanent signage purchased and added to alert paper mill employees not to operate valve without notifying Farley personnel.
2 <sup>nd</sup> Quarter CR2008106842 EXCLUDED	TLD Station RC-1104 A & B WSW @ 4 miles	No direct radiation data available.	TLD badges missing at end of quarter collection.	Replaced TLDs at beginning of quarter.
2 <sup>nd</sup> Quarter CR2008106842 EXCLUDED	TLD Station RI-0201B NE @ 1.0 mile	TLD rendered suspect by presence of water in bag.	Moisture / rain water entered holding bag.	Replaced TLDs at beginning of quarter.
07/22/08-07/29/08 CR2008107578	PI-1601/II-1601 North Perimeter	Non-representative sample of airborne particulates.	Sample pump circuit breaker tripped. Probable cause was inclement weather. Sample time short about 16 hours.	Station operation satisfactory after sample change out.
08/19/08-08/26/08 CR2008108902 EXCLUDED	PC-1605 Columbia	Non-representative sample of airborne particulates.	Sample lost – possibly inadvertently discarded. Visual confirmation not performed when samples received by lab.	Horizon labels are now affixed to each AF and AC upon receipt by the lab requiring the receiver to visually confirm that each sample has arrived and been accounted for.
06/17/08-09/09/08 CR2008111287	WRI Paper Mill	3 <sup>rd</sup> Quarter river water tritium composite sample higher than usual (923 pCi/l).	No limits were exceeded, but an investigation revealed that radiological liquid releases made in the 3 <sup>rd</sup> quarter were higher activity and river water levels were low due to drought conditions (therefore less dilution).	The quarterly sample was reanalyzed (confirmed 875 pCi/L). The monthly river water gamma samples were also analyzed for tritium (6/17-7/15 was <MDA, 7/15-8/12 was 991 pCi/L, and 8/12-9/9 was 731 pCi/L) which further confirmed the results. 9/9-10/7 results were ~500 pCi/L which was a more typical result for river water tritium.

## 4.1 Land Use Census

In accordance with ODCM 4.1.2, a land use census was conducted during the month of November 2008. The land use census is used to determine the locations of the nearest permanent residence and milk animal in each of the 16 compass sectors within a distance of 5 miles. A milk animal is a cow or goat producing milk for human consumption. The 2008 survey revealed no significant changes from the 2007 survey. No milk animals were found within a 5 mile distance. The census results are tabulated in Table 4.1-1.

**Table 4.1-1**

### **LAND USE CENSUS RESULTS**

#### **Distance in Miles to the Nearest Location in Each Sector**

<b>SECTOR</b>	<b>RESIDENCE</b>	<b>MILK ANIMAL</b>
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	1.3	none
WNW	2.1	none
NW	1.5	none
NNW	3.4	none

The Houston County, Alabama and the Early County, Georgia Extension Agents were contacted for assistance in locating commercial dairy farms and privately owned milk animals within 5 miles of the plant. A list of commercial dairy farms in Houston County, AL and Seminole County, GA was provided; there are no commercial dairy farms in Early County. Neither agent knew of privately owned milk animals within 5 miles of FNP. In addition, field surveys were conducted in the plant vicinity along the state and county highways and the interconnecting secondary roads. No milk animals were found within 5 miles of the plant.

ODCM 4.1.2.2.1 requires a new controlling receptor to be determined, if the land use census identifies a location that yields a calculated receptor dose greater than the one in current use. Neither current sampling locations nor the controlling receptor were affected by the 2008 land use census results. The current controlling receptor as described in ODCM Table 3-7 remains a child in the SW Sector at 1.2 miles.

## 4.2 Airborne

As specified in Table 2-1 and shown in Figures 4.2-1 and 4.2-2, airborne particulate filters and charcoal canisters are collected weekly at 4 indicator, 3 control and 3 community stations. Particulate filters are collected at all of the stations while the charcoal canisters are collected at all but 2 of the community stations. At each location, air is continuously drawn through a glass fiber filter to retain airborne particulates and, as appropriate, an activated charcoal canister is placed in series to adsorb radioiodine.

Each particulate filter is counted for gross beta activity. A quarterly gamma isotopic analysis is performed on a composite of the air particulate filters for each station. Each charcoal canister is analyzed for I-131.

As provided in Table 3-1, the 2008 annual average weekly gross beta activity was  $16.7 \text{ fCi/m}^3$  at the indicator stations and  $20.6 \text{ fCi/m}^3$  at the control stations. The difference of  $3.9 \text{ fCi/m}^3$  between the two averages is statistically discernible since the MDD for these two average values is  $1.8 \text{ fCi/m}^3$ . However, the trend over the years has shown close agreement between the control, community, and indicator stations, and in most years (including pre-op), the indicator station gross beta average activity was lower than the control and community annual averages.

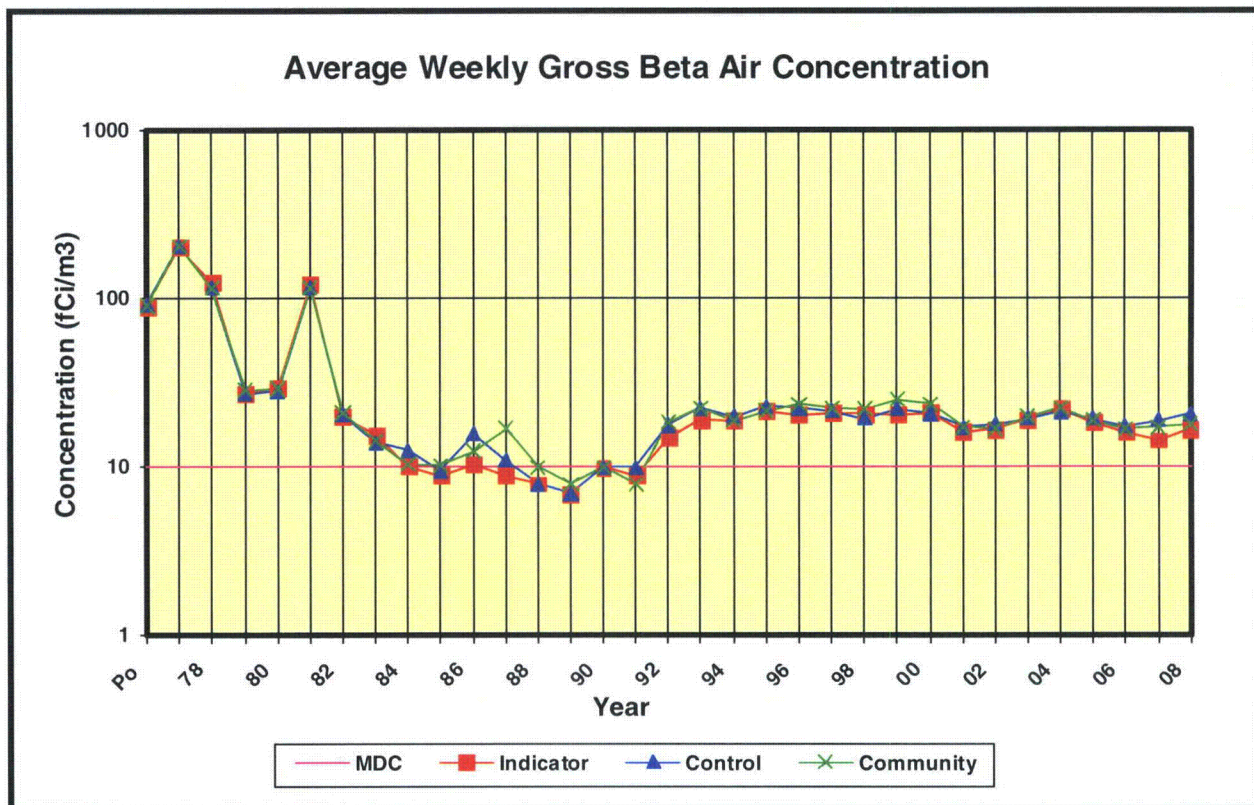
As shown in Table 3-1, the 2008 annual average weekly gross beta concentration was  $18.0 \text{ fCi/m}^3$  at community stations. The community stations average was  $2.6 \text{ fCi/m}^3$  less than the average for the control stations. The difference is not statistically discernible since it is less than the MDD of  $1.9 \text{ fCi/m}^3$  between the two averages.

Due to the weapons tests during preoperation and the early years of operation, the average gross beta concentrations were 5 to 10 times greater than those currently being measured. By the mid 1980s, the readings had diminished to about half the current levels. These annual averages approximately doubled as a consequence of the Chernobyl incident in 1986; this impact faded away in approximately 2 years. The installation of new air monitoring equipment in 1992 yielded an approximate factor of 2 increase in the readings. Since then, the levels have been fairly flat.

The historical trending of the average weekly gross beta air concentrations for each year of operation and the preoperational period at the indicator, control and community stations is plotted in Figure 4.2-1 and listed in Table 4.2-1. 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's contribution to gross beta concentration in air is insignificant.



Figure 4.2-1



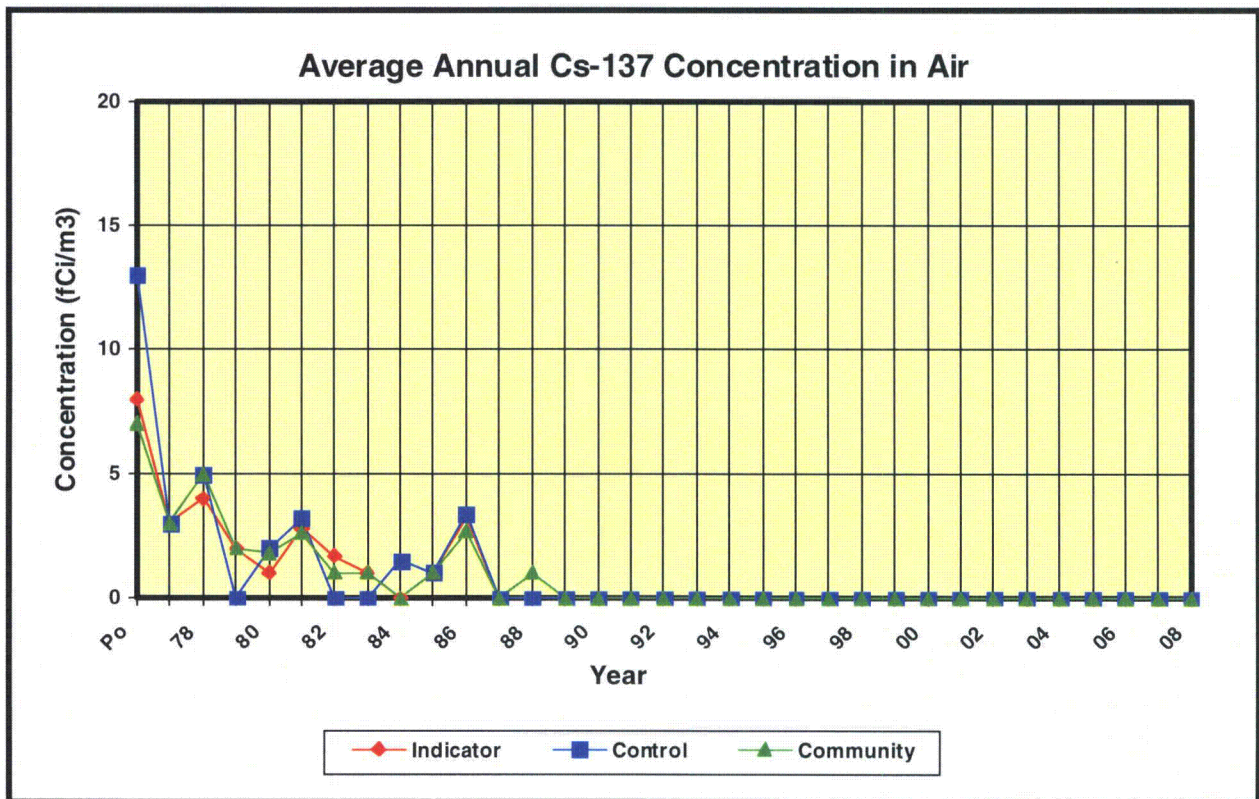
**Table 4.2-1**  
**Average Weekly Gross Beta Air Concentration**

<b>Period</b>	<b>Indicator (fCi/m3)</b>	<b>Control (fCi/m3)</b>	<b>Community (fCi/m3)</b>
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
1988	8.0	8.0	10.0
1989	7.0	7.0	8.0
1990	10.0	10.0	10.0
1991	9.0	10.0	8.0
1992	15.0	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	18.0	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

During 2008, no man-made radionuclides were detected from the gamma isotopic analysis of the quarterly composites of the air particulate filters. This has generally been the case since the impact of the weapons tests and the Chernobyl incident have faded. During preoperation and the early years of operation, a number of fission and activation products were detected. During preoperation, the average levels for Cs-134 and Cs-137 were 22 and 9 fCi/m<sup>3</sup>, respectively. In 1986, as a consequence of the Chernobyl incident, Cs-134 and Cs-137 levels of 3 to 4 fCi/m<sup>3</sup> were found. The MDC and RL for Cs-134 are 50 and 10,000 fCi/m<sup>3</sup> and the MDC and RL for Cs-137 are 60 and 20,000 fCi/m<sup>3</sup> respectively.

The historical trending of the annual detectable Cs-137 concentrations for the indicator, control and community stations is provided in Figure 4.2-2 and Table 4.2-2. The trend has been generally downward since preoperation and no positive results have been observed since 1988.

**Figure 4.2-2**



**Table 4.2-2**  
**Average Annual Cs-137 Concentration in Air**

<b>Period</b>	<b>Indicator (fCi/m3)</b>	<b>Control (fCi/m3)</b>	<b>Community (fCi/m3)</b>
Pre-op	8	13	7
1977	3.0	3.0	3.0
1978	4.0	5.0	5.0
1979	2.0	NDM	2.0
1980	1.0	2.0	1.8
1981	2.8	3.2	2.6
1982	1.7	NDM	1.0
1983	1.0	NDM	1.0
1984	NDM	1.5	NDM
1985	1.0	1.0	1.0
1986	3.3	3.4	2.7
1987	NDM	NDM	NDM
1988	NDM	NDM	1
1989	NDM	NDM	NDM
1990	NDM	NDM	NDM
1991	NDM	NDM	NDM
1992	NDM	NDM	NDM
1993	NDM	NDM	NDM
1994	NDM	NDM	NDM
1995	NDM	NDM	NDM
1996	NDM	NDM	NDM
1997	NDM	NDM	NDM
1998	NDM	NDM	NDM
1999	NDM	NDM	NDM
2000	NDM	NDM	NDM
2001	NDM	NDM	NDM
2002	NDM	NDM	NDM
2003	NDM	NDM	NDM
2004	NDM	NDM	NDM
2005	NDM	NDM	NDM
2006	NDM	NDM	NDM
2007	NDM	NDM	NDM
2008	NDM	NDM	NDM

Airborne I-131 was not detected in the charcoal canisters during 2008. In 1978, levels between 40 and 50 fCi/m<sup>3</sup> were found in a few samples and attributed to the Chinese weapons tests; then after the Chernobyl incident, levels up to a few hundred fCi/m<sup>3</sup> were found in some samples. At no other times has airborne I-131 been detected in the environmental samples. The MDC and RL for airborne I-131 are 70 and 900 fCi/m<sup>3</sup> respectively.

Table 4-3 lists REMP deviations that occurred during 2008. Although there were 10 air sampling deviations listed in Table 4-3, nine results passed Chauvenet's Criterion and the data was retained in the calculation of the mean values. The one excluded air sample was because the particulate filter was inadvertently discarded prior to analysis. Seven of the 10 were minor deviations where less than 2 hours of sampling time was lost for the week due to power interruptions.

## 4.3 Direct Radiation

Direct (external) radiation is measured with thermoluminescent dosimeters (TLDs). Two Panasonic UD-814 TLD badges are placed at each station. Each badge contains three phosphors composed of calcium sulfate crystals (with thulium impurity). The gamma dose at each station is based upon the average readings of the phosphors from the two badges. The two badges for each station are placed in thin plastic bags for protection from moisture while in the field. The badges are nominally exposed for periods of a quarter of a year (91 days). An inspection is performed near mid-quarter to assure that all badges are on-station and to replace any missing or damaged badges.

Two TLD stations are established in each of the 16 sectors, to form 2 concentric rings. The inner ring stations are located near the plant perimeter, as shown in Figure 2-1, and the outer ring stations are located at distances of approximately 3 to 5 miles from the plant, as shown in Figure 2-2. The stations forming the inner ring are designated as the indicator stations. The 6 control stations are located at distances greater than 10 miles from the plant, as shown in Figure 2-3. Stations are also provided which monitor special interest areas: the nearest occupied residence (SW at 1.2 miles), as shown in Figure 2-1, and the city of Ashford (WSW at 8 miles), as shown in Figure 2-3. The 16 outer ring stations and the 2 special interest stations are designated as community stations.

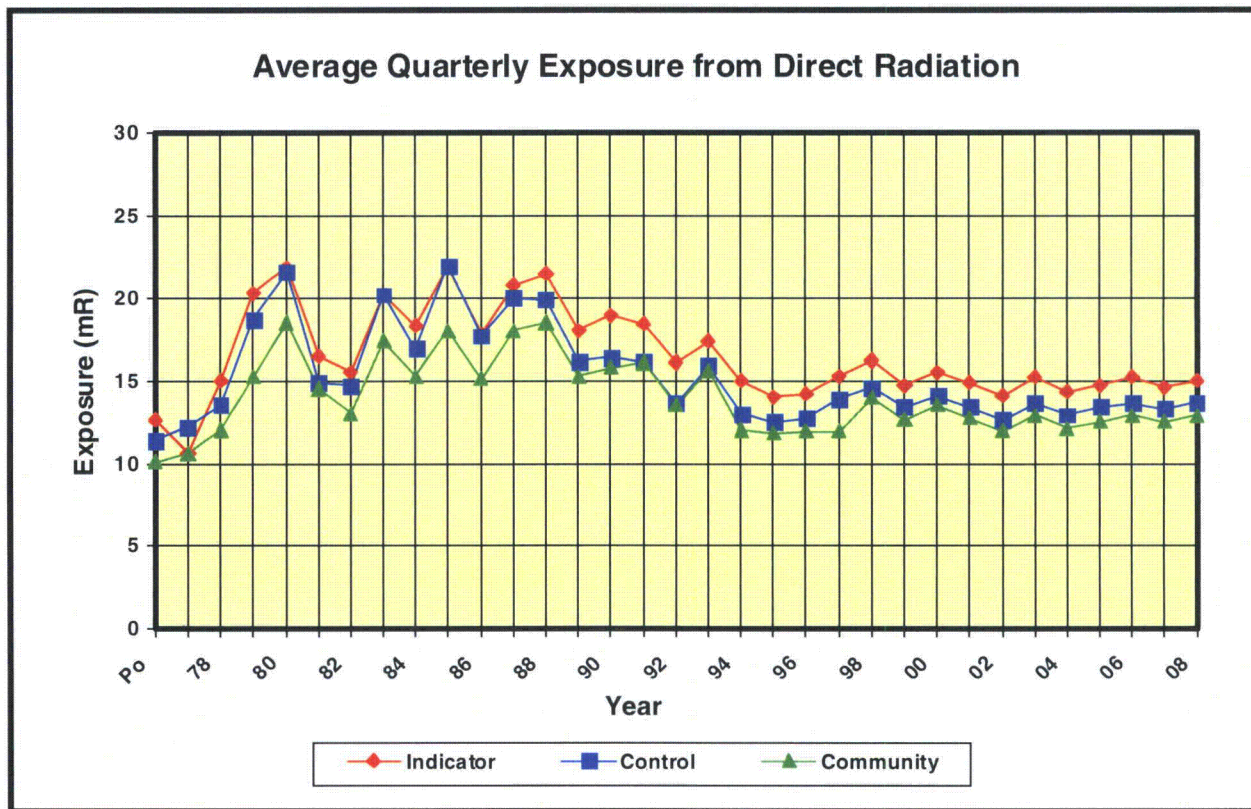
As provided in Table 3-1, the average quarterly exposure measured at the indicator stations (inner ring) during 2008 was 15.0 mR which was 1.3 mR greater than the 13.7 mR which was acquired at the control stations. This difference is not statistically discernible since it is less than the MDD of 1.4 mR. The difference of 0.78 mR found between the control stations (13.7 mR) and community stations (12.9 mR) is not statistically discernible since the difference is less than the MDD of 0.84 mR. The difference between the indicator and control and between the control and community stations is consistent with what has been seen in previous years.

The historical trending of the average quarterly exposures in units of mR at the indicator, control, and community locations are plotted in Figure 4.3-1 and listed in Table 4.3-1. During preoperation the average exposure at the indicator stations was 1.2 mR greater than that for the control stations, but the average over the entire period of operation was only 1.1 mR greater. During preoperation, the average exposure at the control stations was 1.3 mR greater than that at the community stations and the average over the period of operation is 1.5 mR greater. This supports the position that the plant is not contributing significantly to direct radiation in the environment.

Table 4-3 lists the REMP program deviations that occurred in 2008. There were two deviations (both in second quarter) involving TLD badges. RI-0201B had moisture in the TLD holding bag. The results from the "B" badge failed Chauvenet's Criterion and were excluded while the "A" badge results were retained in the data set. The badges at RC-1104 were missing at the end of the second quarter therefore no data was available from the station for that quarter.



Figure 4.3-1



**Table 4.3-1****Average Quarterly Exposure from Direct Radiation**

<b>Period</b>	<b>Indicator (mR)</b>	<b>Control (mR)</b>	<b>Community (mR)</b>
Pre-op	12.6	11.4	10.1
1977	10.6	12.2	10.6
1978	15.0	13.5	12.0
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	13.0
1983	20.2	20.2	17.4
1984	18.3	16.9	15.3
1985	21.9	22.0	18.0
1986	17.8	17.7	15.1
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



The standard deviation for the quarterly result for each badge was subjected to a self imposed limit of 1.4. This limit is calculated using a method developed by the American Society for Testing and Materials (ASTM) (ASTM Special Technical Publication 15D, ASTM Manual on Presentation of Data and Control Chart Analysis, Fourth Revision, Philadelphia, PA, October 1976). The calculation is based upon the standard deviations obtained by the EL with the Panasonic UD-814 badges during 1992. This limit serves as a flag to initiate an investigation. To be conservative, readings with a standard deviation greater than 1.4 are excluded since the high standard deviation is interpreted as an indication of unacceptable variation in TLD response.

The TLD results from the following stations were excluded from the data set because their standard deviations were greater than 1.4:

Quarter 1 – RI-1401A, RI-1501A

Quarter 2 – RC-0304B, RC-1504B, RI-1101B

Quarter 3 – RC-0104B, RC-1404B, RI-0201A, RI-0201B, RI-0901B, RI-1301B

Quarter 4 – None

For the TLD stations where these badges were located, only the reading of the companion badge was used to determine the quarterly exposure for the station with the exception of 3<sup>rd</sup> Qtr RI-0201. Both badges were greater than 1.4 standard deviation so the 3<sup>rd</sup> Qtr results from RI-0201 were excluded.

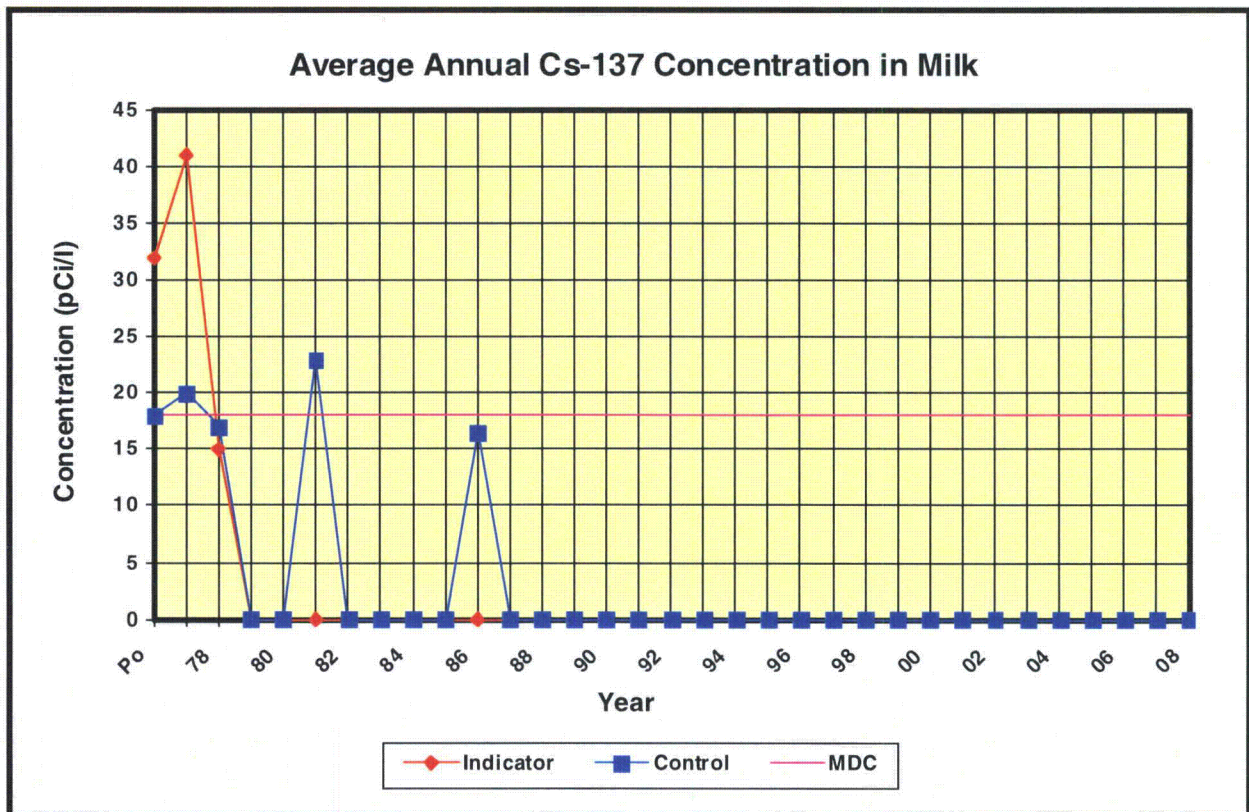
The affected badges were visually inspected under a microscope and the glow curve and test results for the anneal data and the element correction factors were reviewed. No reason was found for the high standard deviations.

## 4.4 Milk

In accordance with Table 2-1, milk samples are collected biweekly from a control location. 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 2008 land use census.

Gamma isotopic analyses were performed on each sample as specified in Table 2-1. No man-made radionuclides were identified from the gamma isotopic analysis of the milk samples during 2008. The MDC and RL for Cs-137 in milk are 18 and 70 pCi/l, respectively. The historical trending of the average annual detectable Cs-137 concentration in milk samples is shown in Figure 4.4-1 and Table 4.4-1. Cs-137 has not been detected in milk since 1986. Its presence at that time is attributed to the Chernobyl incident. The earlier detectable results were attributed to the weapons tests.

Figure 4.4-1

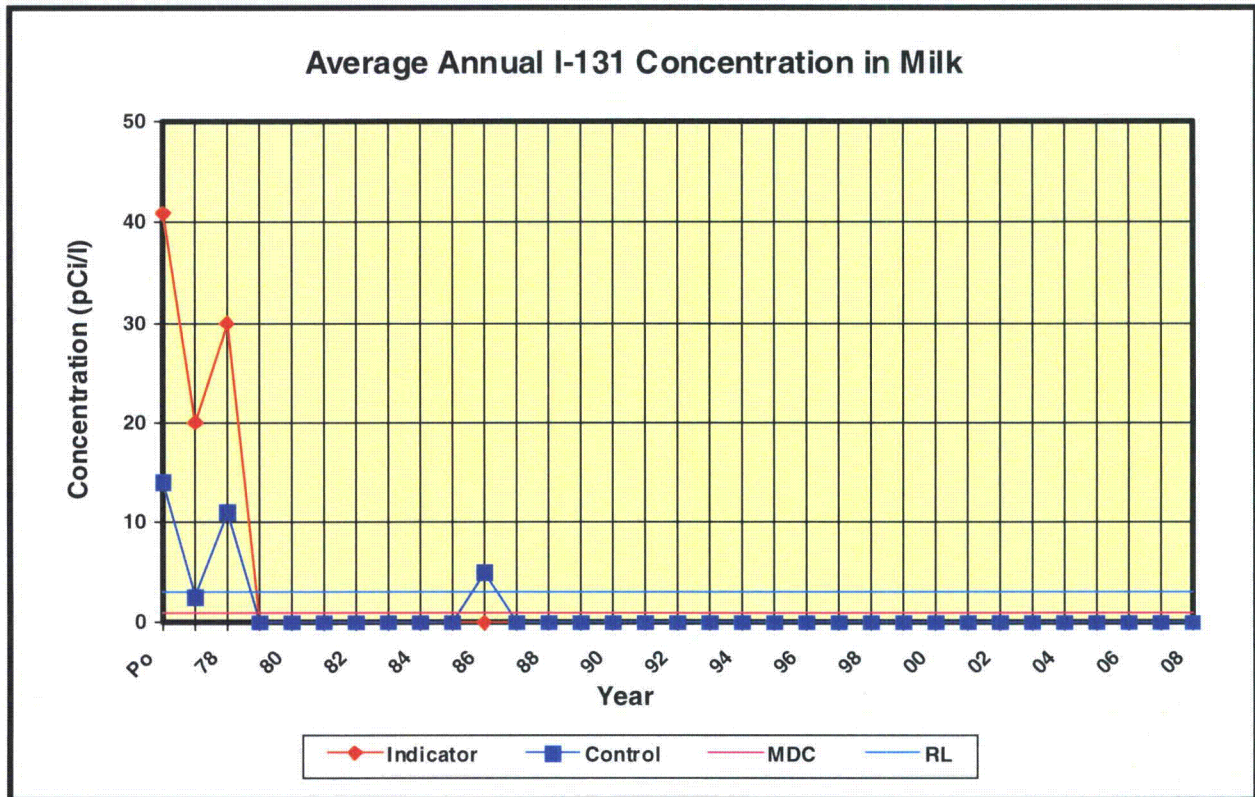


**Table 4.4-1**  
**Average Annual Cs-137 Concentration in Milk**

<b>Period</b>	<b>Indicator (pCi/l)</b>	<b>Control (pCi/l)</b>
Pre-op	32	18
1977	41	20
1978	15	17
1979	NDM	NDM
1980	NDM	NDM
1981	NDM	23.0
1982	NDM	NDM
1983	NDM	NDM
1984	NDM	NDM
1985	NDM	NDM
1986	NDM	16.5
1987	NDM	NDM
1988	NDM	NDM
1989	NDM	NDM
1990	NDM	NDM
1991	NDM	NDM
1992	NDM	NDM
1993	NDM	NDM
1994	NDM	NDM
1995	NDM	NDM
1996	NDM	NDM
1997	NDM	NDM
1998	NDM	NDM
1999	NDM	NDM
2000	NDM	NDM
2001	NDM	NDM
2002	NDM	NDM
2003	NDM	NDM
2004	NDM	NDM
2005	NDM	NDM
2006	NDM	NDM
2007	NDM	NDM
2008	NDM	NDM

As specified in Table 2-1, each sample was analyzed for I-131, which has not been detected in milk since 1986. The presence of I-131 at that time is attributed to the Chernobyl incident. The earlier detectable results were attributed to the weapons tests. The MDC and RL for I-131 are 1 and 3 pCi/l, respectively. Figure 4.4-2 and Table 4.4-2 show the historical trending of the average annual detectable I-131 concentration in milk samples.

**Figure 4.4-2**



**Table 4.4-2****Average Annual I-131 Concentration in Milk**

<b>Period</b>	<b>Indicator (pCi/l)</b>	<b>Control (pCi/l)</b>
Pre-op	41	14
1977	20	2.6
1978	30	11
1979	NDM	NDM
1980	NDM	NDM
1981	NDM	NDM
1982	NDM	NDM
1983	NDM	NDM
1984	NDM	NDM
1985	NDM	NDM
1986	NDM	5.0
1987	NDM	NDM
1988	NDM	NDM
1989	NDM	NDM
1990	NDM	NDM
1991	NDM	NDM
1992	NDM	NDM
1993	NDM	NDM
1994	NDM	NDM
1995	NDM	NDM
1996	NDM	NDM
1997	NDM	NDM
1998	NDM	NDM
1999	NDM	NDM
2000	NDM	NDM
2001	NDM	NDM
2002	NDM	NDM
2003	NDM	NDM
2004	NDM	NDM
2005	NDM	NDM
2006	NDM	NDM
2007	NDM	NDM
2008	NDM	NDM

## 4.5 Forage

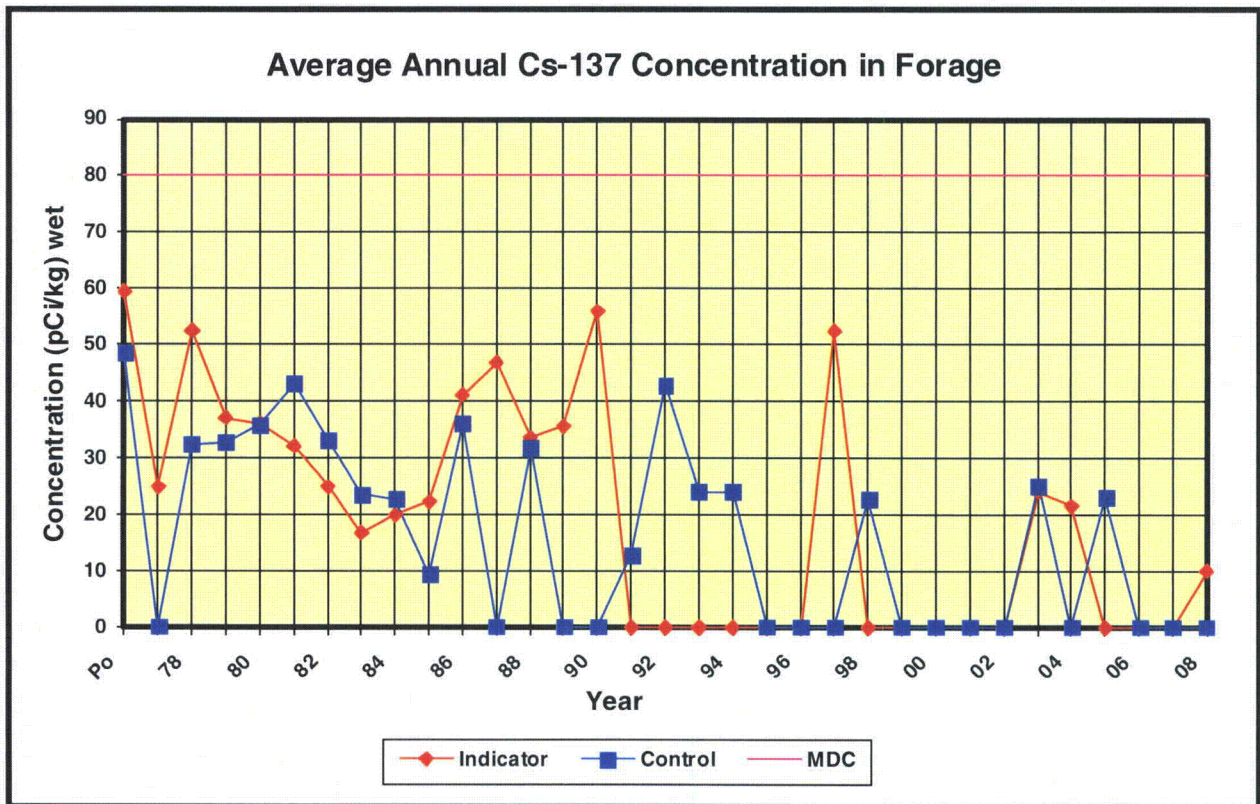
In accordance with Table 2-1, forage samples are collected every 4 weeks at two indicator stations on the plant perimeter, and at one control station located approximately 18 miles west of the plant, in Dothan. Gamma isotopic analyses are performed on each sample.

During preoperation and the years of operation through 1986 (the year of the Chernobyl incident), Cs-137 was typically found in about a third of the 35 to 40 forage samples collected per year. In 1987 and 1988 the number dropped to about a seventh of the total samples and from 1989 through 1994, it was only found in one or two samples every year. From 1994 to 2006, Cs-137 was detected in only a few samples, three indicator samples and three control samples.

In 2008, Cs-137 was not detected in any of the 13 control samples and detected in only one of the 26 indicator samples at 10.1 pCi/kg wet at FI-0701, 1.0 mile SSE Perimeter. The occasional presence of Cs-137 in vegetation samples is attributed primarily to fallout from nuclear weapons tests and from the Chernobyl incident. The MDC and RL for Cs-137 in forage are 80 and 2000 pCi/kg wet, respectively. Table 4.5-1 presents the average detectable results of Cs-137 found in forage over the life of the plant and Figure 4.5-1 shows the historical trending of this data.



Figure 4.5-1



**Table 4.5-1****Average Annual Cs-137 Concentration in Forage**

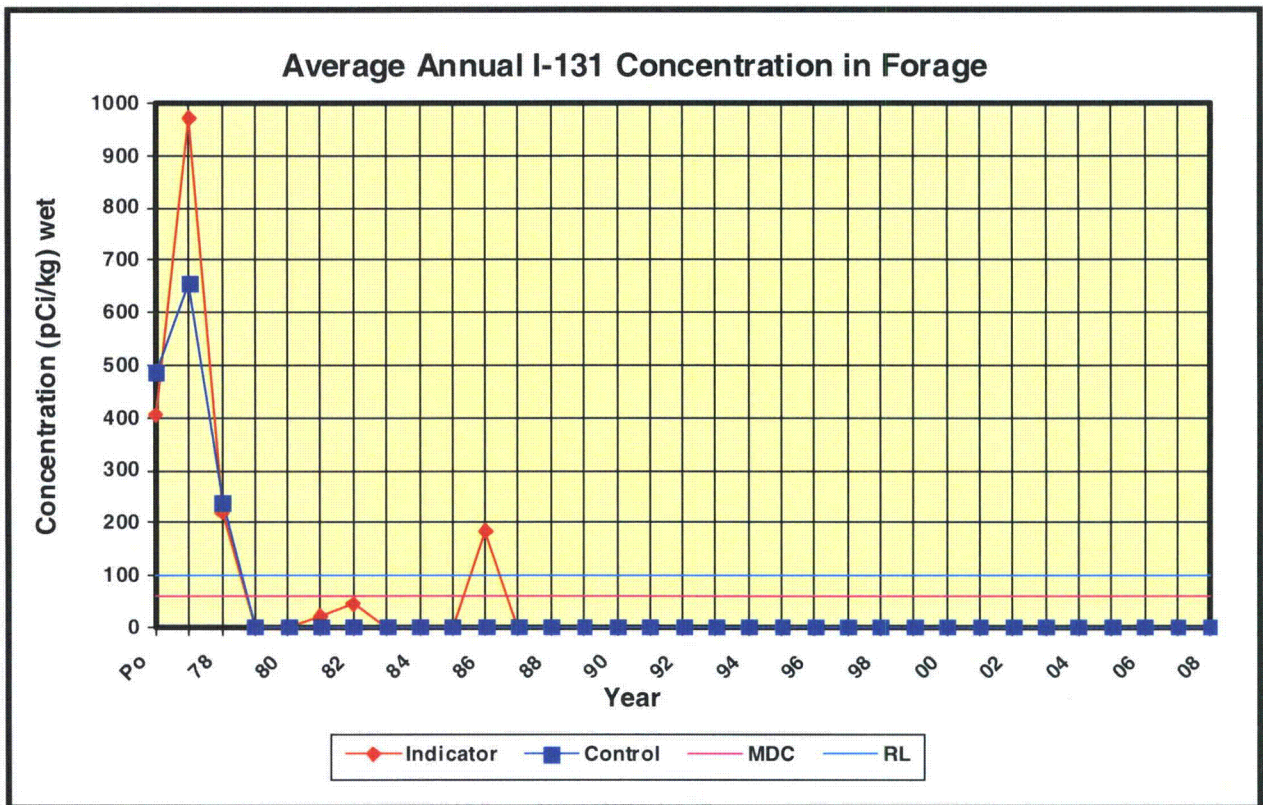
<b>Period</b>	<b>Indicator (pCi/kg) wet</b>	<b>Control (pCi/kg) wet</b>
Pre-op	59.4	48.6
1977	25.0	NDM
1978	52.5	32.5
1979	37.2	32.8
1980	36.2	35.9
1981	32.1	43.1
1982	25.0	33.1
1983	16.8	23.6
1984	19.9	22.8
1985	22.2	9.5
1986	41.2	36.2
1987	46.8	NDM
1988	33.6	31.7
1989	35.7	NDM
1990	56.0	NDM
1991	NDM	12.9
1992	NDM	43.0
1993	NDM	24.0
1994	NDM	24
1995	NDM	NDM
1996	NDM	NDM
1997	52.6	NDM
1998	NDM	22.7
1999	NDM	NDM
2000	NDM	NDM
2001	NDM	NDM
2002	NDM	NDM
2003	24.1	25.2
2004	21.6	NDM
2005	NDM	23.1
2006	NDM	NDM
2007	NDM	NDM
2008	10.1	NDM



During preoperation and in the early years of operation, I-131 was found in 10% to 25% of the forage samples at very high levels which ranged from around 100 to 1,000 pCi/kg wet. In 1986 (Chernobyl incident), I-131 reappeared after not having been detected for 3 years. The MDC and RL for I-131 are 60 and 100 pCi/kg wet, respectively. Table 4.5-2 lists the average detectable results of I-131 found in forage over the life of the plant and Figure 4.5-2 plots the historical trending of this data.

I-131 has not been detected in forage samples since the 1986 Chernobyl accident.

**Figure 4.5-2**



**Table 4.5-2****Average Annual I-131 Concentration in Forage**

<b>Period</b>	<b>Indicator (pCi/kg) wet</b>	<b>Control (pCi/kg) wet</b>
Pre-op	405	486
1977	971	654
1978	220	240
1979	NDM	NDM
1980	NDM	NDM
1981	21.4	NDM
1982	46.4	NDM
1983	NDM	NDM
1984	NDM	NDM
1985	NDM	NDM
1986	184	NDM
1987	NDM	NDM
1988	NDM	NDM
1989	NDM	NDM
1990	NDM	NDM
1991	NDM	NDM
1992	NDM	NDM
1993	NDM	NDM
1994	NDM	NDM
1995	NDM	NDM
1996	NDM	NDM
1997	NDM	NDM
1998	NDM	NDM
1999	NDM	NDM
2000	NDM	NDM
2001	NDM	NDM
2002	NDM	NDM
2003	NDM	NDM
2004	NDM	NDM
2005	NDM	NDM
2006	NDM	NDM
2007	NDM	NDM
2008	NDM	NDM

These forage analyses results show the impact of the weapons tests during preoperation and the early years of operation and of the Chernobyl incident in 1986 and for a few years afterwards. The impact is reflected by the number of different radionuclides detected, the fraction of samples with detectable results, as well as the magnitude of the results. During preoperation and for the first few years of operation, 11 different radionuclides from fission and activation products were detected. By 1985, only 2 different radionuclides were detected and the fraction of samples with detectable results had diminished. In 1986, the same two nuclides as seen in 1985 appeared at a significantly higher magnitude and I-131 reappeared. In the years following 1986, only Cs-137 has been found in forage and it has been found in a decreasing fraction of the samples.

## 4.6 Ground Water

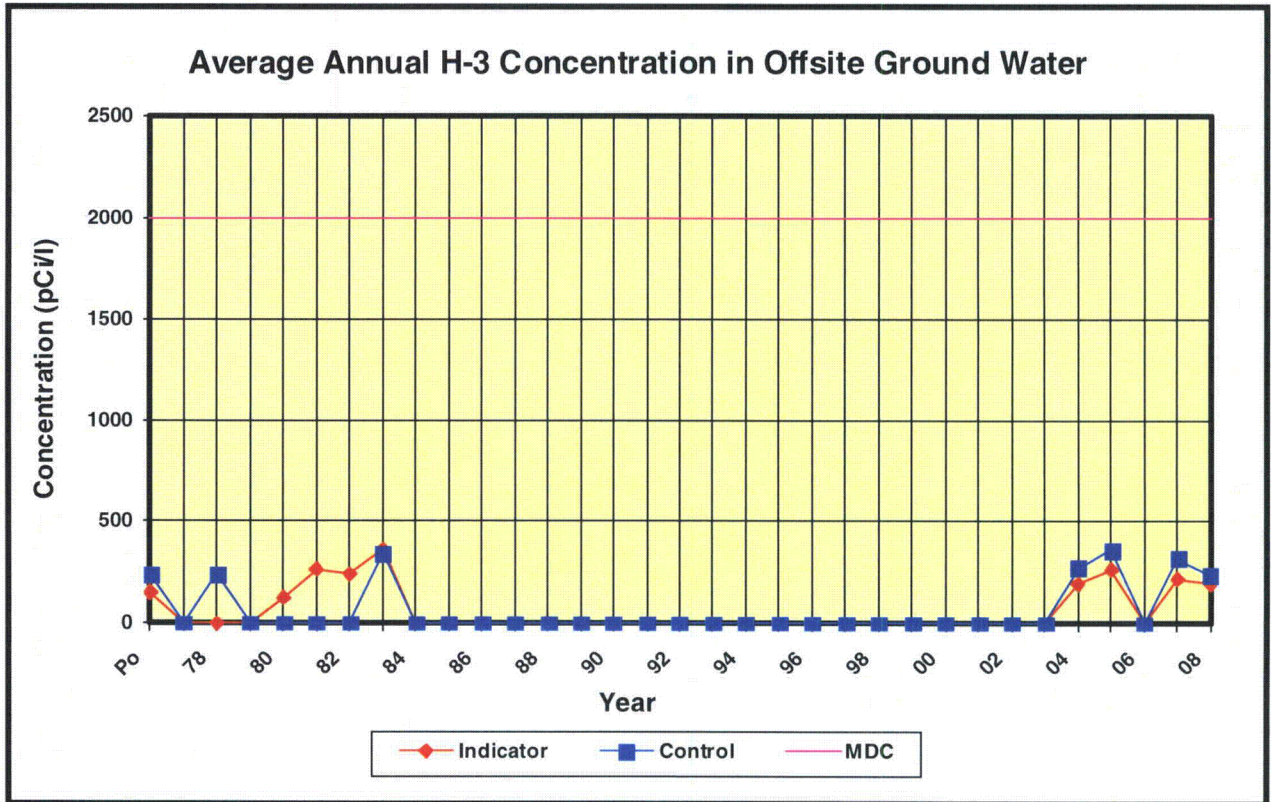
In the FNP offsite environs, there are no true indicator sources of ground water. A well, located about four miles south-southeast of the plant on the east bank of the Chattahoochee River, serves Georgia Pacific Paper Company as a source of potable water and is designated as the indicator station. A 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 2008, one indicator sample and two control samples were positive for tritium. No other radionuclides were detected.

In 1983, 1985, and 1986, Cs-134 was detected in single samples at levels ranging from 3 to 13 pCi/l. The MDC and RL for Cs-134 in water are 15 and 30 pCi/l, respectively.

During preoperation, Cs-137 was detected in two of the samples at levels of 15 and 17 pCi/l. Then in 1984 and 1985, Cs-137 was again detected in a few samples with levels ranging from 4 to 5 pCi/l. The MDC and RL for Cs-137 in water are 18 and 50 pCi/l, respectively.

Iodine-131 has never been detected in ground water samples. From 1986-2003, no radionuclides were detected. In 2004, 2005, 2007, and 2008, tritium was detected at very low concentrations (near the instrument detection level) and close to environmental background concentration which is approximately 350 pCi/l (+/- 150 pCi/l) in the area around Farley. The positive results seen in these years were less than 2% of the reporting level for tritium. In 2008, the difference between the single positive value (196 pCi/L) seen at the indicator station and the average of the 2 positive values (237 pCi/L) seen at the control station was not statistically discernible (using the modified Student's t-test). The MDC and RL for tritium in drinking water are 2,000 and 20,000 pCi/l, respectively. Figure 4.6-1 and Table 4.6-1 show the historical trending of the average annual detectable tritium concentration in ground water.

Figure 4.6-1



**Table 4.6-1****Average Annual H-3 Concentration in Offsite Ground Water**

<b>Period</b>	<b>Indicator (pCi/l)</b>	<b>Control (pCi/l)</b>
Pre-op	150	240
1977	NDM	NDM
1978	NDM	240
1979	NDM	NDM
1980	124	NDM
1981	264	NDM
1982	240	NDM
1983	360	341
1984	NDM	NDM
1985	NDM	NDM
1986	NDM	NDM
1987	NDM	NDM
1988	NDM	NDM
1989	NDM	NDM
1990	NDM	NDM
1991	NDM	NDM
1992	NDM	NDM
1993	NDM	NDM
1994	NDM	NDM
1995	NDM	NDM
1996	NDM	NDM
1997	NDM	NDM
1998	NDM	NDM
1999	NDM	NDM
2000	NDM	NDM
2001	NDM	NDM
2002	NDM	NDM
2003	NDM	NDM
2004	194	271
2005	264	360
2006	NDM	NDM
2007	218	321
2008	196	237

As nuclear plants began to undergo decommissioning in the late 1990's to early 2000s, instances of subsurface and/or groundwater contamination were identified. In addition, several operating facilities also identified groundwater contamination resulting from spills and leaks or equipment failure. In one instance, low levels of licensed material were detected in a private well located on property adjacent to a nuclear power plant.

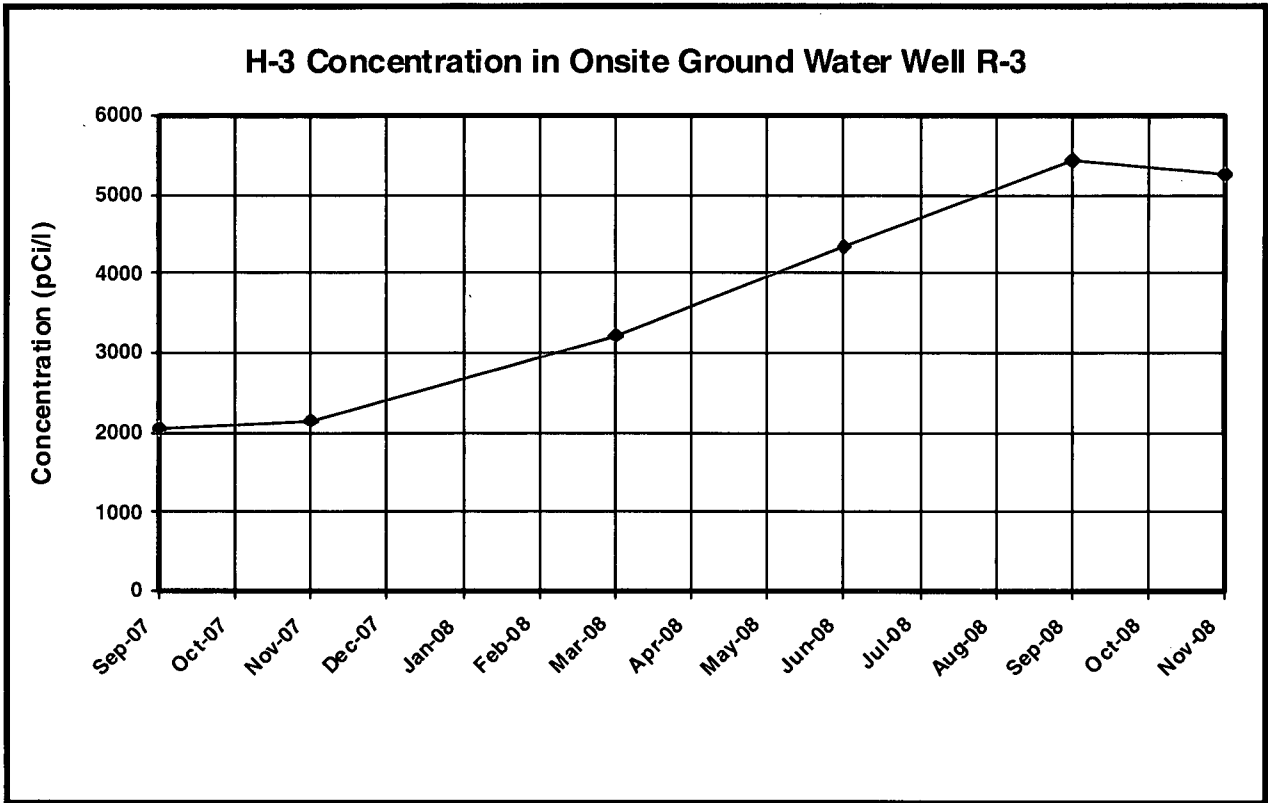
In 2006, NEI (Nuclear Energy Institute) formed a task force to address monitoring onsite groundwater for radionuclides at nuclear facilities. A Groundwater Protection Initiative was developed which was adopted by all U.S. commercial operating nuclear plants.

The NRC also formed a task force to study the groundwater issues and released Information Notice 2006-13 "Ground-water Contamination due to Undetected Leakage of Radioactive Water" which summarized its review of radioactive contamination of ground water at multiple facilities as a result of undetected leakage from structures, systems, or components that contain or transport radioactive fluids. Licensees were instructed to review the information for applicability and to consider appropriate actions to avoid similar problems.

The NEI task force felt it was prudent for the industry to update site hydrology information and to develop radiological groundwater monitoring plans at each site. These groundwater protection plans would ensure that underground leaks and spills would be addressed promptly. Additionally, the task force recommended developing a communications protocol to report radioactive leaks or spills that entered groundwater (or might eventually enter groundwater) to the NRC and State and Local government officials as needed.

In 2006, Farley located several old onsite piezometer wells and sampled these and the onsite drinking water wells for tritium and gamma isotopic activity. None of these wells contained detectable amounts of radioactivity. In 2007, after the site hydrology was evaluated, Farley implemented a more extensive radiological groundwater monitoring program which included drilling twelve new onsite monitoring wells (see Table 2-2). The twelve new wells along with one of the existing piezometer wells, the onsite drinking water wells, and several surface water / discharge locations comprise the monitoring program. These locations were sampled twice in the latter portion of 2007 and sampled quarterly in 2008. Of the numerous samples taken during 2007 and 2008 (from the locations described above), only one location (groundwater well R-3) showed low levels of radiological contamination (see Figure 4.6-2). Tritium was the only nuclide identified. R-3 was also analyzed for gamma emitters (quarterly) and strontium (initially and after increase was noted) and these were not detected. This well is located near the Protected Area and in the vicinity of the site where the Unit-2 radioactive effluent discharge line ruptured several years ago. For guidance regarding monitoring wells with unexpected results, Southern Nuclear developed a company-wide communications protocol which is contained in the Nuclear Management Procedure, *Actions for Potential Groundwater Contamination Events*, to ensure radioactive leaks and spills are addressed and communicated appropriately.

Figure 4.6-2





## 4.7

# Surface Water

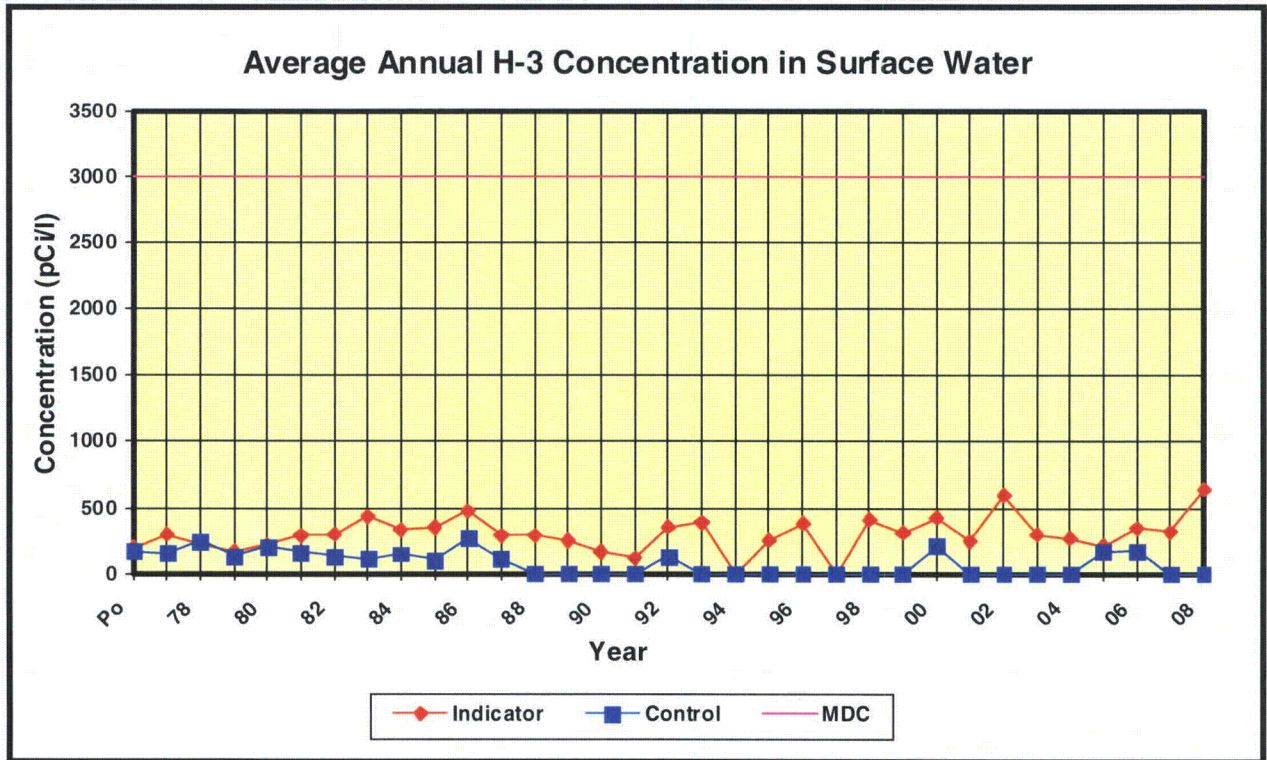
As specified in Table 2-1 and shown in Figure 2-2, water samples are collected from the Chattahoochee River at a control station approximately 3 miles upstream of the intake structure and at an indicator station approximately 4 miles downstream of the discharge structure. Small quantities are collected during the week at periodic intervals using automatic samplers. For each station, one liter from each of four consecutive weekly samples is combined into a composite sample which is analyzed for gamma emitters. In addition, 0.075 liters is collected from 13 consecutive weekly samples for each station to form composite quarterly samples which are analyzed for tritium.

No detectable results have been found from these gamma isotopic analyses since 1988. During preoperation and in every year of operation through 1988 (except 1979 and 1980), a few samples showed at least one of nine different activation or fission products at levels less than or on the order of their MDCs. During preoperation, Cs-137 was found in about 3% of the samples. From 1981 through 1988, it was found in about 15% of the samples. Cs-134 was found in about 15% of the samples from 1981 to 1986. All of these gamma emitters are attributed to the weapons tests and the Chernobyl incident.

In 2008, as shown in Table 3-1, tritium was detected in the 2<sup>nd</sup> quarter (412 pCi/L) and 3<sup>rd</sup> quarter (875 pCi/L) composite samples collected at the indicator station and in none of the 4 quarterly composite samples collected at the control station. The annual average concentration at the indicator station was 644 pCi/l. The initial result of the 3<sup>rd</sup> Qtr indicator composite was 923 pCi/L of tritium. Although no limits were exceeded, Condition Report 2008111287 was written to investigate the higher than typical quarterly result. The sample was reanalyzed at 875 pCi/L and this value was used in the annual average. The reason for the atypical quarterly result was due to higher activity liquid releases during the summer in combination with lower river flow due to drought conditions.

Historical trending of the detectable concentrations of tritium in surface water is provided in Figure 4.7-1 and Table 4.7-1. The slightly elevated plot of the indicator stations is indicative of plant tritium contributions to surface water. However, it is noteworthy that the annual average levels are less than 10% of the MDC and less than 1% of the RL. The MDC and RL for tritium in surface water are 3,000 and 30,000, respectively.

Figure 4.7-1



**Table 4.7-1****Average Annual H-3 Concentration in Surface Water**

<b>Period</b>	<b>Indicator (pCi/l)</b>	<b>Control (pCi/l)</b>
Pre-op	200	170
1977	300	160
1978	230	250
1979	169	135
1980	221	206
1981	294	162
1982	300	132
1983	434	111
1984	333	152
1985	351	105
1986	478	272
1987	291.8	116.5
1988	293.3	NDM
1989	253.8	NDM
1990	166	NDM
1991	122	NDM
1992	360.5	134
1993	388.8	NDM
1994	NDM	NDM
1995	257	NDM
1996	386	NDM
1997	NDM	NDM
1998	415	NDM
1999	314	NDM
2000	424	212
2001	252	NDM
2002	598	NDM
2003	296	NDM
2004	270	NDM
2005	215	173
2006	348	179
2007	321	NDM
2008	644	NDM

## 4.8 Fish

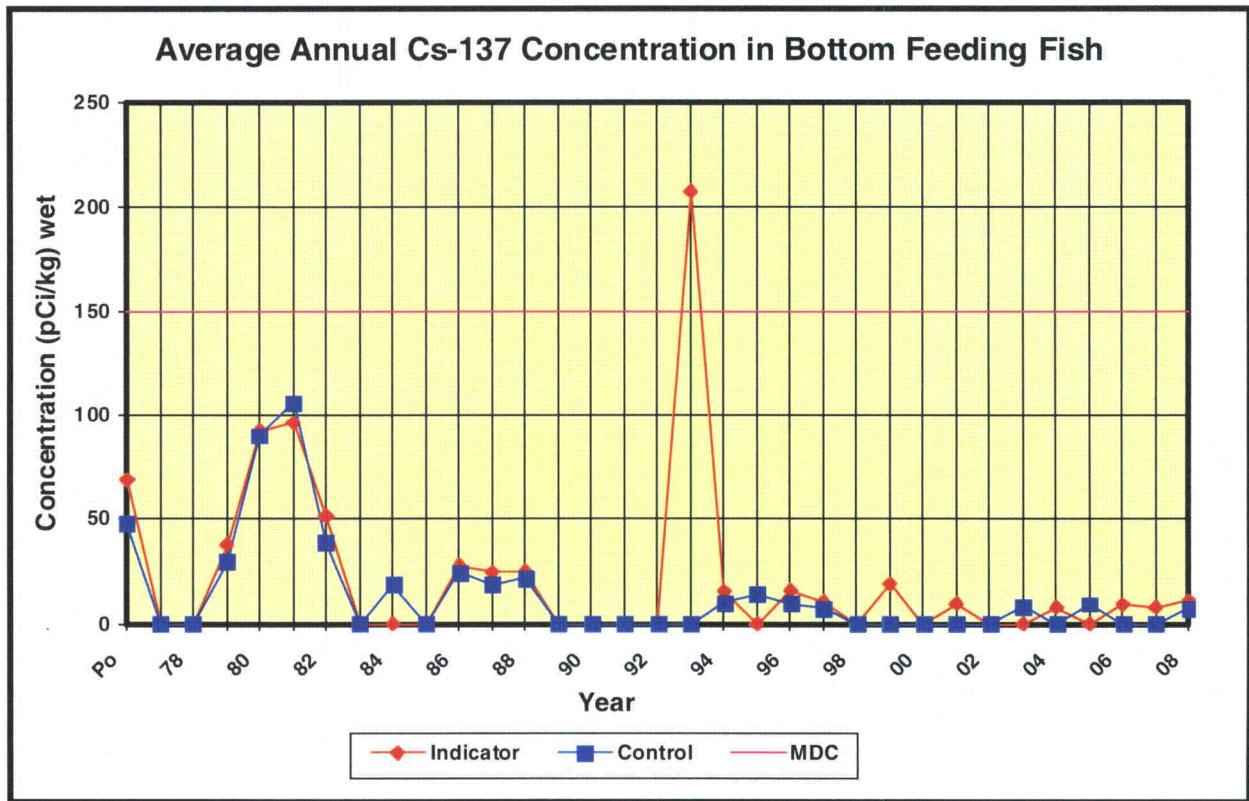
Two types of fish (bottom feeding and game) are collected semiannually from the Chattahoochee River at a control station several miles upstream of the plant intake structure and at an indicator station a few miles downstream of the plant discharge structure. These locations are shown in Figure 2-2. Gamma isotopic analysis is performed on the edible portions of each sample as specified in Table 2-1.

As provided in Table 3-1, Cs-137 was the only radionuclide of interest that was found from the gamma isotopic analysis of fish samples in 2008. Cs-137 was detected in both the fall and spring collection of game fish samples at the indicator station. The average was 16.6 pCi/kg wet. Cs-137 was detected in one game fish sample at the control station (23.2 pCi/kg-wet). Using the modified Student's t-test, the difference between the indicator and control station was not statistically discernible. The average of the samples at the indicator station was less than 1% of the reporting level. The MDC for Cs-137 in fish is 150 pCi/kg wet and the RL is 2000 pCi/kg wet.

Cesium-137 was detected in both the fall and spring collection of bottom feeding fish samples at the indicator location. The average of the two samples was 11.4 pCi/kg wet. Cs-137 was detected in one (7.7 pCi/kg wet) of the two bottom feeding fish samples collected at the control station. Using the modified Student's t-test, the difference between the indicator and control station was not statistically discernible. The average of the samples at the indicator station was less than 1% of the reporting level. The MDC for Cs-137 in fish is 150 pCi/kg wet and the RL is 2000 pCi/kg wet.

Historically, Cs-137 has been found in approximately 30% of the bottom feeding fish samples and in 80% of the game fish samples. Figures 4.8-1 and 4.8-2 and Tables 4.8-1 and 4.8-2 provide the historical trending of the average annual detectable concentrations of Cs-137 in pCi/kg wet in bottom feeding and game fish, respectively. Since the early 1980s, values have generally decreased for both indicator and control groups, with the exception of the bottom feeding fish collected at the indicator station in 1993. While some contribution from the plant cannot be ruled out, most of the Cs-137 in these samples may be attributed to the nuclear weapons tests and the Chernobyl incident, as evidenced by the normally close agreement between the control and indicator station results.

Figure 4.8-1

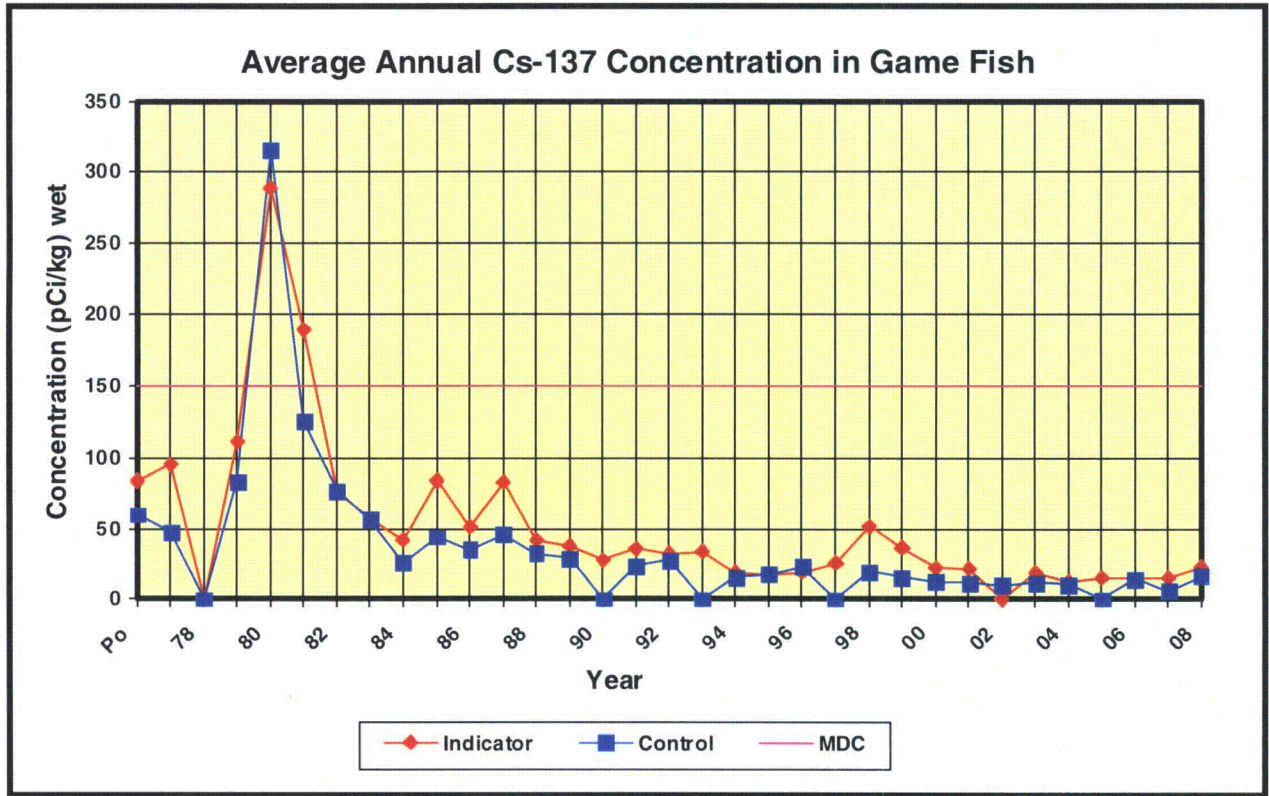


**Table 4.8-1****Average Annual Cs-137 Concentration in Bottom Feeding Fish**

<b>Period</b>	<b>Indicator (pCi/kg) wet</b>	<b>Control (pCi/kg) wet</b>
Pre-op	69	48
1977	NDM	NDM
1978	NDM	NDM
1979	38	30
1980	92	90
1981	96	106
1982	51.5	39.0
1983	NDM	NDM
1984	NDM	19
1985	NDM	NDM
1986	28	25
1987	25	19
1988	25.5	22.0
1989	NDM	NDM
1990	NDM	NDM
1991	NDM	NDM
1992	NDM	NDM
1993	208	NDM
1994	15.9	10.3
1995	NDM	14.2
1996	16.4	9.9
1997	10.9	7.7
1998	NDM	NDM
1999	19.2	NDM
2000	NDM	NDM
2001	9.8	NDM
2002	NDM	NDM
2003	NDM	8.5
2004	8.1	NDM
2005	NDM	9.6
2006	9.7	NDM
2007	8.1	NDM
2008	11.4	7.7



Figure 4.8-2



**Table 4.8-2****Average Annual Cs-137 Concentration in Game Fish**

<b>Period</b>	<b>Indicator (pCi/kg) wet</b>	<b>Control (pCi/kg) wet</b>
Pre-op	84	60
1977	95	48
1978	NDM	NDM
1979	111	83.5
1980	289	316
1981	189	126
1982	76	77
1983	57	56.5
1984	42	26
1985	84	44
1986	51	35
1987	83	46
1988	42	33
1989	38	29
1990	28	NDM
1991	36	24
1992	32.5	28
1993	34	NDM
1994	19	16
1995	17.9	18.2
1996	19.6	23.1
1997	25.9	NDM
1998	52	20
1999	36.9	15.9
2000	22.9	12.5
2001	22.4	12.3
2002	NDM	10.1
2003	19.3	12.0
2004	12.7	10.8
2005	15.7	NDM
2006	15.0	14.7
2007	15.4	6.5
2008	16.6	23.2



Radionuclides of interest other than Cs-137 have been found in only a few samples in the past. The following table provides a summary of the results in pCi/kg wet compared with the applicable MDCs.

<b>YEAR</b>	<b>Nuclide</b>	<b>Fish Type</b>	<b>Indicator (pCi/kg)</b>	<b>Control (pCi/kg)</b>	<b>MDC (pCi/kg)</b>
<b>1978</b>	Ce-144	Bottom Feeding	NDM	200	
<b>1981</b>	Nb-95	Bottom Feeding	38	NDM	50 (a)
<b>1982</b>	Nb-95	Game	31	NDM	50 (a)
<b>1986</b>	Co-60	Game	25	NDM	130

(a) Determined by the EL. Not defined in ODCM Table 4-3 (Table 4-1 of this report)

## 4.9 Sediment

River sediment samples are collected semiannually on the Chattahoochee River at a control station which is approximately 4 miles upstream of the intake structure and at an indicator station which is approximately 2 miles downstream of the discharge structure as shown in Figure 2-2. A gamma isotopic analysis is performed on each sample as specified in Table 2-1. During 2008, no nuclides of interest were detected in river sediment.

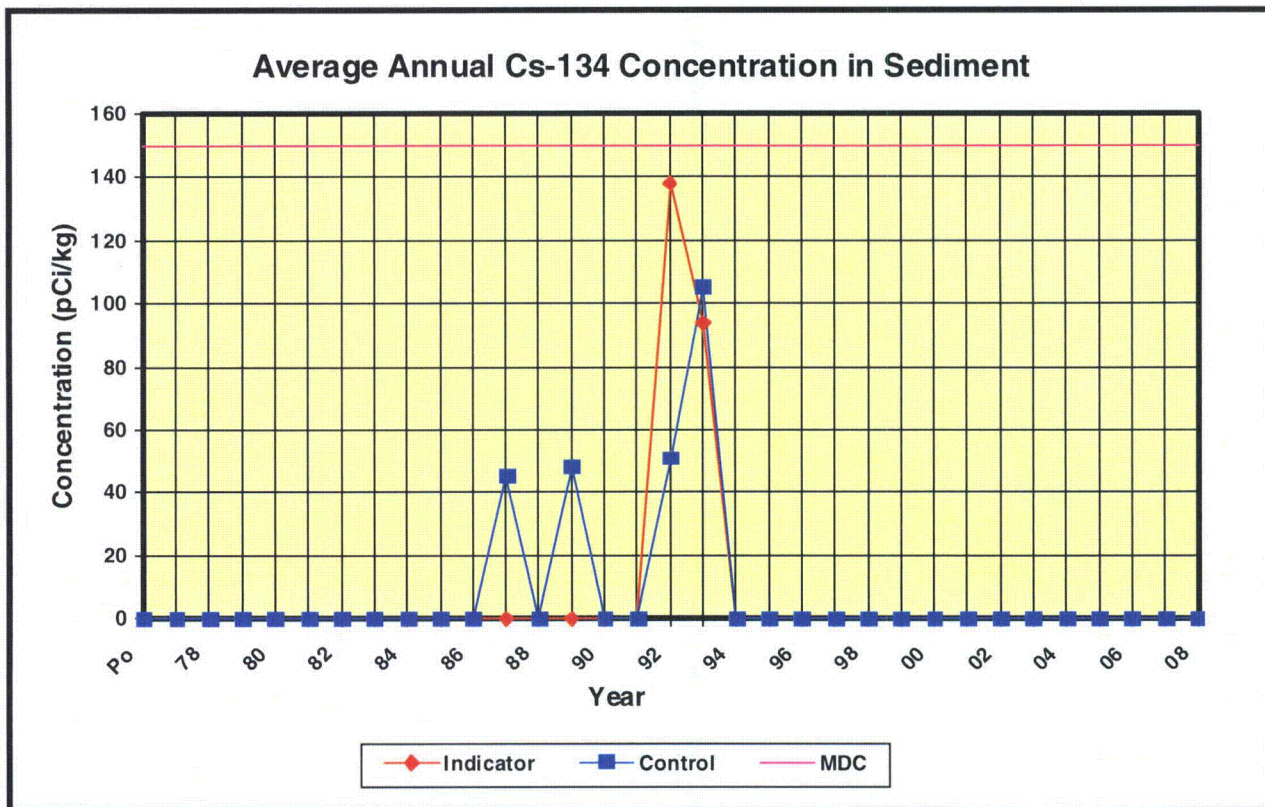
Historically, Be-7, Cs-134, Cs-137, and Nb-95 have been detected in some samples. These positive results were generally for samples collected at the control station. A summary of the positive historical results for these nuclides along with their applicable MDCs in units of pCi/kg dry is provided in Table 4.9. Cs-134 and Cs-137 data are plotted in Figures 4.9-1 and 4.9-2, respectively.

**Table 4.9**  
**Sediment Nuclide Concentrations**

<b>Nuclide</b>	<b>YEAR</b>	<b>Indicator (pCi/kg)</b>	<b>Control (pCi/kg)</b>	<b>MDC (pCi/kg)</b>
Be-7	1985	535	945	655 (a)
	2003	199	NDM	
Cs-134	1987	NDM	45	150
	1989	NDM	48	
	1992	138	51	
	1993	94	105	
Cs-137	1981	NDM	185	180
	1985	NDM	97	
	1989	NDM	39	
	1994	29	11	
	1996	11.8	NDM	
	2005	14.5	NDM	
Nb-95	1981	52	113	50 (a)

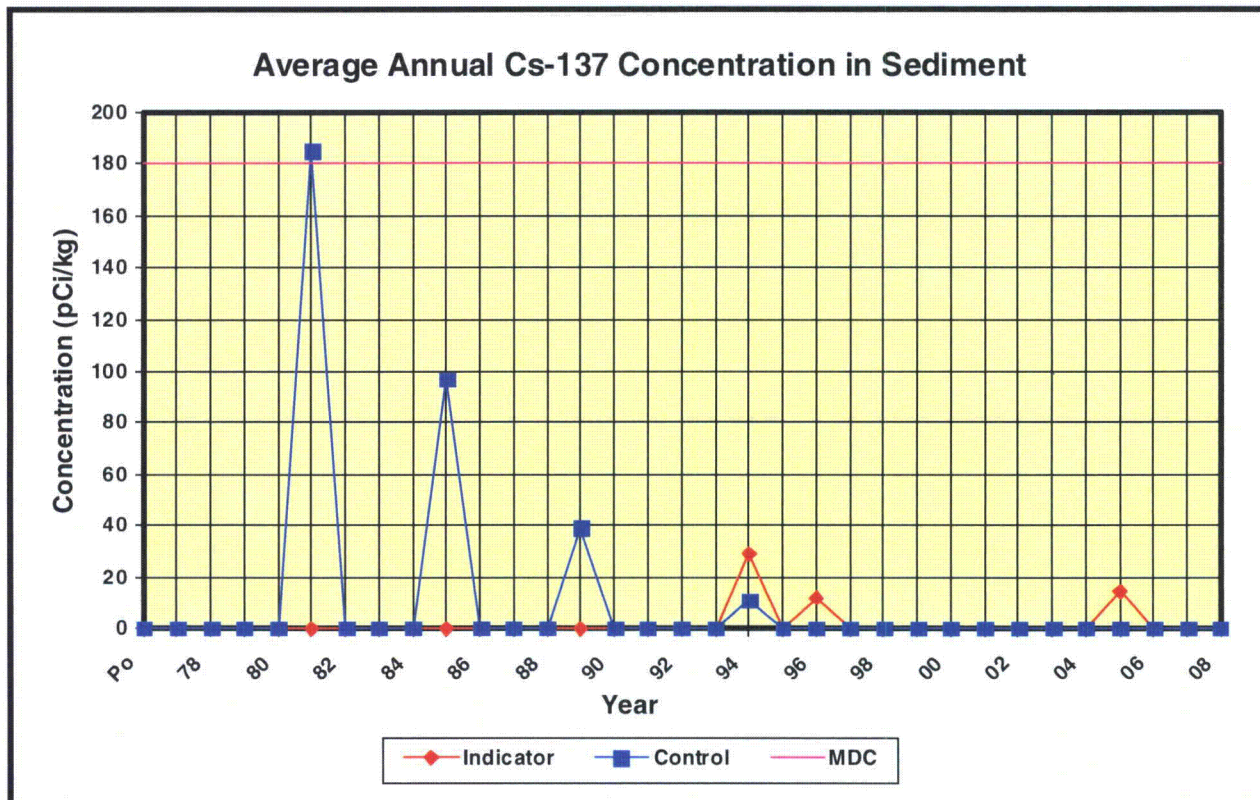
(a) Determined by the EL. Not defined in ODCM Table 4-3 (Table 4-1 of this report).

Figure 4.9-1



The positive results for Cs-134 appear mostly at the control station. Due to its relatively short half-life of approximately 2 years, the positive results may be attributed to the Chernobyl incident. The overall plotting of the positive results does not show any discernible trends.

Figure 4.9-2



Cs-137 appears to be trending down since the ceasing of above ground weapons testing and the majority of the positive results appear at the control stations. Therefore in general, the positive results can be attributed to the weapons tests and the Chernobyl incident.

## 5.0 INTERLABORATORY COMPARISON PROGRAM

In accordance with ODCM 4.1.3, the EL participates in an 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 guide indicates the ICP is to be conducted with the Environmental Protection Agency (EPA) Environmental Radioactivity Laboratory Intercomparison Studies (Cross-check) Program or an equivalent program, and the ICP should include all of the determinations (sample medium/radionuclide combinations) that are offered by the EPA and included in the REMP.

The ICP is conducted by Analytics, Inc. of Atlanta, Georgia. Analytics 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. Analytics supplies the crosscheck samples to the EL which performs the laboratory analyses in a normal manner. Each of the specified analyses is performed three times. The results are then sent to Analytics who performs an evaluation which may be helpful to the EL in the identification of instrument or procedural problems.

The samples offered by Analytics and included in the EL analyses are gross beta and gamma isotopic analyses of an air filter; gamma isotopic analyses of milk samples; and gross beta, tritium and gamma isotopic analyses of water samples.

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. The total error is the square root of the sum of the squares of the uncertainties of the known value and of the reported average. The uncertainty of the known value includes all analytical uncertainties as reported by Analytics. The uncertainty of the reported average is the propagated error of the values in the reported average by the EL. The precision of each result is measured by the coefficient of variation, which is defined as the standard deviation of the reported result divided by the reported average. 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 as follows:

Nuclide	Concentration *	Total Sample Activity (pCi)	Percent Coefficient of Variation
Cr-51	<300	NA	25
Cr-51	NA	>1000	25
Cr-51	>300	<1000	15
Fe-59	<80	NA	25
Fe-59	>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 EL's participation in the ICP is provided in Table 5-1 for: the gross beta and gamma isotopic analyses of an air filter; gamma isotopic analyses of milk samples; and gross beta, tritium and gamma isotopic analyses of water samples. Delineated in this table for each of the media/analysis combinations, are: the specific radionuclides; Analytics' preparation dates; the known values with their uncertainties supplied by Analytics; the reported averages with their standard deviations; and the resultant normalized deviations and coefficients of variation expressed as a percentage.

The GPC EL analyzed 13 samples for 43 parameters in 2008. The analyses included tritium, gross beta, Fe-55, Sr-89/90 and gamma emitting radio-nuclides in milk, water, air cartridge and air filter matrices. The attached results indicate three analyses outside the three sigma control limits. They were the following:

- 1) Mn-54 in air filter (Environmental Program) for accuracy.
- 2) Co-58 in water (Environmental Program) for precision
- 3) Gross alpha in water (Effluent Program) for accuracy.

The first quarter effluent water sample analyzed for gross alpha had a low activity recovery. The gross alpha in water self absorption curve was evaluated and updated. The second quarter alpha sample was in control for both accuracy and precision. A known alpha activity sample will be processed with the blind samples in the future to assure accurate results.

The third quarter environmental air filter sample was analyzed by gamma spectroscopy and had a high activity recovery for Mn-54. The sample was analyzed by three detectors and a weighted average reported. A small range from the three detectors produced an elevated normalized deviation result. The value was above the three sigma control limit, however the recovery of the Mn-54 activity is 114% and is acceptable.

The precision failure was in the first quarter water sample analyzed by gamma spectroscopy. The %CV for Co-58 was above the control limit. The sample was analyzed on three detectors with an error weighted average reported. An elevated range of values in the analysis is due to one of the detectors measuring a higher activity. No inconsistencies were found in the detector shaping or analysis of the 810 keV gamma peak. No further investigation will be performed.

In 2009 the Environmental Laboratory will adopt the NRC Inspection Procedure's guidance for acceptance criteria in performance sample testing. The adoption of the NRC Inspection Procedure 84750 will keep the lab consistent with the nuclear industry.

TABLE 5-1 (SHEET 1 of 3)

INTERLABORATORY COMPARISON PROGRAM RESULTS

GROSS BETA ANALYSIS OF AN AIR FILTER (pCi/filter)

Analysis or Radionuclide	Date Prepared	Reported Average	Known Value	Standard Deviation EL	Uncertainty Analytics (3S)	Percent Coef of Variation	Normalized Deviation
Gross Beta	09/18/08	128.00	121.00	4.82	2.03	5.43	1.01

GAMMA ISOTOPIC ANALYSIS OF AN AIR FILTER (pCi/filter)

Analysis or Radionuclide	Date Prepared	Reported Average	Known Value	Standard Deviation EL	Uncertainty Analytics (3S)	Percent Coef of Variation	Normalized Deviation
Ce-141	09/18/08	134.00	132.00	6.74	0.74	5.81	0.25
Co-58	09/18/08	149.70	146.00	6.7	0.81	3.84	0.61
Co-60	09/18/08	197.10	192.00	7.81	1.07	3.22	0.74
Cr-51	09/18/08	390.10	345.00	14.59	1.92	6.74	1.69
Cs-134	09/18/08	186.90	190.00	6.88	1.06	4.54	-0.35
Cs-137	09/18/08	143.20	133.00	5.23	0.74	4.92	1.40
Fe-59	09/18/08	140.60	118.00	2.99	0.66	4.58	3.40
Mn-54	09/18/08	154.60	136.00	1.14	0.76	3.42	3.30
Zn-65	09/18/08	295.40	262.00	13.08	1.46	5.70	1.93

GAMMA ISOTOPIC ANALYSIS OF A MILK SAMPLE (pCi/liter)

Analysis or Radionuclide	Date Prepared	Reported Average	Known Value	Standard Deviation EL	Uncertainty Analytics (3S)	Percent Coef of Variation	Normalized Deviation
Ce-141	06/19/08	180.10	174.00	13.17	0.97	8.56	0.39
Co-58	06/19/08	68.90	61.90	4.77	0.34	0.65	0.96
Co-60	06/19/08	112.60	104.00	5.69	0.58	6.87	1.10
Cr-51	06/19/08	146.70	138.00	23.39	0.77	25.12	0.24
Cs-134	06/19/08	74.70	76.70	2.67	0.43	7.18	-0.36
Cs-137	06/19/08	118.20	116.00	5.44	0.65	7.27	0.25

TABLE 5-1 (SHEET 2 of 3)

INTERLABORATORY COMPARISON PROGRAM RESULTS

GAMMA ISOTOPIC ANALYSIS OF A MILK SAMPLE (pCi/liter)

Analysis or Radionuclide	Date Prepared	Reported Average	Known Value	Standard Deviation EL	Uncertainty Analytics (3S)	Percent Coef of Variation	Normalized Deviation
Fe-59	06/19/08	109.40	91.70	13.67	0.51	14.96	1.08
I-131	06/19/08	88.90	71.40	9.9	0.40	12.83	1.53
Mn-54	06/19/08	152.00	135.00	4.56	0.75	5.68	1.92
Zn-65	06/19/08	135.40	127.00	8.19	0.71	10.23	0.60

GROSS BETA ANALYSIS OF WATER SAMPLE (pCi/liter)

Analysis or Radionuclide	Date Prepared	Reported Average	Known Value	Standard Deviation EL	Uncertainty Analytics (3S)	Percent Coef of Variation	Normalized Deviation
Gross Beta	03/20/08	182.00	209.00	11.15	1.16	8.57	-1.73
	06/19/08	151.10	169.00	6.13	0.94	5.61	-2.10

GAMMA ISOTOPIC ANALYSIS OF WATER SAMPLES (pCi/liter)

Analysis or Radionuclide	Date Prepared	Reported Average	Known Value	Standard Deviation EL	Uncertainty Analytics (3S)	Percent Coef of Variation	Normalized Deviation
Ce-141	03/20/08	204.60	198.00	8.08	2.21	5.87	0.55
Co-58	03/20/08	58.50	56.40	9.22	0.63	15.77	0.23
Co-60	03/20/08	188.90	189.00	9.74	2.09	6.57	0.06
Cr-51	03/20/08	356.30	286.00	21.56	2.85	12.23	1.61
Cs-134	03/20/08	99.90	99.70	2.29	1.11	5.91	0.03



TABLE 5-1 (SHEET 3 of 3)

INTERLABORATORY COMPARISON PROGRAM RESULTS

GAMMA ISOTOPIC ANALYSIS OF WATER SAMPLES (pCi/liter)

Analysis or Radionuclide	Date Prepared	Reported Average	Known Value	Standard Deviation EL	Uncertainty Analytics (3S)	Percent Coef of Variation	Normalized Deviation
Cs-137	03/20/08	121.50	116.00	9.85	1.29	10.22	0.45
Fe-59	03/20/08	92.60	81.40	7.75	0.91	12.21	0.99
I-131	03/20/08	68.90	70.40	0.98	0.79	8.64	-0.25
Mn-54	03/20/08	83.20	75.00	4.32	0.83	8.84	1.11
Zn-65	03/20/08	119.90	109.00	6.41	1.21	11.03	0.83

TRITIUM ANALYSIS OF WATER SAMPLES (pCi/liter)

Analysis or Radionuclide	Date Prepared	Reported Average	Known Value	Standard Deviation EL	Uncertainty Analytics (3S)	Percent Coef of Variation	Normalized Deviation
H-3	03/20/08	3988.70	4010.00	87.41	22.33	4.28	-0.13
	06/19/08	12,900.00	13,000.00	44.32	72.33	2.16	-0.48

I-131 ANALYSIS OF AN AIR CARTRIDGE (pCi/cartridge)

Analysis or Radionuclide	Date Prepared	Reported Average	Known Value	Standard Deviation EL	Uncertainty Analytics (3S)	Percent Coef of Variation	Normalized Deviation
I-131	12/11/08	51.30	54.80	0.22	0.31	3.83	-1.75

5-5

## 6.0 CONCLUSIONS

This report confirms the licensee's conformance with the requirements of Chapter 4 of the ODCM. It provides a summary and discussion of the results of the laboratory analyses for each type of sample.

In 2008, there were two instances where the indicator station results were statistically discernible from the control station results – tritium in surface water and Cs-137 in forage. These are discussed below. No discernible radiological impact upon the environment or the public as a consequence of plant discharges to the atmosphere and to the river was established for any other REMP samples.

Tritium was detected at the indicator station in two of the four quarterly surface water sample collections. No tritium was detected at the control station. Although no drinking water pathway via surface water exists in the plant vicinity, a potential dose was calculated assuming a person regularly consumed drinking water from the river. The potential dose of 0.049 mrem in a year is less than 2% of the annual dose limit for the total body due to liquid effluents (3 mrem). Another pathway to obtain dose from tritium in the river is through consumption of fish. The potential total body dose for an adult who consumed fish regularly from the river would be about  $1.3E-03$  mrem in a year which is approximately 0.04% of the annual limit for the total body (3 mrem) due to liquid effluents.

Cesium-137 was detected in forage in one of 26 samples at the indicator station, FI-0701 Plant Perimeter 1.0 mile SSE, (at 10.1 pCi/kg wet) and in none of the 13 samples at the control station. The potential dose to an adult (member of the public who would receive the highest dose) due to regular consumption of leafy vegetation containing Cs-137 at this low level would be 0.016 mrem in a year. This dose is approximately 0.1% of the regulatory limit of 15 mrem per year to any organ due to gaseous effluents. Low levels of Cs-137 in the environment are attributed primarily to fallout from nuclear weapons testing and from the Chernobyl incident. However, the level of Cs-137 seen at FI-0701 could potentially be attributed to plant effluents.

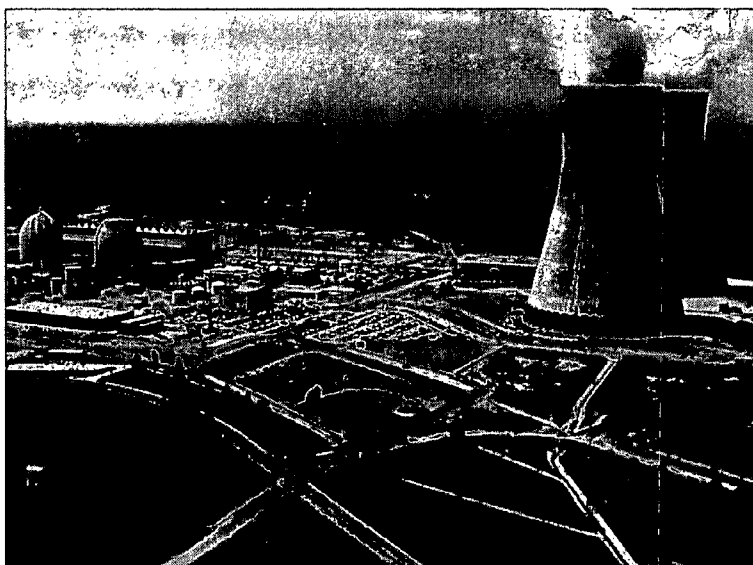
The radiological levels reported in 2008 were low and are generally trending downward. The REMP trends over the course of time from preoperation to the present are generally decreasing or have remained fairly constant. This supports the conclusion that there is no adverse radiological impact on the environment or to the public as a result of the operation of Farley Nuclear Plant.

**Edwin I. Hatch Nuclear Plant  
Joseph M. Farley Nuclear Plant  
Vogtle Electric Generating Plant  
Annual Radiological Environmental Operating Reports for 2008**

**Enclosure 3**

**Vogtle Annual Radiological Environmental Operating Report for 2008**

**VOGTLE ELECTRIC GENERATING PLANT  
ANNUAL RADIOLOGICAL ENVIRONMENTAL  
OPERATING REPORT FOR 2008**



**SOUTHERN**   
**COMPANY**  
*Energy to Serve Your World<sup>SM</sup>*

## **TABLE OF CONTENTS**

<b>Section and/or Title</b>	<b>Subsection</b>	<b>Page</b>
List of Figures		ii
List of Tables		iii
List of Acronyms		iv
1.0 Introduction		1-1
2.0 REMP Description		2-1
3.0 Results Summary		3-1
4.0 Discussion of Results		4-1
	4.1 Land Use Census and River Survey	4-5
	4.2 Airborne	4-7
	4.3 Direct Radiation	4-11
	4.4 Milk	4-17
	4.5 Vegetation	4-19
	4.6 River Water	4-22
	4.7 Drinking Water	4-25
	4.8 Fish	4-35
	4.9 Sediment	4-38
	4.10 Groundwater	4-47
5.0 Interlaboratory Comparison Program		5-1
6.0 Conclusions		6-1

## LIST OF FIGURES

<b>Figure Number</b>	<b>Title</b>	<b>Page</b>
Figure 2-1	REMP Stations in the Plant Vicinity	2-11
Figure 2-2	REMP Control Stations for the Plant	2-12
Figure 2-3	REMP Indicator Drinking Water Stations	2-13
Figure 2-4	Groundwater Monitoring Wells	2-14
Figure 4.2-1	Average Weekly Gross Beta Air Concentration	4-8
Figure 4.3-1	Average Quarterly Exposure from Direct Radiation	4-12
Figure 4.3-2	Average Quarterly Exposure from Direct Radiation at Special Interest Areas	4-14
Figure 4.4-1	Average Annual Cs-137 Concentration in Milk	4-17
Figure 4.5-1	Average Annual Cs-137 Concentration in Vegetation	4-20
Figure 4.6-1	Average Annual H-3 Concentration in River Water	4-23
Figure 4.7-1	Average Monthly Gross Beta Concentration in Raw Drinking Water	4-26
Figure 4.7-2	Average Monthly Gross Beta Concentration in Finished Drinking Water	4-28
Figure 4.7-3	Average Annual H-3 Concentration in Raw Drinking Water	4-31
Figure 4.7-4	Average Annual H-3 Concentration in Finished Drinking Water	4-33
Figure 4.8-1	Average Annual Cs-137 Concentration in Fish	4-36
Figure 4.9-1	Average Annual Be-7 Concentration in Sediment	4-39
Figure 4.9-2	Average Annual Co-58 Concentration in Sediment	4-41
Figure 4.9-3	Average Annual Co-60 Concentration in Sediment	4-43
Figure 4.9-4	Average Annual Cs-137 Concentration in Sediment	4-45
Figure 4.10-1	Ground Water H3 Concentration in Protected Area Water Table Wells	4-49
Figure 4.10-2	Ground Water H3 Concentration in Existing Water Table Wells	4-50
Figure 4.10-3	Ground Water H3 Concentration in New Water Table Wells	4-51

## LIST OF TABLES

<b>Table Number</b>	<b>Title</b>	<b>Page</b>
Table 2-1	Summary Description of Radiological Environmental Monitoring Program	2-2
Table 2-2	Radiological Environmental Sampling Locations	2-7
Table 2-3	Groundwater Monitoring Locations	2-10
Table 3-1	Radiological Environmental Monitoring Program Annual Summary	3-2
Table 4-1	Minimum Detectable Concentrations (MDC)	4-1
Table 4-2	Reporting Levels (RL)	4-2
Table 4-3	Deviations from Radiological Environmental Monitoring Program	4-4
Table 4.1-1	Land Use Census Results	4-5
Table 4.2-1	Average Weekly Gross Beta Air Concentration	4-9
Table 4.3-1	Average Quarterly Exposure from Direct Radiation	4-13
Table 4.3-2	Average Quarterly Exposure from Direct Radiation at Special Interest Areas	4-15
Table 4.4-1	Average Annual Cs-137 Concentration in Milk	4-18
Table 4.5-1	Average Annual Cs-137 Concentration in Vegetation	4-21
Table 4.6-1	Average Annual H-3 Concentration in River Water	4-24
Table 4.7-1	Average Monthly Gross Beta Concentration in Raw Drinking Water	4-27
Table 4.7-2	Average Monthly Gross Beta Concentration in Finished Drinking Water	4-29
Table 4.7-3	Average Annual H-3 Concentration in Raw Drinking Water	4-32
Table 4.7-4	Average Annual H-3 Concentration in Finished Drinking Water	4-34
Table 4.8-1	Average Annual Cs-137 Concentration in Fish	4-37
Table 4.9-1	Average Annual Be-7 Concentration in Sediment	4-40
Table 4.9-2	Average Annual Co-58 Concentration in Sediment	4-42
Table 4.9-3	Average Annual Co-60 Concentration in Sediment	4-44
Table 4.9-4	Average Annual Cs-137 Concentration in Sediment	4-46
Table 4.9-5	Additional Sediment Nuclide Concentrations	4-46
Table 5-1	Interlaboratory Comparison Program Results	5-3

# **LIST OF ACRONYMS**

Acronyms presented in alphabetical order.

<b>Acronym</b>	<b>Definition</b>
ASTM	American Society for Testing and Materials
CL	Confidence Level
EL	Georgia Power Company Environmental Laboratory
EPA	Environmental Protection Agency
GPC	Georgia Power Company
ICP	Interlaboratory Comparison Program
MDC	Minimum Detectable Concentration
MDD	Minimum Detectable Difference
MWe	MegaWatts Electric
NA	Not Applicable
NDM	No Detectable Measurement(s)
NRC	Nuclear Regulatory Commission
ODCM	Offsite Dose Calculation Manual
Po	Preoperation
PWR	Pressurized Water Reactor
REMP	Radiological Environmental Monitoring Program
RL	Reporting Level
RM	River Mile
TLD	Thermoluminescent Dosimeter
TS	Technical Specification
VEGP	Alvin W. Vogtle Electric Generating Plant



## 1.0 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 2008 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) 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. Unit 1, a Westinghouse Electric Corporation Pressurized Water Reactor (PWR), with a licensed core thermal power of 3565 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 3565 MWt, received its operating license on February 9, 1989 and began commercial operation on May 19, 1989.

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. Maps showing the sampling stations are keyed to a table which indicates the direction and distance of each station from a point midway between the two reactors. Section 3 provides a summary of the results of the analyses of REMP samples for the year. The results are discussed, including an assessment of any radiological impacts upon the environment and the results of the land use census and the river survey, in Section 4. The results of the Interlaboratory Comparison Program (ICP) are provided in Section 5. Conclusions are provided in Section 6.

## **2.0 REMP DESCRIPTION**

A summary description of the REMP is provided in Table 2-1. This table summarizes the program as it meets the requirements outlined in ODCM Table 4-1. It details 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 delineates the collection and analysis frequencies. In addition, Table 2-1 references the locations of stations as described in ODCM Section 4.2 and in Table 2-2 of this report. The stations are also depicted on maps in Figures 2-1 through 2-3.

REMP samples are collected by Georgia Power Company's (GPC) Environmental Laboratory (EL) personnel. The same lab performs all the laboratory analyses at their headquarters in Smyrna, Georgia.

TABLE 2-1 (SHEET 1 of 5)

SUMMARY DESCRIPTION OF RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Number of Representative Samples and Sample Locations	Sampling and Collection Frequency	Type and Frequency of Analysis
1. Direct Radiation	<p>Thirty nine routine monitoring stations with two or more dosimeters placed as follows:</p> <p>An inner ring of stations, one in each compass sector in the general area of the site boundary;</p> <p>An outer ring of stations, one in each compass sector at approximately 5 miles from the site; and</p> <p>Special interest areas, such as population centers, nearby recreation areas, and control stations.</p>	Quarterly	Gamma dose, quarterly
2. Airborne Radioiodine and Particulates	<p>Samples from seven locations:</p> <p>Five locations close to the site boundary in different sectors;</p> <p>A community having the highest calculated annual average ground level D/Q;</p> <p>A control location near a population center at a distance of about 14 miles.</p>	Continuous sampler operation with sample collection weekly, or more frequently if required by dust loading.	<p>Radioiodine canister: I-131 analysis, weekly.</p> <p>Particulate sampler: Gross beta analysis<sup>1</sup> following filter change and gamma isotopic analysis<sup>2</sup> of composite (by location), quarterly.</p>

TABLE 2-1 (SHEET 2 of 5)

SUMMARY DESCRIPTION OF RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Number of Representative Samples and Sample Locations	Sampling and Collection Frequency	Type and Frequency of Analysis
3. Waterborne			
a. Surface <sup>3</sup>	<p>One sample upriver.</p> <p>Two samples downriver.</p>	<p>Composite sample over one month period<sup>4</sup>.</p>	<p>Gamma isotopic analysis<sup>2</sup>, monthly.</p> <p>Composite for tritium analysis, quarterly.</p>
b. Drinking	<p>Two samples at each of the three nearest water treatment plants that could be affected by plant discharges.</p> <p>Two samples at a control location.</p>	<p>Composite sample of river water near the intake of each water treatment plant over two week period<sup>4</sup> 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.</p>	<p>I-131 analysis on each sample when the dose calculated for the consumption of the water is greater than 1 mrem per year<sup>5</sup>.</p> <p>Composite for gross beta and gamma isotopic analysis<sup>2</sup> on raw water, monthly.</p> <p>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.</p>
c. Groundwater	<p>See Table 2-3 and Figure 2-4 for well locations.</p>	<p>Quarterly sample; pump used to sample GW wells; grab sample from yard drains and ponds</p>	<p>Tritium, gamma isotopic, and field parameters (pH, temperature, conductivity, dissolved oxygen, oxidation/reduction potential, and turbidity) of each sample quarterly;</p> <p>Hard to detect radionuclides as necessary based on results of tritium and gamma</p>

**TABLE 2-1 (SHEET 3 of 5)**

**SUMMARY DESCRIPTION OF RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM**

Exposure Pathway and/or Sample	Number of Representative Samples and Sample Locations	Sampling and Collection Frequency	Type and Frequency of Analysis
d. Sediment from Shoreline	<p>One sample from downriver area with existing or potential recreational value.</p> <p>One sample from upriver area with existing or potential recreational value.</p>	Semiannually	Gamma isotopic analysis <sup>2</sup> , semiannually.
4. Ingestion			
a. Milk	Two samples from milking animals <sup>6</sup> at control locations at a distance of about 10 miles or more.	Biweekly	Gamma isotopic analysis <sup>2,7</sup> , biweekly.
b. Fish	<p>At least one sample of any commercially or recreationally important species near the plant discharge.</p> <p>At least one sample of any commercially or recreationally important species in an area not influenced by plant discharges.</p> <p>At least one sample of any anadromous species near the plant discharge.</p>	<p>Semiannually</p> <p>During the spring spawning season.</p>	<p>Gamma isotopic analysis<sup>2</sup> on edible portions, semiannually.</p> <p>Gamma isotopic analysis<sup>2</sup> on edible portions, annually.</p>

TABLE 2-1 (SHEET 4 of 5)

SUMMARY DESCRIPTION OF RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

<b>Exposure Pathway and/or Sample</b>	<b>Number of Representative Samples and Sample Locations</b>	<b>Sampling and Collection Frequency</b>	<b>Type and Frequency of Analysis</b>
c. 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 <sup>2, 7</sup> , monthly.

**TABLE 2-1 (SHEET 5 of 5)**

**SUMMARY DESCRIPTION OF RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM**

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 (SHEET 1 of 3)

RADIOLOGICAL ENVIRONMENTAL SAMPLING LOCATIONS

Station Number	Station Type	Descriptive Location	Direction <sup>1</sup>	Distance (miles) <sup>1</sup>	Sample Type
1	Indicator	River Bank	N	1.1	Direct Rad.
2	Indicator	River Bank	NNE	0.8	Direct Rad.
3	Indicator	Discharge Area	NE	0.6	Airborne Rad.
3	Indicator	River Bank	NE	0.7	Direct Rad.
4	Indicator	River Bank	ENE	0.8	Direct Rad.
5	Indicator	River Bank	E	1.0	Direct Rad.
6	Indicator	Plant Wilson	ESE	1.1	Direct Rad.
7	Indicator	Simulator Building	SE	1.7	Airborne Rad. Direct Rad. Vegetation
8	Indicator	River Road	SSE	1.1	Direct Rad.
9	Indicator	River Road	S	1.1	Direct Rad.
10	Indicator	Met Tower	SSW	0.9	Airborne Rad.
10	Indicator	River Road	SSW	1.1	Direct Rad.
11	Indicator	River Road	SW	1.2	Direct Rad.
12	Indicator	River Road	WSW	1.2	Airborne Rad. Direct Rad.
13	Indicator	River Road	W	1.3	Direct Rad.
14	Indicator	River Road	WNW	1.8	Direct Rad.
15	Indicator	Hancock Landing Road	NW	1.5	Direct Rad. Vegetation
16	Indicator	Hancock Landing Road	NNW	1.4	Airborne Rad. Direct Rad.
17	Other	Sav. River Site (SRS), River Road	N	5.4	Direct Rad.
18	Other	SRS, D Area	NNE	5.0	Direct Rad.
19	Other	SRS, Road A.13	NE	4.6	Direct Rad.
20	Other	SRS, Road A.13.1	ENE	4.8	Direct Rad.
21	Other	SRS, Road A.17	E	5.3	Direct Rad.
22	Other	River Bank	ESE	5.2	Direct Rad.
23	Other	River Road	SE	4.6	Direct Rad.
24	Other	Chance Road	SSE	4.9	Direct Rad.
25	Other	Chance Road near Highway 23	S	5.2	Direct Rad.
26	Other	Highway 23 and Ebenezer Church Road	SSW	4.6	Direct Rad.
27	Other	Highway 23 opposite Boll Weevil Road	SW	4.7	Direct Rad.
28	Other	Thomas Road	WSW	5.0	Direct Rad.



TABLE 2-2 (SHEET 2 of 3)

RADIOLOGICAL ENVIRONMENTAL SAMPLING LOCATIONS

Station Number	Station Type	Descriptive Location	Direction <sup>1</sup>	Distance (miles) <sup>1</sup>	Sample Type
29	Other	Claxton-Lively Road	W	5.1	Direct Rad.
30	Other	Nathaniel Howard Road	WNW	5.0	Direct Rad.
31	Other	River Road at Allen's Chapel Fork	NW	5.0	Direct Rad.
32	Other	River Bank	NNW	4.7	Direct Rad.
35	Other	Girard	SSE	6.6	Airborne Rad. Direct Rad.
36	Control	GPC Waynesboro Op. HQ	WSW	13.9	Airborne Rad. Direct Rad.
37	Control	Substation Waynesboro, GA	WSW	16.7	Direct Rad Vegetation
43	Other	Employee's Rec. Center	SW	2.2	Direct Rad.
47	Control	Oak Grove Church	SE	10.4	Direct Rad.
48	Control	McBean Cemetery	NW	10.2	Direct Rad.
51	Control	SGA School Sardis, GA	S	11.0	Direct Rad.
52	Control	Oglethorpe Substation; Alexander, GA	SW	10.7	Direct Rad.
80	Control	Augusta Water Treatment Plant	NNW	29.0	Drinking Water <sup>2</sup>
81	Control	Sav River	N	2.5	Fish <sup>3</sup> Sediment <sup>4</sup>
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 <sup>4</sup>
84	Other	Sav River (RM 149.5)	ESE	1.6	River Water
85	Indicator	Sav River	ESE	4.3	Fish <sup>3</sup>
87	Indicator	Beaufort-Jasper County Water Treatment Plant	SE	76	Drinking Water <sup>5</sup>
88	Indicator	Cherokee Hill Water Treatment Plant, Port Wentworth, Ga	SSE	72	Drinking Water <sup>6</sup>

**TABLE 2-2 (SHEET 3 of 3)**

**RADIOLOGICAL ENVIRONMENTAL SAMPLING LOCATIONS**

89	Indicator	Purrysburg Water Treatment Plant; Purrysburg, SC	SSE	76	Drinking Water <sup>7</sup>
98	Control	W.C. Dixon Dairy	SE	9.8	Milk
100 <sup>8</sup>	Control	Coble Dairy	WSW	23.8	Milk
101	Indicator	Girard Dairy	S	5.5	Milk

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 nearer to the Savannah River at the beginning of the canal.
- (8) Milk sampling was discontinued at Coble Dairy in April 2008 when Girard Dairy was added. Girard Dairy was much closer to the plant (@ 5.5 miles) and would be considered an indicator station since a control station is usually 10 miles or greater.

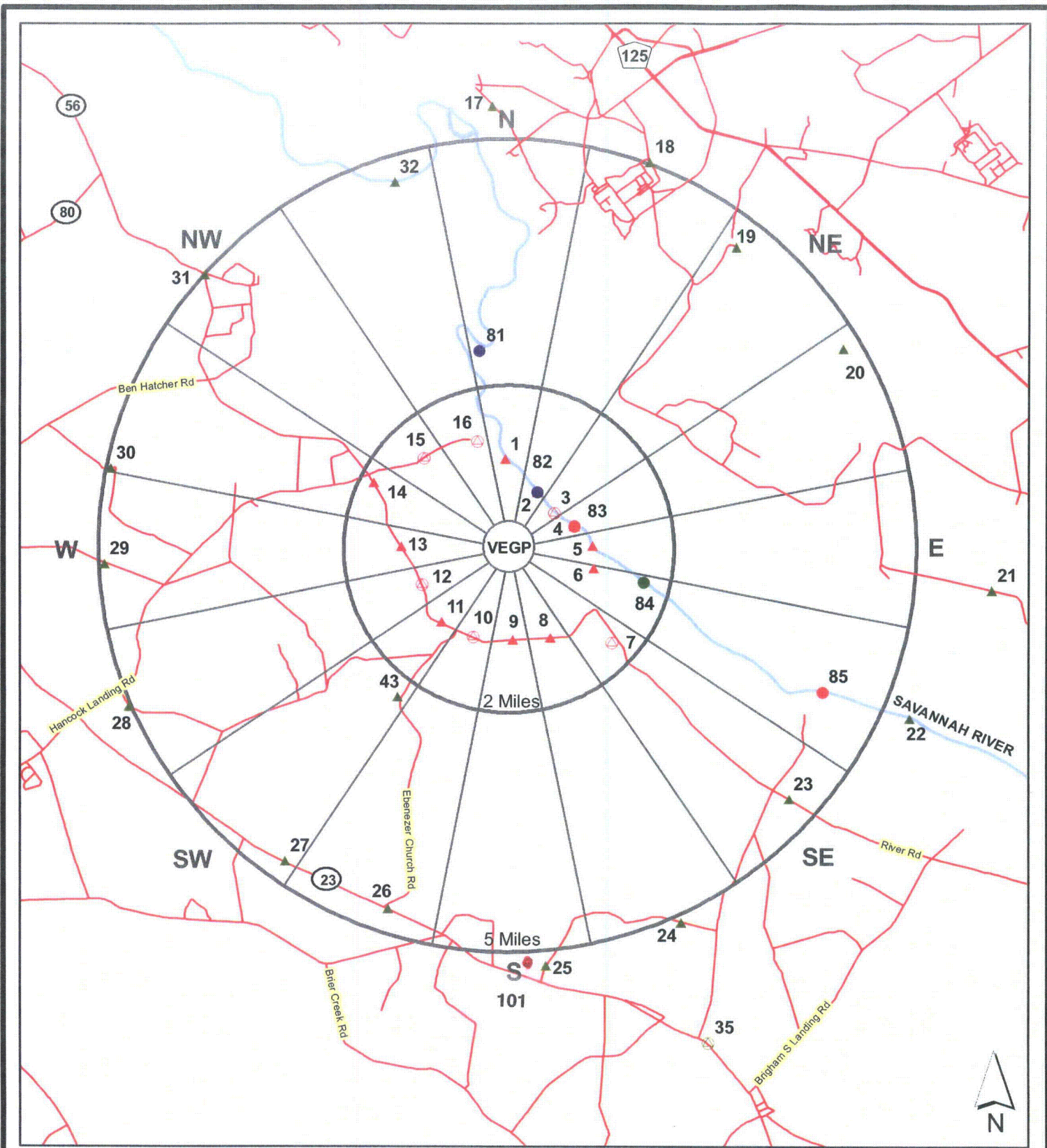
## Groundwater Monitoring Locations

**Table 2-3**

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 bldg 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
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

\* Wells abandoned in Feb. 2009 due to construction activities with proposed new units



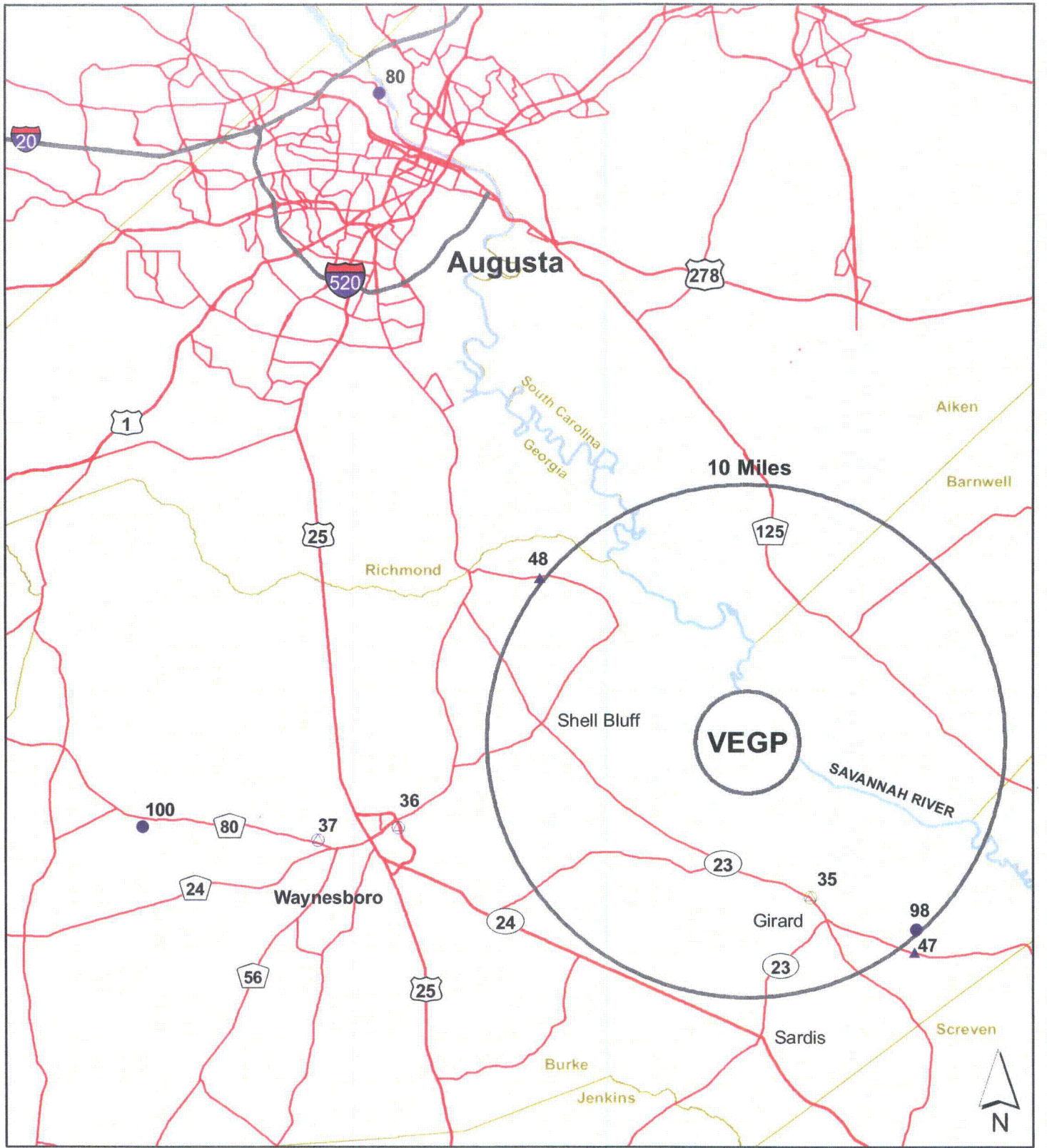
**Radiological Environmental Sampling Locations**

	Indicator	Control	Additional
TLD	▲	▲	▲
Other	●	●	●
TLD & Other	⊕	⊕	⊕

**REMP Stations  
in the Plant Vicinity**

**Figure 2-1**



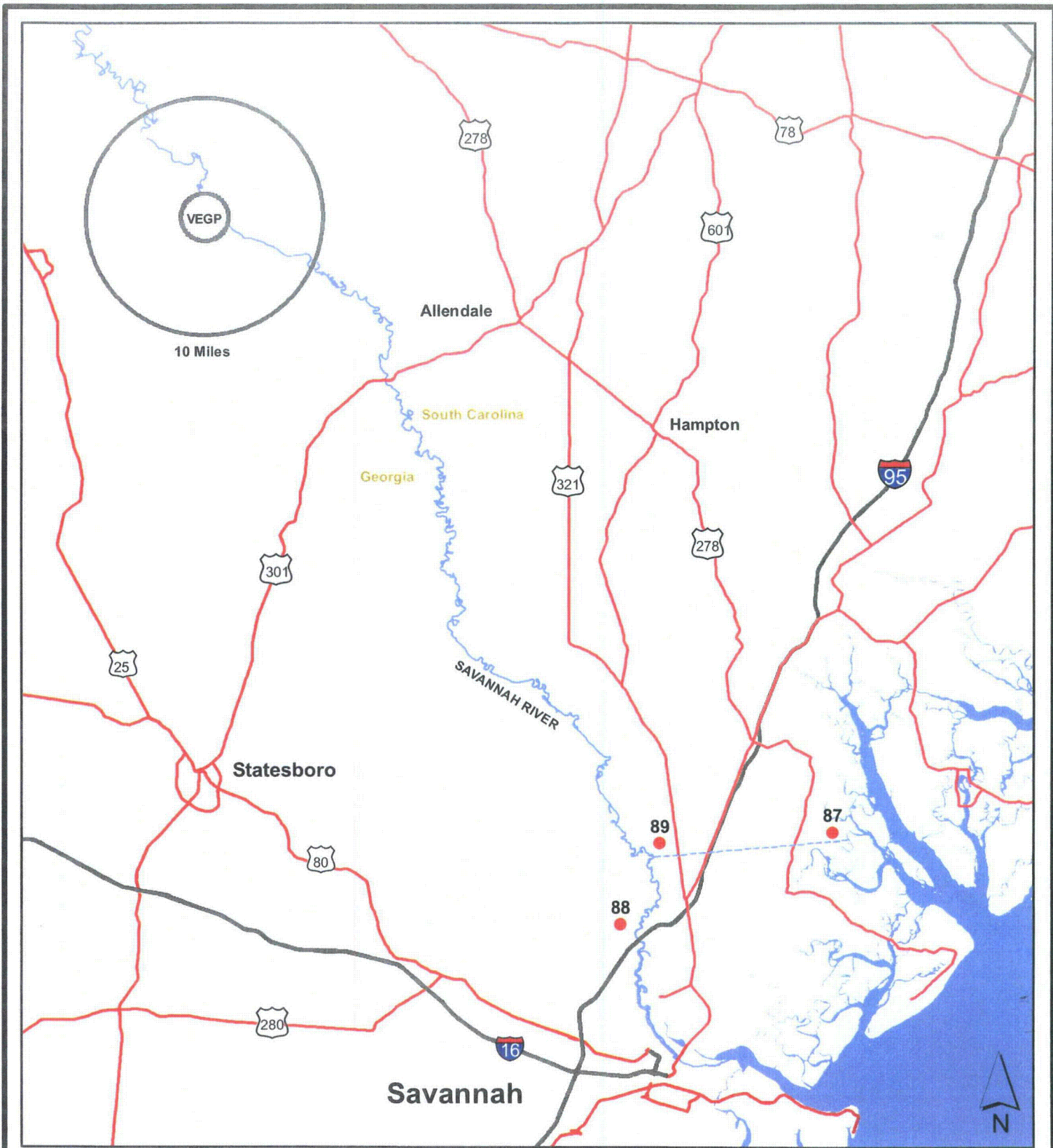


**Radiological Environmental Sampling Locations**

	Indicator	Control	Additional
TLD	▲	▲	▲
Other	●	●	●
TLD & Other	▲	▲	▲

**REMP Control Stations for the Plant**

**Figure 2-2**



**Radiological Environmental Sampling Locations**

	Indicator	Control	Additional
TLD	▲	▲	▲
Other	●	●	●
TLD & Other	⊗	⊗	⊗

**REMP Indicator Drinking Water Stations**

**Figure 2-3**



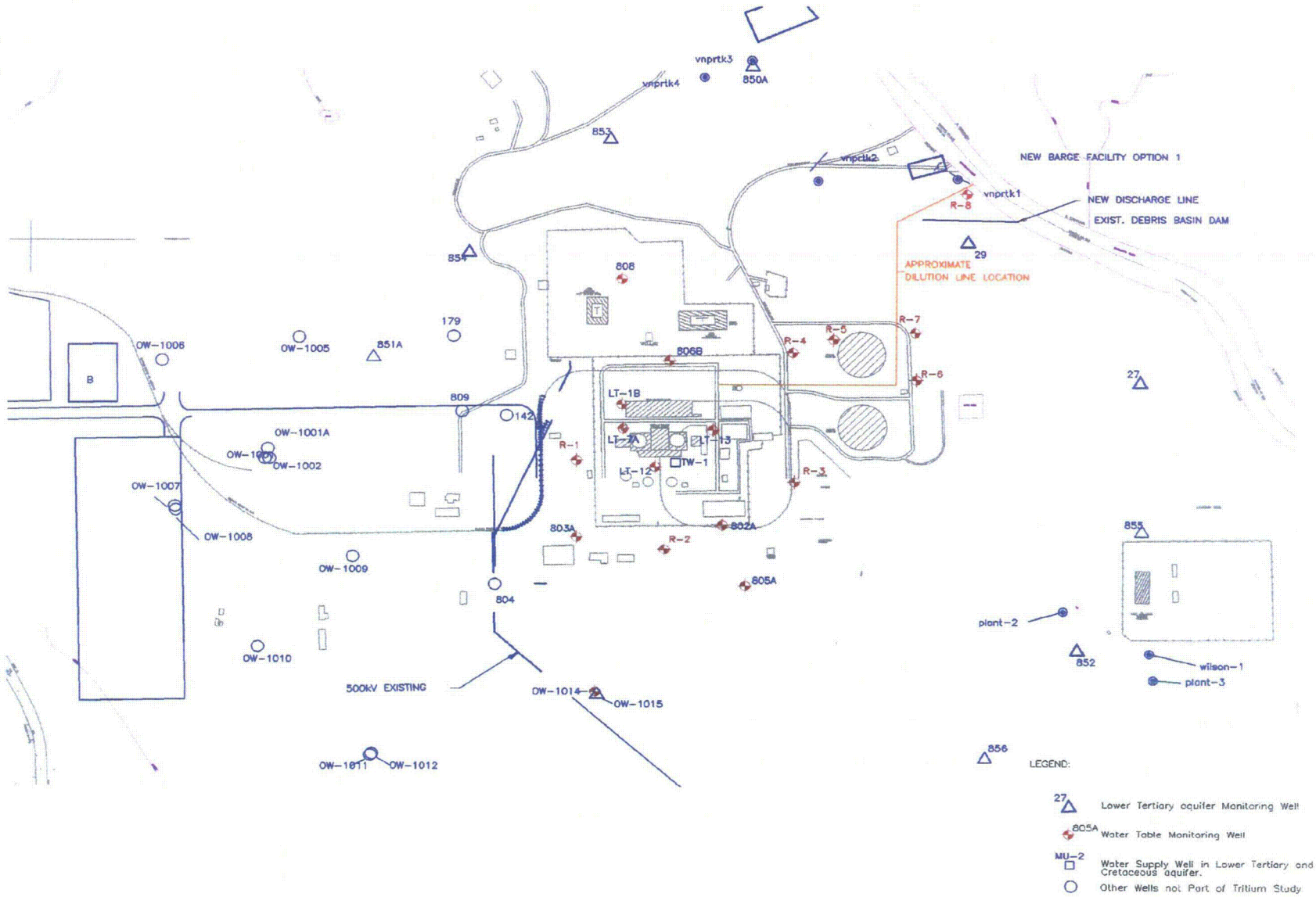


FIGURE 2-4 Groundwater Monitoring Wells

## 3.0 RESULTS SUMMARY

In accordance with ODCM 7.1.2.1, the summarized and tabulated results for all of the regular samples collected for the year at the designated indicator and control stations are presented in Table 3-1. The format of Table 3-1 is similar to Table 3 of the Nuclear Regulatory Commission (NRC) Branch Technical Position, "An Acceptable Radiological Environmental Monitoring Program", Revision 1, November 1979. Results for samples collected at locations other than indicator or control stations are discussed in Section 4 under the particular sample type.

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. The radionuclide Be-7, which occurs abundantly in nature, is often detected in REMP samples. It is occasionally detected in the plant's liquid and gaseous effluents. When it is detected in effluents, it is also included in the REMP results. In 2008, Be-7 was not detected in Vogtle's liquid or gaseous effluents.



TABLE 3-1 (SHEET 1 of 8)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY

Vogtle Electric Generating Plant, Docket Nos. 50-424 and 50-425

Burke County, Georgia

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 (g) Mean (b), Range (Fraction)	Control Locations Mean (b), Range (Fraction)
				Name Distance & Direction	Mean (b), Range (Fraction)		
Airborne Particulates (fCi/m3)	Gross Beta 364	10	24.0 6.5-48.0 (260/260)	Station 3 Discharge Area 0.6 miles NE	25.3 14.5-44.5 (52/52)	23.7 12.0-40.4 (52/52)	23.2 9.3-42.7 (52/52)
	Gamma Isotopic 28 Cs-134 Cs-137	50 60	NDM (c) NDM		NDM NDM	NDM NDM	NDM NDM
Airborne Radioiodine (fCi/m3)	I-131 364	70	NDM		NDM	NDM	NDM
Direct Radiation (mR/91 days)	Gamma Dose 157	NA (d)	13.3 9.9-18.7 (62/62)	Station 20 SRS Road A.13.1 4.8 miles ENE	17.0 15.7-18.9 (3/3)	13.1 9.1-19.0 (71/71)	13.0 10.6-17.2 (24/24)

TABLE 3-1 (SHEET 2 of 8)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY

Vogtle Electric Generating Plant, Docket Nos. 50-424 and 50-425  
 Burke County, Georgia

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 (g) Mean (b), Range (Fraction)	Control Locations Mean (b), Range (Fraction)
				Name Distance & Direction	Mean (b), Range (Fraction)		
Milk (pCi/l)	Gamma Isotopic 54						
	Cs-134	15	NA		NDM	NA	NDM
	Cs-137	18	NA		NDM	NA	NDM
	Ba-140	60	NA		NDM	NA	NDM
	La-140	15	NA		NDM	NA	NDM
	I-131 53	1	NA		NDM	NA	NDM
Vegetation (pCi/kg-wet)	Gamma Isotopic 36						
	I-131	60	NDM		NDM	NA	NDM
	Cs-134	60	NDM		NDM	NA	NDM
	Cs-137	80	24.6 20.6-29.2 (3/24)	Station 37 Waynesboro Substation 16.7 miles WSW	62.2 41.9-82.3 (2/12)	NA	62.2 41.9-82.3 (2/12)

TABLE 3-1 (SHEET 3 of 8)

**RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY**

Vogtle Electric Generating Plant, Docket Nos. 50-424 and 50-425  
Burke County, Georgia

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 (g) Mean (b), Range (Fraction)	Control Locations Mean (b), Range (Fraction)
				Name Distance & Direction	Mean (b), Range (Fraction)		
River Water (pCi/l)	Gamma Isotopic 36						
	Be-7	124(e)	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	NDM	NDM
	Ba-140	60	NDM		NDM	NDM	NDM
	La-140	15	NDM		NDM	NDM	NDM
	Tritium 12	2000	1873 289-3870 (4/4)	Station 83 RM 150.4 0.8 miles ENE	1873 289-3870 (3/4)	1105 630-2030 (4/4)	832 664-1000 (2/4)

TABLE 3-1 (SHEET 4 of 8)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY

Vogtle Electric Generating Plant, Docket Nos. 50-424 and 50-425  
 Burke County, Georgia

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 (g) Mean (b), Range (Fraction)	Control Locations Mean (b), Range (Fraction)
				Name Distance & Direction	Mean (b), Range (Fraction)		
Water Near Intakes to Water Treatment Plants (pCi/l)	Gross Beta 48	4	3.46 1.17-11.4 (36/36)	Station 87 Beaufort-Jasper WTP 76 miles SE	5.32 3.58-11.4 (12/12)	NA	2.37 1.01-3.61 (12/12)
	Gamma Isotopic 48						
	Be-7	124(e)	NDM		NDM	NA	NDM
	Mn-54	15	NDM		NDM	NA	NDM
	Fe-59	30	NDM		NDM	NA	NDM
	Co-58	15	NDM		NDM	NA	NDM
	Co-60	15	NDM		NDM	NA	NDM
	Zn-65	30	NDM		NDM	NA	NDM
	Zr-95	30	NDM		NDM	NA	NDM
	Nb-95	15	NDM		NDM	NA	NDM
	I-131(f)	15	NDM		NDM	NA	NDM
	Cs-134	15	NDM		NDM	NA	NDM
	Cs-137	18	NDM		NDM	NA	NDM
	Ba-140	60	NDM		NDM	NA	NDM
	La-140	15	NDM		NDM	NA	NDM
	Tritium 16	2000	726 303-1370 (12/12)	Station 89 Purrysburg WTP 76 miles SSE	855 387-1370 (4/4)	NA	386 367-404 (2/4)

TABLE 3-1 (SHEET 5 of 8)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY

Vogtle Electric Generating Plant, Docket Nos. 50-424 and 50-425

Burke County, Georgia

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 (g) Mean (b), Range (Fraction)	Control Locations Mean (b), Range (Fraction)
				Name Distance & Direction	Mean (b), Range (Fraction)		
Finished Water at Water Treatment Plants (pCi/l)	Gross Beta 48	4	2.86 1.25-4.37 (35/36)	Station 88 Cherokee Hill WTP Port Wentworth 72 miles SSE	3.07 2.26-4.30 (11/12)	NA	2.07 1.05-3.50 (12/12)
	Gamma Isotopic 48						
	Be-7	124(e)	NDM		NDM	NA	NDM
	Mn-54	15	NDM		NDM	NA	NDM
	Fe-59	30	NDM		NDM	NA	NDM
	Co-58	15	NDM		NDM	NA	NDM
	Co-60	15	NDM		NDM	NA	NDM
	Zn-65	30	NDM		NDM	NA	NDM
	Zr-95	30	NDM		NDM	NA	NDM
	Nb-95	15	NDM		NDM	NA	NDM
	I-131	1	NDM		NDM	NA	NDM
	Cs-134	15	NDM		NDM	NA	NDM
	Cs-137	18	NDM		NDM	NA	NDM
	Ba-140	60	NDM		NDM	NA	NDM
	La-140	15	NDM		NDM	NA	NDM
	Tritium 16	2000	661 332-992 (12/12)	Station 89 Purrysburg WTP Purrysburg, SC 76 miles SSE	669 534-824 (4/4)	NA	391 286-495 (2/4)

TABLE 3-1 (SHEET 6 of 8)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY

Vogtle Electric Generating Plant, Docket Nos. 50-424 and 50-425

Burke County, Georgia

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 (g) Mean (b), Range (Fraction)	Control Locations Mean (b), Range (Fraction)
				Name Distance & Direction	Mean (b), Range (Fraction)		
Anadromous Fish (pCi/kg-wet)	Gamma Isotopic 1						
	Be-7	655(e)	NDM		NDM	NA	NA
	Mn-54	130	NDM		NDM	NA	NA
	Fe-59	260	NDM		NDM	NA	NA
	Co-58	130	NDM		NDM	NA	NA
	Co-60	130	NDM		NDM	NA	NA
	Zn-65	260	NDM		NDM	NA	NA
	Cs-134	130	NDM		NDM	NA	NA
	Cs-137	150	NDM		NDM	NA	NA
Fish (pCi/kg-wet)	Gamma Isotopic 6						
	Be-7	655(e)	NDM		NDM	NA	NDM
	Mn-54	130	NDM		NDM	NA	NDM
	Fe-59	260	NDM		NDM	NA	NDM
	Co-58	130	NDM		NDM	NA	NDM
	Co-60	130	NDM		NDM	NA	NDM
	Zn-65	260	NDM		NDM	NA	NDM
	Cs-134	130	NDM		NDM	NA	NDM
	Cs-137	150	39.4 16.4-64.2 (3/3)	39.4 16.4-64.2 (3/3)	Station 81 2.5 miles N (upstream)	47.0 19.9-90.2 (3/3)	NA

TABLE 3-1 (SHEET 7 of 8)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY

Vogtle Electric Generating Plant, Docket Nos. 50-424 and 50-425

Burke County, Georgia

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 (g) Mean (b), Range (Fraction)	Control Locations Mean (b), Range (Fraction)
				Name Distance & Direction	Mean (b), Range (Fraction)		
Sediment (pCi/kg-dry)	Gamma Isotopic 4						
	Be-7	655(e)	394 (1/2)	Station 81 2.5 miles N (upstream)	1274 (1/2)	NA	805 (1/2)
	Co-60	70(e)	61.9 (1/2)	Station 83 0.8 miles ENE (downstream)	61.9 (1/2)	NA	NDM
	Cs-134	150	NDM		NDM	NA	NDM
	Cs-137	180	66.2 48.5-83.9 (2/2)	Station 83 0.8 miles ENE (downstream)	66.2 48.5-83.9 (2/2)	NA	60.9 33.4-88.4 (2/2)

**TABLE 3-1 (SHEET 8 of 8)**

**RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY**

**Vogtle Electric Generating Plant, Docket Nos. 50-424 and 50-425**

**Burke County, Georgia**

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. Any a posteriori MDC greater than the value listed in this column is discussed in Section 4.
- 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).
- d. Not Applicable.
- e. The EL has determined that this value may be routinely attained under normal conditions. No value is provided in ODCM Table 4-3.
- f. 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 than 1 mrem per year. However, I-131 analyses have been performed on the finished drinking water samples.
- g. "Other" stations, as identified in the "Station Type" column of Table 2-2, are "Community" and/or "Special" stations.

-



## 4.0 DISCUSSION OF RESULTS

Included in this section are evaluations of the laboratory results for the various sample types. Comparisons were made between the difference in mean values for pairs of station groups (e.g., indicator and control stations) and the calculated Minimum Detectable Difference (MDD) between these pairs at the 99% Confidence Level (CL). The MDD was determined using the standard Student's t-test. A difference in the mean values that was less than the MDD was considered to be statistically indiscernible.

The 2008 results were compared with past results, including those obtained during preoperation. As appropriate, results were compared with their Minimum Detectable Concentrations (MDC) and Reporting Levels (RL) which are listed in Tables 4-1 and 4-2 of this report, respectively. The required MDCs were achieved during laboratory sample analysis. Any anomalous results are explained within this report.

Results of interest are graphed to show historical trends. The data points are tabulated and included in this report. The points plotted and provided in the tables represent mean values of only detectable results. Periods for which no detectable measurements (NDM) were observed or periods for which values were not applicable (e.g., milk indicator, etc.) are listed as NDM and are plotted in the tables as 0's.

**Table 4-1**  
**Minimum Detectable Concentrations (MDC)**

Analysis	Water (pCi/l)	Airborne Particulate or Gases (fCi/m <sup>3</sup> )	Fish (pCi/kg- wet)	Milk (pCi/l)	Grass or Leafy Vegetation (pCi/kg- wet)	Sediment (pCi/kg)
Gross Beta	4	10				
H-3	2000 (a)					
Mn-54	15		130			
Fe-59	30		260			
Co-58	15		130			
Co-60	15		130			
Zn-65	30		260			
Zr-95	30					
Nb-95	15					
I-131	1 (b)	70		1	60	
Cs-134	15	50	130	15	60	150
Cs-137	18	60	150	18	80	180
Ba-140	60			60		
La-140	15			15		

(a) If no drinking water pathway exists, a value of 3000 pCi/l may be used.

(b) If no drinking water pathway exists, a value of 15 pCi/l may be used.

**Table 4-2  
Reporting Levels (RL)**

<b>Analysis</b>	<b>Water (pCi/l)</b>	<b>Airborne Particulate or Gases (fCi/m<sup>3</sup>)</b>	<b>Fish (pCi/kg-wet)</b>	<b>Milk (pCi/l)</b>	<b>Grass or Leafy Vegetation (pCi/kg-wet)</b>
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.

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 preoperation, and the earlier years of operation. Some long lived radionuclides, such as Cs-137, continue to have some impact. A significant component of the Cs-137 which has often been found in various samples over the years (and continues to be found) is attributed to the nuclear weapons tests.

Data in this section has been modified to remove any obvious non-plant short term impacts. The specific short term impact data that has been removed includes: the nuclear atmospheric weapon test in the fall of 1980; abnormal releases from the Savannah River Site (SRS) during 1987 and 1991; and the Chernobyl incident in the spring of 1986.

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 as described in Table 2-1 are summarized in Table 4-3 along with their causes and resolutions.

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. No data were excluded exclusively for failing Chauvenet's criterion. Data exclusions are discussed in this section under the appropriate sample type.

**TABLE 4-3**

**DEVIATIONS FROM RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM**

<b>COLLECTION PERIOD</b>	<b>AFFECTED SAMPLES</b>	<b>DEVIATION</b>	<b>CAUSE</b>	<b>RESOLUTION</b>
01/30/08-02/12/08 CR2009101392	Coble Dairy	No milk sample available	Dairy operator not able to provide sample	Sample available at next collection period
1st Quarter CR2008113434	River Bank TLD 23B SE @ 4.6 miles	TLD rendered suspect by presence of water in bag	Moisture / rain water entered holding bag	Replaced TLDs at beginning of quarter
April 2008 CR2008113435	Girard Dairy replaced Coble Dairy	None	NA	New dairy at Girard much closer to VEGP than Coble Dairy
2 <sup>nd</sup> Quarter CR2009100123	River Road TLDs 10 and 12 @ 1.1 mile SSW and 1.2 miles WSW, respectively	TLDs missing at collection time	TLDs destroyed during transmission line relocation	TLDs replaced at beginning of quarter
09/03/08 CR2009103649	Station 83 River Water RM 150.4	Non-representative river water sample	Weak battery on autosampler; had to pull a grab sample to complete monthly gamma composite sample	Replaced battery on autosampler
10/22/08-11/04/08 CR2008113436	Girard Dairy	Milk sample had high fat content and would not pass through resin column used for low level iodine analysis; could not meet 1 pCi/L MDC	Alternate sampling method had to be utilized; normal milk sample not available	Gamma analysis resulted in 2.7 pCi/L MDC

## 4.1 Land Use Census and River Survey

In accordance with ODCM 4.1.2, a land use census was conducted on November 11, 2008 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 5 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.

**Table 4.1-1**

### LAND USE CENSUS RESULTS

Distance in Miles to the Nearest Location in Each Sector

SECTOR	RESIDENCE	MILK ANIMAL	BEEF CATTLE	GARDEN
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	4.4	None	5.0	4.5
SSE	4.6	None	4.7	None
S	4.4	None	None	None
SSW	4.7	None	4.5	None
SW	2.7	None	4.9	None
WSW	2.6	None	2.7	None
W	3.4	None	4.5	None
WNW	1.9	None	None	None
NW	1.6	None	1.6	None
NNW	1.5	None	None	None

ODCM 4.1.2.2.1 requires a new controlling receptor to be identified, if the land use census identifies a location that yields a calculated receptor dose greater than the one in current use. In 2008, the controlling receptor was moved to a more conservative location at 1.2 miles WSW. This property was acquired by Georgia Power in 2008. The residents were relocated but this property will potentially be used for contract labor in the near future.

ODCM 4.1.2.2.2 requires that whenever the land use census identifies a location which yields a calculated dose (via the same ingestion pathway) 20% greater than

that of a current indicator station, the new location must become a REMP station (if samples are available). None of the identified locations yielded a calculated dose 20% greater than that for any of the current indicator stations. No milk animals were identified within five miles of the plant. A new dairy was started at Girard in 2008 and was added to the REMP. Since control stations are approximately 10 miles or greater, this dairy is considered an indicator station.

A survey of the Savannah River downstream of the plant for approximately 100 miles was conducted on September 30, 2008 to identify any withdrawal of water from the river for drinking or irrigation purposes. No such usage was identified. These results were corroborated by checking with the Georgia Department of Natural Resources on October 2, 2008 and the South Carolina Department of Health and Environmental Control on October 2, 2008. Each of these agencies confirmed that no water withdrawal permits for drinking or irrigation purposes had been issued for this stretch of the Savannah River. The three water treatment plants used as indicator stations for drinking water are located farther downriver.

## 4.2 Airborne

As specified in Table 2-1 and shown in Figures 2-1 through 2-3, airborne particulate filters and charcoal canisters are collected weekly at 5 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 7 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.

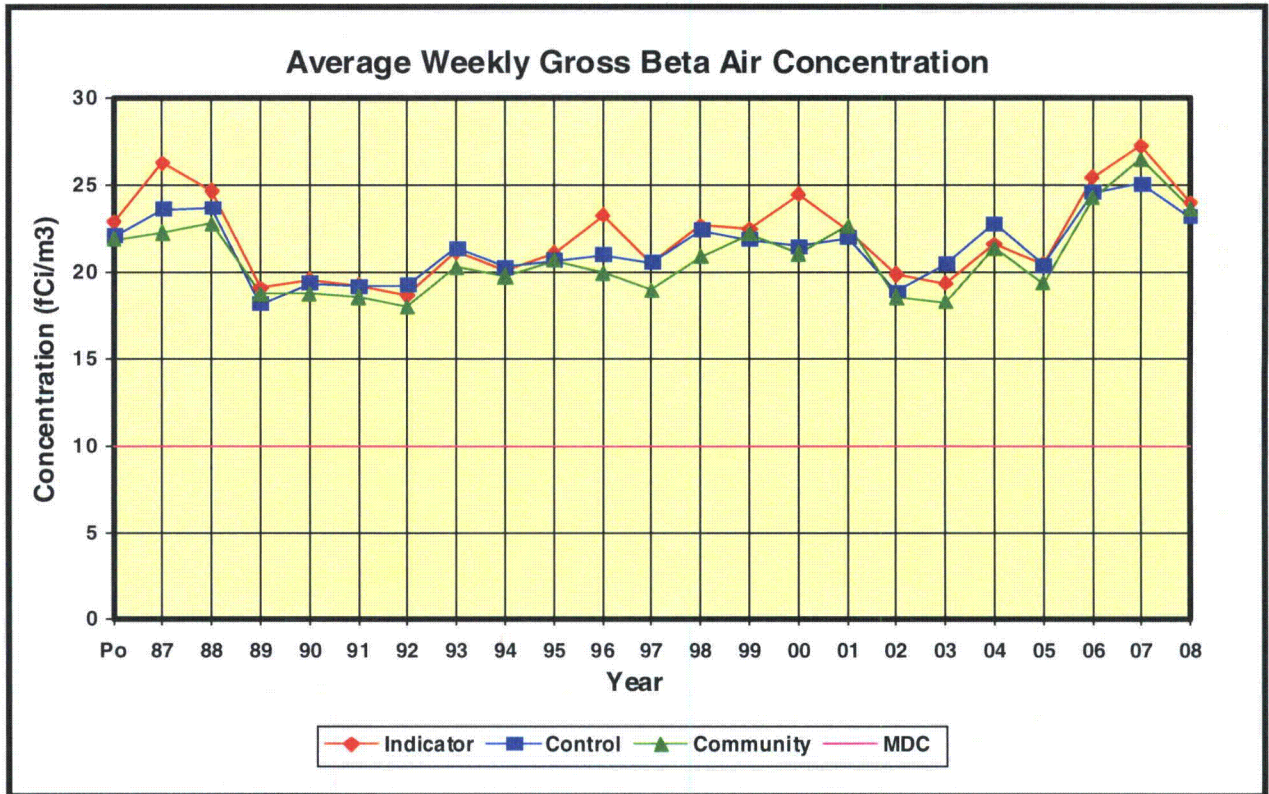
Each particulate filter is counted for gross beta activity. A quarterly gamma isotopic analysis is performed on a composite of the air particulate filters for each station. Each charcoal canister is analyzed for I-131.

As provided in Table 3-1, the 2008 annual average weekly gross beta activity was  $24.0 \text{ fCi/m}^3$  for the indicator stations. It was  $0.8 \text{ fCi/m}^3$  greater than the control station average of  $23.2 \text{ fCi/m}^3$  for the year. This difference is not statistically discernible, since it is less than the calculated MDD of  $2.24 \text{ fCi/m}^3$ .

The 2008 annual average weekly gross beta activity at the Girard community station was  $23.7 \text{ fCi/m}^3$  which was  $0.5 \text{ fCi/m}^3$  less than the control station average. This difference is not statistically discernible since it is less than the calculated MDD of  $2.83 \text{ fCi/m}^3$ .

The historical trending of the average weekly gross beta air concentrations for each year of operation and the preoperational period (September, 1981 to January, 1987) at the indicator, control and community stations is plotted in Figure 4.2-1 and listed in Table 4.2-1. 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.

Figure 4.2-1





**Table 4.2-1**  
**Average Weekly Gross Beta Air Concentration**

<b>Period</b>	<b>Indicator (fCi/m3)</b>	<b>Control (fCi/m3)</b>	<b>Community (fCi/m3)</b>
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
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

During 2008, no man-made radionuclides were detected from the gamma isotopic analysis of the quarterly composites of the air particulate filters. In 1987, Cs-137 was found in one indicator composite at a concentration of 1.7 fCi/m<sup>3</sup>. During pre-operation, Cs-137 was found in approximately 12% of the indicator composites and 14% of the control composites with average concentrations of 1.7 and 1.0 fCi/m<sup>3</sup>, respectively. The MDC for airborne Cs-137 is 60 fCi/m<sup>3</sup>. Also, during pre-operation, Cs-134 was found in about 8% of the indicator composites at an average concentration of 1.2 fCi/m<sup>3</sup>. The MDC for Cs-134 is 50 fCi/m<sup>3</sup>.

The naturally occurring radionuclide Be-7 is typically detected in all indicator and control station gamma isotopic analyses of the quarterly composites of the air particulate filters. In 2008, Be-7 was not identified in plant gaseous effluents therefore it is not included in the 2008 REMP summary table for the airborne pathway samples. Be-7 has been detected in gaseous effluents in only eight of the years of plant operation. However, there was not a statistically discernible difference between the indicator and control station Be-7 concentrations in air samples in any of the years.

Airborne I-131 was not detected in any sample during 2008. During pre-operation, positive results were obtained only during the Chernobyl incident when concentrations as high as 182 fCi/m<sup>3</sup> were observed. The MDC and RL for airborne I-131 are 70 and 900 fCi/m<sup>3</sup>, respectively.

Table 4-3 lists REMP deviations that occurred in 2008. There were no air monitoring deviations in 2008.

## 4.3 Direct Radiation

Direct (external) radiation is measured with thermoluminescent dosimeters (TLDs). Two Panasonic UD-814 TLD badges are placed at each station. Each badge contains three phosphors composed of calcium sulfate crystals (with thulium impurity). The gamma dose at each station is based upon the average readings of the phosphors from the two badges. The badges for each station are placed in thin plastic bags for protection from moisture while in the field. The badges are nominally exposed for periods of a quarter of a year (91 days). An inspection is performed near mid-quarter to assure that all badges are on-station and to replace any missing or damaged badges.

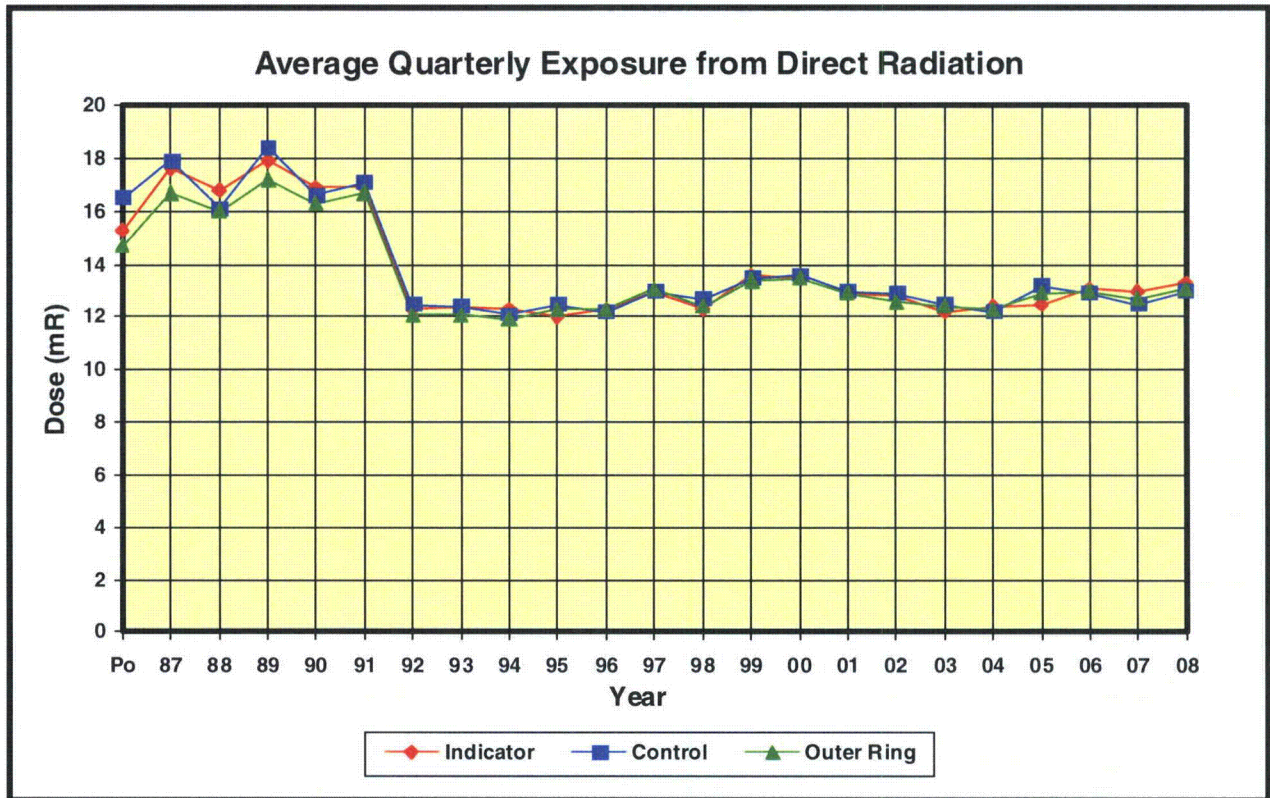
Two TLD stations are established in each of the 16 compass sectors, to form 2 concentric rings. The inner ring (Stations 1 through 16) is located near the plant perimeter as shown in Figure 2-1 and the outer ring (Stations 17 through 32) is located at a distance of approximately 5 miles from the plant as shown in Figure 2-2. 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 6 control stations (Stations 36, 37, 47, 48, 51 and 52) are located at distances greater than 10 miles from the plant as shown in Figure 2-2. Monitored special interest areas consist of the following: Station 35 at the town of Girard, and Station 43 at the employee recreational area. The TLD mean and range values presented in the "Other" column in Table 3-1 (page 1 of 8) includes the outer ring stations (stations 17 through 32) as well as stations 35 and 43.

As provided in Table 3-1 the average quarterly exposure measured at the indicator stations was 13.3 mR with a range of 9.9 to 18.7 mR. This average was 0.3 mR greater than the average quarterly exposure measured at the control stations (13.0 mR). This difference is not statistically discernible since it is less than the MDD of 1.15 mR. Over the operational history of the site, the annual average quarterly exposures shows a variation of no more than 0.7 mR difference between the indicator and control stations. The overall average quarterly exposure for the control stations during preoperation was 1.2 mR greater than that for the indicator stations.

The quarterly exposures acquired at the outer ring stations during 2008 ranged from 9.1 to 19.0 mR with an average of 13.1 mR which was 0.1 mR greater than that for the control stations. However, this difference is not discernible since it is less than the MDD of 1.3 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. The overall average quarterly exposure for the outer ring stations during preoperation was 1.8 mR less than that for the control stations.

The historical trending of the average quarterly exposures for the indicator inner ring, outer ring, and the control stations are plotted in Figure 4.3-1 and listed in Table 4.3-1. 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. The close agreement between the station groups supports the position that the plant is not contributing significantly to direct radiation in the environment.

Figure 4.3-1

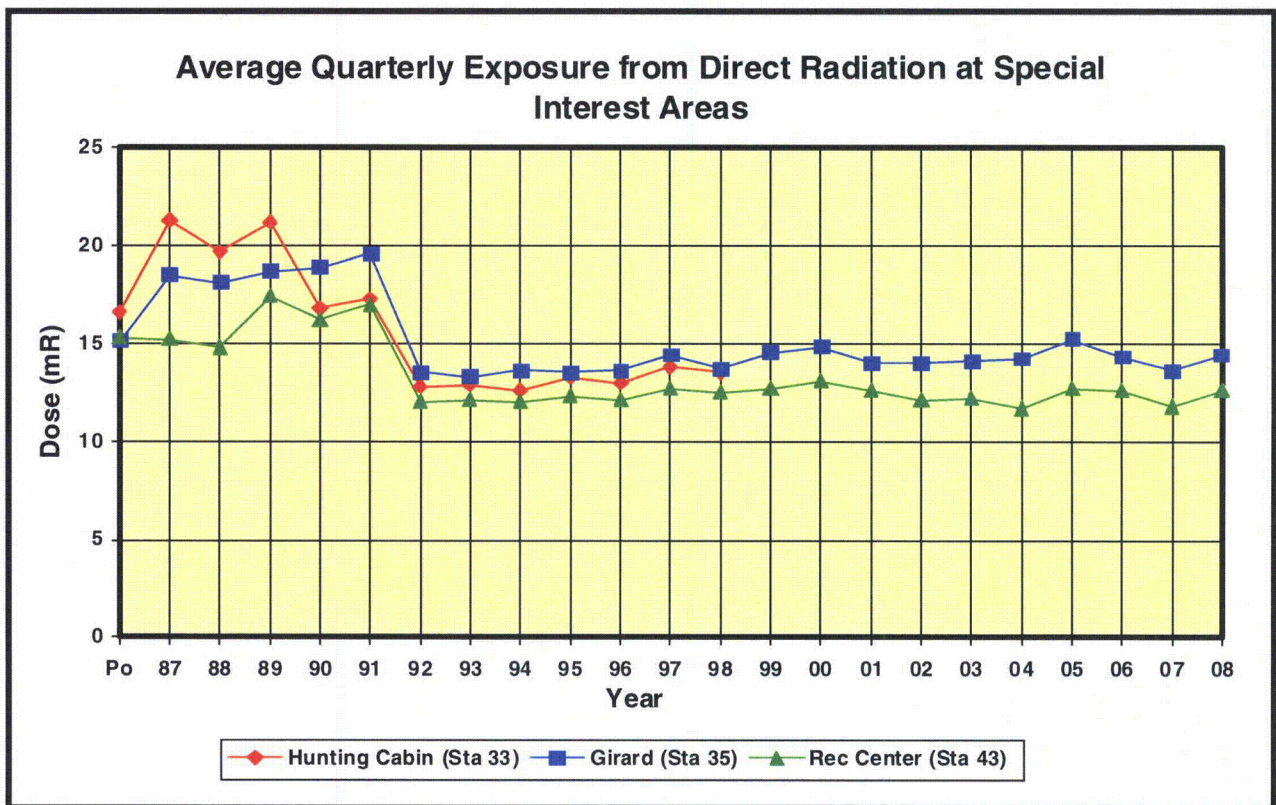


**Table 4.3-1****Average Quarterly Exposure from Direct Radiation**

<b>Period</b>	<b>Indicator (mR)</b>	<b>Control (mR)</b>	<b>Outer Ring (mR)</b>
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

The historical trending of the average quarterly exposures at the special interest areas for the same periods are provided in Figure 4.3-2 and listed in Table 4.3-2. These exposures are within the range of those acquired at the other stations. They too, show that the plant is not contributing significantly to direct radiation at the special interest areas.

Figure 4.3-2



**Table 4.3-2****Average Quarterly Exposure from Direct Radiation  
at Special Interest Areas**

Period	Station 33 (mR)	Station 35 (mR)	Station 43 (mR)
Pre-op	16.6	15.1	15.3
1987	21.3	18.5	15.2
1988	19.7	18.1	14.8
1989	21.2	18.7	17.4
1990	16.8	18.9	16.2
1991	17.3	19.6	17.0
1992	12.8	13.5	12.0
1993	12.9	13.3	12.1
1994	12.6	13.6	12.0
1995	13.3	13.5	12.3
1996	13.0	13.6	12.1
1997	13.8	14.4	12.7
1998	13.5	13.7	12.5
1999	NA	14.5	12.7
2000	NA	14.8	13.1
2001	NA	14.0	12.6
2002	NA	14.0	12.1
2003	NA	14.1	12.2
2004	NA	14.2	11.7
2005	NA	15.2	12.7
2006	NA	14.3	12.6
2007	NA	13.6	11.8
2008	NA	14.4	12.6

The hunting cabin activities at Station 33 have been discontinued and, consequently, this location is no longer considered as an area of special interest. Monitoring at this location was discontinued at the end of 1998.

There were three deviations from the REMP pertaining to measuring quarterly gamma doses during 2008. In first quarter, moisture was found in the TLD holding bag at River Road location 23B. The result from this deviation passed Chauvenet's Criterion and was included in the data set. In the second quarter, River Road locations 10 and 12 were destroyed during transmission line relocation. These TLDs were missing at the end of the quarter therefore no data was available from these two stations for the second quarter.

The standard deviation for the quarterly result for each badge was subjected to a self imposed limit of 1.4. This limit is based upon the standard deviations obtained with the Panasonic UD-814 badges during 1992 and is calculated using a method developed by the American Society of Testing and Materials (ASTM Special Technical Publication 15D, ASTM Manual on Presentation of Data and Control Chart Analysis, Fourth Revision, Philadelphia, PA, October 1976). The limit serves as a flag to initiate an investigation. To be conservative, readings with a standard deviation greater than 1.4 are excluded since the high standard deviation is interpreted as an indication of unacceptable variation in TLD response.

The readings for the following badges were deemed unacceptable since the standard deviation for each badge was greater than the self-imposed limit of 1.4:

First Quarter:	V10B, V24B, V52B
Second Quarter:	None
Third Quarter:	V20A, V20B, V32A
Fourth Quarter:	None

However, for the cases when only one badge exceeded a standard deviation of 1.4, the companion badges were available and were used for determining the quarterly doses. The badges exceeding the self-imposed limit were visually inspected under a microscope and the glow curve and test results for the anneal data and the element correction factors were reviewed. No reason was evident for the high standard deviation.

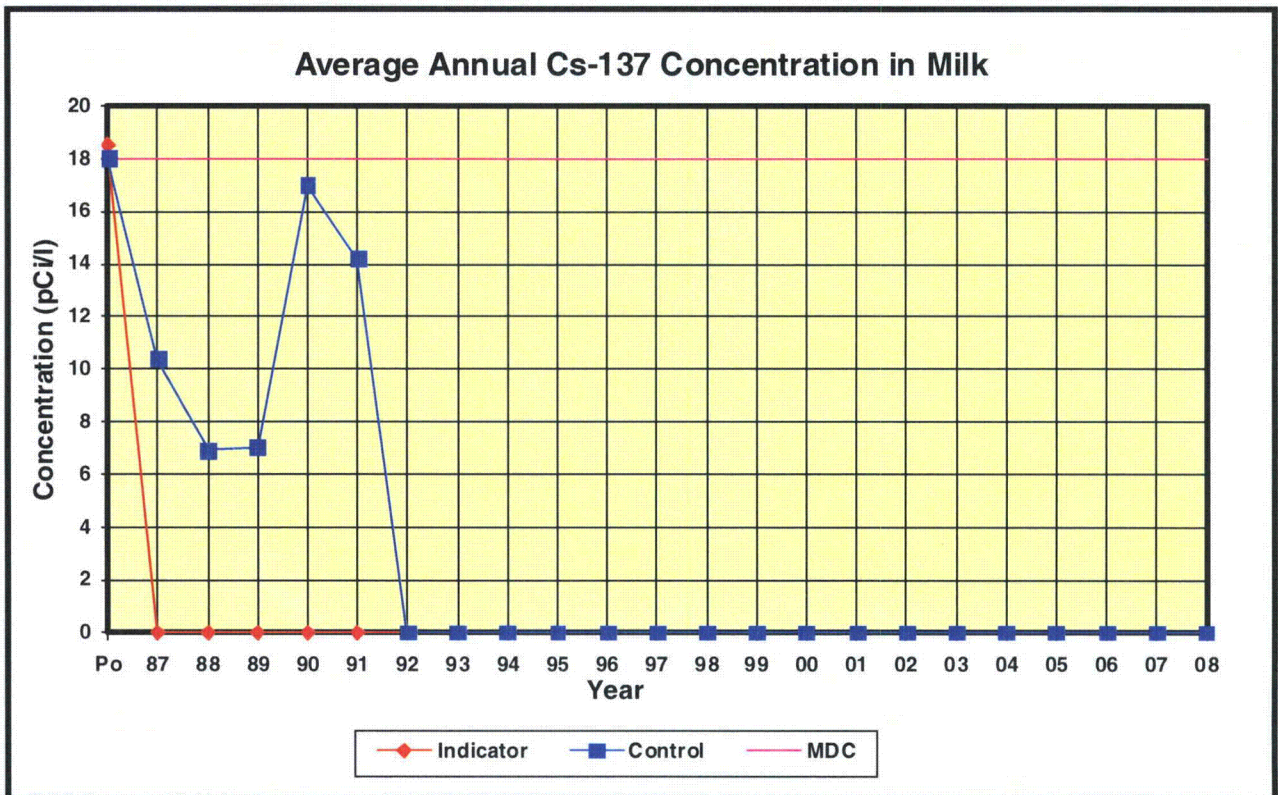


## 4.4 Milk

In accordance with Tables 2-1 and 2-2, milk samples are collected biweekly from two locations, the W. C. Dixon Dairy (Station 98) and the Coble Dairy (Station 100). Both are control locations. A new dairy was added to the REMP in April 2008. Since it was much closer to the plant, Coble Dairy was dropped as a sampling location. Since control stations are approximately 10 miles or more, the Girard Station was considered an indicator station. As discussed in Section 4.1, no milk animal was found during the 2008 land use census. There was one collection period in 2008 where milk samples were not available from Coble Dairy (01/30/08-02/12/08). In November 2008, one of the Girard samples had an extremely high fat content and would not pass through the resin used in the low level iodine analysis. The required MDC of 1 pCi/L for I-131 could not be met. However, an MDC of 2.7 pCi/L was met by gamma spectroscopy of the liquid sample which is less than the Reporting Level of 3 pCi/L for I-131.

Gamma isotopic and I-131 analyses are performed on each milk sample. No man-made radionuclides were identified by gamma isotopic analysis in 2008. The MDC and RL for Cs-137 in milk are 18 and 70 pCi/l, respectively. During preoperation and each year of operation through 1991, Cs-137 was found in 2 to 6% of the samples at concentrations ranging from 5 to 27 pCi/l. During preoperation, Cs-134 was detected in one sample and in the first year of operation, Zn-65 was detected in one sample. Figure 4.4-1 and Table 4.4-1 provide the historical trending of the Cs-137 concentration in milk.

Figure 4.4-1



**Table 4.4-1**  
**Average Annual Cs-137 Concentration in Milk**

Year	Indicator (pCi/l)	Control (pCi/l)
Pre-op	18.5	18
1987	NDM	10.4
1988	NDM	6.9
1989	NDM	7
1990	NDM	17
1991	NDM	14.2
1992	NDM	NDM
1993	NDM	NDM
1994	NDM	NDM
1995	NDM	NDM
1996	NDM	NDM
1997	NDM	NDM
1998	NDM	NDM
1999	NDM	NDM
2000	NDM	NDM
2001	NDM	NDM
2002	NDM	NDM
2003	NDM	NDM
2004	NDM	NDM
2005	NDM	NDM
2006	NDM	NDM
2007	NDM	NDM
2008	NDM	NDM

During 2008, I-131 was not detected in any of the milk samples. Since plant operations began in 1987, I-131 may have been detected in one sample in 1996 and two during 1990; however, its presence in these cases was questionable, due to large counting uncertainties. During preoperation, positive I-131 results were found only during the Chernobyl incident with concentrations ranging from 0.53 to 5.07 pCi/l. The MDC and RL for I-131 in milk are 1 and 3 pCi/l, respectively.

## 4.5 Vegetation

In accordance with Tables 2-1 and 2-2, grass samples are collected monthly at two indicator locations onsite near the site boundary (Stations 7 and 15) and at one control station located about 17 miles WSW from the plant (Station 37). Gamma isotopic analyses are performed on the samples. During 2008, three samples out of the 24 samples collected at the indicator stations were positive for the man-made radionuclide, Cs-137. The average of the three positive indicator samples was 24.6 pCi/kg-wet. The two positive values for Cs-137 at the control station were 41.9 pCi/kg-wet and 82.3 pCi/kg-wet and were higher than any of the three values seen at the indicator stations. However, Cs-137 is often detected in environmental samples as a result of atmospheric weapons testing and the Chernobyl incident.

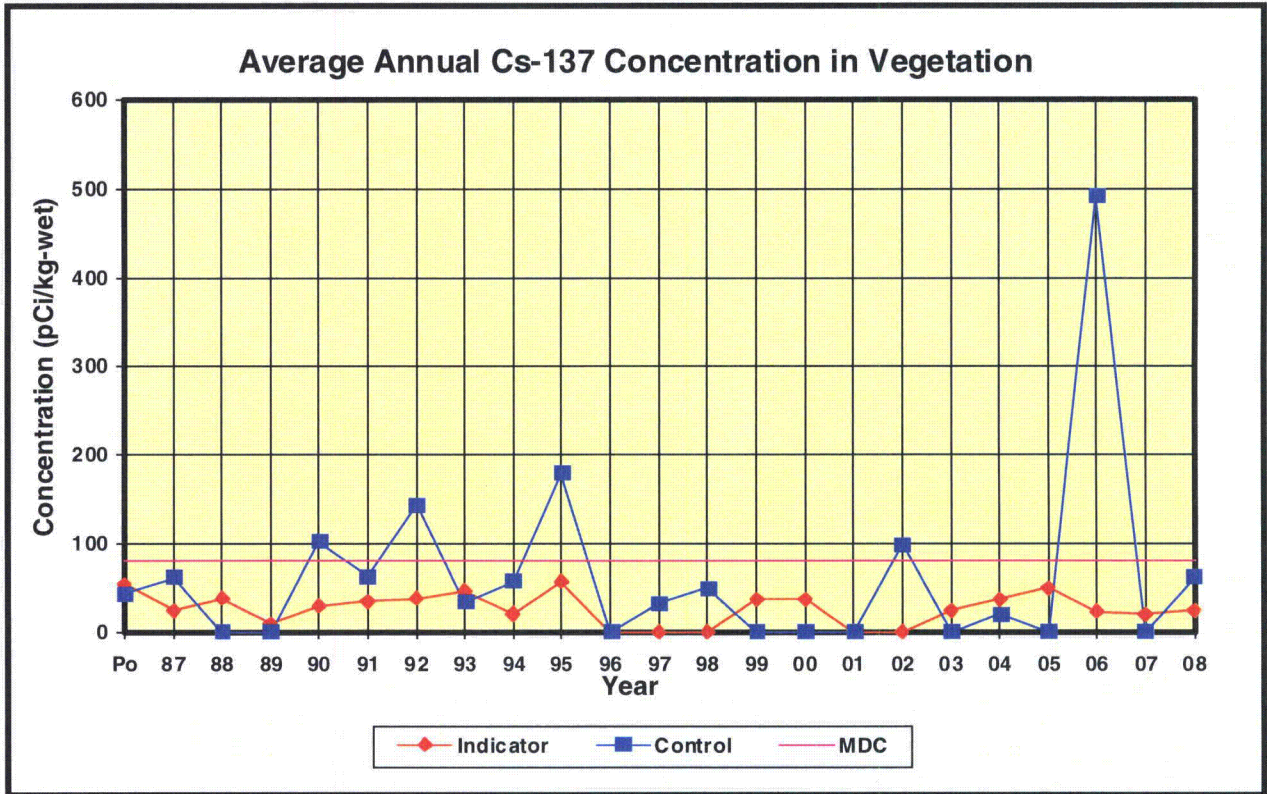
In 2006, one sample at the control station was positive for Cs-137 at a higher concentration, 491.8 pCi/kg-wet, than typically seen over the years in Vogtle vegetation samples. A duplicate sample (which is taken periodically) happened to be taken at the same collection time and also revealed a similar activity. The higher concentration more than likely resulted from plowing and seeding activities (to maintain the vegetation plot) which took place a couple of weeks prior to the sample collection.

The historical trending of the average concentration of Cs-137 at the indicator and control stations is provided in Figure 4.5-1 and listed in Table 4.5-1. No trend is recognized in this data. The MDC and RL for Cs-137 in vegetation samples are 80 and 2000 pCi/kg-wet, respectively. Cs-137 is the only man-made radionuclide that has been identified in vegetation samples during the operational history of the plant. During preoperation, Cs-137 was found in approximately 60% of the samples from indicator stations and in approximately 20% of the samples from the control station. These percentages have generally decreased during operation.

The naturally occurring radionuclide Be-7 is typically detected in indicator and control station vegetation samples. Be-7 was not detected in gaseous effluents in 2008, therefore it is not included in the REMP summary table for the airborne pathway samples. Be-7 has been detected in gaseous effluents eight of the twenty years of plant operation and is therefore of interest in the REMP program. However, the levels of Be-7 found in the REMP make no significant contribution to dose.

In May and June of 1986 during preoperation, as a consequence of the Chernobyl incident, I-131 was found in nearly all the samples collected for a period of several weeks in the range of 200 to 500 pCi/kg-wet. The MDC and RL for I-131 in vegetation are 60 and 100 pCi/kg-wet, respectively. Also during this time period, Co-60 was found in one of the samples at a concentration of 62.5 pCi/kg-wet. There is no specified MDC or RL for Co-60 in vegetation.

Figure 4.5-1



**Table 4.5-1****Average Annual Cs-137 Concentration in Vegetation**

<b>Year</b>	<b>Indicator (pCi/kg-wet)</b>	<b>Control (pCi/kg-wet)</b>
Pre-op	54.6	43.7
1987	24.4	61.5
1988	38.7	NDM
1989	9.7	NDM
1990	30.0	102.0
1991	35.3	62.4
1992	38.1	144.0
1993	46.4	34.1
1994	20.7	57.4
1995	57.8	179.0
1996	NDM	NDM
1997	NDM	32.6
1998	NDM	50.1
1999	37.2	NDM
2000	36.6	NDM
2001	NDM	NDM
2002	NDM	98.3
2003	24.5	NDM
2004	36.8	19.7
2005	49.5	NDM
2006	23.9	491.8
2007	20.2	NDM
2008	24.6	62.1



## 4.6 River Water

Surface water from the Savannah River is obtained at three locations using automatic samplers. Small quantities are drawn at intervals not exceeding a few hours. The samples drawn are collected monthly; quarterly composites are produced from the monthly collections.

The collection points consist of a control location (Station 82) which is located about 0.4 miles upriver of the plant intake structure, an indicator location (Station 83) which is located about 0.4 miles downriver of the plant discharge structure, and a special location (Station 84) which is located approximately 1.3 miles downriver of the plant discharge structure. 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.

There was one river water sampling deviation that occurred in 2008. The autosampler at the indicator station (150.4) had a week battery and the monthly composite collected on 9/03/08 had to be supplemented with a grab sample.

A gamma isotopic analysis is conducted on each monthly sample. As in all previous years, there were no gamma emitting radionuclides of interest detected in the 2008 river water samples.

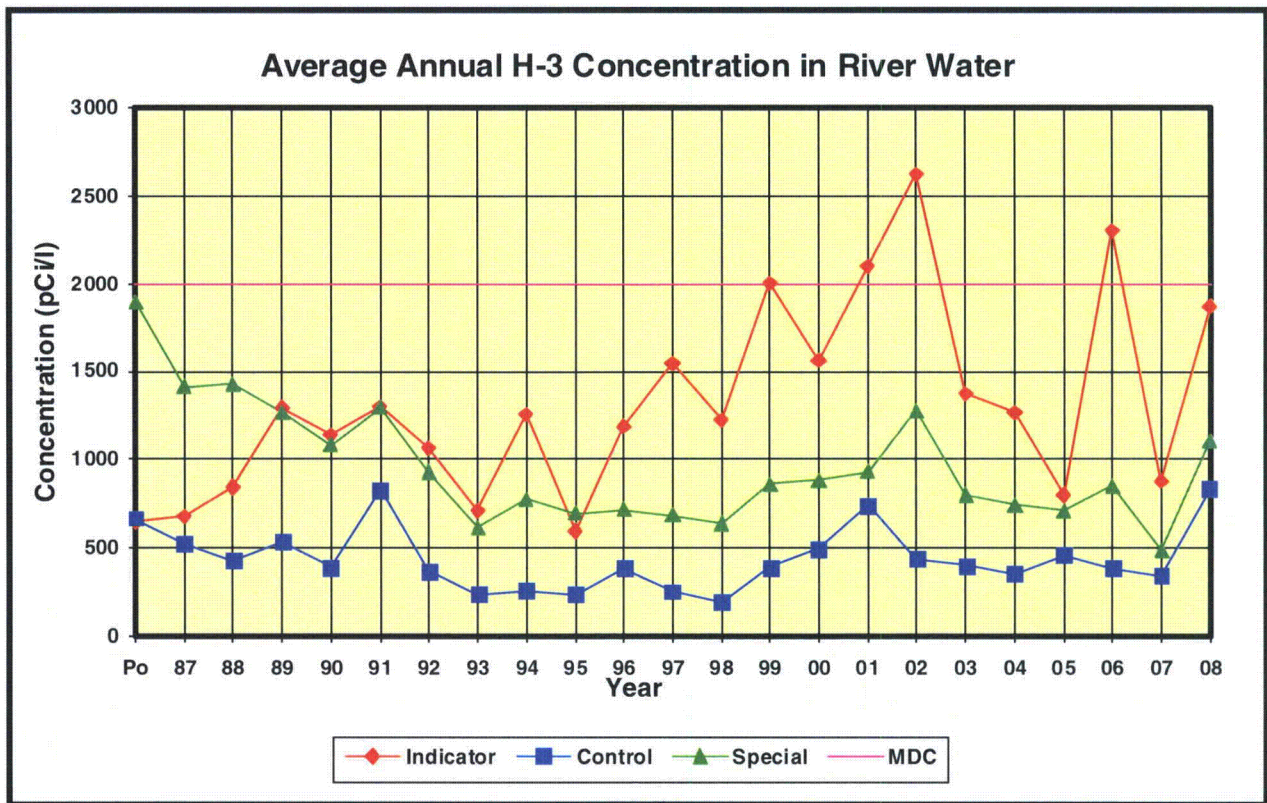
Each quarterly composite is analyzed for tritium. As indicated in Table 3-1, the average concentration found at the indicator station was 1874 pCi/l which was 1042 pCi/l greater than the average at the control station (832 pCi/l). The difference between the indicator and the control station was less than the calculated MDD (4838 pCi/l). The MDD is influenced by the variability of concentrations at the indicator station from quarter to quarter. The low number of samples (four quarterly composite samples), the variability of the four sample values, and the high standard deviation contributed to the large MDD value. The MDC for tritium in river water used to supply drinking water is 2000 pCi/l and the RL is 20,000 pCi/l.

At the special river water sampling station, the results ranged from 630 pCi/l to 2030 pCi/l with an average of 1105 pCi/l. The difference between the average concentration at the control station and the average at the special station was less than the calculated MDD of 1843 pCi/l. The decrease in tritium concentration between the indicator station and the special station is due to the additional dispersion over the 0.9 miles that separates the two stations. In the first two years of operation, the tritium concentration at the special station was somewhat greater than that at the indicator station. In recent years, the level at the special station has generally become less than the level at the indicator station.

The historical trending of the average tritium concentrations found at the special, indicator, and control stations along with the MDC for tritium is plotted on Figure 4.6-1. The data for the plot is listed in Table 4.6-1. Also included in the table are data from the calculated difference between the indicator and control stations; the MDD between the indicator and control stations; and the total curies of tritium released from the plant in liquid effluents.

The annual downriver survey of the Savannah River showed that river water is not being used for purposes of drinking or irrigation for at least 100 miles downriver (discussed in Section 4.1).

**Figure 4.6-1**



**Table 4.6-1****Average Annual H-3 Concentration in River Water**

<b>Year</b>	<b>Special (pCi/l)</b>	<b>Indicator (pCi/l)</b>	<b>Control (pCi/l)</b>	<b>Difference Between Indicator and Control (pCi/l)</b>	<b>MDD (pCi/l)</b>	<b>Annual Site Tritium Released (Ci)</b>
Pre-op	1900	650	665	-15	145	NA
1987	1411	680	524	156	416	321
1988	1430	843	427	416	271	390
1989	1268	1293	538	755	518	918
1990	1081	1142	392	750	766	1172
1991	1298	1299	828	471	626	1094
1992	929	1064	371	693	714	1481
1993	616	712	238	474	1526	761
1994	774	1258	257	1001	2009	1052
1995	699	597	236	361	766	968
1996	719	1187	387	800	2147	1637
1997	686	1547	254	1293	1566	1449
1998	640	1226	196	1030	1313	1669
1999	859	2005	389	1616	1079	1674
2000	885	1564	496	1068	1786	869
2001	931	2101	743	1358	1696	1492
2002	1280	2628	437	2190	1211	1566
2003	800	1376	399	977	1706	1932
2004	743	1269	351	918	1061	1212
2005	713	800	458	342	1333	1860
2006	852	2307	384	1882	2688	2005
2007	489	879	344	535	1189	757
2008	1105	1874	832	1042	4838	1364



## 4.7 Drinking Water

Samples are collected at a control location (Station 80 - the Augusta Water Treatment Plant in Augusta, Georgia located about 56 river miles upriver), and at three indicator locations (Station 87 - the Beaufort-Jasper County Water Treatment Plant near Beaufort, South Carolina, 112 river miles downriver; Station 88 - the Cherokee Hill Water Treatment Plant near Port Wentworth, Georgia, 122 river miles downriver; and Station 89 - the Purrysburg Water Treatment Plant near Purrysburg, South Carolina, located about 112 miles downriver. The Purrysburg Station was added to the REMP in January 2006.) Stations 87 and 89 are located on the same canal with the Purrysburg location at the beginning of the canal (nearer the Savannah River) and the Beaufort-Jasper location near the end of the canal. These upriver and downriver distances in river miles are the distances from the plant to the point on the river where water is diverted to the intake for each of these water treatment plants.

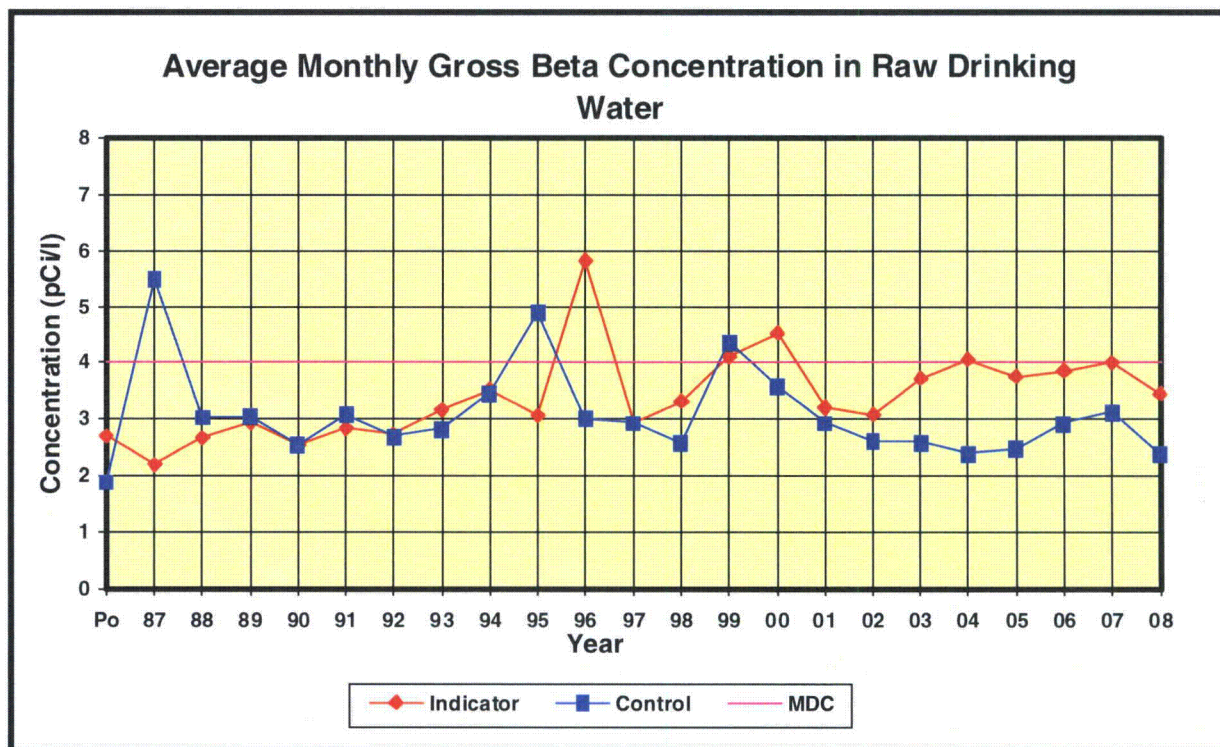
Water samples are taken near the intake of each water treatment plant (raw drinking water) using automatic samplers that take periodical small aliquots from the stream. These composite samples are collected monthly along with a grab sample of the processed water coming from the treatment plants (finished drinking water). Quarterly composites are made from these monthly collections for both raw and processed river water. Gross beta and gamma isotopic analyses are performed on each of the monthly samples while tritium analysis is conducted on the quarterly composites. An I-131 analysis is not required to be conducted on these samples, since the dose calculated from the consumption of water is less than 1 mrem per year (see ODCM Table 4-1). However, an I-131 analysis is conducted on each of the monthly finished water grab samples, since a drinking water pathway exists.

Provided in Figures 4.7-1 and 4.7-2 and Tables 4.7-1 and 4.7-2, are the historical trends of the average gross beta concentrations found in the monthly collections of raw and finished drinking water.

For 2008, the indicator station average gross beta concentration in the raw drinking water was 3.46 pCi/l which was 1.09 pCi/l greater than the average gross beta concentration at the control station (2.37 pCi/l). This difference is statistically discernible, since it is greater than the calculated MDD of 0.95 pCi/l. The required MDC for gross beta in water is 4.0 pCi/l. There is no RL for gross beta in water.

For 2008, the indicator station average gross beta concentration in the finished drinking water was 2.86 pCi/l which was 0.79 pCi/l more than the average gross beta concentration at the control station (2.07 pCi/l). This difference is more than the MDD of 0.57 pCi/l. The gross beta concentrations at the indicator stations ranged from 1.24 to 4.37 pCi/l while the concentrations at the control station ranged from 1.05 to 2.07 pCi/l. The required MDC for gross beta in water is 4.0 pCi/l. There is no RL for gross beta in water.

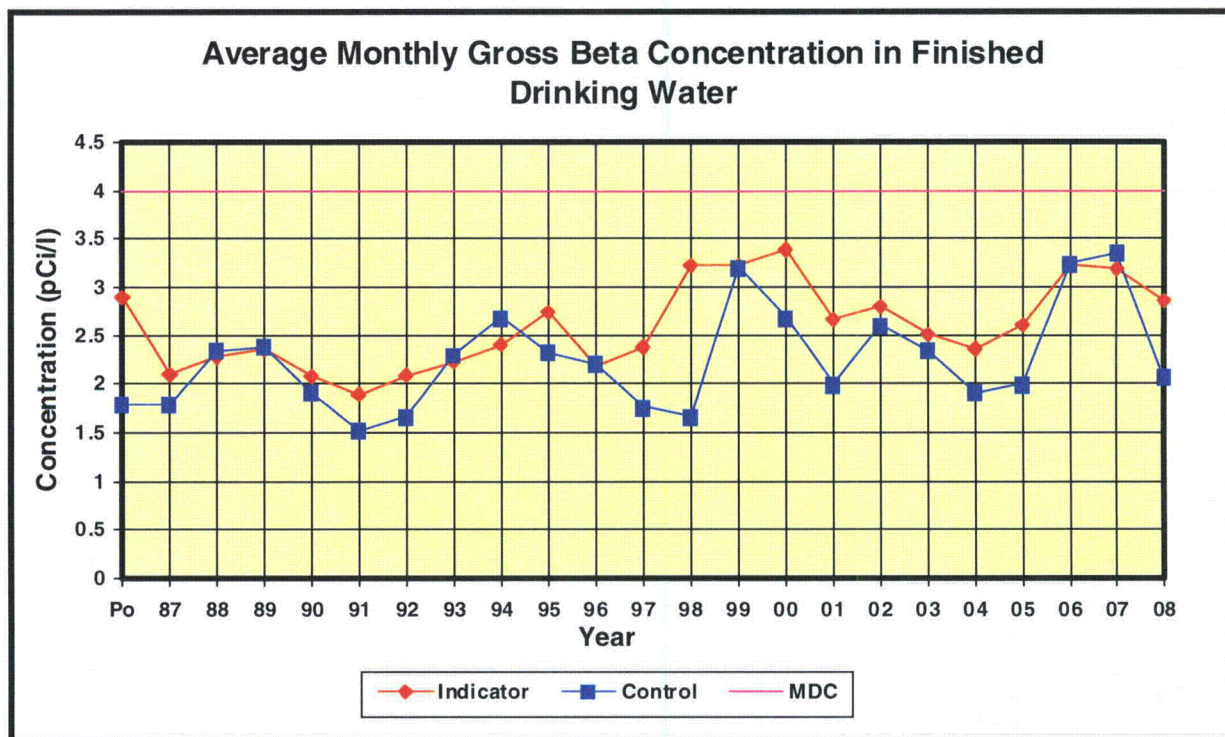
Figure 4.7-1



**Table 4.7-1****Average Monthly Gross Beta Concentration in Raw Drinking Water**

<b>Period</b>	<b>Indicator (pCi/l)</b>	<b>Control (pCi/l)</b>
Pre-op	2.70	1.90
1987	2.20	5.50
1988	2.67	3.04
1989	2.93	3.05
1990	2.53	2.55
1991	2.83	3.08
1992	2.73	2.70
1993	3.17	2.83
1994	3.51	3.47
1995	3.06	4.90
1996	5.83	3.02
1997	2.93	2.94
1998	3.31	2.58
1999	4.10	4.37
2000	4.52	3.59
2001	3.21	2.94
2002	3.09	2.61
2003	3.73	2.59
2004	4.06	2.39
2005	3.75	2.48
2006	3.85	2.93
2007	4.00	3.13
2008	3.46	2.37

Figure 4.7-2



**Table 4.7-2**  
**Average Monthly Gross Beta Concentration in Finished**  
**Drinking Water**

<b>Period</b>	<b>Indicator (pCi/l)</b>	<b>Control (pCi/l)</b>
Pre-op	2.90	1.80
1987	2.10	1.80
1988	2.28	2.35
1989	2.36	2.38
1990	2.08	1.92
1991	1.90	1.53
1992	2.09	1.67
1993	2.23	2.30
1994	2.40	2.68
1995	2.74	2.32
1996	2.19	2.21
1997	2.38	1.77
1998	3.23	1.67
1999	3.23	3.21
2000	3.39	2.68
2001	2.67	2.00
2002	2.80	2.61
2003	2.51	2.34
2004	2.36	1.92
2005	2.61	2.00
2006	3.23	3.25
2007	3.19	3.36
2008	2.86	2.07

As provided in Table 3-1, there were no positive results during 2008 for the radionuclides of interest from the gamma isotopic analysis of the monthly collections for both raw and finished drinking water. Only one positive result has been found since operation began. Be-7 was found at a concentration of 68.2 pCi/l in the sample collected for September 1987 at Station 87. During preoperation Be-7 was found in about 5% of the samples at concentrations ranging from 50 to 80 pCi/l. The MDC assigned for Be-7 in water is 124 pCi/l. Also during preoperation, Cs-134 and Cs-137 were detected in about 7% of the samples at concentrations on the order of their MDCs which are 15 and 18 pCi/l, respectively.

I-131 was detected in finished drinking water in 1997 at levels near the MDC. This was the first occurrence for detecting I-131 in finished drinking water since operation began. During preoperation, it was detected in only one of 73 samples at a concentration of 0.77 pCi/l at Port Wentworth. The MDC and RL for I-131 in drinking water are 1 and 2 pCi/l, respectively.

Figures 4.7-3 and 4.7-4 and Tables 4.7-3 and 4.7-4 provide historical trending for the average tritium concentrations found in the quarterly composites of raw and finished drinking water collected at the indicator and control stations. The tables also list the calculated differences between the indicator and control stations, and list the MDDs between these two station groups.

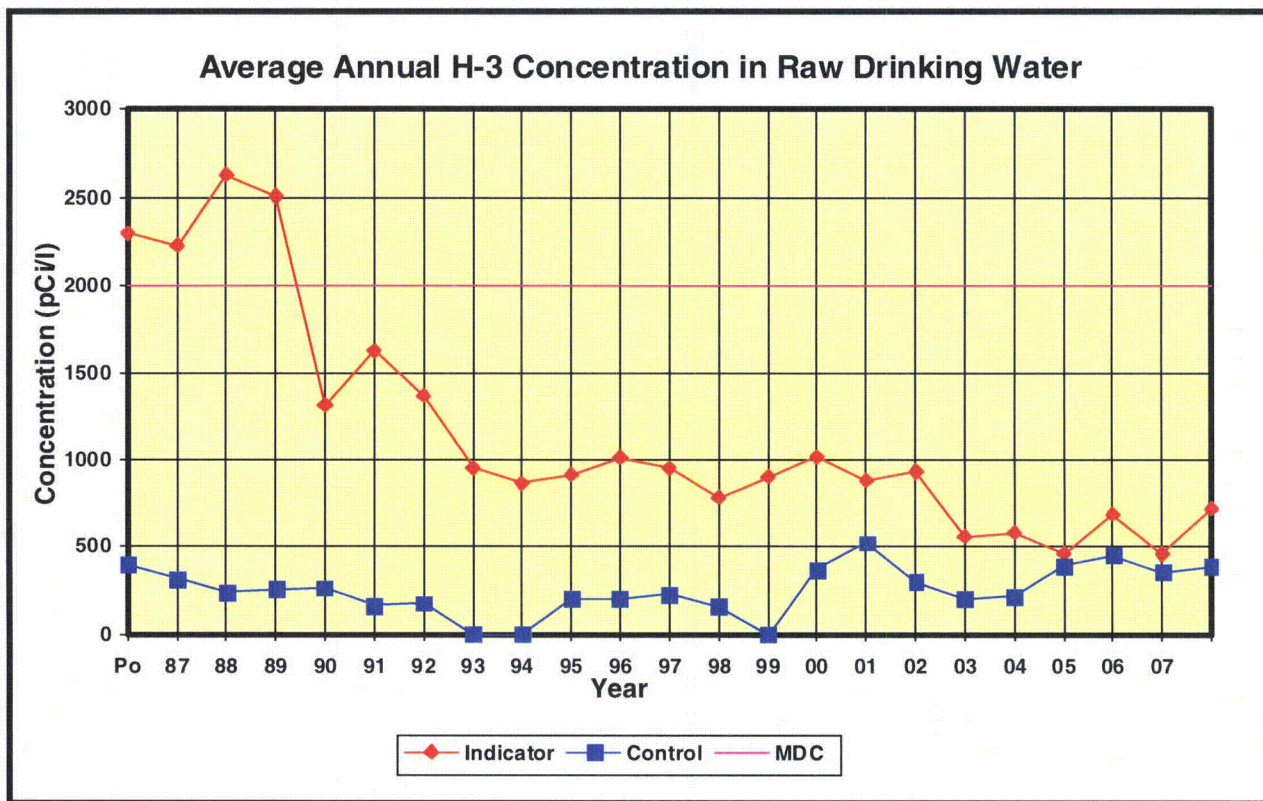
The graphs and tables show that the tritium concentrations in the drinking water samples, both raw and finished, have been gradually trending downward since 1988. The small increase in average concentrations at the indicator stations for 1991 and 1992 reflect the impact of the inadvertent release from SRS of 7,500 Ci of tritium to the Savannah River about 10 miles downriver of VEGP, in December 1991 (SRS release data was obtained from "Release of 7,500 Curies of Tritium to the Savannah River from the Savannah River Site", Georgia Department of National Resources, Environmental Protection Division, Environmental Radiation Program, January 1992).

The 2008 raw drinking water indicator stations average tritium was 726 pCi/l which was 340 pCi/l greater than the average of the two positive concentrations found at the control station (386 pCi/l). The difference between the average at the indicator stations and the average at the control station is statistically discernible since it is greater than the calculated MDD of 269 pCi/l. The MDC and RL for tritium in drinking water are 2000 pCi/l and 20,000 pCi/l, respectively.

The finished drinking water average tritium concentration at the indicator stations during 2008 was 661 pCi/l which was 270 pCi/l more than that the average of the two positive concentrations found at the control station (391 pCi/l). The difference between the average at the indicator stations and the average at the control station is not statistically discernible since it is less than the calculated MDD of 486 pCi/l. The MDC and RL for tritium in drinking water are 2000 pCi/l and 20,000 pCi/l, respectively.



Figure 4.7-3

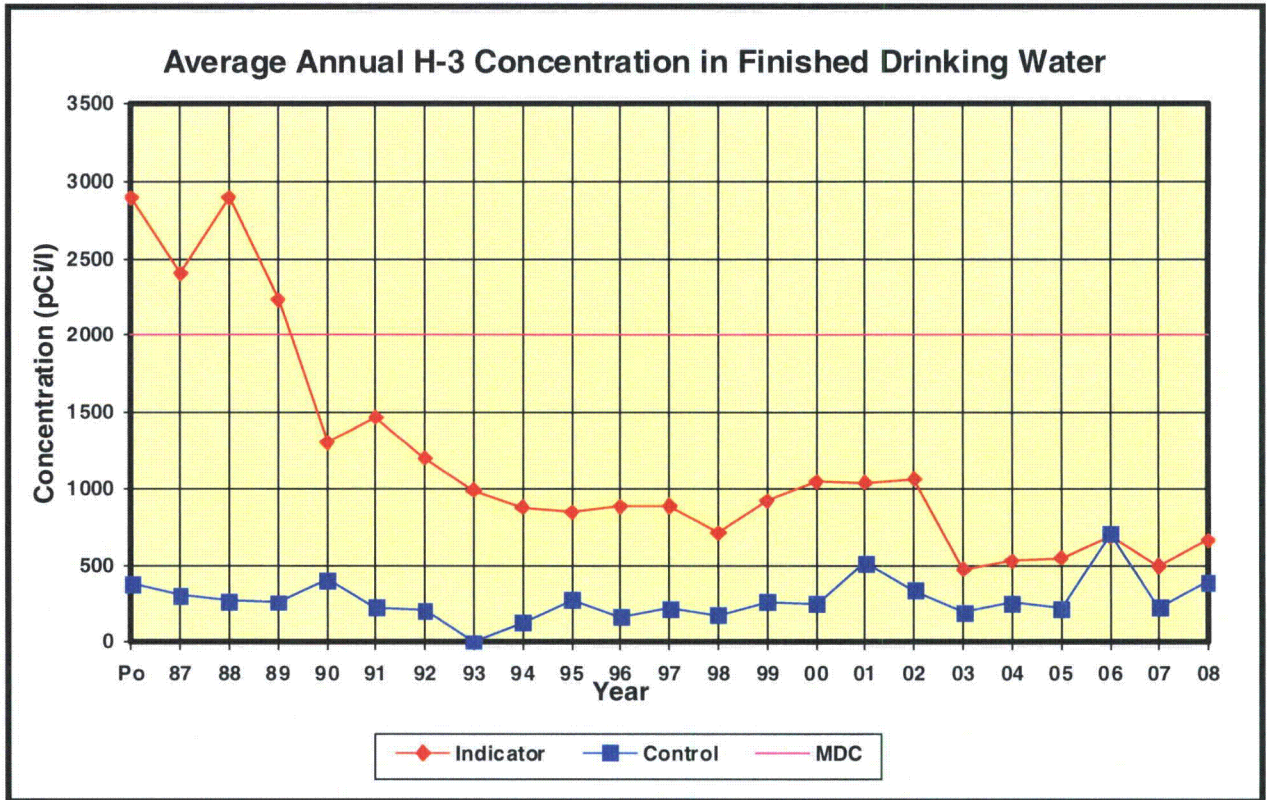


**Table 4.7-3****Average Annual H-3 Concentration in Raw Drinking Water**

<b>Period</b>	<b>Indicator (pCi/l)</b>	<b>Control (pCi/l)</b>	<b>Difference Between Ind. &amp; Control (pCi/l)</b>	<b>MDD (pCi/l)</b>
Pre-op	2300	400	1900	
1987	2229	316	1913	793
1988	2630	240	2390	580
1989	2508	259	2249	1000
1990	1320	266	1054	572
1991	1626	165	1461	834
1992	1373	179	1194	353
1993	955	NDM	955	NA
1994	871	NDM	871	NA
1995	917	201	716	NA
1996	1014	207	807	151
1997	956	230	726	61
1998	791	160	631	NA
1999	908	NDM	908	NA
2000	1020	373	647	704
2001	889	525	364	NA
2002	938	304	634	284
2003	563	203	360	NA
2004	585	220	365	204
2005	463	393	70	301
2006	690	451	239	394
2007	462	357	105	NA
2008	726	386	340	269



Figure 4.7-4



**Table 4.7-4****Average Annual H-3 Concentration in Finished Drinking Water**

<b>Period</b>	<b>Indicator (pCi/l)</b>	<b>Control (pCi/l)</b>	<b>Difference Between Ind. &amp; Control (pCi/l)</b>	<b>MDD (pCi/l)</b>
Pre-op	2900	380	2520	
1987	2406	305	2101	1007
1988	2900	270	2630	830
1989	2236	259	1977	627
1990	1299	404	895	1131
1991	1471	225	1246	647
1992	1195	211	984	427
1993	993	NDM	993	NA
1994	880	131	749	270
1995	847	279	568	NA
1996	884	168	716	NA
1997	887	221	666	383
1998	713	180	533	NA
1999	920	263	657	NA
2000	1043	251	792	833
2001	1037	516	521	NA
2002	1060	340	720	416
2003	473	196	277	NA
2004	531	255	276	314
2005	546	223	323	NA
2006	688	710	22	NA
2007	494	229	265	NA
2008	661	391	270	468

## 4.8 Fish

Table 2-1 requires the collection of at least one sample of any anadromous species of fish in the vicinity of the plant discharge during the spring spawning season, and for the semi-annual collection of at least one sample of any commercially or recreationally important species in the vicinity of the plant discharge area and in an area not influenced by plant discharges. Table 2-1 specifies that a gamma isotopic analysis be performed on the edible portions of each sample collected.

As provided in Table 2-2, a 5-mile stretch of the river is generally needed to obtain adequate fish samples. For the semiannual collections, the control location (Station 81) extends from approximately 2 to 7 miles upriver of the plant intake structure, and the indicator location (Station 85) extends from about 1.4 to 7 miles downriver of the plant discharge structure. For anadromous species, all collection points can be considered as indicator stations.

The anadromous fish (American Shad) sample was collected on April 15, 2008 during the spring spawning season. No man-made radionuclides were detected in the 2008 sample. In all but three previous years of operation, no radionuclides were detected. In 2005, Cs-137 was detected in the anadromous fish sample at a low level of 28.8 pCi/kg-wet. In 1987, as well as in 1991, Cs-137 was found in a single sample of American Shad at concentrations of 10 and 12 pCi/kg-wet, respectively.

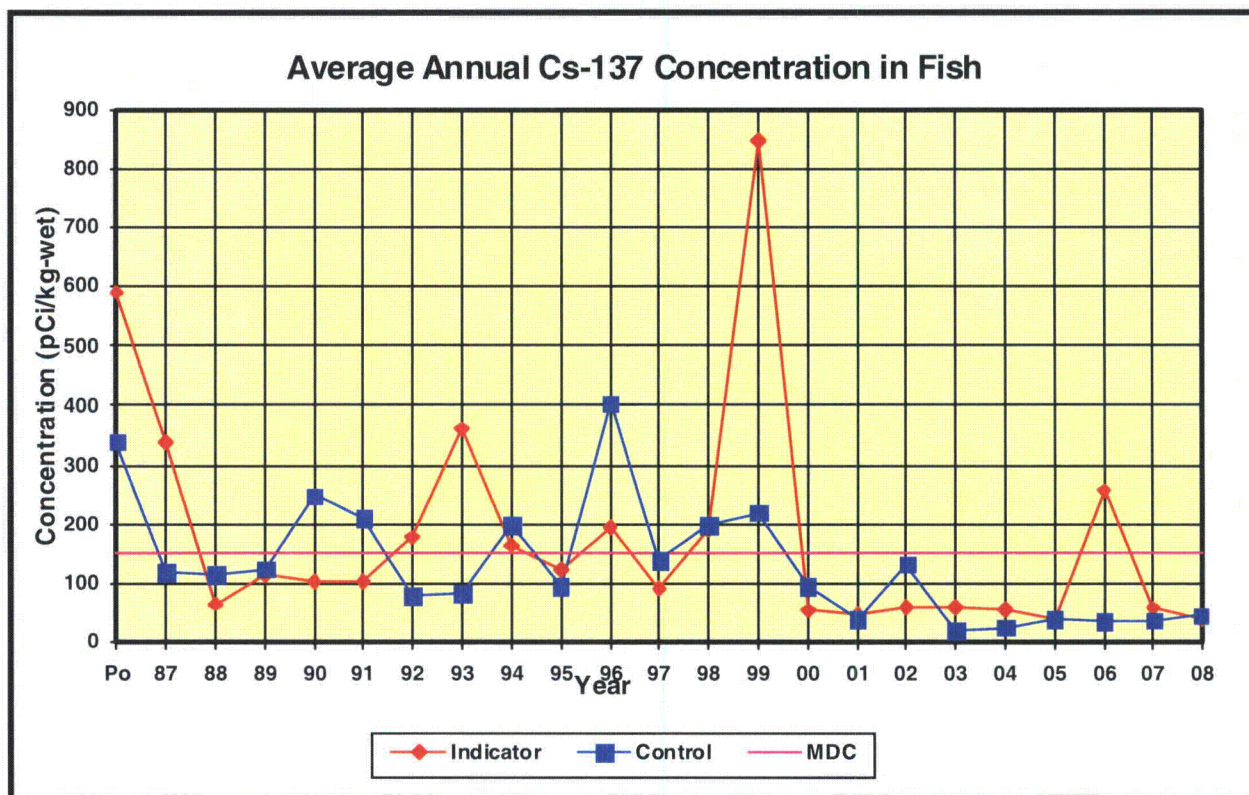
The dates and compositions of the semi-annual catches at the indicator and control stations during 2008 are shown below.

<b>Date</b>	<b>Indicator</b>	<b>Control</b>
April 15	Largemouth Bass	Largemouth Bass
November 20	Largemouth Bass Channel Catfish	Largemouth Bass Mullet

As indicated in Table 3-1, Cs-137 was found in the semiannual collections of a commercially or recreationally important species of fish. It has been found in all but 4 of the 135 samples collected during operation and in all but 5 of the 32 samples collected during preoperation. As provided in Table 3-1, the average concentration at the indicator station was 39.4 pCi/kg-wet which was 7.6 pCi/kg-wet less than that at the control station (47.0 pCi/kg-wet). The difference between the average at the indicator station and the average at the control station is less than the calculated MDD of 97 pCi/kg-wet and therefore is not statistically discernible. No discernible difference has occurred for any year of operation or during pre-operation.

Figure 4.8-1 and Table 4.8-1 provide the historical trending of the average concentrations of Cs-137 in units of pCi/kg-wet found in fish samples at the indicator and control stations. The indicator station fish sample concentration of Cs-137 in 1999 was greatly influenced by a largemouth bass collected in October with a concentration of 2500 pCi/kg-wet. Other than the fact that largemouth bass are predators that concentrate Cs-137, no specific cause for the elevated concentration in this sample is known. No trend is recognized in this data. The MDC and RL for Cs-137 in fish are 150 and 2000 pCi/kg-wet, respectively.

Figure 4.8-1



**Table 4.8-1**  
**Average Annual Cs-137 Concentration in Fish**

Year	Indicator (pCi/kg-wet)	Control (pCi/kg-wet)
Pre-op	590	340
1987	337	119
1988	66	116
1989	117	125
1990	103	249
1991	105	211
1992	178	80
1993	360	84
1994	165	200
1995	125	96
1996	194	404
1997	93	139
1998	190	200
1999	848	221
2000	55	96
2001	48	39
2002	59	133
2003	62	21
2004	56.4	26.0
2005	39.3	40.2
2006	257	35.7
2007	58.7	37.7
2008	39.4	47.0

The only other radionuclide found in fish samples during operation is I-131. In 1989, it was found in one sample at the indicator station at a concentration of 18 pCi/kg-wet. In 1990, it was found in one sample at the indicator station and in one sample at the control station, at concentrations of 13 and 12 pCi/kg-wet, respectively. The MDC assigned to I-131 in fish is 53 pCi/kg-wet. In the November 2008 collection, the Largemouth Bass sample from the control location showed 90 pCi/kg-wet of I-131. The specific source of the I-131 is unknown but is likely due to medical waste.

During preoperation, Cs-134 was found in two of the 17 samples collected at the control station at concentrations of 23 and 190 pCi/kg-wet. The MDC and RL for Cs-134 are 130 and 1000 pCi/kg-wet, respectively. Nb-95 was also found in one of the control station samples at a concentration of 34 pCi/kg-wet. The assigned MDC and calculated RL for Nb-95 are 50 and 70,000 pCi/kg-wet, respectively.

## 4.9 Sediment

Sediment was collected along the shoreline of the Savannah River on April 22 and October 7, 2008 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 of interest identified in 2008 samples were Be-7, Co-60, and Cs-137.

Be-7, which is abundant in nature, was not identified in plant liquid effluents during 2008. However, it continues to be trended in river sediment in the REMP report. In 2008, the single positive value at the indicator station was 394 pCi/kg-dry and at the control station the single positive value was 805 pCi/kg-dry. Because there continues to be no significant difference between the indicator and control station, the Be-7 found at the indicator station is not attributed to plant releases.

For Cs-137, the average concentration at the indicator station during 2008 was 66.2 pCi/kg-dry which was 5.3 pCi/kg-dry greater than that at the control station (60.9 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 228 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. The Cs-137 level at the indicator station has averaged nearly 100 pCi/kg-dry greater than that at the control station over the entire period of operation. During preoperation, the Cs-137 was 170 pCi/kg-dry greater at the indicator station than at the control station.

During 2008, Co-60 was detected in one sediment sample at the indicator station at 61.9 pCi/kg-dry and in no samples at the control station. Cobalt-60 has been detected in sediment collected at the indicator station every year of plant operation but three. The concentrations of Co-60 often found at the indicator station could be attributed to plant releases or, potentially, to other facilities that release radioactive effluents in the vicinity of the plant.

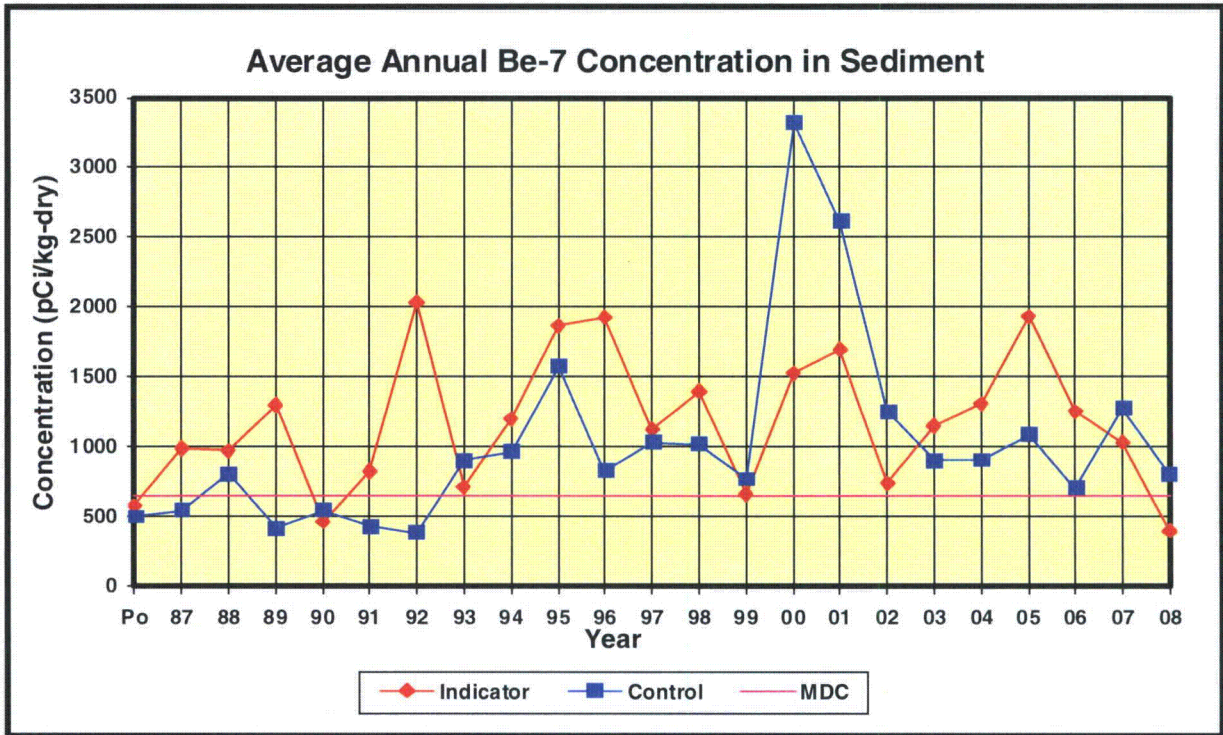
The historical average concentrations of Be-7, Co-58, Co-60, and Cs-137 in sediment are plotted in Figures 4.9-1 through 4.9-4 along with listings of their concentrations in Tables 4.9-1 through 4.9-4. The concentrations of the solely man-made nuclides (Co-58, Co-60, & Cs-137) are consistent with past average concentrations. No pattern has been detected. Be-7, produced by man and nature, is also within the range that is typically seen.

During preoperation, Zr-95, Nb-95, Cs-134, and Ce-141 were detected in at least one of the control station samples and Nb-95 was detected in one of the indicator station samples. Be-7 and Cs-137 were found in several of the samples. The concentrations of these preoperational nuclides were on the order of their respective MDC values. The presence of these preoperational nuclides could be attributed to atmospheric weapons testing and the Chernobyl incident.

Mn-54 and I-131 were found sporadically over several years of operation. A summary of the positive results for these nuclides along with their applicable MDCs is provided in Table 4.9-5.



Figure 4.9-1

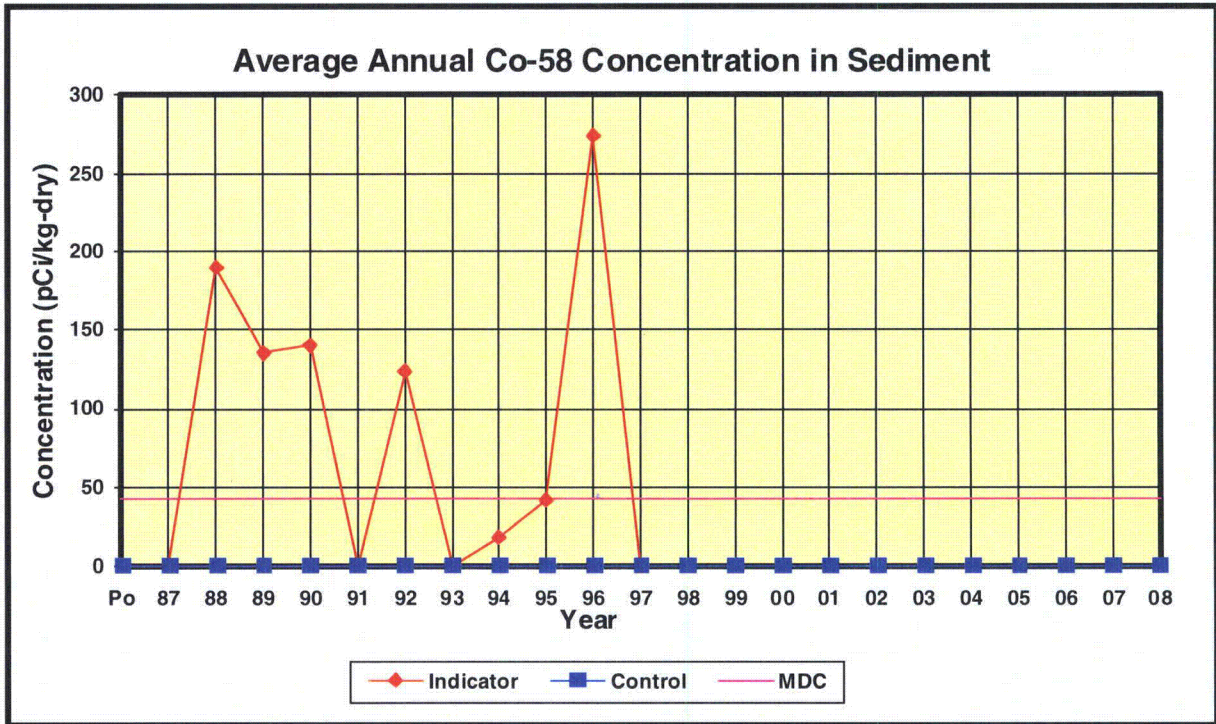


**Table 4.9-1**  
**Average Annual Be-7 Concentration in Sediment**

MDC=655 pCi/kg-dry		
Year	Indicator (pCi/kg-dry)	Control (pCi/kg-dry)
Pre-op	580	500
1987	987	543
1988	970	810
1989	1300	415
1990	465	545
1991	826	427
1992	2038	380
1993	711	902
1994	1203	964
1995	1865	1575
1996	1925	831
1997	1130	1028
1998	1396	1016
1999	662	769
2000	1526	3324
2001	1697	2614
2002	742	1254
2003	1150	903
2004	1309	905
2005	1931	1086
2006	1254	704
2007	1034	1274
2008	394	805



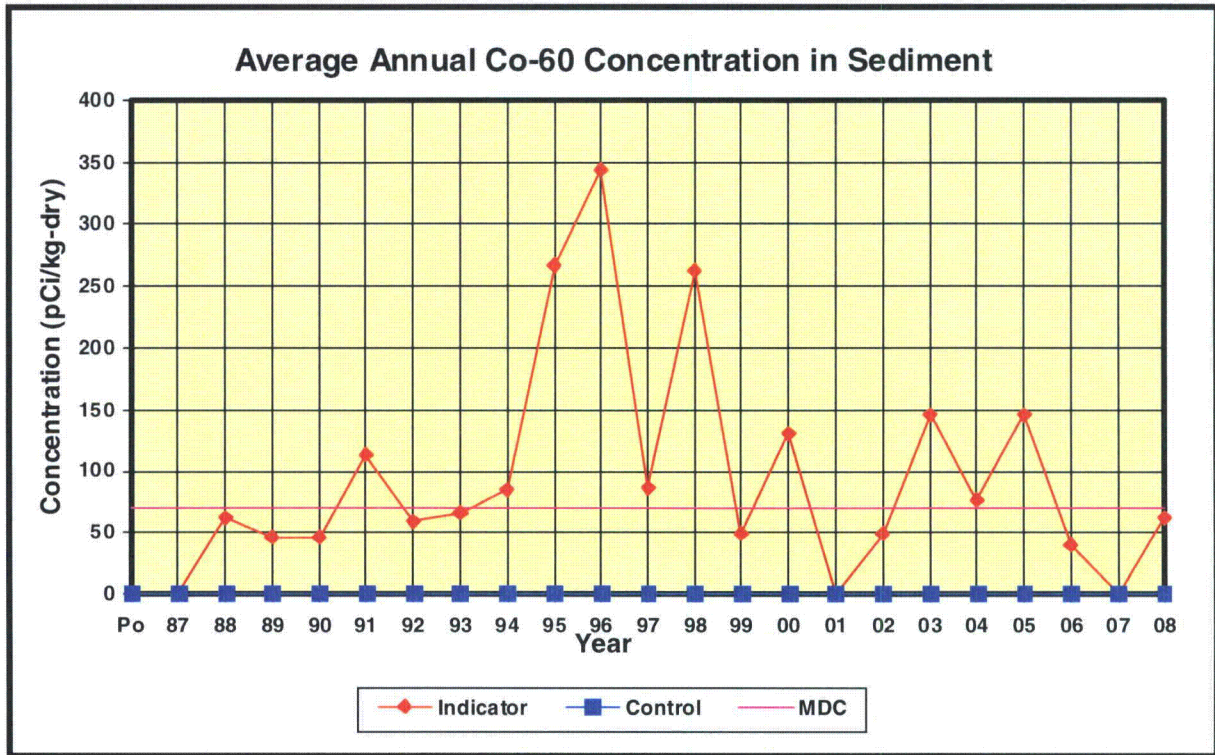
Figure 4.9-2



**Table 4.9-2**  
**Average Annual Co-58 Concentration in Sediment**

<b>MDC=43 pCi/kg-dry</b>		
<b>Year</b>	<b>Indicator (pCi/kg-dry)</b>	<b>Control (pCi/kg-dry)</b>
Pre-op	NDM	NDM
1987	NDM	NDM
1988	190	NDM
1989	135	NDM
1990	140	NDM
1991	NDM	NDM
1992	124	NDM
1993	NDM	NDM
1994	18.4	NDM
1995	42.4	NDM
1996	274	NDM
1997	NDM	NDM
1998	NDM	NDM
1999	NDM	NDM
2000	NDM	NDM
2001	NDM	NDM
2002	NDM	NDM
2003	NDM	NDM
2004	NDM	NDM
2005	NDM	NDM
2006	NDM	NDM
2007	NDM	NDM
2008	NDM	NDM

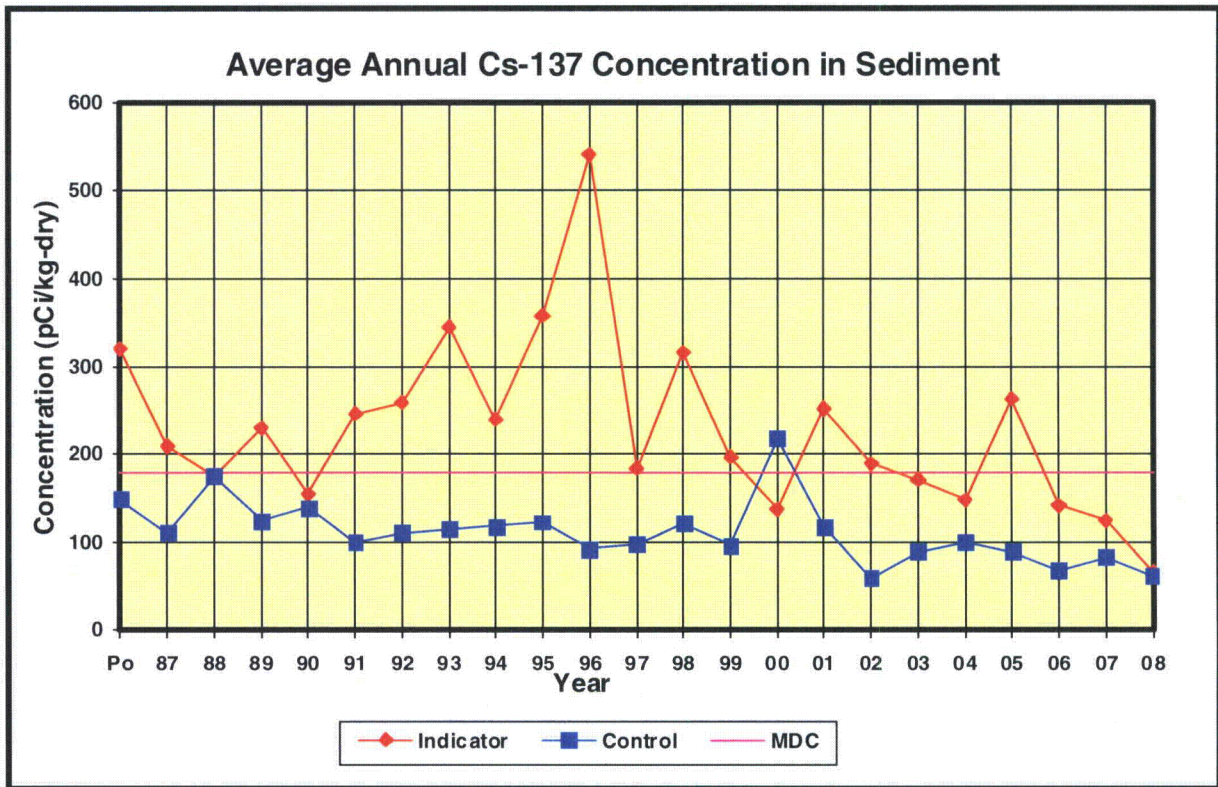
Figure 4.9-3



**Table 4.9-3****Average Annual Co-60 Concentration in Sediment**

MDC=70 pCi/kg-dry		
Year	Indicator (pCi/kg-dry)	Control (pCi/kg-dry)
Pre-op	NDM	NDM
1987	NDM	NDM
1988	62	NDM
1989	46	NDM
1990	46	NDM
1991	113	NDM
1992	59.5	NDM
1993	65.9	NDM
1994	85.2	NDM
1995	267	NDM
1996	344	NDM
1997	86	NDM
1998	263	NDM
1999	49.5	NDM
2000	131.3	NDM
2001	NDM	NDM
2002	49.7	NDM
2003	146	NDM
2004	77	NDM
2005	146	NDM
2006	40	NDM
2007	NDM	NDM
2008	61.9	NDM

Figure 4.9-4



**Table 4.9-4**

**Average Annual Cs-137 Concentration in Sediment**

MDC=180 pCi/kg		
Year	Indicator (pCi/kg)	Control (pCi/kg)
Pre-op	320	150
1987	209	111
1988	175	175
1989	230	125
1990	155	140
1991	246	100
1992	259	111
1993	345	115
1994	240	118
1995	357	123
1996	541	93
1997	184	98
1998	316	122
1999	197	97
2000	138	218
2001	252	118
2002	189	60
2003	171	90
2004	149	100
2005	263	89
2006	142	68
2007	125	83
2008	66.2	60.9

**Table 4.9-5**

**Additional Sediment Nuclide Concentrations**

Nuclide	YEAR	Indicator (pCi/kg-dry)	Control (pCi/kg-dry)	MDC (pCi/kg-dry)
Mn-54	1988	22	NDM	42
	1989	18	NDM	
	1994	32	NDM	
I-131	1992	194	20	53
	1994	51	41	



## 4.10 Groundwater

As nuclear plants began to undergo decommissioning in the late 1990's to early 2000s, instances of subsurface and/or groundwater contamination were identified. In addition, several operating facilities also identified groundwater contamination resulting from spills and leaks or equipment failure. In one instance, low levels of licensed material were detected in a private well located on property adjacent to a nuclear power plant.

In 2006, NEI (Nuclear Energy Institute) formed a task force to address monitoring onsite groundwater for radionuclides at nuclear facilities. A Groundwater Protection Initiative was developed which was adopted by all U.S. commercial operating nuclear plants.

The NRC also formed a task force to study the groundwater issues and released Information Notice 2006-13 "Ground-water Contamination due to Undetected Leakage of Radioactive Water" which summarized its review of radioactive contamination of ground water at multiple facilities as a result of undetected leakage from structures, systems, or components that contain or transport radioactive fluids. Licensees were instructed to review the information for applicability and to consider appropriate actions to avoid similar problems.

The NEI task force felt it was prudent for the industry to update site hydrology information and to develop radiological groundwater monitoring plans at each site. These groundwater protection plans would ensure that underground leaks and spills would be addressed promptly. Additionally, the task force recommended developing a communications protocol to report radioactive leaks or spills that entered groundwater (or might eventually enter groundwater) to the NRC and State and Local government officials as needed.

For guidance regarding monitoring wells with unexpected results, Southern Nuclear has developed a company-wide communications protocol which is contained in the Nuclear Management Procedure, *Actions for Potential Groundwater Contamination Events*, to ensure radioactive leaks and spills would be addressed and communicated appropriately.

In 2006, Vogtle sampled onsite drinking water deep wells and onsite makeup water deep wells for tritium and gamma isotopic activity. These wells did not contain detectable amounts of radioactivity. In 2007, Vogtle implemented a more extensive radiological groundwater monitoring program. A qualified hydrologist made recommendations for drilling additional onsite monitoring wells and updated the site hydrology information. Eight new wells and 17 existing wells comprise the current VEGP groundwater monitoring program (see Table 2-3). These locations were sampled twice in the latter portion of 2007. Several wells were positive for tritium but no gamma emitters were detected. The highest activity sample showed approximately 900 pCi/l of tritium. This level of tritium is typical background for the area around Plant Vogtle based on historical information from Georgia Department of Natural Resources and Savannah River Site. Drinking water wells, sewage treatment plant effluent, and several surface water locations supplement the monitoring program and were also sampled in 2007. None of these locations showed activity above typical environmental levels in this area. This is also true of the 2008 supplemental sampling.

The tritium levels in the water table since the radiological groundwater sampling program started in mid-2007 through 2008 are graphed in Figures 4.10-1, 4.10-2, and 4.10-3. The February 2008 sampling event appears to be an outlier, however, more data is needed to determine seasonal changes and typical fluctuations in tritium concentration due to rain washout and recharge of the aquifer. None of the tertiary aquifer wells have shown tritium concentrations above background.

In 2008, three of the monitoring wells (1013, 1003, and 1004) used for groundwater monitoring (but not newly drilled for the program) were retired due to preliminary construction activities of two potential new operating reactors. These wells were not critical to the radiological groundwater monitoring program as they were upgradient and used primarily to obtain background data for site characterization.



FIGURE 4.10-1  
VEGP GW Wells in PA

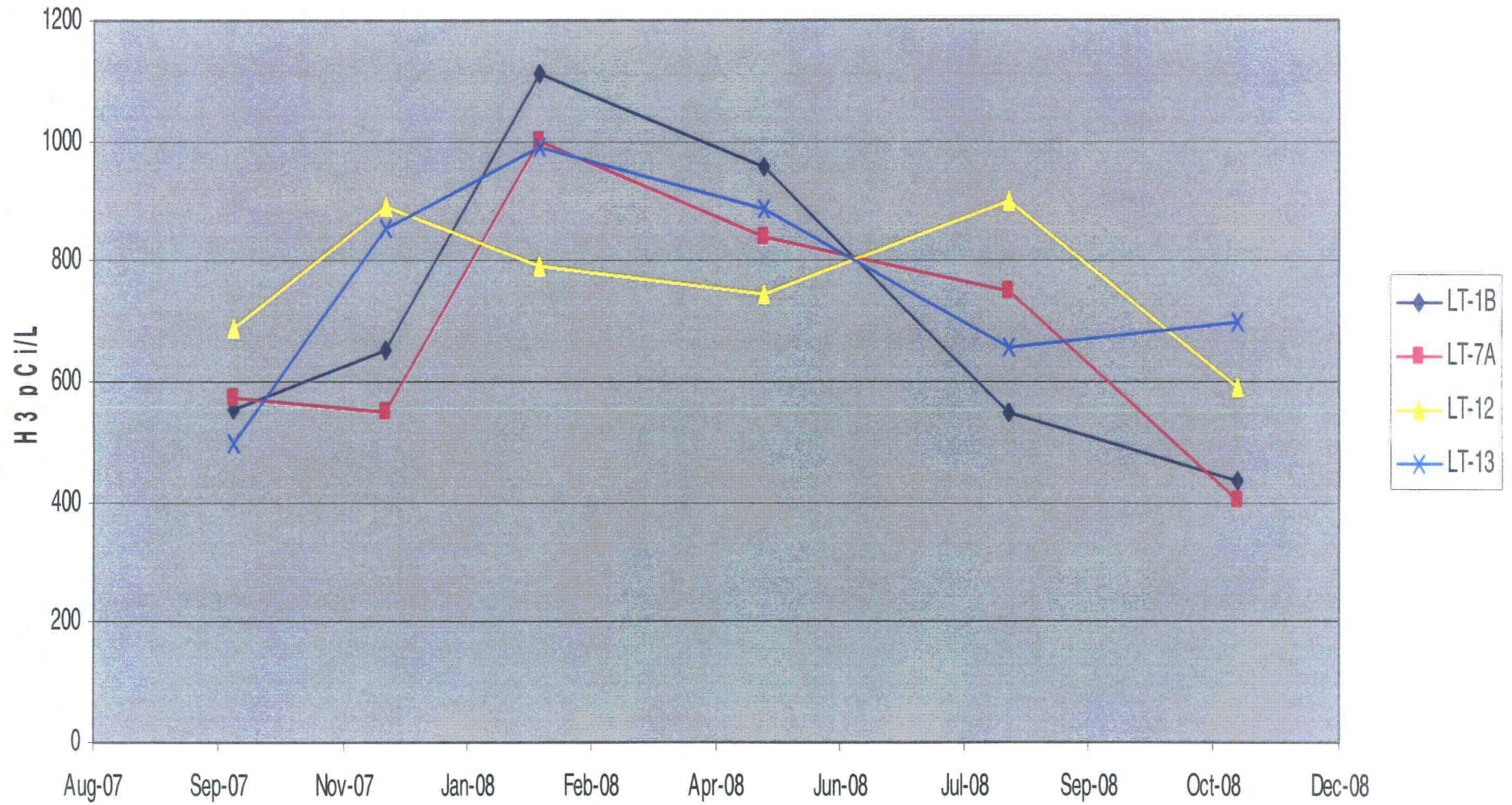




FIGURE 4.10-2  
Existing Water Table Wells  
(Zeroes are below MDA)

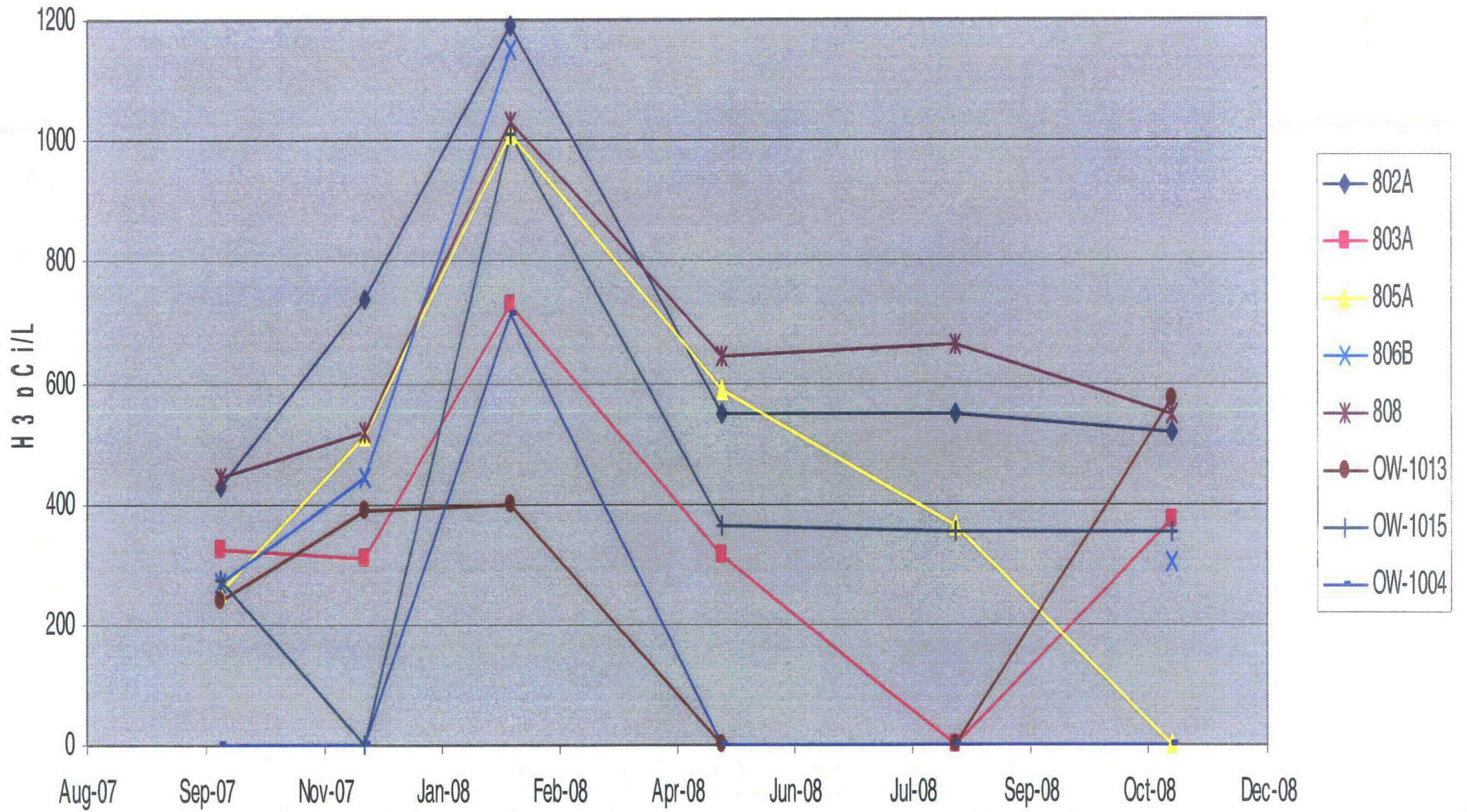
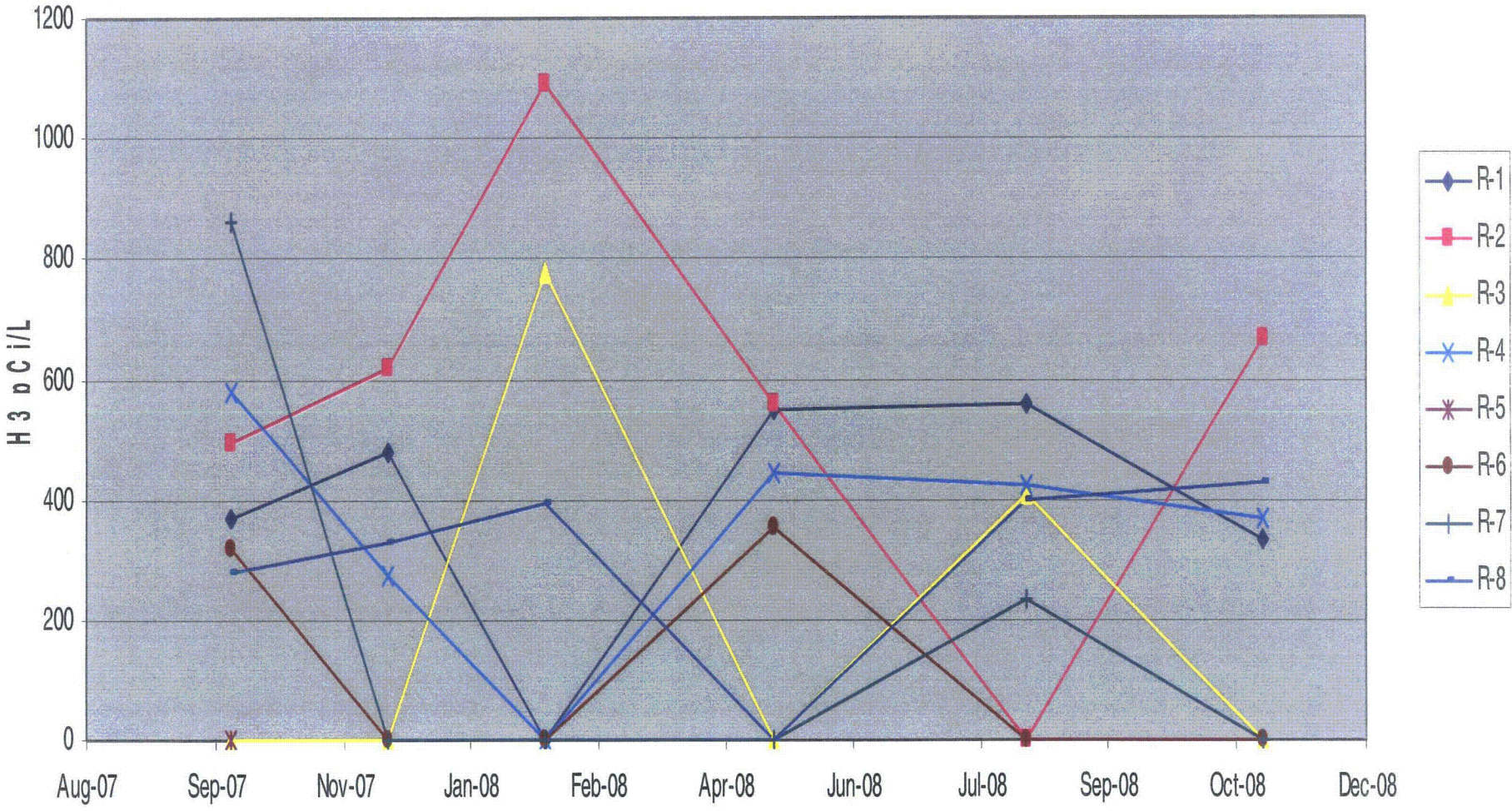




FIGURE 4.10-3  
New Water Table Wells  
(Zeroes are below MDA)



## 5.0 INTERLABORATORY COMPARISON PROGRAM

In accordance with ODCM 4.1.3, the EL participates in an 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 guide indicates the ICP is to be conducted with the Environmental Protection Agency (EPA) Environmental Radioactivity Laboratory Intercomparison Studies (Cross-check) Program or an equivalent program, and the ICP should include all of the determinations (sample medium/radionuclide combinations) that are offered by the EPA and included in the REMP.

The ICP is conducted by Analytics, Inc. of Atlanta, Georgia. Analytics 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. Analytics supplies the crosscheck samples to the EL which performs the laboratory analyses in a normal manner. Each of the specified analyses is performed three times. The results are then sent to Analytics who performs an evaluation which may be helpful to the EL in the identification of instrument or procedural problems.

The samples offered by Analytics and included in the EL analyses are gross beta and gamma isotopic analyses of an air filter; gamma isotopic analyses of milk samples; and gross beta, tritium and gamma isotopic analyses of water samples.

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. The total error is the square root of the sum of the squares of the uncertainties of the known value and of the reported average. The uncertainty of the known value includes all analytical uncertainties as reported by Analytics. The uncertainty of the reported average is the propagated error of the values in the reported average by the EL. The precision of each result is measured by the coefficient of variation, which is defined as the standard deviation of the reported result divided by the reported average. 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 as follows:

Nuclide	Concentration *	Total Sample Activity (pCi)	Percent Coefficient of Variation
Cr-51	<300	NA	25
Cr-51	NA	>1000	25
Cr-51	>300	<1000	15
Fe-59	<80	NA	25
Fe-59	>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 EL's participation in the ICP is provided in Table 5-1 for: the gross beta and gamma isotopic analyses of an air filter; gamma isotopic analyses of milk samples; and gross beta, tritium and gamma isotopic analyses of water samples. Delineated in this table for each of the media/analysis combinations, are: the specific radionuclides; Analytics' preparation dates; the known values with their uncertainties supplied by Analytics; the reported averages with their standard deviations; and the resultant normalized deviations and coefficients of variation expressed as a percentage.

The GPC EL analyzed 13 samples for 43 parameters in 2008. The analyses included tritium, gross beta, Fe-55, Sr-89/90 and gamma emitting radio-nuclides in milk, water, air cartridge and air filter matrices. The attached results indicate three analyses outside the three sigma control limits. They were the following:

- 1) Mn-54 in air filter (Environmental Program) for accuracy.
- 2) Co-58 in water (Environmental Program) for precision
- 3) Gross alpha in water (Effluent Program) for accuracy.

The first quarter effluent water sample analyzed for gross alpha had a low activity recovery. The gross alpha in water self absorption curve was evaluated and updated. The second quarter alpha sample was in control for both accuracy and precision. A known alpha activity sample will be processed with the blind samples in the future to assure accurate results.

The third quarter environmental air filter sample was analyzed by gamma spectroscopy and had a high activity recovery for Mn-54. The sample was analyzed by three detectors and a weighted average reported. A small range from the three detectors produced an elevated normalized deviation result. The value was above the three sigma control limit, however the recovery of the Mn-54 activity is 114% and is acceptable.

The precision failure was in the first quarter water sample analyzed by gamma spectroscopy. The %CV for Co-58 was above the control limit. The sample was analyzed on three detectors with an error weighted average reported. An elevated range of values in the analysis is due to one of the detectors measuring a higher activity. No inconsistencies were found in the detector shaping or analysis of the 810 keV gamma peak. No further investigation will be performed.

In 2009 the Environmental Laboratory will adopt the NRC Inspection Procedure's guidance for acceptance criteria in performance sample testing. The adoption of the NRC Inspection Procedure 84750 will keep the lab consistent with the nuclear industry.

TABLE 5-1 (SHEET 1 of 3)

INTERLABORATORY COMPARISON PROGRAM RESULTS

GROSS BETA ANALYSIS OF AN AIR FILTER (pCi/filter)

Analysis or Radionuclide	Date Prepared	Reported Average	Known Value	Standard Deviation EL	Uncertainty Analytics (3S)	Percent Coef of Variation	Normalized Deviation
Gross Beta	09/18/08	128.00	121.00	4.82	2.03	5.43	1.01

GAMMA ISOTOPIC ANALYSIS OF AN AIR FILTER (pCi/filter)

Analysis or Radionuclide	Date Prepared	Reported Average	Known Value	Standard Deviation EL	Uncertainty Analytics (3S)	Percent Coef of Variation	Normalized Deviation
Ce-141	09/18/08	134.00	132.00	6.74	0.74	5.81	0.25
Co-58	09/18/08	149.70	146.00	6.7	0.81	3.84	0.61
Co-60	09/18/08	197.10	192.00	7.81	1.07	3.22	0.74
Cr-51	09/18/08	390.10	345.00	14.59	1.92	6.74	1.69
Cs-134	09/18/08	186.90	190.00	6.88	1.06	4.54	-0.35
Cs-137	09/18/08	143.20	133.00	5.23	0.74	4.92	1.40
Fe-59	09/18/08	140.60	118.00	2.99	0.66	4.58	3.40
Mn-54	09/18/08	154.60	136.00	1.14	0.76	3.42	3.30
Zn-65	09/18/08	295.40	262.00	13.08	1.46	5.70	1.93

GAMMA ISOTOPIC ANALYSIS OF A MILK SAMPLE (pCi/liter)

Analysis or Radionuclide	Date Prepared	Reported Average	Known Value	Standard Deviation EL	Uncertainty Analytics (3S)	Percent Coef of Variation	Normalized Deviation
Ce-141	06/19/08	180.10	174.00	13.17	0.97	8.56	0.39
Co-58	06/19/08	68.90	61.90	4.77	0.34	0.65	0.96
Co-60	06/19/08	112.60	104.00	5.69	0.58	6.87	1.10
Cr-51	06/19/08	146.70	138.00	23.39	0.77	25.12	0.24
Cs-134	06/19/08	74.70	76.70	2.67	0.43	7.18	-0.36
Cs-137	06/19/08	118.20	116.00	5.44	0.65	7.27	0.25



TABLE 5-1 (SHEET 2 of 3)

INTERLABORATORY COMPARISON PROGRAM RESULTS

GAMMA ISOTOPIC ANALYSIS OF A MILK SAMPLE (pCi/liter)

Analysis or Radionuclide	Date Prepared	Reported Average	Known Value	Standard Deviation EL	Uncertainty Analytics (3S)	Percent Coef of Variation	Normalized Deviation
Fe-59	06/19/08	109.40	91.70	13.67	0.51	14.96	1.08
I-131	06/19/08	88.90	71.40	9.9	0.40	12.83	1.53
Mn-54	06/19/08	152.00	135.00	4.56	0.75	5.68	1.92
Zn-65	06/19/08	135.40	127.00	8.19	0.71	10.23	0.60

GROSS BETA ANALYSIS OF WATER SAMPLE (pCi/liter)

Analysis or Radionuclide	Date Prepared	Reported Average	Known Value	Standard Deviation EL	Uncertainty Analytics (3S)	Percent Coef of Variation	Normalized Deviation
Gross Beta	03/20/08	182.00	209.00	11.15	1.16	8.57	-1.73
	06/19/08	151.10	169.00	6.13	0.94	5.61	-2.10

GAMMA ISOTOPIC ANALYSIS OF WATER SAMPLES (pCi/liter)

Analysis or Radionuclide	Date Prepared	Reported Average	Known Value	Standard Deviation EL	Uncertainty Analytics (3S)	Percent Coef of Variation	Normalized Deviation
Ce-141	03/20/08	204.60	198.00	8.08	2.21	5.87	0.55
Co-58	03/20/08	58.50	56.40	9.22	0.63	15.77	0.23
Co-60	03/20/08	188.90	189.00	9.74	2.09	6.57	0.06
Cr-51	03/20/08	356.30	286.00	21.56	2.85	12.23	1.61
Cs-134	03/20/08	99.90	99.70	2.29	1.11	5.91	0.03

TABLE 5-1 (SHEET 3 of 3)

INTERLABORATORY COMPARISON PROGRAM RESULTS

GAMMA ISOTOPIC ANALYSIS OF WATER SAMPLES (pCi/liter)

Analysis or Radionuclide	Date Prepared	Reported Average	Known Value	Standard Deviation EL	Uncertainty Analytics (3S)	Percent Coef of Variation	Normalized Deviation
Cs-137	03/20/08	121.50	116.00	9.85	1.29	10.22	0.45
Fe-59	03/20/08	92.60	81.40	7.75	0.91	12.21	0.99
I-131	03/20/08	68.90	70.40	0.98	0.79	8.64	-0.25
Mn-54	03/20/08	83.20	75.00	4.32	0.83	8.84	1.11
Zn-65	03/20/08	119.90	109.00	6.41	1.21	11.03	0.83

TRITIUM ANALYSIS OF WATER SAMPLES (pCi/liter)

Analysis or Radionuclide	Date Prepared	Reported Average	Known Value	Standard Deviation EL	Uncertainty Analytics (3S)	Percent Coef of Variation	Normalized Deviation
H-3	03/20/08	3988.70	4010.00	87.41	22.33	4.28	-0.13
	06/19/08	12,900.00	13,000.00	44.32	72.33	2.16	-0.48

I-131 ANALYSIS OF AN AIR CARTRIDGE (pCi/cartridge)

Analysis or Radionuclide	Date Prepared	Reported Average	Known Value	Standard Deviation EL	Uncertainty Analytics (3S)	Percent Coef of Variation	Normalized Deviation
I-131	12/11/08	51.30	54.80	0.22	0.31	3.83	-1.75



## 6.0 CONCLUSIONS

This report confirms the licensee's conformance with the requirements of Chapter 4 of the ODCM. It provides a summary and discussion of the results of the laboratory analyses for each type of sample.

In 2008, there were four instances in which the indicator station readings were statistically discernible from the control station readings. This is discussed in detail below. No discernible radiological impact upon the environment or the public as a consequence of plant discharges to the atmosphere and to the river was established for any other REMP samples.

Gross beta results in raw and finished drinking water were statistically higher at the indicator stations than at the control station. For raw drinking water the average results at the indicator stations were 3.46 pCi/l and the average at the control station was 2.37 pCi/l. For finished drinking water the average results at the indicator stations were 2.86 pCi/l and the average at the control station was 2.07 pCi/l. All average results were below the required MDC for gross beta in water which is 4 pCi/l. There is no reporting level for gross beta in water. Gross beta is a screening analysis for beta activity. No gamma emitters were detected in raw or finished drinking water samples. The low level of beta activity seen is likely due to naturally-occurring radionuclides but could be attributed to plant effluents.

Tritium in raw drinking water was statistically higher at the indicator stations than at the control station. The average tritium at the indicator stations was 726 pCi/l and the average at the control station was 386 pCi/l. The concentration seen at the indicator station could be attributed to plant effluents. The MDC and RL for tritium in drinking water are 2000 pCi/l and 20,000 pCi/l, respectively. Although raw water is not intended for human consumption, a potential dose from tritium in the drinking water pathway was calculated assuming that a person regularly consumed untreated water taken from the river near the intake to the water treatment plants. Under these assumed circumstances, the potential dose to such an individual would be approximately 0.026 mrem in a year. This dose is approximately 1% of the annual dose limit from liquid effluents which is 3 mrem.

One of the two sediment samples at the indicator station was positive for Co-60 at 61.9 pCi/kg-dry. Neither of the two samples at the control station was positive. There has not been a positive sample at the control station from pre-op to present. The results seen at the indicator station over the years could be attributed to plant effluents. The potential dose to the maximally exposed individual from the Co-60 concentration seen at the indicator station in 2008 would be approximately  $2.82E-3$  mrem in a year which is only 0.1% of the annual dose limit from liquid effluents.

The radiological levels reported in 2008 were low. The REMP trends over the course of time from preoperation to the present are generally decreasing or have remained fairly constant. This supports the conclusion that there is no adverse radiological impact on the environment or to the public as a result of the operation of Plant Vogtle.