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, 1982, THROUGH DECEMBER 31, 1982

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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 1982. This is the sixth 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. Although a relatively insignificant dose is involved, 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.

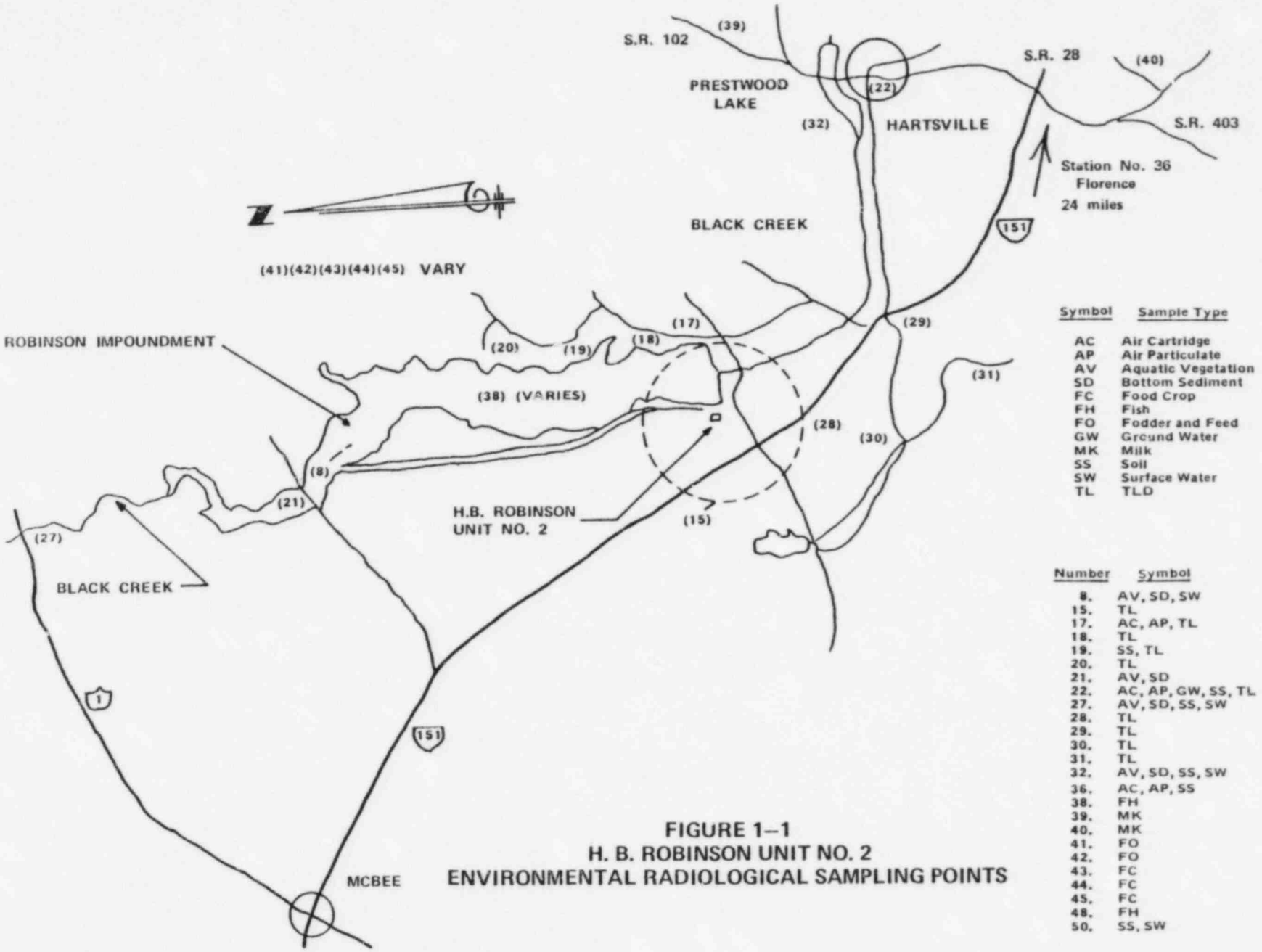
A tabulation of the specific methods used in monitoring the various pathways of exposure to man is as follows:

### Gaseous Effluent Path

| | |
|---|---|
| Submersion Dose and other External Dose | Thermoluminescent Dosimetry Area Monitors |
| Vegetation Path | Vegetation Samples<br>Soil Samples<br>Air Samples |
| Inhalation Path | Air Samples |
| Milk Path | Milk Samples<br>Feed and Fodder Crop<br>Air Samples |

### Liquid Effluent Path

| | |
|---|---|
| Fish Path | Surface Water Samples<br>Bottom Sediment Samples<br>Aquatic Vegetation Samples<br>Fish Samples |
| Water and Shoreline Dose | Thermoluminescent Dosimetry Area Monitors<br>Surface Water Samples<br>Bottom Sediment Samples<br>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**

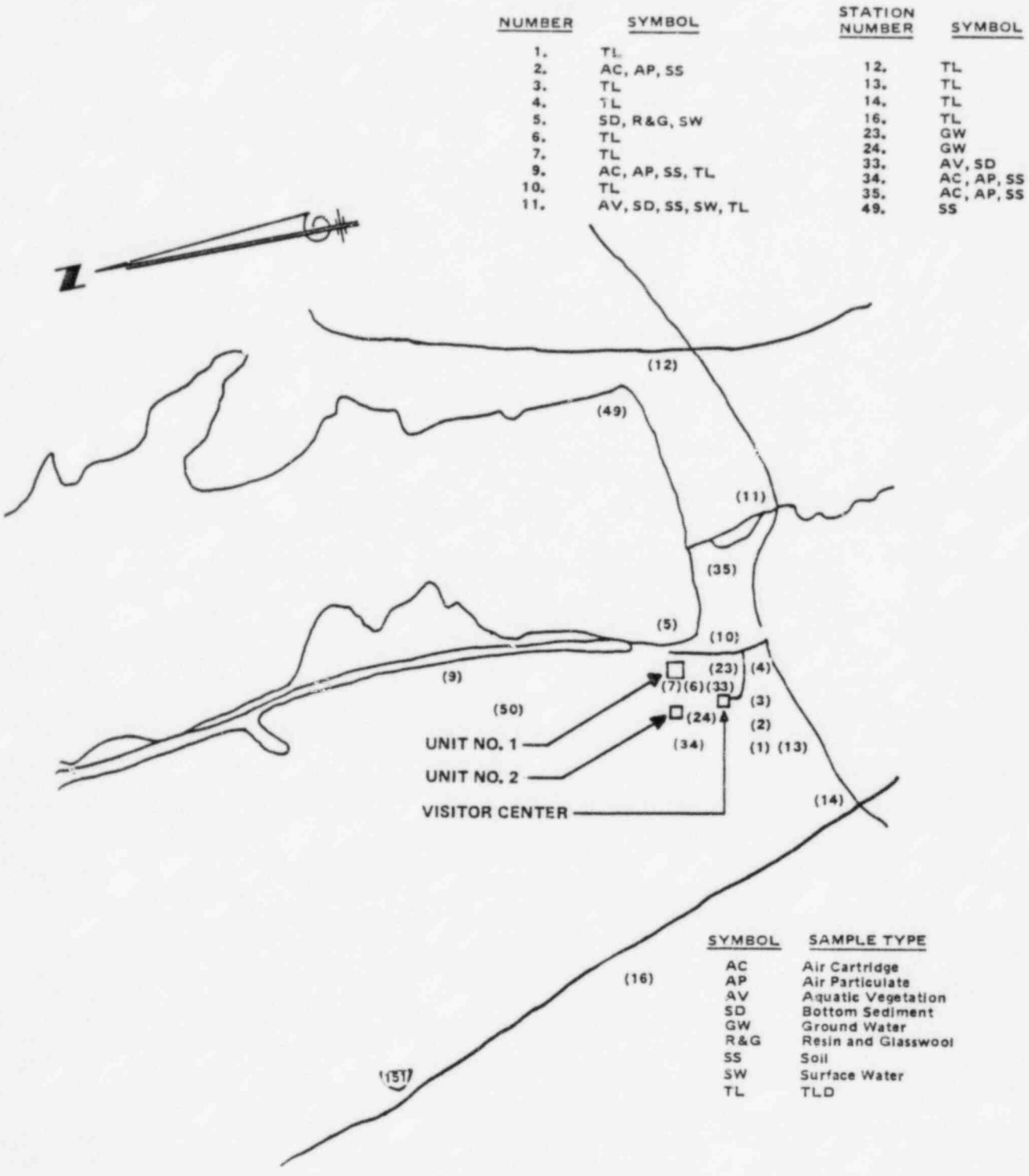



FIGURE 1–2
H. B. ROBINSON UNIT NO. 2
ENVIRONMENTAL RADIOLOGICAL SAMPLING POINTS
ON SITE

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<br>9-Microwave Tower<br>17-East Shore of Lake Across from Plant Intake<br>22-Hartsville[1]<br>34-End of Construction Road West of Plant<br>35-Dam (West End)<br>36-Florence | Weekly | 300 cu. m. | Iodine |
| Air Particulate (AP) | 2-Visitors Center<br>9-Microwave Tower<br>17-East Shore of Lake Across from Plant Intake<br>22-Hartsville[1]<br>34-End of Construction Road West of Plant<br>35-Dam (West End)<br>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<br>11-Black Creek at Road 1623<br>21-Bridge at North End of Lake<br>27-Black Creek at U.S. 1[1]<br>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<br>8-Discharge Canal Outfall<br>11-Black Creek at Road 1623<br>21-Bridge at North End of Lake<br>27-Black Creek at U.S. 1[1]<br>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 |
| Feed Crop (FO) | 39-Lyndales's Farm<br>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 |

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<br>45-Varies | Twice during growing season (started 1977) | 500 grams | Gamma |
| Groundwater (GW) | 22-Hartsville<br>23-Unit 1 Well near Site Entrance<br>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<br>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-Visitors Center<br>9-Microwave Tower<br>11-Black Creek at Road 1623<br>19-East Shore of Lake (North of 18)<br>22-Hartsville<br>27-Black Creek at U.S. 1<br>32-Prestwood Lake<br>34-End of Construction Road West of Plant<br>35-Dam (West End)<br>36-Florence | *Every 3 years<br><br>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 | Semiannual (1 square foot by 1-inch deep) | 500 grams | Gross Beta, K-40, Gamma |
| | 50-Ash Pond[3] | Semiannual (1 square foot by 1-inch deep) | 500 grams | K-40, Gamma |

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

TABLE 1-1 (cont'd)

| Sample Type | Sampling Point and Description | Sampling Frequency | Sample Size | Sample Analysis |
|---|---|---|---|---|
| Surface Water (SW) | 5-Plant Intake<br>8-Discharge Canal Outfall<br>32-Prestwood Lake | Weekly | 2.5 liters | Weekly--Gross Alpha, Gross Beta, and Tritium, (Gamma and Sr-89, 90 if Gross Beta > 100 pCi/l)<br>Monthly Composite--Gross Alpha, Gross Beta, Tritium, Gamma, and Sr-89, 90<br>Quarterly Composite--Gross Alpha, Gross Beta, Tritium (Gamma Sr-89, 90 if Gross Beta > 100 pCi/l) |
| | 11-Black Creek at Road 1623<br>27-Black Creek at U.S. 1[1] | Twice Weekly[4]<br>Weekly (started on 3/4/77) | | |
| | 5-Plant Intake (Ion Exchange Resin)<br>5-Plant Intake (Glasswool) | Weekly | 2,000 liters | Gamma |
| | 50-Ash Pond[4] | Monthly | 2.5 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<br>3-South Property Line near Visitors Center<br>4-South Property Line near Road 1623<br>6-Robinson Unit 1<br>7-Robinson Unit 1<br>9-Microwave Tower<br>10-Picnic Area<br>11-Black Creek at Road 1623<br>12-Intersection of Roads 1623) and 1639<br>13-West Property Line near Construction Road<br>14-Intersection Area for Road 1623 and Route 151<br>15-Pine Ridge Baptist Church and Route 151<br>16-Route 151 - 0.5 mile North of Road 1623<br>17-East Shore of Lake across from Plant Intake<br>18-East Shore of Lake (North of 17)<br>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)<br>22-Hartsville[1]<br>28-Intersection of Transmission Lines and Route 151<br>29-Intersection of S.C. 200 and Route 151<br>30-Intersection of S.C. 200 and S.C. 53<br>31-Kelly Town | Monthly | Not Applicable | TLD Readout |

[1]Control Station

[2]This particular sampling station is an alternate pathway for low-level liquid releases to the environment. Based on previous results, a more frequent sampling program has been implemented.

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

[4]This location was sampled twice weekly as a result of a directive by the NRC to CP&L due to no composite sampler being available until the week of April 6, 1982.

## 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

No specific control locations have been 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 1982.

TABLE 2-1

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

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

Docket Numbers - 50-261
Calendar Year 1982

| Medium or Pathway Sampled or Measured (Unit of Measurement) | Type and 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 Nonroutine Reported Measurements (3) |
|---|---|---|---|---|---|---|---|
| Air Cartridges ($pCi/m^3$) | $I-131_{(4)}$ 363 | 7.00E-2 | All less than MDA | All less than MDA | | All less than MDA | N/A |
| Air Particulate ($pCi/m^3$) | Gross Alpha 362(4) | 2.00E-3 | 1.09E-2 (301/310) 8.25E-4 - 5.55E-2 | Visitor's Center 0.2 mi SW | 1.33E-2 (52/52) 1.00E-3 - 5.55E-2 | 1.30E-2 (49/52) 1.12E-3 - 5.59E-2 | N/A |
| | Gross Beta 362(4) | 3.00E-3 | 2.89E-2 (309/310) 5.13E-3 - 8.79E-2 | Visitor's Center 0.2 mi SW | 3.33E-2 (52/52) 7.74E-3 - 8.79E-2 | 3.01E-2 (52/52) 1.09E-2 - 9.56E-2 | N/A |
| | Sr89 84 | 1.40E-3 | 3.73E-3 (3/72) 8.48E-4 - 7.43E-3 | End of Construction Road - West of Plant 0.2 mi W | 7.43E-3 (1/12) (single value) | All less than MDA | N/A |
| | Sr90 84 | 9.00E-4 | 5.99E-3 (1/72) (single value) | Visitor's Center 0.2 mi SW | 5.99E-3 (1/12) (single value) | 5.93E-4 (1/12) (single value) | N/A |

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|---|---|---|---|---|---|---|---|
| Air Particulate ($pCi/m^3$) | Gamma 84 | | | | | | |
| | Cs-137 | 6.00E-3 | 5.46E-3 (2/72) 3.91E-3 - 7.02E-3 | Visitors Center 0.2 mi SW | 7.02E-3 (1/12) (single value) | All less than MDA | N/A |
| Aquatic Vegetation (pCi/gram) dry | Gross Beta 32 | 4.00E+0 | 1.46E+1 (28/28) 1.29E+0 - 4.89E+1 | Prestwood Lake 4.9 mi ESE | 2.35E+1 (4/4) 1.04E+1 - 4.89E+1 | 6.42E+0 (4/4) 2.59E+0 - 1.25E+1 | N/A |
| | Sr-89 32 | 1.30E-1 | 2.02E-1 (5/28) 4.32E-2 - 3.23E-1 | Bridge at N End of Lake 4.7 mi N | 3.23E-1 (1/4) (single value) | 6.78E-1 (1/4) (single value) | N/A |
| | Sr-90 32 | 6.10E-2 | 9.97E-2 (7/28) 2.87E-2 - 2.02E-1 | Discharge Canal Outfall 3.8 mi N | 8.92E-2 (3/4) 6.54E-2 - 1.25E-1 | 8.64E-2 (2/4) 8.55E-2 - 8.73E-2 | N/A |
| | Gamma 36 | | | | | | |
| | Mn-54 | 6.50E-2 | 2.75E-1 (5/32) 9.28E-2 - 9.15E-1 | Discharge Canal Outfall 3.8 mi N | 5.28E-2 (2/4) 2.42E-1 - 8.15E-1 | All less than MDA | N/A |

TABLE 2-1

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

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

Docket Numbers - 50-261
Calendar Year 1982

| Medium or Pathway Sampled or Measured (Unit of Measurement) | Type and 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 Nonroutine Reported Measurements (3) |
|---|---|---|---|---|---|---|---|
| Aquatic Vegetation (pCi/gram) dry | Gamma 36 | | | | | | |
| | Co-58 | 6.00E-2 | 6.80E-1 (9/32) 1.85E-1 - 2.13E+0 | Discharge Canal Outfall 3.8 mi N | 1.29E+0 (2/4) 4.44E-1 - 2.13E+0 | All less than MDA | N/A |
| | Co-60 | 6.50E-2 | 8.79E-1 (11/32) 5.82E-2 - 5.37E+0 | Discharge Canal Outfall 3.8 mi N | 2.12E+0 (3/4) 4.87E-1 - 5.37E+0 | All less than MDA | N/A |
| | Nb-95 | 6.00E-2 | 1.68E-1 (1/32) (single value) | Bridge at N End of Lake 4.7 mi N | 1.68E-1 (1/4) (single value) | All less than MDA | N/A |
| | Cs-134 | 6.50E-2 | 3.64E-1 (3/32) 2.59E-1 - 4.25E-1 | Ditch Behind Visitors Center 0.1 mi SW | 3.64E-1 (3/12) 2.59E-1 - 4.25E-1 | All less than MDA | N/A |

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|---|---|---|---|---|---|---|---|
| Aquatic Vegetation (pCi/gram) dry | Gamma 36 | | | | | | |
| | Cs-137 | 7.00E-2 | 1.03E+0 (28/32) 1.16E-1 - 4.83E+0 | Ditch Behind Visitors Center 0.1 mi SW | 1.86E+0 (12/12) 1.47E-1 - 4.83E+0 | 4.97E-1 (4/4) 1.90E-1 - 6.89E-1 | N/A |
| | Ce-144 | 2.65E-1 | 7.33E-1 (4/32) 6.83E-1 - 7.70E-1 | Bridge at N End of Lake 4.7 mi N | 7.70E-01 (1/4) (single value) | All less than MDA | N/A |
| Bottom Sediment (pCi/gram) dry | Gross Beta 36 | 1.10E-1 | 1.29E+0 (29/32) 1.06E-1 - 4.44E+0 | Ditch Behind Visitors Center 0.1 mi SW | 2.45E+0 (12/12) 6.27E-1 - 4.44E+0 | 3.43E-1 (4/4) 7.02E-2 - 8.84E-1 | N/A |
| | Sr-89 36 | 5.00E-1 | 1.00E-1 (1/32) (single value) | Plant Intake 0.1 mi E | 1.00E-1 (1/4) (single value) | All less than MDA | N/A |
| | Sr-90 36 | 5.00E-1 | 2.75E-1 (5/32) 9.78E-2 - 4.31E-1 | Ditch Behind Visitors Center 0.1 mi SW | 2.82E-1 (3/12) 1.93E-1 - 3.60E-1 | All less than MDA | N/A |

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|---|---|---|---|---|---|---|---|
| Bottom Sediment (pCi/gram) dry | Gamma 36 | | | | | | |
| | K-40 | 2.30E-1 | 5.86E+0 (26/32) 2.05E-1 - 2.12E+1 | Ditch Behind Visitors Center 0.1 mi SW | 1.05E+1 (12/12) 8.52E-1 - 2.12E+1 | 4.14E-1 (4/4) 2.76E-1 - 6.23E-1 | N/A |
| | Co-60 | 3.00E-2 | 3.04E+0 (19/32) 1.46E-1 - 1.18E+1 | Ditch Behind Visitors Center 0.1 mi SW | 4.56E+0 (12/12) 7.66E-1 - 1.18E+1 | All less than MDA | N/A |
| | Cs-137 | 2.80E-2 | 5.22E-1 (21/32) 3.23E-2 - 1.94E+0 | Ditch Behind Visitors Center 0.1 mi SW | 6.67E-1 (12/12) 5.55E-2 - 1.94E+0 | 1.60E-1 (2/4) 2.67E-2 - 2.94E-1 | N/A |
| | Ce-141 | 4.30E-2 | 2.23E-1 (1/32) (single value) | Black Creek at Road 1623 0.6 mi ESE | 2.23E-1 (1/4) (single value) | All less than MDA | N/A |

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|---|---|---|---|---|---|---|---|
| Fish Bone (pCi/gram) dry (Bottom Feeders) | Sr-89 3(5) | 2.00E+0 | 1.51E+0 (2/3) 9.03E-1 - 2.11E+0 | Site varies within Lake Robinson | 1.51E+0 (2/3) 9.03E-1 - 2.11E+0 | No Control | N/A |
| | Sr-90 3(5) | 2.00E+0 | 7.19E+0 (3/3) 8.16E-1 - 9.88E+0 | Site varies within Lake Robinson | 7.19E+0 8.16E-1 - 9.88E+0 | No Control | N/A |
| Fish Bone (pCi/gram) dry (Free Swimmers) | Sr-89 4 | 2.00E+0 | 1.46E+0 (3/4) 1.49E-1 - 3.66E+0 | Site varies within Lake Robinson | 1.46E+0 (3/4) 1.49E-1 - 3.66E+0 | No Control | N/A |
| | Sr-90 4 | 2.00E+0 | 6.27E+0 (2/4) 5.53E+0 - 7.01E+0 | Site varies within Lake Robinson | 6.27E+0 (2/4) 5.53E+0 - 7.01E+0 | No Control | N/A |
| Fish Flash (pCi/gram) dry (Bottom Feeders) | Gross Beta 3(5) | 4.00E+0 | 1.37E+1 (3/3) 1.28E+1 - 9.70E+0 | Site varies within Lake Robinson | 1.37E+1 (3/3) 1.28E+1 - 9.70E+0 | No Control | N/A |
| (Free Swimmers) | Gross Beta 4 | 4.00E+0 | 1.36E+1 (4/4) 1.17E+1 - 1.61E+1 | Site varies within Lake Robinson | 1.36E+1 (4/4) 1.17E+1 - 1.61E+1 | No Control | N/A |

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|---|---|---|---|---|---|---|---|
| Fish Flesh (pCi/gram) dry Bottom Feeders | Sr-89 3(5) | 2.00E-1 | 6.10E-1 (1/3) (single value) | Site varies within Lake Robinson | 6.10E-1 (1/3) (single value) | No Control | N/A |
| | Sr-90 3(5) | 1.00E-1 | 4.60E-1 (3/3) 2.33E-1 - 6.32E-1 | Site varies within Lake Robinson | 4.60E-1 (3/3) 2.33E-1 - 6.32E-1 | No Control | N/A |
| Free Swimmers | Sr-89 4 | 2.00E-1 | 5.38E-1 (1/4) (single value) | Site varies within Lake Robinson | 5.38E-1 (1/4) (single value) | No Control | N/A |
| | Sr-90 4 | 1.00E-1 | 1.84E-1 (3/4) 8.04E-2 - 2.81E-1 | Site varies within Lake Robinson | 1.84E-1 (3/4) 8.04E-2 - 2.81E-1 | No Control | N/A |
| (Bottom Feeders) | Gamma 3(5) | | | | | | |
| | K-40 | 3.00E-1 | 8.01E+0 (3/3) 6.92E+0 - 9.12E+0 | Site varies within Lake Robinson | 8.01E+0 (3/3) 6.92E+0 - 9.12E+0 | No Control | N/A |

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| Medium or Pathway Sampled or Measured (Unit of Measurement) | Type and 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 Nonroutine Reported Measurements (3) |
|---|---|---|---|---|---|---|---|
| Fish Flesh (pCi/gram) dry (Bottom Feeders) | Gamma 3(5) Cs-137 | 7.00E-2 | 5.75E-1 (3/3) 3.21E-1 - 8.29E-1 | Site varies within Lake Robinson | 5.75E-1 (3/3) 3.21E-1 - 8.29E-1 | No Control | N/A |
| Free Swimmers | Gamma 4 K-40 | 3.00E-1 | 6.51E+0 (4/4) 7.34E-1 - 9.83E+0 | Site varies within Lake Robinson | 6.51E+0 (4/4) 7.34E-1 - 9.83E+0 | No Control | N/A |
| | Cs-137 | 7.00E-2 | 6.98E-1 (4/4) 9.86E-2 - 1.30E+0 | Site varies within Lake Robinson | 6.98E-1 (4/4) 9.86E-2 - 1.30E+0 | No Control | N/A |
| Fodder and Feed (pCi/gram) dry | Gamma 4 Cs-137 | 7.00E-2 | 2.65E-1 (3/4) 1.98E-1 - 3.52E-1 | Lyndale's Farm 11.3 mi SSW | 2.98E-1 (2/2) 2.45E-1 - 3.52E-1 | No Control | N/A |
| Food Crop(6) (pCi/gram) dry | Gamma 6 Cs-137 | 7.00E-2 | 3.52E-1 (3/6) 1.36E-1 - 5.36E-1 | Howle's Farm 5.0 mi ESE | 4.60E-1 (2/2) 3.84E-1 - 5.36E-1 | No Control | N/A |

TABLE 2-1

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

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Darlington County, South Carolina

Docket Numbers - 50-261
Calendar Year 1982

| Medium or Pathway Sampled or Measured (Unit of Measurement) | Type and 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 Nonroutine Reported Measurements (3) |
|---|---|---|---|---|---|---|---|
| Groundwater (pCi/liter) | Gross Alpha 12 | 2.00E-1 | 9.74E-1 (8/12) 6.57E-1 - 140E+0 | Well at West Side - Unit 2 0.1 mi SW | 1.03E+0 (2/4) 6.57E-1 - 1.40E+0 | No Control | N/A |
| | Gross Beta 12 | 8.20E-1 | 9.44E-1 (9/12) 4.56E-1 - 2.03E+0 | Unit 1 Well Near Site Entrance 0.1 mi SSE | 1.06E+0 (4/4) 5.73E-1 - 2.03E+0 | No Control | N/A |
| | Sr-89 12 | 5.00E+0 | All less than MDA | All less than MDA | | No Control | N/A |
| | Sr-90 12 | 1.20E+0 | All less than MDA | All less than MDA | | No Control | N/A |
| | Tritium 12 | 3.50E+2 | 2.11E+2 (2/12) 1.60E+2 - 3.17E+2 | Hartsville 5.8 mi ESE | 3.17E+2 (1/4) (single value) | No Control | N/A |

TABLE 2-1

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

H. B. Robinson Steam Electric Plant
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Calendar Year 1982

| Medium or Pathway Sampled or Measured (Unit of Measurement) | Type and 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 Nonroutine Reported Measurements (3) |
|---|---|---|---|---|---|---|---|
| | Gamma | | | | | | |
| Groundwater | 12 | | | | | | |
| (pCi/liter) | Cs-137 | 8.00E+0 | 7.35E+0 (2/12)<br>7.19E+0 - 7.51E+0 | Well at West Side of Unit 2<br>0.1 mi SW | 7.51E+0 (1/4)<br>(single value) | No Control | N/A |
| Milk | I-131 | 1.50E-1 | 6.91E-1 (3/24) | Lyndale's Farm | 6.91E-1 (3/12) | No Control | N/A |
| (pCi/liter) | 24 | | 4.90E-1 - 9.60E-1 | 11.3 mi SSW | 4.90E-1 - 9.60E-1 | | |
| | Sr-89 | 3.00E+0 | 3.65E+0 (4/24) | Lyndale's Farm | 3.97E+0 (2/12) | No Control | N/A |
| | 24 | | 1.97E+0 - 4.70E+0 | 11.3 mi SSW | 3.79E+0 - 4.16E+0 | | |
| | Sr-90 | 2.00E+0 | 2.37E+0 (8/24) | Fink's Farm | 2.48E+0 (4/12) | No Control | N/A |
| | 24 | | 1.38E+0 - 3.76E+0 | 7.0 mi SE | 1.38E+0 - 3.76E+0 | | |
| | Gamma | | | | | | |
| | 24 | | | | | | |
| | K-40 | 3.00E+2 | 9.00E+2 (24/24) | Fink's Farm | 1.08E+3 (12/12) | No Control | N/A |
| | | | 1.20E+2 - 1.46E+3 | 7.0 mi SE | 1.20E+2 - 1.46E+3 | | |

TABLE 2-1

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

H. B. Robinson Steam Electric Plant
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|---|---|---|---|---|---|---|---|
| | Gamma | | | | | | |
| Milk | 24 | | | | | | |
| (pCi/liter) | Cs-137 | 9.00E+0 | 7.55E+0 (5/24) | Fink's Farm | 7.56E+0 (2/12) | No Control | N/A |
| | | | 4.47E+0 - 1.03E+1 | 7.0 mi SE | 6.50E+0 - 8.63E+0 | | |
| Soil | Gross Beta | 9.00E-2 | 5.06E-1 (6/6) | Hartsville | 1.48E+0 | No Control | N/A |
| (pCi/gram) dry | 6 | | 9.88E-2 - 1.48E+0 | 5.8 mi ESE | (single value) | | |
| | Sr-89 | 2.70E-1 | All less than MDA | All less than MDA | | No Control | N/A |
| | 4 | | | | | | |
| | Sr-90 | 1.30E-1 | 3.68E-1 (1/4) | Black Creek | 3.68E-1 (1/1) | No Control | N/A |
| | 4 | | (single value) | at US 1 | (single value) | | |
| | | | | 5.1 mi ESE | | | |
| | Gamma | | | | | | |
| | 8 | | | | | | |
| | K-40 | 2.30E-1 | 1.34E+0 (6/8) | Ash Pond | 3.27E+0 (2/2) | No Control | N/A |
| | | | 1.26E-1 - 4.47E+0 | .9 mi NNW | 2.08E+0 - 4.47E+0 | | |

TABLE 2-1

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

H. B. Robinson Steam Electric Plant
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| Medium or Pathway Sampled or Measured (Unit of Measurement) | Type and 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 Nonroutine Reported Measurements (3) |
|---|---|---|---|---|---|---|---|
| | Gamma | | | | | | |
| Soil | 8 | | | | | | |
| (pCi/gram) dry | Co-60 | 3.00E-2 | 2.02E+0 (2/8)<br>6.37E-1 - 3.40E+0 | Ash Pond<br>0.9 mi NNW | 2.02E+0 (2/2)<br>6.37E-1- 3.40E+0 | No Control | N/A |
| | Cs-137 | 2.80E-2 | 2.97E-i (5/8)<br>8.83E-2 - 7.70E-1 | Hartsville<br>5.8 mi ESE | 7.70E-1 (1/1)<br>(single value) | No Control | N/A |
| Surface Water (pCi/liter) (Sampled Weekly) | Gross Alpha 273(7) | 2.00E-1 | 1.22E+0 (117/221)<br>4.42E-1 - 3.66E+0 | Prestwood Lake<br>4.9 mi ESE | 1.33E+0 (34/52)<br>5.27E-1 - 3.66E+0 | 1.10E+0 (24/52)<br>4.50E-1 - 2.37E+0 | N/A |
| | Gross Beta 273(7) | 8.20E-1 | 1.59E+0 (193/221)<br>5.42E-1 - 5.13E+0 | Black Creek at Road 1623<br>0.6 mi ESE | 1.68E+0 (55/65)<br>7.93E-1 - 5.13E+0 | 1.19E+0 (42/52)<br>4.93E-1 - 2.33E+0 | N/A |
| | Tritium 273(7) | 3.50E+2 | 7.19E+2 (160/221)<br>3.24E+2 - 2.58E+3 | Discharge Canal Outfall<br>3.8 mi N | 7.81E+2 (40/52)<br>3.51E+2 - 2.26E+3 | 4.10E+2 (8/52)<br>3.31E+2 - 4.94E+2 | N/A |

TABLE 2-1

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|---|---|---|---|---|---|---|---|
| (Monthly Composite) | Gross Alpha | 2.00E-1 | 1.16E+0 (29/48) | Prestwood Lake | 1.21E+0 (7/12) | 1.01E+0 (3/12) | N/A |
| | 60 | | 4.69E-1 - 2.27E+0 | 4.9 mi ESE | 5.74E-1 - 1.73E+0 | 6.39E-1 - 1.32E+0 | |
| | Gross Beta | 8.20E-1 | 1.55E+0 (47/48) | Plant Intake | 1.67E+0 (12/12) | 1.31E+0 (11/12) | N/A |
| | 60 | | 6.59E-1 - 2.39E+0 | 0.1 mi E | 6.49E-1 - 2.30E+0 | 5.35E-1 - 2.02E+0 | |
| | Sr-89 | 5.00E+0 | 2.00E+0 (1/48) | Plant Intake | 2.00E+0 (1/12) | All less than MDA | N/A |
| | 60 | | (single value) | 0.1 mi E | (single value) | | |
| | Sr-90 | 1.20E+0 | 5.56E+0 (3/48) | Black Creek at Road 1623 0.6 mi ESE | 8.61E+0 (1/12) | 3.21E+0 (1/12) | N/A |
| | 60 | | 3.80E+0 - 8.61E+0 | | (single value) | (single value) | |
| Surface Water (pCi/liter) (Monthly Composite) | Tritium | 3.50E+2 | 6.54E+2 (43/48) | Discharge Canal Outfall 3.8 mi N | 7.51E+2 (11/12) | 3.69E+2 (2/12) | N/A |
| | 60 | | 4.31E+2 - 1.36E+3 | | 4.45E+2 - 1.36E+3 | 3.29E+2 - 4.10E+2 | |

TABLE 2-1

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY

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

Docket Numbers - 50-261
Calendar Year 1982

| Medium or Pathway Sampled or Measured (Unit of Measurement) | Type and 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 Nonroutine Reported Measurements (3) |
|---|---|---|---|---|---|---|---|
| | Gamma | | | | | | |
| Surface Water | 72 | | | | | | |
| (pCi/liter) | Cs-137 | 9.00E+0 | 5.29E+0 (4/60) | Black Creek | 5.84E+0 (1/12) | All less than MDA | N/A |
| (Monthly Composite) | | | 4.44E+0 - 5.84E+0 | at Road 1623 | (single value) | | |
| | | | | 0.6 mi ESE | | | |
| Surface Water | Gross Alpha | 2.00E-1 | 8.70E-1 (13/16) | Prestwood Lake | 1.00E+0 (4/4) | 6.79E-1 (3/4) | N/A |
| (pCi/liter) | 20 | | 3.16E-1 - 1.30E+0 | 4.9 mi ESE | 8.06E-1 - 1.26E+0 | 3.09E-1 - 1.31E+0 | |
| (Quarterly Composite) | | | | | | | |
| | Gross Beta | 8.20E-1 | 1.67E+0 (16/16) | Prestwood Lake | 1.76E+0 (4/4) | 1.30E+0 (4/4) | N/A |
| | 20 | | 9.73E-1 - 2.30E+0 | 4.9 mi ESE | 1.31E+0 - 2.20E+0 | 9.40E-1 - 1.95E+0 | |
| | Tritium | 3.50E+2 | 6.59E+2 (12/16) | Discharge Canal | 8.24E+2 (3/4) | All less than MDA | N/A |
| | 20 | | 3.29E+2 - 1.06E+3 | Outfall | 6.80E+2 - 1.06E+3 | | |
| | | | | 3.8 mi N | | | |
| | Gamma | | | | | | |
| Surface Water | 52 | | | | | | |
| (pCi/liter) | Mn-54 | 8.00E-3 | 3.77E-2 (8/52) | Plant Intake | 3.77E-2 (8/52) | No Control | N/A |
| (Ion Exchange Resin) | | | 1.57E-2 - 8.03E-2 | 0.1 mi E | 1.57E-2 - 8.03E-2 | | |

TABLE 2-1

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|---|---|---|---|---|---|---|---|
| | Gamma | | | | | | |
| Surface Water | 52 | | | | | | |
| (pCi/liter) | Co-58 | 9.00E-3 | 1.01E-1 (32/52) | Plant Intake | 1.01E-1 (32/52) | No Control | N/A |
| (Ion Exchange Resin) | | | 6.61E-3 - 2.50E-1 | 0.1 mi E | 6.61E-3 - 2.50E-1 | | |
| | Co-60 | 9.00E-3 | 1.61E-1 (32/52) | Plant Intake | 1.61E-1 (32/52) | No Control | N/A |
| | | | 1.08E-2 - 4.36E-1 | 0.1 mi E | 1.08E-2 - 4.36E-1 | | |
| | Cs-137 | 9.00E-3 | 1.12E-1 (37/52) | Plant Intake | 1.12E-1 (37/52) | No Control | N/A |
| | | | 2.71E-2 - 4.07E-1 | 0.1 mi E | 2.71E-2 - 4.07E-1 | | |
| Surface Water | Gamma | N/A | All less than MDA | All less than MDA | | No Control | N/A |
| (pCi/liter) | 52 | | | | | | |
| (Glass Wool) | | | | | | | |
| TLD | TLD | 3.00E-1 | 1.91E+0 (249/249) | Robinson Unit 1 | 4.65E+0 (12/12) | 1.61E+0 (12/12) | N/A |
| (millirem per wk) | 261(8) | | 6.00E-1 - 7.30E+0 | .02 mi E | 2.90E+0 - 7.30E+0 | 1.10E+0 - 2.40E+0 | |

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 parentheses.

3. Measurements in excess, at the 99.5 percent 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 cartridges are collected weekly for a possible 364 samples. However, samples collected on January 18 and April 5 at Station 17 and Station 35 were unavailable due to burned-out compressor and to wind blowing air filter into creek.

5. Third quarter bottom feeder flesh and bone samples were lost in analysis.

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

7. Surface water was sampled twice a week at Station 11 during the first quarter of 1982 as a result of not having a composite sampler. There was a total of 273 samples collected during 1982 of which 26 samples were for the first quarter at Station 11, plus 39 samples for the remaining three quarters, plus 4 other stations times 52 weeks.

8. Three TLDs were reported as missing in the field: Stations 11, 30, and 12 for the month of October, September, and June, respectively.

## 3.0 INTERPRETATION AND CONCLUSIONS

### 3.1 Air Samples

Air samples collected during 1982 contained no unusual levels of radioactivity. Gross alpha concentrations were measurable in 301 of 310 samples, averaging 1.09 E-2 $pCi/m^3$, compared to the control station average of 1.30 E-2 $pCi/m^3$. Measurable gross beta concentrations were observed in 309 of 310 samples, averaging 2.89 E-2 $pCi/m^3$, compared to the control station average of 3.01 E-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 three radionuclides during 1982 as summarized in Table 3-1.

Table 3-1
Radionuclides Detected During 1982 in
Monthly Composited Air Particulate Samples
and Fractional Occurrence

| Month | Location | Radionuclides ($pCi/m^3$) |
|---|---|---|
| February | Florence (1/12) | Sr-89<br>2.90 E-3 |
| March | Microwave Tower (1/12) | Sr-89<br>8.48 E-4 |
| May | Visitors Center (1/12) | Sr-90<br>5.99 E-3 |
| May | Hartsville - Control (1/12) | Sr-90<br>5.93 E-4 |
| May | End of Construction Road West of Plant (1/12) | Sr-89<br>7.43 E-3 |
| October | Visitors Center (1/12) | Cs-137<br>7.02 E-3 |
| October | Microwave Tower (1/12) | Cs-137<br>3.91 E-3 |

The concentrations and sporadic appearances of these radionuclides are consistent with ambient levels observed in recent years. In general, these radionuclides do not indicate the Robinson Plant as their source since other shorter-lived fission products would likewise be detected in these samples.

Figure 3-1

CP&L ENVIRONMENTAL MONITORING SYSTEM
GROSS BETA
AIR PARTICULATE
(PICOCURIES PER CUBIC METER)

STAR IS SAMPLE STATION ACTIVITY
DIAMOND IS CONTROL STATION ACTIVITY
PLANT=HBR POINT=02

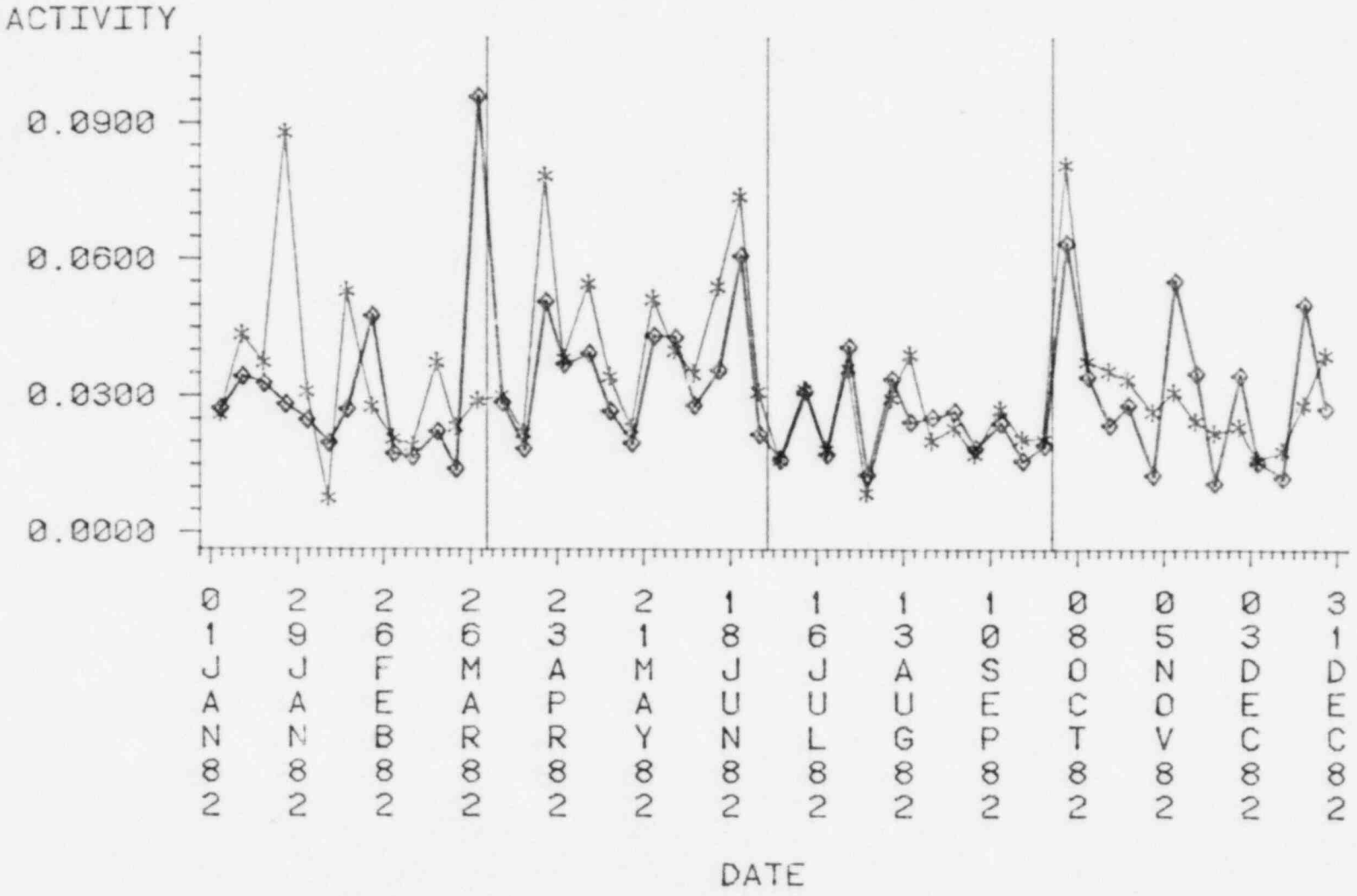


Figure 3-2

CP&L ENVIRONMENTAL MONITORING SYSTEM
GROSS BETA
AIR PARTICULATE
(PICOCURIES PER CUBIC METER)

STAR IS SAMPLE STATION ACTIVITY
DIAMOND IS CONTROL STATION ACTIVITY
PLANT=HBR POINT=09

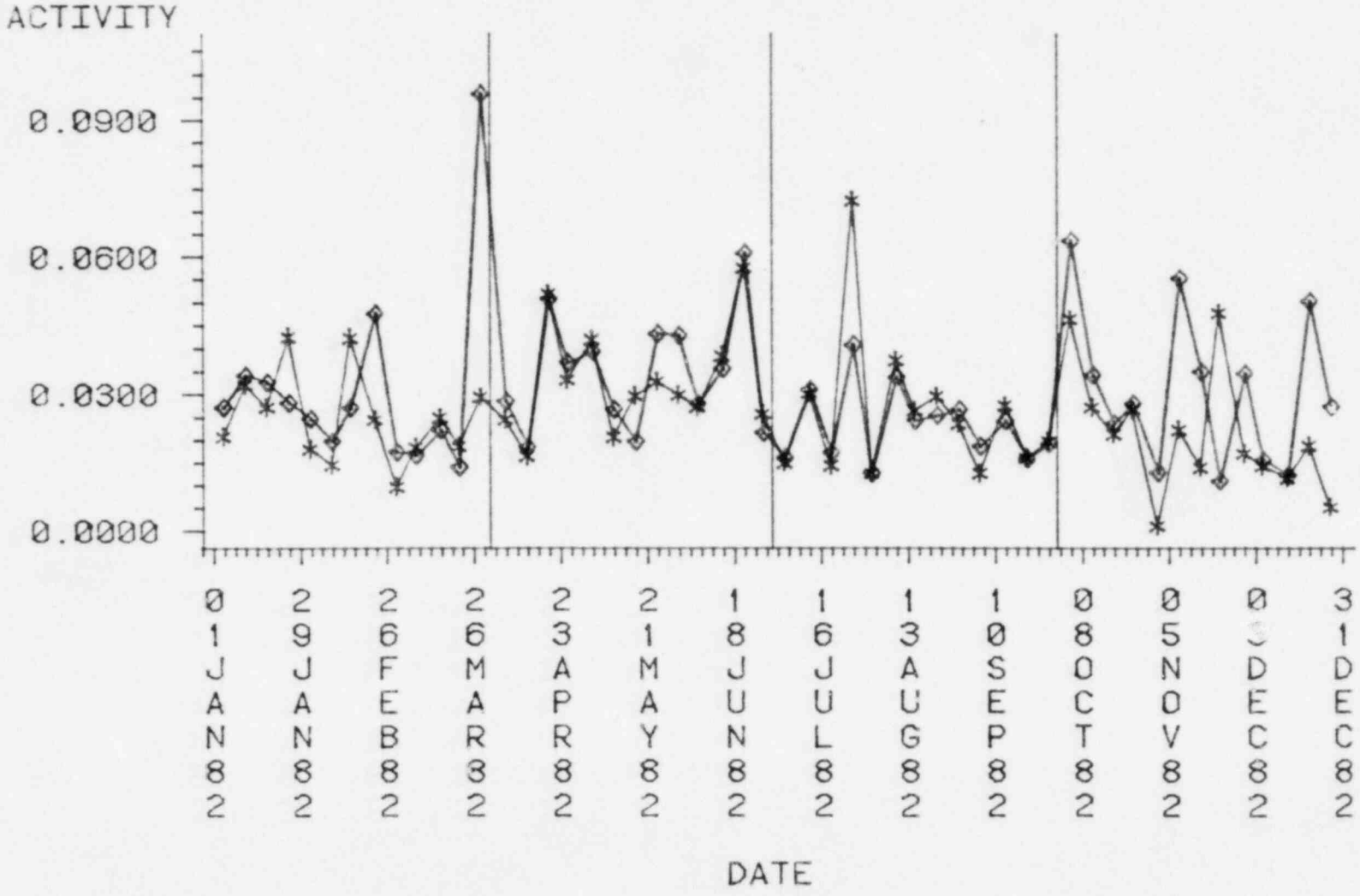


Figure 3-3

CP&L ENVIRONMENTAL MONITORING SYSTEM
GROSS BETA
AIR PARTICULATE
(PICOCURIES PER CUBIC METER)

STAR IS SAMPLE STATION ACTIVITY
DIAMOND IS CONTROL STATION ACTIVITY
PLANT=HBR POINT=17

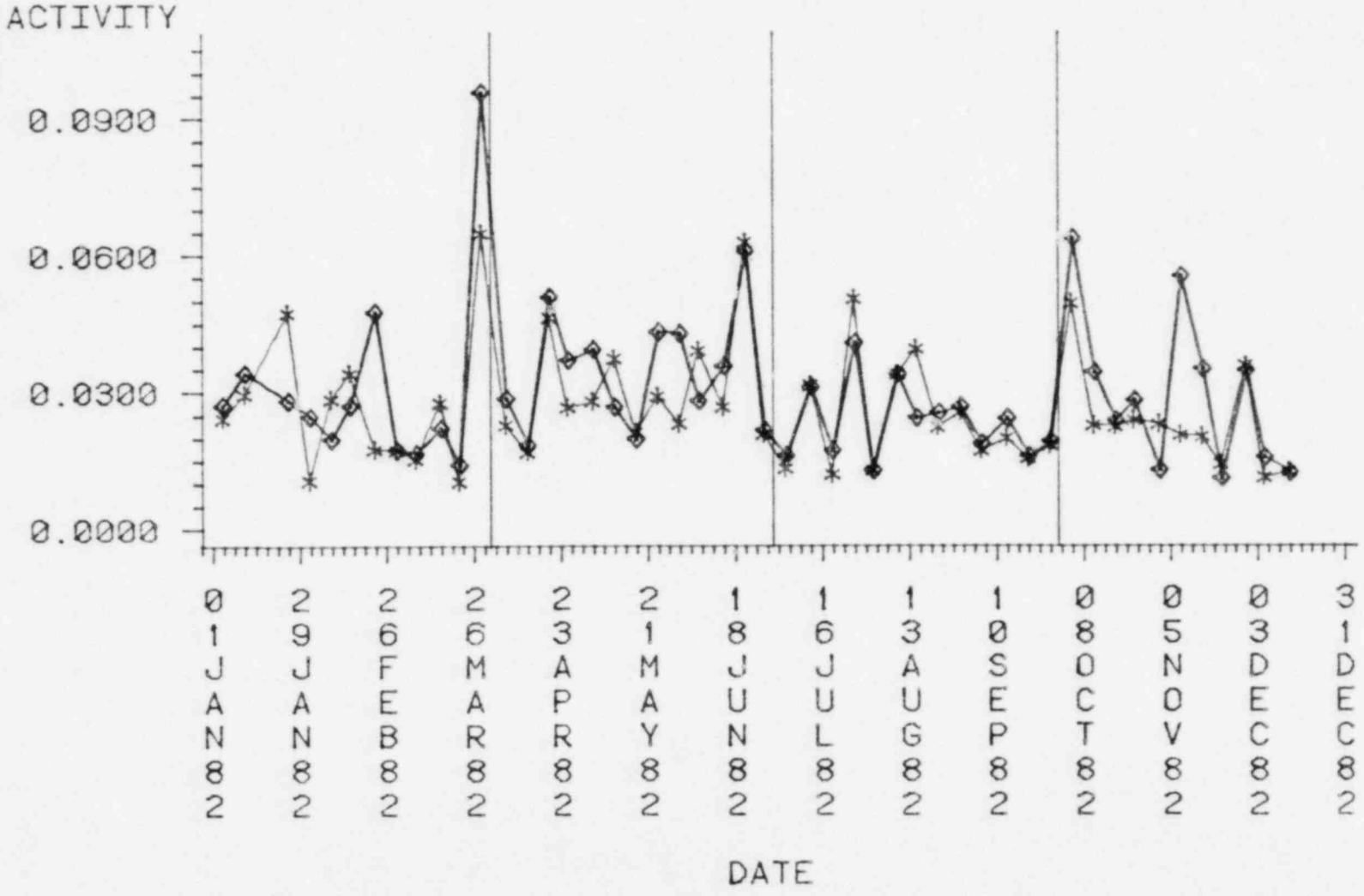


Figure 3-4

CP&L ENVIRONMENTAL MONITORING SYSTEM
GROSS BETA
AIR PARTICULATE
(PICOCURIES PER CUBIC METER)

STAR IS SAMPLE STATION ACTIVITY
DIAMOND IS CONTROL STATION ACTIVITY
PLANT=HBR POINT=34

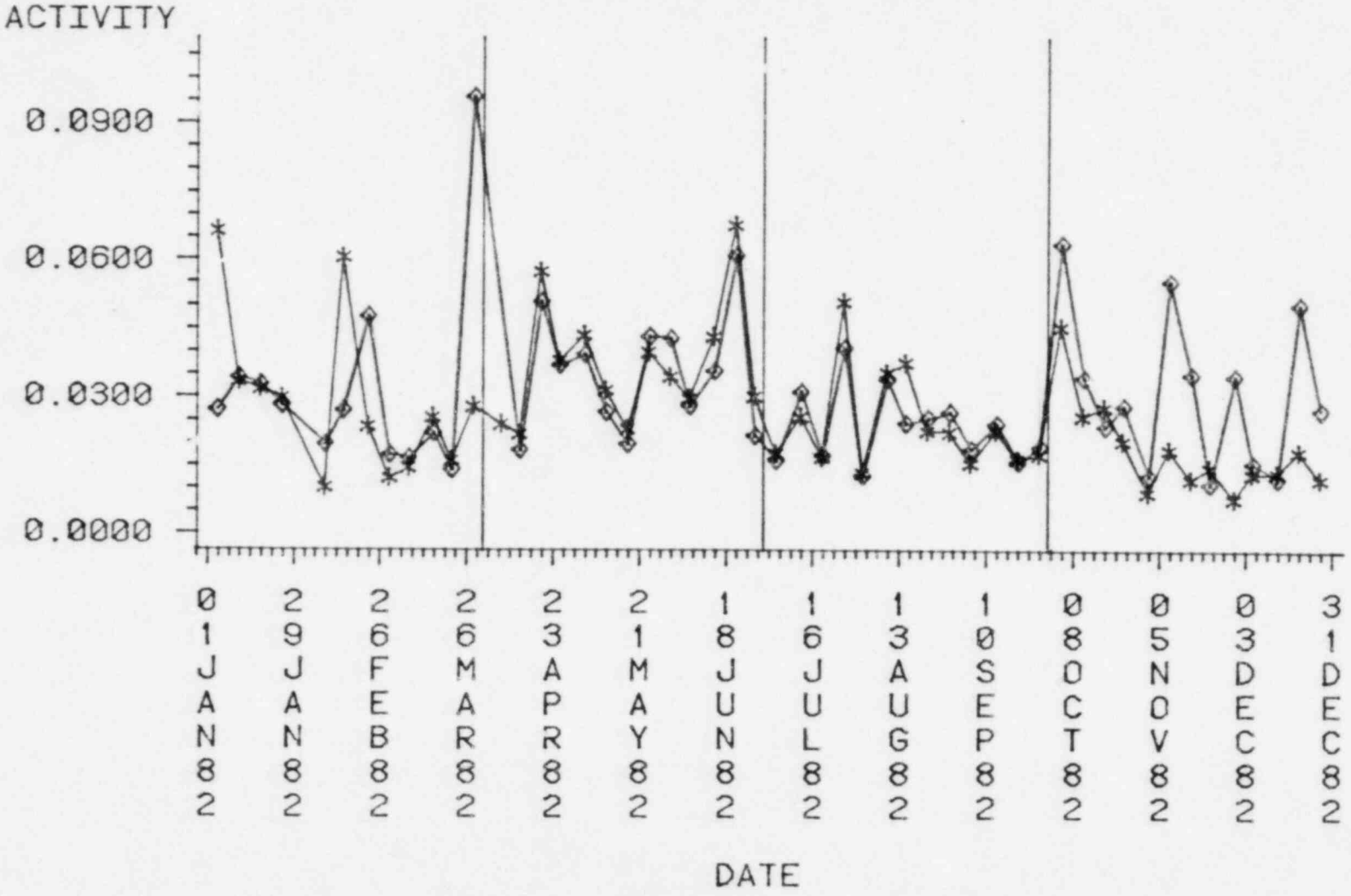


Figure 3-5

CP&L ENVIRONMENTAL MONITORING SYSTEM
GROSS BETA
AIR PARTICULATE
(PICOCURIES PER CUBIC METER)

STAR IS SAMPLE STATION ACTIVITY
DIAMOND IS CONTROL STATION ACTIVITY
PLANT=HBR POINT=35

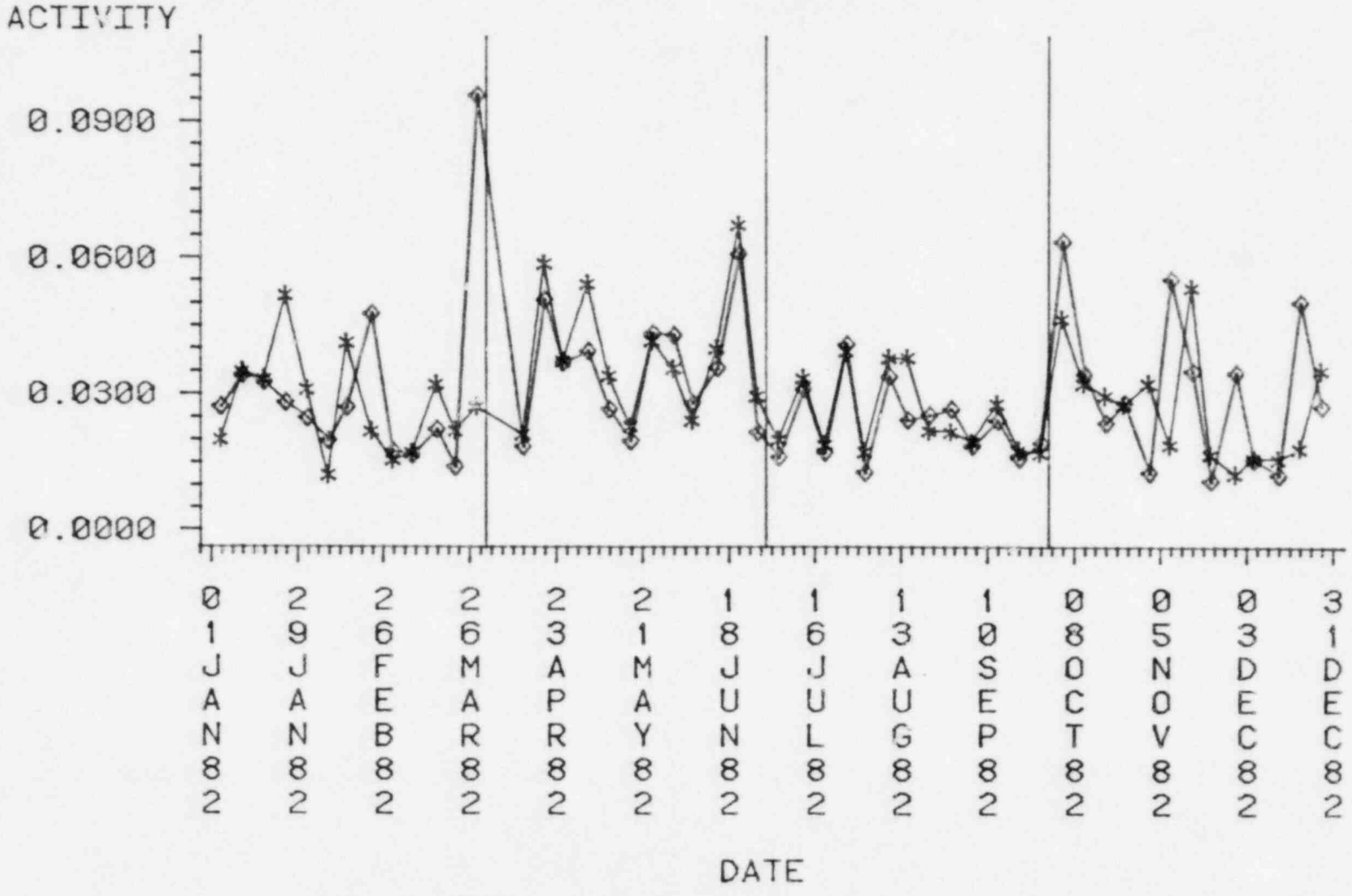
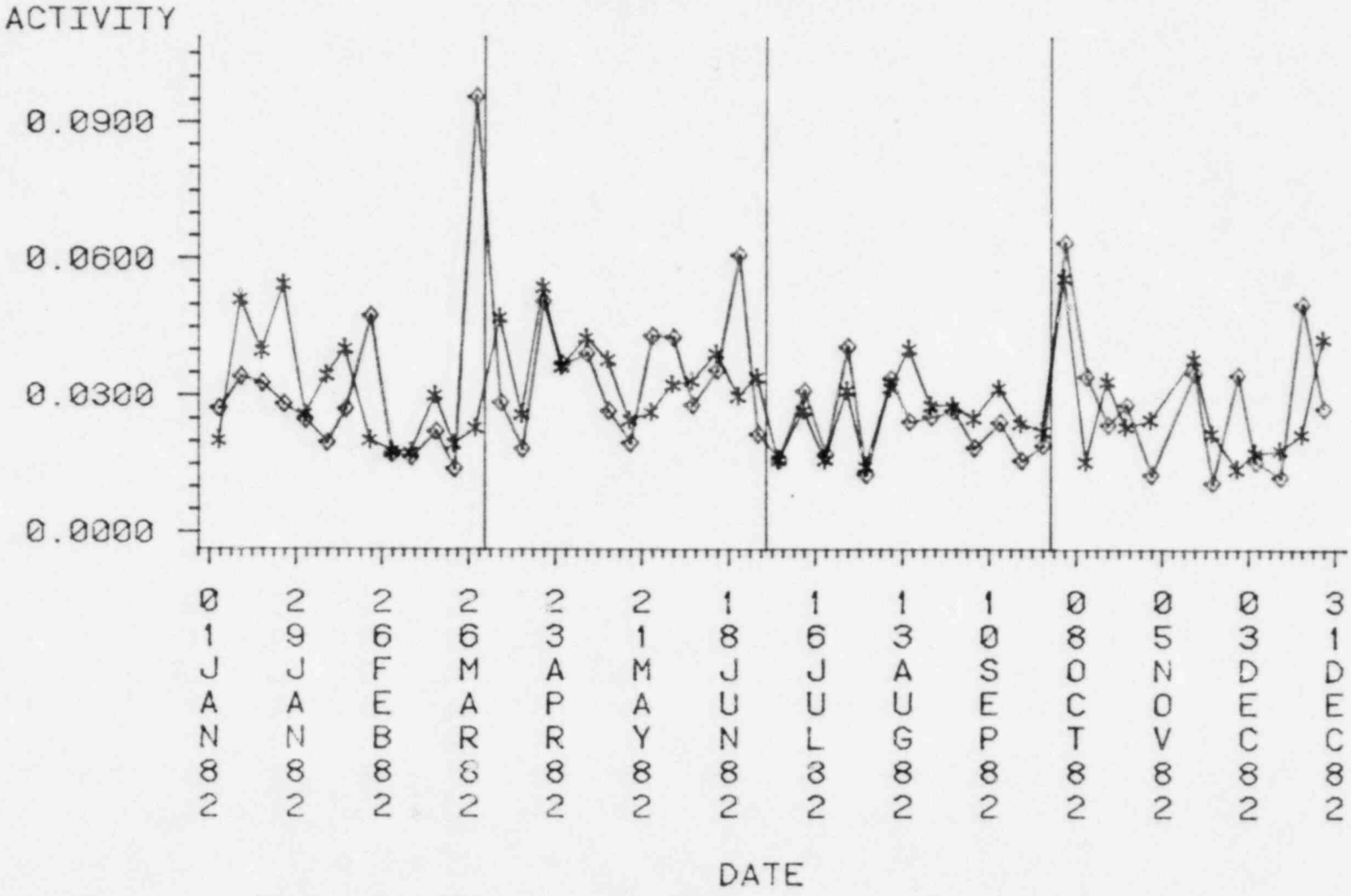


Figure 3-6

CP&L ENVIRONMENTAL MONITORING SYSTEM
GROSS BETA
AIR PARTICULATE
(PICOCURIES PER CUBIC METER)

STAR IS SAMPLE STATION ACTIVITY
DIAMOND IS CONTROL STATION ACTIVITY
PLANT=HBR POINT=36



## 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. Monthly bottom sediment and aquatic vegetation samples are 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 are expected.

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 3-2.

**Table 3-2**

**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 |
|---|---|---|
| Co-60 | 3.040 (19/32) | SD-33 |
| Sr-89 | 0.100 (1/32) | SD-5 |
| Sr-90 | 0.275 (5/32) | SD-33 |
| Cs-137 | 0.522 (21/32) | SD-33 |
| Ce-141 | 0.223 (1/32) | SD-11 |

Table 3-2
(Continued)

AQUATIC VEGETATION

| Isotope | Annual Average (pCi/g dry) | Location with Highest Annual Mean |
|---|---|---|
| Mn-54 | 0.275 (5/32) | AV-8 |
| Co-58 | 0.680 (9/32) | AV-8 |
| Co-60 | 0.879 (11/32) | AV-8 |
| Sr-89 | 0.202 (5/28) | AV-21 |
| Sr-90 | 0.099 (7/28) | AV-8 |
| Nb-95 | 0.168 (1/32) | AV-21 |
| Cs-134 | 0.364 (3/32) | AV-33 |
| Cs-137 | 1.030 (28/32) | AV-33 |
| Ce-144 | 0.733 (4/32) | AV-21 |

Most occurrences of activity observed were at Station 33. The activity at this location is lower than previous years and is within the confines of the plant. It discharges just below the spillway where the general public has minimum access. The samples collected at Station 11, located approximately 200 yards downstream from the discharge point of Station 33, showed no significant increases in comparison to previous data. Bottom sediments and aquatic vegetation are not consumed by man but are useful for documentation of trends in plant effluent. Review of past data indicates that there is no continuous increase in the concentrations observed at any sampling locations.

## 3.3 Fish

Fish samples are analyzed quarterly for radiostrontium and gamma-emitting radionuclides. Strontium-89 was observed once in free swimmers during the fourth quarter of 1982 and once in bottom feeders during the first quarter of 1982 at the concentration of 0.538 pCi/g (dry) and 0.610 pCi/g (dry), respectively. The concomitant dose to man is insignificant (<0.001 mrem/year).

The strontium-90 and cesium-137 continued to manifest itself in fish flesh as summarized in Table 3-3.

**Table 3-3**
**Average Concentration of Radionuclides in Fish Flesh**
**(pCi/gram dry)**

| Radionuclide | Bottom Feeders | Free Swimmers |
|---|---|---|
| Sr-90 | 0.460 (3/3) | 0.184 (3/4) |
| Cs-137 | 0.575 (3/3) | 0.698 (4/4) |

It is worthy of note that strontium-90 and cesium-137 concentrations are lower in comparison to previous years.

During the fourth quarter of 1982, a special study was performed to evaluate the strontium-90 and cesium-137 activity in fish samples. Samples were collected from Lake Bee (9.0 miles NW) which is totally unaffected by nuclear operations of H. B. Robinson. These special samples, as well as the usual quarterly Lake Robinson samples, were separated by species and analyzed for strontium-90 and cesium-137. These results are compared in Table 3-4.

Table 3-4

Fish in Lake Bee Compared to Fish in H. B. Robinson Lake

(pCi/kg wet)

| Collection Date | Species | Radionuclide | Lake Bee | H. B. Robinson Lake |
|---|---|---|---|---|
| 10/18/82 | Chub Sucker | Cs-137 | 133.0 | 290.0 |
| | | Sr-90 | 344.0 | 227.0 |
| 10/18/82 | Sun Fish | Cs-137 | 116.0 | 311.0 |
| | | Sr-90 | 732.0 | 150.0 |
| 10/18/82 | Large Mouth Bass | Cs-137 | 259.0 | No Sample |
| | | Sr-90 | 120.0 | No Sample |
| 10/18/82 | Pickeral | Cs-137 | No Sample | 336.0 |
| | | Sr-90 | No Sample | 359.0 |
| 10/18/82 | Yellow Bull Head | Cs-137 | 346.0 | 231.0 |
| | | Sr-90 | 49.1 | 80.8 |
| 11/10/82 | Spotted Sucker | Cs-137 | No Sample | 37.2 |
| | | Sr-90 | No Sample | 117.0 |

Table 3-4 - (Continued)
Fish in Lake Bee Compared to Fish in H. B. Robinson Lake
(pCi/kg wet)

| Collection Date | Species | Radionuclide | Lake Bee | H. B. Robinson Lake |
|---|---|---|---|---|
| 11/10/82 | Chub Sucker | Cs-137 | *173.0 | 72.1 |
| | | Sr-90 | *353.0 | 89.0 |
| 11/10/82 | Sunfish | Cs-137 | *184.0 | No Sample |
| | | Sr-90 | *504.0 | No Sample |
| 11/10/82 | Pickeral | Cs-137 | *394.0 | 309.0 |
| | | Sr-90 | *368.0 | 66.4 |
| 12/01/82 | Bass | Cs-137 | 318.0 | No Sample |
| | | Sr-90 | 178.0 | No Sample |

*Collected on 12/01/82

A statistical t-test* was performed on cesium-137 and strontium-90 data for bottom feeders and free swimmers to determine if fish from Lake Robinson exhibited significantly higher concentrations of these radionuclides than those observed in fish from Lake Bee. At the 95 percent confidence level, no significant difference was determined to exist.

*This test was performed as described by Section 3-3.2, Page 3-4, Experimental Statistics, Handbook 91, United States Department of Commerce, National Bureau of Standards, August 1, 1963.

## 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 3-5. The low-level cesium-137 activity detected is believed to be attributable to contamination of the Ge(Li) detectors at the time of analysis.

Table 3-5

Average Concentration (pCi/g dry) and Fractional Occurrences of Radionuclides in Cattle Feed and Food Crops

Cattle Feed (FO)

| Isotope | Annual Avg. (pCi/g) | Fractional Occurrence |
|---|---|---|
| Cs-137 | 0.265 | 3/4 |

Food Crop (FC)

| Isotope | Annual Avg. (pCi/g) | Fractional Occurrence |
|---|---|---|
| Cs-137 | 0.352 | 3/6 |

## 3.5 Groundwater

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

Gross alpha activity was observed in 8 of 12 samples averaging 9.74 E-1 pCi/l. Gross beta activity was detected in 9 of 12 samples averaging 9.44 E-1 pCi/l. This average is comparable to data obtained during preoperational surveillance. Radiostrontium analyses revealed no measurable activity. Tritium was detected in 2 of 12 analyses at an average concentration of 211 pCi/l with high relative counting errors. This average is considerably lower than the normal minimum detectable activity of 350 pCi/l. Gamma analyses revealed cesium-137 activity at an average concentration of 7.35 pCi/l in 2 of 12 samples. This is not possible since it is 7 times higher than the gross beta analysis. Again, contamination is suspected. Subsequent samples contained no detectable levels of cesium-137.

## 3.6 Milk samples

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

Radiochemical determination of I-131 yielded measurable activity in 3 of 24 samples analyzed. For the collection periods of 4/19/82, 5/10/82, and 9/13/82, iodine-131 activity concentrations were 0.49 pCi/l, 0.96 pCi/l, and 0.623 pCi/l, respectively. The samples collected on 4/19/82 and 9/13/82 were counted by a low-beta counter. These activities were at or below the required minimum detectable activity of 0.5 pCi/l and appears to be statistical artifacts. The sample collected on 5/10/82 was counted by a beta-gamma coincidence system. This system was recalibrated using a new detector and standard

on 5/3/82. It appears in retrospect that this sample was analyzed immediately following a QC check and may be attributed to contamination of the detector.

Radiostrontium analyses of milk revealed Sr-89 in 4 of 24 samples averaging 3.65 pCi/l. Strontium-90 was detected in 8 of 24 samples averaging 2.37 pCi/l. These concentrations are in agreement with averages from previous years and do not indicate that the Robinson operation affects the milk pathway to man during 1982.

Gamma isotopic analyses detected Cs-137 in 5 of the 24 samples averaging 7.55 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 weapons testing.

## 3.7 Soil Samples

Ten sampling locations are sampled every three years. Two sample locations are sampled semiannually on a rotating basis. During 1982, Station 2 (Visitors Center), Station 9 (Microwave Tower), Station 22 (Hartsville), and Station 24 (Black Creek at U.S. 1) 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 6 of 6 samples analyzed averaging 5.06 E-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 5 of 8 samples analyzed. All concentrations observed were comparable to previous data reported for the area.

Low levels of Co-60 and Cs-137 were detected at Station 50. Since this is a new station, there is no previous data with which to compare the activities measured. The results are comparable to those observed in bottom sediment sampled at Station 33 which is also located on site.

## 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 117 of 221 samples analyzed. The average of 1.22 E+0 pCi/l was comparable to the control station average of 1.10 E+0 pCi/l. Measurable gross beta concentrations were reported in 193 of 221 samples averaging 1.59 E+0 pCi/l. These gross beta activities are comparable to the average of 4.08 E+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 29 of 48 and 47 of 48 cases, respectively. The average concentration for gross alpha and gross beta in these samples was 1.16 E+0 pCi/l and 1.55 E+0 pCi/l, respectively. These compare favorably with the control station averages of 1.01 E+0 pCi/l and 1.31 E + 0 pCi/l for gross alpha and gross beta, respectively.

Quarterly composites of the monthly composites revealed measurable alpha and beta activities similiar to the monthly samples. Gross alpha activity was detected in 13 of 16 samples, averaging 8.70 E-1 pCi/l compared to 6.79 E-1 pCi/l at the control station. Measurable gross beta activity was observed in 16 of 16 samples averaging 1.67 E+0 pCi/l. This is comparable to 1.30 E+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 | 703 | 781 | 729 | 650 |
| Range | 337-1830 | 351-2260 | 324-2580 | 331-1590 |
| **Monthly Composite** | | | | |
| Average | 652 | 751 | 598 | 614 |
| Range | 484-911 | 445-1360 | 431-794 | 431-1150 |
| **Quarterly Composite** | | | | |
| Average | 632 | 824 | 636 | 497 |
| Range | 507-766 | 680-1060 | 435-808 | 329-665 |

Specific isotopic analyses of monthly surface water composites were accomplished through high resolution gamma spectrometry. In 68 of 72 samples analyzed, no fission or activation products were measurable. The four exceptions are given below:

| | Cs-137 | pCi/l |
|---|---|---|
| September Composite | SW-11 | 5.84 ± 1.28 |
| November Composite | SW-05 | 5.26 ± 1.24 |
| | SW-08 | 4.44 ± 1.26 |
| | SW-50 | 5.64 ± 1.53 |

The sporadic appearance of cesium-137 in several isolated cases does not clearly indicate the Robinson Plant as the source. The activities observed are below the typical minimum detectable activity of 9.0 pCi/l with high relative counting errors.

Radiostrontium analyses of monthly composited surface water samples revealed a single incidence of Sr-89 activity at the concentration of 2.00 pCi/l during May at Station 5. Strontium-90 activity was quantified in 3 of 60 analyses at an average concentration at Station 5 at a concentration of 5.56 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 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). 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 3-6.

Table 3-6

Ion Exchange Resin
(pCi/l)

| Radionuclide | Occurrence | Average (pCi/l) | High (pCi/l) | Low (pCi/l) |
|---|---|---|---|---|
| Mn-54 | 8/52 | 3.77 E-2 | 8.03 E-2 | 1.57 E-2 |
| Co-58 | 32/52 | 1.01 E-1 | 2.50 E-1 | 6.61 E-3 |
| Co-60 | 32/52 | 1.61 E-1 | 4.36 E-1 | 1.08 E-2 |
| Cs-137 | 37/52 | 1.12 E-1 | 4.07 F-1 | 2.71 E-2 |

Comparison of radionuclide concentrations collected on the resin and glasswool indicates a much greater fraction of the radionuclides appear in ionic form rather than as suspended particulates.

Figure 3-7

CP&L ENVIRONMENTAL MONITORING SYSTEM
GROSS BETA
SURFACE WATER
(PICOCURIES PER LITER)

STAR IS SAMPLE STATION ACTIVITY
DIAMOND IS CONTROL STATION ACTIVITY
PLANT=HBR POINT=05

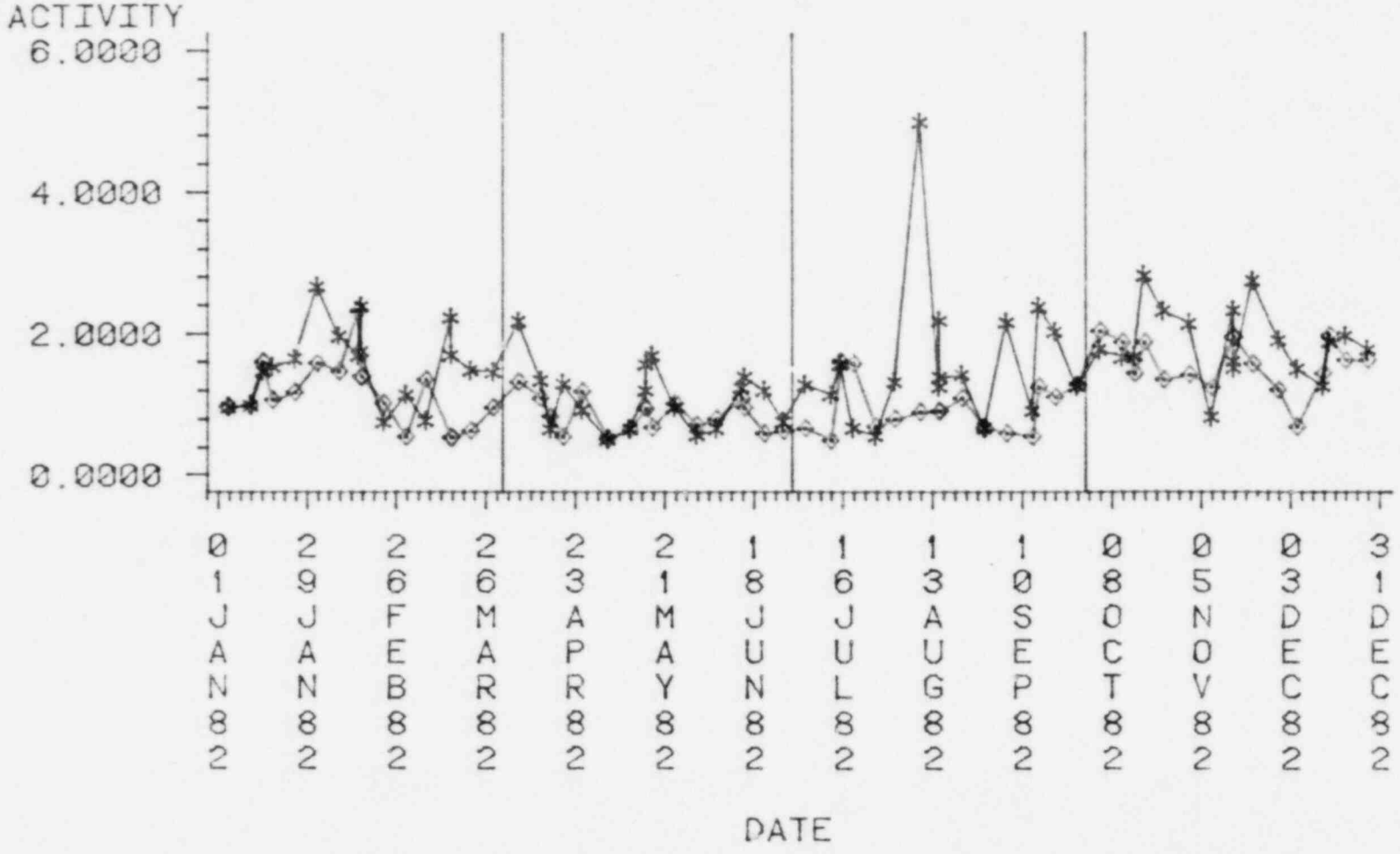


Figure 3-8

CP&L ENVIRONMENTAL MONITORING SYSTEM
GROSS BETA
SURFACE WATER
(PICOCURIES PER LITER)

STAR IS SAMPLE STATION ACTIVITY
DIAMOND IS CONTROL STATION ACTIVITY
PLANT=HBR POINT=08

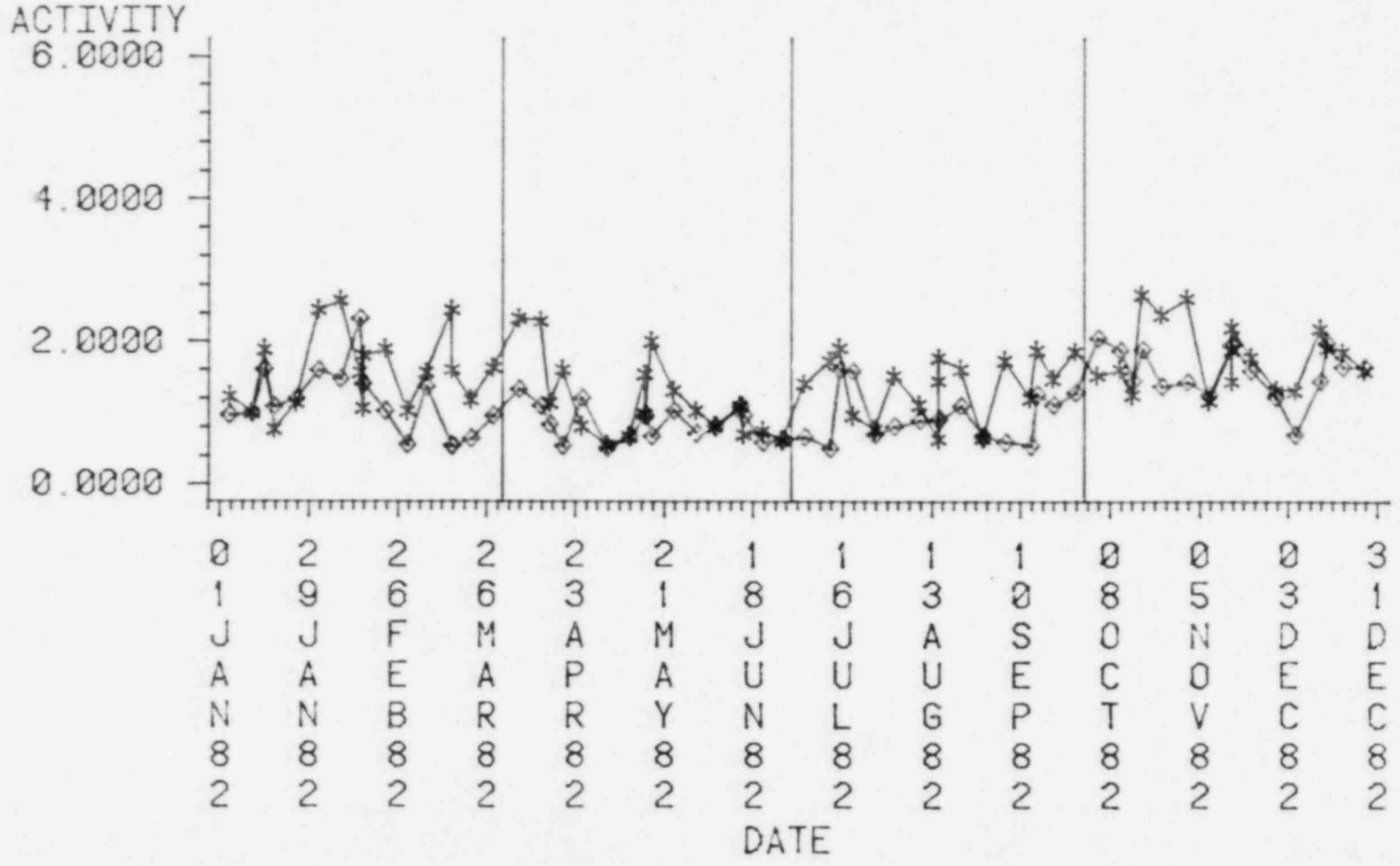


Figure 3-9

CP&L ENVIRONMENTAL MONITORING SYSTEM
GROSS BETA
SURFACE WATER
(PICOCURIES PER LITER)

STAR IS SAMPLE STATION ACTIVITY
DIAMOND IS CONTROL STATION ACTIVITY
PLANT=HBR POINT=11

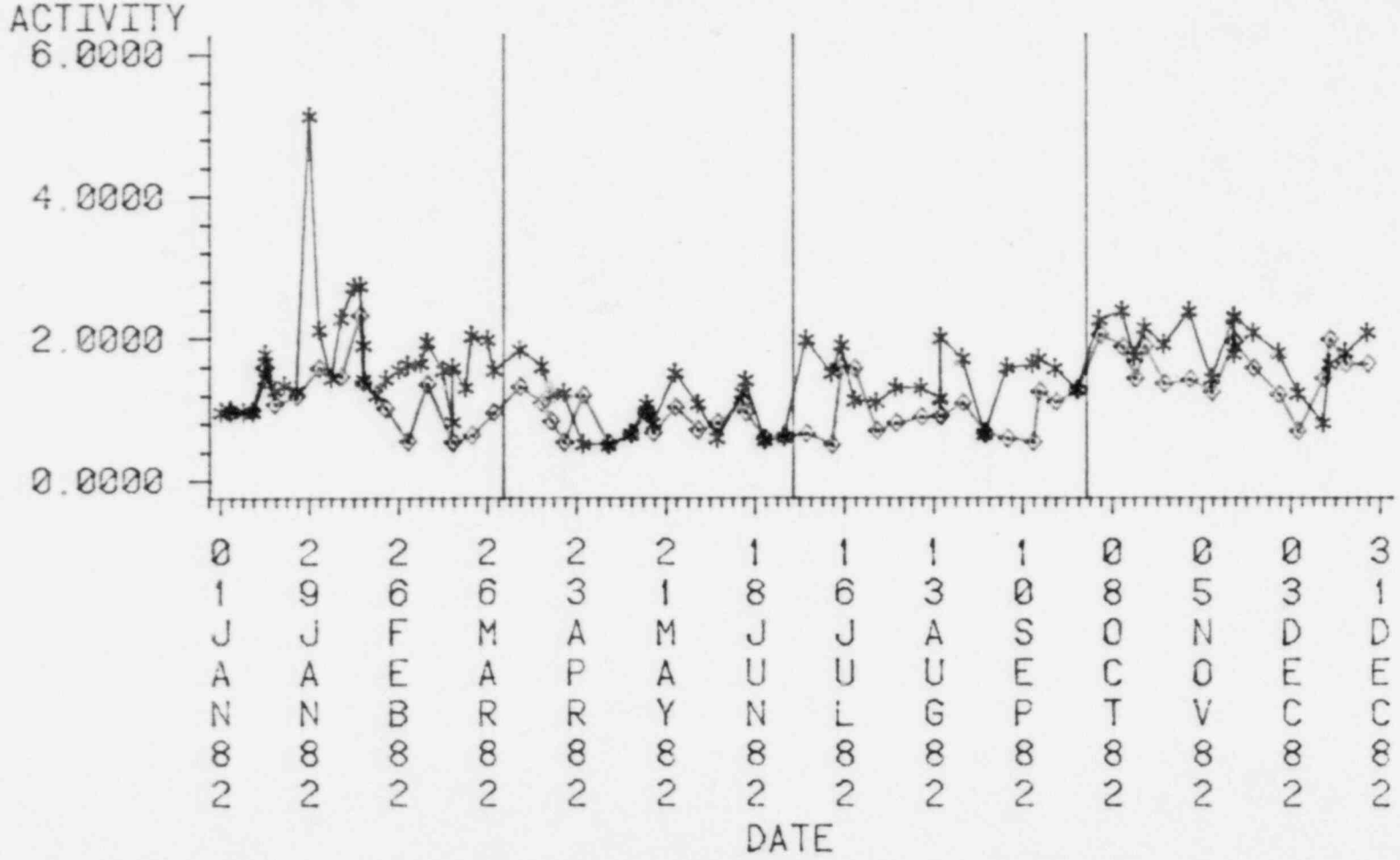
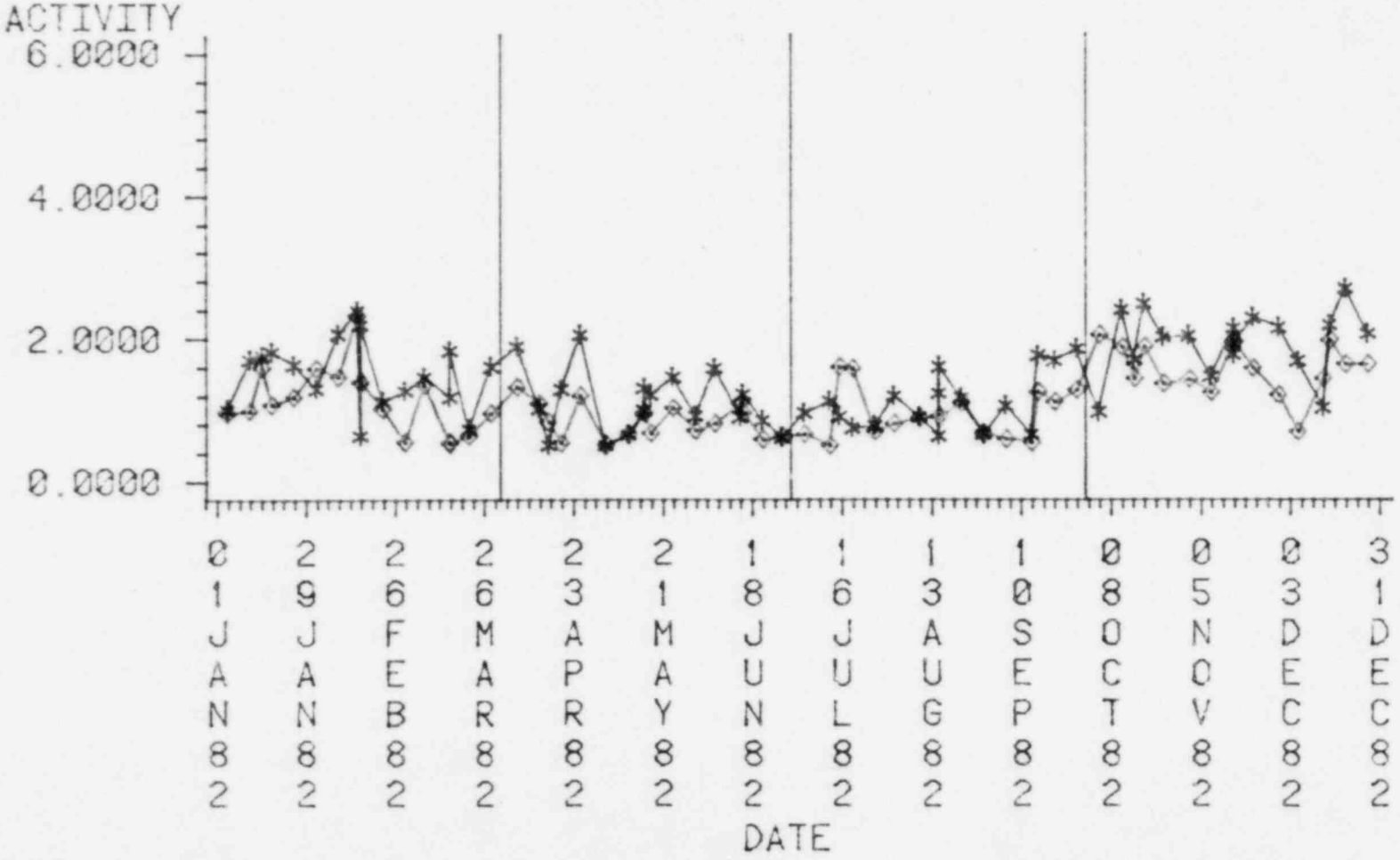


Figure 3-10

CP&L ENVIRONMENTAL MONITORING SYSTEM
GROSS BETA
SURFACE WATER
(PICOCURIES PER LITER)

STAR IS SAMPLE STATION ACTIVITY
DIAMOND IS CONTROL STATION ACTIVITY
PLANT=HBR POINT=32



## 3.9 Thermoluminescent Dosimetry Area Monitors

The average dose rate from all indicator stations 1.91 mrem/wk which is comparable to the control station average of 1.61 mrem/wk. The only significantly higher reading was observed at Station 7 (Robinson Unit 1). This station has traditionally exhibited higher readings and shows no significant change from previous years.

## 3.10 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 1982 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)

Samples collected January 18, 1982, and April 5, 1982, at Station 17 and Station 35 were unavailable due to a burned out compressor and due to wind blowing air filter into creek, respectively.

### 4.2 Fish

Third quarter bottom feeder flesh and bone samples were lost in analysis.

### 4.3 Environmental TLDs

The following thermoluminescent dosimeter results were missing in 1982:

| Month | Sample Station | Reason |
|---|---|---|
| January | 12 | Badge Lost in Field |
| September | 30 | Badge Lost in Field |
| October | 11 | Badge Lost in Field |