

50-395/0
RP

Virgil C. Summer Environmental Surveillance Laboratory
Jenkinsville, South Carolina

RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

VIRGIL C. SUMMER NUCLEAR STATION

FOR THE OPERATING PERIOD

January 1, 1983 - December 31, 1983

April 30, 1984



V. C. SUMMER NUCLEAR STATION
SOUTH CAROLINA ELECTRIC AND GAS COMPANY

Prepared by:

Gregory M. Gowdy
Gregory M. Gowdy, Supervisor
Radiological Environmental Programs

Reviewed by:

W. Baehr
William R. Baehr, Manager
Corporate Health Physics and
Environmental Programs

Approved by:

Mark E. Whitaker, Jr.
Mark E. Whitaker, Jr., Group Manager
Regulatory and Support Services

IE 25
111

OFFICIAL COPY

84-72

8504040455 831231
PDR ADOCK 05000395
R PDR

VIRGIL C. SUMMER NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

TABLE OF CONTENTS

	<u>Page</u>
1.0 INTRODUCTION	1
1.1 Plant Location and Characteristics	1
2.0 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM.	5
2.1 Purpose	5
2.2 Environmental Radiation Pathways.	5
2.3 Land Use Census (1983)	24
2.4 Program Changes from Previous Reporting Period.	28
2.4.1 Environmental Laboratory Move.	28
2.4.2 Sampling Site Changes.	28
2.4.3 Analysis Changes	30
2.5 Indicator and Control Samples	30
2.6 Operational Radiological Monitoring Results	32
2.7 Program Exceptions.	32
3.0 INTERPRETATION OF MONITORING FINDINGS AND CONCLUSIONS.	45
3.1 Airborne	45
3.1.1 Air Particulates	45
3.1.2 Air Radioiodine.	46
3.1.3 Direct (TLD)	46
3.2 Waterborne.	47
3.2.1 Surface Water.	47
3.2.2 Ground Water	48
3.2.3 Drinking Water	49
3.3 Ingestion	50
3.3.1 Milk	50
3.3.2 Grass (Forage)	50
3.3.3 Food Products.	51
3.3.4 Fish	51
3.4 Aquatic	52
3.4.1 Bottom Sediment.	52
4.0 GENERAL CONCLUSIONS.	52
APPENDICES.	53
A. Preoperational Radiological Monitoring Results.	54
B. Laboratory Intercomparisons with EPA.	66

VIRGIL C. SUMMER NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

LIST OF FIGURES

<u>FIGURE</u>		<u>Page</u>
1-1	Control Site Locations (50 Mile Radius around the Virgil C. Summer Nuclear Station)	2
1-2	Radiological Monitoring Program Local Indicator Sample Sites (5 Mile Radius around Virgil C. Summer Nuclear Station)	3
1-3	Radiological Monitoring Program Local Indicator Sample Sites (On Site and up to 1 Mile Radius around Virgil C. Summer Nuclear Station)	4

VIRGIL C. SUMMER NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

LIST OF TABLES

<u>TABLE</u>		<u>Page</u>
2-1	Radiological Environmental Monitoring Program - Virgil C. Summer Nuclear Station	7
2-2	Sampling Site Locations	21
2-3	Census Verification - September 1983	25
2-4	Critical Receptors - 1983 Census	26
2-5	Radiological Environmental Monitoring Program Summary - 1983 Operational Report.	33
2-6	1983 Environmental Program Exceptions.	42
A-1	Radiological Environmental Monitoring Program Summary - Preoperational (Baseline) Report	55
B-1	Results of EPA Intercomparisons	67

VIRGIL C. SUMMER NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

1.0 INTRODUCTION

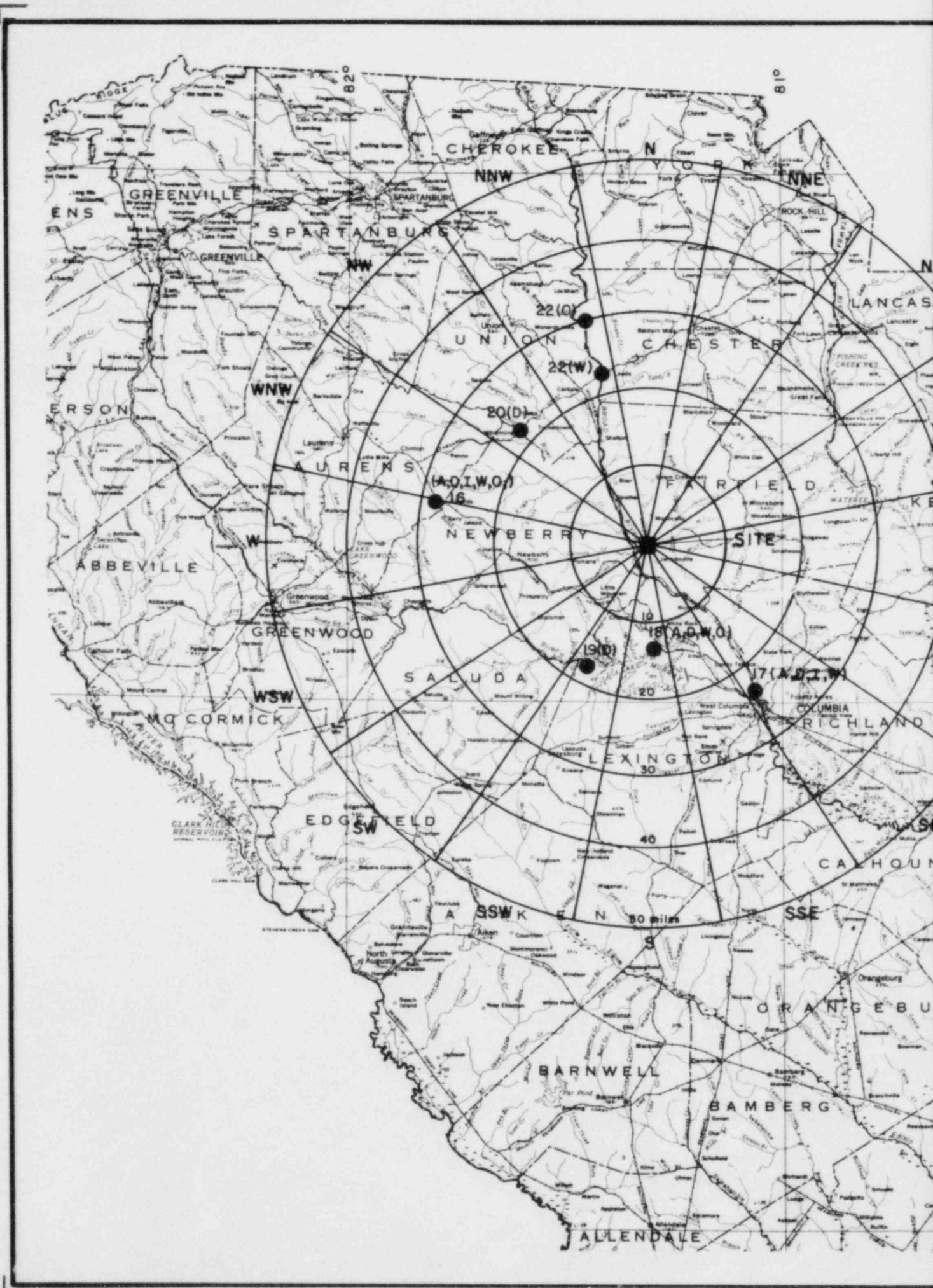
The following report summarizes the Radiological Environmental Monitoring Program conducted for the Virgil C. Summer Nuclear Station during the operating period, January 1, 1983 through December 31, 1983. The entire sampling, analysis and data interpretation program (including the preoperational baseline program) has been carried out "in-house" by South Carolina Electric and Gas Company (SCE&G).

1.1 Plant Location and Characteristics

The Virgil C. Summer Nuclear Station (VCSNS) is a 900 MWe Westinghouse pressurized water reactor located adjacent to the Monticello Reservoir near Jenkinsville, South Carolina and approximately 26 miles northwest of Columbia, South Carolina (see Figure 1-1). VCSNS achieved initial criticality October 22, 1982, reached 50% power December 12, 1982 and 100% power June 10, 1983 following a general steam generator modification. The Nuclear Station is used in conjunction with the adjacent Fairfield Pumped Storage Facility (FPSF) which consists of eight reversible pump-turbine units of 60 MWe capacity each. During periods of off-peak power demand, excess generating capacity is used to pump water from the Parr Reservoir to the Monticello Reservoir which is approximately 150 ft. higher. The pump-turbine units operate in the generating mode to meet peak system loads. Monticello Reservoir (approximately 6,000 acres) provides condenser cooling water for VCSNS. Intake and discharge structures are separated by a jetty to ensure adequate circulation within the reservoir (see Figures 1-2 and 1-3). There are two discharge points in Monticello Reservoir into which liquids are released from the plant:

- (1) Circulating Water Discharge Canal
from:
 - a) Unprocessed steam generator blowdown
 - b) Non-nuclear drains
- (2) Fairfield Pumped Storage Facility Penstocks
from:
 - a) Liquid waste processing system
 - b) Processed steam generator blowdown

There are two main radioactive gaseous waste release points around VCSNS from which various plant vents, exhausts, ventilators and relief valves are vented. 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.





TI APERTURE CARD

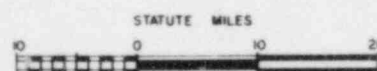
LEGEND

- 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.

Also Available On
Aperture Card

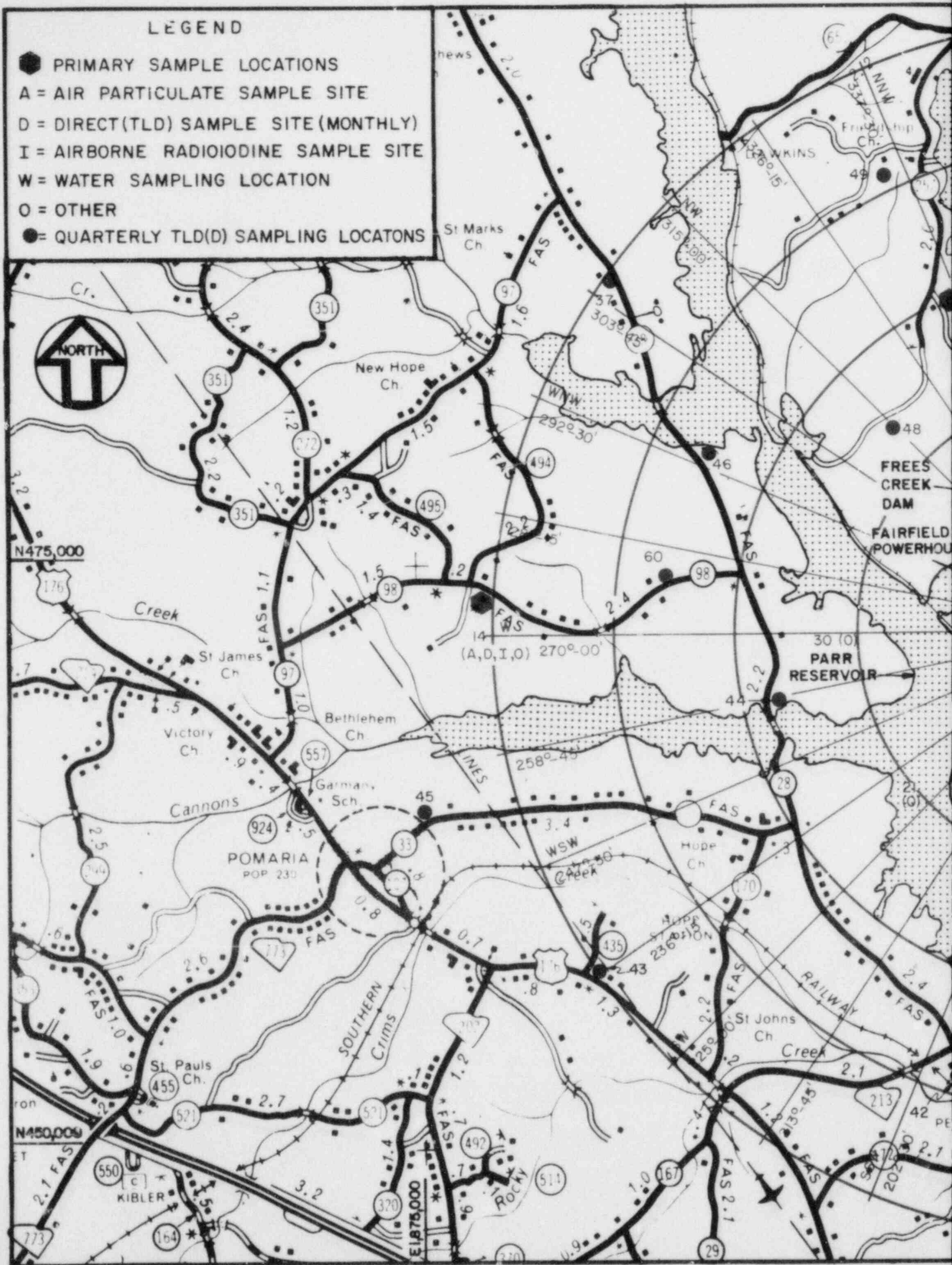


South Carolina Electric & Gas Co.
Virgil C. Summer Nuclear Station

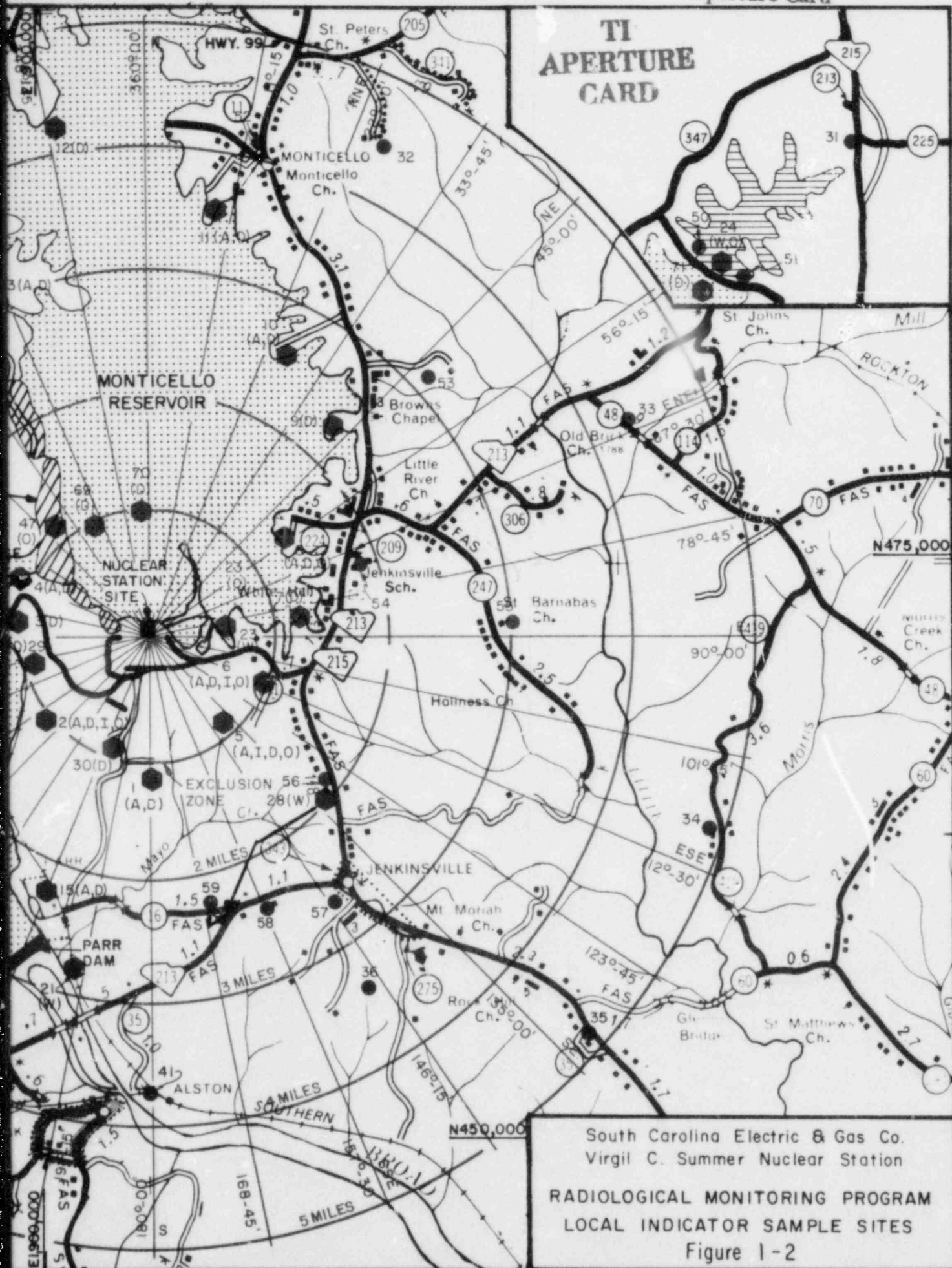
Regional Location Map

Figure 1-1

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

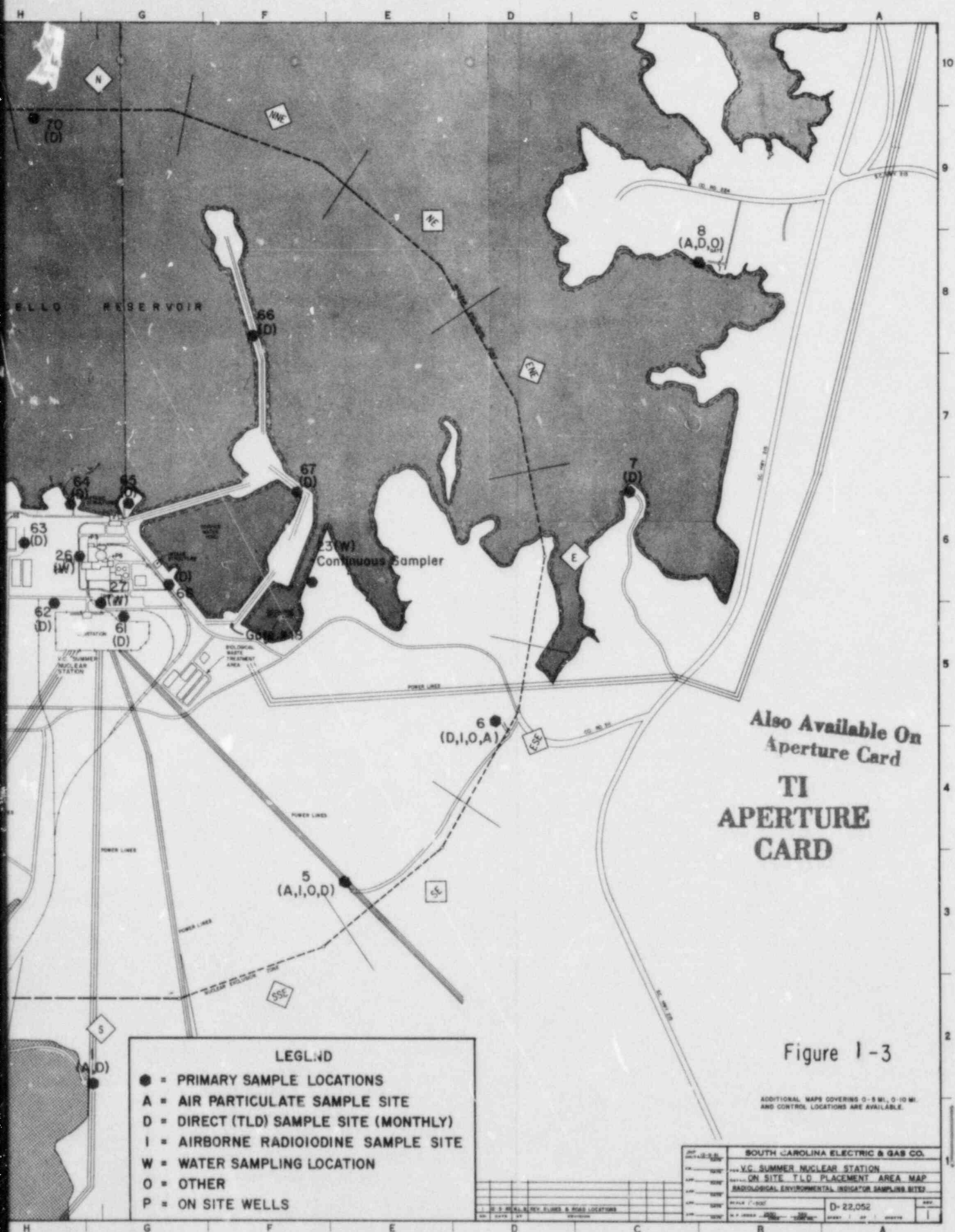


Also Available On
Aperture Card



(3) 8504040455-02





(4) 8504040455-03

VIRGIL C. SUMMER NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

The Virgil C. Summer Nuclear Station is located in Fairfield County which, along with Newberry County, makes up the principle area within ten (10) miles of the plant. This area is mainly forest with only about 30% devoted to small farming activities -- predominantly dedicated to small grains, pasture, feed crops and beef cattle. Within a twenty (20) mile radius of the plant, significant portions of Lexington and Richland Counties are encompassed. This area has generally the same make up as that within 10 miles of the plant. Within fifty (50) miles of the plant, Columbia (at 26 miles) is the only large city. Small agricultural concerns are predominant, but still make up less than half of the land area. The main industrial activity is concentrated around Columbia and is generally greater than 20 miles from VCSNS.

2.0 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

2.1 Purpose

The Radiological Environmental Monitoring 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 surrounding environment.
- (2) To establish correlations between levels of environmental radioactivity and radioactive effluent from plant operation.

The program utilizes the concepts of control-indicator and preoperational-operational intercomparisons in order to establish the adequacy of source control and to realistically verify the assessment of environmental levels and resultant human radiation dose.

2.2 Environmental Radiation Pathways

Specific measurement, sampling and analysis methodology has been programmatically developed to sensitively monitor the pathways expected to represent the most significant sources of radiation exposure to the public and the environment. Elements of the program monitor the impact of gaseous (airborne) and liquid effluents released from the Virgil C. Summer Nuclear Station. The specific methods used in monitoring the pathways of these effluents leading to exposure of man based on existing demography may be summarized as follows:

VIRGIL C. SUMMER NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

HUMAN EXPOSURE PATHWAYS

<u>(A) Gaseous Effluent Pathway</u>	<u>Monitoring Media</u>
Immersion Dose and other External Dose	Thermoluminescent Dosimetry (TLD) Area Monitors Air Samples (Particulate and Radioiodine)
Vegetation (Ingestion)	Vegetation/Food Crop Samples Air Samples
Milk (Ingestion)	Milk Samples Vegetation Samples Grass (Forage) Samples Air Samples
<u>(B) Liquid Effluent Pathway</u>	<u>Monitoring Media</u>
Fish (Ingestion)	Surface Water Samples Bottom Sediment Samples Fish Samples
Water & Shoreline Exposure (Ingestion and Immersion)	TLD Area Monitors Surface Water Samples Bottom Sediment Samples
Drinking Water (Ingestion)	Ground Water Samples Drinking Water Samples

Site (VCSNS) related dispersion characteristics, demography, hydrology, land use, anticipated source terms, and the critical pathways outlined above have been considered in the selection of sample media, sampling and analysis frequencies, sample locations, and types of analyses. These criteria were used to establish both the preoperational and operational phases of the radiological surveillance program.

The program that evolved during the preoperational (baseline) monitoring period, incorporating all of the elements in the Virgil C. Summer Technical Specifications plus additional special study criteria, is detailed in Table 2-1. The practices and guidance contained in USNRC Regulatory Guide 4.15 are directly reflected in the procedures used in the program. The validity of measurements is assured through various intercomparison and audit programs. The monitoring sites employed, and their distance and direction from the reactor containment building of the Virgil C. Summer Nuclear Station, is presented in Table 2-2.

RADIOLOGICAL ENVIRONMENTAL SURVEILLANCE PROGRAM
VIRGIL C. SUMMER NUCLEAR STATION
TABLE 2-1

Exposure Pathway and/or Sample	Criteria for Selection of Sample Number & Location	Sampling and Collection Frequency	(1) Sample Locations	Type & Frequency of Analysis
<u>AIRBORNE:</u>				
I. Particulates	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 sectoral ground level concentrations are anticipated. (2)	Continuous sampler operation with weekly collection	2 5 10	Gross beta following filter change; Monthly† 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. (2)	"	6	"
	C) 1 Indicator sample to be taken at the location of one of the dairies most likely to be affected. (2,4)	"	14	"
	*D) 6 Additional Indicator samples to be taken at locations (in different sectors) beyond but as close to the exclusion boundary as practicable and nearer to the plant than the nearest critical receptor for the chosen sector. (2)	"	1 4 8 11 13 15	"

(7)

RADIOLOGICAL ENVIRONMENTAL SURVEILLANCE PROGRAM
VIRGIL C. SUMMER NUCLEAR STATION
TABLE 2-1 (Continued)

<u>Exposure Pathway and/or Sample</u>	<u>Criteria for Selection of Sample Number & Location</u>	<u>Sampling and Collection Frequency</u>	<u>(1) Sample Locations</u>	<u>Type & Frequency of Analysis</u>
<u>AIRBORNE (Cont'd)</u>				
	E) 3 Control samples to be taken at locations at least 10 air miles from the site and not in the most prevalent wind directions. (2)	"	16 17 18*	"
(8) II. Radioiodine	A) 3 Indicator samples to be taken at two locations as given in I(A) above.	Continuous sampler operation with weekly cannister collection	2 5 10	Gamma Isotopic for Iodine 131
	B) 1 Indicator sample to be taken at the location as given in I(B) above.	"	6	"
	C) 1 Indicator sample to be taken at the location as given in I(C) above.	"	14	"
	D) 2 Control samples to be taken at locations similar in nature to I(E) above.	"	16 17	"

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
VIRGIL C. SUMMER NUCLEAR STATION
TABLE 2-1 (Continued)

<u>Exposure Pathway and/or Sample</u>	<u>Criteria for Selection of Sample Number & Location</u>	<u>Sampling and Collection Frequency</u>	<u>Sample Locations</u> ⁽¹⁾	<u>Type & Frequency of Analysis</u>
<u>AIRBORNE (Cont'd)</u>				
(6) III. Direct	A) 13 Indicator stations to form an inner ring of stations in the 13 accessible sectors within 1 to 2 miles of the plant.	Monthly or quarterly exchange (5,7); two or more dosimeters at each location.	1	Gamma dose monthly or quarterly
			2	
			3	
			4	
			5	
			6	
			7	
			8	
			9	
			10	
			29	
			30	
			47	
	B) 16 Indicator stations to form an outer ring of stations in the 16 sectors within 3 to 5 miles of the plant.	"	12	"
			14	
			32	
			33	
			34	
			35	
			36	
			37	
			41	
			42	
			43	
			45	
			46	
			49	
			53	
			55	

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
VIRGIL C. SUMMER NUCLEAR STATION
TABLE 2-1 (Continued)

<u>Exposure Pathway and/or Sample</u>	<u>Criteria for Selection of Sample Number & Location</u>	<u>Sampling and Collection Frequency</u>	<u>Sample Locations</u> ⁽¹⁾	<u>Type & Frequency of Analysis</u>
<u>AIRBORNE (Cont'd)</u>				
	**C) 20 Stations to be placed in special interest areas such as population centers, nearby residences, schools and in 2 or 3 areas to serve as controls.	"	11 13 15 16 17 18 19 20 31 44 48 50 51 52 54 56 57 58 59 60	"
	*D) 8 Stations to be placed within the exclusion boundary at the locations of the onsite Pressurized Ion Chamber Detectors (Special Study)	"	61 62 63 64 65 66 67 68	"

(10)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
VIRGIL C. SUMMER NUCLEAR STATION
TABLE 2-1 (Continued)

<u>Exposure Pathway and/or Sample</u>	<u>Criteria for Selection of Sample Number & Location</u>	<u>Sampling and Collection Frequency</u>	<u>Sample Locations</u> ⁽¹⁾	<u>Type & Frequency of Analysis</u>
<u>AIRBORNE(Cont'd)</u>				
	*E) 3 Stations to be placed on buoys on Monticello Reservoir (Background Study)	"	69 70 71	"
<u>WATERBORNE:</u>				
IV. Surface Water	A) 1 Indicator sample downstream to be taken at a location which allows for mixing and dilution in the ultimate receiving river.	Time composite samples with collection every month. (5)	21 (3,6)	Gamma isotopic monthly with quarterly com- posite (by location) or monthly sample [†] to be analyzed for tritium.
	B) 1 Control sample to be taken at a location on the re- ceiving river, sufficiently far up-stream such that no effects of pumped storage operation are anticipated.	"	22(3)	"

(11)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
VIRGIL C. SUMMER NUCLEAR STATION
TABLE 2-1 (Continued)

<u>Exposure Pathway and/or Sample</u>	<u>Criteria for Selection of Sample Number & Location</u>	<u>Sampling and Collection Frequency</u>	<u>Sample⁽¹⁾ Locations</u>	<u>Type & Frequency of Analysis</u>
<u>WATERBORNE</u> <u>(Cont'd)</u>				
	C) 1 Indicator sample from a location immediately upstream of the nearest downstream municipal water supply.	"	17	"
	D) 1 Indicator sample to be taken in the upper reservoir of the pumped storage facility at the plant discharge canal.	"	23(3)	"
(12)	*E) 1 Indicator sample to be taken in the upper reservoir at the intake of the pumped storage facility.	"	25	"
	F) 1 Indicator sample to be taken in the upper reservoir's non-fluctuating recreational area.	Grab sampling monthly (5)	24(3)	As in IV(A) above
	G) 1 Control sample to be taken at a location on a separated unaffected watershed reservoir.	"	18(3)	"

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
VIRGIL C. SUMMER NUCLEAR STATION
TABLE 2-1 (Continued)

<u>Exposure Pathway and/or Sample</u>	<u>Criteria for Selection of Sample Number & Location</u>	<u>Sampling and Collection Frequency</u>	<u>Sample Locations</u> ⁽¹⁾	<u>Type & Frequency of Analysis</u>
<u>WATERBORNE</u> <u>(Cont'd)</u>				
V. Ground Water	A) 2 Indicator samples to be taken within the exclusion boundary and in the direction of potentially affected ground water supplies.	Quarterly grab sampling (7)	26 27	Gamma isotopic and critium analyses quarterly.
	B) 2 Control samples from unaffected locations.	"	16 18*	"
VI. Drinking Water	A) 1 Indicator sample from a nearby public ground water supply source.	Monthly grab sampling (5)	28	Monthly gamma isotopic, gross beta and tritium analyses†
	B) 1 Indicator (finished water) sample from the nearest downstream water supply.	Monthly composite sampling	17	"

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
VIRGIL C. SUMMER NUCLEAR STATION
TABLE 2-1 (Continued)

<u>Exposure Pathway and/or Sample</u>	<u>Criteria for Selection of Sample Number & Location</u>	<u>Sampling and Collection Frequency</u>	<u>Sample Locations</u> ⁽¹⁾	<u>Type & Frequency of Analysis</u>
<u>INGESTION:</u>				
VII. Milk (4)	<p>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 distant where doses are calculated to be greater than 1 mrem per year. (10)</p> <p>B) 1 Control sample to be taken at the location of a dairy > 20 miles distant and not in the most prevalent wind direction. (2)</p>	<p>Biweekly grab sample (8) ††</p> <p>"</p>	<p>14*</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>To be supplied when milking animals are found in accordance with criteria VII.A.</p> </div> <p>16</p>	<p>Gamma isotopic and I-131 analysis bi-weekly (8) ††</p> <p>"</p>

(14)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
VIRGIL C. SUMMER NUCLEAR STATION
TABLE 2-1 (Continued)

Exposure Pathway and/or Sample	Criteria for Selection of Sample Number & Location	Sampling and Collection Frequency	Sample Locations ⁽¹⁾	Type & Frequency of Analysis
<u>INGESTION (Cont'd)</u>				
	C) 1 Indicator grass (forage) sample to be taken at one of the locations beyond but as close to the exclusion boundary as practicable where the highest offsite sectoral ground level concentrations are anticipated. (2)	Monthly when available (5)	6	Gamma Isotopic
	D) 1 Indicator grass (forage) sample to be taken at the location of VII(A) above when animals are on pasture.	"	14* <div style="border: 1px solid black; padding: 2px; display: inline-block;">To be supplied when milking animals are found in accordance with criteria VII.A.</div>	"
	E) 1 Control grass (for- age) sample to be taken at the location of VII(B) above.	"	16	"

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
VIRGIL C. SUMMER NUCLEAR STATION
TABLE 2-1 (Continued)

<u>Exposure Pathway and/or Sample</u>	<u>Criteria for Selection of Sample Number & Location</u>	<u>Sampling and Collection Frequency</u>	<u>Sample⁽¹⁾ Locations</u>	<u>Type & Frequency of Analysis</u>
<u>INGESTION (Cont'd)</u>				
VIII. Food Products	A) Four samples of broadleaf vegetation grown in 1 location of special interest and in the 3 nearest offsite locations 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 5-10 km where the doses are calculated to be greater than 1 mrem/yr(10)	Monthly when available (5)	2* 5 6 8	Gamma Isotopic on edible por- tions.
	*B) 1 Indicator sample of each of the various types of foods grown in the area surrounding the plant.	Annually during grow- ing season (11)	6	"

(16)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
VIRGIL C. SUMMER NUCLEAR STATION
TABLE 2-1 (Continued)

<u>Exposure Pathway and/or Sample</u>	<u>Criteria for Selection of Sample Number & Location</u>	<u>Sampling and Collection Frequency</u>	<u>Sample⁽¹⁾ Locations</u>	<u>Type & Frequency of Analysis</u>
<u>INGESTION (Cont'd)</u>				
	C) 1 Control sample for the same foods in VIII (A) and (B) taken at a location at least 10 miles distant and not in the most prevalent wind direction.	Same as for VIII(A) or (3), as appropriate	18(3)	"
IX. Fish	A) 1 Indicator sample to be taken at a location in the upper reservoir.	Semi-annual (9) collection of the following specie types if available: bass; bream, crappie; catfish, carp; forage fish (shad)	23(3)	Gamma isotopic on edible portions semi-annually

(17)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
VIRGIL C. SUMMER NUCLEAR STATION
TABLE 2-1 (Continued)

<u>Exposure Pathway and/or Sample</u>	<u>Criteria for Selection of Sample Number & Location</u>	<u>Sampling and Collection Frequency</u>	<u>Sample Locations</u> ⁽¹⁾	<u>Type & Frequency of Analysis</u>
<u>INGESTION (Cont'd)</u>				
(18)	B) 1 Indicator sample to be taken at a location in the lower reservoir.	"	21(3)	"
	C) 1 Indicator sample to be taken at a location in the upper reservoir's non-fluctuating recreational area.	"	24(3)	"
	D) 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.	"	22(3)	"
<u>AQUATIC:</u>				
X. Sediment	A) 1 Indicator sample to be taken at a location in the upper reservoir.	Semi-annual grab sample (9)	23(3)	Gamma isotopic

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
VIRGIL C. SUMMER NUCLEAR STATION
TABLE 2-1 (Continued)

<u>Exposure Pathway and/or Sample</u>	<u>Criteria for Selection of Sample Number & Location</u>	<u>Sampling and Collection Frequency</u>	<u>Sample⁽¹⁾ Locations</u>	<u>Type & Frequency of Analysis</u>
<u>AQUATIC (Cont'd)</u>				
	B) 1 Indicator sample to be taken in the upper reservoir's non-fluctuating recreational area.	"	24(3)	"
	C) 1 Indicator sample to be taken on the shoreline of the lower reservoir.	"	21(3)	"
	D) 1 Control sample to be taken in the receiving river, sufficiently far upstream such that no effects of pumped storage operation are anticipated.	"	22(3)	"

(61)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
VIRGIL C. SUMMER NUCLEAR STATION
TABLE 2-1 (Continued)

NOTES

- (20) (1) Location numbers refer to Figures 1-1, 1-2, 1-3 and Table 2-2.
- (2) Sample site locations are based on the meteorological analysis for the period of record as presented in Chapters 5 and 6, Virgil C. Summer Operating License Environmental Report.
- (3) Though generalized areas are noted for simplicity of sample site enumeration, airborne, water and sediment sampling are 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. Should the survey 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) Time composite samples are samples which are collected with equipment capable of collecting an aliquot at time intervals which are short (e.g. hourly) 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) At least once per 400 days.
- (*) Not required by Technical Specifications.
- (**) Only 8 Stations required by Technical Specifications.
- (†) Technical Specification is quarterly.
- (††) Technical Specifications require semi-monthly sampling when animals are on pasture, monthly at other times.

VIRGIL C. SUMMER NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

TABLE 2-2

SAMPLING SITE LOCATIONS

Site #	Description	(1)	(2)	(3)
		Distance (Miles)	Direction	Sample Type(s)
1	Borrow Pit	1.2	182.0 S	AP, DM
2	Transmission Line	1.2	225.0 SW	AP, RI, DM, GA
3	Firing Range	1.2	270.0 W	DM
4	Fairfield Hydro	1.2	289.5 WNW	AP, DM
5	Transmission Line Entrance	0.9	145.5 SE	AP, RI, DM, GA
6	Env. Lab Garden	1.0	104.0 ESE	AP, RI, DM, GR, GA
7	Monticello Penninsula	1.2	83.0 E	DM
8	Monticello Res. S of Rd 224	1.5	63.0 ENE	AP, DM, GA
9	Ball Park	2.2	44.0 NE	DM
10	Meteorological Tower #2	2.5	25.5 NNE	AP, RI, DM
11	Ross Robinson	3.3	8.0 N	AP, DM
12	Old Hwy 99	4.2	349.0 N	DM
13	North Dam	2.9	334.0 NNW	AP, DM
14	Graham's Dairy	5.1	270.0 W	AP, RI, DM, MK, GR
15	Parr Village	2.5	204.0 SSW	AP, DM
* 16	McGinnis' Dairy	28.0	W	AP, RI, DM, GW, MK, GR
* 17	Columbia Water Works	24.7	SE	AP, RI, DM, SW, DW
* 18	Corley/Wyse (Lake Murray) (4)	16.5	S	AP, DM, SW, GW, GA
* 19	Smith (Little Saluda)	17.9	SSW	DM
* 20	Moss (Whitmire)	22.0	NW	DM
21	Parr Reservoir	2.7	199.5 SSW	SW, FH, BS
* 22	Carlisle/Neal Shoals (5)	24.0/30.0	NNW	SW, FH, BS
23	Discharge Canal (Mont. Res.)	0.5	104.5 ESE	SW, FH, BS
24	Recreation Lake	5.5	2.0 N	SW, FH, BS
25	Fairfield Pumped Storage (Monticello Res.)	0.9	302.0 WNW	SW
26	On Site Well (P4)	265 FT	270.0 W	GW
27	On Site Well (P5)	510 FT	180.0 S	GW
28	Nuclear Training Center (EOF)(6)	2.4	168.0 SSE	DW
29	Trans. Line WSW of VCSNS	0.9	248.0 WSW	DM
30	Oak Tree North of Borrow Pit	1.0	197.0 SSW	DM
31	McCrorey-Liston School	5.8	12.5 NNE	DQ
32	Dirt Rd off Rd 205	4.5	25.0 NNE	DQ
33	Rd 48 near Hwy 213	4.2	70.0 ENE	DQ
34	Rd 419 North of Hwy 60	4.8	112.5 ESE	DQ
35	Unnamed Circle Road off Hwy 215	4.8	137.5 SE	DQ

VIRGIL C. SUMMER NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

TABLE 2-2 (continued)

SAMPLING SITE LOCATIONS

<u>Site #</u>	<u>Description</u>	(1) <u>Distance</u> (Miles)	(2) <u>Direction</u>	(3) <u>Sample Type(s)</u>
36	Woods Behind Jenk. Post Office	3.1	151.5 SSE	DQ
37	Ruff House	4.9	305.5 NW	DQ
38	No Sampler			
39	No Sampler			
40	No Sampler			
41	End of Catwalk	3.9	185.0 S	DQ
42	Wicker's Store	3.9	199.0 SSW	DQ
43	Hwy 176 and Rd 435	5.2	236.0 SW	DQ
44	Rd 28 at Cannon's Creek	2.9	255.5 WSW	DQ
45	Rd 33 at Pomaria	5.9	253.0 WSW	DQ
46	Rd 28 at Heller's Creek	3.7	292.5 WNW	DQ
47	Fairfield Tailrace	1.0	316.0 NW	DQ
48	Cemetery	2.3	318.5 NW	DQ
49	North Rd 383	4.0	332.5 NNW	DQ
50	New Rd 99 (West Shore)	5.5	1.0 N	DQ
51	New Rd 99 (East Shore)	5.5	5.0 N	DQ
52	Monticello (Rd 11)	3.9	14.0 NNE	DQ
53	Rd 359	3.0	48.0 NE	DQ
54	Jenkinsville School	1.7	73.0 ENE	DQ
55	St. Barnabas Church	2.8	94.0 E	DQ
56	Jenkinsville Diner	2.0	144.0 SE	DQ
57	Shealy (Hwy 213 and 215)	2.7	146.0 SE	DQ
58	Zack Crumpton	2.5	158.0 SSE	DQ
59	Nuclear Training Center (EOF)(6)	2.4	168.0 SSE	DQ
60	Rd 98 near Rd 28	3.5	275.0 W	DQ
61	Switchyard, SE Entrance to Plant	0.10	180.0 S	DM
62	East of Training Bldg.	0.13	220.0 SW	DM
63	East of Daniel's Office	0.17	270.0 W	DM
64	Riprap W of Intake	0.13	338.5 NNW	DM
65	Guard Tower	0.13	22.5 NNE	DM
66	Jetty	0.6	33.0 NNE	DM
67	Service Water Pond (East Side)	0.5	72.0 ENE	DM
68	Fuel Oil Storage Tank	0.2	108.5 ESE	DM
69	Exclusion Buoy NNW on Monticello Res.	1.0	337.0 NNW	DM
70	Exclusion Buoy N on Monticello Res.	1.0	0.0 N	DM
71	Temperature Buoy on Monticello Res.	5.4	3.0 N	DM

VIRGIL C. SUMMER NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

TABLE 2-2 (continued)

FOOTNOTES

(*) Control Site.

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

AP = Air Particulate	DW = Drinking Water
RI = Air Radioiodine	MK = Milk
DM = Monthly TLD	GR = Grass (Forage)
DQ = Quarterly TLD	GA = Garden
SW = Surface Water	FH = Fish
GW = Ground Water	BS = Bottom Sediment

- (4) Site 18 consists of 4 locations in close proximity next to Lake Murray. Air and TLD Samples are taken at the SCE&G employee recreation area at Pine Island. Ground water samples are taken at the Corley residence. Garden product samples are taken at the Wyse residence. Surface water is taken near the shoreline in Lake Murray.
- (5) Site 22 consists of 2 sampling locations. A continuous surface water sampler is co-located with USGS at the Carlisle Highway 121 bridge over the Broad River. Fish and sediment samples are taken upstream of this location at Neal Shoals.
- (6) Site 28 for drinking water and site 59 for quarterly TLD measurements are co-located at the location of the SCE&G Nuclear Training Center which doubles as the Virgil C. Summer Station Emergency Offsite Facility.

VIRGIL C. SUMMER NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

2.3 Land Use Census (1983)

The annual land use census for 1983 was conducted from September 19 through September 28, 1983. The results of the 1983 census are summarized in Table 2-3. (For results of previous surveys, see the 1982 Radiological Environmental Monitoring Report and the Preoperational Baseline Environmental Report.) Major points of interest coming out of the 1983 census are as follows:

1. The Radiological Environmental Laboratory gardens are now located in the following sectors:
 - a. SW, 1.2 miles - Site #2
 - b. SE, 0.9 miles - Site #5
 - c. ESE, 1.0 miles - Site #6
 - d. ENE, 1.5 miles - Site #8

These locations reflect the results of the $\overline{D/Q}$ calculations for critical receptors following the 1982 land use census (see the 1982 Radiological Environmental Monitoring Report). $\overline{D/Q}$ represents the annual average relative deposition of gaseous effluents released from VCSNS at the location occupied by the maximum exposed individual. These results have been reconfirmed following the 1983 census (see Table 2-4). Sites 5, 6 and 8 are used as the gardens required by Technical Specifications, Table 3.12-1, Item VIII.A. Site 2 is maintained in order to monitor the potential grazing area in that sector on the west side of Parr Reservoir.

2. Residential development of the shorelines of Monticello and Parr Reservoirs is increasing.
3. There are still no milking animals being milked within 5 miles of Virgil C. Summer Nuclear Station.
4. The nearest dairy activity is still in the west sector, 5.1 miles from Virgil C. Summer Nuclear Station.

Changes from the 1982 land use census are noted on the summary Table 2-3.

Upon completion of the census, dose calculations were performed using 1975 and 1979 meteorological data and source terms from the Virgil C. Summer Nuclear Station Final Safety Analysis Report to determine the critical receptor (maximum exposed individual) for each sector around the Virgil C. Summer Nuclear Station. The results of these calculations are compiled in Table 2-4.

TABLE 2-3

CENSUS VERIFICATION - SEPTEMBER 1983

Sector	Nearest Residence	Miles	Nearest Garden	Miles	Cattle	No. Milked	Miles	Goats	No. Milked	Miles
N	Martin	3.8	Martin	3.8						
NNE	McGill	3.1	McGill	3.1	Robinson	0	3.5			
NE	Stone ¹	2.1	Stone ³	2.1	Robinson	0	2.9	Stone	0	2.1
ENE	Johnson	1.4	Willingham	1.5						
E	Anderson ¹	1.4	Martin	1.5						
ESE	Martin ¹	1.1	Martin	1.1						
SE	White	1.5	Summer	1.5						
SSE	Crumpton	2.5	Crumpton	2.5						
S	Eargle	3.9	Eargle	3.9	Yarborough	0	3.8			
SSW	Weber ¹	3.2	Ash	3.4	Smith	0	4.5			
SW	Davis	3.1	Davis	3.1	Summer ⁴	0	3.1			
WSW	Summer	3.3	Summer	3.3	Miller	0	2.3			
W	Amick	2.5	Amick	2.5	Miller ⁴	0	2.3			
WNW	Palmer ¹	2.7	Palmer ³	2.7	Williams*	0	4.5	Turki ⁴	0	4.2
NW	Wright	3.9	Wright	3.9	Cole	0	4.1			
NNW	March ²	2.9	March	3.0	March	0	3.0	March*	0	3.0

*Milking Animal, Not Milked

¹Change in Closest Residence³Change in Closest Garden²Name Change⁴Additional Location

TABLE 2-4

CRITICAL RECEPTORS - 1983 CENSUS

SECTOR	DISTANCE (Miles)	NAME	PATHWAY	1975 METEOROLOGICAL DATA			1979 METEOROLOGICAL DATA		
				\bar{X}/Q	\bar{D}/Q	DOSE RATE mrem/yr	\bar{X}/Q	\bar{D}/Q	DOSE RATE mrem/yr
N	3.8	*Martin	Res/Gar	2.3E-07	6.8E-10	1.9E-01	1.6E-07	4.8E-10	1.3E-01
NNE	3.1	McGill	Res/Gar	4.1E-07	1.3E-09	3.5E-01	2.5E-07	8.6E-10	2.3E-01
NNE	3.5	*Robinson	Res/Gar/Beef	3.5E-07	9.6E-10	3.6E-01	2.0E-07	6.5E-10	2.4E-01
NE	2.1	*Stone(1)	Res/Gar/Goat	9.4E-07	3.6E-09	1.0E-01	6.2E-07	2.5E-09	6.6E-01
NE	2.9	Robinson	Res/Gar/Beef	5.0E-07	1.6E-09	6.0E-01	3.2E-07	1.2E-09	4.4E-01
ENE	1.4	Johnson	Res	1.8E-06	8.0E-09	6.9E-02	1.3E-06	5.6E-09	4.9E-02
ENE	1.5	*Willingham	Res/Gar	1.6E-06	6.8E-09	1.8E+00	1.1E-06	4.9E-09	1.3E+00
E	1.4	Anderson(1)	Res	1.7E-06	6.6E-09	6.4E-02	1.3E-06	5.0E-09	4.9E-02
E	1.5	*Martin	Res/Gar	1.5E-06	5.6E-09	1.5E+00	1.1E-06	4.4E-09	1.2E+00
ESE	1.1	*Martin(1)	Res/Gar	2.8E-06	8.2E-09	2.3E+00	1.5E-06	4.8E-09	1.3E+00
SE	1.5	White	Res	2.1E-06	5.8E-09	7.8E-02	5.5E-07	2.0E-09	2.1E-02
SE	1.5	*Summer	Res/Gar	2.1E-06	5.8E-09	1.6E+00	5.5E-07	2.0E-09	5.4E-01
SSE	2.5	*Crompton	Res/Gar	5.0E-07	1.2E-09	3.4E-01	1.2E-07	5.1E-10	1.4E-01
S	3.9	*Eargle	Res/Gar	2.5E-07	3.6E-10	1.1E-01	8.2E-08	3.3E-10	8.8E-02
S	3.8	Yarborough	Beef (3)	2.6E-07	3.9E-10	4.9E-02	8.6E-08	3.5E-10	3.8E-02
SSW	3.2	Weber(1)	Res	3.3E-07	7.4E-10	1.2E-02	1.2E-07	6.4E-10	4.6E-03
SSW	3.4	*Ash	Res/Gar	2.9E-07	6.4E-10	1.8E-01	1.1E-07	5.8E-10	1.5E-01
SSW	4.5	Smith	Beef (3)	1.8E-07	3.5E-10	4.2E-02	6.3E-08	3.3E-10	3.5E-02
SW	3.1	*Davis	Res/Gar	4.4E-07	1.2E-09	3.3E-01	1.5E-07	1.1E-09	2.8E-01
SW	3.1	Summer	Beef (3)	4.4E-07	1.2E-09	1.4E-01	1.5E-07	1.1E-09	1.2E-01
WSW	3.3	*Summer	Res/Gar	3.1E-07	8.8E-10	2.4E-01(4)	9.0E-08	6.4E-10	1.6E-01(4)
WSW	2.3	Miller	Beef (3)	6.0E-07	2.0E-09	2.2E-01	2.0E-07	1.4E-09	1.5E-01
W	2.3	*Miller	Res/Gar/Beef	4.3E-07	1.4E-09	5.2E-01	2.3E-07	1.1E-09	4.0E-01
W	2.5	Amick	Res/Gar	3.6E-07	1.1E-09	3.0E-01	1.9E-07	9.2E-10	2.4E-01
WNW	2.7	*Palmer(1)	Res/Garden	2.6E-07	7.9E-10	2.2E-01	1.6E-07	7.0E-10	1.8E-01
WNW	4.5	Williams	Res/Gar/Beef	1.0E-07	2.5E-10	9.5E-02	5.9E-08	2.3E-10	8.4E-02
WNW	4.2	Turki	Res/Goat	1.1E-07	3.0E-10	7.7E-03	6.8E-08	2.7E-10	5.8E-03
NW*	3.9	Wright	Res/Gar	1.7E-07	4.6E-10	1.3E-01	1.2E-07	4.0E-10	1.1E-01
NW	4.1	*Cole	Res/Gar/Beef	1.6E-07	4.1E-10	1.6E-01	1.1E-07	3.7E-10	1.4E-01
NNW	2.9	J. March(2)	Residence	2.8E-07	4.0E-10	1.0E-02	3.0E-07	9.4E-10	1.1E-02
NNW	3.0	*F. March	Res/Gar/Beef	2.7E-07	9.4E-10	3.5E-01	2.8E-07	8.6E-10	3.2E-01
NNW	3.0	F. March	Res/Gar/Goat	2.7E-07	9.4E-10	2.7E-01	2.8E-07	8.6E-10	2.5E-01

TABLE 2-4 (continued)

CRITICAL RECEPTORS - 1983 CENSUS

- * Denotes Critical Receptor (maximum exposed individual) for the Sector.
- (1) Change in Closest Residence.
- (2) Name Change.
- (3) Residence assumed in calculations.
- (4) Assuming Summer eats beef from his herd in the SW, Summer's dose rate would be as follows:
0.36 mrem/yr (75 X/Q, D/Q), 0.27 mrem/yr (79 X/Q, D/Q).

VIRGIL C. SUMMER NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

2.4 Program Changes from Previous Reporting Period

2.4.1 Environmental Laboratory Move

On about March 1, 1983, the VCSNS Environmental Surveillance Laboratory completed the move of its entire facility from the old Parr Nuclear Plant Service Building to new quarters in the Virgil C. Summer Nuclear Training Center (NTC) located 2.4 miles SSE of VCSNS at the junction of highways 16 and 213. The new facilities provide ~7000 sq. ft. of laboratory and count room space for both the Radiological and Non-Radiological Environmental Programs groups. Adequate office space, conference rooms and a Butler Building to house the TLD irradiator and company boats and trucks is also available at the new location. The Environmental Surveillance Laboratory is located next to the VCSNS Emergency Offsite Facility (EOF) and its Technical Support Center in order to provide support for emergency functions necessary for the Virgil C. Summer Nuclear Station.

2.4.2 Sampling Site Changes

1. Site 5

As mentioned in Section 2.3, the garden located at Site 4 (1.2 miles WNW) in 1982 was relocated to Site 5 (0.9 miles SE) in 1983 reflecting the results of D/Q calculations from the 1982 land use census. The first garden sample from Site 5 was taken April 4, 1983.

2. Site 18

In 1982, the site 18 control air sampler and monthly TLD were located at the Corley residence near Lake Murray. Sale of the property on which these samplers were located and subsequent construction activity necessitated the movement of the samplers to a new location on Pine Island (an SCE&G recreational facility) at Lake Murray - nearly the same distance and direction from VCSNS. The last air sample was collected at Corleys January 4, 1983 and the first air sample

VIRGIL C. SUMMER NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

started at Pine Island January 12, 1983. The TLD location was switched during the January 5, 1983 changeout between the December, 1982 and January, 1983 samples.

3. Site 28

The Jenkinsville grab drinking water sample taken at the Mobile Diner (2.0 miles SE) was moved to the newly built NTC (2.4 miles SSE) housing the VCSNS Environmental Laboratory (see Section 2.4.1) May 16, 1983 when the Mobile Diner was closed. The NTC and Mobile Diner are on the same well system so the baseline data remains directly comparable.

4. Site 29

A close look at the aerial photographs (see 1982 Operational Radiological Environmental Monitoring Report) of the vicinity of VCSNS revealed that Site 29 was not located as indicated on the maps (Figures 1-2 and 1-3) and table (Table 2-2). During the normal changeout of monthly TLD's on January 5, 1983, this situation was rectified by moving the TLD about 1500 feet northeast from the edge of the Broad River to its present location on the Transmission Line (0.9 mile WSW of VCSNS).

5. Site 59

The quarterly TLD site located on private land just north of highway 16, 2.2 miles SSE of VCSNS, was moved across highway 16 to SCE&G property at the intersection of highways 16 and 213 during the normal quarterly changeout January 13, 1983. The new location was at the front of the newly constructed NTC, 2.4 miles SSE of VCSNS. Once the construction was completed and grass laid, the TLD was moved to its present location at the back of the NTC (still 2.4 miles SSE) during the next scheduled quarterly changeout on April 13, 1983.

VIRGIL C. SUMMER NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

2.4.3 Analysis Changes

With the full development of the liquid scintillation (tritium analysis) program in 1983, a monthly tritium sample count was instituted for all surface and drinking water samples. This is a change from the quarterly tritium composite samples previously analyzed and required by Technical Specifications. Monthly tritium counting will allow Radiological Environmental Programs personnel to monitor the liquid effluent pathway for tritium in a more timely and sensitive manner.

2.5 Indicator and Control Samples

In addition to comparisons between preoperational and operational data (Section 2.2), control-indicator comparisons are performed. The comparisons of operational control-indicator data are utilized to assess the probability that any observed high concentration estimate is due to random or regional fluctuations in measurements rather than to a true increase in local environmental concentrations. Indicator sites are generally within five miles of the plant and are indicative of plant operating conditions. (See Figures 1-2 and 1-3 for detailed maps of the indicator sampling locations around the Virgil C. Summer Nuclear Station and Table 2-2 for specific details.) Control sites are greater than ten miles from the plant and are intended to indicate conditions away from its influence. (See Figure 1-1 and Table 2-2 for locations of control sites around VCSNS.)

Valuable information can be gained through multiple types of sampling and measurements at specific locations. As can be seen from Table 2-2, several multiple sampling combinations are in use around the Virgil C. Summer Nuclear Station. All air sampling locations (Sites 1, 2, 4, 5, 6, 8, 10, 11, 13, 14, 15, 16, 17, 18) are also environmental dosimetry monitoring locations. At those points airborne plant effluent contribution is monitored for gamma immersion dose (noble gases), airborne particulates, and (at Sites 2, 5, 6, 10, 14, 16, 17 only) radioiodine. Eight of these locations have additional complementary sampling/measurement pathways for monitoring plant effluents. Sites 2 (1.2 mi SW), 5 (0.9 mi SE), and 8 (1.5 mi ENE) have broadleaf vegetation gardens for monitoring a gaseous effluent deposition and ingestion pathway. The other five locations (three of them control sites) allow greater definition of existing specific pathways.

VIRGIL C. SUMMER NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

Site 6 - Environmental Lab Garden (1.0 mi ESE)

Air Particulate
Air Radioiodine
Environmental TLD (Monthly)
Broadleaf Vegetation
Other Food Crops
Grass (Forage)

Site 14 - Graham's Dairy (5.1 mi W)

Air Particulate
Air Radioiodine
Environmental TLD (Monthly)
Milk
Grass (Forage)

Site 16 - McGinnis' Dairy (28.0 mi W)

Air Particulate
Air Radioiodine
Environmental TLD (Monthly)
Milk
Grass (Forage)
Ground Water

Site 17 - Columbia Water Works (24.7 mi SE)

Air Particulate
Air Radioiodine
Environmental TLD (Monthly)
Surface Water
Drinking Water

Site 18 - Corley/Wyse/Pine Island (Lake Murray) - (16.5 mi S)

Air Particulate
Environmental TLD (Monthly)
Broadleaf Vegetation
Other Food Crops
Surface Water
Ground Water

In addition, liquid effluents are monitored through three pathways (fish, bottom sediment and surface water) at the three most probably affected bodies of water around the plant - Site 21: Parr Reservoir (2.7 mi SSW), Site 23: Monticello Reservoir (0.5 mi ESE), and Site 24: Recreation Lake (5.5 mi N). The control location for liquid effluent comparisons is at Site 22: Carlisle/Neal Shoals (24.0/30.0 mi NNW on the Broad River).

VIRGIL C. SUMMER NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

2.6 Operational Radiological Monitoring Results

The preoperational radiological monitoring for the VCSNS was conducted from November, 1977 until plant start-up in October, 1982. The baseline data obtained from the preoperational program are summarized in Appendix A-1.

The operating period for VCSNS covered in this report spans the 1983 calendar year (January 1 - December 31, 1983). Table 2-5 summarizes the results of the Radiological Environmental Monitoring Program for the 1983 period of VCSNS operation. Values given for baseline ranges are finalized values taken from baseline data (see Appendix A-1).

2.7 Program Exceptions

Certain samples and analyses were inadvertently omitted or unavoidably lost or altered during the 1983 operational period. These exceptions are delineated in accordance with Technical Specification requirements and the reason for the omissions noted below and summarized by week and site in Table 2-6. Taking these program exceptions into account, the Virgil C. Summer Radiological Environmental Surveillance Laboratory was still able to attain a completion rate of greater than 98%. Detailed analysis of the impact of these omissions verified that program quality has not been affected and there were no violations of Technical Specification requirements.

1. Air Particulates

Seventeen (17) of the 728 air particulate samples taken during 1983 did not result in successful analyses.

- a. Power outages and other equipment failures were the causes of ten air particulate omissions due to an insufficient volume of air passing through each filter.
- b. Wet or washed out particulates were the cause of three additional omissions from the program. The affected air samplers have been modified to preclude this difficulty in the future.
- c. One sample was omitted due to planned relocation of the air sampler (see Section 2.4).
- d. Personnel error resulted in the loss of one sample and the invalidation of two additional related samples.

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Virgil C. Summer Nuclear Station
Fairfield County, South Carolina

Docket No. 50-395
Reporting Period: 1/1/83 - 12/31/83

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection[1] Actual(Max.)	All Indicator Locations Mean [2] (Range)	Location with Highest Annual Mean		Control Locations Mean[2] (Range)	Number of Nonroutine Reported[3] Measurements
				Name (Distance and Direction)	Mean[2] (Range)		
Air Particulate (pCi/m ³)	Gross Beta (711)	0.0035 (0.01)	0.026 (560/560) (0.011 - 0.053)	Site #13, North Dam (2.9 mi. NNW)	0.027 (52/52) (0.014-0.049)	0.026 (151/151) (0.0050-0.060)	0
	Gamma Spec (168)						
	Be-7	0.15	0.14 (48/132) (0.067-0.52)	Site #10, Met Tower #2 (2.5 mi. NNE)	0.23 (4/12) (0.10-0.52)	0.14 (13/36) (0.077-0.22)	0
	Cs-134	0.0025 (0.05)	All < LLD			All < LLD	0
	Cs-137	0.0022 (0.06)	All < LLD			All < LLD	0
Air Radiiodine (pCi/m ³)	I-131 (354)	0.039 (0.07)	All < LLD[4]			All < LLD	0
Direct (TLD) (uR/hr)	Gamma (264) Monthly	0.52[5]	9.1 (168/168) (7.2 - 13.0)	Site #9, Ball Park (2.2 mi. NE)	13.0 (12/12) (12.0 - 13.3)	10.7(96/96) (7.1 - 13.0)	0
	Gamma (108) Quarterly	0.52[5]	9.6 (108/108) (6.0 - 13.7)	Site #55, St. Barnabas Church (2.8 mi E)	13.7 (4/4) (12.7-14.5)		0
Surface Water (pCi/l)	H-3 (90)	520 (2000)	390 (57/64) (12-890)	Site #25, Fairfield Pumped Storage (0.9 mi. WNW)	470 (12/13) (130-860)	All < LLD	0
	Gamma Spec(90)						
	Mn-54	0.19(15)	All < LLD			All < LLD	0

TABLE 2-5 (continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Virgil C. Summer Nuclear Station
Fairfield County, South Carolina

Docket No. 50-395
Reporting Period: 1/1/83 - 12/31/83

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection[1] Actual(Max.)	All Indicator Locations Mean [2] (Range)	Location with Highest Annual Mean		Control Locations Mean[2] (Range)	Number of Nonroutine Reported[3] Measurements
				Name (Distance and Direction)	Mean[2] (Range)		
Surface Water (pCi/l) (Continued)	Co-58	0.22(15)	0.36 (3/64) (0.31-0.43)	Site #21, Parr Reservoir (2.7 mi. SSW)	0.43 (1/13) (Single Value)	All < LLD	0
	Fe-59	5.1 (30)	All < LLD			All < LLD	0
	Co-60	0.18(15)	All < LLD			All < LLD	0
	Zn-65	0.44(30)	All < LLD			All < LLD	0
	Zr-95	0.56(30)	All < LLD			All < LLD	0
	Nb-95	0.49(15)	All < LLD			All < LLD	0
	Cs-134	0.20(15)	All < LLD			All < LLD	0
	Cs-137	0.19(18)	All < LLD			All < LLD	0
	Ba-140	2.4(60)	All < LLD			All < LLD	0
	La-140	0.76(15)	All < LLD			All < LLD	0
	Ra-226	81	19 (12/64) (1.4-50)	Site #25, Fairfield Pumped Storage (0.9 mi. WNW)	27 (2/13) (25-29)	19 (3/26) (4.7-34)	0

TABLE 2- continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Virgil C. Summer Nuclear Station
Fairfield County, South Carolina

Docket No. 50-395
Reporting Period: 1/1/83 - 12/31/83

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection[1] Actual(Max.)	All Indicator Locations Mean [2] (Range)	Location with Highest Annual Mean		Control Locations Mean[2] (Range)	Number of Nonroutine Reported[3] Measurements
				Name (Distance and Direction)	Mean[2] (Range)		
Ground Water [6] (pCi/l)	H-3(19)	530 (2000)	All < LLD			All < LLD	0
	Gamma Spec(19)						
	Mn-54	2.3 (15)	All < LLD			All < LLD	0
	Co-58	2.3(15)	All < LLD			All < LLD	0
	Fe-59	4.5(30)	All < LLD			All < LLD	0
	Co-60	2.3(15)	All < LLD			All < LLD	0
	Zn-65	5.6(30)	All < LLD			All < LLD	0
	Zr-95	4.2(30)	All < LLD			All < LLD	0
	Nb-95	3.0(15)	All < LLD			All < LLD	0
	Cs-134	3.7(15)	All < LLD			All < LLD	0
	Cs-137	2.6(18)	All < LLD			All < LLD	0
	Ba-140	13.3(60)	All < LLD			All < LLD	0
	La-140	3.6(15)	All < LLD			All < LLD	0

TABLE 2-5 (continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Virgil C. Summer Nuclear Station
Fairfield County, South Carolina

Docket No. 50-395
Reporting Period: 1/1/83 - 12/31/83

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection[1] Actual(Max.)	All Indicator Locations Mean [2] (Range)	Location with Highest Annual Mean		Control Locations Mean[2] (Range)	Number of Nonroutine Reported[3] Measurements
				Name (Distance and Direction)	Mean[2] (Range)		
Ground Water [6] (pCi/l) (Continued)	Ra-226	80	31 (3/9) (13-56)	Site #26, Onsite Well (P4)(265 ft. W)	31 (3/9) (13-56)	14 (2/10) (12-15)	0
Drinking Water [7,8] (pCi/l)	Gross Beta (30)	0.96 (4)	8.5(30/30) (1.3-27)	Site #28, Nuclear Train- ing Center (2.4 mi. SSE)	15(15/15) (9.9-27)		0
	H-3 (30)	630 (2000)	All < LLD				0
	Gamma Spec(27)						
	Mn-54	0.16 (15)	All < LLD				0
	Co-58	0.18 (15)	0.30(1/27) (Single Value)	Site #17, Columbia Waterworks (24.7 mi SE)	0.30(1/14) (Single Value)		0
	Fe-59	8.1 (30)	All < LLD				0
	Co-60	0.16 (15)	All < LLD				0
	Zn-65	0.39 (30)	All < LLD				0
	Zr-95	0.46 (30)	All < LLD				0
	Nb-95	0.37 (15)	All < LLD				0

TABLE 2-5 (continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Virgil C. Summer Nuclear Station
Fairfield County, South Carolina

Docket No. 50-395
Reporting Period: 1/1/83 - 12/31/83

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection[1] Actual(Max)	All Indicator Locations Mean [2] (Range)	Location with Highest Annual Mean		Control Locations Mean[2] (Range)	Number of Nonroutine Reported[3] Measurements
				Name (Distance and Direction)	Mean[2] (Range)		
Drinking Water [7,8] (pCi/l) (Continued)	I-131	0.56 (1)	All < LLD				0
	Cs-134	0.19 (15)	All < LLD				0
	Cs-137	0.17 (18)	All < LLD				0
	Ba-140	1.2 (60)	All < LLD				0
	La-140	0.40 (15)	All < LLD				0
	Ra-226	160	20 (2/27) (5.8-34)	Site #17 Columbia Water- works (24.7 mi SE)	20 (2/14) (5.8-34)		0
Milk (pCi/l)	Gamma Spec(56)						
	K-40	91	1430 (28/28) (1330 - 1560)	Site #14, Graham's Dairy (5.1 mi W)	1430 (28/28) (1330-1560)	1410 (28/28) (1280-1530)	0
	I-131	0.62 (1)	All < LLD [9]			All < LLD	0
	Cs-134	2.9 (15)	All < LLD			All < LLD	0
	Cs-137	2.9 (18)	All < LLD			5.5 (28/28) (2.4 - 8.3)	0
	Ba-140	11 (60)	All < LLD			All < LLD	0

TABLE 2-- (continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Virgil C. Summer Nuclear Station
Fairfield County, South Carolina

Docket No. 50-395
Reporting Period: 1/1/83 - 12/31/83

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection[1] Actual(Max.)	All Indicator Locations Mean [2] (Range)	Location with Highest Annual Mean		Control Locations Mean[2] (Range)	Number of Nonroutine Reported[3] Measurements
				Name (Distance and Direction)	Mean[2] (Range)		
Milk (pCi/l) (Continued)	La-140	2.0 (15)	All < LLD			All < LLD	0
Grass (pCi/kg wet)	Gamma Spec(24)						
	Be-7	520	380 (13/16) (100-800)	Site #14, Graham's Dairy (5.1 mi W)	460 (8/8) (290-800)	650 (7/8) (280-1030)	0
	K-40	540	5890 (16/16) (4160-7900)	Site #14, Graham's Dairy (5.1 mi W)	6200 (8/8) (4960-7900)	6420 (8/8) (5180-8140)	0
	I-131	26 (60)	All < LLD			All < LLD	0
	Cs-134	16 (60)	All < LLD			All < LLD	0
	Cs-137	18 (80)	12 (1/16) (Single Value)	Site #6, Garden (1.0 mi ESE)	12 (1/8) (Single Value)	52(1/8) (Single Value)	0
Broadleaf Vegetation (pCi/kg wet)	Gamma Spec(40)						
	Be-7	140	230 (9/31) (90-570)	Site #6, Garden (1.0 mi ESE)	340 (3/7) (170-570)	200 (4/9) (87-300)	0
	K-40	470	4540 (31/31) (2650-7640)	Site #2, Transmission Line (1.2 mi SW)	5080 (6/6) (2980-7640)	4490 (9/9) (2940-5670)	0
	I-131	22 (60)	All < LLD			All < LLD	0

TABLE 2-5 (continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Virgil C. Summer Nuclear Station
Fairfield County, South Carolina

Docket No. 50-395
Reporting Period: 1/1/83 - 12/31/83

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection[1] Actual(Max.)	All Indicator Locations Mean [2] (Range)	Location with Highest Annual Mean		Control Locations Mean[2] (Range)	Number of Nonroutine Reported[3] Measurements
				Name (Distance and Direction)	Mean[2] (Range)		
Broadleaf Vegetation (pCi/kg wet) (Continued)	Cs-134	14 (60)	All < LLD			All < LLD	0
	Cs-137	14 (80)	19 (3/31) (14-22)	Site #5, Trans. Line Entrance (0.9 mi SE)	22 (1/10) (Single Value)	All < LLD	0
Other Vegetation (pCi/kg wet)	Gamma Spec(10) Be-7	150	All < LLD			All < LLD	0
	K-40	310	2450 (8/8) (1520-4270)	Site #6, Garden (1.0 mi ESE)	2620 (3/3) (2300-2980)	3280 (2/2) (2320-4230)	0
	Cs-134	13 (60)	All < LLD			All < LLD	0
	Cs-137	12 (80)	All < LLD			All < LLD	0
Fish (pCi/kg wet)	Gamma Spec(37)						
	K-40	260	3150 (30/30) (1910-4390)	Site #21, Parr Reservoir (2.7 mi SSW)	3190 (10/10) (2400-4120)	2640 (7/7) (1220-3630)	0
	Cs-134	12 (130)	All < LLD			All < LLD	0
	Cs-137	14 (150)	21 (19/30) (8.4-48)	Site #24, Rec. Lake (5.5 mi N)	25 (6/10) (12-48)	20 (4/7) (14-26)	0
	Co-58	19 (130)	All < LLD			All < LLD	0

TABLE 2-5 (continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

Virgil C. Summer Nuclear Station
Fairfield County, South Carolina

Docket No. 50-395
Reporting Period: 1/1/83 - 12/31/83

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection[1] Actual(Max.)	All Indicator Locations Mean [2] (Range)	Location with Highest Annual Mean		Control Locations Mean[2] (Range)	Number of Nonroutine Reported[3] Measurements
				Name (Distance and Direction)	Mean[2] (Range)		
Fish (pCi/kg wet) (Continued)	Co-58	19 (130)	All < LLD			All < LLD	0
	Mn-54	13 (130)	All < LLD			All < LLD	0
	Fe-59	61 (260)	All < LLD			All < LLD	0
	Zn-65	30 (260)	All < LLD			All < LLD	0
	Co-60	13 (130)	All < LLD			All < LLD	0
Sediment [10] (pCi/kg)	Gamma Spec(12)						
	K-40	480	14700 (9/9) (7240-38200)	Site #24, Recreation Lake (5.5 mi N)	24000 (3/3) (14500-38200)	18000 (3/3) (17700-18400)	0
	Cs-134	46 (150)	All < LLD			All < LLD	0
	Cs-137	17 (180)	150 (8/9) (19-330)	Site #21, Parr Reservoir (2.7 mi SSW)	260 (3/3) (200-330)	190 (3/3) (185-200)	0

VIRGIL C. SUMMER NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

TABLE 2-5 (Continued)

FOOTNOTES

1. LLD values given are values calculated from the program data analyses with maximum acceptable 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. Any confirmed measured level of radioactivity in any environmental medium that exceeds ten times the control station value.
4. One sample exceeded maximum LLD. The calculated LLD was 0.072 pCi/m^3 .
5. Detection sensitivity is approximately 5 mrem/yr (0.52 uR/hr) determined from the analyses of five years of preoperational data.
6. Elevated levels of Pb-214 and Bi-214 were observed in the ground water sample taken at Site #18, Corley's Well. The values are not reported here because they are naturally occurring (do not originate from VCSNS) and furnish no quantifiable information of interest.
7. No control location specified for drinking water.
8. Elevated levels of Pb-214 and Bi-214 were observed in all 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.
9. One sample exceeded maximum LLD. The calculated LLD was 1.06 pCi/l .
10. Elevated levels of Pb-214, Bi-214 plus other Ra-226 daughter products and Ac-228 plus other Th-232 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.

VIRGIL C. SUMMER NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

TABLE 2-6

1983 ENVIRONMENTAL PROGRAM EXCEPTIONS (1)

<u>Sample Type</u>	<u>Week[2]</u>	<u>Site[3]</u>	<u>Reason[4]</u>
Air Particulate/ Radioiodine	2	18	Planned sampler move
	18	16	Personnel error
	*26	5	Blown fuse
	27	11	Blown fuse
	29	10	Personnel error
	30	10	Personnel error
	32	4	Wet particulate
	*32	5	Blown fuse
	33	4	Power disconnected
	34	15	Blown fuse
	†34	2	Personnel error
	†35	10	Personnel error
	*35	17	Damaged transformer
	*38	16	Blown fuse
	*38	17	Blown fuse
	*41	5	Transformer problems
	*43	5	Blown fuse
	†45	5	Switch failure
	50	4	Washed out particulate
	52	8	Washed out particulate
	5	70	Buoy broke loose
	48	17	Destroyed by construction
	52	17	Vandalism
Surface Water [6]	6	22	Clogged tubing (grab)
	9	23	Over required period (4 days)
	15	22	Clogged tubing (grab)
	45	17	Missing week in composite
Ground Water	*1	22	Sand in pump head (grab)
	52	16	Pump frozen [7]
	28	17	Personnel error (grab)
Drinking Water [6]	45	17	Missing week in composite
Broadleaf Vegetation	21	2	Late spring freeze
	21	5	Late spring freeze
	21	6	Late spring freeze
	21	8	Late spring freeze
	21	18	Late spring freeze
	34	2	Garden sprayed with herbicide
	38	2	Garden sprayed with herbicide
	42	2	Garden sprayed with herbicide
	43	6	Insect damage
Fish	16	22	Shad not available
	42	22	Bass not available

VIRGIL C. SUMMER NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

TABLE 2-6 (Continued)

FOOTNOTES

- * Both air particulate and radioiodine.
- † Air radioiodine only.
- ** Week 1 of 1984
- [1] Sample has been omitted unless otherwise specified.
- [2] Week in which sample was picked up (ending week for composite samples).
- [3] See Table 2-2 for site locations.
- [4] See text of Section 2-7 for more explanation.
- [5] Data available, but suspect.
- [6] Replacement sample (grab) or incomplete composite sample taken.
- [7] Replacement taken at nearest available well, about 250 yards south of required location.

VIRGIL C. SUMMER NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

2. Air Radioiodine

Analysis of ten (10) of the 364 air radioiodine charcoal cartridge samples for 1983 was not completed.

- a. Eight of the omitted air radioiodine samples related to power outages and equipment failures.
- b. Personnel error resulted in the loss of two additional samples.

3. Direct (TLD)

Three (3) of the 504 TLD sticks (four TLD's each) had adversely affected TLD's during 1983.

- a. The January TLD readings for Site #70 were accumulated at uncertain and variable locations due to buoy anchor failure.
- b. The November TLD stick at Site #17 (Columbia Water Works) was knocked over by construction workers.
- c. The December TLD stick at Site #17 was vandalized and one TLD was missing.

4. Surface Water

All 90 surface water samples were taken during 1983, although grab samples were used to replace composite samples in several instances.

- a. Equipment failures and power outages resulted in collection of three grab, rather than composite samples.
- b. Technician illness resulted in exceeding the 35 day maximum by 4 days for one sampling period.
- c. The water level at Columbia Canal was very low the week of 10/20-10/27/83, necessitating the shut down of the composite water pump. Thus one week of one water sample was omitted.

5. Ground Water

One sample was not taken at the designated well due to a frozen pump. A replacement sample was taken at the nearest well in that area.

VIRGIL C. SUMMER NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

6. Drinking Water

Two variances, one caused by personnel error (inadvertant reversal of tygon pump lines) and one due to low water (see 4c above) were experienced in 1983.

7. Broadleaf Vegetation

No samples were taken between January and March, 1983 as this is outside the normal growing season for this area of South Carolina. Crop damage due to insects, transmission line herbicide application, and a late spring freeze resulted in the unavailability of nine scheduled samples. The media were re-established at all locations as soon as practicable.

8. Fish

Quarterly sampling via electrofisher and nets did not provide two required samples. It is to be expected that certain species may not be available during all sampling periods.

3.0 INTERPRETATIONS AND CONCLUSIONS OF MONITORING FINDINGS

3.1 Airborne

3.1.1 Air Particulates

The gross beta results for air particulates collected at indicator locations during the 1983 operational period of the Virgil C. Summer Nuclear Station were below preoperational levels and comparable to operational control levels. These results can be summarized as follows:

Average Gross Beta Air Particulate Concentrations (pCi/m³)

<u>Indicator Locations</u>		<u>Control Locations</u>	
1983		1983	
<u>Preoperational</u>	<u>Operational</u>	<u>Preoperational</u>	<u>Operational</u>
*2.9E-02	2.6E-02	*3.0E-02	2.6E-02
(7.5E-02 with Chinese bomb fallout)		(8.1E-02 with Chinese bomb fallout)	

*Determined from September, 1981 through October, 1982. This period is more indicative of actual background conditions; the fallout from the Chinese bomb test observed early in 1981 had become insignificant by September 1981.

VIRGIL C. SUMMER NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

The preoperational-operational comparisons between individual indicator sites have similar relationships as those illustrated in the overall comparison above. The highest indicator activity during the 1983 operational period was found at Site #13, North Dam on Monticello Reservoir (2.9 mi NNW) with $2.7\text{E-}02$ pCi/m³. The highest control location activity during the same period was found to be $2.7\text{E-}02$ pCi/m³ at Site #16, McGinnis' Dairy (28.0 mi W). Due to the above observations, it is concluded that Virgil C. Summer Nuclear Station's operation has not resulted in increases of particulate beta activity in the environment.

The monthly composite gamma spectroscopy analyses for the air particulate samples revealed only naturally occurring background activities: Be-7 (from cosmic-ray production) and Ra-226 and K-40 (at essentially room background levels). No fission or activation products were observed.

These observations are expected based on a comparison of environmental data with plant effluent release data reported in the 1983 Semiannual Effluent and Waste Disposal Reports for Virgil C. Summer Nuclear Station. The latter reports show releases of 26.9 uCi of particulate activity for the year 1983. Due to large dilution and dispersion factors experienced in 1983 for atmospheric releases, the releases from VCSNS should not be detectable in environmental samples, as the data has substantiated.

3.1.2 Air Radioiodine

None of the analyses showed measurable radioiodine. The required maximum LLD of $7.0\text{E-}02$ pCi/m³ was met by all but one of the 252 indicator and 101 control measurements. The Site #6 (1.0 mi ESE) charcoal filter collected 12/23 - 12/30/83 showed an LLD of $7.2\text{E-}02$ pCi/m³ due to low sample volume. Total I-131 releases in plant effluents were limited to 20.5 uCi for 1983. This level of activity release is not discernable in environmental media upon applying 1983 dispersion/dilution factors.

3.1.3 Direct (Environmental TLD)

The exposure rates observed from all environmental TLD measurements during 1983 were the same (at the 99.5 percent confidence level) as the preoperational TLD measurements over the same seasonal time periods.

VIRGIL C. SUMMER NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

Indicator and control TLD measurements showed no appreciable differences during plant operation. Site #55, St. Barnabas Church near Jenkinsville (2.8 mi E), was the indicator location showing the highest mean exposure rate of 13.7 uR/hr. This is comparable to the mean exposure rate of 13.6 uR/hr measured during the preoperational period. Gaseous effluent release data from the 1983 Semiannual Effluent and Waste Disposal Reports indicate a total of 388 Ci of measureable gaseous effluents were released from Virgil C. Summer Nuclear Station during 1983. The main portion of this activity (380 Ci) was released in the first quarter when the contents of the waste gas holdup tanks were released. An extensive search of environmental TLD data and meteorological data during these concentrated release periods, indicates no evidence of detection of the activity from the releases. No effects of radiation released from the plant were discernable from observed natural background variations using this monitoring medium.

3.2 Waterborne

3.2.1 Surface Water

Tritium analyses of surface water samples during the 1983 operation of Virgil C. Summer Nuclear Station yielded the following results:

- | | |
|---|-------------|
| 1. Total number of analyses performed | - 90 |
| 2. Total number of analyses with measurable (>0) results | - 80 |
| 3. Total number of analyses with results above (mean) LLD | - 15 |
| 4. Mean LLD | - 520 pCi/l |
| 5. Mean indicator value (57/64 samples) | - 390 pCi/l |
| 6. Mean control value (23/26 samples) | - 220 pCi/l |

The average measured tritium results for both indicator and control sites are less than the mean calculated LLD. Only 15 of the 90 analyses exceeded the mean LLD, all of which were greater than 1000 pCi/l below the maximum LLD. All values were comparable to preoperational values for the same location and to typical surface water tritium levels for the Southeastern United States (eg. see CRC Handbook of Environmental Radiation). No releases from the plant were identifiable above the natural background observed in this sample medium. The dilution of the tritium by the body of water in which it was released and inherent error in low level tritium analysis does not allow the 227.4 Ci of tritium released by VCSNS in 1983 to

VIRGIL C. SUMMER NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

be observed in environmental samples.

Gamma spectroscopy analyses of surface water during 1983 yielded (with 3 notable exceptions) concentrations less than the lower limit of detection (LLD). The only radionuclides seen in these samples above background levels were Ra-226 (12 of 64 samples) which comes from natural sources and Co-58 (3 of 64 samples). The Co-58 (an activation product) was observed in the December, 1983 composite samples from Site #21, Parr Reservoir (2.7 mi SSW) and duplicate samples from Site #17, Columbia Water Works (24.7 mi SE). The results were as follows:

Site #	Location	Sample Collection Dates	Volume (liters)	Co-58 (pCi/l)
17	Columbia	12/8/83-1/6/84	18.55	0.31 \pm 0.11
17	Columbia (duplicate)	12/8/83-1/6/84	17.52	0.33 \pm 0.15
21	Parr	12/7/83-1/5/84	20.98	0.43 \pm 0.12

Parr Reservoir is about 2.5 miles downstream of the VCSNS major liquid effluent release point at the Fairfield Pumped Storage Facility Penstocks (see Page 1 and Figure 1-3). Columbia Water Works is about 22 miles further downstream on the Broad River. The liquid effluent releases of gamma emitters from VCSNS for December, 1983 were 880 mCi (82% of the total for the fourth quarter) of which Co-58 was the major nuclide released (660 mCi in the fourth quarter and about 540 mCi in December). Our conclusion is that the presence of Co-58 (a relatively short-lived radionuclide - 70.78 day half-life) is attributable to releases of liquid effluents from Virgil C. Summer Nuclear Station.

The levels of Co-58 observed are just above the Environmental Laboratory routine LLD (0.22 pCi/l) but much lower than the maximum LLD of 15 pCi/l. The reporting level for Co-58 in water samples is 1000 pCi/l, 3000 times higher than observed concentrations. The estimated dose (using ODCM methodology) to a member of the public would be about 1.1×10^{-3} mrem/yr and 8.6×10^{-4} mrem/yr near Parr Reservoir and Columbia Water Works, respectively, assuming the Co-58 remains in the water for an entire year at the reported level.

3.2.2 Ground Water

Tritium and gamma spectroscopy analyses of ground water samples all yielded results less than the mean calculated LLD

VIRGIL C. SUMMER NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

values. The control site #18, Corley's Well near Lake Murray (16.5 mi S) showed much higher than background levels of the Pb-214 and Bi-214 daughters of Ra-226. This was also seen in the preoperational data and is attributable to the large amount of granite found in this part of South Carolina. The granite contributes uranium and hence Ra-226 and its daughters to the wells in this area. The Pb-214 and Bi-214 are major gamma emitting daughters in this chain, produced through the decay of dissolved Radon gas (Rn-222) in the water. No evidence of radioactivity from operation of the plant is present.

3.2.3 Drinking Water

Indicator water samples taken from the Jenkinsville and Columbia drinking water supplies showed no measurable activities (with one notable exception) for any of the 12 important gamma-emitting radionuclides monitored during the 1983 operation of VCSNS. Activities of Ra-226, Pb-214 and Bi-214 from the decay chain of naturally occurring U-238 were observed in the Jenkinsville water samples at levels significantly above background values. These elevated levels of uranium and uranium daughter product radionuclides were also observed in the preoperational program and appear to be attributable to a series of deep water wells in local granitic aquifers. These levels are similar, but more elevated than, those observed in the ground water from Corley's well near Lake Murray (see Section 3.2.2).

The only radionuclide found other than the naturally occurring uranium daughter products seen in the Jenkinsville Water System was observed in the Columbia composite sample from December, 1983. An activity of 0.30 ± 0.07 pCi/l of Co-58 was observed in 20.68 liters of potable water taken 12/8/83-1/6/84 from the Columbia Drinking Water supply. This minute concentration of Co-58 can be attributed to VCSNS, having followed the same pathway as the Co-58 found in surface water at the same location. This, as with the surface water, is expected from the activation products released in liquid effluents during December (see Section 3.2.1). The expected dose to an individual member of the public is, as in Section 3.2.1 above, on the order of 8.6×10^{-4} mrem/yr assuming the Co-58 remains in the water for an entire year at this reported level.

Gross beta activities showed a similar trend - normal low beta concentrations at Columbia (with a slight upward shift in December) and elevated beta concentrations at Jenkinsville. This data is again comparable to that found

VIRGIL C. SUMMER NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

during the VCSNS preoperational period and is attributable to the naturally occurring uranium associated with the aquifer supplying the Jenkinsville water system.

Tritium analyses showed no concentrations in excess of the LLD.

3.3 Ingestion

3.3.1 Milk

Gamma spectroscopy results for milk samples taken during the 1982 operational period were found to be comparable to the results observed in the preoperational program. During the operating period, no I-131, Ba-140, La-140 or Cs-134 was measured at either the control or indicator location. No Cs-137 was found at the indicator site. Cs-137 was observed in all 27 milk samples taken at the control dairy - Site #16, McGinnis' Dairy (28.0 mi W) - but the mean and highest activities of 5.5 pCi/l and 6.3 pCi/l respectively, were both below the required LLD of 18 pCi/l and are typical of concentrations expected from old bomb test fallout. K-40 and Ra-226 were found in the same concentrations expected from measurements performed during the preoperational period. No radionuclides attributable to the plant were observed as expected from the concentrations of gaseous effluents released from VCSNS during 1983.

3.3.2 Grass (Forage)

Grass samples were taken during the approximate season cows are expected on pasture (April through October). Gamma spectroscopy analyses of these samples showed the presence of Be-7, K-40 and in one case Cs-137. No I-131 or Cs-134 were observed. The naturally-occurring Be-7 and K-40 had comparable activity levels as those found in both preoperational and 1983 control data. The single observation of Cs-137 at 12 pCi/l (lower than both the actual and maximum LLD values) can be attributed to the residual effects of old bomb fallout (i.e. see the preoperational data on the last Chinese bomb test late in 1980). There is no indication of the presence of any radionuclide in grass due to the operation of VCSNS which again supports the findings presented in the Semiannual Effluent and Waste Disposal Reports for gaseous effluent releases in 1983.

VIRGIL C. SUMMER NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

3.3.3 Food Products

Broadleaf vegetation from gardens at sites 2,5,6,8 and 18 were the main food products sampled during the 1983 operation of Virgil C. Summer Nuclear Station. No I-131 or Cs-134 was measured at any of the garden sites. Cs-137 was observed in one sample at Site #2 (20 pCi/kg) and Site #5 (22 pCi/kg). These values were just above the actual LLD determined for this type of sample/geometry (14 pCi/kg) and considerably below the required LLD (80 pCi/kg). These Cs-137 results are also consistent with preoperational findings (five samples were found to contain observable Cs-137) and are typical of concentrations due to old fallout. Background contributions from Ra-226, K-40, Ac-228 and Be-7 have also been measured in the operational samples. All values observed for the indicator sites (2,5,6,8) are comparable to the results found in the preoperational program and at the control site (18).

Other vegetation sampled in 1983 included squash and radishes (non-leafy vegetation), tomatoes (fruit and corn) (grain) from Environmental Laboratory Garden Site #6 (1.0 mi ESE) and control garden at the Wyse residence at Lake Murray, Site #18 (16.5 mi S of VCSNS). Only naturally-occurring K-40 was observed in these samples in concentrations above normal room background. The indicator site K-40 concentrations were consistent with the concentrations observed in preoperational and 1983 control samples of the same or similar type. No Cs-134 or Cs-137 which might be attributable to gaseous effluents released from VCSNS were found in the indicator (Site #6) or control (Site #18) samples.

No radionuclides found in any of the food products can be attributed to the operation of the Virgil C. Summer Nuclear Station.

3.3.4 Fish

Four species of fish (bass, bream, shad, and catfish and/or carp) were sampled at three indicator locations, Site #21 Parr Reservoir, Site #23 Monticello Reservoir and Site #24 Recreation Lake and one control location, Site #22 Neal Shoals in the spring and fall of 1983. No measurable concentrations of fission or activation products with the exception of Cs-137 were seen in any fish species. Cs-137 was found in most fish samples (21/27) at levels (average 19 pCi/kg) just above the calculated LLD of 13 pCi/kg. The highest concentrations, as expected, were found in the shad (forage fish) and their predators, bass. High levels of

VIRGIL C. SUMMER NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

naturally occurring K-40 were also found in all fish samples. The findings for fish at indicator locations are similar to those found at the same sites during the preoperational period and at the Neal Shoals control site in 1983. No effect of the December liquid effluent release from VCSNS was observed (no samples were collected in 1983 after the release alluded to in Sections 3.2.1 and 3.2.3). No radionuclides attributable to the operation of the plant were observed.

3.4 Aquatic

3.4.1 Bottom Sediment

Sediment samples were taken from the bottom of the four bodies of water from which fish are sampled - indicator Sites #21, 23 and 24 and Control Site #22. As with the fish samples, no measurable concentrations of any radionuclides typical of plant effluents with the exception of Cs-137, were observed. Cs-137 was found in 11 of the 12 sediments sampled at concentrations near the maximum LLD value of 180 pCi/kg. The highest concentration was observed in Parr Reservoir, 330 pCi/kg maximum and 260 pCi/kg average. These concentrations are consistent with preoperational and control data and concentrations expected from old fallout. Very high K-40 concentrations are also seen. These are due to the concentrating of organic matter in the sediment by gravity and filtration. The K-40 activities are comparable to the values observed in preoperational and control data. As with the fish, no effect of the December activation product release was seen because no samples were collected in 1983 after the release. No evidence of radioactivity from operation of the plant is present in sediment.

4.0 GENERAL CONCLUSIONS

Based on the data presented in Tables 2-5 and A-1 (Appendix A) and the interpretations and conclusions discussed in Sections 3.1 through 3.4 (above), only minute concentrations of Co-58 in the Broad River can be attributed to the operation of Virgil C. Summer Nuclear Station in 1983. The results of this monitoring effort verify the results reported earlier in the Semiannual Effluent and Waste Disposal Reports (January - June and July - December 1983) for VCSNS. The findings of the Environmental Monitoring Program substantiate the continuing adequacy of source control at Virgil C. Summer Nuclear Station.

VIRGIL C. SUMMER NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

APPENDICES

APPENDIX A

The baseline data from the preoperational monitoring program for the Virgil C. Summer Nuclear Station is summarized in Table A-1.

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

PREOPERATIONAL (BASELINE) REPORT

Virgil C. Summer Nuclear Station
Fairfield County, South Carolina

Docket No. 50-395
Reporting Period: 1/2/81 - 10/22/82

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection[1] Actual(Max.)	All Indicator Locations Mean [2] (Range)	Location with Highest Annual Mean		Control Locations Mean[2] (Range)	Number of Nonroutine Reported[3] Measurements
				Name (Distance and Direction)	Mean[2] (Range)		
Air Particulate (pCi/m ³)	Gross Beta (1323)	0.0045 (0.01)	0.075 (1021/1038)[4] (0.011 - 0.55) 0.029(540/549)[4] (0.011-0.06)	Site #13, North Dam (2.9 mi NNW)	0.13(53/53) (0.021-0.55)	0.081(282/285) (0.005-0.61)	0
	Gamma Spec (307)						
	Be-7	0.18	0.13(106/241) (0.010-0.95)	Site #13, North Dam (2.9 mi NNW)	0.25(10/22) (0.048-0.52)	0.13(30/66) (0.051-0.35)	0
	Zr-95	0.008	0.06(57/241) (0.03-0.11)	Site #13, North Dam (2.9 mi NNW)	0.07(5/22) (0.03-0.12)	0.06(16/66) (0.009-0.12)	0
	Nb-95	0.03	0.33(64/241) (0.10-0.17)	Site #13, North Dam (2.9 mi NNW)	0.45(7/22) (0.12-0.77)	0.37(19/66) (0.10-0.92)	0
	Ru-103	0.007	0.04(35/241) (0.01-0.08)	Site #2, Transm. Line (1.1 mi SW)	0.05(3/22) (0.03-0.07)	0.04(8/66) (0.02-0.09)	0
	Ru/Rh-106	0.004	0.03(6/241) (0.02-0.04)	Site #10, Meteorological Tower #2 (2.4 mi NNE)	0.04(1/22) (Single Value)	0.02(1/66) (Single Value)	0
	Cs-134	0.003 (0.01)	All < LLD			All < LLD	0
	Cs-137	0.003 (0.01)	0.003(21/241) (0.002-0.005)	Site #13, North Dam (2.9 mi NNW)	0.005 (2/22) (0.004-0.006)	0.004(5/66) (0.002-0.006)	0

TABLE A-1 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

PREOPERATIONAL (BASELINE) REPORT

Virgil C. Summer Nuclear Station
Fairfield County, South Carolina

Docket No. 50-395

Reporting Period: 6/26/81 - 10/22/82 (Air Radioiodine)
11/77 - 10/82 (TLD)
12/79 - 10/82 (Surface Water)

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection[1] Actual(Max.)	All Indicator Locations Mean [2] (Range)	Location with Highest Annual Mean		Control Locations Mean[2] (Range)	Number of Nonroutine Reported[3] Measurements
				Name (Distance and Direction)	Mean[2] (Range)		
Air Particulate (pCi/m ³) (Continued)	Ce-141	0.005	0.04(22/241) (0.01-0.07)	Site #10, Meteorological Tower #2 (2.4 mi NNE)	0.06(1/22) (Single Value)	0.04(6/66) (0.002-0.07)	0
	Ce-144	0.004	0.04(68/241) (0.01-0.07)	Site #13, North Dam (2.9 mi NNW)	0.04(7/22) (0.02-0.07)	0.04(18/66) (0.01-0.07)	0
Air Radioiodine (pCi/m ³)	I-131(482)	0.045 (0.07)	All < LLD			All < LLD	0
Direct (TLD) (uR/hr)	Gamma(1238) Monthly	0.52[5]	9.8(915/915) (6.7-14.8)	Site #13, North Dam (2.9 mi NNW)	13.9(60/60) (12.5-14.8)	9.9(295/295) (6.0-14.0)	0
	Gamma(154) Quarterly	0.52[5]	9.9(154/154) (5.3-14.7)	Site #55, St. Barnabas Church (2.8 mi E)	13.6(7/7) (11.4-14.7)		0
Surface Water (pCi/l)	H-3 (71)	1140 (2000)	All < LLD			All < LLD	0
	Gamma Spec (219)						
	Mn-54	0.3 (15)	All < LLD			All < LLD	0
	Co-58	0.3 (15)	All < LLD			All < LLD	0

TABLE A-1 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

PREOPERATIONAL (BASELINE) REPORT

Virgil C. Summer Nuclear Station
Fairfield County, South Carolina

Docket No. 50-395

Reporting Period: 12/79 - 10/82 (Surface Water)
1/80 - 10/82 (Ground Water)

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection[1] Actual(Max.)	All Indicator Locations Mean [2] (Range)	Location with Highest Annual Mean		Control Locations Mean[2] (Range)	Number of Nonroutine Reported[3] Measurements
				Name (Distance and Direction)	Mean[2] (Range)		
Surface Water (pCi/l) (Continued)	Fe-59	0.7 (30)	All < LLD			All < LLD	0
	Co-60	0.3 (15)	All < LLD			All < LLD	0
	Zn-65	0.8 (30)	All < LLD			All < LLD	0
	Zr-95	0.9 (15)	All < LLD			All < LLD	0
	Nb-95	0.7 (15)	All < LLD			All < LLD	0
	Cs-134	0.2 (15)	All < LLD			All < LLD	0
	Cs-137	0.2 (18)	All < LLD			All < LLD	0
	Ba-140	2.6 (60)	All < LLD			All < LLD	0
	La-140	0.9 (15)	All < LLD			All < LLD	0
Ground Water (pCi/l)	H-3 (52)	1170 (2000)	All < LLD			All < LLD	0

TABLE A-1 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

PREOPERATIONAL (BASELINE) REPORT

Virgil C. Summer Nuclear Station
Fairfield County, South Carolina

Docket No. 50-395
Reporting Period: 1/80 - 10/82

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection[1] Actual(Max.)	All Indicator Locations Mean [2] (Range)	Location with Highest Annual Mean		Control Locations Mean[2] (Range)	Number of Nonroutine Reported[3] Measurements
				Name (Distance and Direction)	Mean[2] (Range)		
Ground Water (pCi/l) (Continued)	Gamma Spec (62)						
	Mn-54	4 (15)	All < LLD			All < LLD	0
	Co-58	4 (15)	All < LLD			All < LLD	0
	Fe-59	9 (30)	All < LLD			All < LLD	0
	Co-60	3 (15)	All < LLD			All < LLD	0
	Zn-65	9 (30)	All < LLD			All < LLD	0
	Zr-95	5 (15)	All < LLD			All < LLD	0
	Nb-95	4 (15)	All < LLD			All < LLD	0
	Cs-134	4 (15)	All < LLD			All < LLD	0
	Cs-137	4 (18)	All < LLD			All < LLD	0
	Ba-140	20 (60)	All < LLD			All < LLD	0
	La-140	7 (15)	All < LLD			All < LLD	0

TABLE A-1 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

PREOPERATIONAL (BASELINE) REPORT

Virgil C. Summer Nuclear Station
Fairfield County, South Carolina

Docket No. 50-395
Reporting Period: 1/80 - 10/82

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection[1] Actual(Max.)	All Indicator Locations Mean [2] (Range)	Location with Highest Annual Mean		Control Locations Mean[2] (Range)	Number of Nonroutine Reported[3] Measurements
				Name (Distance and Direction)	Mean[2] (Range)		
Drinking Water [6] (pCi/l)	Gross Beta(80)	1.7(2.0)	10.3 (100/109) (1.1 - 55.1)	Site #28, Jenkinsville Diner (2.0 mi SE) [7]	16.9(55/55) (2.7 - 55.1)		0
	H-3 (22)	950(1000)	All < LLD				0
	Gamma Spec (80)						
	Mn-54	0.3 (15)	All < LLD				0
	Co-58	0.3 (15)	All < LLD				0
	Fe-59	8.9 (30)	All < LLD				0
	Co-60	0.3 (15)	All < LLD				0
	Zn-65	0.9 (30)	All < LLD				0
	Zr-95	0.8 (15)	All < LLD				0
	Nb-95	0.7 (15)	All < LLD				0
	I-131[8]	1.0(1.0)	All < LLD				0

TABLE A-1 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

PREOPERATIONAL (BASELINE) REPORT

Virgil C. Summer Nuclear Station
Fairfield County, South Carolina

Docket No. 50-395

Reporting Period: 1/80 - 10/82 (Drinking Water and Milk)

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection[1] Actual(Max.)	All Indicator Locations Mean [2] (Range)	Location with Highest Annual Mean		Control Locations Mean[2] (Range)	Number of Nonroutine Reported[3] Measurements
				Name (Distance and Direction)	Mean[2] (Range)		
Drinking Water [6] (pCi/l) (Continued)	Cs-134	0.2 (10)	All < LLD				0
	Cs-137	0.3 (18)	All < LLD				0
	Ba-140	20 (60)	All < LLD				0
	La-140	2.4 (15)	All < LLD				0
	Ra-226	0.8	6.4(64/70) (2.5-13)	Site #28, Jenkinsville Diner (2.0 mi ESE) [7]	7.3(27/35) (4.1-13)		0
			55(10/10) (28-84)	Site #28, Jenkinsville Diner (2.0 mi ESE) [7]	55(10/10) (28-84)		0
Milk (pCi/l)	U-235	1.2	3.1(16/80) (2.1-4.5)	Site #28, Jenkinsville Diner (2.0 mi ESE) [7]	3.1(16/45) (2.1-4.5)		0
	Gamma Spec (144)						
	K-40	70	1372(72/72) (233-1580)	Site #14, Graham's Dairy (5.1 mi W)	1372(72/72) (233-1580)	1393(72/72) (276-1590)	0
	I-131 [8]	1.0(1.0)	All < LLD			All < LLD	0

TABLE A-1 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

PREOPERATIONAL (BASELINE) REPORT

Virgil C. Summer Nuclear Station
Fairfield County, South Carolina

Docket No. 50-395

Reporting Period: 1/80 - 10/82 (Milk)
4/80 - 9/82 (Grass)

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection[1] Actual(Max.)	All Indicator Locations Mean [2] (Range)	Location with Highest Annual Mean		Control Locations Mean[2] (Range)	Number of Nonroutine Reported[3] Measurements
				Name (Distance and Direction)	Mean[2] (Range)		
Milk (pCi/l) (Continued)	Cs-134	1.0(15)	All < LLD			All < LLD	0
	Cs-137	1.1(15)	All < LLD			9.5(11/72) (5.5-11.0)	0
	Ba-140	17 (60)	All < LLD			All < LLD	0
	La-140	3.2 (15)	All < LLD			All < LLD	0
Grass (pCi/kg wet)	Gamma Spec (84)						
	Be-7	290	1150 (42/53) (112-7070)	Site #6, Env. Lab. Gar- den (1.0 mi ESE)	1350(16/22) (213-7070)	1150(24/31) (236-8350)	0
	K-40	750	6040(52/53) (1000 - 9540)	Site #14, Graham's Dairy (5.1 mi W)	6500(29/30) (3990-9540)	6780(29/31) (3290-11500)	0
	I-131 [8]	66(60)	All < LLD			All < LLD	0
	Cs-134	27(60)	All < LLD			All < LLD	0
	Cs-137	33(80)	39(13/53) (16-158)	Site #14, Graham's Dairy (5.1 mi W)	59(5/30) (16-158)	131(6/31) (13-336)	0

TABLE A-1 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

PREOPERATIONAL (BASELINE) REPORT

Virgil C. Summer Nuclear Station
Fairfield County, South Carolina

Docket No. 50-395

Reporting Period: 7/79 - 10/82 (Broadleaf Vegetation)
9/79 - 10/82 (Other Vegetation)

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection[1] Actual(Max.)	All Indicator Locations Mean [2] (Range)	Location with Highest Annual Mean		Control Locations Mean[2] (Range)	Number of Nonroutine Reported[3] Measurements
				Name (Distance and Direction)	Mean[2] (Range)		
Broadleaf Vegetation (pCi/kg wet) [10]	Gamma Spec (19)						
	K-40	400	3800(15/15) (1780 - 5700)	Site #2, Trans. Line (1.2 mi SW)	4640(2/2) (3570-5700)	6850(4/4) (4180-9350)	0
	I-131 [8]	35(60)	All < LLD			All < LLD	0
	Cs-134	19(80)	All < LLD			All < LLD	0
	Cs-137	23(80)	31(2/15) (26.6-36.2)	Site #2, Trans. Line (1.2 mi SW)	31(2/2) (26.6-36.2)	16(1/1) (Single Value)	0
Other Vegetation (pCi/kg wet)	Gamma Spec (65)						
	K-40	330	3140 (36/36) (1940-5430)	Site #6, Env. Lab. Gar- den (1.0 mi ESE)	3140(36/36) (1940-5430)	3600(29/29) (2100-9750)	0
	Cs-134	11 (60)	All < LLD			All < LLD	0
	Cs-137	13 (80)	All < LLD			16(1/29) (Single Value)	0

TABLE A-1 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

PREOPERATIONAL (BASELINE) REPORT

Virgil C. Summer Nuclear Station
Fairfield County, South Carolina

Docket No. 50-395
Reporting Period: 5/79 - 10/82

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection[1] Actual(Max.)	All Indicator Locations Mean [2] (Range)	Location with Highest Annual Mean		Control Locations Mean[2] (Range)	Number of Nonroutine Reported[3] Measurements
				Name (Distance and Direction)	Mean[2] (Range)		
Fish (pCi/kg wet) [9]	Gamma Spec (110)						
	K-40	500	3410 (85/85) (2090-7460)	Site #24, Recreation Lake (5.5 mi, N)	3410(27/27) (418-7460)	3650(25/25) (2450-6060)	0
	Cs-134	15(130)	All < LLD			All < LLD	0
	Cs-137	25 (150)	29 (66/85) (9-101)	Site #24, Recreation Lake (5.5 mi N)	31 (20/27) (11-101)	26 (21-25) (10-79)	0
	Co-58	25 (130)	All < LLD			All < LLD	0
	Mn-54	19 (130)	All < LLD			All < LLD	0
	Fe-59	78 (260)	All < LLD			All < LLD	0
	Zn-65	43 (260)	All < LLD			All < LLD	0
	Co-60	18 (130)	All < LLD			All < LLD	0

TABLE A-1 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY

PREOPERATIONAL (BASELINE) REPORT

Virgil C. Summer Nuclear Station
Fairfield County, South Carolina

Docket No. 50-395
Reporting Period: 5/79 - 10/82

Medium or Pathway Sampled (Unit of Measurement)	Type and Total Number of Analyses Performed	Lower Limit of Detection[1] Actual(Max.)	All Indicator Locations Mean [2] (Range)	Location with Highest Annual Mean		Control Locations Mean[2] (Range)	Number of Nonroutine Reported[3] Measurements
				Name (Distance and Direction)	Mean[2] (Range)		
Sediment (pCi/kg)	Gamma Spec (47)						
	K-40	400	15900(32/35) (4450-89600)	Site #24, Recreation Lake (5.5 mi N)	18100(9/12) (12800-21600)	15900(11/12) (11100-20200)	0
	Cs-134	22(150)	All < LLD			All < LLD	0
	Cs-137	25(180)	238(27/35) (12-1090)	Site #23, Discharge Canal (Mont. Res.) (0.5 mi ESE)	265(9/12) (17-1090)	365(12/12, (14-1010)	0

VIRGIL C. SUMNER NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

TABLE A-1 (Continued)

FOOTNOTES

1. LLD values given are values calculated from the program data analyses with maximum acceptable 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 Nonroutine Measurement is any confirmed measured level of radioactivity in any environmental medium that exceeds ten times the control station value.
4. The baseline values are high because of the fallout from the Chinese bomb test in 1980. The second set of values reflects a better set of baseline numbers, essentially free of bomb test fallout. This latter set covers the period 9/4/81 - 10/22/82.
5. Detection sensitivity is approximately 5 mrem/yr (0.52 uR/hr) determined from the analyses of five years of preoperational data.
6. No control location is specified for drinking water.
7. Bimodal distribution of values present; mean of 6.4 through first half of 1981 and after March, 1982 and mean of 55 for a 10 month period beginning June, 1981. These high Ra-226 values (also reflected in gross beta and U-235 measurements) appear to be due to high granite content in some wells added to the Jenkinsville water system during this period.
8. Several individual determinations did not meet the required maximum LLD due to insufficient sample volume and/or delay in counting sample after collection.
9. Detectable levels of natural U-235 were randomly found in samples from all fish sampling locations.
10. Prior to the 1982 growing season there were only two gardens sampled, one indicator, Site #6, Environmental Lab Garden, and one control, Site #18, Corley's Garden. In 1982 the control garden at Site #18 was moved down the street to Wyse's Garden (approximately the same distance and direction) and three additional indicator gardens were added (for broadleaf vegetation only) at Site #2, Transmission Line; Site #4, Fairfield Hydro; and Site #8, Monticello Reservoir South of Road 224. Monthly sampling was begun on broadleaf vegetation at Sites # 2, 4, 6 and 8 in September, 1982.

VIRGIL C. SUMMER NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

APPENDIX B

The Virgil C. Summer Radiological Environmental Surveillance Laboratory (RESL) has participated in the EPA Laboratory Inter-comparison Program for the duration of the preoperational and operational periods of the Radiological Monitoring Program. The RESL laboratory participation code for the intercomparison program is FL. The results of Environmental Laboratory analyses of EPA samples performed during the 1983 operational period of the Virgil C. Summer Nuclear Station are summarized in Table B-1. All results (with 3 exceptions, see table) show agreement with EPA values and are well within EPA control limits.

VIRGIL C. SUMMER NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

TABLE B-1

1983 RESULTS OF EPA INTERCOMPARISONS

Comparison Study (Measurement Unit)	Date	Nuclide	EPA Value	Control Limits(±)	VCS Env. Lab. Results		Dates Analyzed	Avg. of all Contributors	
					Individual	Average			
Air filter (pCi/filter)	11/82	beta	59.2	8.7	75,76,70	*73.7	1/27/83	66	
		Cs-137	27.0	8.7	33,30,31	31.7	1/28/83	30	
	3/83	beta	68	8.7	66,68,66	66.7	5/18/83	69	
		Cs-137	27	8.7	30,32,32	31.3	6/1-6/11/83	31	
	8/83	beta	36	8.7	44,43,41	42.7	11/4/83	39	
		Cs-137	15	8.7	19,17,17	17.7	8/31-9/1/83	19	
Gamma in Water (pCi/liter)	2/83	Cr-51	45	8.7	46,47,50	47.7	2/14-2/20/83	48	
		Co-60	22	8.7	24,26,26	25.3	2/14-2/20/83	23	
		Zn-65	21	8.7	23,21,22	22.0	2/14-2/20/83	22	
		Ru-106	48	8.7	49,39,55	47.7	2/14-2/20/83	47	
		Cs-134	20	8.7	20,19,19	19.3	2/14-2/20/83	20	
		Cs-137	19	8.7	21,20,20	20.3	2/14-2/20/83	19	
	6/83	Cr-51	60	8.7	57,62,58	59.0	6/29-7/1/83	62	
		Co-60	13	8.7	15,14,14	14.3	6/29-7/1/83	14	
		Zn-65	36	8.7	39,33,41	39.7	6/29-7/1/83	37	
		Ru-106	40	8.7	48,45,45	46.0	6/29-7/1/83	40	
		Cs-134	47	8.7	46,46,42	45.0	6/29-7/1/83	44	
		Cs-137	26	8.7	28,27,29	28.0	6/29-7/1/83	28	
	10/83	Cr-51	51	8.7	50,59,54	54.3	10/21-10/22/83	48	
		Co-60	19	8.7	22,18,20	20.0	10/21-10/22/83	19	
		Zn-65	40	8.7	40,40,42	40.7	10/21-10/22/83	40	
		Ru-106	52	8.7	51,55,54	53.3	10/21-10/22/83	48	
		Cs-134	15	8.7	15,14,14	14.3	10/21-10/22/83	15	
		Cs-137	22	8.7	23,24,21	22.7	10/21-10/22/83	22	
	Gross Beta in Water (pCi/liter)	1/83	beta	31	8.7	26,22,24	24.0	2/12/83	32
		5/83	beta	57	8.7	50,48,51	49.7	6/10/83	54
		9/83	beta	9	8.7	8,9,8	8.3	11/11/83	10
	Iodine in Water (pCi/liter)	4/83	I-131	27	10.4	29,30,30	29.7	4/5-4/7/83	26.5
		8/83	I-131	14	10.4	15,11,14	13.3	8/15-8/17/83	14
		12/83	I-131	20	10.4	21,18,21	20.0	12/21-12/27/83	20

VIRGIL C. SUMMER NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

TABLE B-1 (continued)
1983 RESULTS OF EPA INTERCOMPARISONS

Comparison Study (Measurement Unit)	Date	Nuclide	EPA Value	Control Limits(±)	VCS Env. Lab. Results		Dates Analyzed	Avg. of all Contributors
					Individual	Average		
Laboratory Blind (pCi/liter)	5/83	beta	149	12.4	132,140,122	*131.3	11/11/83	136
		Co-60	30	8.7	33,33,31	32.3	10/21/83	31
		Cs-134	33	8.7	29,32,31	30.7	10/21/83	31
		Cs-137	27	8.7	30,32,28	30.0	10/21/83	27
	11/83	beta	63	8.7	52,50,52	* 51.3	12/14/83	58
		Co-60	11	8.7	12,11,12	11.7	12/9-12/12/83	11
		Cs-134	15	8.7	17,15,16	16.0	12/9-12/12/83	14
		Cs-137	15	8.7	16,17,16	16.3	12/9-12/12/83	15
	3/83	I-131	37	10.4	41,40,41	40.7	3/6-3/9/83	37.1
		Cs-137	31	8.7	37,36,37	36.7	3/6-3/9/83	32.9
		Ba-140	0	---	<10,<12,<11	<11.0	3/6-3/9/83	0
Radionuclides in Milk (pCi/liter)	2/83	I-131	55	10.4	57,58,58	57.7	3/4-3/8/83	54.5
		Cs-137	26	8.7	27,28,24	26.3	3/4-3/8/83	26.3
		Ba-140	0	---	<13,<19,<21	<17.7	3/4-3/8/83	0
	6/83	I-131	30	10.4	30,32,31	31.0	6/21-6/25/83	30
		Cs-137	47	8.7	49,47,46	47.3	6/21-6/25/83	47
	10/83	I-131	40	10.4	42,40,44	42.0	11/8-11/11/83	41
		Cs-137	33	8.7	36,35,37	36.0	11/8-11/11/83	34
Tritium in Water (pCi/liter)	4/83	H-3	3330	627	3260,3220,3150	3210	4/18-5/4/83	3298
	6/83	H-3	1529	583	1460,1450,1330	1413	6/20/83	1552
	8/83	H-3	1836	593	2050,2000,2090	2047	8/30/83	1864
	10/83	H-3	1210	570	1200,1190,1340	1243	11/4-11/8/83	1226

*These gross beta values, one air particulate (11/82) and two in water from Laboratory (Blind) Performance (5/83 and 11/83) are not within the EPA control limits. However, if the average of all contributors is considered, all three values are in agreement (using the EPA control limits).

O'Brien *RT*
SOUTH CAROLINA ELECTRIC & GAS COMPANY

POST OFFICE 764

COLUMBIA, SOUTH CAROLINA 29218

O. W. DIXON, JR.
VICE PRESIDENT
NUCLEAR OPERATIONS

May 1, 1984

3

ALL: 23
Montgomery
Docket file

Mr. J. P. O'Reilly,
Regional Administrator
U. S. Nuclear Regulatory Commission
Region II, Suite 2900
101 Marietta Street, N.W.
Atlanta, GA 30303

Subject: Virgil C. Summer Nuclear Station
Docket No. 50/395/D
Operating License No. NPF-12
Radiological Environmental
Monitoring Report

Dear Mr. O'Reilly:

Please find attached South Carolina Electric and Gas Company's (SCE&G) Radiological Environmental Monitoring Report as required by Regulatory Guide 4.8 and Sections 6.9.1.6 and 6.9.1.7 of the Virgil C. Summer Nuclear Station Technical Specifications.

If there are any questions, please call us at your convenience.

Very truly yours,

O. W. Dixon, Jr.
O. W. Dixon, Jr.

GMG/WRB/OWD/gj

cc: V. C. Summer	C. L. Ligon (NSRC)
T. C. Nichols, Jr./O. W. Dixon, Jr.	K. E. Nodland
E. H. Crews, Jr.	R. A. Stough
E. C. Roberts	G. Percival
W. A. Williams, Jr.	C. W. Hehl
D. A. Nauman	J. B. Knotts, Jr.
Group Managers	I & E Washington
O. S. Bradham	NPCF
C. A. Price	File
D. A. Lavigne	

IE25

1/1
OFFICIAL COPY

84-72