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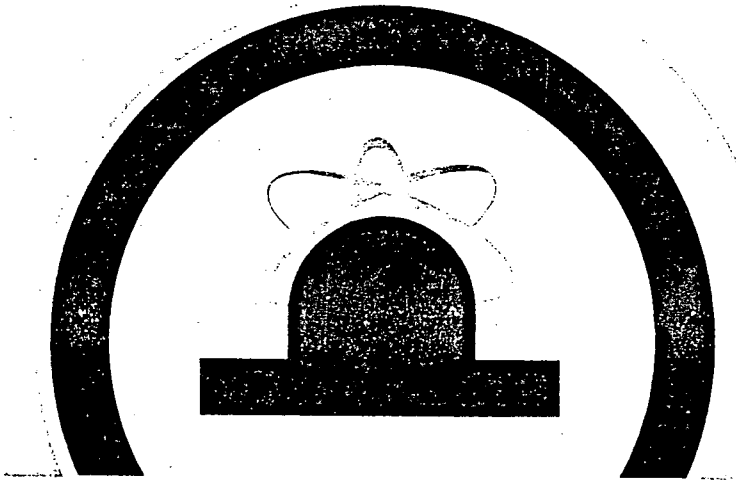
Environmental Surveillance Report

January 1, 1983 — December 31, 1983



H.B. ROBINSON
STEAM ELECTRIC PLANT
Unit No. 2
CAROLINA POWER & LIGHT COMPANY

IE25

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, 1983, THROUGH DECEMBER 31, 1983

Prepared By:

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Principal Specialist - Environmental
March 14, 1984

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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 1983. This is the seventh 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 fish-man pathway due to liquid releases. Other potentially important exposure pathways to man are the airborne radioiodine-pasture-milk and direct external radiation exposure due to ground plume of noble gases. Although a relatively insignificant dose is involved, contact with Lake Robinson including 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.

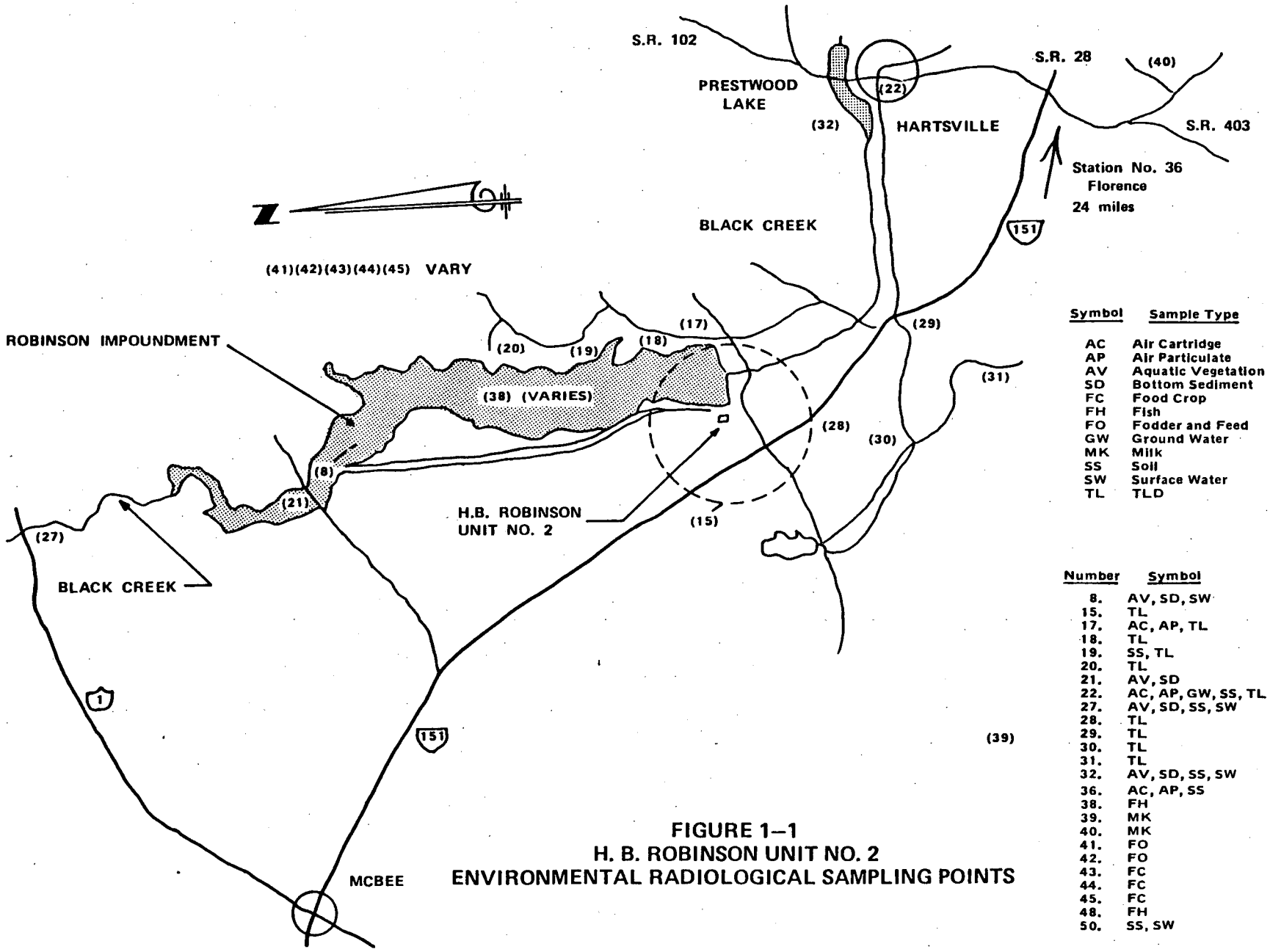
A tabulation of the specific methods used in monitoring the various pathways of exposure to man is as follows:

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

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
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
50.	SS, SW

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

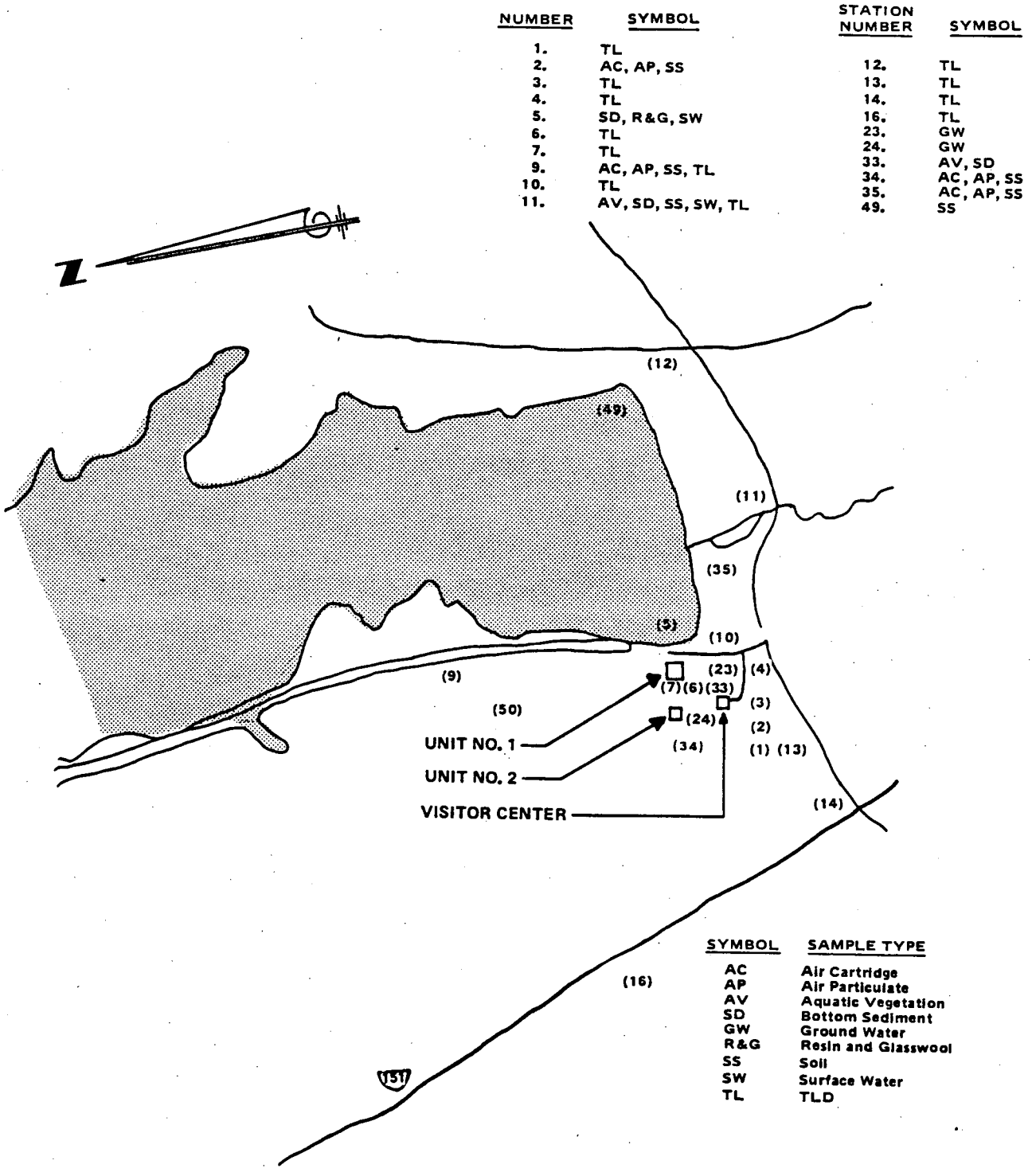


FIGURE 1–2
H. B. ROBINSON UNIT NO. 2
ENVIRONMENTAL RADIOLOGICAL SAMPLING POINTS
ON SITE

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-Visitors Center 9-Microwave Tower 17-East Shore of Lake Across from Plant Intake 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-Visitors Center 9-Microwave Tower 17-East Shore of Lake Across from Plant Intake 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.)

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 Visitors Center	Monthly[2]	500 grams	Gross Beta, Gamma, and Sr-89, 90
	50-Ash Pond[3]	Quarterly	500 grams	Gamma
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, K-40, Gamma, and Sr-89, 90
	33-Ditch Behind Visitors Center	Monthly[2]	500 grams	Gross Beta, Gamma, and Sr-89, 90
	50-Ash Pond[3]	Semiannually	500 grams	Gamma
Feed Crop (FO)	39-Lyndales's Farm 40-Fink's Farm	Twice during growing season (started 1977)	500 grams	Gamma
Fish (FH)	38-Site Varies within Lake Robinson	Quarterly	500 grams	Flesh--Gross Beta, K-40, Gamma, and Sr-89, 90, Bone--Sr-89, 90
	51-Lake Bee[1]			Flesh--Gamma and Sr-89, 90

TABLE 1-1 (cont.)

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-Lyndale's Farm 40-Fink's Farm	Monthly	8 liters	Iodine, Gamma, and Sr-89, 90

TABLE 1-1 (cont.)

Sample Type	Sampling Point and Description	Sampling Frequency	Sample Size	Sample Analysis
Soil (SS)	2-Visitors Center 9-Microwave Tower 11-Black Creek at Road 1623 19-East Shore of Lake (North of 18) 22-Hartsville 27-Black Creek at U.S. 1 32-Prestwood Lake 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, K-40, Gamma, Sr-89, 90, on a composite of each station.
	49-East Shore of Lake at Boat Launch	Semiannually (1-square foot by 1-inch deep)	500 grams	Gross Beta, K-40, Gamma

*Two sample locations will be sampled semiannually on a rotating basis.

TABLE 1-1 (cont.)

Sample Type	Sampling Point and Description	Sampling Frequency	Sample Size	Sample Analysis
Surface Water (SW)	5-Plant Intake 8-Discharge Canal Outfall 32-Prestwood Lake 27-Black Creek at U.S. 1[1] 11-Black Creek at Road 1623	Weekly Weekly Weekly Composite	2.5 liters	Weekly--Gross Alpha, Gross Beta, and Tritium, (Gamma and Sr-89, 90 if Gross Beta > 100 pCi/l) Monthly Composite--Gross Alpha, Gross Beta, Tritium, Gamma, and Sr-89, 90 Quarterly Composite--Gross Alpha, Gross Beta, Tritium (Gamma Sr-89, 90 if Gross Beta > 100 pCi/l)
	5-Plant Intake (Ion-Exchange Resin) 5-Plant Intake (Glass Wool)	Weekly	2000 liters	Gamma
	50-Ash Pond[4]	Monthly	2.5 liters	Gamma

TABLE 1-1 (cont.)

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 Visitors 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.)

Sample Type	Sampling Point and Description	Sampling Frequency	Sample Size	Sample Analysis
External Radiation Dose (TL) (cont.)	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 sampling station was an alternate pathway for low-level liquid releases to the environment. Based on previous results, a more frequent sampling program had been implemented. July 1983 was the last sample taken as a result of the completion of a drainage modification. A safety analysis was performed (Serial: LAP-83-85) and permission was granted from the NRC.

[3]This location was added in 1981 and will be sampled montly for surface water, semiannually for sediment, and quarterly for aquatic vegetation.

2.0 PROGRAM SUMMARY

The purpose of the Environmental Radiological Monitoring Program is to measure any release and accumulation of radioactivity in the environment, to determine whether this radioactivity is the result of the operation of the H.B. Robinson Plant, and to interpret the potential dose to off-site populations based on the cumulative measurement of radiation of plant origin.

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 I-131

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

Aquatic Vegetation
Bottom Sediment
Surface Water

Lake Bee
(Sample Station 51)

Fish

Lyndale's Farm
(Sample Station 39)

Milk
Feed Crops

No specific control locations have been designated for food crops, soil, and groundwater.

Table 2-1 summarizes the environmental radiological monitoring data for the entire year of 1983.

TABLE 2-1

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

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

Docket Numbers - 50-261
Calendar Year 1983

Medium or Pathway Sampled or Measured (Unit of Measurement)	Type and Total No. of Measurements Performed	Lower Limit of Detetection (LLD) (1)	All Indicator Locations (2) Mean Range	Location w/Highest Annual Mean Name, Distance, and Direction	Mean Range (2)	Control Locations Mean Range (2)	No. of Nonroutine Reported Measurements (3)
Air Cartridge (pCi/m^3)	I-131 364	2.00E-2	All less than LLD	All less than LLD		All less than LLD	N/A
Air Particulate (pCi/m^3)	Gross Alpha 361(4)	7.00E-4	3.80E-3 (293/309) 3.78E-4 - 3.58E-2	Visitors Center 0.2 mile SW	4.66E-3 (47/52) 4.83E-4 - 3.58E-2	4.17E-3 (49/52) 4.53E-4 - 1.88E-2	N/A
	Gross Beta 361(4)	1.00E-3	1.83E-2 (309/309) 3.84E-3 - 3.63E-2	Dam - west end 0.4 mile east	2.01E-2 (50/50) 7.35E-3 - 3.63E-2	1.95E-2 (51/52) 8.39E-3 - 6.08E-2	N/A
	Sr-89 84	8.00E-4	7.77E-3 (1/72) (Single value)	Dam - west end 0.4 mile east	7.77E-3 (1/12) (Single value)	All less than LLD	N/A
	Sr-90 84	4.00E-4	All less than LLD	All less than LLD		All less than LLD	N/A
	Gamma 84	N/A	All less than LLD	All less than LLD		All less than LLD	N/A
Aquatic Vegetation (pCi/g) dry	Gross Beta 27(5)	8.00E-1	1.29E+01 (23/23) 4.07E+0 - 2.99E+1	Ditch behind Visitors Center 0.1 mile SW	1.64E+1 (7/7) 1.00E+1 - 2.99E+1	1.06E+1 (4/4) 8.82E+0 - 1.38E+1	N/A
	Sr-89 27(5)	1.30E-1	2.64E-1 (2/23) 1.71E-1 - 3.57E-1	Ditch behind Visitors Center 0.1 mile SW	3.57E-1 (1/7) (Single value)	All less than LLD	N/A
	Sr-90 27(5)	5.00E-2	2.41E-1 (4/23) 7.75E-2 - 5.67E-1	Ditch behind Visitors Center	3.82E-1 (2/7) 1.98E-1 - 5.67E-1	1.54E-1 (2/4) 1.22E-1 - 1.87E-1	N/A

TABLE 2-1 (continued)

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

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

Docket Numbers - 50-261
Calendar Year 1983

Medium or Pathway Sampled or Measured (Unit of Measurement)	Type and Total No. of Measurements Performed	Lower Limit of Detetection (LLD) (1)	All Indicator Locations (2) Mean Range	Location w/Highest Annual Mean Name, Distance, and Direction	Location w/Highest Annual Mean Mean Range (2)	Control Locations Mean Range (2)	No. of Nonroutine Reported Measurements (3)
Aquatic Vegetation (pCi/g) dry	Gamma 31[5]		1.32E-01 (3/27)	Discharge Canal Outfall	1.60E-01 (2/4)		
	Mn-54	7.00E-3	7.59E-2 - 1.78E-1	3.8 miles north	1.42E-1 - 1.78E-1	All less than LLD	N/A
			3.00E-1 (4/27)	Discharge Canal Outfall	3.87E-1 (3/4)		
	Co-50	7.00E-3	3.84E-2 - 4.52E-1	3.8 miles north	2.94E-1 - 4.52E-1	All less than LLD	N/A
			1.11E+0 (15/27)	Discharge Canal Outfall	2.55E+0 (4/4)		
	Co-60	1.00E-2	7.97E-2 - 4.45E+0	3.8 miles north	1.24E+0 - 4.45E+0	All less than LLD	N/A
			2.55E+1 (1/27)	Prestwood Lake	2.55E+1 (1/4)		
	I-131	7.00E-3	(Single value)	4.9 miles ESE	(Single value)	All less than LLD	N/A
			3.87E-1 (2/27)	Black Creek at Road 1623	6.04E-1 (1/4)		
	Cs-134	8.00E-3	1.71E-1 - 6.04E-1	0.6 mile ESE	(Single value)	All less than LLD	N/A
			4.29E-1 (20/27)	Discharge Canal Outfall	6.03E-1 (4/4)	5.25E-1 (3/4)	
	Cs-137	8.00E-3	6.16E-2 - 1.16E+0	3.8 miles north	1.28E-1 - 1.16E+0	2.97E-1 - 7.62E-1	N/A
Bottom Sediment (pCi/g) dry	Gross Beta 31[6]		1.21E+0 (27/27)	Ditch behind Visitors Center	2.90E+0 (7/7)	5.86E-1 (4/4)	
		1.00E-2	1.22E-1 - 5.01E+0	0.1 mile SW	1.21E+0 - 5.01E+0	1.70E-1 - 1.61E+0	N/A
	Sr-89 31[6]	3.00E-1	All less than LLD	All less than LLD		All less than LLD	N/A
			2.47E-1 (1/27)	Discharge Outfall	2.41E-1 (1/4)		
	Sr-90 31[6]	2.00E-1	(Single value)	3.8 miles north	(Single value)	All less than LLD	N/A

TABLE 2-1 (continued)

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

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

Docket Numbers - 50-261
Calendar Year 1983

Medium or Pathway Sampled or Measured (Unit of Measurement)	Type and Total No. of Measurements Performed	Lower Limit of Detetection (LLD) (1)	All Indicator Locations (2) Mean Range	Location w/Highest Annual Mean Name, Distance, and Direction	Location w/Highest Annual Mean Mean Range (2)	Control Locations Mean Range (2)	No. of Nonroutine Reported Measurements (3)
Bottom Sediment (pCi/g) dry	Gamma 34[6]		3.68E+0 (26/30)	Ditch behind Visitors Center	7.57E+0 (7/7)	2.13E+0 (2/4)	
	K-40	4.00E-1	9.28E-2 - 1.83+1	0.1 mile SW	6.78E-1 - 1.60E+1	7.42E-1 - 3.51E+0	N/A
			4.56E-2 (2/30)	Ditch behind Visitors Center	6.99E-2 (1/7)		
	Mn-54	2.00E-2	2.14E-2 - 6.99E-2	0.1 mile SW	(Single value)	All less than LLD	N/A
			9.80E-1 (12/30)	Ditch behind Visitors Center	1.60E+0 (7/7)		
	Co-60	3.00E-2	4.85E-2 - 2.84E+0	0.1 mile SW	7.04E-2 - 2.84E+0	All less than LLD	N/A
			3.54E-1 (21/30)	Ditch behind Visitors Center	7.88E-1 (7/7)	8.33E-2 (3/4)	
	Cs-137	2.00E-2	1.28E-2 - 1.67E+0	0.1 mile SW	7.67E-2 - 1.67E+0	2.50E-2 - 1.50E-1	N/A
Fish Bone (pCi/g) wet (Bottom Feeders)	Sr-89 4	2.00E+0	All less than LLD	All less than LLD		No control	N/A
	Sr-90 4	3.00E-1	2.79E+0 (4/4) 7.19E-1 - 4.53E+0	Site varies within Lake Robinson	2.79E+0 (4/4) 7.19E-1 - 4.53E+0	No control	N/A
Fish Bone (pCi/g) wet (Free Swimmers)	Sr-89 4	2.00E+0	1.56E+0 (1/4) (Single value)	Site varies within Lake Robinson	1.56E+0 (1/4) (single value)	No control	N/A
	Sr-90 4	3.00E-1	2.48E+0 (4/4) 8.43E-1 - 5.96E+0	Site varies within Lake Robinson	2.48E+0 (4/4) 8.43E-1 - 5.96E+0	No control	N/A

TABLE 2-1 (continued)

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

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

Docket Numbers - 50-261
Calendar Year 1983

Medium or Pathway Sampled or Measured (Unit of Measurement)	Type and Total No. of Measurements Performed	Lower Limit of Detetection (LLD) (1)	All Indicator Locations (2) Mean Range	Location w/Highest Annual Mean: Name, Distance, and Direction	Location w/Highest Annual Mean: Mean Range (2)	Control Locations Mean Range (2)	No. of Nonroutine Reported Measurements (3)
Fish Flesh (pCi/g) dry (Bottom Feeders)	Gross Beta 4	9.00E-1	1.06E+1 (4/4) 5.92E+0 - 1.35E+1	Site varies within Lake Robinson	1.06E+1 (4/4) 5.92E+0 - 1.35E+1	No control	N/A
(Free Swimmers)	Gross Beta 4	9.00E-1	1.49E+1 (4/4) 9.25E+0 - 1.99E+1	Site varies within Lake Robinson	1.49E+1 (4/4) 9.25E+0 - 1.99E+1	No control	N/A
Fish Flesh (Bottom Feeders) (pCi/g) wet	Sr-89 9(7)	4.50E-2	8.76E-2 (3/8) 4.37E-2 - 1.27E-1	Site varies within Lake Robinson	8.76E-2 (3/8) 4.37E-2 - 1.27E-1	1.66E-1 (Single value)	N/A
	Sr-90 9(7)	2.00E-2	6.52E-2 (8/8) 3.92E-2 - 9.55E-2	Site varies within Lake Robinson	6.23E-2 (8/8) 3.92E-2 - 9.55E-2	1.79E-1 (Single value)	N/A
(Free Swimmers (pCi/g) wet	Sr-89 8	4.50E-2	8.37E-2 (1/5) (Single value)	Site varies within Lake Robinson	8.37E-2 (1/5) (Single value)	3.02E-1 (3/3) 8.58E-2 - 4.26E-1	N/A
	Sr-90 8	2.00E-2	5.39E-2 (5/5) 3.57E-2 - 7.00E-2	Site varies within Lake Robinson	5.39E-2 (5/5) 3.57E-2 - 7.00E-2	1.63E-1 (3/3) 3.03E-2 - 3.50E-1	N/A
Fish Flesh (Bottom Feeders) (pCi/g) dry	Gamma 9(7) K-40	2.00E-1	1.13E+1 (8/8) 5.16E+0 - 1.95E+1	Site varies within Lake Robinson	1.13E+1 (8/8) 5.16E+0 - 1.95E+1	1.33E+1 (1/1) (Single value)	N/A
	Cs-134	8.00E-3	1.01E-1 (2/8) 9.77E-2 - 1.05E-1	Site varies within Lake Robinson	1.01E-1 (2/8) 9.77E-2 - 1.05E-1	All less than LLD	N/A
	Cs-137	8.00E-3	4.46E-1 (7/8) 2.41E-1 - 6.03E-1	Site varies within Lake Robinson	4.46E-1 (7/8) 2.41E-1 - 6.03E-1	7.02E-1 (1/1) (Single value)	N/A
(Free Swimmers) (pCi/g) dry	Gamma 8(7) K-40	2.00E-1	1.03E+1 (4/5) 7.60E+0 - 1.14E+1	Site varies within Lake Robinson	1.03E+1 (4/5) 7.60E+0 - 1.14E+1	1.19E+1 (3/3) 6.31E+0 - 1.48E+1	N/A
	Cs-134	8.00E-3	5.47E-1 (2/5) 1.97E-1 - 8.97E-1	Site varies within Lake Robinson	5.47E-1 (2/5) 1.97E-1 - 8.97E-1	All less than LLD	N/A
	Cs-137	8.00E-3	8.88E-1 (5/5) 1.08E-1 - 1.82E+0	Site varies within Lake Robinson	8.88E-1 (5/5) 1.08E-1 - 1.82E+0	1.32E+0 (3/3) 7.48E-1 - 1.63E+0	N/A

TABLE 2-1 (continued)

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

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

Docket Numbers - 50-261
Calendar Year 1983

Medium or Pathway Sampled or Measured (Unit of Measurement)	Type and Total No. of Measurements Performed	Lower Limit of Detetection (LLD) (1)	All Indicator Locations (2) Mean Range	Location w/Highest Annual Mean Name, Distance, and Direction	Mean Range (2)	Control Locations Mean Range (2)	No. of Nonroutine Reported Measurements (3)
Fodder & Feed (pCi/g) dry	Gamma 4 Cs-137	8.00E-3	1.30E-1 (1/2) (Single value)	Fink's Farm 7.0 miles SE	1.30E-1 (1/2) (Single value)	1.47E-1 (1/2) (Single value)	N/A
Food Crop (pCi/g) dry	Gamma 5 Cs-137	8.00E-3	9.53E-3 (1/5) (Single value)	Isgett's Farm 4.0 miles NE	9.53E-3 (1/5) (Single value)	No control	N/A
Groundwater (pCi/l)	Gross Alpha 12	7.00E-1	1.04E+0 (9/12) 6.01E-1 - 2.19E+0	Unit 1 well near site entrance 0.1 mile SSE	1.21E+0 (3/4) 7.07E-1 - 2.19E+0	No control	N/A
	Gross Beta 12	8.00E-1	9.10E-1 (11/12) 5.49E-1 - 1.64E+0	Hartsville 5.8 miles ESE	1.00E+0 (4/4) 6.37E-1 - 1.64E+0	No control	N/A
	Sr-89 12	2.00E+0	All less than LLD	All less than LLD		No control	N/A
	Sr-90 12	2.00E+0	3.00E+0 (1/12) (Single value)	Unit 1 well near site entrance 0.1 mile SSE	3.00E+0 (1/4) (Single value)	No control	N/A
	Tritium 12	5.00E+2	All less than LLD	All less than LLD		No control	N/A
	Gamma 12	N/A	All less than LLD	All less than LLD		No control	N/A

TABLE 2-1 (continued)

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

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

Docket Numbers - 50-261
Calendar Year 1983

Medium or Pathway Sampled or Measured (Unit of Measurement)	Type and Total No. of Measurements Performed	Lower Limit of Detetection (LLD) (1)	All Indicator Locations (2) Mean Range	Location w/Highest Annual Mean: Name, Distance, and Direction	Location w/Highest Annual Mean: Mean Range (2)	Control Locations Mean Range (2)	No. of Nonroutine Reported Measurements (3)
Milk (pCi/l)	I-131						
	24	4.00E-1	All less than LLD	All less than LLD		All less than LLD	N/A
	Sr-89		All less than LLD			2.24E+0 (1/12)	
	24	1.30E+0	(Single value)	All less than LLD		(Single value)	N/A
	Sr-90		1.81E+0 (7/12)	Fink's Farm	1.81E+0 (7/12)	1.86E+0 (6/12)	
	24	2.00E+0	9.02E-1 - 4.00E+0	7.0 miles SE	9.02E-1 - 4.00E+0	9.00E-1 - 3.15E+0	N/A
	Gamma						
	24		1.35E+3 (12/12)	Fink's Farm	1.35E+3 (12/12)	1.22E+3 (12/12)	
	K-40	1.00E+2	9.73E+2 - 1.65E-3	7.0 miles SE	9.73E+2 - 1.65E+3	1.05E+3 - 1.48E+3	N/A
Soil (pCi/g) dry	Gross Beta		4.85E-1 (4/6)	End of construction road west	6.36E-1 (1/1)		
	6	1.00E-2	2.91E-1 - 6.63E-1	of plant	(Single value)	No control	N/A
	Sr-89						
	4	3.00E-1	All less than LLD	All less than LLD		No control	N/A
	Sr-90						
	4	2.00E-1	All less than LLD	All less than LLD		No control	N/A
	Gamma			End of construction road west	1.08E+0 (1/1)		
	6		6.74E-1 (5/6)	of plant	(Single value)	No control	N/A
	K-40	5.00E-1	1.85E-1 - 1.23E+0				
			8.53E-2 (3/6)	End of construction road west	1.34E-1 (1/1)		
	Cs-137	2.00E-2	1.29E-2 - 1.34E-1	of plant	(Single value)	No control	N/A

TABLE 2-1 (continued)

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

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

Docket Numbers - 50-261
Calendar Year 1983

Medium or Pathway Sampled or Measured (Unit of Measurement)	Type and Total No. of Measurements Performed	Lower Limit of Detetection (LLD) (1)	All Indicator Locations (2) Mean Range	Location w/Highest Annual Mean: Name, Distance, and Direction	Location w/Highest Annual Mean: Mean Range (2)	Control Locations Mean Range (2)	No. of Nonroutine Reported Measurements (3)
Surface Water (pCi/l) (Sampled weekly)	Gross Alpha 260	7.00E-1	1.36E+0 (137/208) 6.13E-1 - 3.30E+0	Prestwood Lake 4.9 miles ESE	1.65E+0 (40/52) 9.38E-1 - 3.30E+0	1.06E+0 (25/52) 6.31E-1 - 1.74E+0	N/A
	Gross Beta 260	8.00E-1	1.85E+0 (201/208) 8.17E-1 - 4.97E+0	Discharge Canal Outfall 3.8 miles north	1.91E+0 (50/52) 9.46E-1 - 4.97E+0	1.23E+0 (45/52) 6.50E-1 - 2.44E+0	N/A
	Tritium 260	5.00E+2	1.03E+3 (178/208) 5.03E+2 - 2.15E+3	Discharge Canal Outfall 3.8 miles north	1.07E+3 (45/52) 5.43E+2 - 2.15E+3	6.04E+2 (1/52) (Single value)	N/A
Surface Water (Monthly composite (pCi/l)	Gross Alpha 60	7.00E-1	9.61 E-1 (14/48) 6.33E-1 - 1.27E+0	Prestwood Lake 4.9 miles ESE	1.07E+0 (5/12) 7.93E-1 - 1.27E+0	7.19E-1 (5/12) 5.17E-1 - 9.01E-1	N/A
	Gross Beta 60	8.00E-1	1.72 E+0 (44/48) 6.37E-1 - 2.89E+0	Black Creek at Road 1623 0.6 miles ESE	1.81E+0 (11/12) 9.23E-1 - 2.83E+0	1.07E+0 (9/12) 5.16E-1 - 1.40E+0	N/A
	Tritium 60	5.00E+2	1.14E+3 (45/48) 4.98E+2 - 1.87E+3	Discharge Canal Outfall 3.8 miles north	1.27E+3 (11/12) 7.06E+2 - 1.87E+3	6.82E+2 (1/12) (Single value)	N/A
	Sr-89 60	2.00E+0	All less than LLD	All less than LLD		All less than LLD	N/A
	Sr-90 60	1.71E+0	2.67E+0 (1/48) (Single value)	Black Creek at Road 1623 0.6 mile ESE	2.67E+0 (1/12) (Single value)	All less than LLD	N/A
	Gamma 60	N/A	All less than LLD	All less than LLD		All less than LLD	N/A

TABLE 2-1 (continued)

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

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

Docket Numbers - 50-261
Calendar Year 1983

Medium or Pathway Sampled or Measured (Unit of Measurement)	Type and Total No. of Measurements Performed	Lower Limit of Detetection (LLD) (1)	All Indicator Locations (2) Mean Range	Location w/Highest Annual Mean Name, Distance, and Direction	Location w/Highest Annual Mean Mean Range (2)	Control Locations Mean Range (2)	No. of Nonroutine Reported Measurements (3)
Surface Water (pCi/l) (Quarterly composite)	Gross Alpha 20	7.00E-1	1.08E+0 (5/16) 8.25E-1 - 1.47E+0	Discharge Canal Outfall 3.8 miles north	1.15E+0 (2/4) 8.25E-1 - 1.47E+0	1.20E+0 (2/4) 1.05E+0 - 1.35E+0	N/A
	Gross Beta 20	8.00E-1	1.63E+0 (13/16) 1.15E+0 - 2.65E+0	Discharge Canal Outfall 3.8 miles north	2.09E+0 (3/4) 1.67E+0 - 2.65E+0	2.67E+0 (2/4) 8.17E-1 - 4.53E+0	N/A
	Tritium 20	5.00E+2	1.11E+3 (15/16) 5.85E+2 - 1.50E+3	Discharge Canal Outfall 3.8 miles north	1.25E+3 (4/4) 9.42E+2 - 1.50E+3	All less than LLD	N/A
Surface Water (pCi/l) (Ion exchange Resin)	Gamma 47(5) Mn-54	6.00E-3	9.91E-3 (7/47) 6.34E-3 - 1.44E-2	Plant Intake 0.1 mile east	9.91E-3 (7/47) 6.34E-3 - 1.44E-2	No control	N/A
	Co-58	8.00E-3	2.66E-2 (11/47) 8.68E-3 - 6.02E-2	Plant Intake 0.1 mile east	2.66E-2 (11/47) 8.68E-3 - 6.02E-2	No control	N/A
	Co-60	6.00E-3	4.84E-2 (30/47) 2.32E-2 - 8.35E-2	Plant Intake 0.1 mile east	4.84E-2 (30/47) 2.32E-2 - 8.35E-2	No control	N/A
	I-131	1.00E-2	1.89E-2 (5/47) 9.47E-3 - 3.45E-2	Plant Intake 0.1 mile east	1.89E-2 (5/47) 9.47E-3 - 3.45E-2	No control	N/A
	Cs-134	1.40E-2	2.22E-1 (16/47) 9.50E-3 - 5.48E-1	Plant Intake 0.1 mile east	2.22E-1 (16/47) 9.50E-3 - 5.48E-1	No control	N/A
	Cs-137	1.10E-2	2.26E-1 (37/47) 8.85E-3 - 7.40E-1	Plant Intake 0.1 mile east	2.26E-1 (37/47) 8.85E-3 - 7.40E-1	No control	N/A
	Sn-113	6.00E-3	3.38E-3 (1/47) (Single value)	Plant Intake 0.1 mile east	3.38E-3 (1/47) (Single value)	No control	N/A

TABLE 2-1 (continued)

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

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

Docket Numbers - 50-261
Calendar Year 1983

Medium or Pathway Sampled or Measured (Unit of Measurement)	Type and Total No. of Measurements Performed	Lower Limit of Detetection (LLD) (1)	All Indicator Locations (2) Mean Range	Location w/Highest Annual Mean Name, Distance, and Direction	Mean Range (2)	Control Locations Mean Range (2)	No. of Nonroutine Reported Measurements (3)
Surface Water (pCi/l) (Glass Wool)	Gamma 47(5)	N/A	All less than LLD	All less than LLD		All less than LLD	N/A
TLD Millirem per week	TLD 250(9)	3.00E-1	1.68E+0 (239/239) 7.00E-1 - 5.60E+0	Robinson Unit 1 .02 mile east	2.68E+0 (10/10) 1.20E+0 - 5.20E+0	1.65E+0 (11/11) 9.00E-1 - 2.20E+0	N/A

FOOTNOTES:

1. The Lower Level of Detection (LLD) is the smallest concentration of radioactive material in a sample that will yield a net count, above system background, which will be detected with 95 percent probability with only 5 percent probability of falsely concluding that a blank observation represents a "real" signal.

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 percent confidence level) of ten times the control station value or ten times the lower level of detection (LLD)--whichever is larger. Present Environmental Technical Specifications do not require such reports.

4. Air particulate and charcoal cartridges are collected weekly for a possible 364 samples. Sample results for air particulate samples collected on February 28 at Station 17 were not included as a result of low volume (run time = 3 hours). Samples collected on April 11 and December 4 at Station 35 were not included due to wind blowing air filter into creek and due to low volume ($< 4\ m^3$) as a result of tripped breaker switch, respectively.

5. There were a possible 32 gross beta and strontium analyses and 36 gamma analyses; however, Station 33 (ditch behind Visitors Center) was modified in July. Seven samples were collected during 1983 at this location.

6. There were a possible 36 gross beta and strontium analyses for bottom sediment. Station 33 (ditch behind Visitors Center) was modified in July for a total of seven samples collected at this location during 1983.

   There were a possible 38 gamma analyses for bottom sediment. Station 50 (Ash Pond) was sampled and analyzed three times during 1983 as opposed to semiannually.

7. A special study was performed during 1983 on edible portions of fish (see Section 3.3).

8. No glass wool and resin samples were collected on January 3, August 29, September 4, September 11, and September 18 due to sampler being out of service.

9. There were a possible 264 TLD analyses. The 14 analyses missing are summarized below:

Month			
January	Station 12, 13	June	Station 6, 18, 31
February	Station 22, 4	July	Station 6
March	Station 9, 16, 30	August	Station 7, 9
May	Station 29		

3.0 INTERPRETATION AND CONCLUSIONS

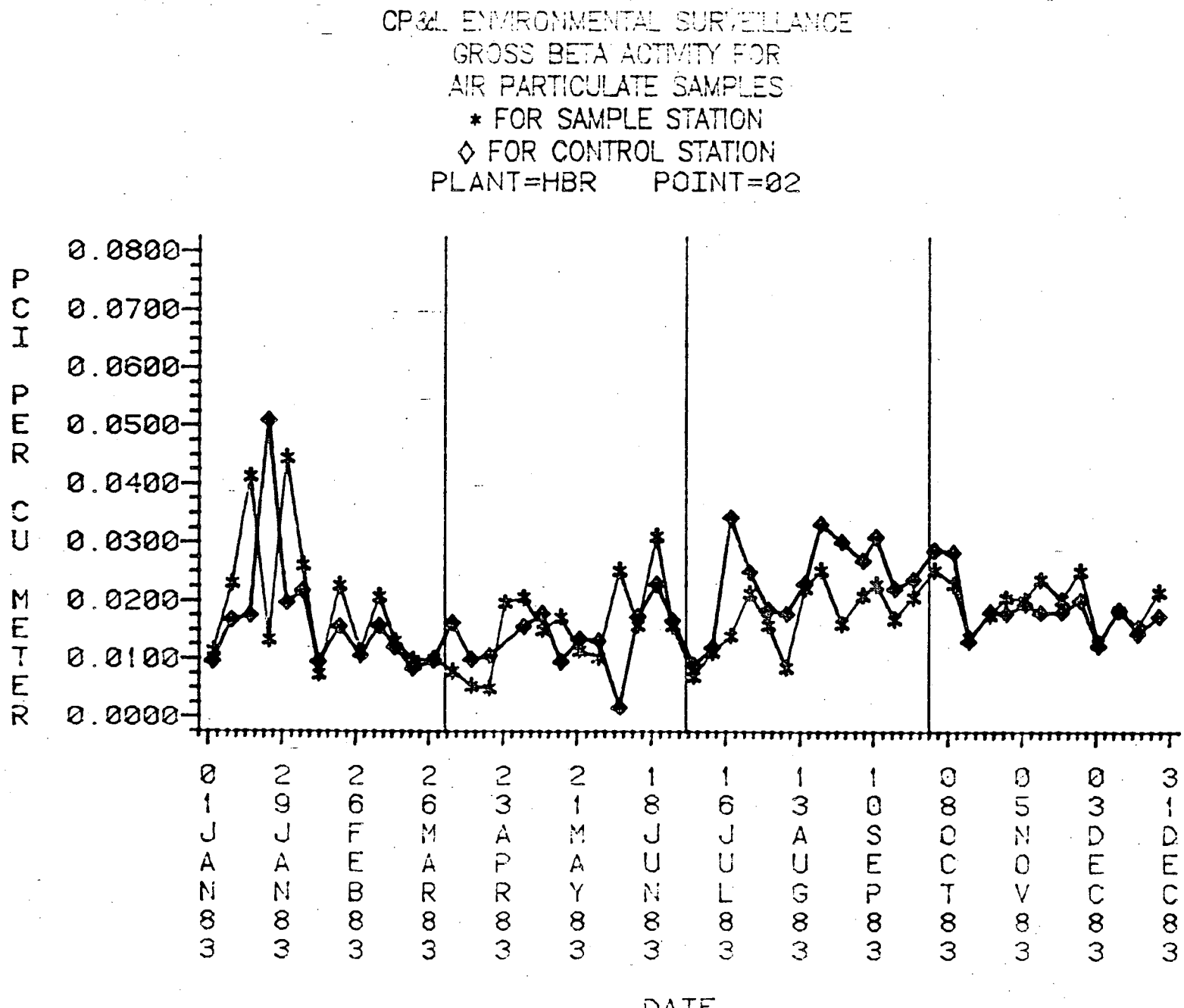
3.1 Air Samples

Air samples collected during 1983 contained no unusual levels of radioactivity. Gross alpha concentrations were measurable in 293 of 309 samples, averaging 3.80E-3 pCi/m^3, compared to the control station average of 4.17E-3 pCi/m^3. Measurable gross beta concentrations were observed in 309 of 309 samples, averaging 1.83E-2 pCi/m^3, compared to the control station average of 1.95E-2 pCi/m^3. These levels are consistent with preoperational data obtained for the H.B. Robinson Plant. Graphs of the individual air sampling station (gross beta activity) compared to control station gross beta activity are included as Figures 3-1 through 3-6 to demonstrate that all stations were comparable to the control station with no large deviation at any single location.

The monthly composite gamma and radiostrontium analyses for air particulate samples revealed only one radionuclide during 1983. Strontium-89 activity was detected at Station 35 (Dam--West End) at a concentration of 7.77E-3 pCi/m^3. The following are doses and assumptions from Regulatory Guide 1.109 for inhalation of strontium-89 in air using the average concentration of 1.62E-3 pCi/m^3 which includes the minimum detectable activities for the year:

	Infant	Child	Teenager	Adult
Inhalation m^3/yr	1400	3700	8000	8000
Dose factor (mrem/pCi)	1.45E-3	5.83E-4	3.02E-4	1.75E-4
Dose to lungs (mrem/yr)	3.29E-3	3.49E-3	3.91E-3	2.27E-3

Determination of iodine-131 in air via charcoal was made using gamma spectrometry. No iodine was detected for the entire year.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GROSS BETA ACTIVITY FOR
AIR PARTICULATE SAMPLES
* FOR SAMPLE STATION
◇ FOR CONTROL STATION
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PCI PER CU METER
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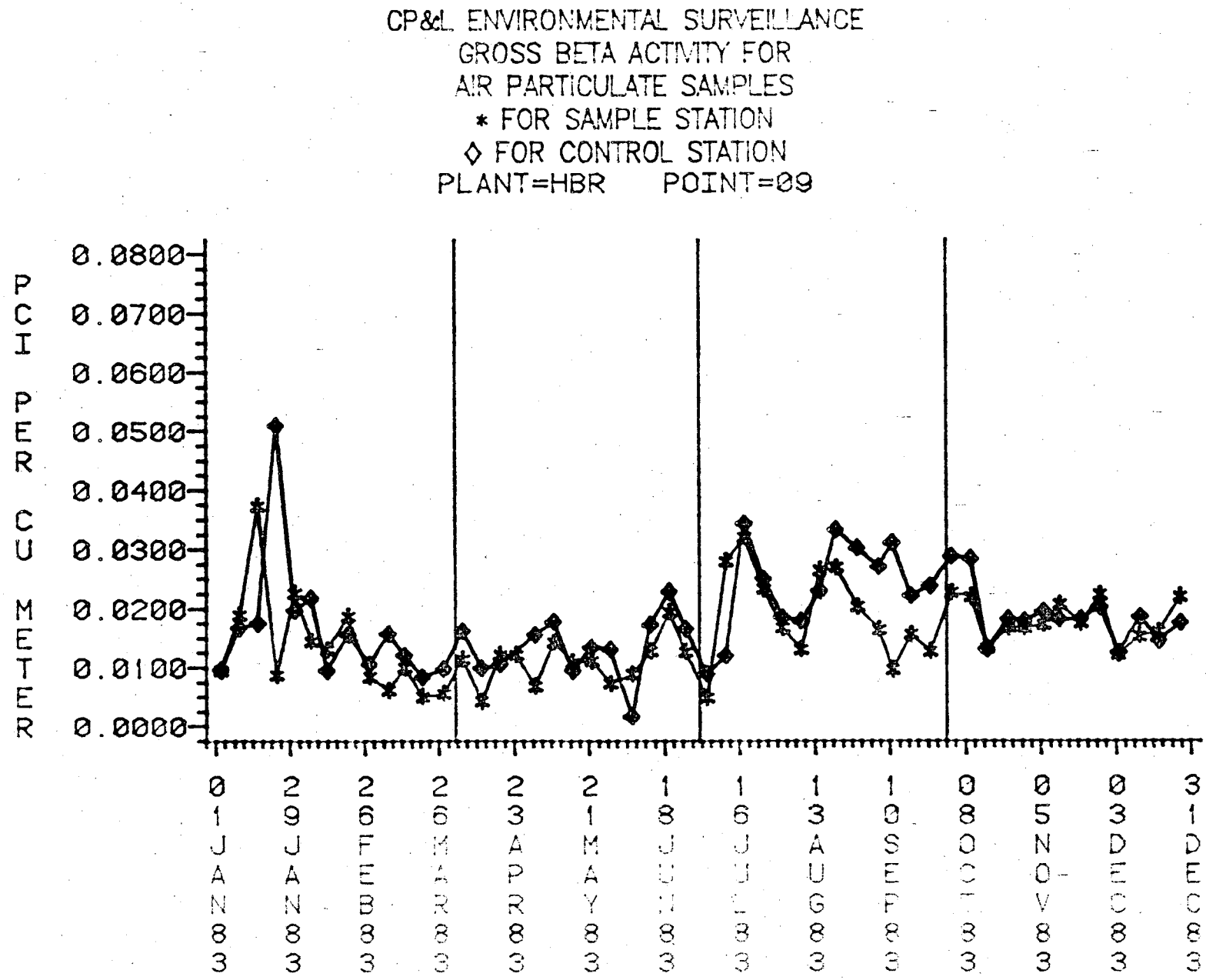
0.0600
0.0500
0.0400
0.0300
0.0200
0.0100
0.0000
01JAN83
29JAN83
26FEB83
26MAR83
23APR83
21MAY83
18JUN83
16JUL83
13AUG83
10SEP83
08OCT83
05NOV83
03DEC83
31DEC83
DATE

Figure 3-1


CP&L ENVIRONMENTAL SURVEILLANCE
GROSS BETA ACTIVITY FOR
AIR PARTICULATE SAMPLES
* FOR SAMPLE STATION
◊ FOR CONTROL STATION
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PCI PER CU METER
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0.0700
0.0600
0.0500
0.0400
0.0300
0.0200
0.0100
0.0000
01JAN83
29JAN83
26FEB83
26MAR83
23APR83
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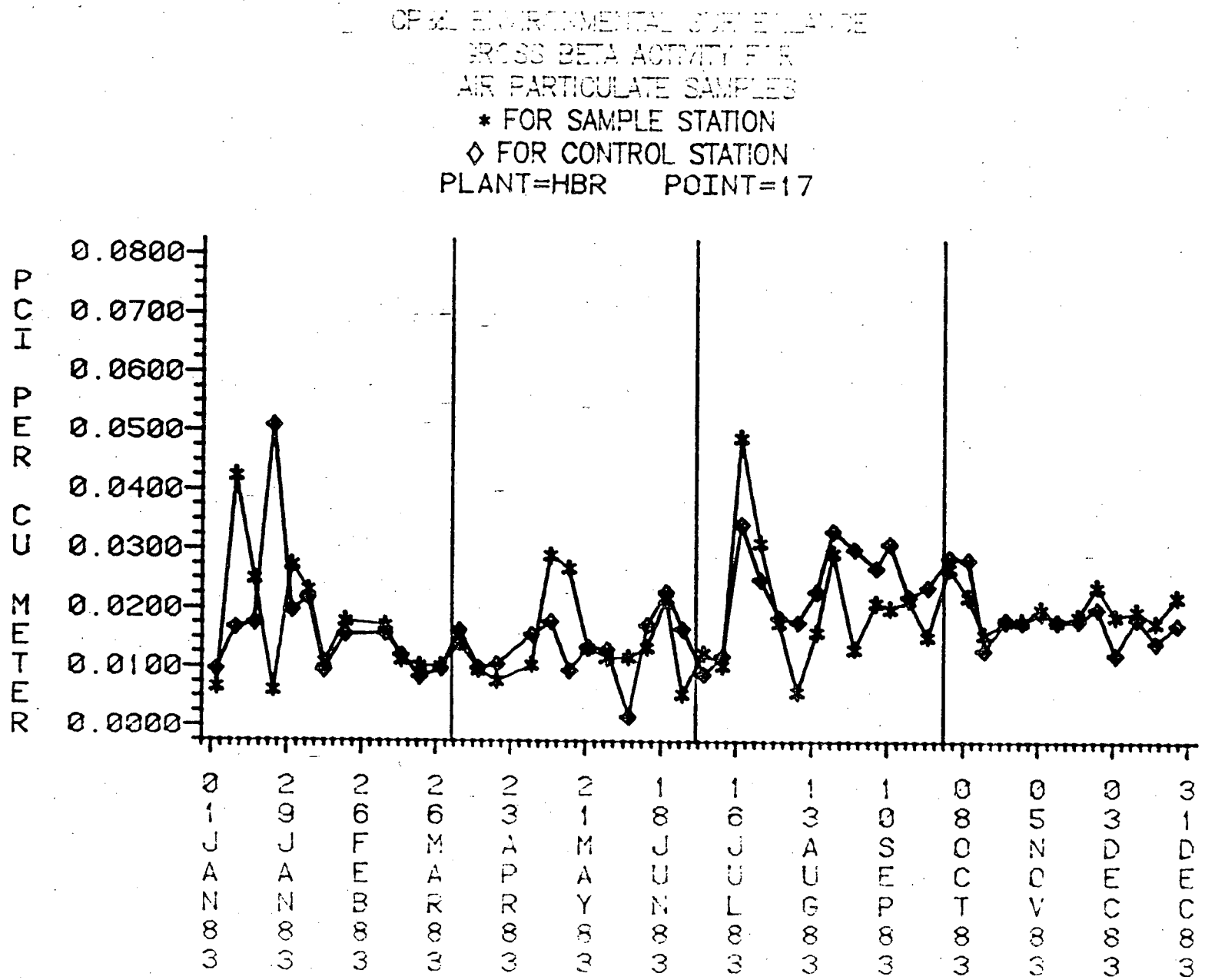
08OCT83
05NOV83
03DEC83
31DEC83
DATE

Figure 3-2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GROSS BETA ACTIVITY FOR
AIR PARTICULATE SAMPLES
* FOR SAMPLE STATION
◊ FOR CONTROL STATION
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PCI PER CU METER
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0.0300
0.0200
0.0100
0.0000
01JAN83
29JAN83
26FEB83
26MAR83
23APR83
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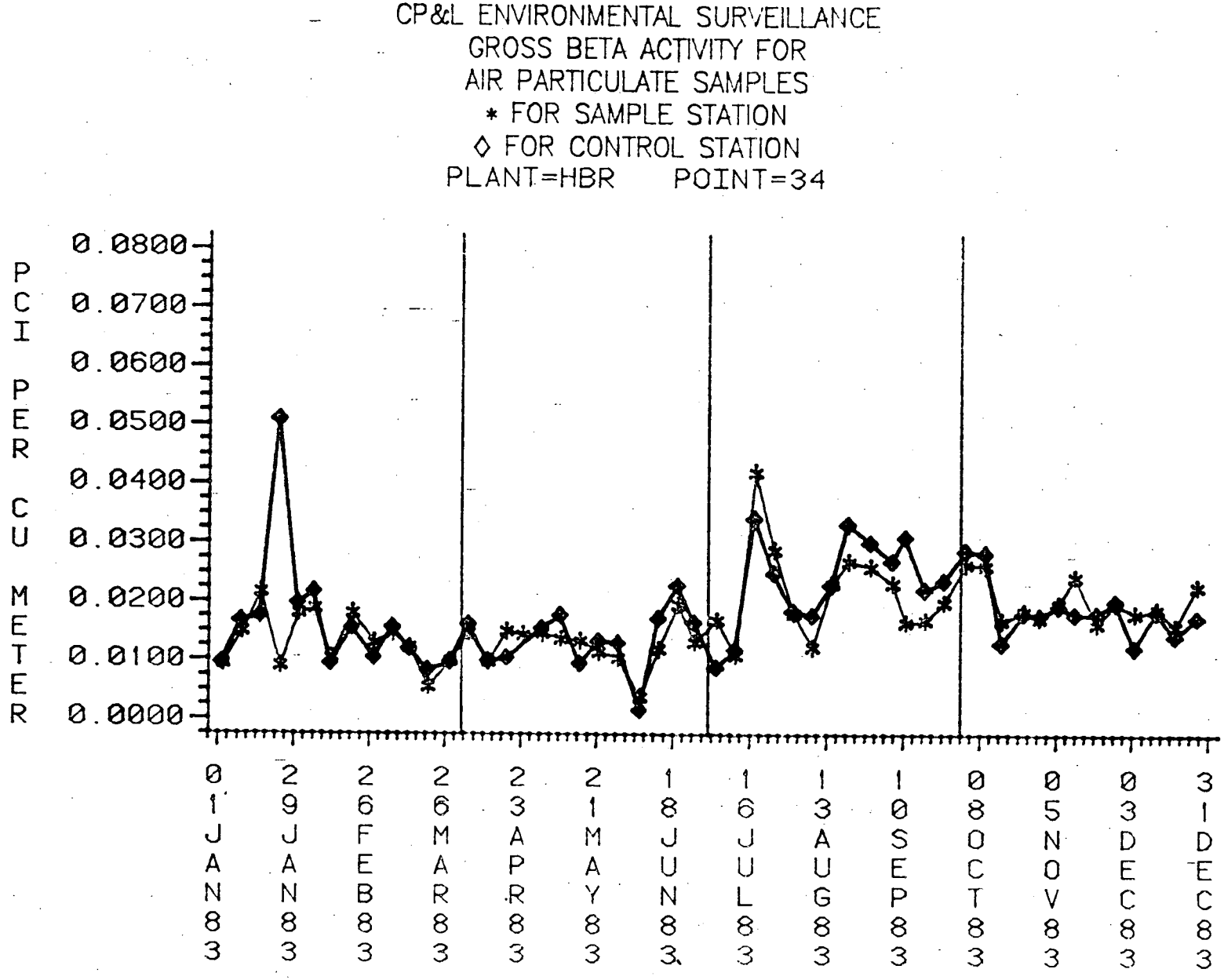
08OCT83
05NOV83
03DEC83
31DEC83
DATE

Figure 3-3


CP&L ENVIRONMENTAL SURVEILLANCE
GROSS BETA ACTIVITY FOR
AIR PARTICULATE SAMPLES
* FOR SAMPLE STATION
◇ FOR CONTROL STATION
PLANT=HBR POINT=34
PCI PER CU METER
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0.0200
0.0100
0.0000
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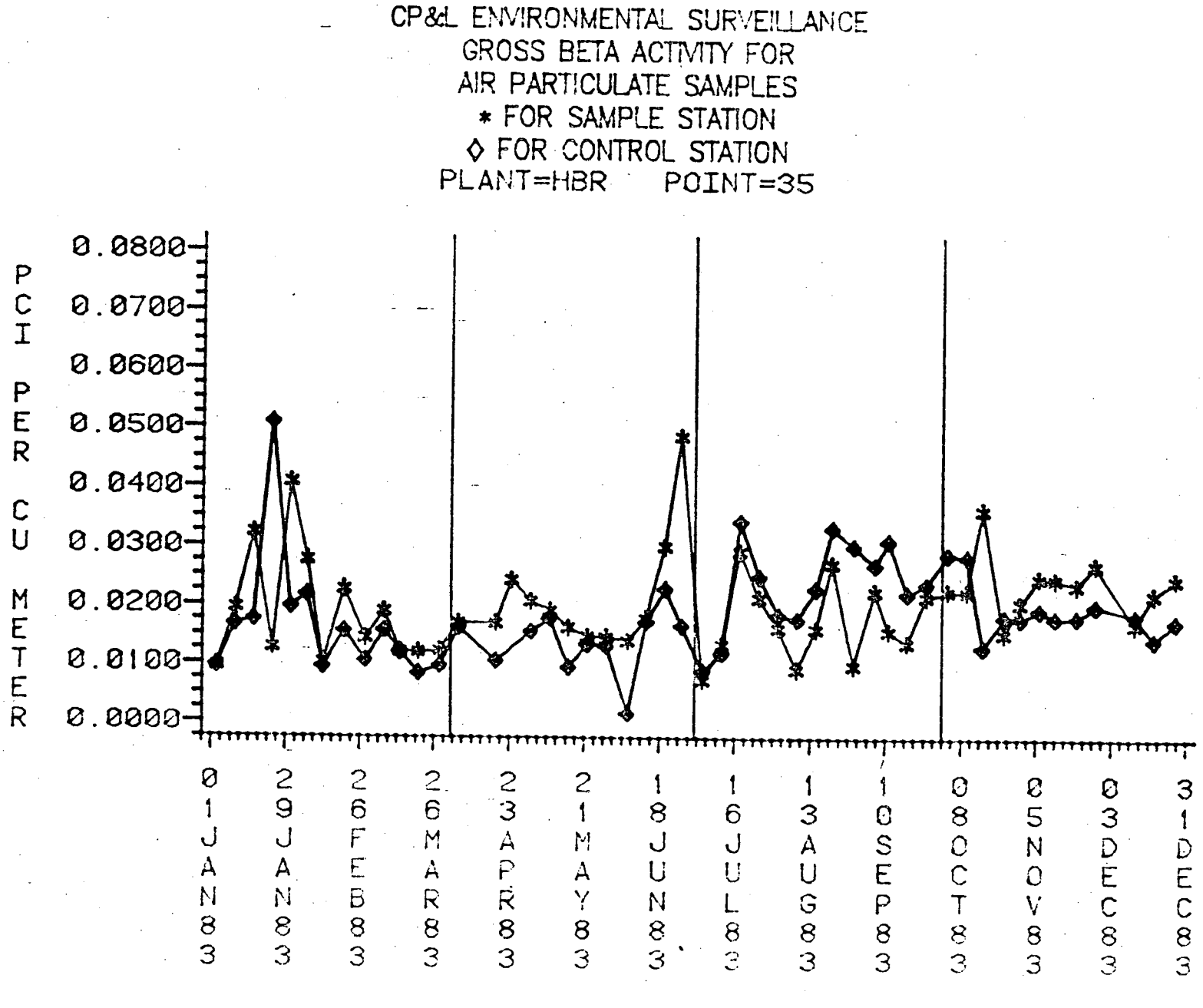
29 JAN 83
26 FEB 83
26 MAR 83
23 APR 83
21 MAY 83
18 JUN 83
16 JUL 83
13 AUG 83
10 SEP 83
08 OCT 83
05 NOV 83
03 DEC 83
31 DEC 83
DATE

Figure 3-4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GROSS BETA ACTIVITY FOR
AIR PARTICULATE SAMPLES
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◊ FOR CONTROL STATION
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PCI PER CU METER
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29JAN83
26FEB83
26MAR83
23APR83
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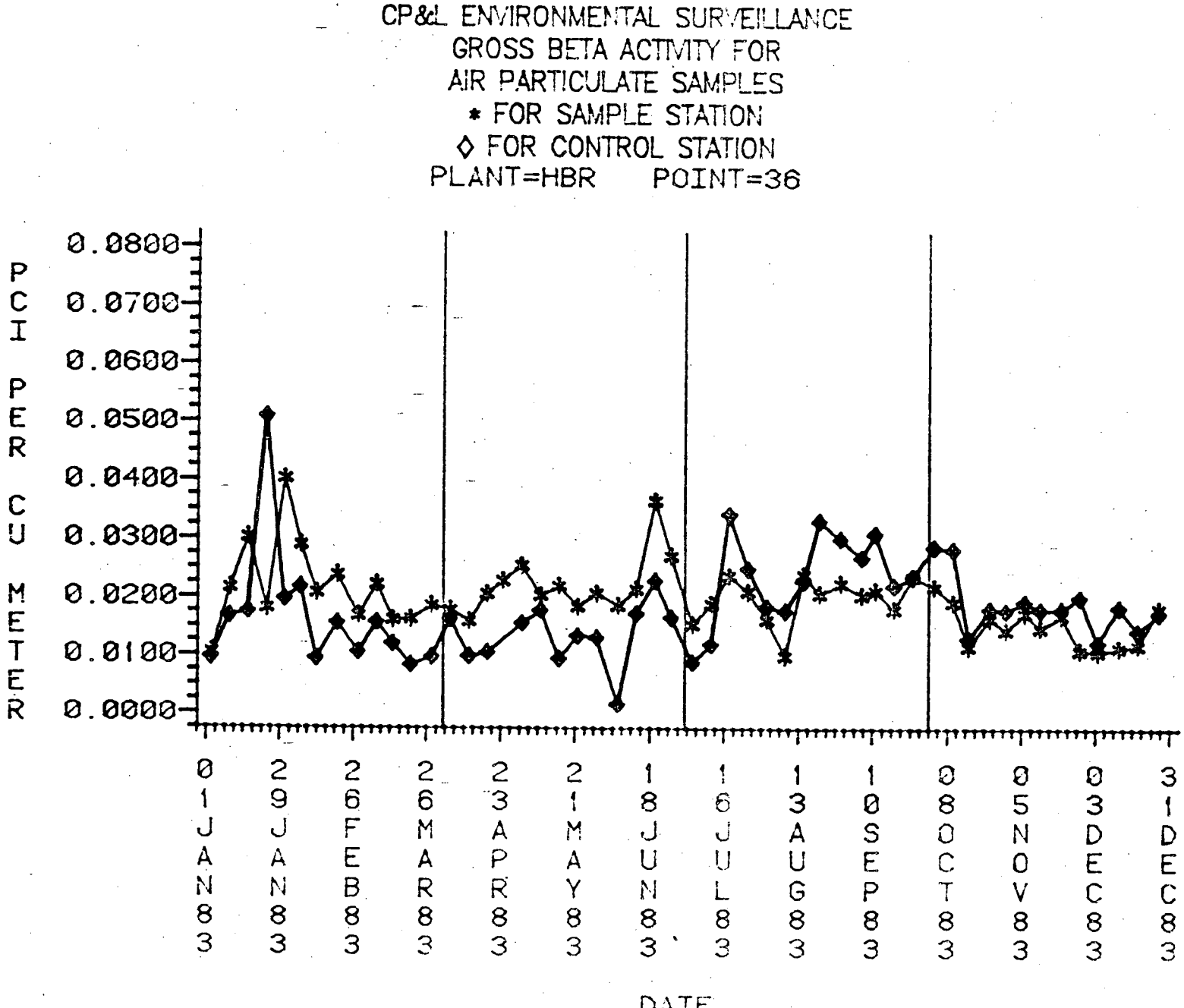
03DEC83
31DEC83
DATE

Figure 3-5


CP&L ENVIRONMENTAL SURVEILLANCE
GROSS BETA ACTIVITY FOR
AIR PARTICULATE SAMPLES
* FOR SAMPLE STATION
◊ FOR CONTROL STATION
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PCI PER CU METER
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26FEB83
26MAR83
23APR83
21MAY83
18JUN83
16JUL83
13AUG83
10SEP83
08OCT83
05NOV83
03DEC83
31DEC83
DATE

Figure 3-6

3.2 Aquatic Vegetation and Bottom Sediment

Aquatic vegetation and bottom sediment samples are taken quarterly at five locations to monitor the expected effluent path from the Robinson Plant. An additional bottom sediment sample is taken quarterly at the plant intake. Until July 1983, monthly bottom sediment and aquatic vegetation samples were taken from the open ditch (Station 33) near the Visitors Center in order to monitor any liquid effluent from those locations where only low-level activity concentrations were expected. Permission was granted from the NRC to modify this ditch in July 1983 based on a safety analysis (Serial LAP-83-85).

Gamma analyses revealed the continued presence of several radionuclides predominant in plant liquid effluent as well as fission products attributed to old debris from nuclear testing. These radionuclides are summarized in Table 3-1.

Table 3-1

Average Concentration (pCi/g, dry) and Fractional Occurrences of Radionuclides in Bottom Sediment and Aquatic Vegetation

BOTTOM SEDIMENT

Isotope	Annual Average (pCi/g, dry)	Location with Highest Annual Mean
Mn-54	0.046 (2/30)	SD-33
Co-60	0.980 (12/30)	SD-33
Sr-90	0.247 (1/27)	SD-8
Cs-137	0.354 (21/30)	SD-33
Natural Occurring		
K-40	3.680 (26/30)	SD-33

Table 3-1
(Continued)

AQUATIC VEGETATION

Isotope	Annual Average (pCi/g, dry)	Location with Highest Annual Mean
Mn-54	0.132 (3/27)	AV-8
Co-58	0.300 (4/27)	AV-8
Co-60	1.110 (15/27)	AV-8
Sr-89	0.037 (2/23)	AV-33
Sr-90	0.030 (4/23)	AV-33
Cs-134	0.387 (2/27)	AV-11
Cs-137	0.429 (20/27)	AV-8
I-131	25.5 (1/27)	AV-32

The iodine-131 activity precipitated additional sampling including a milk sample from Frank Flower's Plantation (≈ 6 miles downstream from Station 32) since he irrigates from Black Creek. The milk results were less than the lower level of detection (LLD), and all other sample media revealed no radiological hazards to the public.

3.3 Fish

Fish samples are collected and analyzed quarterly for radiostrontium and gamma-emitting radionuclides. Normally, the above is performed on bottom feeders and free swimmers (edible portions). For 1983, the fish samples were analyzed by species. Additionally, two other locations were added to the sampling program during the fourth quarter--Station 32 (Prestwood Lake) approximately 4.5 miles downstream of Lake Robinson and Lake Bee (9.0 miles northwest of site) which is totally unaffected by Robinson's operations. Table 3-2 shows all observed radionuclides are comparable to the control station using a t-test and are approximately an order of magnitude lower than the natural occurring K-40. The observed concentrations in Lake Robinson and Prestwood are not totally attributed to Robinson's operations.

Table 3-2

RADIONUCLIDES DETECTED IN FISH BY SPECIES
(pCi/Kg, wet)

Species	Radionuclide	First Quarter HBR	Second Quarter HBR	Third Quarter HBR	Fourth Quarter HBR	Fourth Quarter Prestwood Lake	Fourth Quarter Lake Bee
Chub	Sr-89	127 ± 50	92.1 ± 24.4	< LLD		34.8 ± 7.8	166 ± 52.3
Sucker	Sr-90	55.8 ± 8.2	49.0 ± 12.7	65.9 ± 12.9		10.4 ± 4.2	179 ± 22.5
	Cs-134	< LLD	< LLD	21.7 ± 5.7		71.8 ± 11.1	< LLD
	Cs-137	71.2 ± 8.4	52.8 ± 12.1	119 ± 13		257 ± 14	142 ± 10
	K-40	2,160 ± 150	1,610 ± 210	1,840 ± 190		1,770 ± 170	2,690 ± 140
Spotted	Sr-89	< LLD	43.7 ± 16.7	< LLD	< LLD		
Sucker	Sr-90	69.8 ± 12	49.0 ± 8.8	58.4 ± 10.9	95.5 ± 13.8		
	Cs-134	< LLD	< LLD	< LLD	< LLD		
	Cs-137	80.9 ± 4.8	124 ± 8	97.0 ± 7	94.6 ± 11		
	K-40	4,110 ± 130	3,030 ± 150	2,030 ± 150	2,860 ± 140		
Catfish	Sr-89			< LLD		58.7 ± 9.4	
	Sr-90			78.3 ± 16.2		10.4 ± 4	
	Cs-134			< LLD		38.7 ± 7.5	
	Cs-137			< LLD		283 ± 12	
	K-40			866 ± 396		2,810 ± 160	
Pickerel	Sr-89	< LLD	< LLD			< LLD	426 ± 49
	Sr-90	69.9 ± 13.1	35.7 ± 13.1			90.7 ± 12.2	30.3 ± 7.4
	Cs-134	< LLD	< LLD			12.1 ± 1.9	< LLD
	Cs-137	25.7 ± 2	279 ± 24			56.4 ± 3	365 ± 20
	K-40	< LLD	3,030 ± 380			651 ± 41	1,405 ± 260

Table 3-2
(Continued)

Species	Radionuclide	First Quarter HBR	Second Quarter HBR	Third Quarter HBR	Fourth Quarter HBR	Fourth Quarter Prestwood Lake	Fourth Quarter Lake Bee
Bass	Sr-89		83.7 ± 23.9	< LLD		22.8 ± 9.1	85.8 ± 33.7
	Sr-90		45.2 ± 12.7	80 ± 17		7.4 ± 4.5	110 ± 15.2
	Cs-134		< LLD	38.5 ± 6		14.9 ± 1.6	< LLD
	Cs-137		175 ± 10	151 ± 1		46.3 ± 2	351 ± 14
	K-40		1,900 ± 180	2,230 ± 120		211 ± 5	3,140 ± 150
Crappie	Sr-89				< LLD		
	Sr-90				49.1 ± 10		
	Cs-134				191 ± 14		
	Cs-137				387 ± 18.2		
	K-40				2,270 ± 190		
Sunfish	Sr-89					< LLD	394 ± 110
	Sr-90					20.7 ± 9	350 ± 47
	Cs-134					23.3 ± 2	< LLD
	Cs-137					71.9 ± 3	152 ± 14
	K-40					746 ± 47	3,020 ± 220
Bowfin	Sr-89					< LLD	
	Sr-90					< LLD	
	Cs-134					5.9 ± 1.8	
	Cs-137					53.5 ± 2.5	
	K-40					433 ± 59	

3.4 Vegetation

Cattle feed (FO) and locally grown food crops (FC) were sampled and analyzed for gamma-emitting radionuclides. The only radionuclide detected was cesium-137 as summarized in Table 3-3. The low-level cesium-137 activity detected is attributed to old debris from nuclear testing.

Table 3-3

Cesium-137 Concentration (pCi/g, dry) and Fractional Occurrences of Radionuclides in Cattle Feed and Food Crops

Cattle Feed (FO)

Isotope	Fink's Farm	Lyndales' Farm (Control Station)
Cs-137	0.130 (1/2)	0.147 (1/2)

Food Crop (FC)

Isotope	Isgetts' Farm
Cs-137	0.010 (1/5)

3.5 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 averaging 1.04 pCi/l. Gross beta activity was detected in 11 of 12 samples averaging 0.91 pCi/l. This average is comparable to data obtained during preoperational surveillance. Radiostrontium

analyses revealed measurable strontium-90 activity at the concentration of 3.0 pCi/l with a high relative counting error. This concentration is considerably lower than the normal minimum detectable activity of 5 pCi/l. Tritium and gamma analyses revealed no measurable activity.

3.6 Milk Samples

Monthly milk samples were taken at two locations--Fink's Farm (7.0 miles SE) and Lyndales' Farm (11.3 miles SSW control station). These samples were analyzed for radioiodine, radiostrontium, and gamma-emitting radionuclides.

Radiochemical determination of iodine-131 revealed no measurable activity.

Radiostrontium analyses of milk at Fink's Farm revealed strontium-90 in 7 of 12 samples averaging 1.60 pCi/l. Using a t-test, this is comparable to the control station's average concentration of 1.86 pCi/l. Strontium-90 was detected in 6 of 12 samples at this location.

Gamma isotopic analyses revealed no measurable man-made radioactivity.

3.7 Soil Samples

Ten sampling locations are sampled every three years. Two sample locations are sampled semiannually on a rotating basis. During 1983, Station 11 (Black Creek at Road 1623), Station 19 (east shore of lake north of 18), Station 32 (Prestwood), and Station 34 (end of construction road west of plant) were sampled and analyzed for gross beta, strontium, and gamma emitters.

Station 49 (east shore of lake at boat launch) is sampled semiannually as shoreline sediment and is analyzed for gross beta

and gamma emitters. In addition, Station 50 (Ash Pond) was added to the sampling program in 1981. This station is sampled semiannually and analyzed for gamma-emitting radionuclides. Station 50 is located within the site boundary and was added to the environmental program as a directive from the Company's Nuclear Safety and Research Department.

Gross beta activities were detected in 4 of 6 samples analyzed averaging 6.63E-1 pCi/g. This is in agreement with gross beta activities observed on the same sample type during preoperational surveillance. Gamma analyses revealed cesium-137 in 3 of 6 samples analyzed. All concentrations observed were comparable to previous data reported for the area.

3.8 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 137 of 208 samples analyzed. The average of 1.36E+0 pCi/l was comparable to the control station average of 1.06E+0 pCi/l. Measurable gross beta concentrations were reported in 201 of 208 samples averaging 1.85E+0 pCi/l. These gross beta activities are comparable to the average of 4.08E+0 pCi/l reported during preoperational surveillance. These activities were consistent at all stations with no one station showing significant deviation as shown in Figures 3-7 through 3-10.

Monthly composites of the weekly samples showed measurable gross alpha and beta activities in 14 of 48 and 44 of 48 cases, respectively. The average concentration for gross alpha and gross beta in these samples was 9.61E-1 pCi/l and 1.72E+0 pCi/l, respectively. These compare favorably with the control station averages of 7.19E-1 and 1.07E+0 pCi/l for gross alpha and gross beta, respectively.

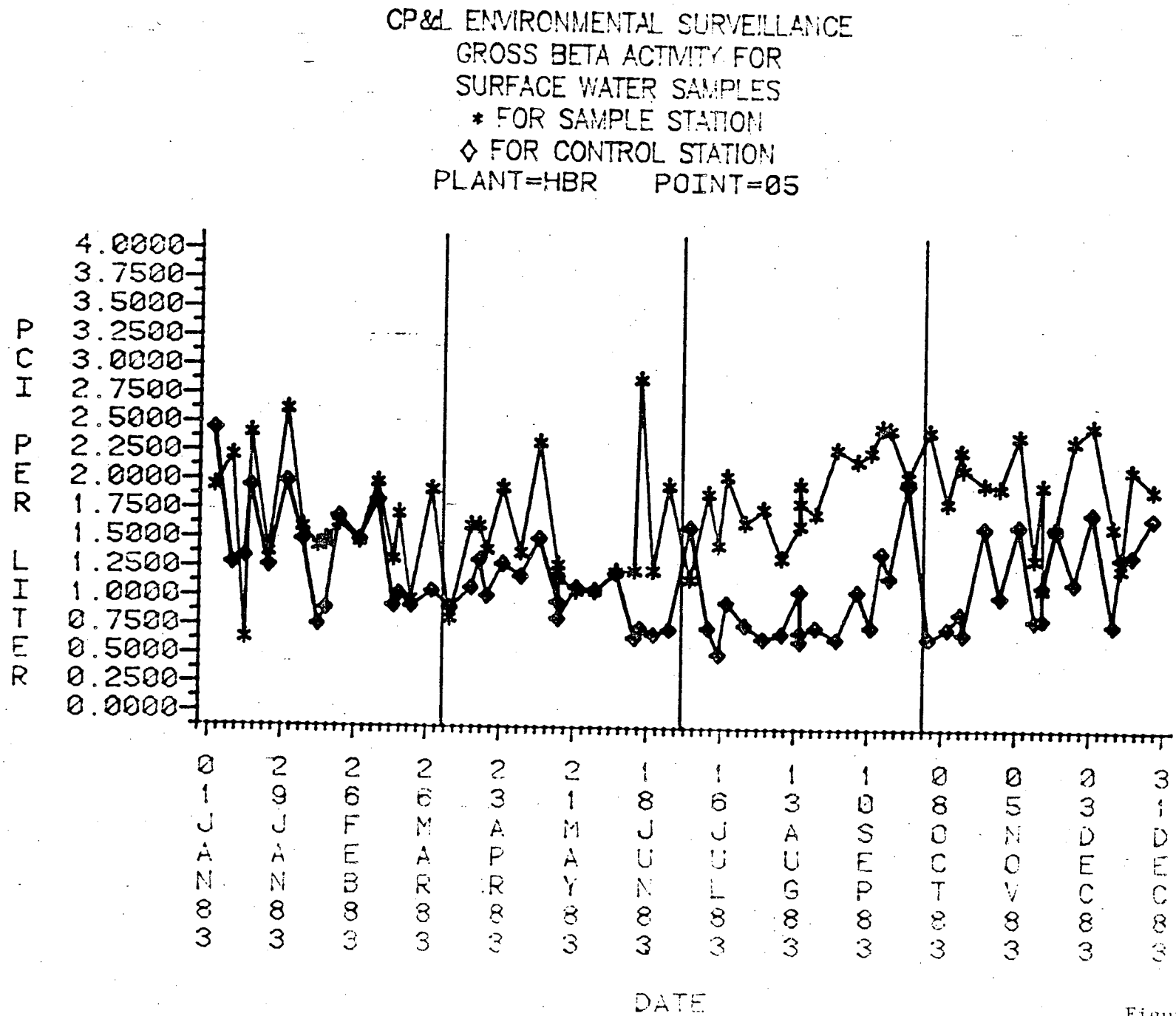
CP&L ENVIRONMENTAL SURVEILLANCE
GROSS BETA ACTIVITY FOR
SURFACE WATER SAMPLES
* FOR SAMPLE STATION
◇ FOR CONTROL STATION
PLANT=HBR POINT=05
PCI PER LITER
4.0000
3.7500
3.5000
3.2500
3.0000
2.7500
2.5000
2.2500
2.0000
1.7500
1.5000
1.2500
1.0000
0.7500
0.5000
0.2500
0.0000
01JAN83
29JAN83
26FEB83
26MAR83
23APR83
21MAY83
18JUN83
16JUL83
13AUG83
10SEP83
08OCT83
05NOV83
03DEC83
31DEC83
DATE

Figure 3-7

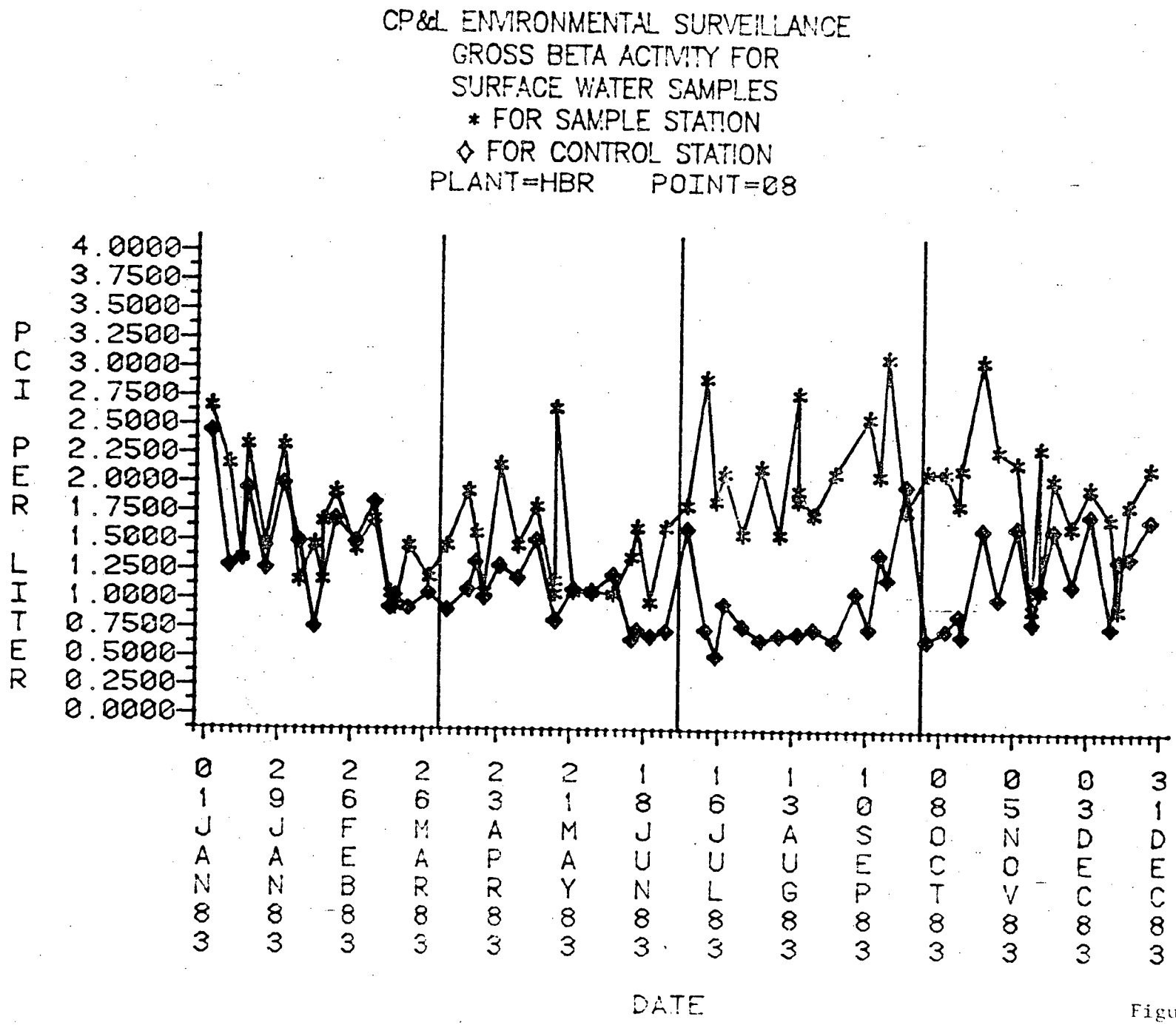
CP&L ENVIRONMENTAL SURVEILLANCE
GROSS BETA ACTIVITY FOR
SURFACE WATER SAMPLES
* FOR SAMPLE STATION
◇ FOR CONTROL STATION
PLANT=HBR POINT=08
PICOCURIES PER LITER
4.0000
3.7500
3.5000
3.2500
3.0000
2.7500
2.5000
2.2500
2.0000
1.7500
1.5000
1.2500
1.0000
0.7500
0.5000
0.2500
0.0000
01JAN83
29JAN83
26FEB83
26MAR83
23APR83
21MAY83
18JUN83
16JUL83
13AUG83
10SEP83
08OCT83
05NOV83
03DEC83
31DEC83
DATE

Figure 3-8

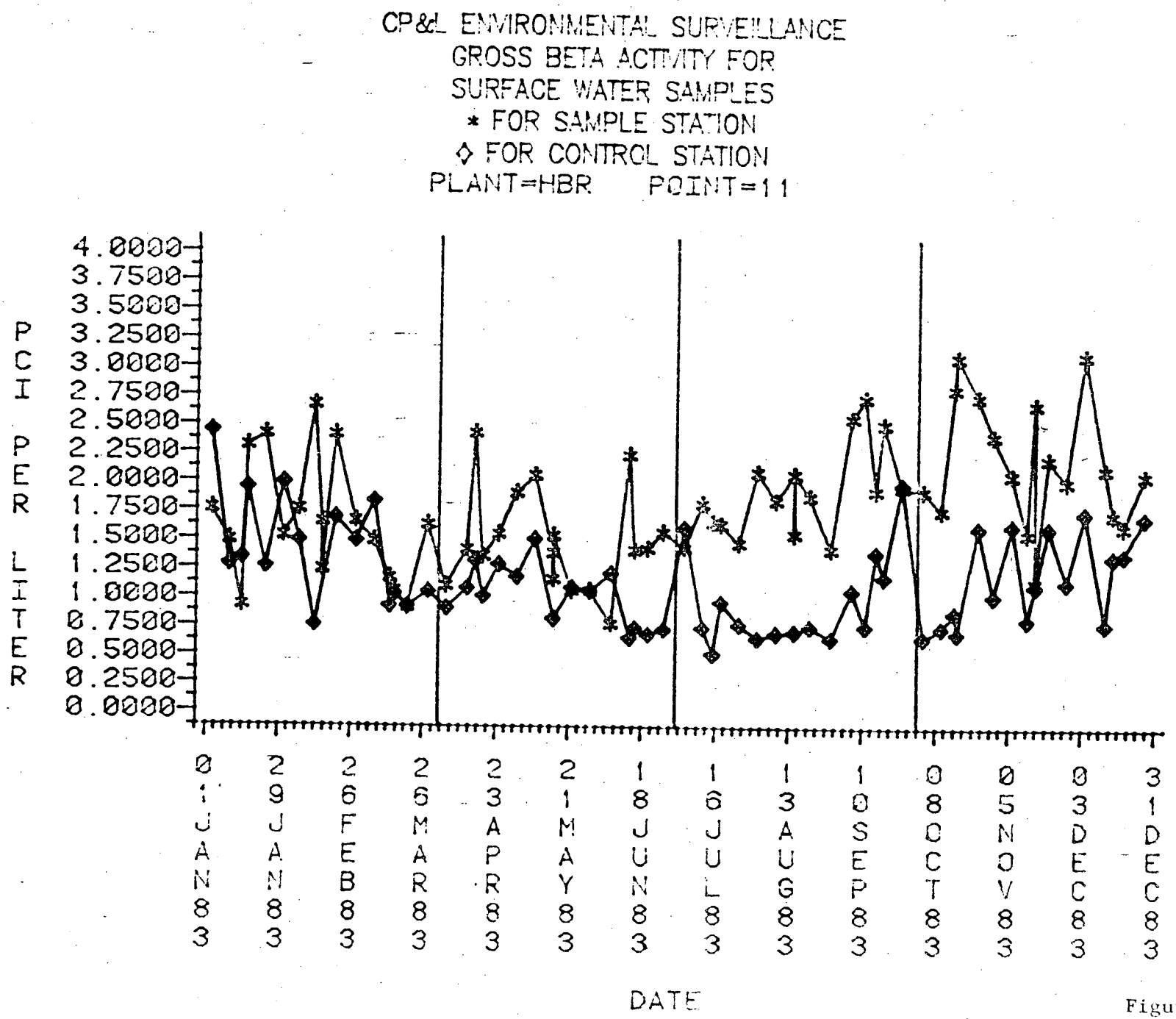
CP&L ENVIRONMENTAL SURVEILLANCE
GROSS BETA ACTIVITY FOR
SURFACE WATER SAMPLES
* FOR SAMPLE STATION
◇ FOR CONTROL STATION
PLANT=HBR POINT=11
PCI PER LITER
4.0000
3.7500
3.5000
3.2500
3.0000
2.7500
2.5000
2.2500
2.0000
1.7500
1.5000
1.2500
1.0000
0.7500
0.5000
0.2500
0.0000
01 JAN 83
29 JAN 83
26 FEB 83
26 MAR 83
23 APR 83
21 MAY 83
18 JUN 83
16 JUL 83
13 AUG 83
10 SEP 83
08 OCT 83
05 NOV 83
03 DEC 83
31 DEC 83
DATE

Figure 3-9

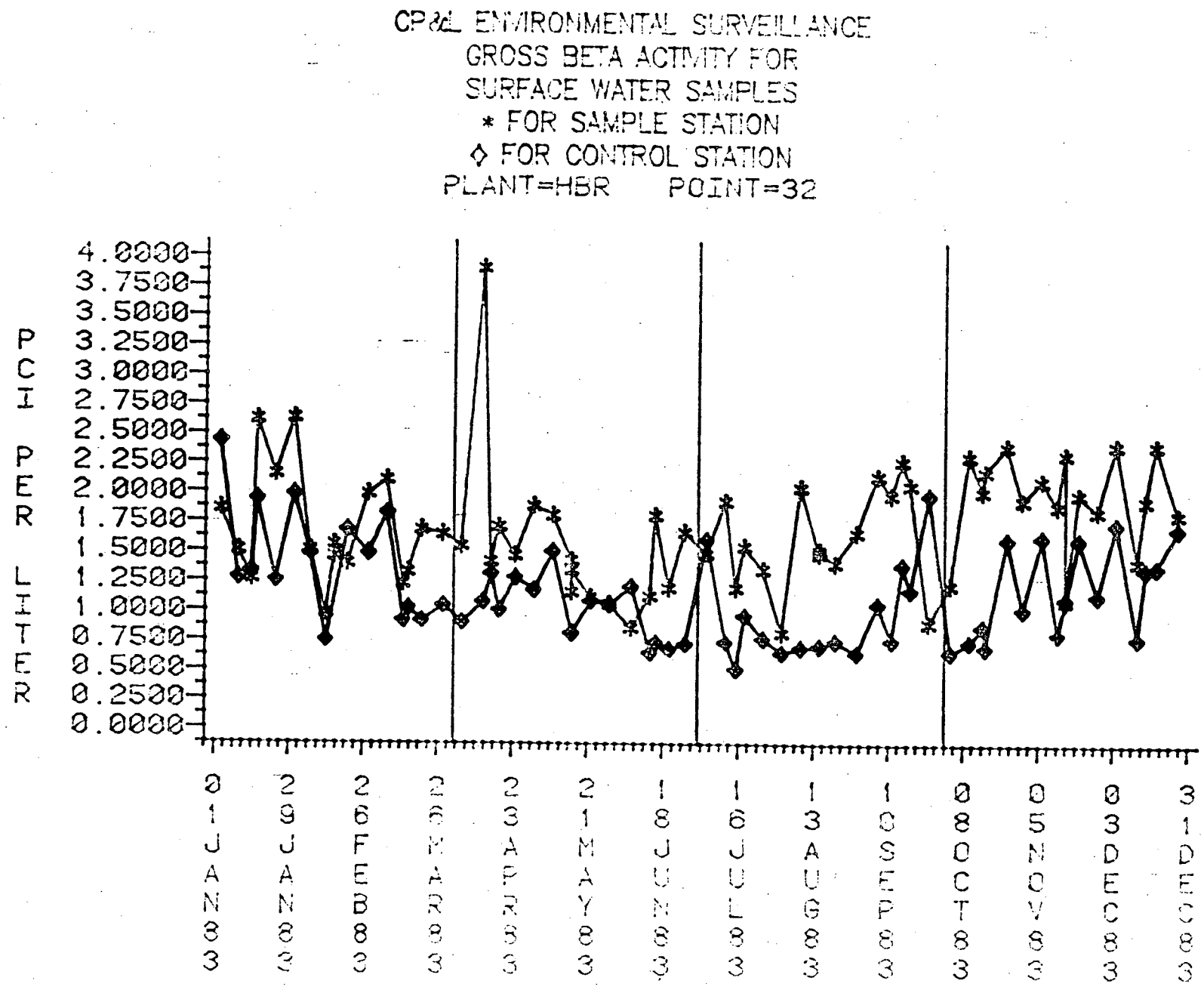
CP&L ENVIRONMENTAL SURVEILLANCE
GROSS BETA ACTIVITY FOR
SURFACE WATER SAMPLES
* FOR SAMPLE STATION
◇ FOR CONTROL STATION
PLANT=HBR POINT=32
PCI PER LITER
4.0000
3.7500
3.5000
3.2500
3.0000
2.7500
2.5000
2.2500
2.0000
1.7500
1.5000
1.2500
1.0000
0.7500
0.5000
0.2500
0.0000
21JAN83
29JAN83
26FEB83
26MAR83
23APR83
21MAY83
18JUN83
16JUL83
13AUG83
10SEP83
08OCT83
05NOV83
03DEC83
31DEC83
DATE

Figure 3-10

Quarterly composites of the monthly composites revealed measurable alpha and beta activities similar to the monthly samples. Gross alpha activity was detected in 5 of 16 samples, averaging 1.08E+0 pCi/l compared to 1.20E+0 pCi/l at the control station. Measurable gross beta activity was observed in 13 of 16 samples averaging 1.63 E+0 pCi/l. This is comparable to 2.67E+0 pCi/l detected at the control location.

Tritium activity concentrations were 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. All activities are comparable to previous data revealing no increase in activity. The tritium data is summarized by station below:

Tritium Concentrations (pCi/l)

Weekly Samples	**SW-5**	**SW-8**	**SW-11**	**SW-32**
Average	1030	1070	1060	945
Range	433-1900	543-2150	503-2030	523-1760
Monthly Composite				
Average	1220	1270	1100	982
Range	673-1470	706-1870	498-1540	626-1370
Quarterly Composite				
Average	1120	1250	1130	875
Range	942-1310	942-1500	896-1440	585-1150

Specific gamma isotopic analyses of monthly surface water composites were accomplished through high resolution gamma spectrometry. In 60 of 60 samples analyzed, no fission or activation products were detectable.

Radiostrontium analyses of monthly composited surface water samples revealed no strontium-89 radioactivity. Strontium-90 activity was quantified in 1 of 60 analyses at Station 11 at a concentration of 2.67 pCi/l. The sporadic appearance of strontium-90 in surface water does not clearly indicate the Robinson Plant as the source.

The measurement of very low levels of fissions 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 glass wool (for suspended particulate collection). Thus, the analytical sensitivity for gamma isotopic analyses was improved sufficiently to allow measurement of many fission and activation products. The radionuclides measured by this method are listed in Table 3-4.

Table 3-4

Ion-Exchange Resin
(pCi/l)

Radionuclide	Occurrence	Average (pCi/l)	High (pCi/l)	Low (pCi/l)
Mn-54	7/47	9.91E-3	1.44E-2	6.34E-3
Co-58	11/47	2.66E-2	6.02E-2	8.68E-3
Co-60	30/47	4.84E-2	8.35E-2	2.32E-2
I-131	5/47	1.89E-2	3.45E-2	9.47E-3
Cs-134	16/47	2.22E-1	5.48E-1	9.50E-3
Cs-137	37/47	2.26E-1	7.40E-1	8.85E-3
Sn-113	+1/48	3.38E-3	single	value

3.9 Thermoluminescent Dosimetry Area Monitors

The average dose rate from all indicator stations 1.68 mrem/wk which is comparable to the control station average of 1.65 mrem/wk. The only significantly higher reading was observed at Station 6 (Robinson Unit 1). This station has traditionally exhibited higher readings and shows no significant change from previous years.

3.10 Special Activities

Carolina Power & Light Company received NRC approval on February 17, 1983, to dispose slightly contaminated sediment from the east and west settling ponds within the H.B. Robinson Plant restricted area to the ash pond in the owner-controlled area. Sequently, 4,793 cubic meters of material, primarily fly and bottom ash, was transferred in July and August 1983. The average concentration was 1.68E-5 μCi/g, wet, and 4.08E-6 μCi/g, wet, for east and west settling pond sediment, respectively.

3.11 Summary

In summary, the following statements can be made in regard to all radioactive effluents (air particulate, gaseous, and liquid) from the H.B. Robinson Steam Electric Plant:

1. All detectable radioactivities have been below the levels set forth in the Code of Federal Regulations, Title 10, Part 20.

2. The radioactivity released from the H.B. Robinson Steam Electric Plant has not significantly increased the amount of radioactivity detected in the environs surrounding the plant.

3. The environmental analyses performed during 1983 demonstrate that the H.B. Robinson Steam Electric Plant and the environment can exist in harmony and produce electricity safely while ensuring the safety of the general public.

4.0 MISSED SAMPLES AND ANALYSES

4.1 Air Particulate (Weekly)

Analyses not included in Table 2-1 for gross alpha and gross beta are summarized below:

Location	Date	Reason
Station 17	February 28	Vibrations caused it to unplug itself. Volume = 23.5 m^3
Station 35	April 11	Wind blew air filter into creek.
Station 35	December 4	Tripped breaker switch. Volume = 3.9 m^3

4.2 Aquatic Vegetation and Bottom Sediment

Station 33 has been dropped from H.B. Robinson's Environmental Program effective July 1983 due to ditch modification.

4.3 Glass Wool and Resin Samples at Station 5

No glass wool and resin samples collected on January 3, August 29, September 4, September 11, and September 18 due to sampler being out of service.

4.4 Environmental TLDs

The following thermoluminescent dosimeter results were missing in 1983:

Month	Sample Station	Reason
January	Station 12	Badge lost in field.
	Station 13	Damaged by water.
February	Station 4	Lost in analysis.
	Station 22	Badge lost in field.
March	Station 9	Damaged by water.
	Station 16	Damaged by water.
	Station 30	Damaged by water.
May	Station 29	Badge lost in field.
June	Station 6	Badge lost in field.
	Station 18	Badge lost in field.
	Station 31	Badge lost in field.
July	Station 6	Badge lost in field.
August	Station 7	Badge lost in field.
	Station 9	Damaged by water.

5.0 EPA LABORATORY INTERCOMPARISON PROGRAM

The Radiological Environmental Laboratory at the Harris Energy & Environmental Center in New Hill, North Carolina, provides radioanalytical services for CP&L's nuclear plant environmental surveillance programs. The laboratory is a participant in the EPA cross-check program and uses its performance in this program as a major determinant of the accuracy and precision of its analytical results.

During 1983, 28 samples comprising the four major types of environmental media (milk, water, food, and air filters) were received. A total of 83 individual radionuclide analyses were performed on these samples. A summary of the analytical results is as follows:

Normalized Deviation From Known Value (∂)	Percent of Analyses
≤ 0.5	40
≤ 1.0	59
≤ 1.5	75
≤ 2.0	82
≤ 2.5	89
≤ 3.0	90

Eight of eighty three analyses exceeded three standard deviations from the known values. These results required investigative and corrective actions as follows:

- In February 1983, a Sr-89 value for milk was reported which was 32 percent lower than the known activity. The beta counter was recalibrated for Sr-89 and Y-90 efficiencies. Two subsequent Sr-89 analyses of milk were within acceptable limits.

- In June 1983, two gross beta analyses performed within three days of one another were low by 13 and 19 percent, respectively. Recalibration of the beta detector resulted in subsequent gross beta values within acceptable limits.

- In February and May 1983, Ru-106 analysis of two mixed gamma samples were low in one case and high in another. At the same time, the activities reported for the five other nuclides in the mixture were very close to the known values. The erratic results are primarily due to the need to rely on a low-abundance (9.9 percent) Ru-106 peak at 621.8 kev to calculate sample activity. The most abundant energy line is too close to the positron annihilation peak for accurate quantitative analyses.

- In May and June 1983, low Sr-90 activities were reported for a water and a milk sample. The levels were approximately 30 percent low and were traced to the use of a two-year-old yttrium carrier solution which was no longer at its stated concentration. A monthly standardization program for all carrier solutions used in radiochemical analyses was initiated.

- In December 1983 the Sr-90 activity reported for a milk sample was low by a factor of 4. The Sr-89 activity was correct, and other possible sources of error were eliminated. Technician error at a critical step in the yttrium analyses was suspected.