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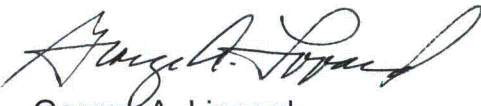
Dear Sir/Madam:

Subject: VIRGIL C. SUMMER NUCLEAR STATION UNIT 1  
DOCKET NO. 50/395  
OPERATING LICENSE NO. NPF-12  
RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

Enclosed is the South Carolina Electric & Gas Company (SCE&G) Annual Radiological Environmental Operating Report as required by Regulatory Guide 4.8 and Section 6.9.1.6 of the Virgil C. Summer Nuclear Station Technical Specifications.

If there are any questions, please contact Ms. Susan B. Reese at (803) 345-4591.

Very truly yours,



George A. Lippard

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# ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

## VIRGIL C. SUMMER NUCLEAR STATION

FOR THE OPERATING PERIOD

JANUARY 1, 2011 - DECEMBER 31, 2011

April 2012

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## **EXECUTIVE SUMMARY**

This Annual Radiological Environmental Operating Report describes the V.C. Summer Environmental Monitoring Program and the program results for the calendar year 2011.

Included are the identification of sample locations, descriptions of environmental sampling and type of analysis. Comparisons of present environmental radioactivity levels and pre-operational environmental data, land use census comparisons of doses calculated from environmental measurements, and a summary of environmental radiological sampling results. Quality assurance practices, sampling deviations and unavailable samples are also discussed.

Sampling activities were conducted as prescribed by the Offsite Dose Calculation Manual (ODCM) for V.C. Summer Nuclear Station (VCSNS) and applicable Health Physics Procedures. Required analyses were performed and detection limits met for required samples with exceptions noted. Samples were collected comprising one thousand three hundred two analyses (1,302) performed to compile the data for the 2011 Environmental Report. Supplemental samples comprising one hundred ninety six (196) analyses were performed on some media for additional information. Based on the results from the annual land use census, the current number of sampling sites for V.C. Summer Nuclear Station is sufficient.

Concentrations observed in the environment in 2011 from V.C. Summer related radionuclide concentrations were within the range of concentrations observed in the past. Review of the data indicated that very low tritium concentration in surface water was the only indicator with VCSNS produced radioactivity. This activity was well below the applicable reporting level requirements of the ODCM. It is therefore concluded that VCSNS operations have no significant radiological impact on the health and safety of the public or the environment.

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## INTRODUCTION

Virgil C. Summer Nuclear Station (VCSNS) utilizes a pressurized water reactor rated at 2900 MWt (990 MWe gross). The station is located adjacent to the Monticello Reservoir near Jenkinsville, South Carolina and approximately 26 miles northwest of Columbia. VCSNS achieved initial criticality on October 22, 1982, reached 50% power December 12, 1982 and 100% power June 10, 1983 following steam generator feedwater modifications. Steam generators were replaced in the fall of 1994. During the ninth refuel the plant was uprated to 2900 MWt (990 MWe gross). VCSNS is currently operating in the 20<sup>th</sup> fuel cycle.

VCSNS is operating in conjunction with the adjacent Fairfield Pump Storage Facility (FPSF) which consists of eight reversible pump-turbine units of 60 MWe capacity each. During periods of off-peak power demand, base load generating capacity is used to pump water from Parr Reservoir to Monticello Reservoir. Monticello Reservoir has a surface area of approximately 6800 acres and lies about 150 feet above Parr Reservoir whose full pool area is approximately 4400 acres. The pump-turbine units operate in the generating mode to meet peak system loads while Monticello Reservoir also provides condenser cooling water for VCSNS. Cooling water intake and discharge structures are separated by a jetty to ensure adequate circulation within the reservoir.

VCSNS is located in Fairfield County which, along with Newberry County, makes up the principle area within a 10 mile radius of the plant. This area is mainly forest with only about 30% devoted to small farming activities principally producing small grains, feed crops and beef cattle. Significant portions of Lexington and Richland Counties are encompassed within the 20 mile radius of the plant and exhibit similar agricultural activities. Columbia, the state capital, is the only large city within the 50 mile radius of the plant. Small agricultural concerns are predominant, but make up less than 50% of the land area. The main industrial activity is concentrated around Columbia and is generally greater than 20 miles from the VCSNS.

Liquid effluents from VCSNS are released into the Monticello/Parr Reservoirs at two discharge points: the Circulating Water Discharge Canal (CWDC) and the FPSF Penstocks. Non-nuclear drains are released to the CWDC. Effluent from the liquid waste processing system and processed steam generator blowdown are released through the penstocks. Radioactive gaseous effluents from VCSNS are released from two points: the Main Plant Vent and the Reactor Building Purge Exhaust, all considered to be ground level releases.

Radioactive liquid and gaseous releases from the facility and their potential influence on the surrounding biota and man are the primary concern of the Radiological Environmental Monitoring Program at VCSNS. This report summarizes the results of the Radiological Environmental Monitoring Program conducted during 2011. Data trends, control/indicator and preoperational/operational data intercomparisons, and other data interpretations are presented.

## DESCRIPTION OF THE RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

The Radiological Environmental Monitoring Program is carried out in its entirety by South Carolina Electric and Gas Company. The program has been designed to meet the following general commitments:

1. To analyze selected samples in important anticipated pathways for the qualification and quantification of radionuclides released to the environment surrounding VCSNS.
2. To establish correlations between levels of environmental radioactivity and radioactive effluents from VCSNS operation.

The program utilizes the concepts of control/indicator and preoperational /operational intercomparisons in order to establish the adequacy of radioactivity source control and to realistically verify the assessment of environmental radioactivity levels and subsequent radiation dose to man.

Sample media and analysis sensitivity requirements have been established to ensure that the maximum dose pathways are monitored and sensitivities represent a small fraction of annual release limits. Effluent dispersion characteristics, demography, hydrology and land use have been considered in selection of environmental sampling locations. These criteria were used to establish both the preoperational and operational phases of the Radiological Environmental Monitoring Program. Elements of the program monitor the impact of gaseous and liquid effluents released from VCSNS.

Specific methods used in monitoring the pathways of these effluents which may lead to radiation exposure of the public, based on existing demography, are summarized below in Table 1. Requirements of the Radiological Environmental Monitoring Program are specified in the VCSNS Offsite Dose Calculation Manual (ODCM). Elements of the program monitor the impact of gaseous and liquid effluents released from VCSNS.

**Table 1 - Monitoring Methods for Critical Radiation Exposure Pathways**

Effluent Release Type	Exposure Pathway	Monitoring Media
Gaseous	Immersion Dose and other External Dose Vegetation (Ingestion) Milk (Ingestion)	Thermoluminescent Dosimetry (TLD), Area Monitoring, Air Sampling, Vegetation and Food Crop Sampling, Milk Sampling, Grass (Forage) Sampling
Liquid	Fish (Ingestion) Water & Shoreline Exposure (Ingestion and Immersion) Drinking Water (Ingestion)	Fish Sampling, Surface Water Sampling, Ground Water Sampling, Shoreline and Bottom Sediment Sampling, Drinking Water Sampling

Monitoring sites indicative of plant operating conditions are generally located within a 5 mile radius of the plant. Table 6 provides a list of ODCM required sampling locations. Table 7 provides a list of supplemental sampling locations. Maps showing radiological environmental sampling locations within a radius of approximately 5 miles from VCSNS are presented as Figures 1-2 through 1-5. Figure 1-1 shows monitoring sites at distances greater than 10 miles from the plant. These locations indicate regional fluctuations in background radiation levels.

In addition to preoperational/operational data intercomparisons, control/indicator data intercomparisons are utilized. This is done to assess the probability that any observed abnormal measurement of radioactivity concentration is due to random or regional fluctuations rather than to a true increase in local environmental radioactivity concentration.

Environmental data is gathered through multiple types of sampling and measurements at specific locations. Several multiple sampling combinations are in use around the VCSNS. For example, all air sampling locations serve as environmental dosimetry monitoring locations. At these locations, airborne plant effluents are monitored for gamma immersion dose (noble gases), in addition to air contaminants. Monitoring locations Site 6 (1.0 mi. ESE) and Site 7 (1.0 mi. E) have broadleaf vegetation gardens for monitoring gaseous effluent deposition (ingestion pathway) in the two sectors having the highest deposition coefficients (D/Q) with real potential for exposure. Monitoring location Site 18 (16.5 mi. S) serves as a control location for direct radiation and Site 40 (11.9 mi. SSE) serves as a control location for garden monitoring. In the past Site 18 which is a private residence, was used as the control location for garden monitoring. The land owner declined to renew the lease and the control garden was relocated to Site 40 which is the location of the Station's Emergency Operating Facility.

Liquid effluents are monitored using three different monitoring media (fish, bottom sediment and surface water) at the two most probable affected bodies of water around the plant: Site 21, Parr Reservoir (2.7 mi. SSW) and Site 23, Monticello Reservoir (0.5 mi. ESE). The control location for liquid effluent comparisons is at Site 22, Neal Shoals (26.0 mi. NNW) on the Broad River.

Quality of analytical measurements is demonstrated by participation in a laboratory intercomparison program. Results of the intercomparison program with an outside vendor and VCSNS Count Room were satisfactory in 2011. The results of each of these quality control checks of the Radiological Environmental Monitoring program verify the technical credibility of analytical data generated and reported by the program.

## LAND USE CENSUS

Annually a land use census is performed within a 5 mile radius of VCSNS to verify the adequacy of sample locations. In addition, the location of the maximum exposed individual (MEI) is identified. The results of the land use census performed in 2011 are included in Table 4. A verification of the maximum exposed individual location is presented in Table 5. Identification of the highest offsite dose locations was performed by calculating a hypothetical dose based on predicted VCSNS source term from the Operating License Environmental Report and 2011 meteorological data. Exposure pathways used in the analysis were those identified during the land use census.

The location and pathway presently used in the ODCM for offsite organ dose calculations (E 1.1 miles - residence/garden) was found to have a calculated dose of  $3.46\text{E}+0$  mrem/yr. In addition, the ODCM required environmental gardens (ESE 1.0 and E 1.0 mile) were found to have a calculated dose of  $2.20\text{E}+0$  and  $4.26\text{E}+0$  mrem/year. There were no milking animals or dairy activity found within 5 kilometers of VCSNS. Therefore, changes to the ODCM gaseous effluent calculations or garden sample locations are not indicated.

## MONITORING RESULTS AND DISCUSSION

The results of the Radiological Environmental Monitoring Program for 2011 are summarized in Table 8. For comparison, preoperational data are summarized in Table 9. The Radiological Environmental Program attained a program compliance rate of approximately 98.4%. A listing of program exceptions and their respective causes are included in Table 11. Analysis of the impact of these omissions verified that program quality has not been affected.

Corbicula harvest for possible human consumption was observed in Lake Monticello in 2005. Since that time Corbicula analysis has been incorporated in the Supplemental Sampling Program. Samples were collected and analyzed for gamma emitting isotopes. No measurable gamma emitting nuclides were detected above minimum detectable activity (MDA).

Gross beta activities measured in air particulate samples collected at indicator locations around VCSNS were consistent with preoperational levels and not statistically different from control locations. The highest site-specific mean activity ( $2.24\text{E}-2$  pCi/m<sup>3</sup>) was measured at indicator location Site 7 (Lab Garden 1.0 mi. E). The results indicate that the operation of VCSNS has not contributed to detectable increases of airborne gross beta activity in the environment.

Gamma spectroscopy measurements of composited air particulate samples indicated <sup>137</sup>Cs at 1 of 12 samples taken at indicator location, Site 2 (transmission line 1.2 mi. SW) at a concentration of  $2.33\text{E}-3$  pCi/m<sup>3</sup>. This activity is below the required LLD of  $6.00\text{E}-2$  pCi/m<sup>3</sup>.

Activated charcoal cartridges indicated  $^{131}\text{I}$  activity in 21 of 259 samples at all five indicator sites with concentrations ranging from  $1.68\text{E-}2$  to  $1.76\text{E-}1$   $\text{pCi/m}^3$ . Control Site 17 (Columbia Water Works 25 mi. SE) also indicated  $^{131}\text{I}$  in 4 of 51 samples at concentrations ranging from  $2.56\text{E-}2$  to  $1.39\text{E-}1$   $\text{pCi/m}^3$ . 99.4% of the required indicator/control air samples were collected.

Environmental dosimetry measurements did not differ significantly from preoperational measurements. Indicator and control dosimetry measurements also showed no appreciable differences. Comparison with other operational years shows no statistically significant difference. Monitoring locations Site 4 (Fairfield Hydro 1.2 mi. WNW) and Site 17 (Columbia Water Works 25 mi. SE) were the indicator locations showing the highest mean exposure rate of  $1.14\text{E+}1$   $\mu\text{R/hr}$ . This is similar to the 2010 value of  $1.14\text{E+}1$   $\mu\text{R/hr}$  and consistent with the highest mean exposure rate of  $1.40\text{E+}1$   $\mu\text{R/hr}$  measured during the preoperational period. 99.4% of the required TLDs were collected.

Gamma spectroscopy measurements of surface water samples did not indicate the presence of activated corrosion or fission products above the respective MDA for indicator sites. Tritium analysis indicated the presence of tritium above MDA in two indicator samples. Site's 21 (Parr Reservoir 2.7 mi. SSW) and Site 23 (Discharge Canal Monticello Reservoir 0.5 mi. ESE) had tritium concentrations of  $7.34\text{E+}2$  and  $7.32\text{E+}2$   $\text{pCi/l}$  respectively. All concentrations were well below the reporting limit. 97.2% of indicator/control surface water samples were collected.

Gamma spectroscopy measurements of the ODCM required ground water samples did not indicate the presence of activated corrosion or fission products above the respective MDAs. Tritium analysis indicated the presence of tritium above MDA in one indicator sample. Site 112 (NPDES Well GW-9 0.36 mi. SSE) had a tritium concentration of  $5.42\text{E+}2$   $\text{pCi/l}$ . This is an on-site well. 91.3% of indicator/control ground water samples were collected.

Gamma spectroscopy measurements of drinking water samples collected from the Jenkinsville water supply and Site 17 (Columbia Water Works 25.0 mi. SE) did not indicate the presence of activated corrosion or fission product activity above the respective MDAs with the exception of one sample from Site 17 (Columbia Water Works 25.0 mi. SE) which had an I-131 concentration of  $5.34\text{E-}1$   $\text{pCi/l}$ . This concentration is below the required LLD. The highest indicator and control site-specific gross beta activity was measured at Site 17 (Columbia Water Works 25.0 mi. SE) at a level of  $7.45\text{E+}0$   $\text{pCi/l}$ . 100% of indicator/control drinking water samples were collected.

There were no milk samples collected in 2011. Milk sampling is required to be performed at the three highest dose locations within 5 kilometers of the plant or at 5 to 8 kilometers of the plant, if doses are calculated to be greater than 1 mrem per year. Presently there are no locations meeting this criteria for indicator dairies. The closest dairy is approximately 8 kilometers from the plant (see Table 4). Milk samples will be obtained from this dairy if gaseous releases from the plant exceed 5% of quarterly organ dose limits or radionuclides (attributed to the operation of VCSNS) are detected in broadleaf vegetation, grass or air samples at concentrations greater than required LLDs.



Gamma spectroscopy measurement of supplemental grass samples collected indicated  $^{137}\text{Cs}$  in 6 of 9 samples at Site 2 (transmission line 1.2 mi. SW) at concentrations ranging from  $1.63\text{E}+1$  to  $3.38\text{E}+1$  pCi/kg. 1 of 11 samples taken at control Site 40 (Emergency Operations Facility 11.9 mi. SSE) indicated  $^{137}\text{Cs}$  at a concentration of  $1.29\text{E}+1$  pCi/kg. The maximum preoperational control activity was  $3.40\text{E}+2$  pCi/kg. 91.7% of indicator/control supplemental grass samples were collected.

Gamma spectroscopy measurements of the broadleaf samples collected indicated  $^{131}\text{I}$  in 1 of 12 samples at Site 6 (Environmental Lab Garden 1.0 mi. ESE), and one of twelve samples at Site 7 (Environmental Lab Garden 1.0 mi. E), at concentrations of  $9.69\text{E}+0$  and  $1.94\text{E}+1$  pCi/kg respectively. These concentrations are below the required LLD. All of the required indicator/control broadleaf samples were collected.

Gamma spectroscopy measurements of all non-leafy (other vegetation) supplemental samples collected did not indicate the presence of activated corrosion or fission products above the respective MDA.

Gamma spectroscopy measurements of the fish samples collected did not indicate the presence of activated corrosion or fission products above the respective MDAs for indicator sites. 1 of 6 control samples taken from Site 22 (Neal Shoals 26 mi. NNW) indicated  $^{137}\text{Cs}$  at a concentration of  $1.17\text{E}+1$  pCi/kg. All of the required indicator/control fish samples were collected.

Gamma spectroscopy measurements of sediment samples indicated the detection of  $^{137}\text{Cs}$  in 1 of 4 indicator samples. At Site 21 (Parr Res. 2.7 mi. SSW)  $^{137}\text{Cs}$  at a concentration of  $1.08\text{E}+2$  pCi/kg was detected.  $^{137}\text{Cs}$  was detected in 2 of 2 control samples taken at Site 22 (Neal Shoals 26 mi. NNW) at a concentration of  $7.93\text{E}+1$  and  $1.43\text{E}+2$  pCi/kg. All required indicator/control sediment samples were collected.

**Table 2 - 2011 Fission and Activated Corrosion Product Activity in Sediment**

Location	Radionuclide	Activity (pCi/kg)		Corresponding Calculated Annual Dose Equivalent (mrem/yr)	
				Total Body	
Monticello Reservoir		Maximum	Mean	Maximum	Mean
	$^{137}\text{Cs}$	$1.08\text{E}+2$	$1.08\text{E}+2$	$9.07\text{E}-3$	$9.07\text{E}-3$

## CONCLUSION

As in previous years of VCSNS operation, the presence of fission product activity attributed to residual fallout from atmospheric weapons testing and the Chernobyl accident were detected in environmental media including sediment, fish and grass.

No detectable fission or activation product activity attributed to VCSNS operations was observed in environmental media with the exception of:

- Tritium in two surface water samples at Site 21 (Parr Res. 2.7 mi. SSW) and Site 23 (Discharge Canal Monticello Reservoir .5 mi. ESE), and one ground water sample, Site 112 (NPDES Well GW-9 0.36 mi. SSE) which were well below the EPA drinking water standard.
- Cs-137 in one sediment sample Site 21 (Parr Reservoir 2.7 mi. SSW). Sediment samples at Control Site 22 (Neal Shoals 26.0 mi. NNW) also contained CS-137.

Samples obtained from all Control and Indicator air sample Sites, drinking water at Site 17 (Columbia Water Works 16.5 mi. S), broadleaf vegetation at Site 6 (Environmental Lab Garden 1.0 mi. ESE), and Site 7 (Environmental Lab Garden 1.0 mi. E), identified detectable concentrations of I-131 that could be related to operation of VCSNS. Given the following facts, the detectable concentrations are not a result of VCSNS operation:

- The quantities of radioactive airborne effluents from VCSNS operations during 2011 did not increase significantly compared to 2010.
- Prior REMP sample results have not detected the presence of these isotopes in composited air particulate, activated charcoal cartridges, or broadleaf samples.
- The concentrations being detected in the indicator samples were also identified in the control samples for air samples.

As such, the atypical detection of these radionuclides is credibly attributed to the trans-Pacific transport of airborne releases from Dai-Ichi, Fukushima following the March 11, 2011 Tohoku earthquake and is not related to the operations of VCSNS.

The dose from this activity represents a small fraction of VCSNS effluent dose limits. The absence of an impact was expected since historically, releases from VCSNS have been a small fraction of ODCM Specification limits.

The dose calculated for the maximum exposed individual will not result in observable effect on the ecosystem or general public. The results of the Radiological Environmental Monitoring Program, therefore, substantiate the continuing adequacy of source control at VCSNS and conformance of station operation to 10 CFR 50, Appendix I design objectives.

**Table 3 - Required Sampling Site Locations**

Site No.	Description	Distance <sup>1</sup> (Miles)	Direction <sup>2</sup>	Sample Type(s) <sup>3</sup>
1	Borrow Pit	1.2	179.8 S	DQ
2	Transmission Line	1.1	225.0 SW	AP, RI, DQ
3	Firing Range	1.2	270.0 W	DQ
4	Fairfield Hydro	1.2	289.5 WNW	DQ
5	Transmission Line Entrance	0.9	144.0 SE	DQ
6	Environmental Lab Garden	1.0	111.0 ESE	AP,RI,GA,DQ,GW
7	Environmental Lab Garden	1.0	97.8 E	AP,RI,DQ, GA
8	Monticello Res. S of Rd 224	1.5	62.0 ENE	DQ
9	Ball Park	2.3	41.6 NE	DQ
10	Meteorological Tower #2	2.5	25.5 NNE	DQ
12	Old Hwy 99	4.2	349.4N	DQ
13	North Dam	2.9	333.0 NNW	DQ
14	Dairy (Shealy) <sup>4</sup>	6.5	277.0 W	MK,GR
16	Dairy (Parr) <sup>4</sup>	20.0	275.5 W	MK,GR
16a	TLD Location	28.0	278.6W	DQ
17	Columbia Water Works	25.0	144.0 SE	AP,RI,DQ,DW
18	Residence/Pine Island Club <sup>5,8</sup>	16.5	165.0 S	DQ,GA
19	Residence/Little Saluda	21.0	224.0 SSW	DQ
20	Residence/Whitmire	22.0	309.5 NW	DQ
21	Parr Reservoir	2.7	199.5 SSW	SW,FH,BS
22	Neal Shoals	26.0	343.1 NNW	SW,FH,BS
23	Discharge Canal (Mont, Res.)	0.5	104.5 ESE	SW,FH,BS
26	On Site Well (P2)	460 Ft	270.0 W	GW
27	On Site Well (P5)	510 Ft	180.0 S	GW
28	New Nuclear Deployment <sup>6</sup>	2.6	170.2 SSE	DW
29	Trans. Line WSW of VCSNS	1.0	260.6 WSW	DQ
30	Oak Tree North of Borrow Pit <sup>7</sup>	1.0 / 0.5	196.2 SSW	DQ, AP, RI
31	McCrorey-Liston School	6.6	11.5 NNE	DQ
32	Clark Bridge Road and Brooks Drive	4.6	24.0 NNE	DQ
33	Rd 48 near Hwy 213	4.2	68.0 ENE	DQ
34	Rd 419 North of Hwy 60	4.9	111.0 ESE	DQ
35	Glenn's Bridge Road	4.6	132.0 SE	DQ
36	Woods at Jenkinsville Post Office	3.1	151.0 SSE	DQ
37	Residence	4.9	304.8 NW	DQ
39	Lake Murray Water Treatment Facility	14.0	168.0 SSE	DW
40	Emergency Operations Facility <sup>8</sup>	11.9	157.0 SSE	GA, GR

**Table 3 (cont) – Required Sampling Site Locations**

<b>Site No.</b>	<b>Description</b>	<b>Distance<sup>1</sup> (Miles)</b>	<b>Direction<sup>2</sup></b>	<b>Sample Type(s)<sup>3</sup></b>
41	Below Catwalk at Trestle	3.8	182.0 S	DQ
42	Broad River Rd (Peak Residence)	3.8	198.0 SSW	DQ
43	Hwy 176 and Rd 435	5.2	236.0 SW	DQ
44	Rd 28 at Cannon's Creek	2.8	256.6 WSW	DQ
45	Rd 33 at Pomaria	5.8	253.2 WSW	DQ
46	Rd 28 at Heller's Creek	3.7	291.5 WNW	DQ
47	Fairfield Tailrace	1.0	316.0 NW	DQ
52	Monticello (Rd 11)	3.8	13.0 NNE	DQ
53	Rd 359	3.0	46.5 NE	DQ
54	Jenkinsville School	1.7	72.5 ENE	DQ
55	St. Barnabas Church	2.8	91.5 E	DQ
56	Old Jenkinsville Dinner	2.0	144.0 SE	DQ
58	Residence	2.5	157.0 SSE	DQ
59	New Nuclear Deployment <sup>6</sup>	2.6	170.2 SSE	DQ, GW
60	Rd 98 near Rd 28	3.5	274.6 W	DQ
100	Remediation Well (B-1)	450 Ft	NW	GW
101	Remediation Well (B-2)	300 Ft	NNW	GW
102	Remediation Well (B-6)	400 Ft	NE	GW
103	Remediation Well (DW-13)	80 Ft	NE	GW
104	Remediation Well (B-9)	175 Ft	NE	GW
105	Remediation Well (DW-11)	100 Ft	ESE	GW
106	Remediation Well (DW-7)	250 Ft	SE	GW
107	Remediation Well (B-28)	400 Ft	SW	GW
108	Remediation Well (DW-19)	250 Ft	W	GW
109	Remediation Well (B-35)	450 Ft	NW	GW
110	Remediation Well (B-36)	300 Ft	NW	GW
111	NPDES Well (GW-8)	0.27	320 SE	GW
112	NPDES Well (GW-9)	0.36	331 SSE	GW
113	NPDES Well (GW-12)	0.33	332 SSE	GW
114	NPDES Well (GW-13A)	0.39	317 SE	GW
115	NPDES Well (GW-15)	0.39	330 SSE	GW

**Table 3 (cont) – Required Sampling Site Locations**

Footnotes

1. Distance given is the distance between the site location and the VCSNS reactor containment building.
2. Direction given in degrees from true north-south line through center of reactor containment building.
3. Sample Types:  

AP = Air Particulate	GW = Ground Water	GA = Garden
RI = Air Radioiodine	DW = Drinking Water	FH = Fish
DQ = Quarterly TLD	MK = Milk	BS = Bottom Sediment
SW = Surface Water	GR = Grass (Forage)	
4. Sites 14 and 16 are not presently in use. If conditions change, requiring a renewal of dairy sampling these sites will be reactivated.
5. Site 18 consists of two locations in close proximity to Lake Murray. Garden product samples are taken at the Wyse residence. The TLD is located on Pine Island.
6. Site 28 for drinking water and Site 59 for quarterly TLD measurements are co-located at the location of the SCE&G New Nuclear Deployment.
7. Site 30 consists of two locations in the same sector. The air sampler is located 0.5 miles from the reactor to support construction of a new facility. The TLD is located at the site boundary in the same sector.
8. Site 40 (11.9 mi. SSE) serves as a control location for garden monitoring. In the past Site 18 which is a private residence, was used as the control location for garden monitoring. The land owner declined to renew the lease and the control garden was relocated to Site 40 which is the location of the Station's Emergency Operating Facility.

**Table 4 - Results of the 2011 Land Use Census Verification**

Sector	Nearest Residence	Miles	Nearest Garden	Miles	Nearest Cattle	No. Milked	Miles	Nearest Goat	No. Milked	Miles
N	P. Oliver	3.73	Edna Fuller	4.01	John Robinson	0	3.4			
NNE	Thomas K. Crumblin	2.9		3.21	W/ Charles Coleman	0	4.97			
NE	Gregrey Guinyard Jr.	1.55	Edna Richards	3.21						
ENE	Essie Gregg (A)	1.56	Essie Mae Glenn	1.68						
E	Lynn Mincy	1.2	Lynn Mincy	1.2						
ESE	Carie Lee Martin	1.1	James Pearson	1.36						
SE	Mary White	1.44	Mary White	1.44	Sim Roberts	0	4.7			
SSE	Ronnie Mann	2.39	Ronnie Mann	2.39						
S	Kelly Boulware	3.56	Kelly Boulware	3.56	Shirley Counts	0	5			
SSW	Nick Bates	3.11	Nora Wicker	3.77	Joe Smith	0	4.73			
SW	Marvin Miller	3.3	Marvin Miller	3.3						
WSW	Ron Hope	2.9	Steve All	4.83	Ken/ Virg Graham (*)	0	4.98	Steve All	10	4.83
W	Jerry Cassado	2.55	Marion Livingston	2.8	Marion Livingston	0	2			
W					Ken/ Virg Graham (*)	90	5			
WNW	Unknown Residence	2.53	Ronnie Leitzey	4.72	Ronnie Leitzey	1	4.15	Ronnie Leitzey	15	4.15
NW	Louise Workman	3.9								
NNW	Frank March	2.9	Frank March	2.9	Frank March	0	2.9			

(A) Change In Closest Residence

(\*) Keneth and Virgil Graham cows grazed in the W and WSW

**Table 5 Critical Receptor Evaluation for 2011**

NAME	SECTOR	MILES	PATHWAY	X/Q	D/Q	DOSE* mRem/y
John Robinson	N	3.4	B	2.60E-07	8.00E-10	8.01E-02
P. Oliver	N	3.73	Res	2.20E-07	6.50E-10	8.21E-03
Thomas K. Crumblin	NNE	2.9	Res	4.00E-07	1.40E-09	1.50E-02
Will/Charles Coleman	NNE	4.97	B	1.40E-07	4.30E-10	4.31E-02
Gregrey Guinyard Jr.	NE	1.55	Res	2.00E-06	6.60E-09	7.50E-02
Edna Richards	NE	3.21	Res,Gar	4.40E-07	1.20E-09	3.33E-01
Bessie Gregg	ENE	1.56	Res	1.80E-06	6.40E-09	6.77E-02
Essie Mae Glenn	ENE	1.68	Res,Gar	1.50E-06	5.30E-09	1.43E+00
** Garden-7	E	1	Res,Gar	4.10E-06	1.60E-08	4.26E+00
<sup>1</sup> Lynn Mincy	E	1.2	Res,Gar	2.60E-06	1.00E-08	2.67E+00
** Garden-6	ESE	1	Res,Gar	2.30E-06	8.20E-09	2.20E+00
Carrie Lee Martin	ESE	1.1	Res	1.80E-06	6.40E-09	6.77E-02
James Pearson	ESE	1.36	Res,Gar	1.10E-06	3.70E-09	1.00E+00
Mary White	SE	1.44	Res,Gar	7.20E-07	3.00E-09	7.94E-01
Sim Roberts	SE	4.7	Res,Gar,B	6.00E-08	1.90E-10	7.07E-02
Ronnie Mann	SSE	2.39	Res,Gar	1.50E-07	8.10E-10	2.10E-01
Kelly Boulware	S	3.56	Res,Gar	7.90E-08	4.00E-10	1.04E-01
Shirley Counts	S	5	Res,Gar,B	4.00E-08	1.90E-10	6.86E-02
NND Construction Site	SSW	0.49	Res	8.10E-06	6.40E-08	3.23E-01
Nick Bates	SSW	3.11	Res	1.40E-07	9.50E-10	5.50E-03
Nora Wicker	SSW	3.77	Res,Gar	9.60E-08	6.20E-10	1.59E-01
Joe Smith	SSW	4.73	Res,B	6.00E-08	3.70E-10	3.91E-02
Marvin Miller	SW	3.3	Res,Gar	1.00E-07	8.50E-10	2.14E-01
Ron Hope	WSW	2.9	Res	1.10E-07	6.90E-10	4.29E-03
Steve All	WSW	4.83	Res,Gar,G	3.70E-08	2.20E-10	5.92E-02
Ken/Virg Graham	WSW	4.98	B	3.50E-08	2.10E-10	2.08E-02
Jerry Cassado	W	2.55	Res	1.10E-07	6.60E-10	4.27E-03
Marion Livingston	W	2	B	1.90E-07	1.20E-09	1.20E-01
Marion Livingston	W	2.8	Res,Gar	9.00E-08	5.30E-10	1.36E-01
Marion Livingston	W	2 & 2.8	Res,Gar,B	BOTH	BOTH	2.56E-01
Ken/Virg Graham	W	5	Res,Gar,B,C/M	2.70E-08	1.40E-10	7.57E-02
Unknown Resident	WNW	2.53	Res	7.90E-08	3.80E-10	3.02E-03
Ronnie Leitzsey	WNW	4.15	C/M,B,G/M,G	2.80E-08	1.20E-10	1.20E-01
Ronnie Leitzsey	WNW	4.72	Res,Gar	2.20E-08	9.20E-11	2.43E-02
Ronnie Leitzsey	WNW	4.15 & 4.72	Res,Gar,C/M,B,G/M,G	BOTH	BOTH	1.44E-01
Louise Workman	NW	3.9	Res	8.50E-08	3.00E-10	3.20E-03
Frank March	NNW	2.9	Res,Gar,B	2.80E-07	8.80E-10	3.28E-01
ODCM ORGAN DOSE	E	1.1	Res,Gar	3.30E-06	1.30E-08	3.46E+00

**Pathway**

Res = Residence

B = Beef

G = Goat

Gar = Garden

C/M = Cow/Milk(Infant)

G/M = Cow/Milk(Infant)

**Footnotes:**

<sup>1</sup> Maximum exposed individual.

\* Hypothetical dose based on Operating License Environmental Report Source Term.

\*\* ODCM required environmental gardens.



**Table 6 – Radiological Environmental Monitoring Program Specifications**

Exposure Pathway and/or Sample	Criteria for Selection of Sample Number & Location	Sampling and Collection Frequency	Sample Location	Type & Frequency of Analysis
<b>AIRBORNE:</b> I. Particulate	A) 3 Indicator samples to be taken at locations (in different sectors) beyond but as close to the exclusion boundary as practicable where the highest offsite sector ground level concentrations are anticipated. <sup>2</sup>	Continuous sampler operation with weekly collection.	2 7 30	Gross beta following filter change; Quarterly composite (by location) for gamma isotopic.
	B) 1 Indicator sample to be taken in the sector beyond but as close to the exclusion boundary as practicable corresponding to the residence having the highest anticipated offsite ground level concentration or dose. <sup>2</sup>	Continuous sampler operation with weekly collection.	6	Gross beta following filter change; Quarterly composite (by location) for gamma isotopic.
	C) 1 Indicator sample to be taken at the location of one of the dairies being sampled meeting the criteria of VII(A). <sup>2,4</sup>	Continuous sampler operation with weekly collection.	N/A	Gross beta following filter change; Quarterly composite (by location) for gamma isotopic.
	D) 1 Control sample to be taken at a location at least 10 air miles from the site and not in the most prevalent wind directions. <sup>2</sup>	Continuous sampler operation with weekly collection.	17	Gross beta following filter change; Quarterly composite (by location) for gamma isotopic.
II. Radioiodine	A) 3 Indicator samples to be taken at two locations as given in I(A) above.	Continuous sampler operation with weekly canister collection.	2 7 30	Gamma Isotopic for Iodine 131 weekly.
	B) 1 Indicator sample to be taken at the location as given in I(B) above.	Continuous sampler operation with weekly canister collection.	6	Gamma Isotopic for Iodine 131 weekly.
	C) 1 Indicator sample to be taken at the location as given in I(C) above.	Continuous sampler operation with weekly canister collection.	N/A	Gamma Isotopic for Iodine 131 weekly.
	D) 1 Control sample to be taken at a location similar in nature to I(D) above.	Continuous sampler operation with weekly canister collection.	17	Gamma Isotopic for Iodine 131 weekly.

Exposure Pathway and/or Sample	Criteria for Selection of Sample Number & Location	Sampling and Collection Frequency	Sample Location	Type & Frequency of Analysis
III. Direct	<p>A) 13 Indicator stations to form an inner ring of stations in the 13 accessible sectors within 1 to 2 miles of the plant.</p> <p>B) 16 indicator stations to form an outer ring of stations in the 16 accessible sectors within 3 to 5 miles of the plant.</p> <p>C) 11 Stations to be placed in special interest areas such as population centers, nearby residences, schools and in 4 or 5 areas to serve as controls.</p>	<p>Monthly or quarterly exchange<sup>5,7</sup> two or more dosimeters at each location.</p> <p>Monthly or quarterly exchange<sup>5,7</sup> two or more dosimeters at each location.</p> <p>Quarterly exchange<sup>7</sup>; two or more dosimeters at each location.</p>	<p>1,2,3,4,5,6, 7,8,9,10,29, 30,47</p> <p>12,13,32,33, 34,35,36,37, 41,42,43,44, 46,53,55,60</p> <p>16,17,18,19, 20,31,45,52, 54,56,58</p>	<p>Gamma dose monthly or quarterly.</p> <p>Gamma dose monthly or quarterly.</p> <p>Gamma dose quarterly.</p>
WATERBORNE IV. Surface Water	<p>A) 1 Indicator sample downstream to be taken at a location which allows for mixing a dilution in the ultimate receiving river.</p> <p>B) 1 Control sample to be taken at a location on the receiving river sufficiently far upstream such that no effects of pumped storage operation are anticipated.</p> <p>C) 1 Indicator sample to be taken in the upper reservoir of the pumped storage facility at the plant discharge canal.</p>	<p>Time composite samples<sup>6</sup> with collection every month.<sup>5</sup></p> <p>Time composite samples<sup>6</sup> with collection every month.<sup>5</sup></p> <p>Time composite samples<sup>6</sup> with collection every month.<sup>5</sup></p>	<p>21<sup>3</sup></p> <p>22<sup>3</sup></p> <p>23<sup>3</sup></p>	<p>Gamma isotopic monthly with quarterly composite (by location) to be analyzed for tritium.<sup>7</sup></p> <p>Gamma isotopic monthly with quarterly composite (by location) to be analyzed for tritium.<sup>7</sup></p> <p>Gamma isotopic monthly with quarterly composite (by location) to be analyzed for tritium.<sup>7</sup></p>
V. Ground Water	<p>A) 19 Indicator samples to be taken within the exclusion boundary and in the direction of potentially affected ground water supplies.</p> <p>B) 1 Control sample from unaffected location.</p>	<p>Quarterly grab sampling.<sup>7</sup></p> <p>Quarterly grab sampling.<sup>7</sup></p>	<p>6, 26, 27, 100-115</p> <p>59</p>	<p>Gamma isotopic and tritium analyses quarterly.<sup>7</sup></p> <p>Gamma isotopic and tritium analyses quarterly.<sup>7</sup></p>

Exposure Pathway and/or Sample	Criteria for Selection of Sample Number & Location	Sampling and Collection Frequency	Sample Location	Type & Frequency of Analysis
VI. Drinking Water	A) 1 Indicator sample from a nearby public ground water supply source.	Monthly grab sampling. <sup>5</sup>	28	Monthly <sup>5</sup> gamma isotopic and gross beta analyses and quarterly <sup>7</sup> composite for tritium analyses.
	B) 1 Indicator (finished water) sample from the nearest downstream water supply.	Monthly composite sampling.	17	Monthly <sup>5</sup> gamma isotopic and gross beta analyses and quarterly <sup>7</sup> composite for tritium analyses.
	C) 1 Control (finished water) sample from an unaffected water supply.	Monthly composite sampling.	39	Monthly <sup>5</sup> gamma isotopic and gross beta analyses and quarterly <sup>7</sup> composite for tritium analyses.
INGESTION: VII. Milk <sup>4</sup>	A) Samples from milking animals in 3 locations within 5 km having the highest dose potential. If there are none then 1 sample from milking animals in each of 3 areas between 5 to 8 km distance where doses are calculated to be greater than 1 mrem per year. <sup>10</sup>	Semimonthly when animals are on pasture <sup>8</sup> , monthly other times. <sup>5</sup>	To be supplied when milk animals are found in accordance with criteria VII.A.	Gamma isotopic and I-131 analysis semimonthly <sup>8</sup> when animals are on pasture, monthly other times. <sup>5</sup>
	B) 1 Control sample to be taken at the location of a dairy > 20 miles distance and not in the most prevalent wind direction. <sup>2</sup>	Semimonthly when animals are on pasture <sup>8</sup> , monthly other times. <sup>5,11</sup>	16	Gamma isotopic and I-131 analysis semimonthly <sup>8</sup> when animals are on pasture, monthly other times. <sup>5</sup>
	C) 1 Indicator grass (forage) sample to be taken at the location of one of the dairies being sampled meeting the criteria of VII(A), above, when animals are on pasture.	Monthly when available. <sup>5</sup>	To be supplied when milk animals are found in accordance with criteria VII.A.	Gamma isotopic.
	D) 1 Control grass (forage) sample to be taken at the location of VII(B) above.	Monthly when available. <sup>5,11</sup>	16	Gamma isotopic.

Exposure Pathway and/or Sample	Criteria for Selection of Sample Number & Location	Sampling and Collection Frequency	Sample Location	Type & Frequency of Analysis
VIII. Food Products	A) 2 Indicator samples of broadleaf vegetation grown in the 2 nearest offsite location of highest calculated annual average ground level D/Q if milk sampling is not performed within 3 km or if milk sampling is not performed at a location within 5-8 km where the doses are calculated to be greater than 1 mrem/yr. <sup>10</sup>	Monthly when available. <sup>5</sup>	6 7	Gamma isotopic on edible portion.
	B) 1 Control sample for the same foods taken at least 10 miles distance and not in the most prevalent wind direction if milk sampling is not performed within 3 km or if milk sampling is not performed at a location within 5 to 8 km where the doses are calculated to be greater than 1 mrem/yr. <sup>10</sup>	Monthly when available. <sup>5,12</sup>	18,40	Gamma isotopic on edible portion.
IX. Fish	A) 1 Indicator sample to be taken at a location in the upper reservoir.	Semiannual <sup>9</sup> collection. <sup>1</sup>	23 <sup>3</sup>	Gamma isotopic on edible portions semiannually. <sup>9</sup>
	B) 1 Indicator sample to be taken at a location in the lower reservoir.	Semiannual <sup>9</sup> collection. <sup>1</sup>	21 <sup>3</sup>	Gamma isotopic on edible portions semiannually. <sup>9</sup>
	C) 1 Control sample to be taken at a location on the receiving river sufficiently far upstream such that no effects of pumped storage operation are anticipated.	Semiannual <sup>9</sup> collection. <sup>1</sup>	22 <sup>3</sup>	Gamma isotopic on edible portions semiannually. <sup>9</sup>
AQUATIC: X. Sediment	A) 1 Indicator sample to be taken at a location in the upper reservoir.	Semiannual grab sample. <sup>9</sup>	23 <sup>3</sup>	Gamma isotopic.
	B) 1 Indicator sample to be taken on or near the shoreline of the lower reservoir.	Semiannual grab sample. <sup>9</sup>	21 <sup>3</sup>	Gamma isotopic.
	C) 1 Control sample to be taken at a location on the receiving river sufficiently far upstream such that no effects of pumped storage operation are anticipated.	Semiannual grab sample. <sup>9</sup>	22 <sup>3</sup>	Gamma isotopic.

**Table 6 (cont) - Radiological Environmental Monitoring Program Specifications**

**FOOTNOTES**

1. Fish include 3 groups (Bass, Bream/Crappie, Catfish/Carp.)
2. Sample site locations are based on 5-year average meteorological analysis.
3. Though generalized areas are noted for simplicity of sample site enumeration, airborne, water and sediment sampling is done at the same location, whereas biological sampling sites are generalized areas in order to reasonably assure availability of samples.
4. Milking animal and garden survey results will be analyzed annually. If the survey should indicate new activity the owners shall be contacted with regard to a contract for supplying sufficient samples. If contractual arrangements can be made, site(s) will be added for additional milk sampling up to a total of three Indicator locations.
5. Not to exceed 35 days.
6. Time composite samples are samples which are collected with equipment capable of collecting an aliquot at time intervals which are short relative to the compositing period.
7. At least once per 100 days.
8. At least once per 18 days.
9. At least once per 200 days.
10. The dose shall be calculated for the maximum organ and age group, using the guidance/methodology contained in Regulatory Guide 1.109, Rev. 1 and the parameters particular to the site.
11. Milk and forage sampling at the control location is only required when locations meeting the criteria of VII(A) are being sampled.
12. Site 40 serves as a control location for garden monitoring. In the past Site 18 which is a private residence, was used as the control location for garden monitoring. The land owner declined to renew the lease and the control garden was relocated to Site 40 which is the location of the Station's Emergency Operating Facility.

**Table 7 – Supplemental Radiological Environmental Monitoring**

Exposure Pathway and/or Sample	Criteria for Selection of Sample Number & Location	Sampling and Collection Frequency	Sample Location	Type & Frequency of Analysis
AIRBORNE: S-I. Particulate	A) 1 Indicator sample monitoring the nearest community with the highest anticipated dose or ground level concentration.	Continuous sampler operation with weekly collection.	8	Gross beta following filter change; Monthly Composite (by location) for gamma isotopic.
S-II. Radioiodine	A) 1 Indicator sample to be taken from the location of S-1(A) above.	Continuous sampler operation with weekly collection.	8	Gamma isotopic for I-131 weekly.
S-III. Direct	A) 5 stations to be placed within the exclusion boundary.	Quarterly exchange <sup>7</sup> ; two or more dosimeters at each location.	61,62,63, 68 & 99	Gamma dose quarterly.
	B) 2 stations to be placed around VCSNS sludge lagoons.	Quarterly exchange <sup>7</sup> ; two or more dosimeters at each location.	94,97	Gamma dose quarterly.
WATERBORNE: S-IV. Surface Water	A) 1 indicator sample to be taken of the combined wastewater discharge.	Composite samples with monthly collection. <sup>13,5</sup>	77	Gamma isotopic and tritium.
	B) 1 Indicator sample taken at each storm drain outfall.	Daily sample with monthly composite.	72,73	Gamma isotopic and tritium.
S-VI. Drinking Water	A) 1 Indicator (finished water) sample to be taken on site.	Quarterly.	99	Quarterly gamma isotopic, gross beta and tritium analysis.
	B) 1 Indicator (finished water) sample of public system.	Quarterly.	31	Quarterly gamma isotopic, gross beta and tritium analysis.

Exposure Pathway and/or Sample	Criteria for Selection of Sample Number & Location	Sampling and Collection Frequency	Sample Location	Type & Frequency of Analysis
INGESTION: S-VII. Milk <sup>4</sup>           S-VII. Milk <sup>4</sup>	A) 1 Sample from one of the nearest affected dairies at or beyond 5 miles.	Biweekly grab sample. <sup>8,14,+</sup>	14	Gamma isotopic and I-131 analysis biweekly.
	B) 1 Control sample to be taken at the location of a dairy greater than 20 miles distance and not in the most prevalent wind direction.	Biweekly grab sample. <sup>8,14,+</sup>	16	Gamma isotopic and I-131 analysis biweekly.
	C) 1 Indicator grass (forage) sample to be taken at the location of S-VII(A) above.	Monthly when available. <sup>14</sup>	14	Gamma isotopic.
	D) 1 Control grass (forage) sample to be taken at the location of S-VII(B) above.	Monthly when available. <sup>14</sup>	16	Gamma isotopic.
	E) 2 Indicator grass (forage) samples to be taken at 2 of the locations beyond but as close to the exclusion boundary as practical where the highest offsite sectorial ground level concentrations are anticipated.	Monthly when available.	2,7	Gamma isotopic.
	F) 1 Control grass (forage) sample to be used for routine monitoring along with S-VII(E) above.	Monthly when available.	18	Gamma isotopic.
S-VIII. Food Products           Corbicula	A) 1 Indicator sample of various types of foods grown in the area surrounding the plant (root, fruit, grain).	Annually during growing season. <sup>11</sup>	6,7	Gamma isotopic on edible portion.
	B) 1 Control sample of various types of foods grown. (root, fruit, grain).	Annually during growing season. <sup>11</sup>	18,40	Gamma isotopic on edible portion.
	C) 1 Indicator sample of edible portions.	Semiannual.	23	Gamma isotopic.



Exposure Pathway and/or Sample	Criteria for Selection of Sample Number & Location	Sampling and Collection Frequency	Sample Location	Type & Frequency of Analysis
S-IX. Sediment/Sludge	A) 1 Indicator sample from each storm drain outfall.	Semiannually.	72,73	Gamma isotopic.
	B) 3 Indicator sludge samples taken at sludge lagoons.	Semiannually. (Reference 2.6)	006A, 006B & 008	Gamma isotopic.

**Table 7 (cont) – Supplemental Radiological Environmental Monitoring**

**FOOTNOTES**

1. Reserved for future use.
  2. Reserved for future use.
  3. Reserved for future use.
  4. Milking animal and garden survey results will be analyzed annually. If the survey should indicate new activity the owners shall be contacted with regard to a contract for supplying sufficient samples. If contractual arrangements can be made, site(s) will be added for additional milk sampling up to a total of 3 Indicator locations.
  5. Not to exceed 35 days.
  6. Reserved for future use.
  7. At least once per 100 days.
  8. At least once per 18 days.
  9. At least once per 200 days.
  10. Reserved for future use.
  11. At least once per 400 days.
  12. Reserved for future use.
  13. Weekly, when circulating water is not operational.
  14. Milk and grass (forage) sampling is not required unless VCSNS gaseous releases exceed 5% of quarterly organ dose limits or radionuclides (attributed to VCSNS operation) are detected in broadleaf vegetation, grass or air samples at concentrations greater than required LLD. Sampling should continue for two months after plant releases are reduced to less than trigger levels and milk contamination levels have returned to background levels.
- + The ODCM requires semimonthly sampling when animals are on pasture, monthly at other times.

**Table 8 – Radiological Environmental Monitoring Program Summary for 2011**

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed <sup>1</sup>	Lower Limit of Detection <sup>2</sup> Actual (Max.)	All Indicator Locations Mean <sup>3</sup> (#/total #) (Range)	Location with Highest Annual Mean		Control Locations Mean <sup>3</sup> (#/total #) (Range)	Number of Nonroutine Reported <sup>4</sup> Measurements
				Name (Distance & Direction)	Mean <sup>3</sup> (#/total #) (Range)		
Air Particulate (pCi/m <sup>3</sup> )	Gross Beta (309)	6.25E-3 (1.0E-2)	2.15E-2 (256/258) (3.41E-3 to 3.39E-2)	Site 7, Environmental Lab Garden, (1.0 mi. E )	2.24E-2 (51/51) (1.17E-2 to 3.24E-2)	2.06E-2 (51/51) (2.60E-3 to 3.20E-2)	0
	Gamma Spec (72)						
	<sup>134</sup> Cs	2.40E-3 (5.0E-2)	All < LLD			All < LLD	0
	<sup>137</sup> Cs	2.85E-3 (6.0E-2)	2.33E-3 (1/60) (2.33E-3 to 2.33E-3)	Site 2, Environmental Lab Garden, (1.2 mi. SW)	2.33E-3 (1/60) <sup>g</sup> (2.33E-3 to 2.33E-3)	All < LLD	0
Air Radioiodine (pCi/m <sup>3</sup> )	<sup>131</sup> I (310)	1.87E-2 (7.0E-2)	6.48E-2 (21/259) (1.68E-2 to 1.76E-1)	Site 30, Site Boundry, (0.5 mi. SSW)	8.23E-2 (4/52) <sup>g</sup> (2.40E-2 to 1.76E-1)	6.80E-2 (4/51) <sup>g</sup> (2.56E-2 to 1.39E-1)	0
Direct (TLD) <sup>5</sup> (μR/hr)	Gamma(135) Quarterly	N/A	8.30E+0 (116/116) (5.27E+0 to 1.18E+1)	Site 4, Fairfield Hydro, (1.2 mi. WNW)	1.14E+1 (4/4) (1.09E+1 to 1.18E+1)	8.38E+0 (19/19) (5.69+0 to 1.22E+1)	0
	Gamma(24) Special Interest	N/A	8.76E+0 (24/24) (5.11E+0 to 1.19E+1)	Site 52, Monticello Rt. 11, (3.8 mi. NNE)	1.16E+1 (4/4) (1.12E+1 to 1.19E+1)	N/A	0
Surface Water (pCi/l)	<sup>3</sup> H (36)	5.10+2 (2.0E+3)	7.33E+2 (2/24) 7.32E+2 to 7.34E+2	Site 21, Parr Res., (2.7 mi. SSW)	7.34E+2 (1/12) 7.34E+2 to 7.34E+2	All < LLD	0
	Gamma Spec(36)						
	<sup>54</sup> Mn	2.30E+0 (1.5E+1)	All < LLD			All < LLD	0
	<sup>58</sup> Co	2.53E+0 (1.5E+1)	All < LLD			All < LLD	0
	<sup>59</sup> Fe	5.83E+0 (3.0E+1)	All < LLD			All < LLD	0
	<sup>60</sup> Co	2.39E+0 (1.5E+1)	All < LLD			All < LLD	0
	<sup>65</sup> Zn	4.98E+0 (3.0E+1)	All < LLD			All < LLD	0
	<sup>95</sup> Zr	4.76E+0 (3.0E+1)	All < LLD			All < LLD	0
	<sup>95</sup> Nb	2.81E+0 (1.5E+1)	All < LLD			All < LLD	0
	<sup>134</sup> Cs	2.09E+0 (1.5E+1)	All < LLD			All < LLD	0

**Table 8 (cont.) - Radiological Environmental Monitoring Program Summary for 2011**

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed <sup>1</sup>	Lower Limit of Detection <sup>2</sup> Actual (Max.)	All Indicator Locations Mean <sup>3</sup> (#/total #) (Range)	Location with Highest Annual Mean		Control Locations Mean <sup>3</sup> (#/total #) (Range)	Number of Nonroutine Reported <sup>4</sup> Measurements
				Name (Distance & Direction)	Mean <sup>3</sup> (#/total #) (Range)		
Surface Water (Continued)	<sup>137</sup> Cs	2.29E+0 (1.8E+1)	All < LLD			All < LLD	0
	<sup>140</sup> Ba	1.50E+1 (6.0E+1)	All < LLD			All < LLD	0
	<sup>140</sup> La	6.69E+0 (1.5E+1)	All < LLD			All < LLD	0
Ground Water (pCi/l)	<sup>3</sup> H (73)	5.10E+2 2.00E+3	5.42E+2 (1/69) 5.42E+2 to 5.42E+2	Site 112 NPDES Well GW-9, (.36 mi. SSE)	5.42E+2 (1/12) 5.42E+2 to 5.42E+2	All < LLD	0
	Gamma Spec (67)						
	<sup>54</sup> Mn	5.60E+0 (1.5E+1)	All < LLD			All < LLD	0
	<sup>58</sup> Co	5.43E+0 (1.5E+1)	All < LLD			All < LLD	0
	<sup>59</sup> Fe	1.09E+1 (3.0E+1)	All < LLD			All < LLD	0
	<sup>60</sup> Co	5.73E+0 (1.5E+1)	All < LLD			All < LLD	0
	<sup>65</sup> Zn	1.24E+1 (3.0E+1)	All < LLD			All < LLD	0
	<sup>95</sup> Zr	9.36E+0 (3.0E+1)	All < LLD			All < LLD	0
	<sup>95</sup> Nb	8.56E+0 (1.5E+1)	All < LLD			All < LLD	0
	<sup>134</sup> Cs	5.04E+0 (1.5E+1)	All < LLD			All < LLD	0
	<sup>137</sup> Cs	5.36E+0 (1.8E+1)	All < LLD			All < LLD	0
	<sup>140</sup> Ba	2.35E+1 (6.0E+1)	All < LLD			All < LLD	0
	<sup>140</sup> La	9.09E+0 (1.5E+1)	All < LLD			All < LLD	0

**Table 8 (Cont.) - Radiological Environmental Monitoring Program Summary for 2011**

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed <sup>1</sup>	Lower Limit of Detection <sup>2</sup> Actual (Max.)	All Indicator Locations Mean <sup>3</sup> (#/total #) (Range)	Location with Highest Annual Mean		Control Locations Mean <sup>3</sup> (#/total #) (Range)	Number of Nonroutine Reported <sup>4</sup> Measurements
				Name (Distance & Direction)	Mean <sup>3</sup> (#/total #) (Range)		
Drinking Water <sup>5</sup> (pCi/l)	Gross Beta (36)	1.39E+0 (4.00E+0)	2.44E+0 (15/24) (1.29E+0 to 7.45E+0)	Site 17, Columbia Water Works, (25 mi, SE)	2.57E+0 (9/12) (1.29E+0 to 7.45E+0)	2.09E+0 (10/12) (1.45E+0 to 2.88E+0)	0
	<sup>3</sup> H (36)	5.11E+2 (2.0E+3)	All < LLD			All < LLD	0
	Gamma Spec (72) <sup>10</sup>						
	<sup>54</sup> Mn	2.96E+ 0 (1.5E+ 1)	All < LLD			All < LLD	0
	<sup>58</sup> Co	2.96E+ 0 (1.5E+ 1)	All < LLD			All < LLD	0
	<sup>59</sup> Fe	5.81E+ 0 (3.0E+ 1)	All < LLD			All < LLD	0
	<sup>60</sup> Co	3.25E+ 0 (1.5E+ 1)	All < LLD			All < LLD	0
	<sup>65</sup> Zn	6.88E+0 (3.0E+ 1)	All < LLD			All < LLD	0
	<sup>95</sup> Zr	5.18E+ 0 (3.0E+ 1)	All < LLD			All < LLD	0
	<sup>95</sup> Nb	4.90E+ 0 (1.5E+ 1)	All < LLD			All < LLD	0
	<sup>131</sup> I	6.36E-1 (1.0E+ 0)	5.34E-1 (1/24) (5.34E-1 to 5.34E-1)	Site 17, Columbia <sup>9</sup> Water Works, (25 mi, SE)	5.34E-1 (1/12) (5.34E-1 to 5.34E-1)	All < LLD	0
	<sup>134</sup> Cs	3.20E+ 0 (1.5E+ 1)	All < LLD			All < LLD	0
	<sup>137</sup> Cs	3.20E+ 0 (1.8E+ 1)	All < LLD			All < LLD	0
	<sup>140</sup> Ba	1.31E+ 1 (6.0E+ 1)	All < LLD			All < LLD	0
	<sup>140</sup> La	4.45E+ 0 (1.5E+ 1)	All < LLD			All < LLD	0

**Table 8 (Cont.) - Radiological Environmental Monitoring Program Summary for 2011**

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed <sup>1</sup>	Lower Limit of Detection <sup>2</sup> Actual (Max.)	All Indicator Locations Mean <sup>3</sup> (#/total #) (Range)	Location with Highest Annual Mean		Control Locations Mean <sup>3</sup> (#/total #) (Range)	Number of Nonroutine Reported <sup>4</sup> Measurements
				Name (Distance & Direction)	Mean <sup>3</sup> (#/total #) (Range)		
Broadleaf Vegetation (pCi/kg wet)	Gamma Spec (38)						
	<sup>131</sup> I	2.11E+1 (6.0E+ 1)	1.45E+1 (2/24) (9.69E+0 to 1.94E+1)	Site 7, Environmental Lab Garden, (1.0 mi. E)	1.94E+1 (1/12) (1.94E+1 to 1.94E+1)	All < LLD	0
	<sup>134</sup> Cs	1.93E+1 (6.0E+ 1)	All < LLD			All < LLD	0
	<sup>137</sup> Cs	2.42E+1 (8.0E+ 1)	All < LLD			All < LLD	0
Fish <sup>7</sup> (pCi/kg wet)	Gamma Spec (18)						
	<sup>54</sup> Mn	1.75E+1 (1.3E+ 2)	All < LLD			All < LLD	0
	<sup>58</sup> Co	1.77E+1 (1.3E+ 2)	All < LLD			All < LLD	0
	<sup>59</sup> Fe	3.89E+1 (2.6E+ 2)	All < LLD			All < LLD	0
	<sup>60</sup> Co	1.95E+1 (1.3E+2)	All < LLD			All < LLD	0
	<sup>65</sup> Zn	4.08E+1 (2.6E+2)	All < LLD			All < LLD	0
	<sup>134</sup> Cs	1.62E+1 (1.3E+2)	All < LLD			All < LLD	0
	<sup>137</sup> Cs	1.76E+1 (1.5E+2)	All < LLD			1.17E+1 (1/6) (1.17E+1 to 1.17E+1)	0

**Table 8 (Cont.) - Radiological Environmental Monitoring Program Summary for 2011**

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed <sup>1</sup>	Lower Limit of Detection <sup>2</sup> Actual (Max.)	All Indicator Locations Mean <sup>3</sup> (#/total #) (Range)	Location with Highest Annual Mean		Control Locations Mean <sup>3</sup> (#/total #) (Range)	Number of Nonroutine Reported <sup>4</sup> Measurements
				Name (Distance & Direction)	Mean <sup>3</sup> (#/total #) (Range)		
Sediment (pCi/kg) <sup>8</sup>	Gamma Spec (6)						
	<sup>54</sup> Mn	1.63E+1 N/A	All < LLD			All < LLD	0
	<sup>58</sup> Co	1.49E+1 N/A	All < LLD			All < LLD	0
	<sup>60</sup> Co	2.48E+1 N/A	All < LLD			All < LLD	0
	<sup>134</sup> Cs	1.32E+1 (1.5E+2)	All < LLD			All < LLD	0
	<sup>137</sup> Cs	1.55E+1 (1.8E+2)	1.08E+2 (1/4) (1.08E+2 to 1.08E+2)	Site 22, Neal Shoals, (26 mi. NNW)	1.11E+2 (2/2) (7.93E+1 to 1.43E+2)	1.11E+2 (2/2) (7.93E+1 to 1.43E+2)	0



**Table 8 (cont) - Radiological Environmental Monitoring Program Summary for 2011**

Footnotes

1. Includes indicator and control analyses. Site 8, Air Particulates and Air Radioiodines are included as indicators. Does not include other supplemental samples.
2. Values given are maximum MDA values for indicator locations calculated from the program data analyses. The maximum acceptable LLD values allowed from NRC guidelines are given in parentheses.
3. Mean and range are based on detectable measurements only. The fractions of detectable measurements (i.e., number of positive results/total number of measurements) at specific locations are indicated in parentheses.
4. Any confirmed measured level of radioactivity in any environmental medium that exceeds the reporting requirements of ODCM, Section 1.4.1.2.
5. Detection sensitivity is approximately 10 mrem/yr (1.0  $\mu$ R/hr).
6. Elevated levels of  $^{214}\text{Pb}$  and  $^{214}\text{Bi}$  were observed in Jenkinsville drinking water samples. The values are not reported here because they are naturally occurring (do not originate from VCSNS) and furnish no quantifiable information of interest.
7. Fish include 3 groups (Bass, Bream/Crappie, Catfish/Carp.)
8. Elevated levels of  $^{214}\text{Pb}$  and  $^{214}\text{Bi}$  plus other  $^{226}\text{Ra}$  daughter products and  $^{228}\text{Ac}$  plus other  $^{232}\text{Th}$  daughter products were observed in all sediment samples. The values are not reported here because they are naturally occurring (do not originate from VCSNS) and furnish no quantifiable information of interest.
9. Samples obtained from these locations during 2011 identified detectable concentrations of isotopes that could be related to operation of VCSNS. Given the following facts, the detectable concentrations are not a result of V.C. Summer Generating Station operation:
  - (1) The quantities of radioactive airborne effluents from VCSNS operations during 2011 did not increase significantly compared to 2010.
  - (2) Prior REMP sample results have not detected the presence of these isotopes in composited air particulate, activated charcoal cartridges, or broadleaf samples.
  - (3) The concentrations being detected in the indicator samples were also identified in the control samples for activated charcoal cartridges.

As such, the atypical detection of these radionuclides is credibly attributed to the trans-Pacific transport of airborne releases from Dai-Ichi, Fukushima following the March 11, 2011 Tohoku earthquake and is not related to the operations of VCSNS.
10. Drinking water resin prepared and counted for  $^{131}\text{I}$  as separate sample.

**Table 9– Radiological Environmental Program Preoperational (Baseline) Summary**

Medium or Pathway Sampled (Unit of Measurement and Reporting Period)	Type and Total Number of Analyses Performed	Lower Limit of Detection <sup>1</sup> Actual (Max.)	All Indicator Locations Mean <sup>2</sup> (#/total #) (Range)	Location with Highest Annual Mean		Control Locations Mean <sup>2</sup> (#/total #) (Range)	Number of Nonroutine Reported <sup>3</sup> Measurements
				Name (Distance & Direction)	Mean <sup>2</sup> (#/total #) (Range)		
Air Particulate (pCi/m <sup>3</sup> ) (1981-1982)	Gross Beta (1300)	4.1E-3 (1.0E-2)	1.1E-1 (562/564) <sup>4</sup> (1.3E-2 to 5.5E-1)	Site 13, North Dam, (2.9 mi NNW)	1.3E-1 (52/52) (2.1E-2 to 5.5E-1)	1.2E-1 (153/155) (7.9E-3 to 6.1E-1)	0
			2.7E-2 (456/462) <sup>4</sup> (9.3E-3 to 6.6E-2)	Site 8, Mon. Res. S of Rd 224, (1.5 ENE)	3.0E-2 (42/42) (1.2E-2 to 6.0E-2)	2.8E-2 (125/126) (1.2E-2 to 5.8E-2)	
	Gamma Spec (307)						
	<sup>134</sup> Cs	3.0E-3 (1.0E-2)	All < LLD			All < LLD	0
	<sup>137</sup> Cs	3.1E-3 (1.0E-2)	3.2E-3 (22/241) (1.5E-3 to 5.2E-3)	Site 10, Met Tower, (2.4 mi NNE)	3.8E-3 (2/22) (2.5E-3 to 5.2E-3)	4.2E-3 (4/66) (3.2E-3 to 5.6E-3)	0
Air Radioiodine (pCi/m <sup>3</sup> ) (1982)	<sup>131</sup> I (290)	3.6E-2 (7.0E-2)	All < LLD			All < LLD	0
Direct (TLD) <sup>5</sup> (μR/hr) (1978-1982)	Gamma (1220) Monthly	0.5 N/A	9.9 (915/915) (6.7 to 14.7)	Site 13, North Dam, (2.9 mi NNW)	13.1 (61/61) (12.2 to 14.2)	9.7 (305/305) (6.4 to 13.5)	0
	Gamma (161) Quarterly	0.5 N/A	10.2 (154/154) (6.8 to 14.7)	Site 55, St. Barnabas Church, (2.8 mi E)	14.0(7/7) (13.1 to 14.7)		0
Surface Water (pCi/l) (1981-1982)	<sup>3</sup> H (43)	1.1E+3 (2.0E+3)	1.4E+3 (18/29) (1.1E+3 to 2.4E+3)	Site 17, Columbia Canal, (24.7 mi, SE)	1.6E+3 (2/7) (1.4E+3 to 1.8E+3)	1.2E+3 (6/14) (6.7E+2 to 1.6E+3)	0
	Gamma Spec (140)						
	<sup>54</sup> Mn	2.7E-1 (1.5E+1)	All < LLD			All < LLD	0
	<sup>58</sup> Co	2.9E-1 (1.5E+1)	All < LLD			All < LLD	0
	<sup>59</sup> Fe	6.0E+0 (3.0E+1)	All < LLD			All < LLD	0
	<sup>60</sup> Co	2.4E-1 (1.5E+1)	All < LLD			All < LLD	0
	<sup>65</sup> Zn	7.9E-1 (3.0E+1)	All < LLD			All < LLD	0
	<sup>95</sup> Zr	5.2E-1 (1.5E+1)	All < LLD			All < LLD	0
	<sup>95</sup> Nb	3.3E-1 (1.5E+1)	All < LLD			All < LLD	0
	<sup>134</sup> Cs	3.0E-1 (1.5E+1)	All < LLD			All < LLD	0

Medium or Pathway Sampled (Unit of Measurement and Reporting Period)	Type and Total Number of Analyses Performed	Lower Limit of Detection <sup>1</sup> Actual (Max.)	All Indicator Locations Mean <sup>2</sup> (#/total #) (Range)	Location with Highest Annual Mean		Control Locations Mean <sup>2</sup> (#/total #) (Range)	Number of Nonroutine Reported <sup>3</sup> Measurements
				Name (Distance & Direction)	Mean <sup>2</sup> (#/total #) (Range)		
	<sup>137</sup> Cs	2.2E-1 (1.8E+1)	All < LLD			All < LLD	0
	<sup>140</sup> Ba	2.2E+0 (6.0E+1)	All < LLD			All < LLD	0
	<sup>140</sup> La (1982 only)	5.5E-1 (1.5E+1)	All < LLD			All < LLD	0
Ground Water (pCi/l) (1981-1982)	<sup>3</sup> H (29)	9.0E+2 (2.0E+3)	1.5E+3 (16/16) (9.5E+2 to 2.3E+3)	Site 26, Onsite Well P4, (265 ft, W)	1.6E+3 (8/8) (9.5E+2 to 2.3E+3)	1.3E+3 (13/13) (1.0E+3 to 1.9E+3)	0
	Gamma Spec (32)						
	<sup>54</sup> Mn	3.7E+0 (1.5E+1)	All < LLD			All < LLD	0
	<sup>58</sup> Co	3.8E+0 (1.5E+1)	All < LLD			All < LLD	0
	<sup>59</sup> Fe	7.8E+0 (3.0E+1)	All < LLD			All < LLD	0
	<sup>60</sup> Co	3.8E+0 (1.5E+1)	All < LLD			All < LLD	0
	<sup>65</sup> Zn	8.1E+0 (3.0E+1)	All < LLD			All < LLD	0
	<sup>95</sup> Zr	6.8E+0 (1.5E+1)	All < LLD			All < LLD	0
	<sup>95</sup> Nb	4.6E+0 (1.5E+1)	All < LLD			All < LLD	0
	<sup>134</sup> Cs	3.7E+0 (1.5E + 1)	All < LLD			All < LLD	0
	<sup>137</sup> Cs	3.8E+0 (1.8E + 1)	All < LLD			All < LLD	0
	<sup>140</sup> Ba	1.9E+1 (6.0E+1)	All < LLD			All < LLD	0
	<sup>140</sup> La (1982 only)	5.0E0 (1.5E+1)	All < LLD			All < LLD	0
Drinking Water <sup>6</sup> (pCi/l) (1981-1982)	Gross Beta <sup>7</sup>	(2.0E+0)					
	<sup>3</sup> H (14)	6.3E+2 (1.0E+3)	7.8E+2 (6/14) (6.8E+2 to 9.8E+2)	Site 28, Jenkinsville, (2.0 mi SE) <sup>7</sup>	8.4E+2 (3/7) (7.0E+2 to 9.8E+2)		0
	Gamma Spec (44)						
	<sup>54</sup> Mn	3.0E-1 (1.5E+1)	All < LLD				0
	<sup>58</sup> Co	2.7E-1 (1.5E+1)	All < LLD				0

Medium or Pathway Sampled (Unit of Measurement and Reporting Period)	Type and Total Number of Analyses Performed	Lower Limit of Detection <sup>1</sup> Actual (Max.)	All Indicator Locations Mean <sup>2</sup> (#/total #) (Range)	Location with Highest Annual Mean		Control Locations Mean <sup>2</sup> (#/total #) (Range)	Number of Nonroutine Reported <sup>3</sup> Measurements
				Name (Distance & Direction)	Mean <sup>2</sup> (#/total #) (Range)		
	<sup>59</sup> Fe	9.6E0 (3.0E+1)	All < LLD				0
	<sup>60</sup> Co	2.6E-1 (1.5E+1)	All < LLD				0
	<sup>65</sup> Zn	3.4E-1 (3.0E+1)	All < LLD				0
	<sup>95</sup> Zr	4.8E-1 (1.5E+1)	All < LLD				0
	<sup>131</sup> I	3.4E-1 (1.5E+1)	All < LLD				0
	<sup>95</sup> Nb	7.4E-1 (1.0E+0)	All < LLD				0
	<sup>134</sup> Cs	2.2E-1 (1.0E+1)	All < LLD				0
	<sup>137</sup> Cs	2.4E-1 (1.8E+1)	All < LLD				0
	<sup>140</sup> Ba	2.5E0 (6.0E+1)	All < LLD				0
	<sup>140</sup> La (1982 only)	4.4E-1 (1.5E+1)	All < LLD				0
Milk (pCi/l) (1981-1982)	Gamma Spec (94)						
	<sup>131</sup> I	6.3E-1 (1.0E+0)	All < LLD			All < LLD	0
	<sup>134</sup> Cs	3.3E+0 (1.5E+1)	All < LLD			All < LLD	0
	<sup>137</sup> Cs	4.6E0 (1.5E+1)	4.1E+0 (8/47) (2.8E+0 to 6.1E+0)	Site 14, Dairy, (5.1 mi., W)	4.1E+0 (8/47) (2.8E+0 to 6.1E+0)	5.7E+0 (37/47) (3.7E+0 to 9.2E+0)	0
	<sup>140</sup> Ba	1.1E+1 (1.5E + 1)	All < LLD			All < LLD	0
	<sup>140</sup> La	4.4E+0 (1.5E+1)	All < LLD			All < LLD	0
Grass (pCi/kg wet) (1981-1982)	Gamma Spec (82)						
	<sup>131</sup> I	6.7E+1 (6.0E+1)	All < LLD			All < LLD	0
	<sup>134</sup> Cs	2.7E+1 (8.0E+1)	All < LLD			All < LLD	0
	<sup>137</sup> Cs	3.3E+1 (8.0E+1)	5.0E+1 (13/51) (1.6E+1 to 1.6E+2)	Site 14, Dairy, (5.1 mi W)	5.9E+1 (5/29) (1.6E+1 to 1.6E+2)	1.3E+2 (6/31) (1.3E+1 to 3.4E+2)	0

Medium or Pathway Sampled (Unit of Measurement and Reporting Period)	Type and Total Number of Analyses Performed	Lower Limit of Detection <sup>1</sup> Actual (Max.)	All Indicator Locations Mean <sup>2</sup> (#/total #) (Range)	Location with Highest Annual Mean		Control Locations Mean <sup>2</sup> (#/total #) (Range)	Number of Nonroutine Reported <sup>3</sup> Measurements
				Name (Distance & Direction)	Mean <sup>2</sup> (#/total #) (Range)		
Broadleaf Vegetation (pCi/kg wet) (1980-1982)	Gamma Spec (10)						
	<sup>131</sup> I	3.7E+1 (6.0E+1)	All < LLD				0
	<sup>134</sup> Cs	1.9E+1 (8.0E+1)	All < LLD				0
	<sup>137</sup> Cs	2.1E+1 (8.0E+1)	3.1E+1 (2/7) (1.8E+1 to 3.6E+1)	Site 2, Trans. Line, (1.2 mi SW)	3.6E+1 (1/1) (Single Value)	All < LLD	0
Other Vegetation (pCi/kg wet) (1980-1982)	Gamma Spec (32)						
	<sup>134</sup> Cs	8.4E+0 (8.0E+1)	All < LLD			All < LLD	0
	<sup>137</sup> Cs	1.0E+1 (8.0E+1)	All < LLD			All < LLD	0
Fish (pCi/kg wet) (1980 - 1982)	Gamma Spec (92)						
	<sup>134</sup> Cs	1.4E+1 (1.3E+2)	All < LLD			All < LLD	0
	<sup>137</sup> Cs	1.8E+1 (1.3E+2)	2.8E+1 (50/71) (1.1E+1 to 1.0E+2)	Site 24, Recreation Lake, (5.5 mi, N)	3.4E+1 (17/23) 1.2E+1 to 1.0E+2	3.1E+1 (19/21) (1.0E+1 to 7.9E+1)	0
	<sup>58</sup> Co	2.6E+1 (1.3E+2)	All < LLD			All < LLD	0
	<sup>54</sup> Mn	1.8E+1 (1.3E+2)	All < LLD			All < LLD	0
	<sup>59</sup> Fe	9.0E+1 (2.6E+2)	All < LLD			All < LLD	0
	<sup>65</sup> Zn	4.1E+1 (2.6E+2)	All < LLD			All < LLD	0
	<sup>60</sup> Co	1.8E+1 (1.3E+2)	All < LLD			All < LLD	0
Sediment (pCi/kg) (1980-1982)	Gamma Spec (24)						
	<sup>134</sup> Cs	2.3E+1 (1.5E+2)	All < LLD			All < LLD	0
	<sup>137</sup> Cs	2.4E+1 (1.5E+2)	1.7E+2 (12/18) (2.6E+1 to 4.5E+2)	Site 21, Parr Reservoir, (2.7 mi, SSW)	2.6E+2 (6/6) (2.6E+1 to 4.5E+2)	4.2E+2 (6/6) (1.8E+1 to 1.0E+3)	0

## **Table 9 (Cont.)- Radiological Environmental Program Preoperational (Baseline) Summary**

### Footnotes

1. Values given are MDA values calculated from the program data analyses with maximum acceptable LLD values allowed from NRC guidelines given in parentheses.
2. Mean and range are based on detectable measurements only. The fractions of detectable measurements at specific locations are indicated in parentheses.
3. A non-routine measurement is any confirmed measured level of radioactivity in an environmental medium that exceeds the reporting requirements of VCSNS ODCM, Section 1.4.1.2.
4. The baseline values are high because of the fallout from the Chinese bomb test in 1980. The first set of data reflects the 1981 baseline. The second set of data reflects the 1982 baseline, essentially free of bomb test fallout. The 1982 data covers the period 1/1/82 - 10/22/82.
5. Detection sensitivity is approximately 5 mrem/yr (0.5  $\mu$ R/hr) determined from the analyses of five years of preoperational data.
6. No control location was specified for drinking water during the preoperational monitoring period.
7. Inconclusive data.

**Table 10 - Results of 2011 Environmental Intercomparison Program with  
Independent Lab, Eckert & Ziegler Analytics, Inc.**

<b>Comparison Study (Measurement Unit)</b>	<b>Date</b>	<b>Nuclides</b>	<b>Vendor Lab Results</b>	<b>Env Lab Results</b>	<b>Agreement</b>
Gamma Isotopic Liquid 1 Liter (pCi/l)	3/23	<sup>131</sup> I	94	112	Yes
		<sup>51</sup> Cr	196	231	Yes
		<sup>134</sup> Cs	85.6	85.6	Yes
		<sup>137</sup> Cs	135	153	Yes
		<sup>58</sup> Co	74.4	82.5	Yes
		<sup>54</sup> Mn	175	202	Yes
		<sup>59</sup> Fe	115	140	Yes
		<sup>65</sup> Zn	172	189	Yes
		<sup>60</sup> Co	113	117	Yes
Gamma Filter (pCi)	9/30	<sup>141</sup> Ce	72.0	73.0	Yes
		<sup>51</sup> Cr	244	304	Yes
		<sup>134</sup> Cs	139	120	Yes
		<sup>137</sup> Cs	123	135	Yes
		<sup>58</sup> Co	105	112	Yes
		<sup>54</sup> Mn	163	186	Yes
		<sup>59</sup> Fe	59.2	54.0	Yes
		<sup>65</sup> Zn	195	223	Yes
		<sup>60</sup> Co	170	175	Yes
Alpha/Beta Water (pCi/l)	4/26	Alpha	238	224	Yes
		Beta	205	230	Yes
Gamma Isotopic Pulverized Soil (pCi/g)	3/21	<sup>51</sup> Cr	4.80E-1	3.74E-1	Yes
		<sup>134</sup> Cs	2.10E-1	1.64E-1	Yes
		<sup>137</sup> Cs	4.19E-1	4.06E-1	Yes
		<sup>58</sup> Co	1.82E-1	1.59E-1	Yes
		<sup>54</sup> Mn	4.28E-1	3.73E-1	Yes
		<sup>59</sup> Fe	2.81E-1	2.72E-1	Yes
		<sup>65</sup> Zn	4.20E-1	3.82E-1	Yes
		<sup>60</sup> Co	2.76E-1	2.41E-1	Yes
I-131 Solid (pCi)	3/31	<sup>131</sup> I	128	123	Yes

Comparison Study (Measurement Unit)	Date	Nuclides	Vendor Lab Results	Env Lab Results	Agreement
Tritium (pCi/l)	4/7	<sup>3</sup> H	4530	4620	Yes
Gross Beta Filter (pCi)	10/19	N/A	80	76.3	Yes
Charcoal Cartridge (pCi)	9/26	<sup>131</sup> I	80.5	95	Yes
Gamma Isotopic Liquid 4 Liter (pCi/l)	9/29	<sup>131</sup> I	80.1	102	Yes
		<sup>141</sup> Ce	91.5	109	Yes
		<sup>51</sup> Cr	310	347	Yes
		<sup>134</sup> Cs	176	197	Yes
		<sup>137</sup> Cs	156	183	Yes
		<sup>58</sup> Co	134	160	Yes
		<sup>54</sup> Mn	207	251	Yes
		<sup>59</sup> Fe	75.2	91.3	Yes
		<sup>65</sup> Zn	247	294	Yes
Gamma Simulated Gas 4 Liter (pCi/l)	9/15	<sup>60</sup> Co	215	241	Yes
		<sup>141</sup> Ce	415	398	Yes
		<sup>51</sup> Cr	1410	1340	Yes
		<sup>134</sup> Cs	798	809	Yes
		<sup>137</sup> Cs	708	714	Yes
		<sup>58</sup> Co	607	626	Yes
		<sup>54</sup> Mn	939	972	Yes
		<sup>59</sup> Fe	341	391	Yes
		<sup>65</sup> Zn	1120	1150	Yes
		<sup>60</sup> Co	977	969	Yes



**Table 11 – 2011 Environmental Sampling Program Exceptions**

<b>Media</b>	<b>Sample Location</b>	<b>Month (Week No.)</b>	<b>Cause for Exception</b>
Air Particulate And Radioiodine	Site 7 Site 17 Site 8	Feb (05) Nov (47) Nov (48)	Filter not centered on sample head. Power out due to construction. Breaker tripped.
Ground Water	Site 111 Site 115 Site 115 Site 107 Site 111 Site 115 Site 107 Site 111 Site 115 Site 107	Feb (07) Feb (07) May (20) Jun (25) Aug (33) Aug (33) Sep (38) Nov (46) Nov (46) Dec (51)	The station has experienced issues with ground water intrusion into plant buildings and structures. In 2008, a modification was implemented to install fourteen dewatering wells. This lowered the water table in the area below the level of the existing wells.
TLD	Site 20	Apr (14)	TLD missing.
Surface Water	Site 21	Aug (33)	Sampler did not collect complete sample due to power outages.
Grass	Site 2 Site 7 Site 18	Jan (04) Jan (04) Feb (07)	Sample not available. Sample not available. Sample not available.



# LEGEND

- CONTROL SAMPLE LOCATIONS
- A=AIR PARTICULATE SITE
- D=DIRECT (TLD) SITE
- I=AIRBORNE RADIOIODINE SITE
- W=WATER SITE
- O=OTHER (GARDEN PRODUCTS, FISH, SEDIMENT, GRASS, MILK)

REFERENCE:  
THE BASE FOR THIS MAP WAS PREPARED FROM A  
PORTION OF USGS STATE OF GEORGIA, 1970.



South Carolina Electric & Gas Co.  
Virgil C. Summer Nuclear Station


Regional Location Map

Figure 1-1

REV. DATE 12-8



### LEGEND

 PRIMARY SAMPLE LOCATIONS


A = AIR PARTICULATE SAMPLE SITE



D = DIRECT (TLD) SAMPLE SITE

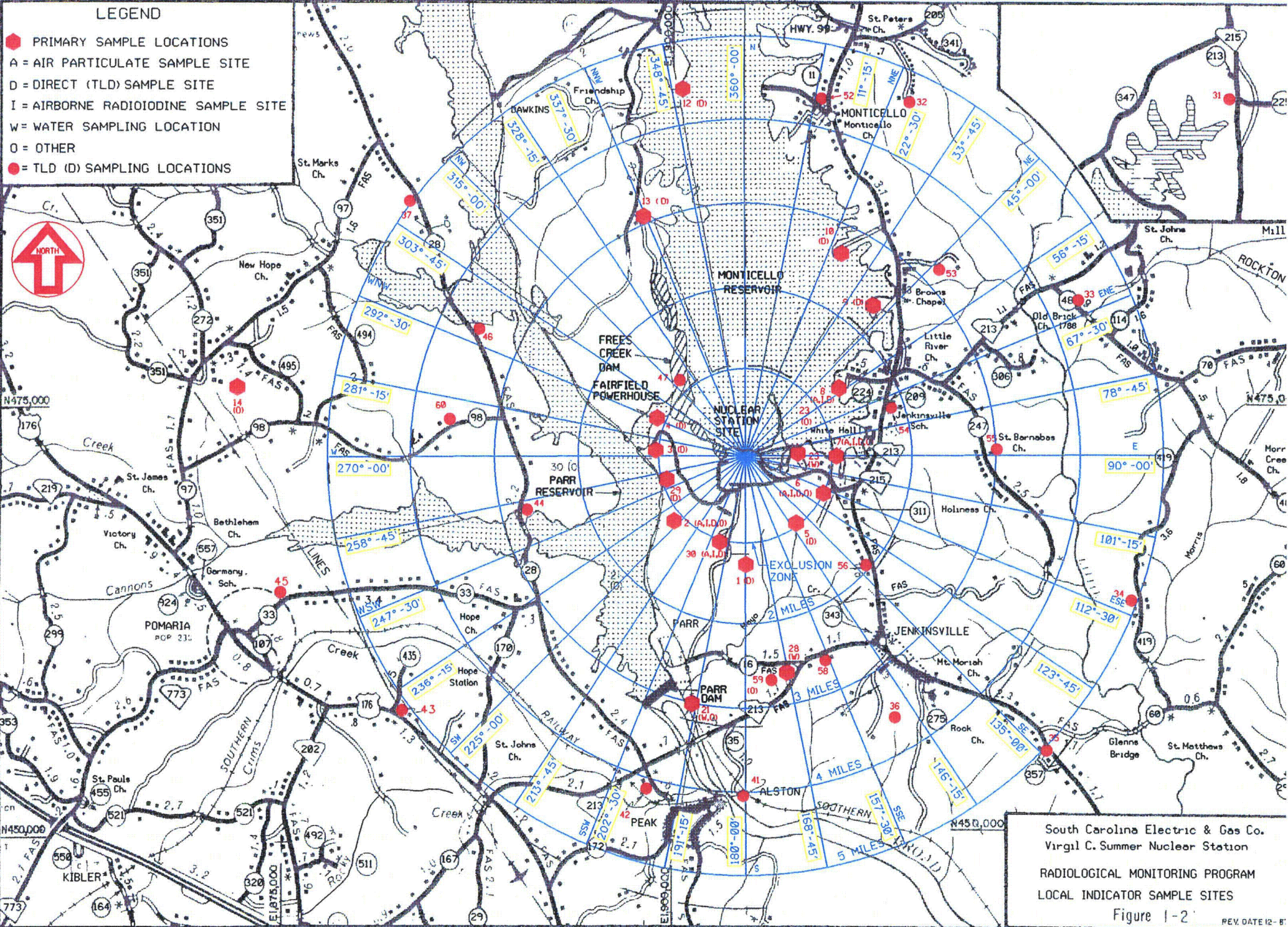
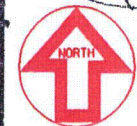
I = AIRBORNE RADIOIODINE SAMPLE SITE

W = WATER SAMPLING LOCATION

O = OTHER

 = TLD (D) SAMPLING LOCATIONS

-  PRIMARY SAMPLE LOCATIONS  
 A = AIR PARTICULATE SAMPLE SITE  
 D = DIRECT (TLD) SAMPLE SITE  
 I = AIRBORNE RADIOIODINE SAMPLE SITE  
 W = WATER SAMPLING LOCATION  
 O = OTHER  
 = TLD (D) SAMPLING LOCATIONS



RADIOLOGICAL MONITORING PROGRAM  
LOCAL INDICATOR SAMPLE SITES

Figure 1-2

REV. DATE 12-8



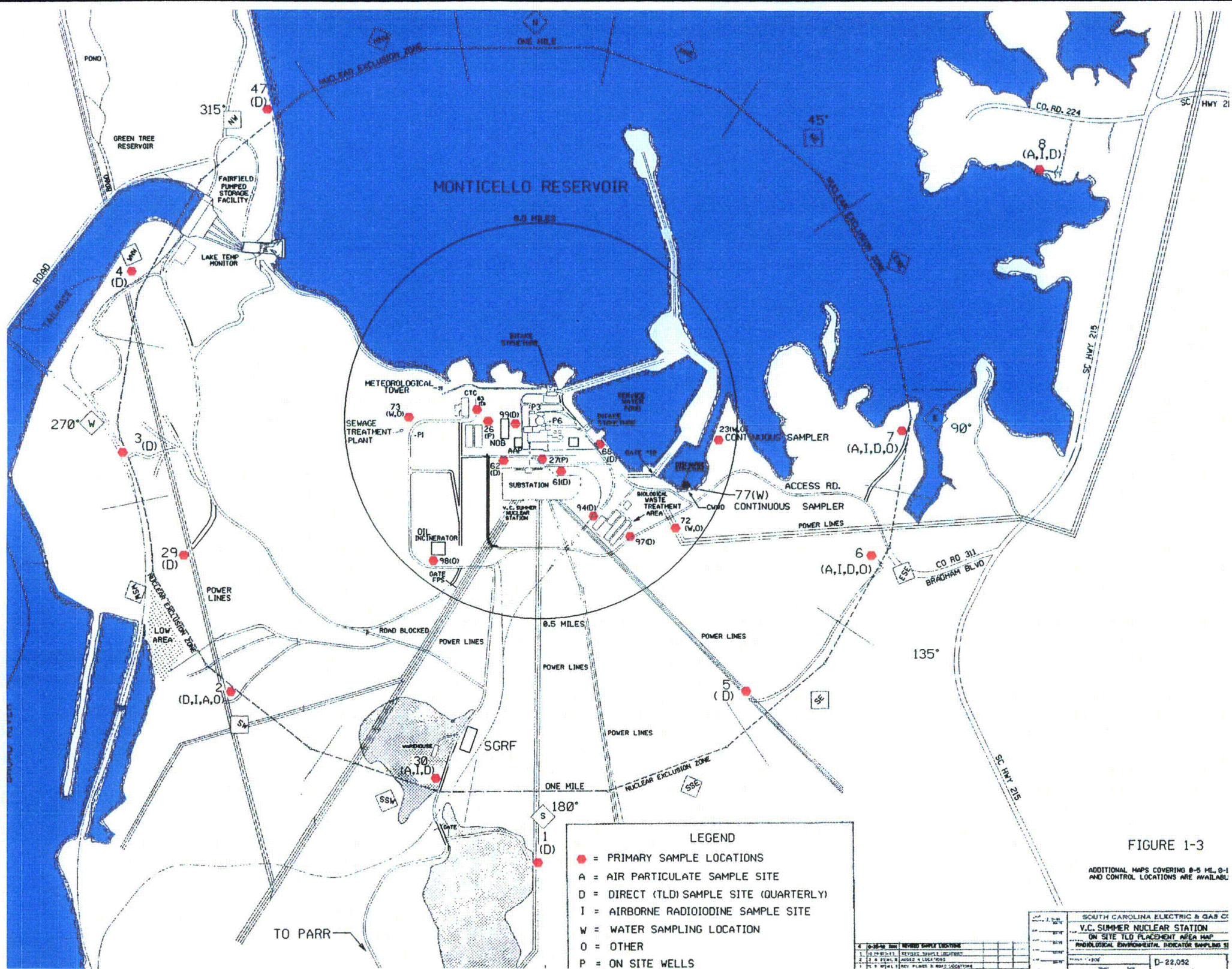


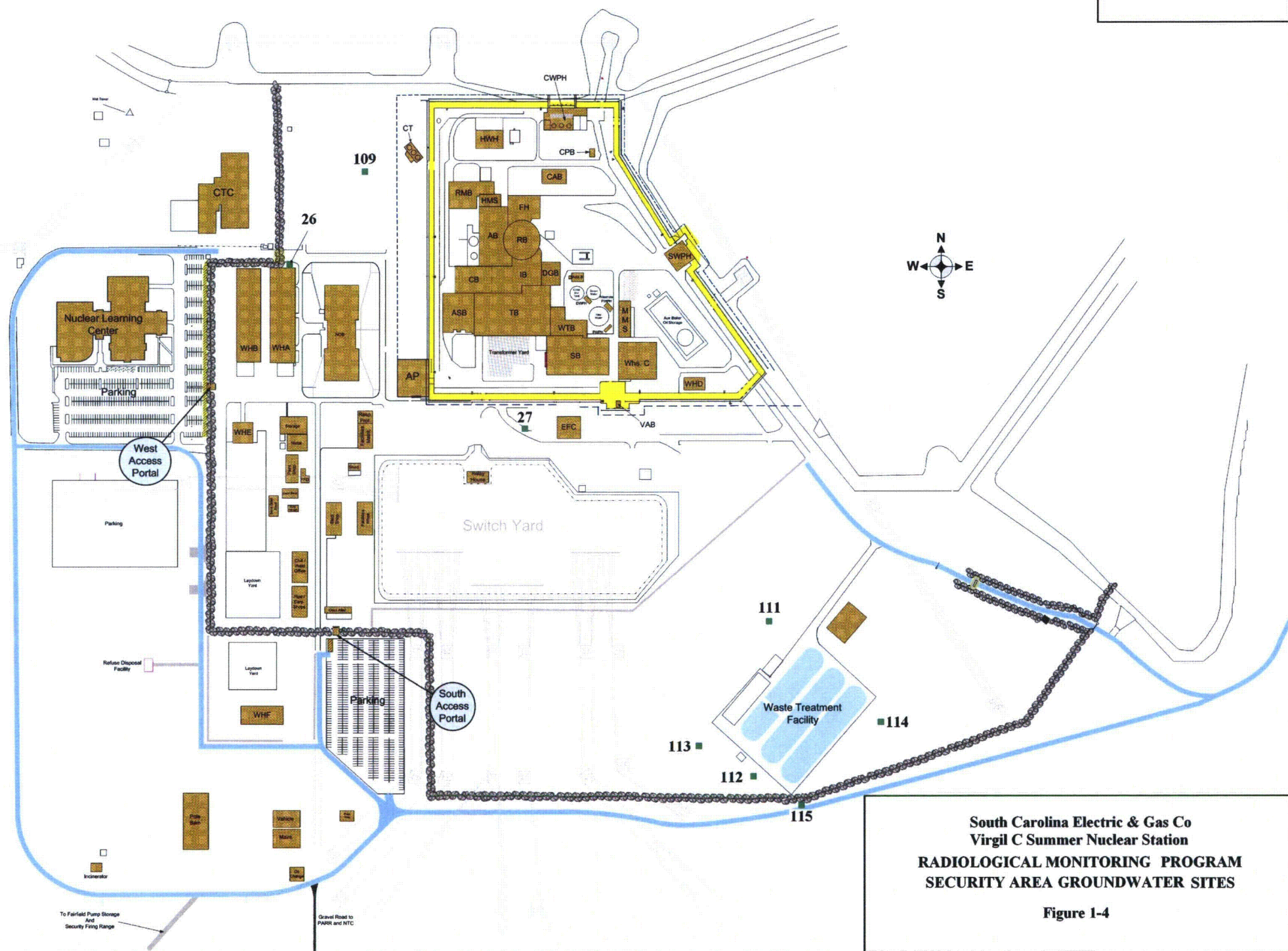
FIGURE 1-3

ADDITIONAL MAPS COVERING 0-5 MI, 0-1 MI AND CONTROL LOCATIONS ARE AVAILABLE.

SOUTH CAROLINA ELECTRIC & GAS CO.	
V.C. SUMMER NUCLEAR STATION	
ON SITE TLD PLACEMENT AREA MAP	
RADIOLOGICAL ENVIRONMENTAL MONITORING SYSTEM	
1. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	2. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
3. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	4. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
5. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	6. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
7. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	8. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
9. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	10. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
11. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	12. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
13. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	14. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
15. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	16. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
17. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	18. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
19. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	20. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
21. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	22. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
23. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	24. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
25. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	26. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
27. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	28. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
29. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	30. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
31. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	32. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
33. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	34. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
35. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	36. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
37. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	38. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
39. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	40. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
41. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	42. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
43. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	44. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
45. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	46. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
47. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	48. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
49. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	50. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
51. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	52. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
53. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	54. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
55. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	56. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
57. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	58. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
59. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	60. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
61. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	62. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
63. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	64. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
65. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	66. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
67. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	68. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
69. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	70. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
71. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	72. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
73. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	74. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
75. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	76. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
77. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	78. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
79. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	80. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
81. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	82. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
83. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	84. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
85. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	86. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
87. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	88. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
89. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	90. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
91. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	92. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
93. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	94. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
95. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	96. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
97. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	98. 1/2" x 1/2" TLD PLACEMENT LOCATIONS
99. 1/2" x 1/2" TLD PLACEMENT LOCATIONS	100. 1/2" x 1/2" TLD PLACEMENT LOCATIONS



■ **Groundwater Well**



**South Carolina Electric & Gas Co  
Virgil C Summer Nuclear Station  
RADIOLOGICAL MONITORING PROGRAM  
SECURITY AREA GROUNDWATER SITES**

**Figure 1-4**





South Carolina Electric & Gas Co  
Virgil C Summer Nuclear Station  
**RADIOLOGICAL MONITORING PROGRAM  
PROTECTED AREA GROUNDWATER SITES**

Figure 1-5