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, 1980, THROUGH DECEMBER 31, 1980

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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 1980. This is the fourth year in which the program's sample analyses 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.

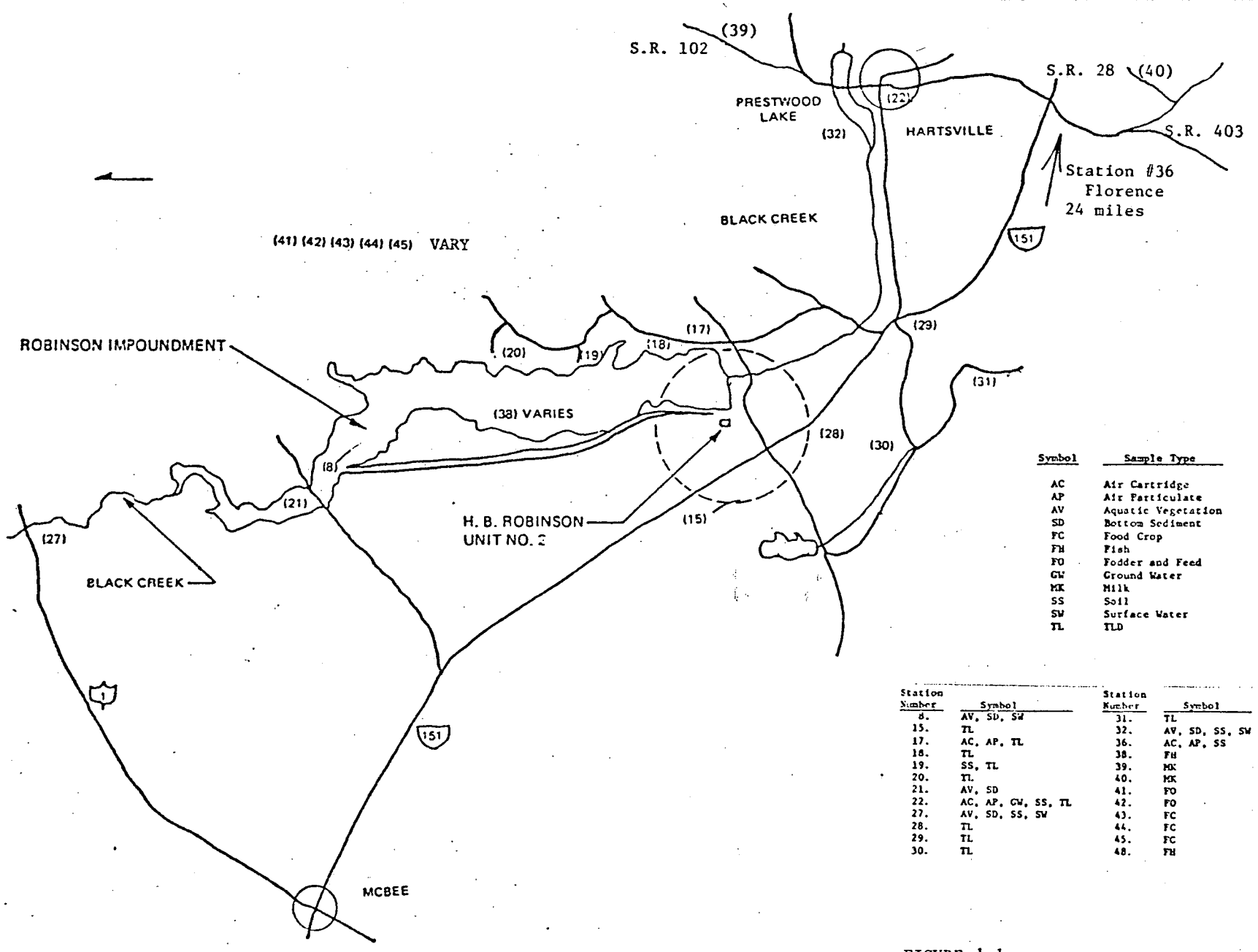
Below is a tabulation of the specific methods used in monitoring the various pathways of exposure to man:

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 Area Monitors Surface Water Samples Bottom Sediment Samples Shoreline Sediment
Drinking Water Path	Groundwater Samples



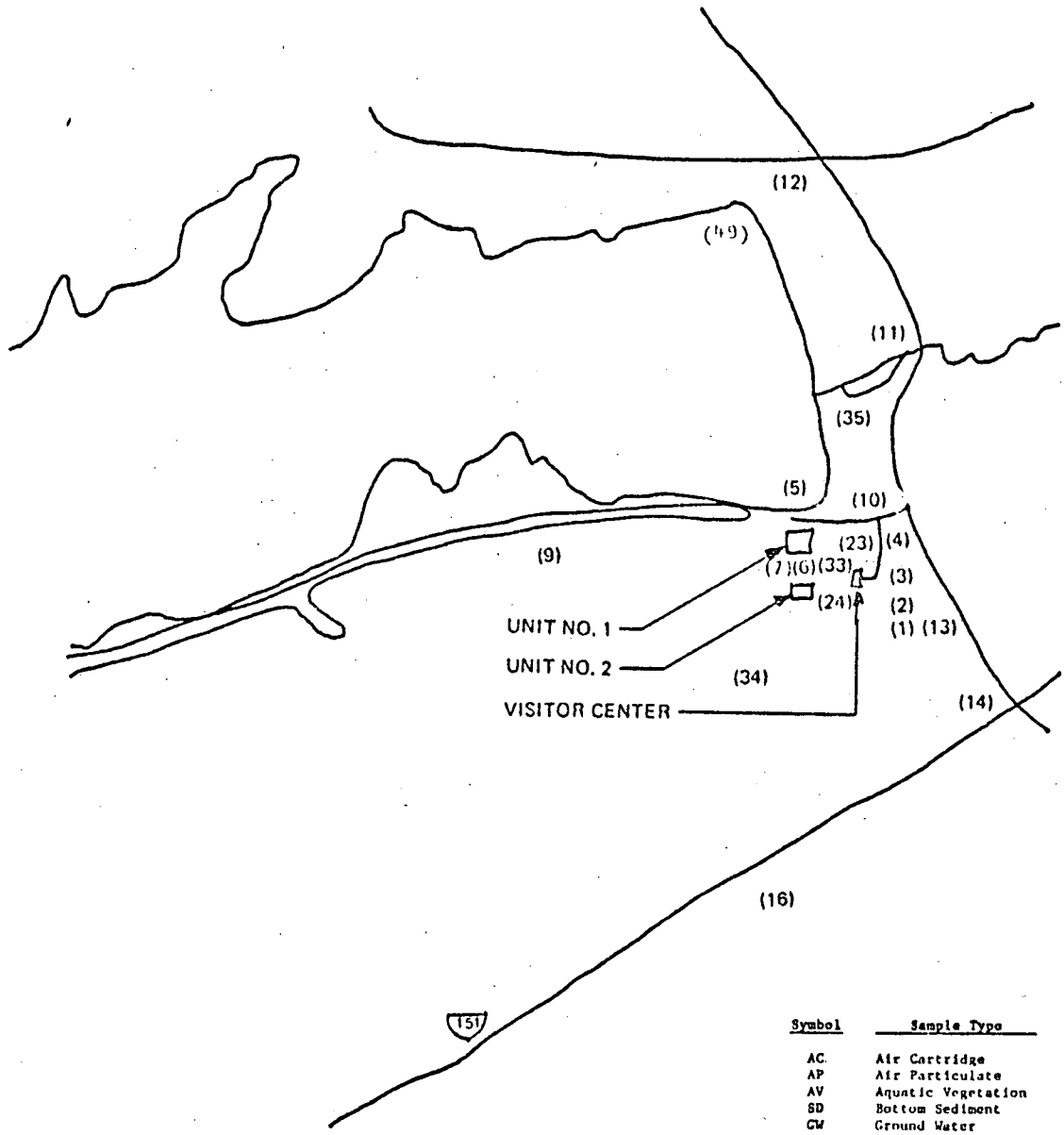
Symbol	Sample Type
AC	Air Cartridge
AP	Air Particulate
AV	Aquatic Vegetation
SD	Bottom Sediment
FC	Food Crop
FH	Fish
FO	Fodder and Feed
GW	Ground Water
MK	Milk
SS	Soil
SW	Surface Water
TL	TLD

Station Number	Symbol
8.	AV, SD, SW
15.	TL
17.	AC, AP, TL
18.	TL
19.	SS, TL
20.	TL
21.	AV, SD
22.	AC, AP, GW, SS, TL
27.	AV, SD, SS, SW
28.	TL
29.	TL
30.	TL

Station Number	Symbol
31.	TL
32.	AV, SD, SS, SW
36.	AC, AP, SS
38.	FH
39.	MK
40.	MK
41.	FO
42.	FO
43.	FC
44.	FC
45.	FC
48.	FH

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

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



Symbol	Sample Type
AC	Air Cartridge
AP	Air Particulate
AV	Aquatic Vegetation
SD	Bottom Sediment
GW	Ground Water
R&G	Resin and Glasswool
SS	Soil
SW	Surface Water
TL	TLD

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

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

TABLE 1-1 (cont'd)

Sample Type	Sampling Point and Description	Sampling Frequency	Sample Size	Sample Analysis
Aquatic Vegetation (AV)	8-Discharge Canal Outfall 11-Black Creek at Road 1623 21-Bridge at North End of Lake 27-Black Creek at U.S. 1[1] 32-Prestwood Lake	Quarterly	500 grams	Gross Beta, Gamma and Sr-89, 90
	33-Ditch Behind Visitor's Center	Monthly[2]	500 grams	Gross Beta, Gamma and Sr-89, 90
Bottom Sediment (SD)	5-Plant Intake 8-Discharge Canal Outfall 11-Black Creek at Road 1623 21-Bridge at North End of Lake 27-Black Creek at U.S. 1[1] 32-Prestwood Lake	Quarterly	500 grams	Gross Beta, ^{40}K, Gamma and Sr-89, 90
	33-Ditch Behind Visitor's Center	Monthly[2]	500 grams	Gross Beta, Gamma and Sr-89, 90
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, ^{40}K, Gamma and Sr-89, 90, Bone--Sr-89, 90

TABLE 1-1 (cont'd)

Sample Type	Sampling Point and Description	Sampling Frequency	Sample Size	Sample Analysis
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 45-Varies	Twice during growing season (started 1977)	500 grams	Gamma
Groundwater (GW)	22-Hartsville 23-Unit 1 Well near Site Entrance 24-Well at West Side of Unit 2	Quarterly (started 1st quarter, 1977)	4 liters	Gross Alpha, Gross Beta, Tritium, Gamma and Sr-89, 90
Milk (MK)	39-McCaskill's Farm 40-Fink's Farm	Monthly	8 liters	Iodine, Gamma, and Sr-89, 90

TABLE 1-1 (cont'd)

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

TABLE 1-1 (cont'd)

Sample Type	Sampling Point and Description	Sampling Frequency	Sample Size	Sample Analysis
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)

Sample Type	Sampling Point and Description	Sampling Frequency	Sample Size	Sample Analysis
External Radiation Dose (TL) (cont'd)	20-East Shore of Lake (North of 19) 22-Hartsville[1] 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	Monthly	Not Applicable	TLD Readout

[1]Control Station

[2]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.

[3]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 ^{131}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 1980.

TABLE 2-1

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

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

Docket Numbers - 50-261
Calendar Year 1980

Medium or Pathway Sampled or Measured (Unit of Measurement)	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 Measurements (3)
Air Cartridge (pCi/m^3)	I-131 361(4)	7.00 E-2	1.57 E-1 (1/309) (single value)	Microwave Tower 0.7 mi. N	1.57 E-1 (1/51) (single value)	All less than MDA	N/A
Air Particulate (pCi/m^3)	Gross Alpha 361(4)	2.00 E-3	8.65 E-3 (281/309) 3.98 E-4 - 5.66 E-1	Microwave Tower 0.7 mi. N	2.44 E-2 (42/51) 1.48 E-3 -5.66 E-1	4.34 E-3 (49/52) 1.04 E-3 - 1.30 E-2	N/A
	Gross Beta 361(4)	3.00 E-3	7.91 E-2 (309/309) 2.89 E-3 - 4.02 E+0	Microwave Tower 0.7 mi. N	1.92 E-1 (51/51) 1.65 E-2 -4.02 E+0	4.54 E-2 (52/52) 1.51 E-2 - 1.39 E-1	N/A
	Sr-89 83(5)	1.40 E-3	5.47 E-3 (7/71) 4.29 E-3 - 9.65 E-3	Visitor's Center 0.2 mi. SW	8.14 E-3 (1/12) (single value)	4.84 E-3 (1/12) (single value)	N/A
	Sr-90 83(5)	9.00 E-4	1.02 E-3 (5/71) 5.52 E-4 - 1.82 E-3	Florence 26 mi. SW	1.82 E-3 (1/12) (single value)	1.29 E-3 (1/12) (single value)	N/A

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Air Particulate (pCi/m^3)	Gamma 84 Co-58	3.00 E-3	2.64 E-3 (1/72) (single value)	End of Construction Road 0.2 mi. W	2.64 E-3 (1/12) (single value)	All less than MDA	N/A
	Nb-95	4.00 E-3	1.37 E-2 (4/72) 3.75 E-3 - 1.85 E-2	Visitor's Center 0.2 mi. SW	1.85 E-2 (1/12) (single value)	9.71 E-3 (2/12) 6.71 E-3 - 1.27 E-2	N/A
	Zr-95	1.00 E-2	1.18 E-2 (6/72) 4.17 E-3 - 2.31 E-2	East Shore 0.9 mi. ENE	2.31 E-2 (1/12) (single value)	6.40 E-3 (1/12) (single value)	N/A
	Ru-103	8.00 E-3	1.07 E-2 (9/72) 3.08 E-3 - 1.87 E-2	Microwave Tower 0.7 mi. N	1.80 E-2 (1/12) (single value)	7.72 E-3 (1/12) (single value)	N/A
	Cs-137	6.00 E-3	8.78 E-3 (1/72) (single value)	Visitor's Center 0.2 mi. SW	8.78 E-3 (1/12) (single value)	All less than MDA	N/A

TABLE 2-1

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Air Particulate (pCi/m^3)	Gamma 84 Ce-139	4.00 E-3	1.43 E-3 (1/72) (single value)	Visitor's Center 0.2 mi. SW	1.43 E-3 (1/12) (single value)	All less than MDA	N/A
	Ce-141	5.00 E-3	7.43 E-3 (10/72) 4.34 E-3 - 1.13 E-2	Microwave Tower 0.7 mi. N	1.06 E-2 (1/12) (single value)	7.55 E-3 (1/12) (single value)	N/A
Aquatic Vegetation (pCi/gram dry)	Gross Beta 31(6)	4.00 E+0	2.78 E+1 (27/27) 1.55 E+0 - 6.92 E+1	Ditch Behind Visitor's Center 0.1 mi. SW	3.73 E+1 (11/11) 8.46 E+0 -6.92 E+1	1.97 E+1 (4/4) 5.14 E+0 - 4.20 E+1	N/A
	Sr-89 27(7)	1.30 E-1	1.46 E-1 (2/24) 1.06 E-1 - 1.86 E-1	Ditch Behind Visitor's Center 0.1 mi. SW	1.46 E-1 (2/10) 1.06 E-1 -1.86 E-1	All less than MDA	N/A
	Sr-90 27(7)	6.10 E-2	1.88 E-1 (13/24) 1.04 E-1 - 4.33 E-1	Prestwood Lake 4.9 mi. ESE	2.56 E-1 (3/3) 1.21 E-1 -4.33 E-1	2.16 E-1 (2/3) 6.86 E-2 - 3.64 E-1	N/A

TABLE 2-1

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Aquatic Vegetation (pCi/grams dry)	Gamma 31(6)						
	Mn-54	6.50 E-2	5.77 E-1 (12/27) 1.42 E-1 - 1.01 E+0	Prestwood Lake 4.9 mi. ESE	9.12 E-1 (3/4) 8.81 E-1 -1.01 E+0	All less than MDA	N/A
	Co-58	6.00 E-2	2.05 E+0 (15/27) 1.70 E-1 - 1.20 E+1	Ditch Behind Visitor's Center 0.1 mi. SW	3.69 E+0 (6/11) 5.35 E-1 -4.20 E+0	All less than MDA	N/A
	Co-60	6.50 E-2	2.96 E+0 (25/27) 4.94 E-1 - 9.57 E+0	Prestwood Lake 4.9 mi. ESE	5.08 E+0 (3/4) 4.18 E+0 -5.76 E+0	All less than MDA	N/A
	Nb-95	6.00 E-2	2.39 E-1 (3/27) 8.14 E-2 - 4.23 E-1	Black Creek at Road 1623 0.6 mi. ESE	4.23 E-1 (1/4) (single value)	All less than MDA	N/A
	Zr-95	1.10 E-1	4.08 E-1 (1/27) (single value)	Bridge at North End of Lake 4.7 mi. N	4.08 E-1 (1/4) (single value)	All less than MDA	N/A

TABLE 2-1

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Aquatic Vegetation (pCi/gram dry)	Gamma 31(6)						
	Ru-103	5.50 E-2	2.67 E-1 (4/27) 9.47 E-2 - 4.20 E-1	Black Creek at Road 1623 0.6 mi. ESE	4.20 E-1 (1/4) (single value)	9.34 E-2 (1/4) (single value)	N/A
	Cs-134	6.50 E-2	4.40 E-1 (12/27) 9.42 E-2 - 1.12 E+0	Ditch Behind Visitor's Center 0.1 mi. SW	7.79 E-1 (5/11) 3.39 E-1 -1.12 E+0	Less than MDA	N/A
	Cs-137	7.00 E-2	1.19 E+0 (24/27) 1.03 E-1 - 5.64 E+0	Ditch Behind Visitor's Center 0.1 mi. SW	2.32 E+0 (8/11) 2.05 E-1 -5.64 E+0	5.09 E-1 (4/4) 2.77 E-1 - 8.22 E-1	N/A
	Ba-140	8.23 E-1	7.58 E-1 (1/27) (single value)	Prestwood Lake 4.9 mi. ESE	7.58 E-1 (1/4) (single value)	Less than MDA	N/A
	La-140	3.38 E-1	3.89 E-1 (2/27) 1.59 E-1 - 6.18 E-1	Black Creek at Road 1623 0.6 mi. ESE	6.18 E-1 (1/4) (single value)	Less than MDA	N/A

TABLE 2-1

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Aquatic Vegetation (pCi/gram dry)	Gamma 31(6) Ce-141	6.50 E-2	7.23 E-1 (3/27) 4.41 E-1 - 8.91 E-1	Black Creek at Road 1623 0.6 mi. ESE	8.91 E-1 (1/4) (single value)	Less than MDA	N/A
Bottom Sediment (pCi/gram dry)	Gross Beta 36	1.10 E-1	4.32 E+0 (28/32) 2.56 E-1 - 1.44 E+1	Ditch Behind Visitor's Center 0.1 mi. SW	7.97 E+0 (12/12) 2.44 E+0 -1.44 E+1	1.23 E+0 (4/4) 1.81 E-1 - 3.35 E+0	N/A
	Sr-89 36	5.00 E-1	All less than MDA	All less than MDA		1.21 E+0 (1/4) (single value)	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	4.21 E+0 (30/32) 1.49 E-1 - 1.89 E+1	Ditch Behind Visitor's Center 0.1 mi. SW	7.44 E+0 (12/12) 5.29 E-1 -1.89 E+1	5.40 E-1 (3/4) 4.98 E-1 - 6.07 E-1	N/A

TABLE 2-1

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Bottom Sediment (pCi/gram dry)	Gamma 36						
	Co-58	3.00 E-1	1.35 E-1 (3/32) 6.05 E-2 - 2.40 E-1	Ditch Behind Visitor's Center 0.1 mi. SW	1.35 E-1 (3/12) 6.05 E-2 -2.40 E-1	Less than MDA	N/A
	Co-60	3.00 E-2	1.53 E+0 (23/32) 1.38 E-2 - 7.32 E+0	Ditch Behind Visitor's Center 0.1 mi. SW	2.65 E+0 (12/12) 7.98 E-2 -7.32 E+0	Less than MDA	N/A
	Cs-134	2.60 E-2	4.76 E-1 (16/32) 1.40 E-2 - 2.38 E+0	Ditch Behind Visitor's Center 0.1 mi. SW	7.27 E-1 (10/12) 7.08 E-2 -2.38 E+0	3.40 E-2 (1/4) (single value)	N/A
	Cs-137	2.80 E-2	1.40 E+0 (29/32) 2.15 E-2 - 1.29 E+1	Ditch Behind Visitor's Center 0.1 mi. SW	3.12 E+0 (12/12) 6.66 E-2 -1.29 E+1	1.09 E-1 (1/4) (single value)	N/A
Fish Bone (pCi/gram dry) (Bottom Feeders)	Sr-89 3(8)	2.00 E+0	All less than MDA	All less than MDA		No Control	N/A

TABLE 2-1

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Fish Bone (pCi/gram dry) (Bottom Feeders)	Sr-90 3(8)	2.00 E+0	7.28 E+0 (3/3) 3.82 E+0 - 10.8 E+0	Site Varies Within Lake Robinson	7.28 E+0 (3/3) 3.82 E+0 -10.8 E+0	No Control	N/A
Fish Bone (pCi/gram dry) (Free Swimmers)	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	3.18 E-1 (4/4) 1.86 E-1 - 4.30 E-1	Site Varies Within Lake Robinson	3.18 E-1 (4/4) 1.86 E-1 -4.30 E-1	No Control	N/A
Fish Flesh (pCi/gram dry) (Bottom Feeders)	Gross Beta 4	4.00 E+0	1.30 E+1 (4/4) 1.20 E+1 - 1.53 E+1	Site Varies Within Lake Robinson	1.30 E+1 (4/4) 1.20 E+1 -1.53 E+1	No Control	N/A
(Free Swimmers)	Gross Beta 4	4.00 E+0	1.96 E+1 (4/4) 8.74 E+0 - 3.26 E+1	Site Varies Within Lake Robinson	1.96 E+1 (4/4) 8.74 E+0 -3.26 E+1	No Control	N/A
(Bottom Feeders)	Sr-89 3(9)	2.00 E-1	3.48 E+0 (1/3) (single value)	Site Varies Within Lake Robinson	3.48 E+0 (1/3) (single value)	No Control	N/A

TABLE 2-1

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Docket Numbers - 50-261
Calendar Year 1980

Medium or Pathway Sampled or Measured (Unit of Measurement)	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 Measurements (3)
Fish Flesh (pCi/gram dry) (Bottom Feeders)	Sr-90 3(9)	1.00 E-1	1.97 E-1 (3/3) 1.05 E-1 - 3.35 E-1	Site Varies Within Lake Robinson	1.97 E-1 (3/3) 1.05 E-1 -3.35 E-1	No Control	N/A
(Free Swimmers)	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	5.34 E-1 (4/4) 2.89 E-1 - 1.02 E+0	Site Varies Within Lake Robinson	5.34 E-1 (4/4) 2.89 E-1 -1.02 E+0	No Control	N/A
(Bottom Feeders)	Gamma 4 K-40	3.00 E-1	9.50 E+0 (4/4) 8.03 E+0 - 1.17 E+1	Site Varies Within Lake Robinson	9.50 E+0 (4/4) 8.03 E+0 -1.17 E+1	No Control	N/A
	Cs-134	6.50 E-2	1.12 E-1 (2/4) 1.8 E-1 - 4.35 E-2	Site Varies Within Lake Robinson	1.12 E-1 (2/4) 1.8 E-1 -4.35 E-2	No Control	N/A
	Cs-137	7.00 E-2	7.41 E-1 (4/4) 5.40 E-1 - 1.11 E+0	Site Varies Within Lake Robinson	7.41 E-1 (4/4) 5.40 E-1 -1.11 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
Calendar Year 1980

Medium or Pathway Sampled or Measured (Unit of Measurement)	Type & Total # of Measurements Performed	Minimum Detectable Activity (MDA) (1)	All Indicator Locations (2) Mean Range	Location w/Highest Annual Mean Name Distance & Direction	Location w/Highest Annual Mean Mean Range (2)	Control Locations Mean Range (2)	# of Non-routine Reported Measurements (3)
Fish Flesh (pCi/gram dry) (Free Swimmers)	Gamma 4 K-40	3.00 E-1	7.82 E+0 (4/4) 5.08 E+0 - 9.79 E+0	Site Varies Within Lake Robinson	7.82 E+0 (4/4) 5.08 E+0 - 9.79 E+0	No Control	N/A
	Co-60	6.50 E-2	3.24 E-2 (1/4) (single value)	Site Varies Within Lake Robinson	3.24 E-2 (1/4) (single value)	No Control	N/A
	Cs-134	6.50 E-2	1.32 E-1 (4/4) 8.18 E-2 - 1.86 E-1	Site Varies Within Lake Robinson	1.32 E-1 (4/4) 8.18 E-2 - 1.86 E-1	No Control	N/A
	Cs-137	7.00 E-2	8.99 E-1 (4/4) 6.21 E-1 - 1.35 E+0	Site Varies Within Lake Robinson	8.99 E-1 (4/4) 6.21 E-1 - 1.35 E+0	No Control	N/A
Fodder & Feed Crop (pCi/gram dry)	Gamma $2^{(10)}$ Cs-137	7.00 E-2	9.50 E-2 (1/2) (single value)	McCaskill's Farm 11.3 mi. SSW	9.50 E-2 (1/2) (single value)	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
Calendar Year 1980

Medium or Pathway Sampled or Measured (Unit of Measurement)	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 Measurements (3)
Food Crop[11] (pCi/gram dry)	Gamma 6 Cs-137	7.00 E-2	8.47 E-2 (5/6) 9.10 E-2 - 2.17 E-1	Isgett's Farm 5.2 mi. NE	2.17 E-1 (single value)	No Control	N/A
Ground Water (pCi/liter)	Gross Alpha 12	2.00 E-1	1.00 E+0 (9/12) 5.48 E-1 - 1.96 E+0	Unit 1 Well Near Site Entrance 0.1 mi. SSE	1.25 E+0 (4/4) 5.48 E-1 - 1.96 E+0	No Control	N/A
	Gross Beta 12	8.20 E-1	1.11 E+0 (8/12) 7.15 E-1 - 1.71 E+0	Unit 1 Well Near Site Entrance 0.1 mi. SSE	1.18 E+0 (4/4) 7.90 E-1 - 1.40 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	1.20 E+0	All less than MDA	All less than MDA		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
Calendar Year 1980

Medium or Pathway Sampled or Measured (Unit of Measurement)	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 Measurements (3)
Ground Water (pCi/liter)	Tritium 12	1.20 E+2	All less than MDA	All less than MDA		No Control	N/A
	Gamma	N/A	All less than MDA	All less than MDA		No Control	N/A
Milk (pCi/liter)	I-131 24	1.50 E-1	1.65 E-1 (3/24) 1.13 E-1 - 2.58 E-1	Fink's Farm 7.0 mi. SE	1.86 E-1 (2/12) 1.13 E-1 -2.58 E-1	No Control	N/A
	Sr-89 23(12)	3.00 E+0	All less than MDA	All less than MDA		No Control	N/A
	Sr-90 23(12)	2.00 E+0	4.22 E+0 (21/23) 1.45 E+0 - 21.5 E+0	McCaskill's Farm 11.3 mi. SSW	6.09 E+0 (11/12) 1.87 E+0 -21.5 E+0	No Control	N/A
	Gamma 24 K-40	3.00 E+2	1.17 E+3 (24/24) 9.74 E+2 - 1.43 E+3	Fink's Farm 7.0 mi. SE	1.25 E+3 (12/12) 9.93 E+2 -1.43 E+3	No Control	N/A
	Cs-137	9.00 E+0	1.05 E+1 (11/24) 6.05 E+0 - 1.99 E+1	McCaskill's Farm 11.3 mi. SSW	1.20 E+1 (6/12) 6.05 E+0 -1.99 E+1	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
Calendar Year 1980

Medium or Pathway Sampled or Measured (Unit of Measurement)	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 Measurements (3)
Soil (pCi/gram dry)	Gross Beta 6	9.00 E-2	9.45 E-1 (6/6) 2.98 E-1 - 1.55 E+0	End of Construction Road 0.2 mi. W	1.55 E+0 (1/1) (single value)	No Control	N/A
	Sr-89 2	2.70 E-1	All less than MDA	All less than MDA		No Control	N/A
	Sr-90 2	1.30 E-1	All less than MDA	All less than MDA		No Control	N/A
	Gamma 6 K-40	2.80 E-2	8.61 E-1 (4/6) 4.73 E-1 - 1.49 E+0	Visitor's Center 0.2 mi. SW	1.49 E+0 (1/1) (single value)	No Control	N/A
	Cs-134	2.60 E-2	4.48 E-2 (3/6) 2.82 E-2 - 6.71 E-2	End of Construction Road .2 mi. W	6.71 E-2 (1/1) (single value)	No Control	N/A
	Cs-137	2.80 E-2	1.73 E-1 (5/6) 7.72 E-2 - 3.15 E-1	East Shore of Lake at Boat Launch 0.8 mi. ENE	7.72 E-2 (1/1) (single value)	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
Calendar Year 1980

Medium or Pathway Sampled or Measured (Unit of Measurement)	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 Measurements (3)
Surface Water (pCi/liter) (Sampled Weekly)	Gross Alpha 318(16)	2.00 E-1	1.04 E+0 (175/265) 4.06 E-1 - 2.35 E+0	Discharge Canal Outfall 3.8 mi. N	1.67 E+0 (37/53) 4.06 E-1 - 1.87 E+0	7.52 E-1 (22/53) 4.47 E-1 - 1.99 E+0	N/A
	Gross Beta 318(16)	8.20 E-1	1.75 E+0 (260/265) 5.97 E-1 - 4.60 E+0	Prestwood Lake 4.9 mi. ESE	1.98 E+0 (53/53) 9.44 E- 1 -4.60 E+0	1.38 E+0 (44/53) 6.23 E-1 - 2.40 E+0	N/A
	Tritium 318(16)	3.50 E+2	1.19 E+3 (249/265) 3.33 E+2 - 5.46 E+3	Prestwood Lake 4.9 mi. ESE	9.63 E+2 (50/53) 3.33 E+2 -1.86 E+3	3.53 E+2 (2/53) 3.35 E+2 - 3.70 E+0	N/A
(Monthly Composite)	Gross Alpha 60	2.00 E-1	7.31 E-1 (30/48) 4.13 E-1 - 1.99 E+0	Black Creek at Road 1623 0.6 mi. ESE	9.65 E-1 (6/12) 4.89 E-1 -1.99 E+0	5.35 E-1 (3/12) 4.97 E-1 - 5.59 E-1	N/A
	Gross Beta 60	8.20 E-1	1.78 E+0 (48/48) 8.06 E-1 - 4.20 E+0	Prestwood Lake 4.9 mi. ESE	1.97 E+0 (12/12) 1.11 E+0 -4.20 E+0	1.32 E+0 (11/12) 6.35 E-1 - 2.70 E+0	N/A
	Sr-89 59(13)	5.00 E+0	3.55 E+0 (2/47) 2.37 E+0 - 4.72 E+0	Discharge Canal Outfall 3.8 mi. N	4.72 E+0 (1/12) (single value)	All less than MDA	N/A
	Sr-90 59(13)	5.00 E+0	1.64 E+0 (1/47) (single value)	Black Creek at Road 1623 0.6 mi. ESE	1.64 E+0 (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

Docket Numbers - 50-261
Calendar Year 1980

Medium or Pathway Sampled or Measured (Unit of Measurement)	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 Measurements (3)
Surface Water (pCi/liter) (Monthly Composite)	Tritium 60	3.50 E+2	1.11 E+3 (47/48) 1.03 E+2 - 2.31 E+3	Discharge Canal Outfall 3.8 mi. N	1.21 E+3 (12/12) 3.77 E+2 - 2.08 E+3	All less than MDA	N/A
	Gamma 60 Cs-137	5.00 E+0	1.97 E+0 (1/60) (single value)	Black Creek at Road 1623 0.6 mi. ESE	1.97 E+0 (1/60) (single value)	All less than MDA	N/A
Surface Water (pCi/liter) (Quarterly Composite)	Gross Alpha 20	2.00 E-1	5.97 E-1 (4/16) 4.13 E-1 - 8.36 E-1	Prestwood Lake 4.9 mi. ESE	8.36 E-1 (1/4) (single value)	All less than MDA	N/A
	Gross Beta 20	8.20 E-1	1.48 E+0 (15/16) 5.30 E-1 - 2.55 E+0	Prestwood Lake 4.9 mi. ESE	1.95 E+0 (4/4) 1.17 E+0 -2.55 E+0	1.03 E+0 (4/4) 6.78 E-1 - 1.38 E+0	N/A
	Tritium 20	3.50 E+2	1.09 E+3 (16/16) 3.40 E+2 - 1.68 E+3	Plant Intake 0.1 mi. E	1.22 E+3 (4/4) 5.05 E+2 - 1.68 E+3	All less than MDA	N/A
Surface Water (pCi/liter) (Ion Exchange Resin)	Gamma 51(14) Mn-54	8.00 E-3	1.64 E-2 (10/51) 5.65 E-3 - 1.01 E-1	Plant Intake 0.1 mi. E	1.64 E-2 (10/51) 5.65 E-3 -1.01 E-1	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
Calendar Year 1980

Medium or Pathway Sampled or Measured (Unit of Measurement)	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 Measurements (3)
Surface Water (pCi/liter) (Ion Exchange Resin)	Co-58	9.00 E-3	3.20 E-2 (18/51) 1.75 E-2 - 6.86 E-2	Plant Intake 0.1 mi. E	3.20 E-2 (18/51) 1.75 E-2 -6.86 E-2	No Control	N/A
	Co-60	9.00 E-3	3.57 E-2 (30/51) 1.08 E-2 - 1.55 E-1	Plant Intake 0.1 mi. E	3.57 E-2 (30/51) 1.08 E-2 -1.55 E-1	No Control	N/A
	Cs-134	9.00 E-3	3.45 E-2 (32/51) 8.25 E-3 - 2.92 E-1	Plant Intake 0.1 mi. E	3.45 E-2 (32/51) 8.25 E-3 -2.92 E-1	No Control	N/A
	Cs-137	9.00 E-3	7.05 E-2 (50/51) 1.68 E-2 - 1.09 E+0	Plant Intake 0.1 mi. E	7.05 E-2 (50/51) 1.68 E-2 -1.09 E+0	No Control	N/A
Surface Water (pCi/liter) (Glasswool)	Gamma 51(5)	9.00 E-3	All less than MDA	All less than MDA		No Control	N/A
TLD (Millirem per wk)	TLD 255(15)	3.00 E-1	2.09 E+0 (243/243) 1.1 E+0 - 5.25 E+0	Robinson Unit 1 (On Site)	3.51 E+0 (11/11) 1.20 E+0 -5.25 E+0	1.96 E+0 (12/12) 1.20 E+0 - 3.90 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 52 Mondays in 1980, therefore having a possible total of 364 samples instead of 361 samples. No samples were collected from Station 09 on July 22, from Station 35 on August 4, and from Station 36 on January 1, 1980, as a result of samplers being out of service.

5. There are seven sample stations composited each month for a possible total of 84 analyses. However, the December composite for Station 34 was lost in analysis.

6. There are a possible 32 gross beta and gamma analyses; however, there was no sample media available for the month of December at Station 33.

7. There are a possible 32 strontium analyses; however, there was no sample media available for the month of December 1980 at Station 33. Fourth quarter samples for Stations 21, 27, and 32 were lost in analysis. In addition, the November 1980 sample for Station 33 was also lost in analysis.

8. There was a possible total of 4 strontium analyses on Fish Bone in 1980; however, the fourth quarter sample was lost in analysis.

9. There was a possible total of 4 strontium analyses on Fish Flesh in 1980; however, the fourth quarter sample was lost in analysis.

10. The first semiannual sample of Fodder was not collected.

11. Tobacco samples (cured and uncured) are considered to be food crops.

12. There was a possible total of 24 strontium analyses on milk; however, the November 1980 sample for Station 40 was lost in analysis.

13. There was a possible total of 60 strontium analyses on monthly surface water samples; however, the November 1980 sample for Station 05 was lost in analysis.

14. Resin samples were collected weekly for possible 52 samples in 1980. The sample collected December 5 was invalid due to sample volume being unobtainable as a result of mechanical malfunction.

15. Nine TLDs were reported as missing in the field: Stations 10 and 19 for May, Stations 11 and 14 in June, Stations 7, 10, and 19 in July, and Stations 11 and 14 in August 1980.

16. There were 53 Mondays in 1980; therefore, four of the surface water stations had samples collected weekly for a total of 212 samples. One station had samples collected twice weekly for a total of 106 samples. There were a combined total of 318 weekly surface water samples.

3.0 INTERPRETATION AND CONCLUSIONS

3.1 AIR SAMPLES

January - October

Air samples collected during the first ten months of 1980 contained no unusual levels of radioactivity. Gross alpha and gross beta concentrations from all sampling stations averaged 8.75 E-3 pCi/m^3 and 7.60 E-2 pCi/m^3, respectively. These levels are consistent with preoperational monitoring results and are typical of naturally occurring isotopes 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 three radionuclides during the first ten months of 1980 as summarized in Table 3-1.

TABLE 3-1

Radionuclides Detected During the First Ten Months of 1980 in Monthly Composited Air Particulate Samples

Month	Location	Radionuclides (pCi/m^3
March	End of Construction Road West of Plant (34)	Co-58 2.64 E-3
May	Visitors Center (2)	Cs-137 8.78 E-3
May	East Shore of Lake Across from Plant Intake (17)	Sr-90 9.46 E-4
September	Visitors Center (2)	Sr-90 5.52 E-4
September	End of Construction Road West of Plant (34)	Sr-90 5.62 E-4

These concentrations and the sporadic appearances are consistent with ambient levels observed in recent years with the exception of cobalt-58. 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.

Since Station 34 is close to the plant site, effluent data reveals cobalt-58 in routine releases and the absence of cobalt-58 in typical measurable fallout debris suggests Robinson Plant as the source. Using the assumptions of Regulatory Guide 1.109 and the observed coabalt-58 activity, at the concentration of 2.64 E-3 pCi/m^3, the maximum inhalation dose to an adult's critical organs and total body may be calculated (see Table 3-2).

TABLE 3-2

Maximum Inhalation Exposure from
Environmental Air Particulate Data

Organ	Dose (μRem/yr)
Liver	0.0042
Lung	2.450
GI-LLI	0.281
Total Body	0.0055

It should be noted that the actual dose to an adult would have been significantly less since the concentration used in Table 3-2 was observed only one out of 12 months.

November and December

Air particulate samples taken during the last two months of 1980 revealed the presence of short-lived fission products which are attributed to fallout from the nuclear test conducted by the People's Republic of China on October 16, 1980. Using a t-test at 99.5% confidence level, the average concentrations for the indicator stations are comparable to the average concentrations at the control station (see Table 3-3).

TABLE 3-3

The Average Concentration and Occurrence Fraction of Fission Products Observed in Monthly Composited Air Particulate Samples During November and December

Radionuclide	Indicator Stations (pCi/m^3)	Control Station (pCi/m^3)
Sr-89	6.16 E-3 (7/11)[1]	4.84 E-3 (1/2)
Sr-89	1.52 E-3 (2/11)[1]	1.29 E-3 (1/2)
Nb-95	1.37 E-2 (4/12)	9.71 E-3 (2/2)
Zr-95	1.18 E-2 (6/12)	6.40 E-3 (1/2)
Ru-103	1.07 E-2 (9/12)	7.72 E-3 (1/2)
I-131	1.57 E-1 (1/12)[2]	<7.00 E-2 (0/2)
Ce-139	1.43 E-3 (1/12)	<4.00 E-3 (0/2)
Ce-141	7.43 E-2 (10/12)	7.55 E-3 (1/2)

[1] One strontium composite was lost in analysis.

[2] Weekly collected sample from charcoal cartridge.

The arrival, as well as the global cycling pattern, of the nuclear debris is shown by air particulate gross beta activity for

Station 36 and Station 22 (Control Station) plotted in Figure 3-1. The widespread distribution of this radioactivity has been observed at all sampling stations as well as other environmental monitoring sites in nearby states and cannot be attrubited to the operation of the H. B. Robinson Plant.

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 175 of 265 samples, averaging 1.04 pCi/l, compared to the control station average of 0.752 pCi/l. Measurable gross beta concentrations were reported in 260 of 265 samples, averaging 1.75 pCi/l, compared with the control station average of 1.38 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 as shown in Figures 3-2, 3-3, 3-4, and 3-5.

Monthly composites of the weeky samples showed measurable gross alpha and beta activities in 30 of 48 and 48 of 48 cases, respectively. The average gross alpha concentration was 0.731 pCi/l, compared to 0.535 pCi/l at the control station. The average gross beta concentraton was 1.78 pCi/l, compared to 1.32 pCi/l at the control station.

CP&L ENVIRONMENTAL MONITORING SYSTEM

PROGRAM IRE14=26 ALIAS REPTBETA FEB.1981

GROSS BETA
AIR PARTICULATE
(PICURIES PER CUBIC METER)
COMMON LOGARITHM PLOT
PLOT OF SAMPLE STATION ACTIVITY VS. JULIAN DATE STAR AT THE POINTS
PLOT OF CONTROL ACTIVITY VS. JULIAN DATE DIAMOND AT THE POINTS
PLANT=HBR POINT= 36

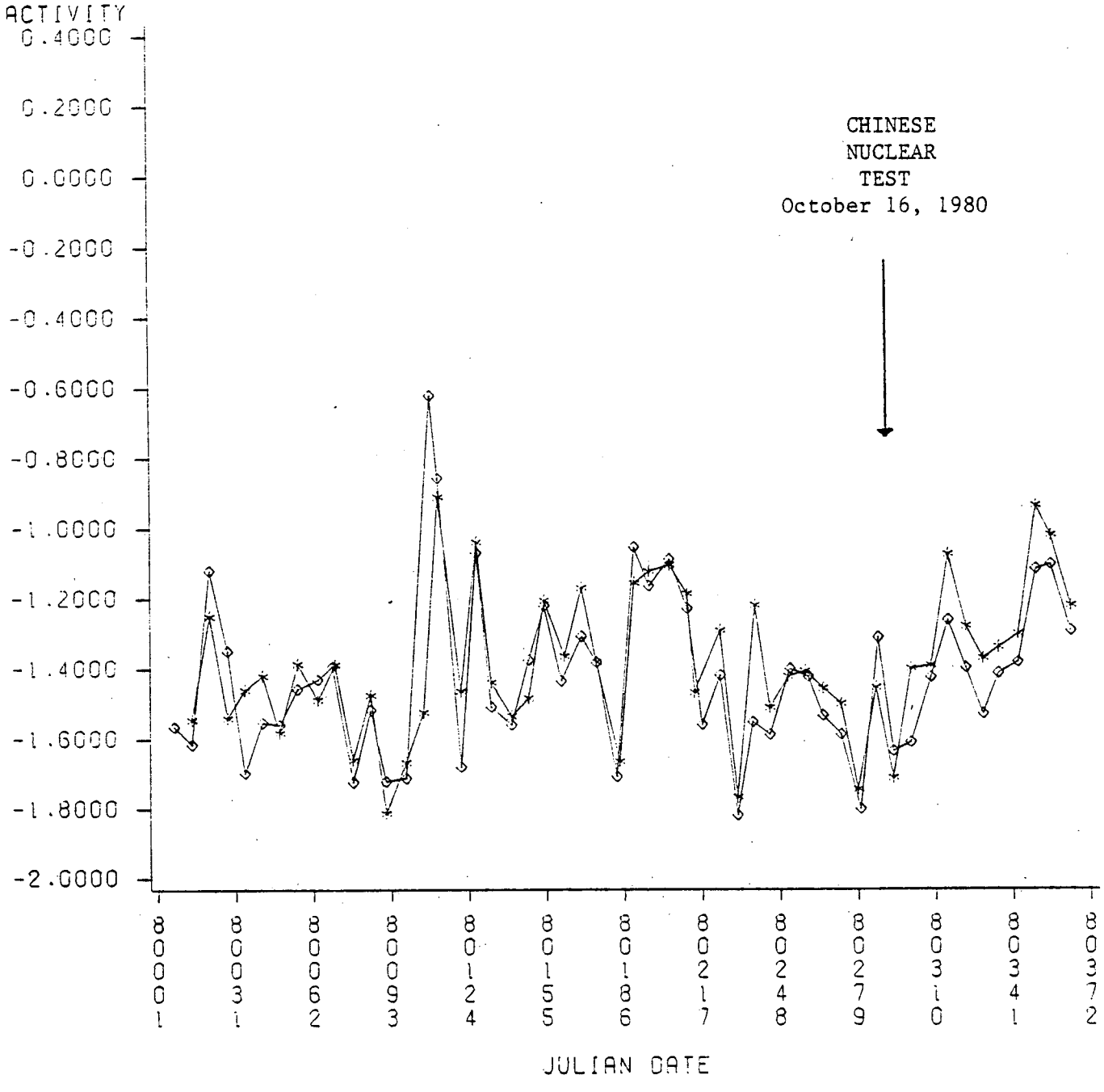

Figure 3-1

CP&L ENVIRONMENTAL MONITORING SYSTEM

PROGRAM IRE14=26 ALIAS REPTBETA FEB.1981

GROSS BETA
SURFACE WATER
(PICOCURIES PER LITER)
COMMON LOGARITHM PLOT
PLOT OF SAMPLE STATION ACTIVITY VS. JULIAN DATE STAR AT THE POINTS
PLOT OF CONTROL STATION ACTIVITY VS. JULIAN DATE DIAMOND AT THE POINTS
PLANT = HBR POINT = 05

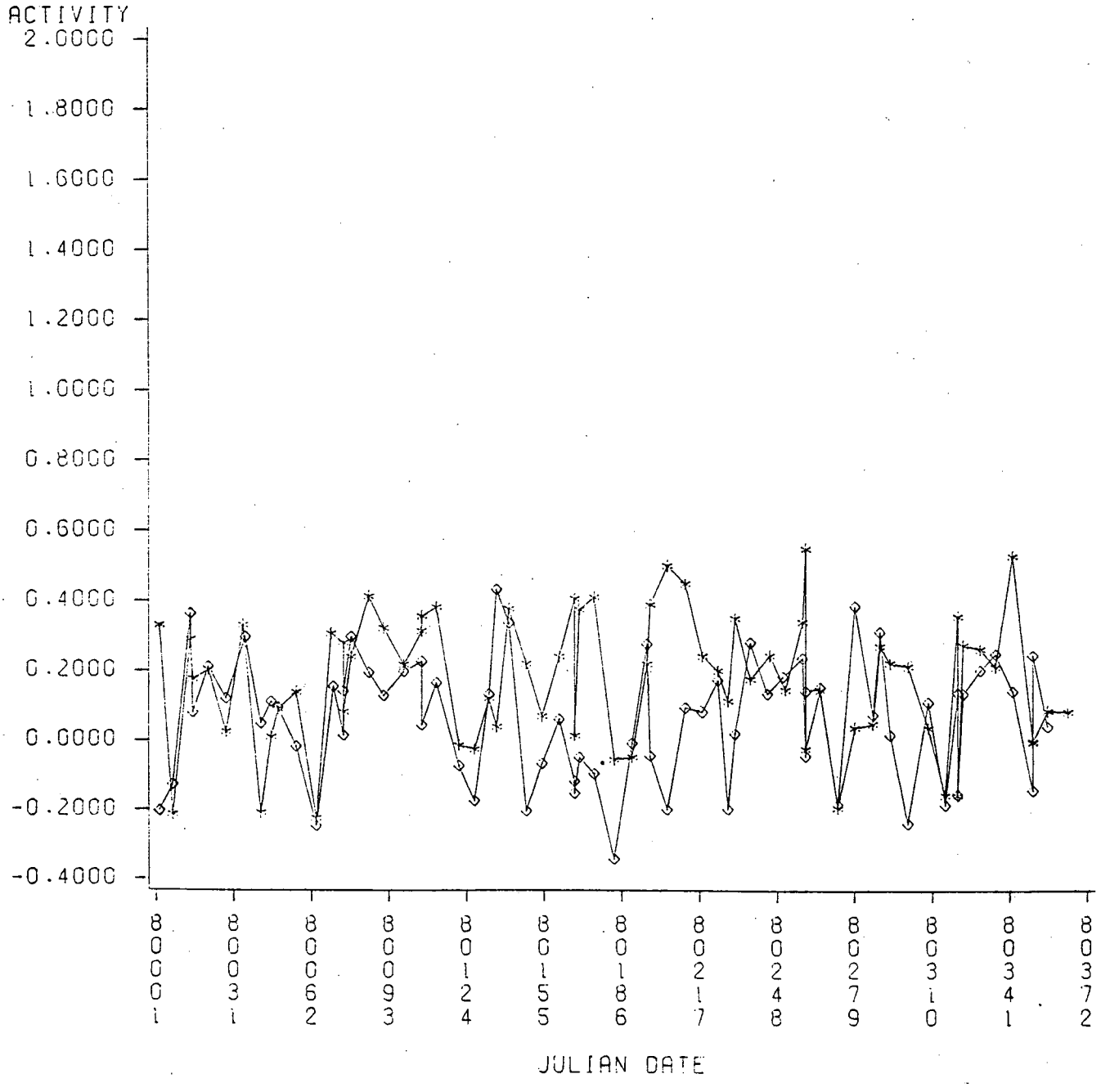

Figure 3-2

CP&L ENVIRONMENTAL MONITORING SYSTEM

PROGRAM IRE14=26 ALIAS REPTBETA FEB.1981

GROSS BETA
SURFACE WATER
(PICOCURIES PER LITER)
COMMON LOGARITHM PLOT
PLOT OF SAMPLE STATION ACTIVITY VS. JULIAN DATE STAR AT THE POINTS
PLOT OF CONTROL STATION ACTIVITY VS. JULIAN DATE DIAMOND AT THE POINTS
PLANT = HBR POINT = 08

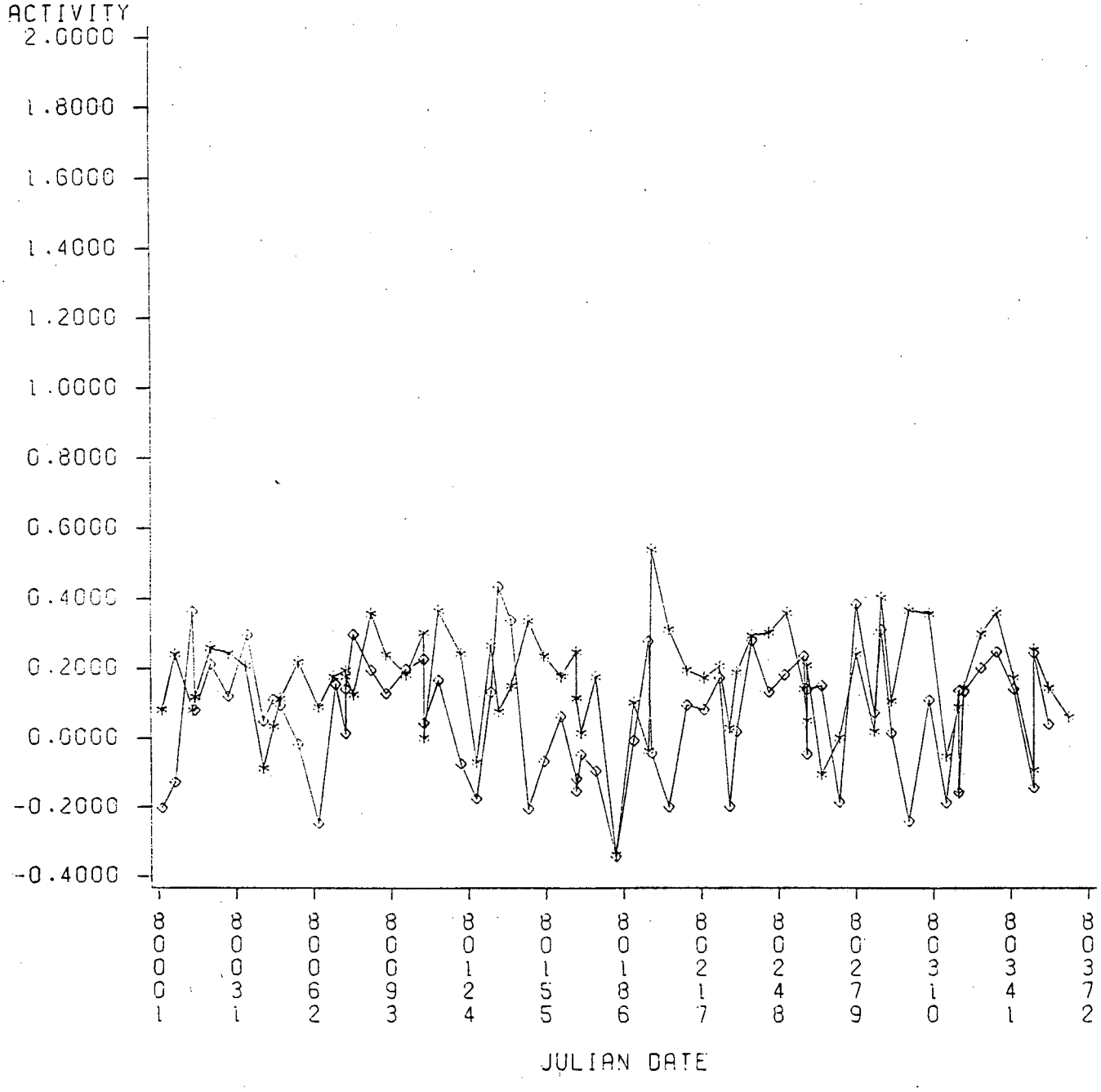

Figure 3-3

CP&L ENVIRONMENTAL MONITORING SYSTEM

PROGRAM IRE14=26 ALIAS REPTBETA FEB.1981

GROSS BETA
SURFACE WATER
(PICOCURIES PER LITER)
COMMON LOGARITHM PLOT
PLOT OF SAMPLE STATION ACTIVITY VS. JULIAN DATE STAR AT THE POINTS
PLOT OF CONTROL STATION ACTIVITY VS. JULIAN DATE DIAMOND AT THE POINTS

PLANT = HBR POINT = 11

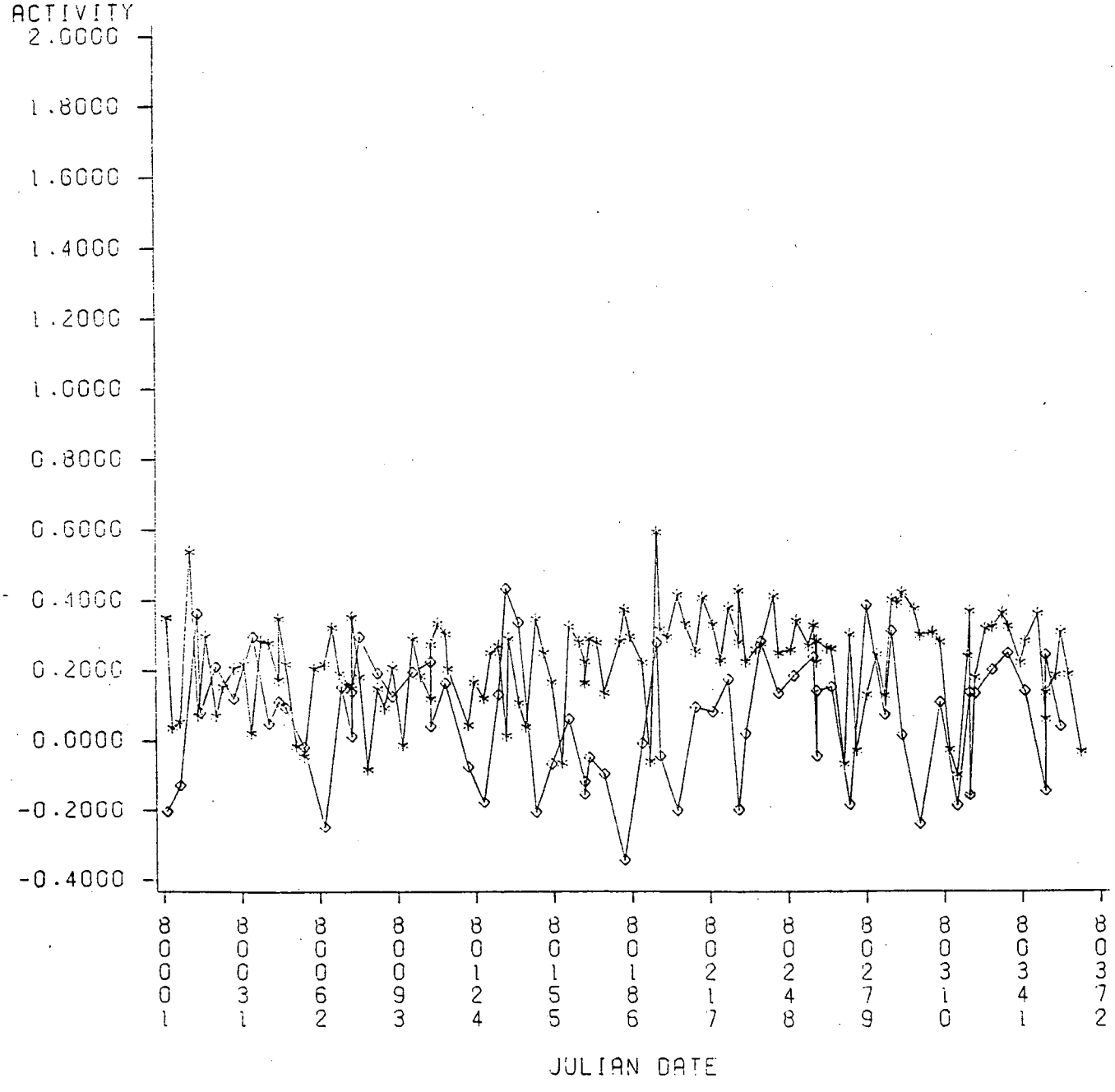

Figure 3-4

CP&L ENVIRONMENTAL MONITORING SYSTEM

PROGRAM IRE14=26 ALIAS REPTBETA FEB.1981

GROSS BETA
SURFACE WATER
(PICOCURIES PER LITER)
COMMON LOGARITHM PLOT
PLOT OF SAMPLE STATION ACTIVITY VS. JULIAN DATE STAR AT THE POINTS
PLOT OF CONTROL STATION ACTIVITY VS. JULIAN DATE DIAMOND AT THE POINTS

PLANT = HBR POINT = 32

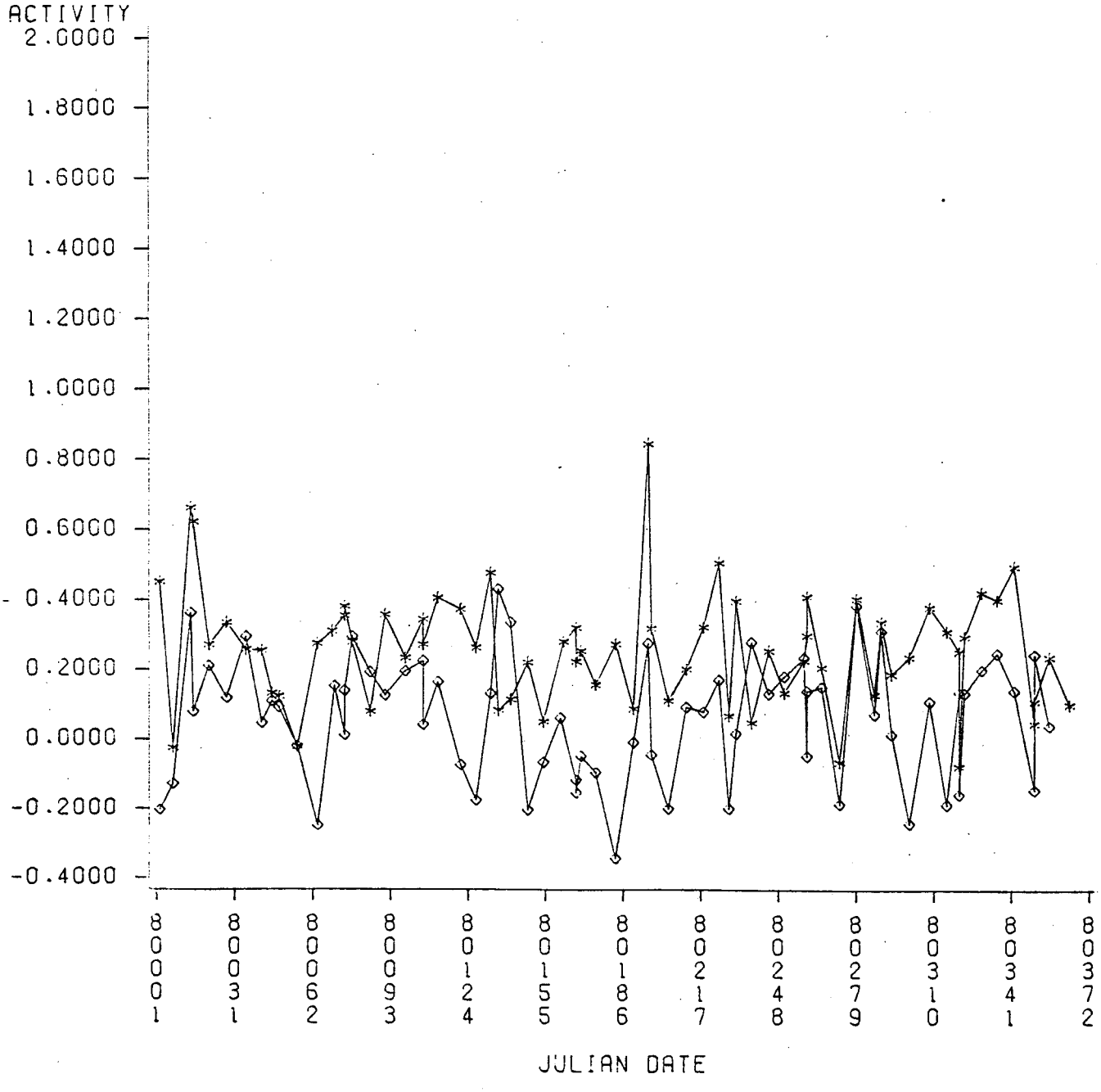

Figure 3-5

Quarterly composites of the monthly composites indicated approximately the same measurable gross alpha and gross beta activities as in the monthly samples (average 0.597 pCi/l in 4 of 16 samples and 1.48 pCi/l in 15 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)

	Weekly Samples			
	SW-5	SW-8	SW-11	SW-32
Average	1170	1360	1237	963
Range	0445-2080	0338-5460	0359-2420	0333-1860
	Monthly Composites			
	SW-5	SW-8	SW-11	SW-32
Average	1192	1210	1166	856
Range	0439-2310	0377-2080	0358-1990	< 330-1540
	Quarterly Composites			
	SW-5	SW-8	SW-11	SW-32
Average	1216	1197	1170	778
Range	0505-1680	0547-1460	0540-1510	340-943

*Control Station (Station 27) revealed tritium activity in 2 of 4 samples during the month of December at the concentrations of 335 pCi/land 370 pCi/l. All other weekly analyses, monthly composited, and quarterly composited analyses were less than minimum detectable activity.

The monthly composited surface water samples analyzed for gamma emitters and radiostrontium revealed no fission or activation products in 59 of 60 and 56 of 59 analyses, respectively. The four exceptions are summarized in Table 3-5.

TABLE 3-5

Detectable Radionuclides in Monthly Composited Surface Water Samples

Month of Composite	Station No.	Radionuclide	Concentration (pCi/l)
March	SW-11	Cs-137	1.97
May	SW-32	Sr-89	2.37
June	SW-11	Sr-90	1.64
November	SW-8	Sr-89	4.72

The sporadic appearance of these particular radionuclides in surface water does not clearly indicate the Robinson Plant as the source. Indeed other radionuclides (i.e., Co-58, Co-60), which are more prominent in routine releases, should also be detectable if the plant were the source.

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 3-6. However, the dose to man at these concentrations is insignificant.

TABLE 3-6

Ion Exchange Resin
(pCi/l)

Radionuclide	Mn-54	Co-58	Co-60	Cs-134	Cs-137
Occurrence	10/51	18/51	30/51	32/51	50/51
Average	0.016	0.032	0.036	0.035	0.071
High	0.101	0.064	0.200	0.292	1.090
Low	0.006	0.018	0.011	0.009	0.017

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 1980 are compared with previous years in Table 3-7.

TABLE 3-7

Average Concentrations in Fish Flesh
(pCi/g dry)

Year	Sr-90	Cs-134	Cs-137
*1980	5.34 E-1	1.32 E-1	8.99 E-1
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

*Cobalt-60 was detected during 1980 in 1 of 4 analyses at the concentration of 0.0324 pCi/g (dry).

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 3-8.

TABLE 3-8

Average Adult's Dose Computer from 1980
Environmental Fish Data Compared to Estimated
Dose Given in Final Environmental Statement (FES)

	*1980 Dose mRem/yr	FES mRem/yr
Bone	5.733	1.4
Liver	0.159	-
Kidney	0.053	-
Lung	0.018	-
GI-LLI	0.168	0.23
Total Body	1.490	1.9

*Activities used for dose calculations
Co-60 7.60 pCi/kg wet
Sr-90 107.6 pCi/kg wet
Cs-134 27.8 pCi/kg wet
Cs-137 173.3 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 5.73 mRem/yr, primarily due to the high uptake of strontium-90 by bone, 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 1980. 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 3-9).

Although concentrations were higher at Station 33 than at other locations, the following characteristics of this sample station should be considered: (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. Station 11 (Black Creek at Road 1623) is located approximately 200 yards downstream from the discharge point of Station 33 and 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 3-9

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

	BOTTOM SEDIMENT			
	Co-58	Co-60	Cs-134	Cs-137
SD-5 Intake Canal	<0.030	0.349 (2/4)	0.028 (1/4)	0.228 (3/4)
SD-8 Discharge Canal	<0.030	0.395 (4/4)	0.066 (1/4)	0.292 (4/4)
SD-11 Black Creek @ Road 1623	<0.030	0.316 (3/4)	0.647 (2/4)	0.312 (3/4)
SD-21 Bridge @ N. End of Lake	<0.030	0.042 (2/4)	0.102 (1/4)	0.105 (3/4)
**SD-27 US-1 (Control Station)	<0.030	0.030	0.034 (1/4)	0.109 (1/4)
SD-32 Prestwood Lake	<0.030	<0.030	0.014 (1/4)	0.051 (4/4)
SD-33 Ditch Behind Visitors Center	0.135 (3/12)	2.652 (12/12)	0.727 (10/12)	3.116 (12/12)

TABLE 3-9

(continued)

AQUATIC VEGETATION

	Mn-54	Co-58	Co-60	Cs-134	Cs-137
AV-8 Discharge Canal	0.63 (4/4)	1.12 (4/4)	3.37 (4/4)	0.24 (3/4)	0.69 (4/4)
AV-11 Black Creek @ Road 1623	<0.065	<0.060	1.29 (4/4)	<0.065	0.59 (4/4)
AV-21 Bridge @ N. End of Lake	0.17 (2/4)	0.39 (2/4)	1.14 (4/4)	0.17 (2/4)	0.82 (4/4)
**AV-27 US-1 (Control Station)	<0.065	<0.060	<0.065	<0.065	0.51
AV-32 Prestwood Lake	0.91 (3/4)	1.11 (3/4)	5.08 (3/4)	0.18 (2/4)	0.39 (4/4)
AV-33 Ditch Behind Visitors Center	0.44 (3/11)	3.69 (6/11)	3.55 (10/11)	0.78 (5/11)	2.32 (8/11)

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

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

Gamma analysis also revealed concentrations of several short-lived fission products (Zr-95, Nb-95, Ru-103, Ba-140, La-140, and Ce-141) during the fourth quarter of 1980 in aquatic vegetation samples. The presence of these radionuclides is consistent with similar data obtained in air particulates during November and December. The Chinese nuclear test on October 16, 1980, is the contributor for these short-lived fission products through the rainfall runoff transport mechanism.

3.5 MILK SAMPLES

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

Radiochemical determination of iodine-131 yielded measurable activity for both sample stations at an average concentration of 0.165 pCi/l during November and December. These concentrations were expected since iodine-131 was detected at an air sampling station during the last two months of the year and is attributed to fallout from the Chinesse nuclear test of October 16, 1980.

Radiostrontium analyses of milk exhibited low levels of Sr-90 in 21 of 24 samples averaging 4.22 pCi/l. These concentrations are in agreement with averages from previous years.

Gamma isotopic analyses detected Cs-137 in 11 of the 24 samples averaging 10.5 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 9 of 12 samples with an average concentration of 1.00 E+0 pCi/liter. Gross beta activity observed in 8 of 12 samples had an average concentration of 1.11 pCi/liter. Tritium and radiostrontium analysis revealed no measurable activity. Gamma analyses revealed only naturally occurring radionuclides.

3.7 SOIL SAMPLES

Ten sampling locations are sampled every three years of which two sample locations are sampled semiannually on a rotating basis. During 1980 Station 2 (Visitors Center), Station 9 (Microwave Tower), Station 27 (Black Creek at US 1), and Station 34 (End of Construction Road West of Plant) were collected and analyzed for gross beta, strontuim, and gamma emitters.

Gross beta activities were detected in 4 of 4 samples averaging 1.25 pCi/g (dry). Gamma analyses revealed cesium-137 in 4 of 4 samples averaging 0.197 pCi/g (dry). Cesium-134 was also detected in 3 of 4 samples at an average concentration of 0.045 pCi/g (dry). All strontium analyses were less than minimum detectable activity. All the above activities are similar to previous data, and no accumulation due to plant effluent is demonstrated.

Station 49 (East Shore of Lake at Boat Launch) is sampled semiannually as shoreline sediment and is analyzed for gross beta and gamma emitters.

Gross beta was detected in 2 of 2 samples at an average concentration of 0.339 pCi/g (dry). Gamma analysis revealed cesium-137 in 1 of 2 samples at the concentration of 0.077 pCi/g (dry). These activities are similar to previous data, and no accumulation due to plant effluent is demonstrated.

3.8 VEGETATION

Cattle feed (FO) and locally grown food crops (FC) were sampled as available during year and analyzed for gamma-emitting radionuclides. The only detectable radionuclide was cesium-137, measured in 6 of 8 samples. The average concentration of 0.086 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 2.09 mRem/wk which is comparable to 1.96 mRem/wk for the control station average. The three locations yielding the highest annual dose were:

Robinson Unit 1	(07)	3.51 mRem/wk
Robinson Unit 2	(06)	2.68 mRem/wk
Picnic Area	(10)	2.41 mRem/wk

The locations have historically shown elevated dose rates.

4.0 MISSED SAMPLES AND ANALYSES

4.1 AIR CARTRIDGES

The following air cartridge results are missing for 1980:

Date	Sample Station	Reason
January 1	36	Sampler Out of Service
July 22	09	Sampler Out of Service
August 4	35	Sampler Out of Service

4.2 AIR PARTICULATES (WEEKLY)

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

Date	Sample Station
January 1	36
July 22	09
August 4	35

4.3 AIR PARTICULATES (MONTHLY)

Strontium (December monthly composite) analysis for Station Sample 34 was lost in analysis.

4.4 AQUATIC VEGETATION

No gross beta, strontium, or gamma analyses were reported for December's aquatic vegetation at Station 33 as a result of sample being unavailable.

Strontium (November's monthly samples at Station 33) was lost in analysis.

Fourth quarter strontium analyses for Stations 21, 27, and 32 were lost in analysis.

4.5 FISH

Strontium in bone and flesh for bottom feeders was lost in analysis during the fourth quarter of 1980.

4.6 FODDER AND FEED CROPS

Fodder or feed crop samples were not collected during the first six months of 1980 due to their nonavailability.

4.7 MILK

Strontium (November's monthly sample at Station 40) was lost in analysis.

4.8 SURFACE WATER

Strontium (November's monthly composite sample at Station 05) was lost in analysis.

The surface water resin sample collected on December 5 was invalid due to sample volume being unobtainable as a result of a mechanical malfunction.

4.9 ENVIRONMENTAL TLDs

The following thermoluminescent dosimeter results were missing in 1980.

Month	Sample Station	Reason
May	10	Badge Lost in Field
May	19	Badge Lost in Field
June	11	Badge Lost in Field
June	14	Badge Lost in Field
July	07	Badge Lost in Field
July	10	Badge Lost in Field
July	19	Badge Lost in Field
August	11	Badge Lost in Field
August	14	Badge Lost in Field