

Shearon Harris Energy & Environmental Center

Carolina Power & Light Company

New Hill, North Carolina

ENVIRONMENTAL RADIOLOGICAL MONITORING REPORT

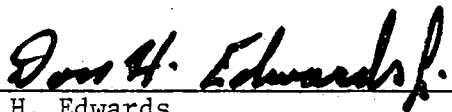
FOR

H. B. ROBINSON STEAM ELECTRIC PLANT

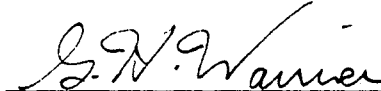
JANUARY 1, 1979, THROUGH DECEMBER 31, 1979

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## 1.0 INTRODUCTION

The following report summarizes the Environmental Radiological Monitoring conducted for the H. B. Robinson Steam Electric Plant during the calendar year 1979. This is the third year in which the program's sample analysis and data interpretation have been entirely performed by Carolina Power & Light Company.

### 1.1 PLANT AND LOCATION

The H. B. Robinson Steam Electric Plant is located in northeastern South Carolina near Hartsville and approximately 25 miles northwest of Florence. This site includes a fossil-fueled plant, Unit 1, which was placed in service in 1960, and a pressurized water nuclear power reactor, Unit 2, which entered commercial operation on March 7, 1971. The Robinson Impoundment (hereafter referred to as Lake Robinson) on the plant site, was created for Unit 1 and is also a cooling reservoir for Unit 2. Lake Robinson has an area of 2,250 acres with plant intake at the south end, adjacent to the dam. Following condenser use, the water is returned by a 4.2-mile canal to the north end of Lake Robinson near the mouth of Black Creek which flows into the lake from the north.

### 1.2 RADIOLOGICAL IMPACT CONSIDERATIONS

The most significant mode of population exposure due to plant operation is direct external radiation exposure due to the

elevated plume of noble gases. Other potentially important exposure pathways to man are the airborne radioiodine-pasture-milk and consumption of fish from Lake Robinson. While relatively insignificant dose is experienced, contact with Lake Robinson, including fishing, boating, and immersion (swimming), is a secondary dose path to man.

### 1.3 ENVIRONMENTAL MONITORING PROGRAM

The significant elements of these exposure pathways were used to establish the present surveillance program. The program, as presently implemented, is an expansion of that required by the H. B. Robinson Environmental Technical Specifications. Table 1-1 details the surveillance program and Figures 1-1 and 1-2 show the environmental monitoring locations.

Below is a tabulation of the specific methods used in monitoring the various pathways of exposure to man:

#### Gaseous Effluent Path

Submersion Dose and Other External Dose	Thermoluminescent Dosimetry Area Monitors
Vegetation Path	Vegetation Samples Soil Samples Air Samples
Inhalation Path	Air Samples
Milk Path	Milk Samples Feed and Fodder Crop Air Samples

Liquid Effluent Path

Fish Path	Surface Water Samples Bottom Sediment Samples Aquatic Vegetation Samples Fish Samples
Water and Shoreline Dose	Thermoluminescent Dosimetry Air Monitors Surface Water Samples Bottom Sediment Samples Shoreline Sediment
Drinking Water Path	Groundwater Samples

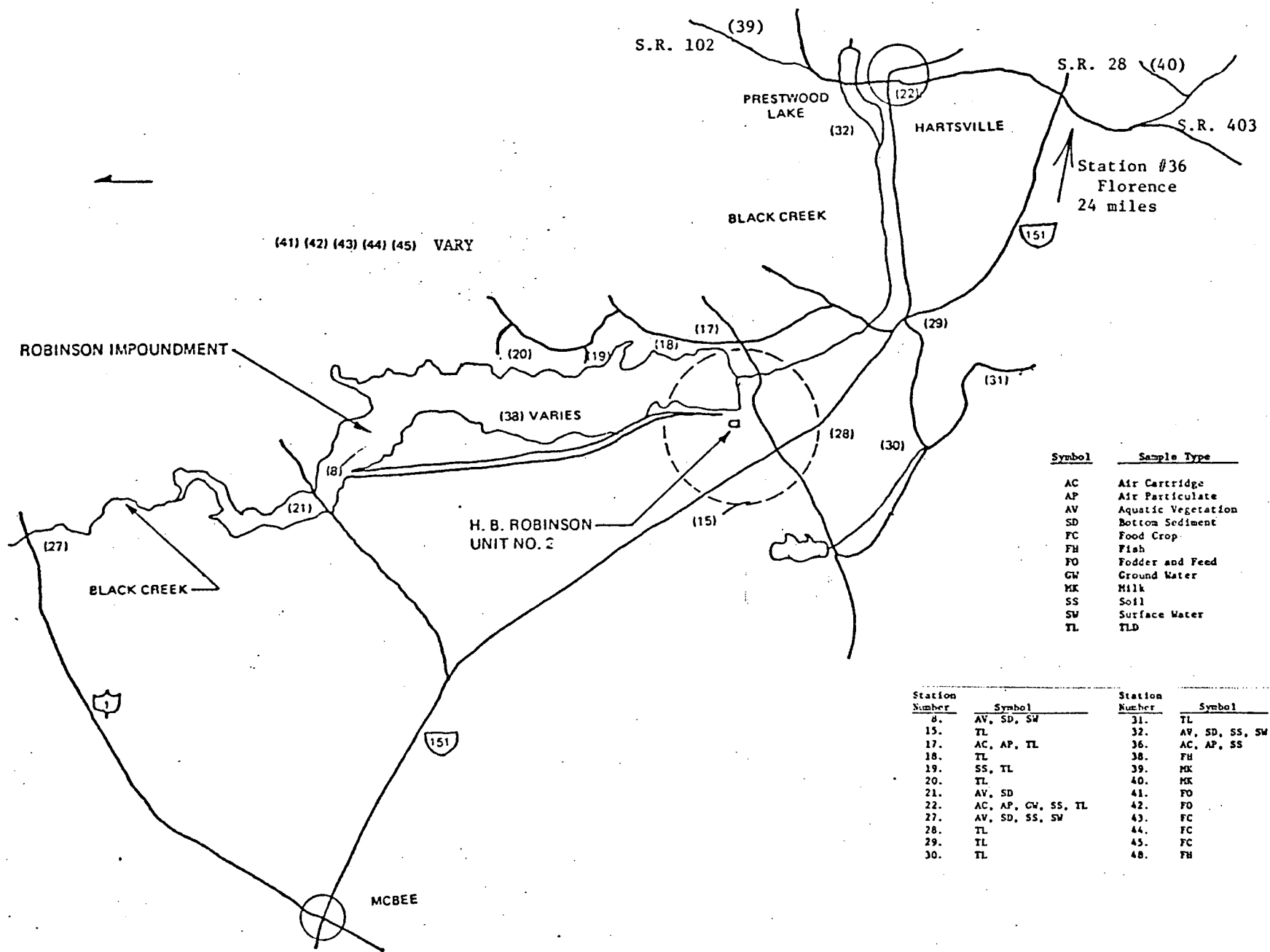


FIGURE 1-1  
H. B. ROBINSON UNIT NO. 2  
ENVIRONMENTAL RADIOLOGICAL SAMPLING POINTS



Station Number	Symbol	Station Number	Symbol
1.	TL	12.	TL
2.	AC, AP, SS	13.	TL
3.	TL	14.	TL
4.	TL	16.	TL
5.	SD, R&G, SW	23.	GW
6.	TL	24.	GW
7.	TL	33.	AV, SD
9.	AC, AP, SS, TL	34.	AC, AP, SS
10.	TL	35.	AC, AP, SS
11.	AV, SD, SS, SW, TL	49.	SS

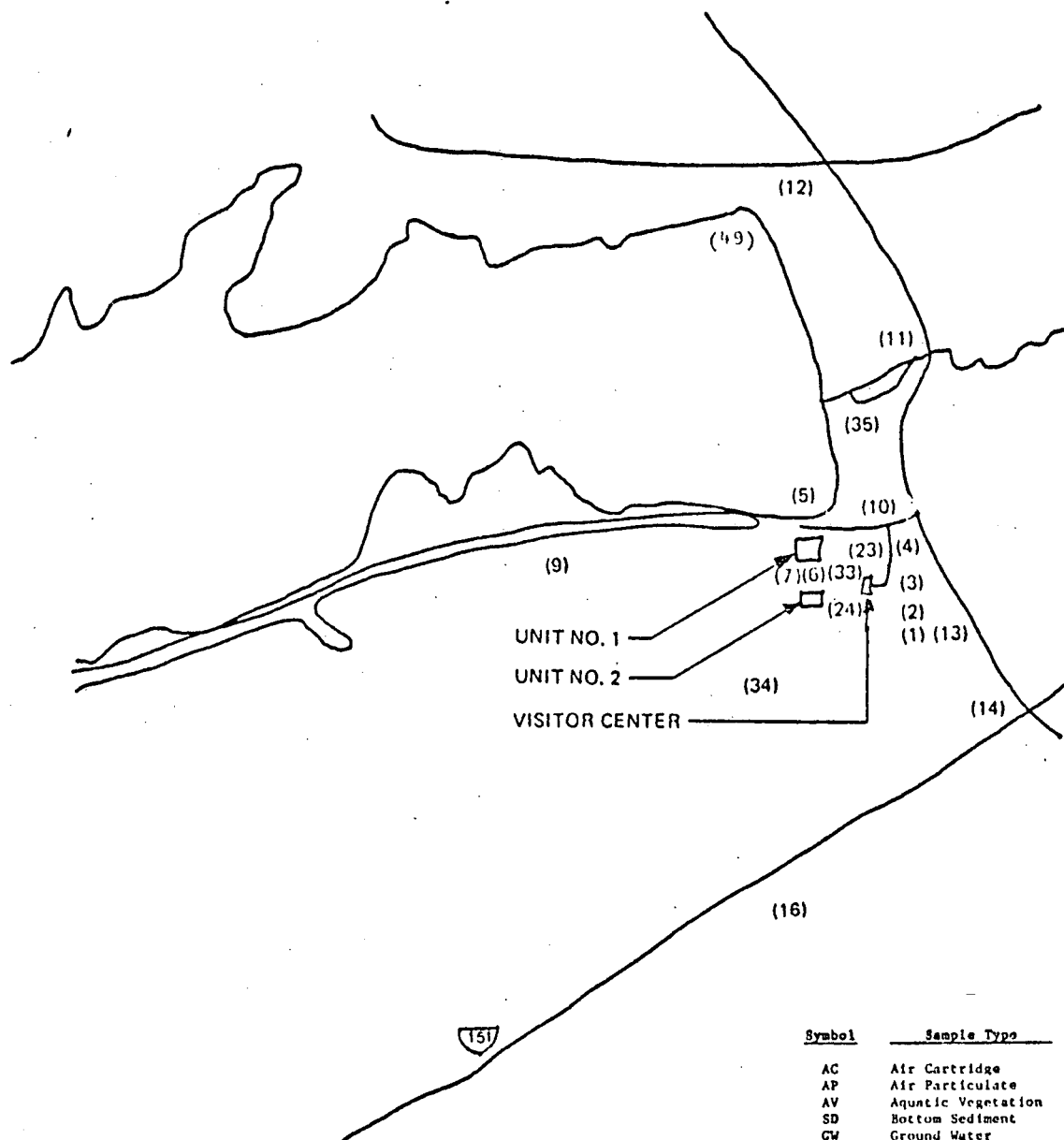


FIGURE 1-2  
H. B. ROBINSON UNIT NO. 2  
ENVIRONMENTAL RADIOLOGICAL SAMPLING POINTS

TABLE 1-1

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM  
H. B. ROBINSON STEAM ELECTRIC PLANT

<u>Sample Type</u>	<u>Sampling Point and Description</u>	<u>Sampling Frequency</u>	<u>Sample Size</u>	<u>Sample Analysis</u>
Air Cartridge (AC)	2-Visitor's Center	Weekly	300 cu. m.	Iodine
	9-Microwave Tower			
	17-East Shore of Lake Across from Plant Intake			
	22-Hartsville <sup>1</sup>			
	34-End of Construction Road West of Plant			
	35-Dam (West End)			
	36-Florence			
Air Particulate (AP)	2-Visitor's Center	Weekly	300 cu. m.	Weekly--Gross Alpha and Gross Beta, Gamma if Gross Beta > 100 pCi/m <sup>3</sup> , Monthly Composite Gamma and Sr-89, 90
	9-Microwave Tower			
	17-East Shore of Lake Across from Plant Intake			
	22-Hartsville <sup>1</sup>			
	34-End of Construction Road West of Plant			
	35-Dam (West End)			
	36-Florence			

TABLE 1-1 (cont'd)

<u>Sample Type</u>	<u>Sampling Point and Description</u>	<u>Sampling Frequency</u>	<u>Sample Size</u>	<u>Sample Analysis</u>
Aquatic Vegetation (AV)	8-Discharge Canal Outfall	Quarterly	500 grams	Gross Beta, Gamma and Sr-89, 90
	11-Black Creek at Road 1623			
	21-Bridge at North End of Lake			
	27-Black Creek at U.S. 1 <sup>1</sup>			
	32-Prestwood Lake			
	33-Ditch Behind Visitor's Center	Monthly <sup>2</sup>	500 grams	Gross Beta, Gamma and Sr-89, 90
Bottom Sediment (SD)	5-Plant Intake	Quarterly	500 grams	Gross Beta, <sup>40</sup> K, Gamma and Sr-89, 90
	8-Discharge Canal Outfall			
	11-Black Creek at Road 1623			
	21-Bridge at North End of Lake			
	27-Black Creek at U.S. 1 <sup>1</sup>			
	32-Prestwood Lake	Monthly <sup>2</sup>	500 grams	Gross Beta, Gamma and Sr-89, 90
	33-Ditch Behind Visitor's Center			
Feed Crop (FO)	41-Varies 42-Varies	Twice during growing season (started 1977)	500 grams	Gamma
Fish (FH)	38-Site Varies within Lake Robinson	Quarterly	500 grams	Flesh--Gross Beta, <sup>40</sup> K, Gamma and Sr-89, 90, Bone--Sr-89, 90

TABLE 1-1 (cont'd)

<u>Sample Type</u>	<u>Sampling Point and Description</u>	<u>Sampling Frequency</u>	<u>Sample Size</u>	<u>Sample Analysis</u>
Food Crop (FC)	43-Varies	One tobacco sample during growing season and one sample after it has been cured (started 1977).	500 grams	Gamma
	44-Varies	Twice during growing season (started 1977)	500 grams	Gamma
	45-Varies			
Groundwater (GW)	22-Hartsville	Quarterly (started 1st quarter, 1977)	4 liters	Gross Alpha, Gross Beta, Tritium, Gamma and Sr-89, 90
	23-Unit 1 Well near Site Entrance			
	24-Well at West Side of Unit 2			
Milk (MK)	39-McCaskill's Farm	Monthly	8 liters	Iodine, Gamma, and Sr-89, 90
	40-Fink's Farm			

TABLE 1-1 (cont'd)

Sample Type	Sampling Point and Description	Sampling Frequency	Sample Size	Sample Analysis
Soil (SS)	2-Visitor's Center	*Every 3 years	500 grams	Gross Beta, <sup>40</sup> K, Gamma, Sr-89, 90
	9-Microwave Tower			
	11-Black Creek and Road 1623	(4 samples taken at each station, 1-inch, 2-inches, 3-inches, and 4-inches deep - 1st 6 months of 1979 only.		on a composite of each station.
	19-East Shore of Lake (North of 18)			
	22-Hartsville			
	27-Black Creek at U.S. 1			
	32-Prestwood			
	34-End of Construction Road West of Plant			
	35-Dam (West End)	Single sample taken at each station, 1 square-foot by 1-inch deep - started 6/30/79.)		Gross Beta, <sup>40</sup> K, Gamma and Sr-89, 90
	36-Florence			
	49-East Shore of Lake at Boat Launch	Semiannual (1-inch deep only)	500 grams	Gross Beta, <sup>40</sup> K, Gamma
*Two sample locations will be sampled semiannually on a rotating basis.				
Surface Water (SW)	5-Plant Intake	Weekly	2.5 liters	Weekly--Gross Alpha, Gross Beta and Tritium, (Gamma and Sr-89, 90 if Gross Beta > 100 pCi/l)
	8-Discharge Canal Outfall			
	32-Prestwood Lake	Twice Weekly <sup>3</sup>		Monthly Composite--
	11-Black Creek at Road 1623	Weekly (started on 3/4/77)		Gross Alpha, Gross Beta Tritium, Gamma, and Sr-89, 90
	27-Black Creek at U.S. 1 <sup>1</sup>			Quarterly Composite--
				Gross Alpha, Gross Beta, Tritium (Gamma and Sr-89, 90 if Gross Beta > 100 pCi/l)
	5-Plant Intake (in Exchange Resin)	Weekly	2,000 liters	Gamma
	5-Plant Intake (Glasswool)			

TABLE 1-1 (cont'd)

<u>Sample Type</u>	<u>Sampling Point and Description</u>	<u>Sampling Frequency</u>	<u>Sample Size</u>	<u>Sample Analysis</u>
External Radiation Dose (TL)	1-South Property Line near Construction Road 3-South Property Line near Visitor's Center 4-South Property Line near Road 1623 6-Robinson Unit 1 7-Robinson Unit 1 9-Microwave Tower 10-Picnic Area 11-Black Creek at Road 1623 12-Intersection of Roads 1623 and 1639 13-West Property Line near Construction Road 14-Intersection Area for Road 1623 and Route 151 15-Pine Ridge Baptist Church and Route 151 16-Route 151 - 0.5 mile North of Road 1623 17-East Shore of Lake across from Plant Intake 18-East Shore of Lake (North of 17) 19-East Shore of Lake (North of 18)	Monthly	Not Applicable	TLD Readout

TABLE 1-1 (cont'd)

<u>Sample Type</u>	<u>Sampling Point and Description</u>	<u>Sampling Frequency</u>	<u>Sample Size</u>	<u>Sample Analysis</u>
External Radiation Dose (TL)	20-East Shore of Lake (North of 19)	Monthly	Not Applicable	TLD Readout
(cont'd)	22-Hartsville <sup>1</sup>			
	28-Intersection of Transmission Lines and Route 151			
	29-Intersection of S.C. 200 and Route 151			
	30-Intersection of S.C. 200 and S.C. 53			
	31-Kelly Town			

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<sup>1</sup>Control Station

<sup>2</sup>This particular location (Sample Station 33) is a direct pathway for radionuclides released to the environment through untreated liquid releases. Based on previous elevated results, a more frequent sampling program is indicated.

<sup>3</sup>This location is sampled more frequently as a result of a directive by the NRC to CP&L due to no composite sampler being available.

## 2.0 PROGRAM SUMMARY

The purpose of the Environmental Radiological Monitoring Program is to measure any accumulation of radioactivity in the environment and to assess whether this radioactivity is the result of the operation of the H. B. Robinson Plant.

Since control stations are not specified in the Technical Specifications to the operating license, for this report the following locations were used as the control locations for the respective measurements and were intended to indicate conditions away from the H. B. Robinson Plant influence:

### Hartsville (Sample Station 22)

Thermoluminescent Dosimetry Area Monitors  
Air Particulate Samples  
Charcoal Cartridge Samples - Airborne <sup>131</sup>I

### Black Creek above Lake Robinson at U.S. #1 (Sample Station 27)

Aquatic Vegetation  
Bottom Sediment  
Surface Water

No specific control locations could be designated for food crops, feed crops, soil, milk, fish, and groundwater, since none of the stations sampled are points selected to be unaffected by station effluents.

Table 2-1 summarizes the environmental radiological monitoring data for the entire year of 1979.



TABLE 2-1

## ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

H. B. Robinson Steam Electric Plant  
Darlington County, South Carolina

Docket Numbers - 50-261  
Calendar Year 1979

Medium or Pathway Sampled or Measured (Unit of Measure- ment)	Type & Total # of Measurements Performed	Minimum Detectable Activity (MDA) (1)	All Indicator Locations (2) Mean Range	Location w/Highest Annual Mean Name Distance & Direction	Mean Range (2)	Control Locations Mean Range (2)	# of Non- routine Reported Measure- ments (3)
Air Cartridge (pCi/m <sup>3</sup> )	I-131 368 <sup>(4)</sup>	7.00 E-2	All less than MDA	All less than MDA		All less than MDA	N/A
Air Particulate (pCi/m <sup>3</sup> )	Gross Alpha 368 <sup>(4)</sup>	2.00 E-3	6.03 E-3 (279/316) 1.39 E-3 - 6.86 E-2	Visitors Center 0.2 mi. SW	7.89 E-3 (38/53) 2.23 E-3 - 1.93 E-2	5.65 E-3 (51/52) 1.15 E-3 - 1.35 E-2	N/A
	Gross Beta 368 <sup>(4)</sup>	3.00 E-3	4.85 E-2 (313/316) 2.61 E-3 - 2.15 E-1	Visitors Center 0.2 mi. SW	5.77 E-2 (52/53) 2.61 E-3 - 2.13 E-1	5.35 E-2 (52/52) 2.02 E-2 - 9.27 E-2	N/A
	Sr-89 84	1.40 E-3	2.86 E-3 (3/72) 1.36 E-3 - 5.69 E-3	Dam (West End) 0.4 mi. E	3.61 E-3 (2/12) 1.53 E-3 - 5.69 E-3	All less than MDA	N/A
	Sr-90 84	9.00 E-4	1.72 E-3 (17/72) 4.92 E-4 - 7.77 E-3	Visitors Center 0.2 mi. SW	6.50 E-3 (2/12) 5.23 E-3 - 7.77 E-3	1.43 E-3 (2/12) 1.23 E-3 - 1.63 E-3	N/A
	Gamma 84 Co-57	3.00 E-3	1.36 E-3 (1/72) (single value)	Microwave Tower 0.7 mi. N	1.36 E-3 (1/12) (single value)	All less than MDA	N/A
	Co-58	5.00 E-3	1.92 E-2 (1/72) (single value)	End of Constr. Rd. 0.2 mi. W	1.92 E-2 (1/12) (single value)	All less than MDA	N/A

TABLE 2-1

## ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

H. B. Robinson Steam Electric Plant  
Darlington County, South Carolina

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Calendar Year 1979

Medium or Pathway Sampled or Measured (Unit of Measure- ment)	Type & Total # of Measurements Performed	Minimum Detectable Activity (MDA) (1)	All Indicator Locations (2) Mean Range	Location w/Highest Annual Mean Name Distance & Direction Mean Range (2)	Control Locations Mean Range (2)	# of Non- routine Reported Measure- ments (3)
Air Particulate (pCi/m <sup>3</sup> )	Gamma 84 Co-60	5.00 E-3	1.61 E-2 (2/72) 1.58 E-2 - 1.63 E-2	Microwave Tower 1.63 E-2 (1/12) 0.7 mi. N (single value)	1.09 E-2 (1/12) (single value)	N/A
	Cs-137	3.00 E-3	8.60 E-3 (3/72) 7.30 E-3 - 1.02 E-2	Microwave Tower 1.02 E-2 (1/12) 0.7 mi. N (single value)	6.69 E-3 (1/12) (single value)	N/A
	Ce-144	1.30 E-2	All less than MDA	All less than MDA	3.32 E-2 (1/12) (single value)	N/A
Aquatic Vegetation (5) (pCi/gram dry)	Gross Beta 32	4.00 E+0	2.11 E+1 (28/28) 5.67 E+0 - 5.14 E+1	Ditch Behind Visitors Center 2.95 E+1 (12/12) 0.1 mi. SW 1.23 E+1 - 5.14 E+1	1.11 E+1 (4/4) 8.15 E+0 - 1.72 E+1	N/A
	Sr-89 32	1.30 E-1	All less than MDA	All less than MDA	All less than MDA	N/A
	Sr-90 32	6.10 E-2	2.37 E-1 (18/28) 7.36 E-2 - 5.62 E-1	Prestwood Lake 4.23 E-1 (4/4) 4.9 mi. ESE 1.74 E-1 - 5.62 E-1	4.21 E-1 (4/4) 2.65 E-1 - 5.60 E-1	N/A

TABLE 2-1

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Docket Numbers - 50-261  
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Aquatic Vegetation (5)  (pCi/gram dry)	Gamma  32  Mn-54	6.50 E-2	3.64 E-1 (18/28)  8.10 E-2 - 4.37 E+0	Discharge Canal Outfall  3.8 mi. N  1.56 E+0 (2/4)  5.53 E-1 - 2.56 E+0	All less than MDA	N/A
	Co-57	9.05 E-2	1.05 E-1 (1/28)  (single value)	Ditch Behind Visitors Center  0.1 mi. SW  1.05 E-1 (1/12)  (single value)	All less than MDA	N/A
	Co-58	6.00 E-2	2.49 E+0 (21/28)  1.74 E-1 - 1.25 E+1	Ditch Behind Visitors Center  0.1 mi. SW  4.47 E+0 (9/12)  1.74 E-1 - 1.25 E+1	All less than MDA	N/A
	Co-60	6.50 E-2	4.50 E+0 (28/28)  1.72 E-1 - 3.97 E+1	Ditch Behind Visitors Center  0.1 mi. SW  7.81 E+0 (12/12)  1.72 E-1 - 3.97 E+1	All less than MDA	N/A
	Nb-95	6.00 E-2	3.92 E-1 (1/28)  (single value)	Discharge Canal Outfall  3.8 mi. N  3.92 E-1 (1/4)  (single value)	All less than MDA	N/A
	Cs-134	6.50 E-2	8.66 E-1 (14/28)  6.77 E-2 - 2.51 E+0	Ditch Behind Visitors Center  0.1 mi. SW  1.27 E+0 (8/12)  6.58 E-1 - 2.51 E+0	All less than MDA	N/A

TABLE 2-1

## ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

H. B. Robinson Steam Electric Plant  
Darlington County, South Carolina

Docket Numbers - 50-261  
Calendar Year 1979

Medium or Pathway Sampled or Measured (Unit of Measure- ment)	Type & Total # of Measurements Performed	Minimum Detectable Activity (MDA) (1)	All Indicator Locations (2) Mean Range	Location w/Highest Annual Mean Name Distance & Direction Mean Range (2)	Control Locations Mean Range (2)	# of Non- routine Reported Measure- ments (3)
Aquatic Vegetation (5)  (pCi/gram dry)	Gamma  32  Cs-137	7.00 E-2	1.97 E+0 (27/28)  1.30 E-1 - 1.00 E+1	Ditch Behind Visitors Center 3.69 E+0 (12/12)  0.1 mi. SW 1.88 E-1 - 1.00 E+0	7.46 E-1 (4/4)  2.54 E-1 - 1.24 E+0	N/A
	Ce-144	2.65 E-1	9.33 E-1 (10/28)  3.26 E-1 - 2.04 E+0	Discharge Canal Outfall 1.28 E+0 (4/4)  3.8 mi. N 3.26 E-1 - 2.04 E+0	1.30 E+0 (1/4)  (single value)	N/A
Bottom Sediment (5)  (pCi/gram dry)	Gross Beta  36	1.10 E-1	4.79 E+0 (32/32)  2.66 E-1 - 1.72 E+1	Ditch Behind Visitors Center 1.08 E+1 (12/12)  0.1 mi. SW 1.12 E+0 - 1.72 E+1	9.48 E-1 (4/4)  2.34 E-1 - 1.96 E+0	N/A
	Sr-89  36	5.00 E-1	All less than MDA	All less than MDA	All less than MDA	N/A
	Sr-90  36	5.00 E-1	All less than MDA	All less than MDA	All less than MDA	N/A
	Gamma  36  K-40	2.30 E-1	4.62 E+0 (26/32)  2.56 E-1 - 1.60 E+1	Ditch Behind Visitors Center 6.73 E+0 (12/12)  0.1 mi. SW 9.70 E-1 - 1.47 E+1	1.12 E+0 (3/4)  6.63 E-1 - 1.68 E+0	N/A

TABLE 2-1

## ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

H. B. Robinson Steam Electric Plant  
Darlington County, South Carolina

Docket Numbers - 50-261  
Calendar Year 1979

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Bottom Sediment <sup>(5)</sup> (pCi/gram dry)	Gamma 36 Mn-54	2.30 E-2	9.40 E-2 (7/32) 2.46 E-2 - 2.21 E-1	Ditch Behind Visitors Center 1.72 E-1 (3/12) 0.1 mi. SW 1.36 E-1 - 2.21 E-1	All less than MDA	N/A
	Co-58	3.00 E-2	5.94 E-1 (11/32) 7.82 E-2 - 1.22 E+0	Ditch Behind Visitors Center 7.68 E-1 (8/12) 0.1 mi. SW 7.96 E-2 - 1.22 E+0	All less than MDA	N/A
	Co-60	3.00 E-2	4.21 E+0 (23/32) 2.41 E-2 - 1.92 E+1	Ditch Behind Visitors Center 7.72 E+0 (12/12) 0.1 mi. SW 1.18 E+0 - 1.92 E+1	All less than MDA	N/A
	Cs-134	2.60 E-2	7.44 E-1 (20/32) 4.33 E-2 - 2.67 E+0	Ditch Behind Visitors Center 1.16 E+0 (12/12) 0.1 mi. SW 4.25 E-1 - 2.67 E+0	All less than MDA	N/A
	Cs-137	2.80 E-2	2.21 E+0 (27/32) 2.40 E-2 - 1.03 E+1	Ditch Behind Visitors Center 4.83 E+0 (12/12) 0.1 mi. SW 1.75 E+0 - 1.03 E+1	All less than MDA	N/A
Fish Bone (pCi/gram dry) (Bottom Feeders)	Sr-89 4	2.00 E+0	All less than MDA	All less than MDA	No Control	N/A

TABLE 2-1

## ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

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Calendar Year 1979

Medium or Pathway Sampled or Measured (Unit of Measure- ment)	Type & Total # of Measurements Performed	Minimum Detectable Activity (MDA) (1)	All Indicator Locations (2) Mean Range	Location w/Highest Annual Mean Name Distance & Direction Mean Range (2)	Control Locations Mean Range (2)	# of Non- routine Reported Measure- ments (3)
Fish Bone  (pCi/gram dry (Bottom Feeders)  (Free Swimmers)	Sr-90 4	2.00 E+0	7.60 E+0 (4/4) 3.37 E+0 - 1.02 E+1	Site Varies Within Lake Robinson 7.60 E+0 (4/4) 3.37 E+0 - 1.02 E+1	No Control	N/A
	Sr-89 4	2.00 E+0	All less than MDA	All less than MDA	No Control	N/A
	Sr-90 4	2.00 E+0	7.12 E+0 (4/4) 4.84 E+0 - 8.76 E+0	Site Varies Within Lake Robinson 7.12 E+0 (4/4) 4.84 E+0 - 8.76 E+0	No Control	N/A
Fish Flesh  (pCi/gram dry (Bottom Feeders)  (Free Swimmers)  (Bottom Feeders)	Gross Beta 4	4.00 E+0	2.58 E+1 (4/4) 1.54 E+1 - 3.68 E+1	Site Varies Within Lake Robinson 2.58 E+1 (4/4) 1.54 E+1 - 3.68 E+1	No Control	N/A
	Gross Beta 4	4.00 E+0	2.01 E+1 (4/4) 8.86 E+0 - 3.82 E+1	Site Varies Within Lake Robinson 2.01 E+1 (4/4) 8.86 E+0 - 3.82 E+1	No Control	N/A
	Sr-89 4	2.00 E-1	All less than MDA	All less than MDA	No Control	N/A
	Sr-90 4	1.00 E-1	4.33 E-1 (4/4) 2.10 E-1 - 7.26 E-1	Site Varies Within Lake Robinson 4.33 E-1 (4/4) 2.10 E-1 - 7.26 E-1	No Control	N/A

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

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Medium or Pathway Sampled or Measured (Unit of Measure- ment)	Type & Total # of Measurements Performed	Minimum Detectable Activity (MDA) (1)	All Indicator Locations (2) Mean Range	Location w/Highest Annual Mean		Control Locations Mean Range (2)	# of Non- routine Reported Measure- ments (3)
				Name Distance & Direction	Mean Range (2)		
Fish Flesh  (pCi/gram dry)  (Free Swimmers)          (Bottom Feeders)	Sr-89  4	2.00 E-1	All less than MDA	All less than MDA		No Control	N/A
	Sr-90  4	1.00 E-1	4.23 E-1 (4/4)  1.74 E-1 - 5.62 E-1	Site Varies Within Lake Robinson  1.74 E-1 - 5.62 E-1	4.23 E-1 (4/4)  1.74 E-1 - 5.62 E-1	No Control	N/A
	Gamma  4  K-40	3.00 E-1	1.11 E+1 (4/4)  7.89 E+0 - 1.57 E+1	Site Varies Within Lake Robinson  7.89 E+0 - 1.57 E+1	1.11 E+1 (4/4)  7.89 E+0 - 1.57 E+1	No Control	N/A
	Cs-134	6.50 E-2	1.65 E-1 (2/4)  1.63 E-1 - 1.66 E-1	Site Varies Within Lake Robinson  1.63 E-1 - 1.66 E-1	1.65 E-1 (2/4)  1.63 E-1 - 1.66 E-1	No Control	N/A
	Cs-137	7.00 E-2	7.95 E-1 (4/4)  5.11 E-1 - 1.05 E+0	Site Varies Within Lake Robinson  5.11 E-1 - 1.05 E+0	7.95 E-1 (4/4)  5.11 E-1 - 1.05 E+0	No Control	N/A

TABLE 2-1

## ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

H. B. Robinson Steam Electric Plant  
Darlington County, South Carolina

Docket Numbers - 50-261  
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Medium or Pathway Sampled or Measured (Unit of Measure- ment)	Type & Total # of Measurements Performed	Minimum Detectable Activity (MDA) (1)	All Indicator Locations (2) Mean Range	Location w/Highest Annual Mean Name Distance & Direction Mean Range (2)	Control Locations Mean Range (2)	# of Non- routine Reported Measure- ments (3)
Fish Flesh (pCi/gram dry) (Free Swimmers)	Gamma 4 K-40	3.00 E-1	8.11 E+0 (4/4) 3.45 E+0 - 1.50 E+1	Site Varies Within Lake Robinson 8.11 E+0 (4/4) 3.45 E+0 - 1.50 E+1	No Control	N/A
	Cs-134	6.50 E-2	1.97 E-1 (4/4) 1.26 E-1 - 3.53 E-1	Site Varies Within Lake Robinson 1.97 E-1 (4/4) 1.26 E-1 - 3.53 E-1	No Control	N/A
	Cs-137	7.00 E-2	1.13 E+0 (4/4) 6.19 E-1 - 1.62 E+0	Site Varies Within Lake Robinson 1.13 E+0 (4/4) 6.19 E-1 - 1.62 E+0	No Control	N/A
Fodder and Feed Crop (pCi/gram dry)	Gamma 4 Cs-137	7.00 E-2	1.46 E-1 (3/4) 7.84 E-2 - 2.28 E-1	Fink's Farm 2.28 E-1 (1/2) 7.0 mi. SE (single value)	No Control	N/A
Food Crop <sup>(6)</sup> (pCi/gram dry)	Gamma 8 Cs-137	7.00 E-2	1.26 E-1 (6/8) 2.45 E-2 - 2.35 E-1	Melton Farm 1.70 E-1 (1/2) 3.9 mi. SSE (single value)	No Control	N/A



TABLE 2-1

## ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

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Medium or Pathway Sampled or Measured (Unit of Measure- ment)	Type & Total # of Measurements Performed	Minimum Detectable Activity (MDA) (1)	All Indicator Locations (2) Mean Range	Location w/Highest Annual Mean Name Distance & Direction Mean Range (2)	Control Locations Mean Range (2)	# of Non- routine Reported Measure- ments (3)
Groundwater (pCi/liter)	Gross Alpha 12	2.00 E-1	7.59 E-1 (11/12) 2.08 E-1 - 1.20 E+0	Hartsville 5.8 mi. ESE 8.51 E-1 (3/4) 6.99 E-1 - 9.42 E-1	No Control	N/A
	Gross Beta 12	8.20 E-1	1.31 E+0 (10/12) 9.69 E-1 - 2.03 E+0	Hartsville 5.8 mi. ESE 1.46 E+0 (3/4) 1.08 E+0 - 2.03 E+0	No Control	N/A
	Sr-89 12	5.00 E+0	All less than MDA	All less than MDA	No Control	N/A
	Sr-90 12	5.00 E+0	All less than MDA	All less than MDA	No Control	N/A
	Tritium 12	1.20 E+2	All less than MDA	All less than MDA	No Control	N/A
	Gamma 12	N/A	All less than MDA	All less than MDA	No Control	N/A
Milk (pCi/liter)	I-131 24	5.00 E-1	3.66 E-1 (1/24) (single value)	McCaskill's Farm 11.3 mi. SSW 3.66 E-1 (1/12) (single value)	No Control	N/A
	Sr-89 24	3.00 E+0	6.79 E+0 (2/24) 2.27 E+0 - 1.13 E+1	McCaskill's Farm 11.3 mi. SSW 6.79 E+0 (2/12) 2.27 E+0 - 1.13 E+1	No Control	N/A

TABLE 2-1

## ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

H. B. Robinson Steam Electric Plant  
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Medium or Pathway Sampled or Measured (Unit of Measure- ment)	Type & Total # of Measurements Performed	Minimum Detectable Activity (MDA) (1)	All Indicator Locations (2) Mean Range	Location w/Highest Annual Mean Name Distance & Direction	Mean Range (2)	Control Locations Mean Range (2)	# of Non- routine Reported Measure- ments (3)
Milk (pCi/liter)	Gamma 24 Cs-137	9.00 E+0	1.40 E+1 (3/24) 6.22 E+0 - 2.43 E+1	McCaskill's Farm 11.3 mi. SSW	1.40 E+1 (3/12) 6.22 E+0 - 2.43 E+1	No Control	N/A
Soil <sup>(7)</sup> (pCi/gram dry)	Gross Beta 14	9.00 E-2	1.26 E+0 (14/14) 1.74 E-1 - 2.55 E+0	Florence 26.0 mi. SW	1.79 E+0 (1/1) (single value)	No Control	N/A
	Sr-89 6	2.70 E-1	All less than MDA	All less than MDA		No Control	N/A
	Sr-90 6	1.30 E-1	All less than MDA	All less than MDA		No Control	N/A
	Gamma 14 K-40	2.80 E-2	7.15 E-1 (9/14) 1.95 E-1 - 2.92 E+0	Prestwood Lake 4.9 mi. ESE	2.92 E+0 (1/1) (single value)	No Control	N/A
	Co-60	3.00 E-2	2.62 E-2 (1/14) (single value)	Prestwood Lake 4.9 mi. ESE	2.62 E-2 (1/1) (single value)	No Control	N/A

TABLE 2-1

## ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

H. B. Robinson Steam Electric Plant  
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Medium or Pathway Sampled or Measured (Unit of Measure- ment)	Type & Total # of Measurements Performed	Minimum Detectable Activity (MDA) (1)	All Indicator Locations (2) Mean Range	Location w/Highest Annual Mean Name Distance & Direction	Mean Range (2)	Control Locations Mean Range (2)	# of Non- routine Reported Measure- ments (3)
Soil <sup>(7)</sup> (pCi/gram dry)	Gamma 14 Cs-137	2.80 E-2	1.17 E-1 (14/14) 2.76 E-2 - 2.90 E-1	Dam (West End) 0.4 mi. E	1.77 E-1 (1/1) (single value)	No Control	N/A
	Ce-144	1.00 E-1	8.95 E-2 (1/14) (single value)	East Shore of Lake 1.5 mi. NNE	8.95 E-2 (1/4) (single value)	No Control	N/A
Surface Water <sup>(8)</sup> (pCi/liter) (Sampled Weekly)	Gross Alpha 312	2.00 E-1	7.02 E-1 (160/260) 2.10 E-1 - 1.44 E+0	Black Creek at Road 1623 0.6 mi. ESE	7.37 E-1 (70/104) 2.65 E-1 - 1.35 E+0	7.12 E-1 (21/52) 4.19 E-1 - 1.27 E+0	N/A
	Gross Beta 312	8.20 E-1	1.91 E+0 (257/260) 6.91 E-1 - 1.43 E+1	Plant Intake 0.1 mi. E	2.14 E+0 (52/52) 8.54 E-1 - 1.43 E+1	1.53 E+0 (49/52) 6.84 E-1 - 2.85 E+0	N/A
	Tritium 312	3.50 E+2	1.63 E+3 (259/260) 3.48 E+2 - 5.88 E+3	Discharge Canal Outfall 3.8 mi. N	1.75 E+3 (52/52) 3.48 E+2 - 5.88 E+3	All less than MDA	N/A
Surface Water (pCi/liter) (Monthly Composite)	Gross Alpha 60	2.00 E-1	7.59 E-1 (21/48) 4.78 E-1 - 1.48 E+0	Prestwood Lake 4.9 mi. ESE	8.91 E-1 (7/12) 5.09 E-1 - 1.48 E+0	5.98 E-1 (5/12) 4.47 E-1 - 8.69 E-1	N/A

TABLE 2-1

## ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

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Medium or Pathway Sampled or Measured (Unit of Measure- ment)	Type & Total # of Measurements Performed	Minimum Detectable Activity (MDA) (1)	All Indicator Locations (2) Mean Range	Location w/Highest Annual Mean Name Distance & Direction	Mean Range (2)	Control Locations Mean Range (2)	# of Non- routine Reported Measure- ments (3)
Surface Water (pCi/liter) (Monthly Composite)	Gross Beta 60	8.20 E-1	1.81 E+0 (48/48) 8.80 E-1 - 3.80 E+0	Black Creek at Road 1623 0.6 mi. ESE	2.02 E+0 (12/12) 8.80 E-1 - 3.80 E+0	1.46 E+0 (12/12) 9.72 E-1 - 2.02 E+0	N/A
	Sr-89 60	5.00 E+0	All less than MDA	All less than MDA		All less than MDA	N/A
	Sr-90 60	5.00 E+0	All less than MDA	All less than MDA		All less than MDA	N/A
	Tritium 60	3.50 E+2	1.59 E+3 (48/48) 3.29 E+2 - 3.82 E+3	Discharge Canal Outfall 3.8 mi. N	1.76 E+3 (12/12) 3.69 E+2 - 3.82 E+3	All less than MDA	N/A
	Gamma 60 Co-58	7.00 E+0	1.12 E+1 (2/48) 9.40 E+0 - 1.30 E+1	Plant Intake 0.1 mi. E	1.30 E+1 (1/12) (single value)	All less than MDA	N/A
Surface Water (pCi/liter) (Quarterly Composite)	Gross Alpha 20	2.00 E-1	7.17 E-1 (8/16) 4.81 E-1 - 9.88 E-1	Plant Intake 0.1 mi. E	9.88 E-1 (1/4) (single value)	6.16 E-1 (1/4) (single value)	N/A

TABLE 2-1

## ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

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Medium or Pathway Sampled or Measured (Unit of Measure- ment)	Type & Total # of Measurements Performed	Minimum Detectable Activity (MDA) (1)	All Indicator Locations (2) Mean Range	Location w/Highest Annual Mean Name Distance & Direction	Mean Range (2)	Control Locations Mean Range (2)	# of Non- routine Reported Measure- ments (3)
Surface Water (pCi/liter)  (Quarterly Composite)	Gross Beta  20	8.20 E-1	1.90 E+0 (16/16) 1.09 E+0 - 3.33 E+0	Black Creek at Road 1623 0.6 mi. ESE	2.17 E+0 (4/4) 1.48 E+0 - 3.33 E+0	1.26 E+0 (4/4) 7.80 E-1 - 1.65 E+0	N/A
	Tritium  20	3.50 E+2	1.51 E+3 (16/16) 3.60 E+2 - 3.26 E+3	Plant Intake 0.1 mi. E	1.68 E+3 (4/4) 8.94 E+2 - 3.01 E+3	All less than MDA	N/A
Surface Water <sup>(9)</sup> (pCi/liter)  (Ion Exchange Resin)	Gamma  53						
	Mn-54	8.00 E-3	5.98 E-2 (30/53) 8.28 E-3 - 1.66 E-1	Plant Intake 0.1 mi. E	5.98 E-2 (30/53) 8.28 E-3 - 1.66 E-1	No Control	N/A
	Co-58	9.00 E-3	1.64 E-1 (36/53) 1.03 E-2 - 9.62 E-1	Plant Intake 0.1 mi. E	1.64 E-1 (36/53) 1.03 E-2 - 9.62 E-1	No Control	N/A
	Co-60	9.00 E-3	1.26 E-1 (42/53) 6.45 E-3 - 1.37 E+0	Plant Intake 0.1 mi. E	1.26 E-1 (42/53) 6.45 E-3 - 1.37 E+0	No Control	N/A
	Cs-134	9.00 E-3	3.62 E-2 (21/53) 6.35 E-3 - 2.38 E-1	Plant Intake 0.1 mi. E	3.62 E-2 (21/53) 6.35 E-3 - 2.38 E-1	No Control	N/A
	Cs-137	9.00 E-3	1.34 E-1 (49/53) 1.56 E-2 - 1.29 E+0	Plant Intake 0.1 mi. E	1.34 E-1 (49/53) 1.56 E-2 - 1.29 E+0	No Control	N/A

TABLE 2-1

## ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

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Docket Numbers - 50-261  
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Medium or Pathway Sampled or Measured (Unit of Measure- ment)	Type & Total # of Measurements Performed	Minimum Detectable Activity (MDA) (1)	All Indicator Locations (2) Mean Range	Location w/Highest Annual Mean Name Distance & Direction	Mean Range (2)	Control Locations Mean Range (2)	# of Non- routine Reported Measure- ments (3)
Surface Water <sup>(9)</sup> (pCi/liter) (Glasswool)	Gamma 53	N/A	All less than MDA	All less than MDA		No Control	N/A
TLD (Millirem per Week)	TLD 259 <sup>(10)</sup>	3.00 E-1	1.59 E+0 (247/247) 6.70 E-1 - 4.05 E+0	On Site 200 ft. W	2.47 E+0 (12/12) 1.47 E+0 - 4.05 E+0	1.45 E+0 (12/12) 7.60 E-1 - 2.73 E+0	N/A

Footnotes:

1. Calculated based on three standard deviations above background, using typical sample size in a given counting time. Due to counting statistics and varying volumes, occasionally lower minimum detectable activities are achieved.
2. Mean and range are based on detectable measurements only. The fractions of detectable measurements at specific locations are indicated in parenthesis.
3. Measurements in excess, at the 99.5% confidence level of ten times the control station value or ten times the minimum detectable activity (MDA)--whichever is larger. Present Environmental Technical Specifications do not require such reports.
4. Air particulate and charcoal cartridge samples were collected every Monday. There were 53 Mondays in 1979, therefore having a possible total of 371 samples instead of 364 samples. Sample Stations 9, 5, and 22 for collection periods ending January 3, May 21, and June 18, respectively, were missed due to samplers being out of service.
5. See Table 1-1, page 7 (Aquatic Vegetation and Bottom Sediment).
6. Tobacco samples (cured and uncured) are considered to be food crops. Sample Stations 44 and 45 were sampled three times each during 1979.
7. See Table 1-1, page 9 (Soil), for normal routine sampling locations and frequency. Sample Stations 2, 9, 27, and 34 were sampled during 1978. Stations 11 and 19 were sampled during the first six months of 1979 for a total of 8 samples. Stations 22, 32, 35, and 36 were sampled during the second six months of 1979 for a total of 4 samples. Station 49 was sampled twice during 1979, therefore giving a total of 14 gross beta, 14 gamma, and 6 strontium analysis for soil samples during 1979.
8. See Table 1-1, page 9 (Surface Water).
9. During the first week of January 1979, resin and glasswool samples were collected twice for a total of 53 samples each instead of 52.
10. Five TLDs are missing in the 1979 report.

### 3.0 INTERPRETATIONS AND CONCLUSIONS

#### 3.1 AIR SAMPLES

Air samples collected during 1979 contained no unusual levels of radioactivity. Gross alpha and gross beta concentrations from all indicator stations averaged  $6.03 \text{ E-3 pCi/m}^3$  and  $4.85 \text{ E-2 pCi/m}^3$ , respectively. These results are comparable to the control station gross alpha and gross beta average concentrations of  $5.65 \text{ E-3 pCi/m}^3$  and  $5.35 \text{ E-2 pCi/m}^3$ , respectively. These levels are consistent with preoperational monitoring results and are typical of naturally occurring radionuclides combined with some contribution from the atmospheric inventory of "old" nuclear debris related to nuclear testing.

The monthly composite gamma and radiostrontium analyses for air particulate samples revealed only four fission products during 1979 as summarized in Table 3-1.

TABLE 3-1

Monthly Compositing Air Particulate Samples  
Fission Products Observed During 1979  
The Average Concentration and Occurrence Fraction

<u>Radionuclide</u>	<u>Indicator Stations (pCi/m<sup>3</sup>)</u>	<u>Control Station (pCi/m<sup>3</sup>)</u>
Strontium-89	2.86 E-3 (3/72)	* $<1.66 \text{ E-3 (0/12)}$
Strontium-90	1.72 E-3 (17/72)	1.43 E-3 (2/12)
Cesium-137	8.60 E-3 (3/72)	6.69 E-3 (1/12)
Cerium-144	<u><math>&lt;1.30 \text{ E-2 (0/72)}</math></u>	3.32 E-2 (1/12)

\*Average minimum detectable activity for the control station



These concentrations and the sporadic appearances are consistent with ambient levels observed in recent years. Using a t-test at 99.5% confidence level, the control station is comparable to all indicator locations. In general these radionuclides do not indicate the Robinson Plant as their source, since other shorter-lived fission products would likewise be detectable in these samples.

September's monthly composited gamma analysis revealed cobalt-57, cobalt-58, and cobalt-60 as summarized in Table 3-2.

TABLE 3-2

Activation Products Observed  
in September's Air Particulate Filters  
(pCi/m<sup>3</sup>)

	<u>Co-57</u>	<u>Co-58</u>	<u>Co-60</u>
AP-9 Microwave Tower	1.36 E-3	<5.00 E-3	1.63 E-2
AP-17 East Shore	<3.00 E-3	<5.00 E-3	1.58 E-3
AP-22 Hartsville	<3.00 E-3	<5.00 E-3	1.09 E-2
AP-34 Construction Rd. W. of Plant	<3.00 E-3	1.92 E-2	<5.00 E-3

Since these stations are close to the plant site (except Station 22), effluent data show these radionuclides to be in

routine releases, and the absence of these radionuclides in typical measurable fallout debris suggests Robinson Plant as the source. Using the highest concentration for these radionuclides and the assumptions of Regulatory Guide 1.109, the maximum inhalation dose to an adult's critical organs and total body may be calculated (see Table 3-3).

TABLE 3-3

Maximum Inhalation Exposure  
From Environmental Air Particulate Data

<u>Organ</u>	<u>*Dose (mRem/yr)</u>
Liver	0.000218
GI-LLI	0.00669
Lung	0.115
Total Body	0.000281

\*Regulatory Guide 1.109 has no inhalation dose factors for Co-57; therefore, no dose assessment could be included.

It should be noted that the actual dose to an adult would have been significantly less since the concentrations used in the above calculations were observed only during one month.

### 3.2 SURFACE WATER

Gross alpha and gross beta activities in weekly surface water samples were generally consistent with previous surveillance data. Gross alpha concentrations were measurable in 160 of 260 samples, averaging 0.702 pCi/l, compared to the control station average of 0.712 pCi/l. Measurable gross beta

concentrations were reported in 257 of 260 samples, averaging 1.91 pCi/l, compared with the control station average of 1.53 pCi/l. These gross beta activities are comparable with averages of 3.5-4.4 pCi/l reported during preoperational surveillance. These activities were consistent at all stations, with no one station showing significant deviation.

Monthly composites of the weekly samples showed measurable gross alpha and beta activities in 21 of 48 and 48 of 48 cases, respectively. The average gross alpha concentration was 0.759 pCi/l, compared to 0.598 pCi/l at the control station. The average gross beta concentration was 1.81 pCi/l, compared to 1.46 pCi/l at the control station.

Quarterly composites of the monthly composites indicated approximately the same measurable gross alpha and gross beta activities as in the monthly samples (average 0.717 pCi/l in 8 of 16 samples and 1.90 pCi/l if 16 of 16 samples, respectively).

Tritium activity concentrations were also determined in weekly samples, monthly composites, and quarterly composites. The tritium measured in the composites was consistent with that reported in samples from which the composites were made. The surveillance program continued to show lower concentration of tritium in Prestwood Lake (Station 32), which is also fed by

Black Creek below Lake Robinson. This is attributed to the dilution of the radioactivity within Lake Prestwood by sources of water other than Black Creek (see Table 3-4).

TABLE 3-4

\*Surface Water Tritium Concentrations (pCi/l)

	<u>Weekly Samples</u>			
	<u>SW-5</u>	<u>SW-8</u>	<u>SW-11</u>	<u>SW-32</u>
Average	1640	1750	1700	1370
Range	0482-3760	0348-5880	0479-3980	0546-3150

	<u>Monthly Composites</u>			
	<u>SW-5</u>	<u>SW-8</u>	<u>SW-11</u>	<u>SW-32</u>
Average	1610	1760	1660	1330
Range	0397-3450	0369-3820	0329-3510	500-2490

	<u>Quarterly Composites</u>			
	<u>SW-5</u>	<u>SW-8</u>	<u>SW-11</u>	<u>SW-32</u>
Average	1680	1490	1670	1190
Range	0894-3010	0678-2710	0833-3260	0360-2120

\*Control station (Station 27) - all samples were less than minimum detectable activities.

The monthly composited surface water samples analyzed for gamma emitters and radiostrontium revealed no measurable radioactivity.

The measurement of very low levels of fission and activation products in lake water was also performed during the year. Weekly samples on the order of several thousand liters were concentrated on mixed bed ion exchange resin (for ion collection) and glasswool (for suspended particulate collection). Therefore, the analytical sensitivity for gamma isotopic analyses was improved by three orders of magnitude, such that any fission and activation products from liquid releases could be measured. All samples collected by this method were taken at the plant intake structure (SW-5). The radionuclides measured by this method, which were reported as a significant fraction of the Robinson Plant's routine liquid effluents, are listed in Table 3-5. However, the dose to man at these concentrations is insignificant.

TABLE 3-5

Ion Exchange Resin  
(pCi/l)

<u>Radionuclide</u>	<u>Mn-54</u>	<u>Co-58</u>	<u>Co-60</u>	<u>Cs-134</u>	<u>Cs-137</u>
Occurrence	30/53	36/53	42/53	21/53	49/53
Average	0.060	0.164	0.126	0.036	0.134
High	0.166	0.962	0.370	0.238	1.290
Low	0.008	0.010	0.006	0.006	0.016

### 3.3 FISH

The uptake of fission products in Lake Robinson by fish continued to manifest itself during the year. Average concentrations of strontium-90, cesium-134, and cesium-137 in fish flesh for 1979 are compared with previous years in Table 3-6.

TABLE 3-6

Average Concentrations in Fish Flesh  
(pCi/g dry)

<u>Year</u>	<u>Sr-90</u>	<u>Cs-134</u>	<u>Cs-137</u>
1979	4.28 E-1	1.86 E-1	9.63 E-1
1978	5.16 E-1	2.21 E-1	8.12 E-1
1977	4.86 E-1	2.54 E-1	9.81 E-1
1976	7.99 E-1	1.16 E+0	2.85 E+0
1975	3.69 E-1	3.04 E+0	6.71 E+0
1974	8.44 E-1	2.29 E+0	4.58 E+0

The annual dose from an adult's average fish consumption for the entire year, based on the assumptions of Regulatory Guide 1.109 and using the annual average concentrations (pCi/g wet) of the above radionuclides, is summarized in Table 3-7.

TABLE 3-7

Dose Computed From 1979  
Environmental Fish Data Compared to Estimated  
Dose Given in Final Environmental Statement (FES)

	<u>*1979 Dose</u> <u>mRem/yr</u>	<u>FES</u> <u>mRem/yr</u>
Bone	5.833	1.4
Liver	0.200	-
Kidney	0.067	-
Lung	0.022	-
GI-LLI	0.169	0.23
Total Body	1.514	1.9

\*Activities used for dose calculations

Sr-90	109 pCi/kg wet
Cs-134	42.6 pCi/kg wet
Cs-137	208 pCi/kg wet

The calculated total body dose is in good agreement with the estimated total body dose (1.9 mRem/yr) given in the H. B. Robinson Final Environmental Statement. The bone dose commitment of 5.8 mRem/yr, primarily due to the high uptake of strontium-90 by bone (5.7 mRem/yr), is higher than the estimated dose of 1.4 mRem/yr as reported in the Final Environmental Statement. The fish samples collected on May 15, 1978, from Beaverdam Millpond revealed strontium-90 and cesium-137 at an average concentration of 56 pCi/kg wet and 82 pCi/kg wet, respectively. This pond is unrelated to Lake Robinson and was used as the 1978 control station. Unfortunately, these samples were unavailable during 1979. Therefore, the source for the longer-lived fission products in fish samples is not totally attributed to H. B. Robinson Plant. The 173-square-mile watershed provides a mechanism for concentrating widespread fallout activity in Lake Robinson.

#### 3.4 BOTTOM SEDIMENT AND AQUATIC VEGETATION

The bottom sediment samples are taken quarterly at six locations--above, below, and in the lake itself--to monitor the expected effluent path from the Robinson Plant. Aquatic vegetation has the same locations as bottom sediment samples, except Station 5 (Plant Intake). Additional monthly bottom sediment and aquatic vegetation samples are taken from the open ditch (Station 33) near the Visitors Center in order to

monitor any untreated liquid effluent from those locations where only low level activity concentrations are expected.

Gamma analyses revealed the continued presence of several radionuclides predominant in plant liquid effluent (see Table 3-8).

Before any interpretation or conclusions can be made of the higher concentrations of the above radionuclides at Station 33, one has to consider the following characteristics of this sample station: (1) the ditch is approximately 2 to 3 feet wide, (2) water depth is approximately 2 to 5 inches, (3) it has a very slow flow rate, (4) the aquatic vegetation is very thick, and (5) it discharges just below the spillway where the general public has minimum access. It appears that this ditch is acting as a filter for untreated releases. However, Station 11 (Black Creek at Road 1623), which is located approximately 200 yards downstream from the discharge point of Station 33, shows no significant increases in comparison to previous data. Bottom sediments and aquatic vegetation are not consumed by man. However, it is documentation of trends in plant effluent.



TABLE 3-8

\*Average Concentration (pCi/g dry) and (Occurrence Fraction) of  
Radionuclides in Bottom Sediment and Aquatic Vegetation

	<u>BOTTOM SEDIMENT</u>				
	<u>Mn-54</u>	<u>Co-58</u>	<u>Co-60</u>	<u>Cs-134</u>	<u>Cs-137</u>
SD-5 Intake Canal	<0.023	<0.030	0.027 (2/4)	<0.026	0.036 (4/4)
SD-8 Discharge Canal	0.035 (2/4)	0.078 (1/4)	0.090 (4/4)	0.100 (2/4)	0.087 (3/4)
SD-11 Black Creek @ Rd. 1623	0.044 (1/4)	0.272 (2/4)	1.240 (3/4)	0.164 (4/4)	0.261 (4/4)
SD-21 Bridge @ N. End of Lake	<0.023	<0.030	0.050 (2/4)	0.068 (2/4)	0.097 (4/4)
**SD-27 US-1 (Control Station)	<0.023	<0.030	<0.030	<0.026	<0.028
SD-32 Prestwood Lake	0.029 (1/4)	<0.030	<0.030	<0.026	<0.028
SD-33 Ditch Behind Visitors Center	0.172 (3/12)	0.768 (8/12)	7.71 (12/12)	1.16 (12/12)	4.83 (12/12)

TABLE 3-8

(continued)

	<u>AQUATIC VEGETATION</u>				
	<u>Mn-54</u>	<u>Co-58</u>	<u>Co-60</u>	<u>Cs-134</u>	<u>Cs-137</u>
AV-8 Discharge Canal	1.561 (2/4)	1.721 (4/4)	3.20 (4/4)	0.201 (1/4)	0.515 (4/4)
AV-11 Black Creek @ Rd. 1623	0.385 (1/4)	0.495 (2/4)	1.92 (4/4)	0.340 (2/4)	1.02 (3/4)
AV-21 Bridge @ N. End of Lake	0.341 (3/4)	0.661 (3/4)	1.07 (4/4)	1.02 (1/4)	0.770 (4/4)
**AV-27 US-1 (Control Station)	<0.065	<0.060	<0.065	<0.065	0.746 (4/4)
AV-32 Prestwood Lake	0.362 (3/4)	0.731 (3/4)	1.88 (4/4)	0.114 (2/4)	0.259 (4/4)
AV-33 Ditch Behind Visitors Center	0.976 (9/12)	4.47 (9/12)	7.81 (12/12)	1.27 (8/12)	3.69 (12/12)

\*Minimum detectable activities are not included in the above averages.

\*\*Station 27 (Control Station) is located approximately 2 miles upstream from the impoundment.

### 3.5 MILK SAMPLES

Monthly milk samples were taken at two locations and subsequently analyzed for radioiodine, radiostrontium, and gamma emitting radionuclides.

The January monthly milk sample at Station 39 (McCaskill's Farm) revealed iodine-131 at the concentration of  $3.66 \pm 2.93 \text{ E-1 pCi/l.}$  The sample was recounted and verified. Since all other sample media did not reveal any iodine-131 or any other short-lived fission products during this time period, it cannot be attributed to Robinson Plant and appears to be a statistical artifact.

Radiostrontium analyses of milk exhibited low levels of Sr-90 in 18 of 24 samples averaging 3.76 pCi/l. These concentrations are in agreement with averages from previous years.

Gamma isotopic analyses detected Cs-137 in 3 of the 24 samples averaging 14.0 pCi/l. These levels of Cs-137 in milk are representative of data obtained over the last several years and reflect the accumulation of debris from old and recent nuclear testing.

### 3.6 GROUNDWATER

Quarterly groundwater samples for all three sampling stations showed no indication of plant contributed radioactivity.

Gross alpha activity was observed in 11 of 12 samples with an average concentration of  $7.59 \text{ E-1 pCi/liter}$ . Gross beta activity observed in 10 of 12 samples had an average concentration of  $1.31 \text{ pCi/liter}$ . Tritium and radiostrontium analysis revealed no measurable activity. Gamma analyses revealed only naturally occurring radionuclides.

### 3.7 SOIL SAMPLES

Fourteen soil samples were taken semiannually from seven locations. Two sample locations (Stations 11 and 19) were taken during the first sampling period at depth profiles of 1, 2, 3, and 4 inches. Stations 22, 32, 35, and 36 were sampled during the second half of 1979. Two additional samples were taken from the Lake Robinson shoreline.

Gross beta activities were detected in 14 of 14 samples averaging  $1.26 \text{ pCi/g}$  of dry sample. Gamma analyses revealed cesium-137 in 14 of 14 samples averaging  $0.117 \text{ pCi/g}$  of dry sample. Soil samples analyzed for strontium-89 and strontium-90 were less than minimum detectable activity.

All the above activities are similar to previous data, and no accumulation due to plant effluent is demonstrated with the exception of Station 32 (Shoreline of Prestwood Lake).

Cobalt-60 was detected at a concentration of  $0.0262 \pm 0.0161 \text{ pCi/g}$  of dry sample, which is below the normal routine minimum detectable activity ( $0.030 \text{ pCi/g dry}$ ).

### 3.8 VEGETATION

Cattle feed (FO) and locally grown food crops (FC) were sampled as available during the year and analyzed for gamma emitting radionuclides. The only detectable radionuclide was cesium-137, measured in 9 of 12 samples. The average concentration of 0.133 pCi/g dry is similar to previous years and is attributed to debris from past atmospheric testing.

### 3.9 THERMOLUMINESCENT DOSIMETRY AREA MONITORS

The average dose rate from all indicator stations was 1.59 mRem/wk, which is comparable to 1.45 mRem/wk for the control station average. The five locations yielding the highest annual dose were:

Robinson Unit 1	(6)	2.47 mRem/wk
Picnic Area	(10)	1.91 mRem/wk
Robinson Unit 1	(7)	1.86 mRem/wk
Rd. 151 @ Rd. 200	(29)	1.82 mRem/wk
Rd. 1623 @ Rd. 1639	(12)	1.69 mRem/wk

These locations have historically shown elevated dose rates. Stations 6 and 7 are located on site and thus do not represent a dose to off-site population.

In conclusion, from the review of all 1979 radiological environmental data, there was minimum to no threat to the general public in the state of South Carolina from Robinson's operation.

#### 4.0 MISSED SAMPLES AND ANALYSES

##### 4.1 AIR CARTRIDGES

The following air cartridge results are missing for 1979:

<u>Date</u>	<u>Sample Station</u>	<u>Reason</u>
January 3	9	Sampler Out of Service
May 21	5	Sampler Out of Service
June 18	22	Sampler Out of Service

##### 4.2 AIR PARTICULATES (WEEKLY)

Three air particulate results are missing due to samplers being out of service.

<u>Date</u>	<u>Sample Station</u>
January 3	9
May 21	5
June 18	22

##### 4.3 ENVIRONMENTAL TLDs

The following thermoluminescent dosimeter results were missing in 1979:

<u>Month</u>	<u>Sample Station</u>	<u>Reason</u>
September	14	Badge Lost in Field
November	7	Badge Lost in Field
November	12	Badge Lost in Field
November	14	Badge was never sent to Robinson site from the Shearon Harris Energy & Environmental Center
December	14	Received the TLD case, but the TLD discs were missing.