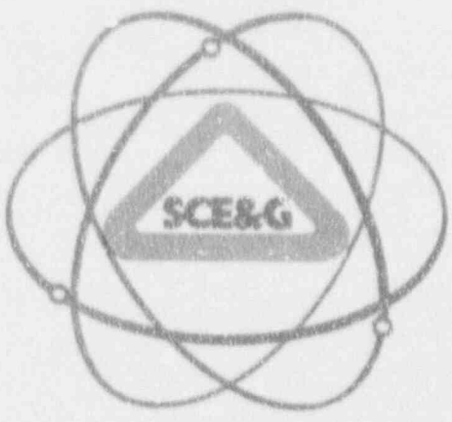
SEMIANNUAL EFFLUENT AND WASTE DISPOSAL REPORT

FOR THE OPERATING PERIOD

January 1, 1992 - June 30, 1992

August 1992



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

Prepared by:

G. M. Gowdy,
Staff Health Physicist

Reviewed and approved by:

E. M. Rollins
Sr. Staff Health Physicist

Reviewed and approved by:

G. G. Hall, Associate Manager
Health Physics

Reviewed and approved by:

W. R. Baehr, Manager
Chemistry and Health Physics

SEMIANNUAL EFFLUENT AND WASTE DISPOSAL REPORT

January - June, 1992

Virgil C. Summer Nuclear Station
South Carolina Electric & Gas

This report is being submitted as a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the Virgil C. Summer Nuclear Station. This report satisfies the requirements in Sections 6.9.1.8 and 6.14.2 of Technical Specifications, Section 1.6.2 of the Offsite Dose Calculation Manual (ODCM) and 10CFR50.36(a). Also included is an assessment of radiation doses from plant releases.

A brief discussion of the Supplemental Information and Tables 2 through 6 is presented in Sections A through D. An evaluation of the radiological impact on man due to operation of the Virgil C. Summer Nuclear Station is presented in Section E and Table 1. Changes made to previous reports are presented in Section F and Appendix I.

A. Supplemental Information

Regulatory limits for doses and maximum permissible concentrations presented in Supplemental Information are from the Virgil C. Summer Nuclear Station Technical Specifications and 40 CFR 190. Average energy ($\bar{E}$) is not applicable to the method for determining release rate limits for fission and activation gaseous effluents; therefore, it has been omitted.

B. Gaseous Effluents

Gaseous effluents released from ground level are summarized in Tables 2 and 3. An elevated release pathway does not exist at Virgil C. Summer Nuclear Station. The errors for gaseous effluent totals are given as the square root of the sum of squares of counting errors and flow or volume measurement errors. A systematic error of 15% has been added to estimate total error. Cumulative doses are discussed in Section E.

C. Liquid Effluents

Liquid effluents are summarized in Tables 4 and 5. Estimated total errors are expressed as in Section B above.

D. Solid Waste Shipments

Solid waste shipments are summarized in Table 6. Curie content of radioactive waste packages is determined by dose rates and/or analysis of samples by gamma spectroscopy. The total error for each type of Curie content determination is conservatively estimated to be the sum of a 15% systematic error and a 20% photon response error for the detector used.

E. Radiological Impact on Man

Potential doses to the maximum exposed individual in the unrestricted area were calculated using measured plant gaseous effluent and meteorological data in accordance with the Offsite Dose Calculation Manual. The source term included four (4) waste gas decay tank (WGDT) batch releases, 1.45 days of 6-inch and 4.77 days of 36-inch Reactor Building purge releases and a continuous six month main plant vent release. Doses are summarized in Table 1. The total activities released are presented in Tables 2 and 3. Air doses to the

maximum exposed individual due to noble gases were 2.09E-2 and 5.41E-2 mrad for gamma and beta, respectively. The maximum organ dose attributed to the releases was 3.66E-3 mrem for the six month period.

Measured plant liquid effluent data was used to calculate estimates of doses to individuals in accordance with the Offsite Dose Calculation Manual. The source term consisted of the isotopic contents of 201 Waste Monitor Tank batch releases, 34.3 days of Steam Generator Blowdown release and a continuous Turbine Building Sump release. Doses are summarized in Table 1 and total radioactivity released is described in Tables 4 and 5. The total body dose to the maximally exposed individual due to the release of radioactive liquid was 1.08E-2 mrem. The maximum organ dose was 3.01E-2 mrem to the thyroid during the six month period.

Table 1

GASEOUS AND LIQUID EFFLUENT DOSE SUMMARY

ODCM Section	Gaseous Limits	First Quarter, 1992 Dose	First Quarter, 1992 Percent of Limit	Second Quarter, 1992 Dose	Second Quarter, 1992 Percent of Limit
1.2.3.1a,b	5 mrad gamma/qtr. 10 mrad gamma/yr.	6.76E-3 mrad	1.35E-1 6.76E-2	1.41E-2 mrad	2.82E-1 2.09E-1*
	(January-June total gamma air dose: 2.09E-2 mrad)				
1.2.3.1a,b	10 mrad beta/qtr. 20 mrad beta/yr.	1.61E-2 mrad	1.61E-1 8.05E-2	3.80E-2 mrad	3.80E-1 2.71E-1*
	(January-June total beta air dose: 5.41E-2 mrad)				
1.2.4.1a,b	7.5 mrem/organ/qtr. 15 mrem/organ/yr.	7.93E-4 mrem	1.06E-2 5.29E-3	2.87E-3 mrem	3.83E-2 2.44E-2*
	(January-June maximum exposed organ dose: 3.66E-3 mrem)				
	Liquid Limits				
1.1.3.1a,b	1.5 mrem/qtr. 3.0 mrem/yr.	1.89E-3 mrem	1.26E-1 6.30E-2	8.93E-3 mrem	5.96E-1 3.61E-1*
	(January-June whole body dose: 1.08E-2 mrem)				
1.1.3.1a,b	5 mrem/organ/qtr. 10 mrem/organ/yr.	6.97E-3 mrem†	1.39E-1 6.97E-2	2.32E-2 mrem†	4.63E-1 3.01E-1*
	(January-June maximum exposed organ dose: 3.01E-2 mrem†)				

* Includes contribution from previous quarters.

† Maximum organ dose for quarters 1 and 2 was to the thyroid.

Dose rates and concentrations were below the limits specified in Supplemental Information, Section 2a, b and c during all the effluent releases.

Radiation doses from radioactive effluents to workers at the Fairfield Hydro Station were calculated for the six-month period to be 1.89E-3 and 4.86E-3 mrad for gamma and beta, respectively.

Radiation doses from nearby uranium fuel cycle sources were not assessed. ODCM, Sections 1.3.1 and B/1.3 establish a five (5) mile limit beyond which doses from nearby plants are insignificant. There are no uranium fuel cycle plants within a five (5) mile radius of Virgil C. Summer Nuclear Station.

F. Offsite Dose Calculation Manual

The ODCM was not revised during the affected six month period.

SEMIANNUAL EFFLUENT AND WASTE DISPOSAL REPORT

January - June, 1992

Virgil C. Summer Nuclear Station
South Carolina Electric & Gas

Supplemental Information

1. Regulatory Limits:

   a. Fission and Activation Gases:

      The air dose to an individual due to noble gases released in gaseous effluents shall be limited to less than or equal to 5 mrad for gamma radiation and 10 mrad for beta radiation during any calendar quarter and 10 mrad for gamma radiation and 20 mrad for beta radiation during any calendar year (ODCM, Section 1.2.3.1).

   b. Iodines, Particulates (half-lives > 8 days) and Tritium:

      The dose to an individual from radioiodines, tritium and radioactive materials in particulate form with half-lives greater than 8 days in gaseous effluents shall be limited to less than or equal to 7.5 mrem to any organ during any calendar quarter and 15 mrem to any organ during any calendar year (ODCM, Section 1.2.4.1).

   c. Liquid Effluents:

      The dose or dose commitment to an individual from radioactive materials in liquid effluents released shall be limited to less than or equal to 1.5 mrem to the total body and 5 mrem to any organ during any calendar quarter and 3 mrem to the total body and 10 mrem to any organ during any calendar year (ODCM, Section 1.1.3.1).

   d All Sources:

      The annual dose equivalent shall not exceed 25 mrem to the whole body, 75 mrem to the thyroid and 25 mrem to any other organ (40 CFR 190).

2. Maximum Permissible Concentrations:

   a. Fission and Activation Gases:

      The dose rate in unrestricted areas due to radioactive materials released in gaseous effluents shall be limited to less than or equal to 500 mrem/year to the total body and less than or equal to 3000 mrem/year to the skin (ODCM, Section 1.2.2.1).

   b. Iodines, Particulates (half-lives > 8 days) and Tritium:

      The dose rate in unrestricted areas due to radioactive materials in effluents shall be limited to less than or equal to 1500 mrem/year to any organ (ODCM, Section 1.2.2.1).

Supplemental Information

c. Liquid Effluents:

The concentration of radioactive materials released from the site shall be limited to the concentrations specified in 10 CFR 20, Appendix B, Table II, Column 2 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to 2E-4 µCi/ml total activity (ODCM, Section 1.1.2.1).

3. Average Energy:

Not Applicable

4. Measurements and Approximations of Total Radioactivity:

a. Fission and activation gases: Gamma spectrometry [Ge(Li) or HPGe]

b. Iodines: Gamma spectrometry [Ge(Li) or HPGe]

c. Particulates: Gamma spectrometry [Ge(Li) or HPGe], beta proportional counting, alpha proportional counting

d. Tritium: Liquid scintillation

e. Liquid effluents: Gamma spectrometry [Ge(Li) or HPGe], liquid scintillation (H-3), beta proportional counting, alpha proportional counting

5. Batch Releases:

a. Gaseous:

1. Number of batch releases: 4

2. Total time period for batch releases: 1.02E + 3 min.

3. Maximum time period for a batch release: 3.97E + 2 min.

4. Average time period for a batch release: 2.54E + 2 min.

5. Minimum time period for a batch release: 1.50E + 1 min.

b. Liquid:

1. Number of batch releases:

98 for first quarter, 1992
103 for second quarter, 1992

Supplemental Information

2. Total time period for batch releases:

   7.27E + 3 min. for first quarter, 1992
   7.88E + 3 min. for second quarter, 1992

3. Maximum time period for a batch release:

   8.80E + 1 min. for first quarter, 1992
   9.60E + 1 min. for second quarter, 1992

4. Average time period for batch releases:

   7.42E + 1 min. for first quarter, 1992
   7.65E + 1 min. for second quarter, 1992

5. Minimum time period for a batch release:

   4.50E + 1 min. for first quarter, 1992
   5.40E + 1 min. for second quarter, 1992

6. Average stream flow during periods of release of effluent into a flowing stream:

   2.85E + 6 gpm for first quarter, 1992
   3.51E + 6 gpm for second quarter, 1992

6. Abnormal Releases:

a. Gaseous:

   1. Number of releases: 0

   2. Total activity released: 0

b. Liquid:

   1. Number of releases: 0

   2. Total activity released: 0

SEMIANNUAL EFFLUENT AND WASTE DISPOSAL REPORT

January - June, 1992

Table 2

GASEOUS EFFLUENTS-SUMMATION OF ALL RELEASES

		First Quarter	Second Quarter	Est.Total Error, %
A. Fission & activation gases				
1. Total release	Ci	8.12E + 1	1.96E + 2	2.34E + 1
2. Average release rate for period	µCi/sec	1.04E + 1	2.50E + 1	
3. Percent of technical specification limit	%	*	*	
B. Iodines				
1. Total iodine-131	Ci	4.12E-5	1.45E-4	2.66E + 1
2. Average release rate for period	µCi/sec	5.30E-6	1.84E-5	
3. Percent of technical specification limit	%	**	**	
C. Particulates				
1. Particulates with half-lives > 8 days	Ci	0	0	N/A
2. Average release rate for period	µCi/sec	0	0	
3. Percent of technical specification limit	%	**	**	
4. Gross alpha radioactivity	Ci	0	0	
D. Tritium				
1. Total release	Ci	0	2.47E-1	3.09E + 1
2. Average release rate for period	µCi/sec	0	3.14E-2	
3. Percent of technical specification limit	%	**	**	

* Calculated as a percent of dose limits found in Supplemental Information, Section 1a. First quarter values were 1.35E-1% and 6.76E-2% of the quarterly and cumulative annual gamma dose limits, respectively and 1.61E-1% and 8.05E-2% of the quarterly and cumulative annual beta dose limits, respectively. Second quarter values were 2.82E-1% and 2.09E-1%† of the quarterly and cumulative annual gamma dose limits, respectively, and 3.80E-1% and 2.71E-1%† of the quarterly and cumulative annual beta dose limits, respectively.

** Calculated as a percent of dose limits found in Supplemental Information, Section 1b. The sum of these values for the first quarter was 1.06E-2% and 5.29E-3% of the quarterly and cumulative annual organ dose limits, respectively. The sum of these values for the second quarter was 3.83E-2% and 2.44E-2%† of the quarterly and cumulative annual organ dose limits, respectively.

† Note: Second quarter values are the sum of the first and second quarter values compared to annual dose limits.

SEMIANNUAL EFFLUENT AND WASTE DISPOSAL REPORT
January - June, 1992

Table 3

GASEOUS EFFLUENTS-GROUND-LEVEL RELEASES

Nuclides Released	Unit	Continuous Mode		Batch Mode	
		First Quarter	Second Quarter	First Quarter	Second Quarter
1. Fission gases					
Krypton-85	Ci	0	0	1.05E-1	7.73E-1
Krypton-85m	Ci	0	5.17E-2	0	0
Krypton-87	Ci	0	0	0	0
Krypton-88	Ci	0	1.18E-3	0	0
Xenon-133	Ci	7.37E+1	1.85E+2	2.12E-4	2.09E-1
Xenon-135	Ci	7.41E+0	7.77E+0	7.74E-6	5.13E-5
Xenon-135m	Ci	0	0	0	0
Xenon-138	Ci	0	0	0	0
Others: Ar-41	Ci	0	1.64E-2	0	0
Xe-131m	Ci	0	9.00E-1	0	1.35E-2
Xe-133m	Ci	0	1.62E+0	0	1.83E-4
Unidentified	Ci	0	0	0	0
Total for period	Ci	8.11E+1	1.95E+2	1.05E-1	9.95E-1
2. Iodines					
Iodine-131	Ci	4.12E-5	1.45E-4	0	0
Iodine-132	Ci	0	0	0	0
Iodine-133	Ci	1.43E-6	1.38E-5	0	0
Iodine-134	Ci	0	0	0	0
Iodine-135	Ci	0	0	0	0
Total for period	Ci	4.26E-5	1.59E-4	0	0
3. Particulates					
Strontium-89	Ci	0	0	0	0
Strontium-90	Ci	0	0	0	0
Cesium-134	Ci	0	0	0	0
Cesium-137	Ci	0	0	0	0
Barium-Lanth.-140	Ci	0	0	0	0
Others: Br-82	Ci	0	3.80E-7	0	0
Rb-88	Ci	0	5.23E-6	0	0
Unidentified	Ci	0	0	0	0
Total for period	Ci	0	5.61E-6	0	0

SEMIANNUAL EFFLUENT AND WASTE DISPOSAL REPORT

January - June, 1992

Table 4

LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES

		First Quarter	Second Quarter	Est. Total Error, %
A. Fission & activation products				
1. Total release (not including tritium, gases, alpha)	Ci	7.04E-2	7.14E-2	1.83E + 1
2. Average diluted concentration during period	µCi/ml	1.91E-10	1.68E-10	
3. Percent of applicable limit	%	*	*	
B. Tritium				
1. Total release	Ci	6.50E + 1	1.41E + 2	1.86E + 1
2. Average diluted concentration during period	µCi/ml	1.76E-7	3.31E-7	
3. Percent of applicable limit	%	*	*	
C. Dissolved and entrained gases				
1. Total release	Ci	2.92E-2	2.31E-1	1.81E + 1
2. Average diluted concentration during period	µCi/ml	7.93E-11	5.44E-10	
3. Percent of applicable limit	%	*	*	
D. Gross alpha radioactivity				
1. Total release	Ci	0	0	N/A
E. Volume of waste released (prior to dilution)	liters	2.04E + 7	4.28E + 7	3.00E + 0
F. Volume of dilution water used during period	liters	3.68E + 11	4.25E + 11	4.30E + 0

* See following page.

Table 4

LIQUID EFFLUENTS-SUMMATION OF ALL RELEASES

* Calculated as a percent of dose limits found in Supplemental Information, Section 1c. The sum of these values for the first quarter was 1.26E-1% and 6.30E-2% of the respective quarterly and cumulative annual whole body dose limits and 1.39E-1% and 6.97E-2% of the respective quarterly and cumulative annual organ dose limits. The sum of these values for the second quarter was 5.96E-1% and 3.61E-1%† of the respective quarterly and cumulative annual whole body dose limits and 4.63E-1% and 3.01E-1%† of the respective quarterly and cumulative annual organ dose limits. Dose to the thyroid was the most limiting organ dose for the first quarter, second quarter and first six (6) months of 1992.

† Note: Second quarter values are the sum of the first and second quarter values compared to annual dose limits.

SEMIANNUAL EFFLUENT AND WASTE DISPOSAL REPORT
January - June, 1992
Table 5

LIQUID EFFLUENTS

†Nuclides Released	Unit	Continuous Mode		Batch Mode	
		First Quarter	Second Quarter	First Quarter	Second Quarter
Strontium-89	Ci	0	0	5.71E-7	1.00E-5
Strontium-90	Ci	0	0	5.28E-7	9.24E-6
Cesium-134	Ci	0	1.68E-4	3.71E-4	2.55E-3
Cesium-137	Ci	0	4.12E-4	5.43E-4	4.38E-3
Iodine-131	Ci	1.77E-3	8.72E-3	3.94E-3	5.51E-3
Cobalt-58	Ci	0	0	3.33E-2	9.38E-3
Cobalt-60	Ci	0	0	1.38E-2	1.17E-2
Iron-59	Ci	0	0	1.72E-4	4.04E-6
Zinc-65	Ci	0	0	0	4.00E-5
Manganese-54	Ci	0	0	1.39E-3	1.41E-3
Chromium-51	Ci	0	0	6.33E-4	1.86E-4
Zirconium-Niobium-95	Ci	0	0	8.93E-4	1.22E-3
Molybdenum-99	Ci	0	0	0	2.20E-5
Technetium-99m	Ci	0	0	3.23E-5	1.67E-4
Barium-Lanth.-140	Ci	0	0	1.80E-5	2.36E-5
Cerium-141	Ci	0	0	0	0
Other: F-18	Ci	1.08E-3	4.13E-3	0	0
Na-24	Ci	4.79E-4	3.06E-3	4.68E-5	1.67E-4
Fe-55	Ci	0	0	4.18E-4	1.39E-3
Co-57	Ci	0	0	1.99E-4	9.98E-5
Zn-69m	Ci	0	0	2.43E-6	0
As-76	Ci	0	0	0	3.15E-6
Ru-103	Ci	0	0	0	7.95E-7
Ru-106	Ci	0	0	8.44E-6	0
Ag-110m	Ci	0	0	7.21E-6	1.34E-4
Sn-113	Ci	0	0	9.60E-6	9.09E-6
Sb-124	Ci	0	0	1.92E-4	7.64E-5
Sb-125	Ci	0	0	7.46E-3	4.74E-3
I-132	Ci	5.62E-4	1.91E-3	0	0
I-133	Ci	1.85E-3	6.24E-3	1.73E-4	2.26E-4
I-134	Ci	1.66E-4	6.23E-4	0	0
I-135	Ci	8.51E-4	2.26E-3	0	0
Cs-136	Ci	0	9.97E-5	0	5.46E-6
Cs-138	Ci	4.90E-6	2.37E-4	0	0
Ce-144	Ci	0	0	4.17E-6	1.84E-5
Unidentified	Ci	0	0	0	0
Total for period (above)	Ci	6.77E-3	2.79E-2	6.37E-2	4.35E-2

SEMIANNUAL EFFLUENT AND WASTE DISPOSAL REPORT

January - June, 1992

Table 5 (continued)

LIQUID EFFLUENTS

†Nuclides Released	Unit	Continuous Mode		Batch Mode	
		First Quarter	Second Quarter	First Quarter	Second Quarter
Xenon-133	Ci	3.43E-3	1.62E-3	2.51E-2	2.24E-1
Xenon-135	Ci	5.32E-4	3.28E-4	1.18E-5	1.56E-5
Other: Kr-85m	Ci	4.62E-5	0	9.33E-7	2.01E-5
Xe-131m	Ci	0	0	6.47E-5	4.66E-3
Xe-133m	Ci	0	0	1.11E-5	6.40E-4
Total entrained gases	Ci	4.01E-3	1.95E-3	2.52E-2	2.29E-1

† Tritium not included. See Table 4 for tritium numbers.

SEMIANNUAL EFFLUENT AND WASTE DISPOSAL REPORT

January - June, 1992
Table 6
SOLID WASTE AND IRRADIATED FUEL SHIPMENTS

A. Solid Waste Shipped Offsite for Burial or Disposal (Not irradiated fuel)

1. Type of waste	Unit	6-month Period	Est. Total Error,%
a. Spent resins, filter sludges, evaporator bottoms, etc.	m^3 Ci	6.92E + 1 1.94E + 2	3.50E + 1
b. Dry compressible waste, contaminated equip., etc.	m^3 Ci	1.24E + 1 8.07E-1	3.50E + 1
c. Irradiated components, control rods, etc.	m^3 Ci	0 0	N/A
d. Other (describe)	m^3 Ci	0 0	N/A

2. Estimate of major nuclide composition (by type of waste)

a.	Fe-55	%	2.20E + 1
	Cs-137	%	1.72E + 1
	Ni-63	%	1.62E + 1
	Cs-134	%	1.51E + 1
	Co-60	%	1.43E + 1
	Co-58	%	1.03E + 1
	Mn-54	%	2.60E + 0
b.	Fe-55	%	4.12E + 1
	Co-60	%	1.99E + 1
	Cs-137	%	1.39E + 1
	Cs-134	%	8.29E + 0
	Ni-63	%	6.90E + 0
	Mn-54	%	2.69E + 0
	H-3	%	1.60E + 0
	Co-58	%	1.57E + 0
c.	None	%	N/A
d.	None	%	N/A

*All nuclides with concentrations above 1.0% are listed in descending order by activity level.

3. Solid Waste Disposition (6 month period)

Number of Shipments	Mode of Transportation	Destination
45†	Truck	Barnwell, SC

†Note: 38 of these are partial shipments of DAW from waste processor to Barnwell, SC.

B. Irradiated Fuel Shipments (Disposition)

Number of Shipments	Mode of Transportation	Destination
None	N/A	N/A