



HAZLETON

ENVIRONMENTAL SCIENCES

A DIVISION OF HAZLETON LABORATORIES AMERICA, INC.
1509 FRONTAGE ROAD, NORTHBROOK, ILLINOIS 60062, U.S.A.

1982 ANNUAL REPORT
TO
THE ILLINOIS POWER COMPANY
CLINTON, ILLINOIS.

PREOPERATIONAL ENVIRONMENTAL RADIOLOGICAL
MONITORING PROGRAM
CLINTON POWER STATION
CLINTON, ILLINOIS

PREPARED AND SUBMITTED
BY
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PROJECT NO. 9109

Reporting Period: January - December 1982

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1.0 Introduction

The following constitutes the 1982 Annual Report for the Radiological Environmental Monitoring Program conducted at the Clinton Power Station, Clinton, Illinois. Results of completed analyses are presented in the attached tables.

Data obtained in the program are well within the ranges to be expected in the environmental media sampled.

None of the media sampled contained radioactivity attributable to the construction of Clinton Power Station.

On March 3, 1982, the automatic water compositor for the collection of drinking water on site was delivered to the station. Sampling at this location, CL-14, will commence twelve months prior to fuel loading.

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2.0. Milch Animals and Vegetable Garden Census

A milch animal and vegetable garden census was conducted on 10 and 11 August 1982. The survey was conducted by visual observation and consultation with Mr. Darrow Cruthis, State Agricultural Agent.

With the exception of one milking cow, there were no milking cows or goats found within a 5 mile radius of the station. The one milking cow was located at the Darrell Wantland Farm, approximately 3 miles SW of the Station. Mr. Wantland is hostile to the IPC and has refused to sell any milk. The milk is used for family consumption only.

Several herds of beef cattle were observed within this area; however, the owners stated that none of the cattle were milked for human consumption.

Several vegetable gardens of greater than 50 M² were located in the area. They are:

- Mr. R. Kuntz residence, approximately 2.5 miles W of the station
- Mr. T. Plunkett residence, approximately 2.25 miles WSW of the station
- Mr. S. M. Kuntz residence, approximately 1.0 mile N of the station
- Mr. R. Wantland residence, approximately 3.0 miles SW of the station

The towns of Birkbeck, DeWitte and Lane were also surveyed. As almost all of the residences had gardens, they are too numerous to list. The sizes ranged from approximately 10 M² to <50 M².

The predominant vegetables grown are tomatoes, beans, peas, cucumbers, sweet corn, lettuce, squash, zucchini, onions, pumpkins, peppers, and carrots.

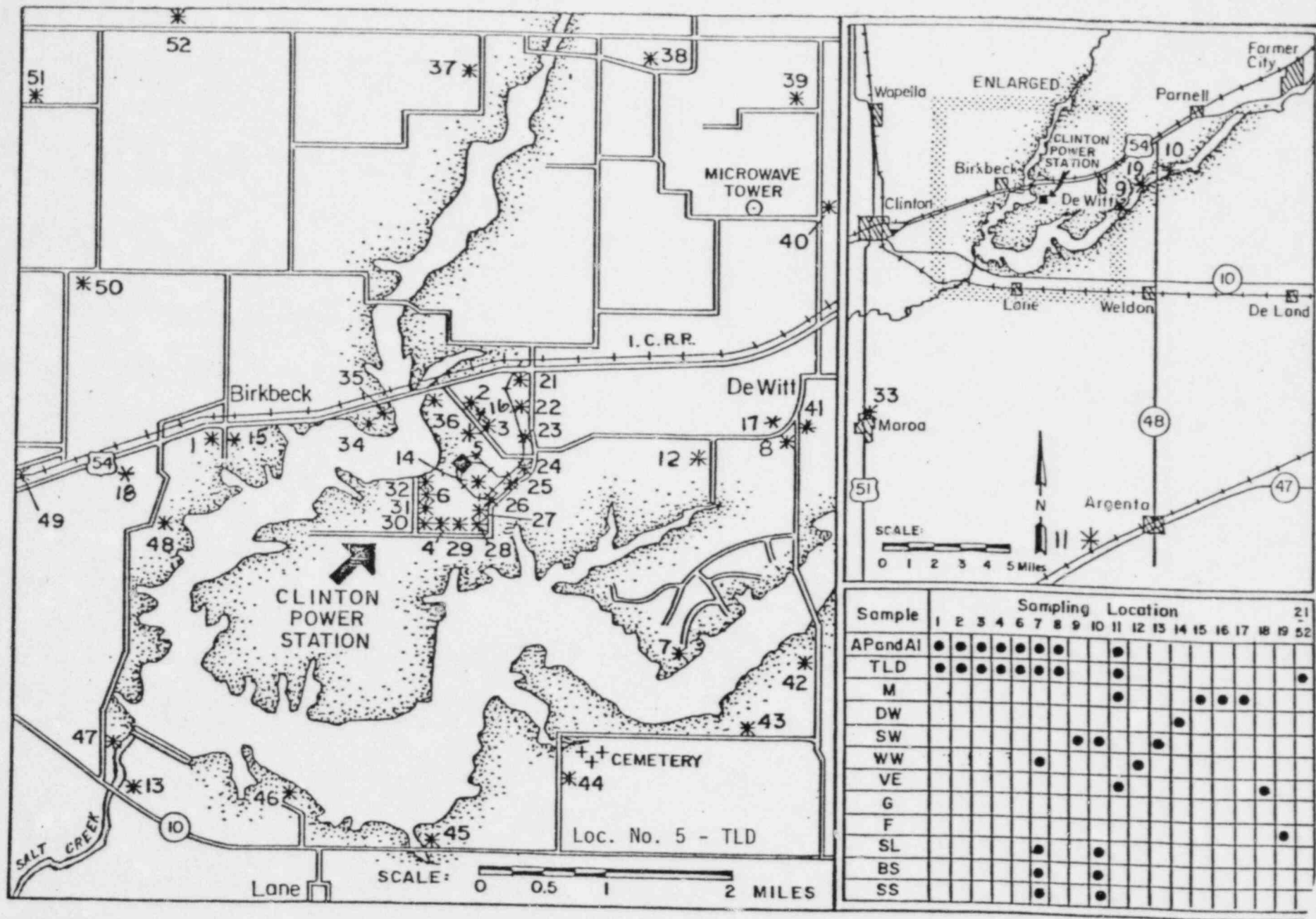


Figure 1. Sampling locations, Clinton Power Station.

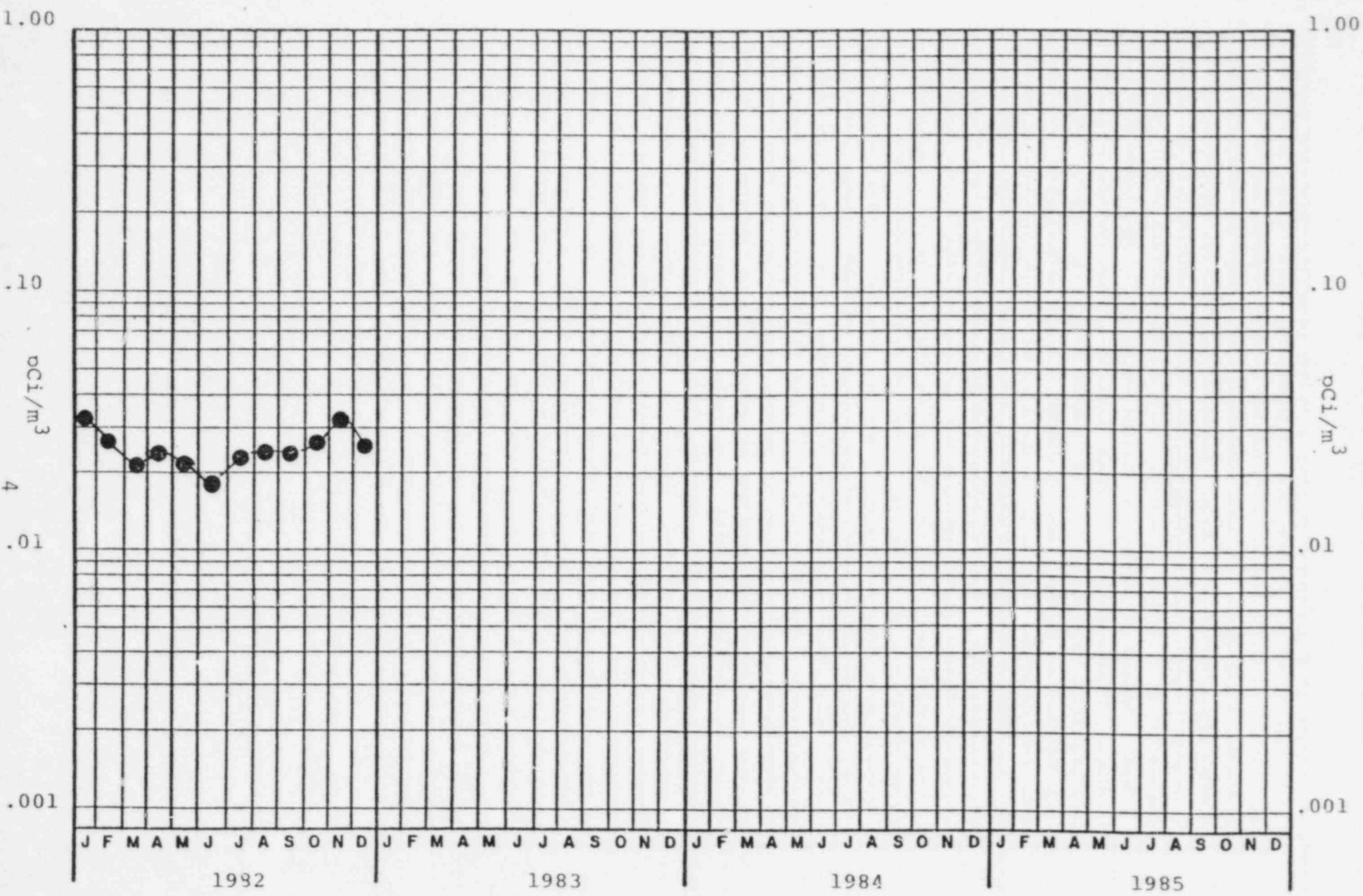


Figure 2. Airborne particulate samples, Location CL-1, gross beta activity, monthly averages.

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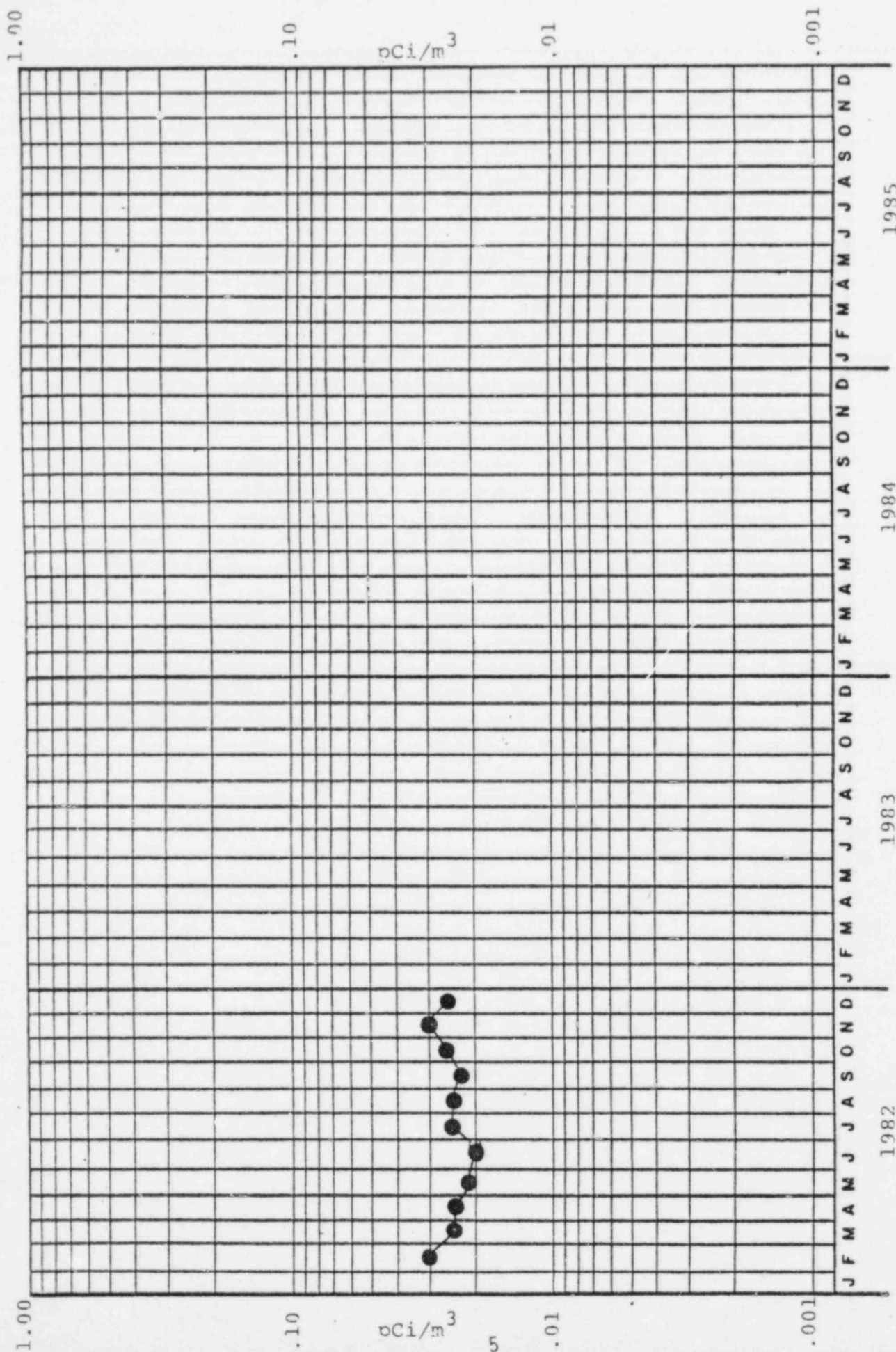


Figure 3. Airborne particulate samples, Location CL-2, gross beta activity, monthly averages.

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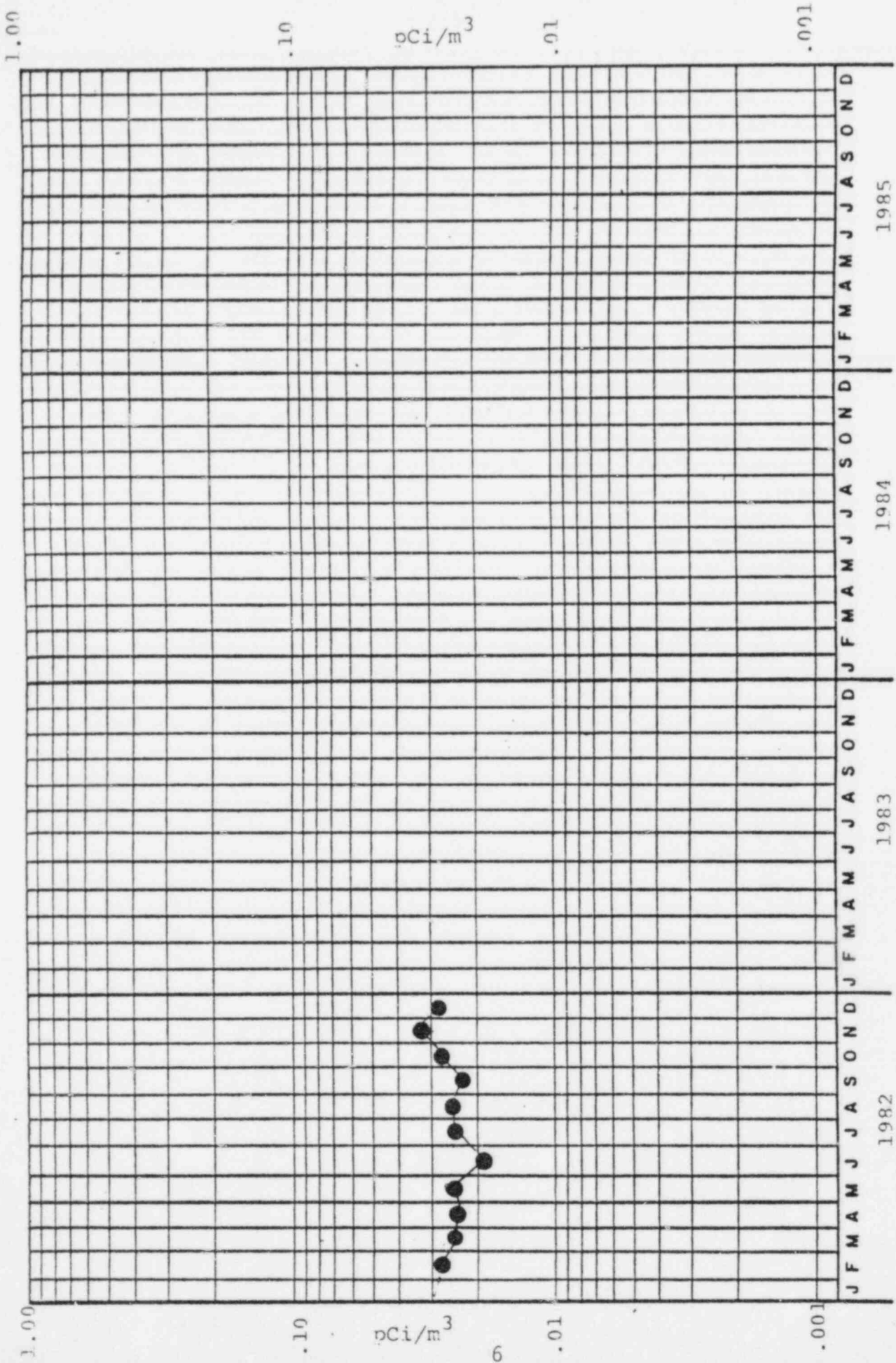


Figure 4. Airborne particulate samples, Location CL-3, gross beta activity, monthly averages.

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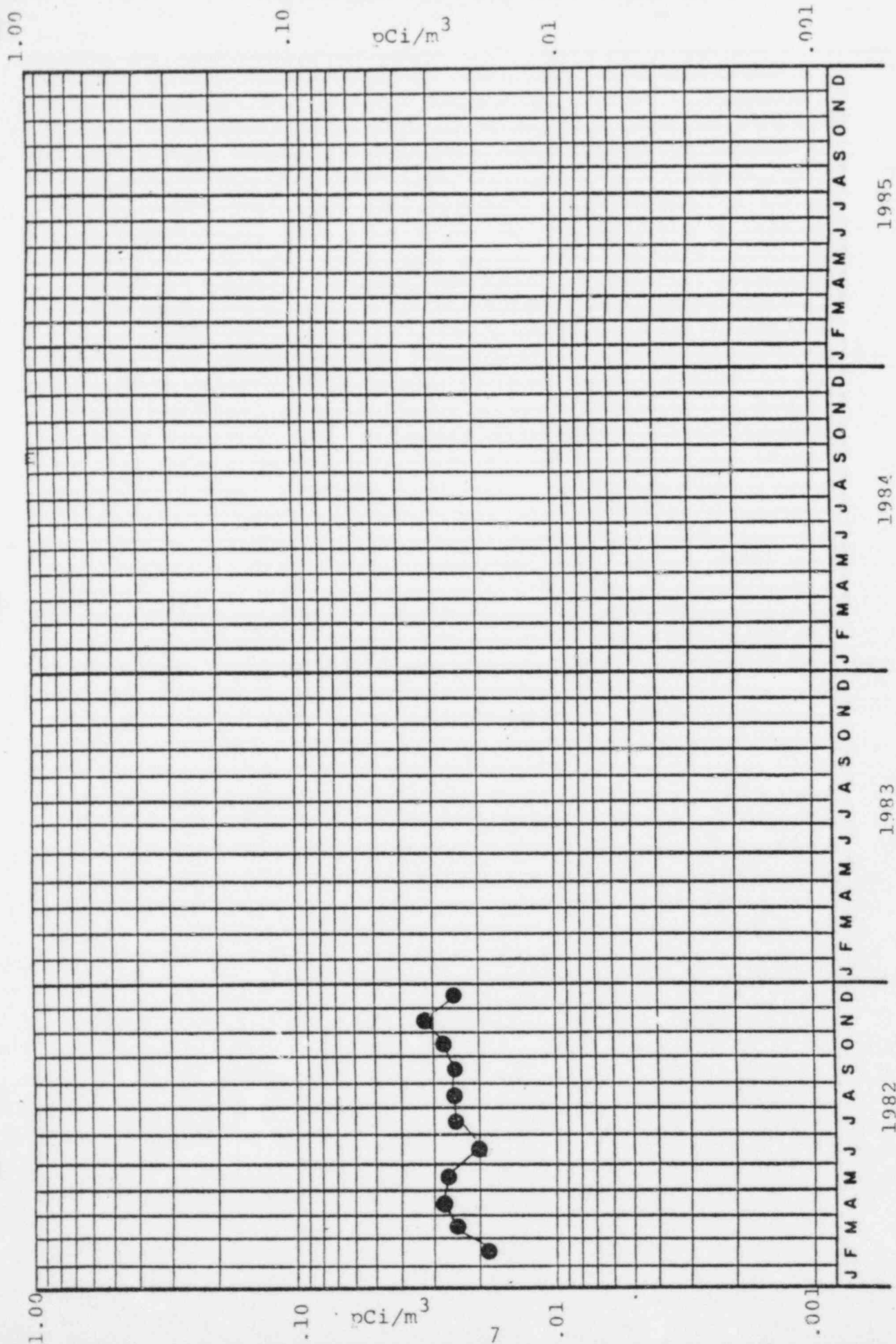


Figure 5 . Airborne particulate samples, Location CL-4, gross beta activity, monthly averages.

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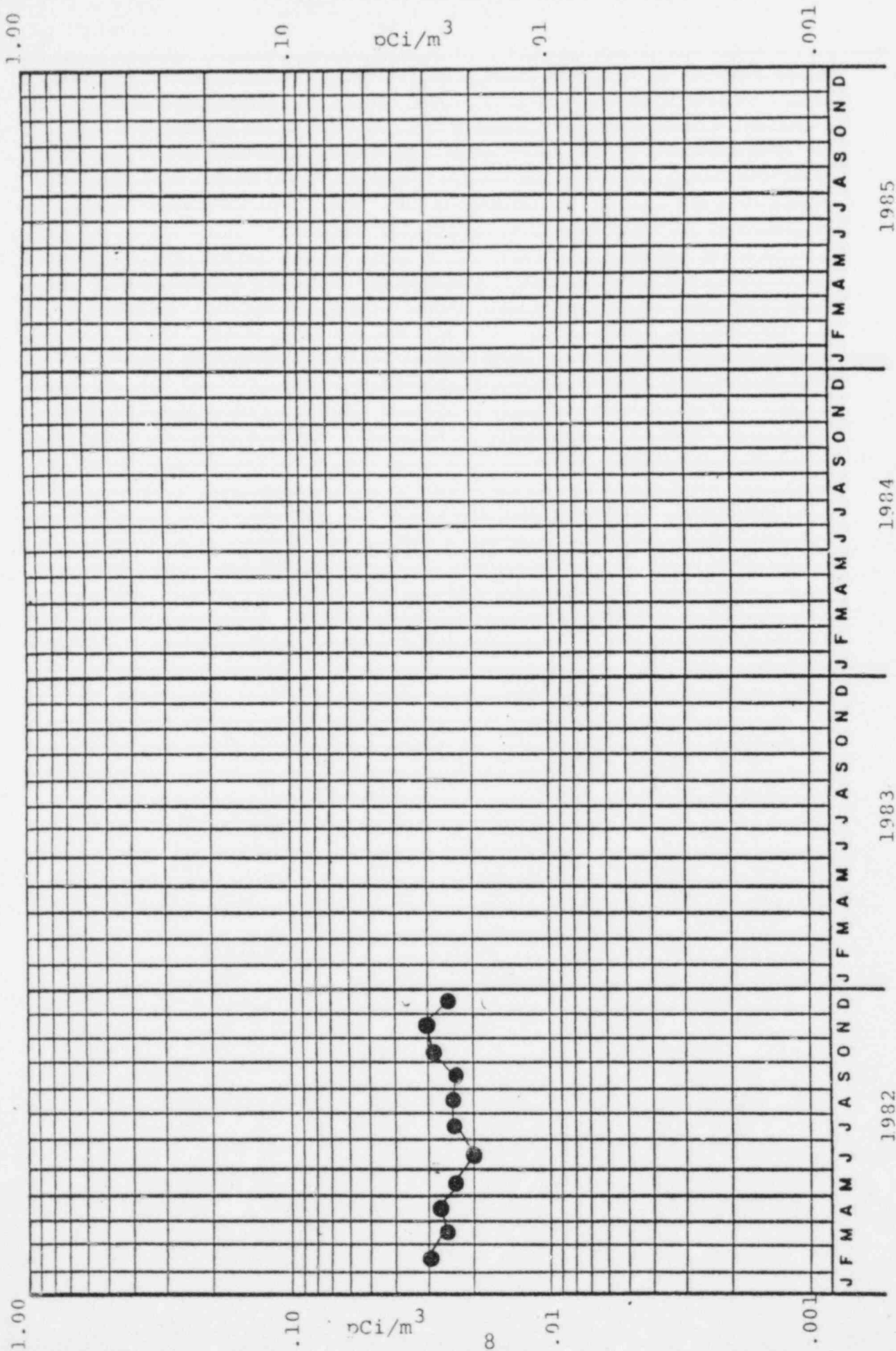


Figure 6. Airborne particulate samples, Location CL-6, gross beta activity, monthly averages.

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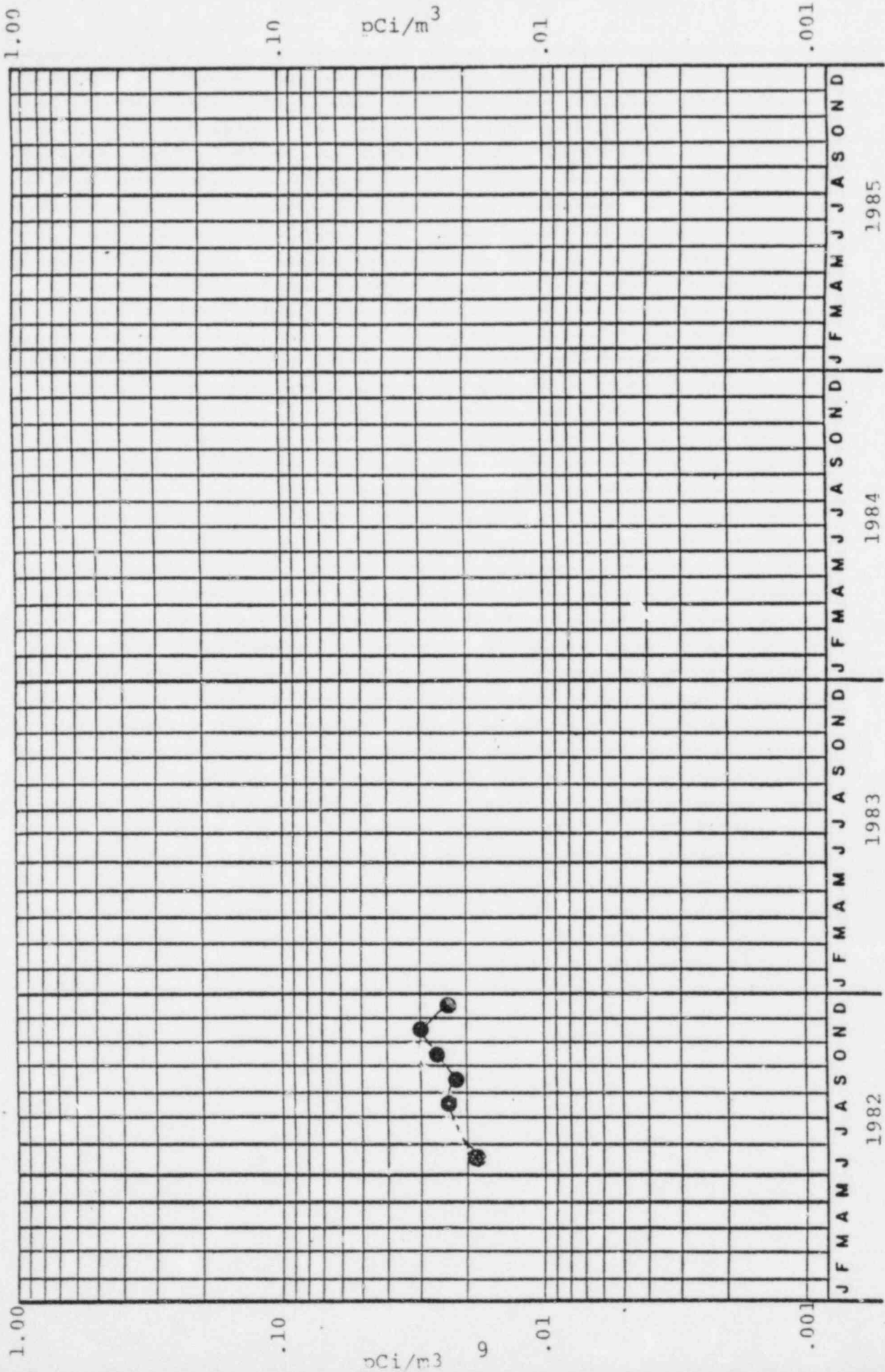


Figure 7. Airborne particulate samples, Location CL-7, gross beta activity, monthly averages. A dashed line indicates missing data.

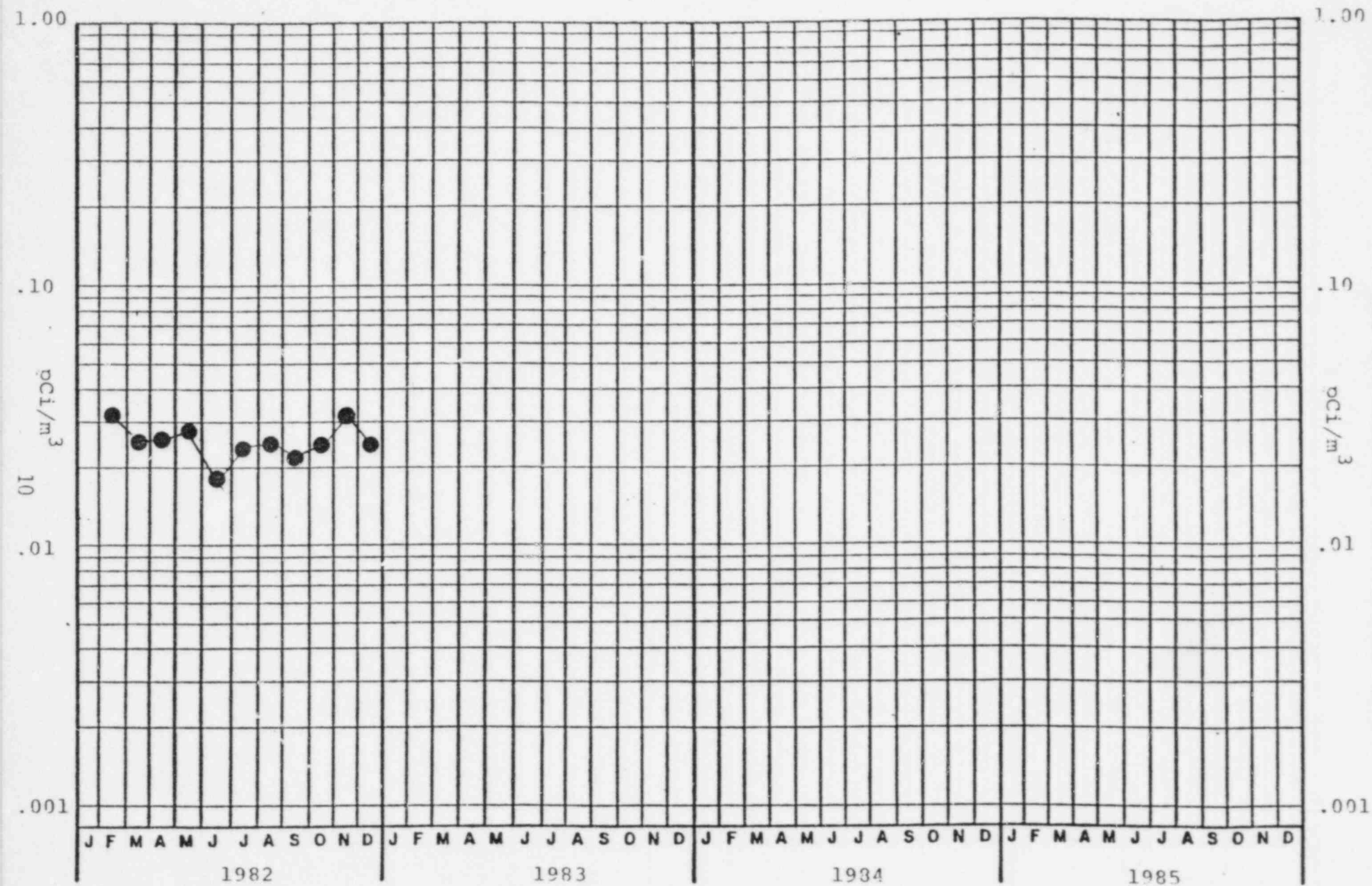


Figure 8. Airborne particulate samples, Location CL-8, gross beta activity, monthly averages.

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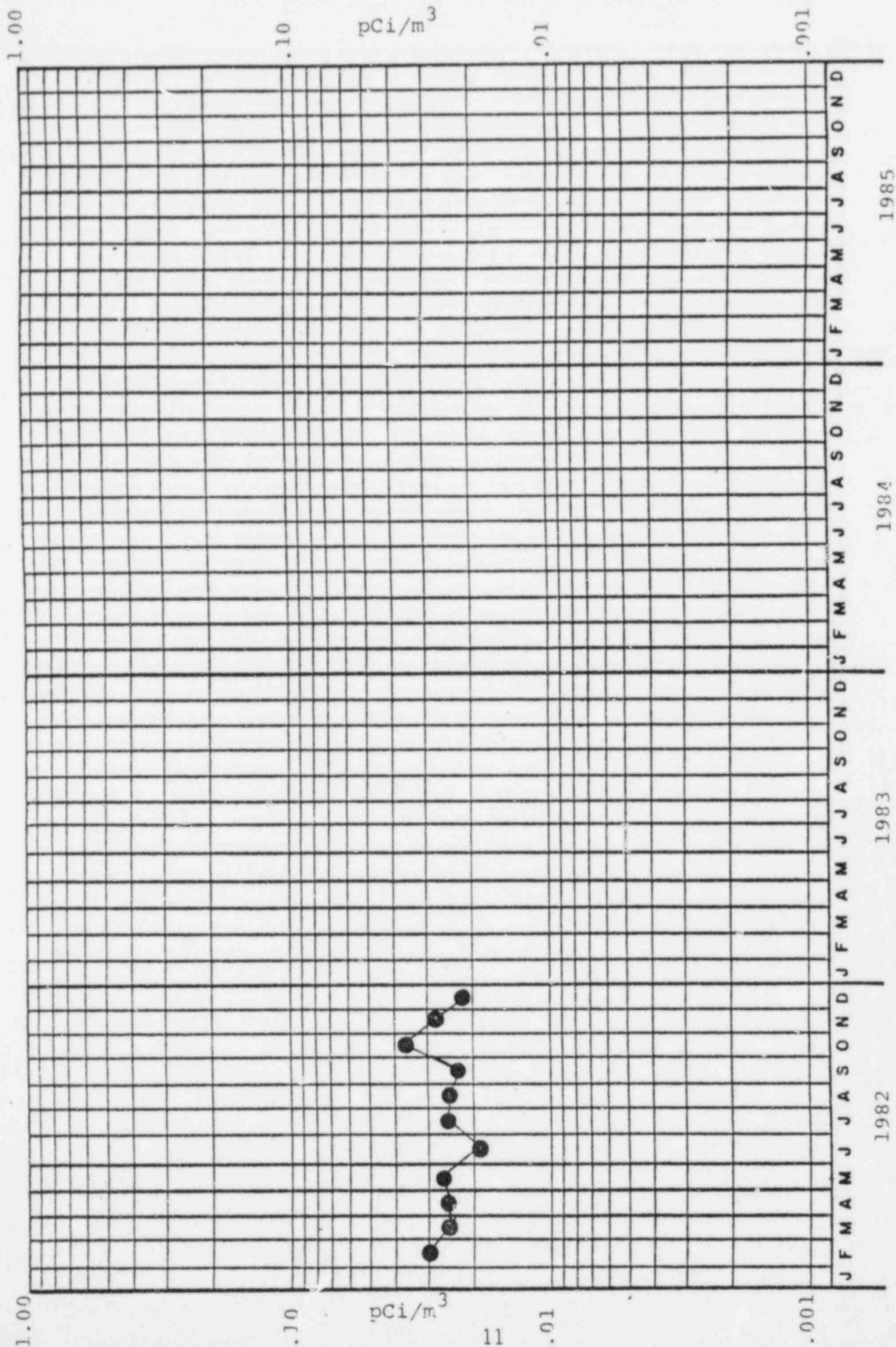


Figure 9. Airborne particulate samples, Location CL-11, gross-beta activity, monthly averages.

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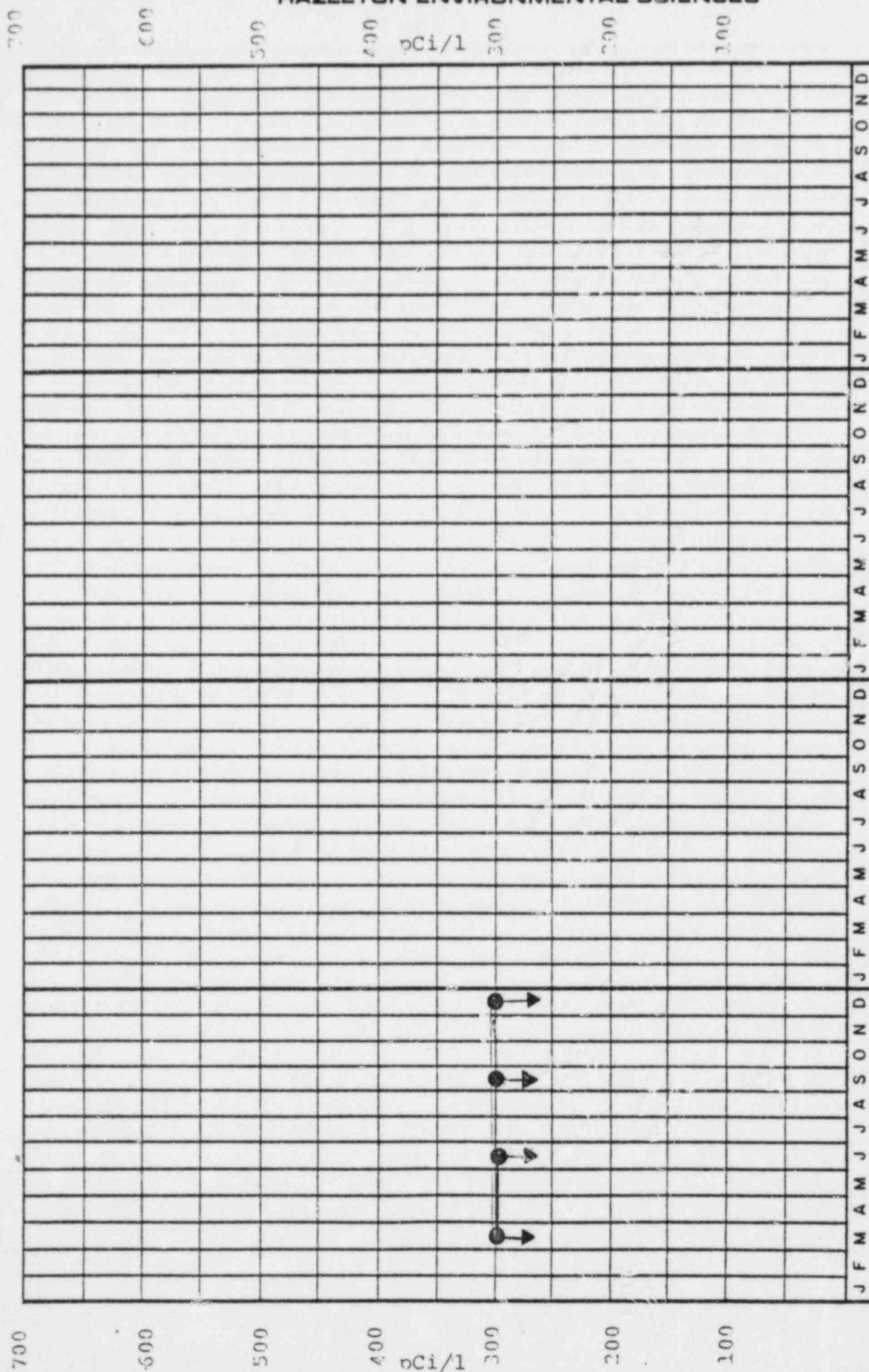


Figure 16. Surface water samples, tritium activity, Location CL-9, (17590 feet E of station)
 (↓) indicates less than value.

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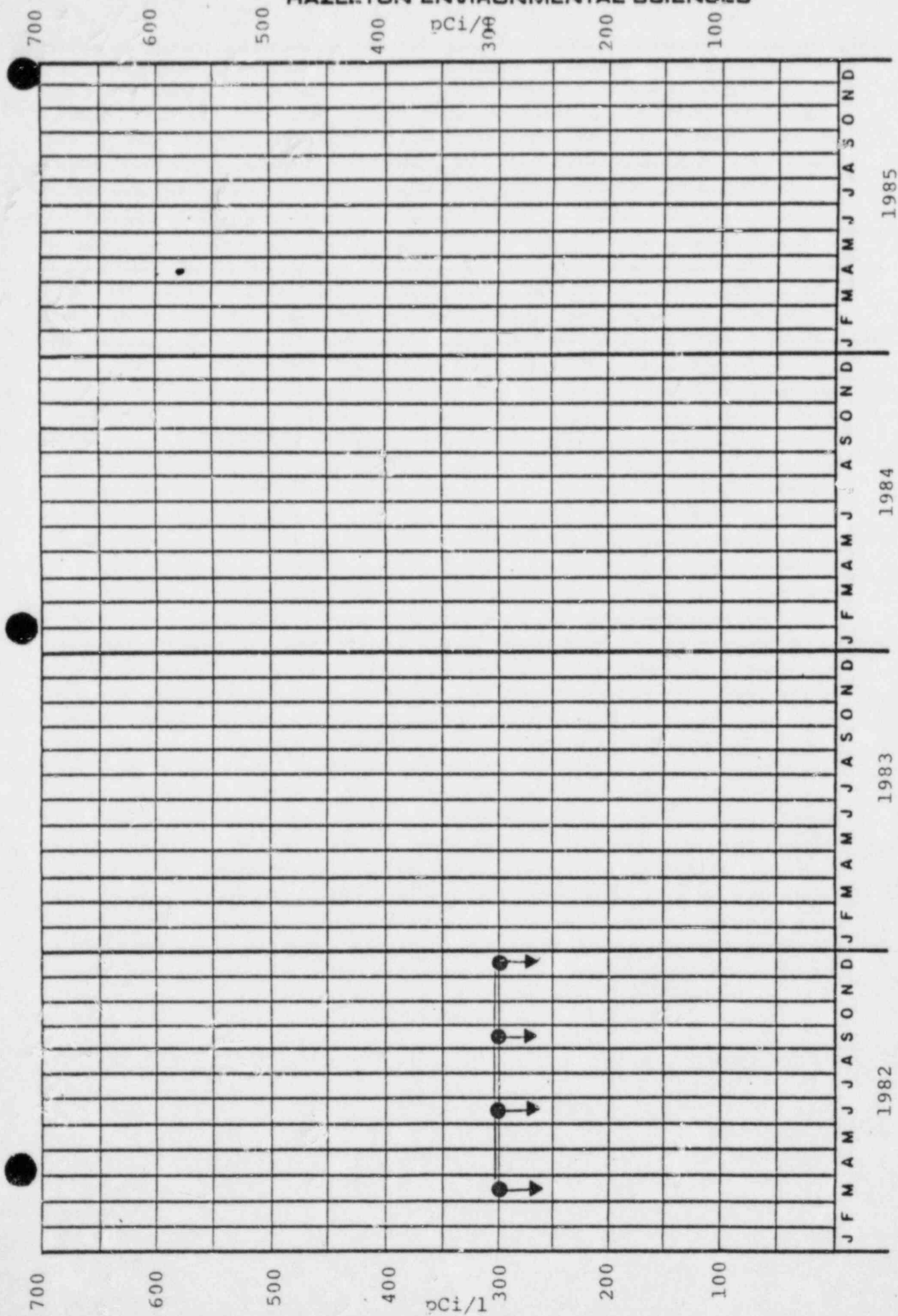


Figure 11. Surface water samples, tritium activity, Location CL-10, (26250 feet ENE of station).
(↓) indicates less than value.

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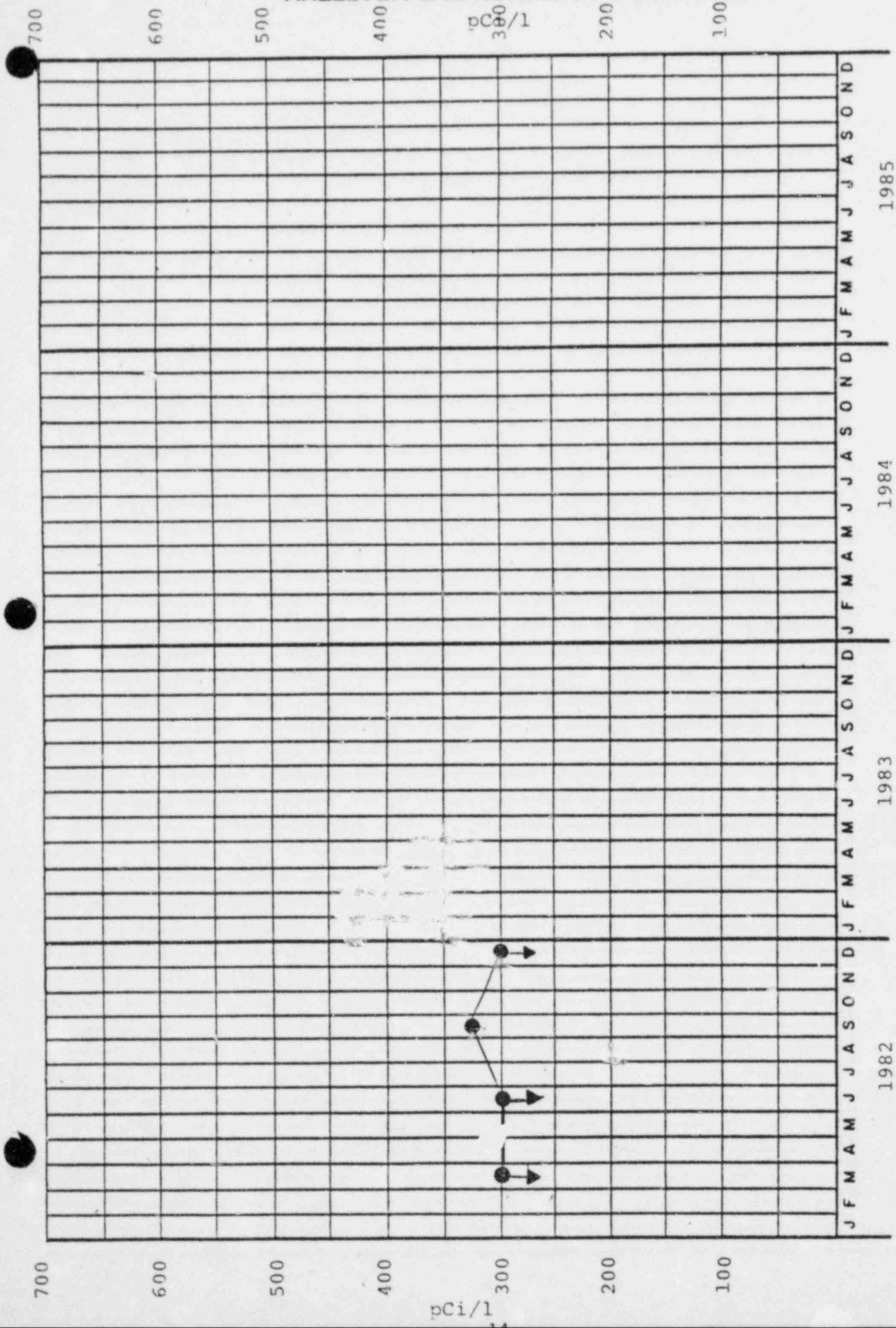


Figure 12. Surface water samples, tritium activity, Location CL-13(20000 feet SW of station).
(↓) indicates less than value.

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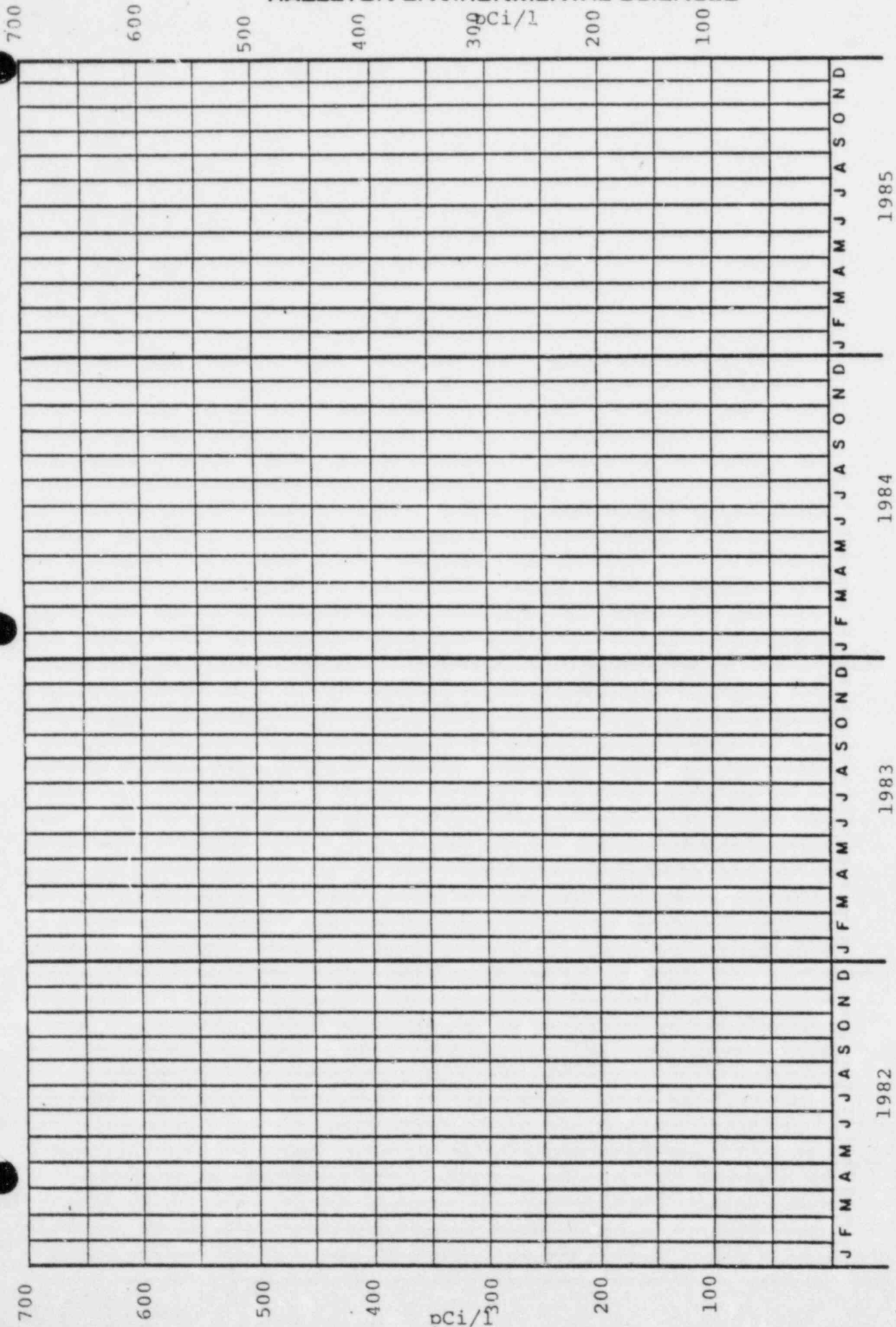


Figure 13. Drinking water samples, tritium activity, Location CL-14 (1000 feet WNW of station).

3.0 Data Tables

Data tables are presented on the following pages.

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Table 1. Sampling locations, Clinton Power Station.

Code	Location Type ^a	Location
CL-1		9750 feet NNW of station
CL-2		3000 feet NNE of station
CL-3		3000 feet NE of station
CL-4		3000 feet WSW of station
CL-5		3000 feet N of station
CL-6		3000 feet SW of station
CL-7		11750 feet SE of station
CL-8		13750 feet ENE of station
CL-9		17500 feet E of station
CL-10	C	26250 feet ENE of station
CL-11	C	10 miles S of station
CL-12		5250 feet S of station
CL-13		20000 feet SW of station
CL-14		In Station Service Building
CL-15		Within 100 feet of CL-1 air sampler
CL-16		Within 100 feet of CL-2 air sampler
CL-17		Within 100 feet of CL-8 air sampler
CL-18		R. Kuntz residence, approx. 2.5 miles W of the station
CL-19		Discharge flume area
CL-21-32, 34-52		15 sectors in an inner ring in the general area of the site boundary. 16 sectors in an outer ring in the 4 to 5 mile range from the site.
CL-33	C	11 miles SW of station, at Maroa

^aControl locations are indicated by "C" in this column. All other locations are indicators.

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Table 2. Type and frequency of collection. Clinton Power Station.

Code	Location Type ^a	Weekly	Semi-Monthly	Monthly	Quarterly	Semi-Annually
CL-1		AP, AI ^b			TLD	
CL-2		AP, AI			TLD	
CL-3		AP, AI			TLD	
CL-4		AP, AI			TLD	
CL-5					TLD	
CL-6		AP, AI			TLD	
CL-7		AP, AI	WW		TLD	BS, SS, SL
CL-8		AP, AI			TLD	
CL-9				SW		
CL-10	C			SW		BS, SS, SL
CL-11	C	AP, AI		M	TLD	VEC
CL-12			WW			
CL-13				SW		
CL-14			DW ^d			
CL-15				M		
CL-16				M		
CL-17				M		
CL-18						VEC
CL-19						F
CL-21-52					TLD	

^a Control locations are indicated by "C" in this column. All other locations are indicators.

^b Not collected at this time. Collection will commence 6 months before fuel loading.

^c Vegetables are collected once a year at the time of harvest.

^d Hourly aliquots composited into semi-monthly, monthly and quarterly composites.

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Table 3. Sample codes used in Table 2.

Code	Description
AP	Airborne Particulates
AI	Airborne Iodine
TLD	Thermoluminescent Dosimeter
M	Milk
DW	Drinking Water
SW	Surface Water
WW	Well Water
VE	Green Leafy Vegetables and Tuborous Vegetables
G	Grass
F	Fish
SL	Slime or Aquatic Vegetation
BS	Bottom Sediments
SS	Shoreline Sediments

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Table 4. Airborne particulates collected at Location CL-1, analysis for gross beta. Collection: weekly

Date Collected	Volume (m ³)	Gross Beta pCi/m ³	Date Collected	Volume (m ³)	Gross Beta pCi/m ³
1-30-82	128	0.032±0.006	9-08-82	220	0.018±0.004
2-06-82	291	0.036±0.004	9-15-82	286	0.032±0.004
2-13-82	274	0.038±0.004	9-22-82	291	0.019±0.003
2-20-82	288	0.029±0.003	9-29-82	285	0.028±0.003
2-24-82	173	0.019±0.004			
3-03-82	286	0.019±0.003	3rd Qtr. mean ± s.d.		0.024±0.005
3-10-82	285	0.034±0.004			
3-17-82	282	0.017±0.003	10-06-82	286	0.059±0.005
3-24-82	288	0.015±0.003	10-13-82	285	0.018±0.003
3-31-82	269	0.018±0.003	10-20-82	291	0.016±0.003
1st Qtr. mean ± s.d.		0.026±0.009	10-27-82	285	0.019±0.003
			11-03-82	287	0.023±0.003
4-07-82	285	0.019±0.003	11-10-82	286	0.029±0.004
4-14-82	291	0.024±0.003	11-17-82	284	0.032±0.004
4-21-82	285	0.018±0.003	11-24-82	294	0.031±0.004
4-28-82	273	0.033±0.004	12-01-82	284	0.030±0.004
5-05-82	293	0.030±0.004	12-08-82	283	0.019±0.003
5-12-82	286	0.027±0.004	12-15-82	274	0.036±0.004
5-19-82	264	0.028±0.004	12-22-82	276	0.032±0.004
5-26-82	306	0.010±0.002	12-29-82	282	0.020±0.003
6-02-82	265	0.015±0.003	4th Qtr. mean ± s.d.		0.028±0.011
6-09-82	286	0.019±0.003			
6-16-82	285	0.019±0.003			
6-23-82	306	0.014±0.003			
6-30-82	285	0.020±0.003			
2nd Qtr. mean ± s.d.		0.021±0.007			
7-07-82	238	0.020±0.003			
7-14-82	301	0.019±0.003			
7-21-82	258	0.025±0.003			
7-28-82	269	0.029±0.004			
8-04-82	279	0.028±0.004			
8-11-82	267	0.023±0.003			
8-18-82	278	0.030±0.004			
8-24-82	249	0.020±0.003			
9-01-82	318	0.018±0.003			

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Table 5. Airborne particulates collected at Location CL-2, analysis for gross beta. Collection: weekly

Date Collected	Volume (m ³)	Gross Beta pCi/m ³	Date Collected	Volume (m ³)	Gross Beta pCi/m ³
2-13-82	187	0.042±0.005	9-08-82	285	0.021±0.003
2-20-82	286	0.032±0.004	9-15-82	286	0.027±0.004
2-24-82	173	0.023±0.005	9-22-82	291	0.013±0.003
3-03-82	290	0.023±0.003	9-29-82	290	0.026±0.003
3-10-82	278	0.037±0.004			
3-17-82	282	0.017±0.003	3rd Qtr. mean ± s.d.		0.024±0.006
3-24-82	277	0.016±0.003			
3-31-82	286	0.022±0.003	10-06-82	291	0.056±0.005
1st Qtr. mean ± s.d.		0.027±0.009	10-13-82	291	0.017±0.003
4-07-82	101 ^a	0.017±0.007	10-20-82	291	0.016±0.003
4-14-82	17 ^b	<0.045	10-27-82	291	0.024±0.003
4-21-82	291	0.022±0.003	11-03-82	287	0.023±0.003
4-28-82	274	0.030±0.004	11-10-82	289	0.033±0.004
5-05-82	290	0.038±0.004	11-17-82	285	0.027±0.003
5-12-82	277	0.012±0.003	11-24-82	282	0.030±0.004
5-19-82	259	0.031±0.004	12-01-82	276	0.031±0.004
5-26-82	299	0.013±0.003	12-08-82	288	0.019±0.003
6-02-82	265	0.017±0.003	12-15-82	280	0.034±0.004
6-09-82	286	0.020±0.003	12-22-82	281	0.028±0.003
6-16-82	285	0.017±0.003	12-29-82	288	0.022±0.003
6-23-82	306	0.020±0.003	4th Qtr. mean ± s.d.		0.028±0.010
6-30-82	285	0.021±0.003			
2nd Qtr. mean ± s.d.		0.022±0.008			
7-07-82	259	0.022±0.003			
7-14-82	301	0.026±0.003			
7-21-82	259	0.026±0.004			
7-28-82	286	0.031±0.004			
8-04-82	279	0.029±0.004			
8-11-82	291	0.021±0.003			
8-18-82	285	0.034±0.004			
8-24-82	247	0.020±0.003			
9-01-82	328	0.020±0.003			

^a Low volume because electricity was off.

^b Low volume because pump was off due to storm.

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Table 6. Airborne particulates collected at Location CL-3, analysis for gross beta. Collection: weekly

Date Collected	Volume (m ³)	Gross Beta pCi/m ³	Date Collected	Volume (m ³)	Gross Beta pCi/m ³
2-13-82	186	0.039±0.005	9-08-82	294	0.024±0.003
2-20-82	289	0.030±0.004	9-15-82	303	0.025±0.003
2-24-82	173	0.020±0.004	9-22-82	297	0.014±0.003
3-03-82	285	0.023±0.003	9-29-82	296	0.026±0.003
3-10-82	280	0.037±0.004			
3-17-82	290	0.017±0.003	3rd Qtr. mean ± s.d.		0.025±0.006
3-24-82	255 ^a	0.017±0.003			
3-31-82	292 ^b	0.020±0.003	10-06-82	297	0.054±0.004
1st Qtr. mean ± s.d.		0.025±0.009	10-13-82	297	0.019±0.003
4-07-82	101 ^c	0.014±0.007	10-20-82	302	0.020±0.003
4-14-82	16 ^d	<0.046	10-27-82	309	0.024±0.003
4-21-82	388	0.024±0.003	11-03-82	287	0.022±0.003
4-28-82	273	0.031±0.004	11-10-82	293	0.031±0.004
5-05-82	136	0.033±0.006	11-17-82	288	0.028±0.003
5-12-82	274	0.030±0.004	11-24-82	280	0.037±0.004
5-19-82	259	0.032±0.004	12-01-82	273	0.032±0.004
5-26-82	306	0.013±0.003	12-08-82	285	0.020±0.003
6-02-82	265	0.015±0.003	12-15-82	282	0.039±0.004
6-09-82	286	0.018±0.003	12-22-82	282	0.033±0.004
6-16-82	285	0.022±0.003	12-29-82	288	0.020±0.003
6-23-82	306	0.018±0.003	4th Qtr. mean ± s.d.		0.029±0.010
6-30-82	285	0.020±0.003			
2nd Qtr. mean ± s.d.		0.023±0.007			
7-07-82	265	0.025±0.003			
7-14-82	307	0.025±0.003			
7-21-82	264	0.024±0.003			
7-28-82	285	0.031±0.004			
8-04-82	291	0.027±0.003			
8-11-82	293	0.020±0.003			
8-18-82	289	0.041±0.004			
8-24-82	251	0.025±0.003			
9-01-82	331	0.019±0.003			

^a Timer stopped working at 39.1 hours. Time and volume estimated from collection data sheet.

^b Timer in for repairs. Time and volume estimated from collection data sheet.

^c Low volume because electricity was off.

^d Low volume because pump was off due to storm.

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Table 7. Airborne particulates collected at Location CL-4, analysis for gross beta. Collection: weekly

Date Collected	Volume (m ³)	Gross Beta pCi/m ³	Date Collected	Volume (m ³)	Gross Beta pCi/m ³
3-03-82	41	0.019±0.014	9-08-82	291	0.024±0.002
3-10-82	283	0.041±0.004	9-15-82	286	0.029±0.004
3-17-82	290	0.023±0.003	9-22-82	297	0.016±0.003
3-24-82	288	0.015±0.003	9-29-82	285	0.029±0.004
3-31-82	280	0.021±0.003			
1st Qtr. mean ± s.d.		0.024±0.010	3rd Qtr. mean ± s.d.		0.027±0.006
4-07-82	285	0.024±0.003	10-06-82	285	0.055±0.005
4-14-82	294	0.034±0.004	10-13-82	286	0.018±0.003
4-21-82	288	0.024±0.003	10-20-82	285	0.021±0.003
4-28-82	276	0.029±0.004	10-27-82	297	0.020±0.003
5-05-82	293	0.036±0.004	11-03-82	281	0.024±0.003
5-12-82	280	0.033±0.004	11-10-82	293	0.035±0.004
5-19-82	251	0.032±0.004	11-17-82	282	0.027±0.003
5-26-82	306	0.015±0.003	11-24-82	288	0.036±0.004
6-02-82	270	0.019±0.003	12-01-82	279	0.029±0.004
6-09-82	286	0.021±0.004	12-08-82	286	<0.002 ^a
6-16-82	285	0.020±0.003	12-15-82	281	0.031±0.004
6-23-82	306	0.018±0.003	12-22-82	281	0.031±0.004
6-30-82	285	0.021±0.003	12-29-82	288	0.019±0.003
2nd Qtr. mean ± s.d.		0.025±0.007	4th Qtr. mean ± s.d.		0.029±0.010
7-07-82	257	0.023±0.003			
7-14-82	307	0.025±0.003			
7-21-82	264	0.023±0.003			
7-28-82	285	0.035±0.004			
8-04-82	285	0.026±0.003			
8-11-82	293	0.023±0.003			
8-18-82	289	0.037±0.004			
8-24-82	245	0.022±0.003			
9-01-82	328	0.022±0.003			

^a Filter paper very light. Very little air particulate matter on the filter.

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Table 8. Airborne particulates collected at Location CL-6, analysis for gross beta. Collection: weekly

Date Collected	Volume (m ³)	Gross Beta pCi/m ³	Date Collected	Volume (m ³)	Gross Beta pCi/m ³
2-13-82	171	0.040±0.005	9-08-82	285	0.023±0.003
2-20-82	286	0.031±0.004	9-15-82	263	0.027±0.004
2-24-82	173	0.026±0.005	9-22-82	285	0.014±0.003
3-03-82	288	0.022±0.003	9-29-82	274	0.027±0.004
3-10-82	285	0.038±0.004			
3-17-82	288	0.019±0.003	3rd Qtr. mean ± s.d.		0.024±0.004
3-24-82	288	0.021±0.003			
3-31-82	290	0.027±0.004	10-06-82	274	0.058±0.005
1st Qtr. mean ± s.d.		0.028±0.008	10-13-82	274	0.017±0.003
4-07-82	282	0.023±0.003	10-20-82	277	0.023±0.003
4-14-82	291	0.030±0.004	10-27-82	286	0.023±0.003
4-21-82	388	0.020±0.003	11-03-82	276	0.023±0.003
4-28-82	278	0.034±0.004	11-10-82	305	0.032±0.004
5-05-82	296	0.026±0.003	11-17-82	293	0.028±0.003
5-12-82	278	0.032±0.004	11-24-82	296	0.031±0.004
5-19-82	259	0.022±0.003	12-01-82	284	0.028±0.004
5-26-82	306	0.015±0.003	12-08-82	286	0.020±0.003
6-02-82	267	0.018±0.003	12-15-82	287	0.033±0.004
6-09-82	286	0.018±0.003	12-22-82	281	0.033±0.004
6-16-82	285	0.022±0.003	12-29-82	300	0.019±0.003
6-23-82	299	0.019±0.003	4th Qtr. mean ± s.d.		0.028±0.010
6-30-82	24 ^a	<0.030			
2nd Qtr. mean ± s.d.		0.023±0.006			
7-07-82	186 ^b	0.021±0.004			
7-14-82	307	0.022±0.003			
7-21-82	264	0.024±0.003			
7-28-82	286	0.030±0.004			
8-04-82	285	0.026±0.003			
8-11-82	251 ^c	0.024±0.004			
8-18-82	282	0.028±0.004			
8-24-82	239	0.020±0.003			
9-01-82	325	0.021±0.003			

^a Low volume due to power failure. Pump ran only 14 hours.

^b Pump ran for only 111.6 hours.

^c Pump ran for only 147.5 hours.

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Table 9. Airborne particulates collected at Location CL-7, analysis for gross beta. Collection: weekly

Date Collected	Volume (m ³)	Gross Beta pCi/m ³	Date Collected	Volume (m ³)	Gross Beta pCi/m ³
6-09-82	528 ^a	0.018±0.002	12-08-82	284	0.016±0.003
6-16-82	ND ^b	ND	12-15-82	289	0.026±0.004
6-23-82	553 ^a	0.020±0.002	12-22-82	281	0.032±0.004
6-30-82	ND ^b	ND	12-29-82	276	0.020±0.003
2nd Qtr. mean ± s.d.		0.019±0.001	4th Qtr. mean ± s.d.		0.027±0.010
7-07-82	ND	ND			
7-14-82	ND	ND			
7-21-82	ND	ND			
7-28-82	ND	ND			
8-04-82	ND	ND			
8-11-82	1952 ^c	0.020±0.001			
8-18-82	322	0.034±0.004			
8-24-82	246	0.020±0.003			
9-01-82	328	0.017±0.003			
9-08-82	288	0.024±0.003			
9-15-82	291	0.023±0.003			
9-22-82	297	0.015±0.003			
9-29-82	291	0.027±0.003			
3rd Qtr. mean ± s.d.		0.023±0.006			
10-06-82	291	0.053±0.005			
10-13-82	291	0.014±0.003			
10-20-82	294	0.021±0.003			
10-27-82	314	0.022±0.003			
11-03-82	264	0.023±0.004			
11-10-82	304	0.032±0.004			
11-17-82	291	0.024±0.003			
11-24-82	288	0.031±0.004			
12-01-82	273	0.033±0.004			

^a Pump ran for two weeks.

^b ND = No Data. The gate that gives access to the sampler was locked.

^c High volume; pump ran 1149.0 hours (7 weeks).

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Table 10. Airborne particulates collected at Location CL-8, analysis for gross beta. Collection: weekly

Date Collected	Volume (m ³)	Gross Beta pCi/m ³	Date Collected	Volume (m ³)	Gross Beta pCi/m ³
2-13-82	194	0.059±0.006	9-08-82	285	0.021±0.003
2-20-82	284	0.028±0.003	9-15-82	286	0.026±0.004
2-24-82	172	0.013±0.004	9-22-82	285	0.014±0.003
3-03-82	285	0.025±0.003	9-29-82	285	0.026±0.003
3-10-82	285	0.038±0.004			
3-17-82	283	0.021±0.003	3rd Qtr. mean ± s.d.		0.024±0.006
3-24-82	287	0.023±0.003			
3-31-82	286	0.024±0.003	10-06-82	285	0.049±0.004
1st Qtr. mean ± s.d.		0.029±0.014	10-13-82	286	0.018±0.003
4-07-82	285	0.020±0.003	10-20-82	285	0.019±0.003
4-14-82	286	0.029±0.004	10-27-82	287	0.022±0.003
4-21-82	282	0.023±0.003	11-03-82	287	0.023±0.003
4-28-82	273	0.033±0.004	11-10-82	284	0.032±0.004
5-05-82	293	0.038±0.004	11-17-82	290	0.027±0.003
5-12-82	286	0.032±0.004	11-24-82	275	0.035±0.004
5-19-82	261	0.034±0.004	12-01-82	284	0.031±0.004
5-26-82	306	0.017±0.003	12-08-82	284	0.021±0.003
6-02-82	265	0.017±0.003	12-15-82	278	0.030±0.004
6-09-82	286	0.017±0.003	12-22-82	276	0.034±0.004
6-16-82	285	0.019±0.003	12-29-82	288	0.020±0.003
6-23-82	307	0.019±0.003	4th Qtr. mean ± s.d.		0.028±0.009
6-30-82	285	0.018±0.003			
2nd Qtr. mean ± s.d.		0.024±0.008			
7-07-82	265	0.021±0.003			
7-14-82	307	0.022±0.003			
7-21-82	266	0.022±0.003			
7-28-82	286	0.032±0.004			
8-04-82	285	0.025±0.003			
8-11-82	295	0.020±0.003			
8-18-82	276	0.037±0.004			
8-24-82	246	0.022±0.003			
9-01-82	325	0.019±0.003			

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Table 11. Airborne particulates collected at Location CL-11, analysis for gross beta. Collection: weekly

Date Collected	Volume (m ³)	Gross Beta pCi/m ³	Date Collected	Volume (m ³)	Gross Beta pCi/m ³
2-13-82	172	0.041±0.005	9-08-82	291	0.024±0.003
2-20-82	292	0.037±0.004	9-15-82	285	0.028±0.004
2-24-82	176	0.022±0.004	9-22-82	292	0.013±0.003
3-03-82	288	0.021±0.003	9-29-82	291	0.027±0.003
3-10-82	285	0.039±0.004			
3-17-82	290	0.023±0.003	3rd Qtr. mean ± s.d.		0.025±0.006
3-24-82	282	0.019±0.003			
3-31-82	283	0.022±0.003	10-06-82	297	0.058±0.005
1st Qtr. mean ± s.d.		0.028±0.009	10-13-82	107 ^a	0.018±0.007
4-07-82	285	0.022±0.003	10-20-82	ND ^b	ND
4-14-82	285	0.031±0.004	10-27-82	ND	ND
4-21-82	280	0.022±0.003	11-03-82	ND	ND
4-28-82	268	0.029±0.004	11-10-82	ND	ND
5-05-82	290	0.038±0.004	11-17-82	306	0.023±0.003
5-12-82	277	0.033±0.004	11-24-82	285	0.030±0.004
5-19-82	262	0.033±0.004	12-01-82	285	0.031±0.004
5-26-82	306	0.014±0.003	12-08-82	281	0.013±0.003
6-02-82	236	0.017±0.004	12-15-82	297	0.025±0.004
6-09-82	285	0.018±0.003	12-22-82	287	0.033±0.004
6-16-82	286	0.023±0.003	12-29-82	276	0.019±0.003
6-23-82	306	0.016±0.003	4th Qtr. mean ± s.d.		0.028±0.013
6-30-82	285	0.018±0.003			
2nd Qtr. mean ± s.d.		0.024±0.008			
7-07-82	259	0.020±0.003			
7-14-82	308	0.024±0.003			
7-21-82	259	0.028±0.004			
7-28-82	280	0.034±0.004			
8-04-82	285	0.032±0.004			
8-11-82	310	0.020±0.003			
8-18-82	278	0.035±0.004			
8-24-82	251	0.020±0.003			
9-01-82	325	0.022±0.003			

^a Low volume; pump ran for only 60.0 hours.

^b ND = No Data. Pump not operating.

HAZLETON ENVIRONMENTAL SCIENCES

Table 12. Airborne particulates, gross beta analysis, Monthly average, minima and maxima, 1982.

Month	Location	Number ^a of samples	Gross beta activity (pCi/m ³)		
			Average	Minimum	Maximum
JANUARY	CL-1	1	0.032	--	--
	CL-2	--b	--	--	--
	CL-3	--b	--	--	--
	CL-4	--b	--	--	--
	CL-6	--b	--	--	--
	CL-7	--b	--	--	--
	CL-8	--b	--	--	--
	CL-11	--b	--	--	--
FEBRUARY	CL-1	5	0.028	0.019	0.038
	CL-2	4	0.030	0.023	0.042
	CL-3	4	0.028	0.020	0.039
	CL-4	1	0.019	--	--
	CL-6	4	0.030	0.022	0.040
	CL-7	--b	--	--	--
	CL-8	4	0.031	0.013	0.059
	CL-11	4	0.030	0.021	0.041
MARCH	CL-1	4	0.021	0.015	0.034
	CL-2	4	0.023	0.016	0.037
	CL-3	4	0.023	0.017	0.037
	CL-4	4	0.025	0.015	0.041
	CL-6	4	0.026	0.019	0.038
	CL-7	--b	--	--	--
	CL-8	4	0.027	0.021	0.038
	CL-11	4	0.026	0.019	0.039
APRIL	CL-1	4	0.024	0.018	0.033
	CL-2	4 (1)	0.023	0.017	0.030
	CL-3	4	0.023	0.014	0.031
	CL-4	4	0.028	0.024	0.034
	CL-6	4	0.027	0.022	0.034
	CL-7	--b	--	--	--
	CL-8	4	0.026	0.020	0.033
	CL-11	4	0.026	0.022	0.031

HAZLETON ENVIRONMENTAL SCIENCES

Table 12. (Continued)

Month	Location	Number ^a of samples	Gross beta activity (pCi/m ³)		
			Average	Minimum	Maximum
MAY	CL-1	5	0.022	0.010	0.030
	CL-2	5	0.022	0.012	0.038
	CL-3	5	0.025	0.013	0.033
	CL-4	5	0.027	0.015	0.036
	CL-6	5	0.023	0.015	0.032
	CL-7	--b	--	--	--
	CL-8	5	0.028	0.017	0.038
	CL-11	5	0.027	0.014	0.038
JUNE	CL-1	4	0.018	0.014	0.020
	CL-2	4	0.020	0.017	0.021
	CL-3	4	0.019	0.018	0.022
	CL-4	4	0.020	0.018	0.021
	CL-6	4 (1)	0.020	0.018	0.022
	CL-7	2	0.019	0.018	0.020
	CL-8	4	0.018	0.017	0.019
	CL-11	4	0.019	0.016	0.023
JULY	CL-1	4	0.023	0.019	0.029
	CL-2	4	0.026	0.022	0.031
	CL-3	4	0.026	0.024	0.031
	CL-4	4	0.026	0.023	0.035
	CL-6	4	0.024	0.021	0.030
	CL-7	--c	--	--	--
	CL-8	4	0.024	0.021	0.032
	CL-11	4	0.027	0.020	0.034
AUGUST	CL-1	5	0.024	0.018	0.030
	CL-2	5	0.025	0.020	0.034
	CL-3	5	0.026	0.019	0.041
	CL-4	5	0.026	0.022	0.037
	CL-6	5	0.024	0.020	0.028
	CL-7	4	0.023	0.017	0.034
	CL-8	5	0.025	0.029	0.037
	CL-11	5	0.026	0.020	0.035

HAZLETON ENVIRONMENTAL SCIENCES

Table 12. (Continued)

Month	Location	Number ^a of samples	Gross beta activity (pCi/m ³)		
			Average	Minimum	Maximum
SEPTEMBER	CL-1	4	0.024	0.018	0.032
	CL-2	4	0.022	0.013	0.027
	CL-3	4	0.022	0.014	0.026
	CL-4	4	0.025	0.016	0.029
	CL-6	4	0.023	0.014	0.027
	CL-7	4	0.022	0.015	0.027
	CL-8	4	0.022	0.014	0.026
	CL-11	4	0.023	0.013	0.028
OCTOBER	CL-1	5	0.027	0.016	0.059
	CL-2	5	0.027	0.016	0.056
	CL-3	5	0.028	0.019	0.054
	CL-4	5	0.028	0.018	0.055
	CL-6	5	0.029	0.017	0.058
	CL-7	5	0.027	0.014	0.053
	CL-8	5	0.026	0.018	0.049
	CL-11	2	0.038	0.018	0.058
NOVEMBER	CL-1	4	0.031	0.029	0.032
	CL-2	4	0.030	0.027	0.033
	CL-3	4	0.032	0.028	0.032
	CL-4	4	0.032	0.027	0.036
	CL-6	4	0.030	0.028	0.032
	CL-7	4	0.030	0.024	0.033
	CL-8	4	0.031	0.027	0.035
	CL-11	3	0.028	0.023	0.031
DECEMBER	CL-1	4	0.027	0.019	0.036
	CL-2	4	0.026	0.019	0.034
	CL-3	4	0.028	0.020	0.039
	CL-4	4 (1)	0.027	0.019	0.031
	CL-6	4	0.026	0.019	0.033
	CL-7	4	0.024	0.016	0.032
	CL-8	4	0.026	0.020	0.034
	CL-11	4	0.022	0.013	0.033

^a Unless specified otherwise, data for samples collected on the first, second or third day of a month are grouped with data of the previous month. Number in parenthesis indicates number of samples with unreliable or less than value results which are excluded from the averages.

^b Pumps not yet operational.

^c No collection for the whole month because the gate that gives access to the sampler was locked.

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Table 13. Airborne particulates, quarterly composites of weekly samples, analysis for gamma-emitting isotopes, 1982.

Location	Isotope	Activity (pCi/m ³)			
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
CL-1	Lab Code	CLAP-67	CLAP-140	CLAP-214	CLAP-266
	Volume (m ³)	2564	3710	3539	3697
	Be-7	0.115±0.031	0.126±0.028	<0.062	<0.048
	Nb-95	<0.0024	<0.0011	<0.0012	<0.0019
	Zr-95	<0.0057	<0.0028	<0.0043	<0.0046
	Ru-103	<0.0027	<0.0033	<0.0053	<0.0031
	Ru-106	<0.020	<0.019	<0.013	<0.013
	Cs-134	<0.0022	<0.0020	<0.0010	<0.0016
	Cs-137	<0.0024	<0.0014	<0.0017	<0.0013
	Ce-141	<0.0008	<0.0053	<0.0088	<0.0050
	Ce-144	<0.0094	<0.0061	<0.0064	<0.011
CL-2	Lab Code	CLAP-68	CLAP-141	CLAP-215	CLAP-267
	Volume (m ³)	2059	3235	3687	3720
	Be-7	0.151±0.038	0.123±0.030	0.113±0.028	0.096±0.025
	Nb-95	<0.0038	<0.0022	<0.0026	<0.0025
	Zr-95	<0.0067	<0.0031	<0.0047	<0.0017
	Ru-103	<0.0044	<0.0033	<0.0037	<0.0037
	Ru-106	<0.016	<0.022	<0.012	<0.0084
	Cs-134	<0.0030	<0.0008	<0.0017	<0.0016
	Cs-137	<0.0025	<0.0013	<0.0014	<0.0010
	Ce-141	<0.010	<0.0050	<0.0092	0.018±0.005
	Ce-144	<0.012	<0.011	<0.011	<0.011
CL-3	Lab Code	CLAP-69	CLAP-142	CLAP-216	CLAP-268
	Volume (m ³)	2050	3180	3766	3763
	Be-7	<0.081	0.098±0.027	0.109±0.027	0.091±0.024
	Nb-95	<0.0045	<0.0019	<0.0031	<0.0014
	Zr-95	<0.0075	<0.0040	<0.0026	<0.0043
	Ru-103	<0.0047	<0.0036	<0.0048	<0.0031
	Ru-106	<0.024	<0.017	<0.013	<0.011
	Cs-134	<0.0040	<0.0016	<0.0015	<0.0006
	Cs-137	<0.0031	<0.0017	<0.0014	<0.0022
	Ce-141	<0.011	<0.0065	<0.0074	<0.0092
	Ce-144	<0.014	<0.0079	<0.011	<0.012

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Table 13. Continued.

Location	Isotope	Activity (pCi/m ³)			
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
CL-4	Lab Code	CLAP-70	CLAP-143	CLAP-217	CLAP-269
	Volume (m ³)	1182	3705	3716	3712
	Be-7	<0.098	0.127±0.030	0.091±0.025	<0.057
	Nb-95	<0.0052	<0.0026	<0.0023	<0.0022
	Zr-95	<0.0082	<0.0039	<0.0047	<0.0057
	Ru-103	<0.0073	<0.0034	<0.0053	<0.0025
	Ru-106	<0.047	<0.017	<0.012	<0.015
	Cs-134	<0.052	<0.0017	<0.0007	<0.0016
	Cs-137	<0.0047	<0.0016	<0.0015	<0.0015
	Ce-141	<0.0098	0.014±0.004	<0.011	<0.0071
	Ce-144	<0.024	<0.0088	<0.010	<0.0064
CL-6	Lab Code	CLAP-71	CLAP-144	CLAP-218	CLAP-270
	Volume (m ³)	2069	3550	3532	3719
	Be-7	<0.079	0.154±0.032	<0.045	0.112±0.025
	Nb-95	<0.0058	<0.0034	<0.0017	<0.0019
	Zr-95	<0.0094	<0.0036	<0.0054	<0.0039
	Ru-103	<0.0066	<0.0045	<0.0053	<0.0061
	Ru-106	<0.024	<0.0093	<0.013	<0.015
	Cs-134	<0.0028	<0.0014	<0.0010	<0.0017
	Cs-137	<0.0025	<0.0017	<0.0025	<0.0014
	Ce-141	<0.0094	<0.0071	<0.0096	<0.0071
	Ce-144	<0.014	<0.010	<0.011	<0.0070
CL-7	Lab Code	ND ^a	CLAP-145 ^b	CLAP-219	CLAP-271
	Volume (m ³)		1081	4015	3740
	Be-7		0.192±0.053	0.092±0.024	<0.056
	Nb-95		<0.0039	<0.0022	<0.0022
	Zr-95		<0.0050	<0.0020	<0.0043
	Ru-103		<0.011	<0.0026	<0.0033
	Ru-106		<0.048	<0.011	<0.010
	Cs-134		<0.0040	<0.0013	<0.0015
	Cs-137		<0.0057	<0.0016	<0.0011
	Ce-141		<0.011	<0.0059	<0.0079
	Ce-144		<0.026	<0.0099	<0.0095

^a ND = No Data. Pump is not yet installed.

^b Second quarter composite includes only June collections. Operation at this location started June 1982.

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Table 13. Continued.

Location	Isotope	Activity (pCi/m ³)			
		1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
CL-8	Lab Code	CLAP-72	CLAP-146	CLAP-220	CLAP-272
	Volume (m ³)	2076	3700	3692	3688
	Be-7	0.150±0.038	0.110±0.028	<0.047	<0.053
	Nb-95	<0.0051	<0.0026	<0.0012	<0.0019
	Zr-95	<0.0051	<0.0039	<0.0022	<0.0026
	Ru-103	<0.0035	<0.0031	<0.0043	<0.0025
	Ru-106	<0.018	<0.012	<0.016	<0.017
	Ca-134	<0.0025	<0.0010	<0.0020	<0.0011
	Cs-137	<0.0020	<0.0015	<0.0015	<0.0012
	Ce-141	<0.0094	<0.0068	<0.0095	<0.0054
	Ce-144	<0.014	<0.0078	<0.012	<0.0087
CL-11	Lab Code	CLAP-73	CLAP-147	CLAP-221	CLAP-273
	Volume (m ³)	2068	3651	3714	2421
	Be-7	0.188±0.042	0.102±0.027	<0.053	0.117±0.028
	Nb-95	<0.0034	<0.0022	<0.0030	<0.0028
	Zr-95	<0.0053	<0.0028	<0.0037	<0.0064
	Ru-103	<0.0080	<0.0036	<0.0067	<0.0061
	Ru-106	<0.022	<0.015	<0.012	<0.016
	Ca-134	<0.0028	<0.0007	<0.0014	<0.0022
	Cs-137	<0.0027	<0.0014	<0.0019	<0.0022
	Ce-141	<0.0071	<0.0064	<0.0085	<0.0078
	Ce-144	<0.016	<0.0065	<0.0095	<0.0085

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Table 14. Ambient gamma radiation (TLD), quarterly exposure, 1982.

Location	mrem/91 days			
	1st Q, 1982	2nd Q, 1982	3rd Q, 1982	4th Q, 1982
CL-1	12.3±0.8	15.4±1.6	15.8±1.0	15.3±1.0
CL-2	14.2±0.5	16.2±1.4	17.9±1.2	16.3±1.1
CL-3	13.5±0.9	14.8±2.2	16.2±1.6	15.3±1.0
CL-4	12.7±0.6	13.7±1.3	14.4±0.8	14.4±1.1
CL-5	14.7±1.6	14.4±1.1	15.5±2.1	14.4±1.2
CL-6	13.6±0.7	14.5±0.8	17.5±1.1	14.6±1.0
CL-7	15.2±0.9	14.9±1.7	16.8±0.8	15.7±1.1
CL-8	12.8±0.6	15.6±1.3	15.0±0.6	16.1±0.9
CL-11	12.1±0.8	13.0±0.9	15.5±1.9	14.2±3.0
CL-21	14.2±0.6	17.8±0.9	16.1±1.6	17.2±1.0
CL-22	11.6±1.2	14.7±1.2	15.6±0.6	15.6±0.9
CL-23	11.9±0.5	13.2±0.8	14.9±1.4	14.3±0.9
CL-24	13.4±0.6	13.9±1.0	15.4±1.2	15.0±1.3
CL-25	10.5±0.6	12.4±3.0	12.0±0.7	12.0±1.2
CL-26	12.3±1.1	12.0±0.8	13.4±1.2	12.9±1.2
CL-27	13.5±1.0	14.6±1.8	14.4±0.5	15.9±1.5
CL-28	12.6±0.5	14.2±0.9	14.9±0.7	15.4±1.1
CL-29	14.4±1.1	15.4±1.0	15.4±0.9	15.5±1.5
CL-30	13.2±1.4	13.2±0.8	16.2±0.8	15.0±1.1
CL-31	11.2±0.4	12.2±0.8	14.5±0.6	13.0±1.3
CL-32	13.1±1.1	13.7±1.2	14.9±1.0	14.7±1.4
CL-33	12.8±1.2	14.7±0.9	15.9±0.9	14.2±1.3
CL-34	14.3±1.6	15.3±1.4	18.1±1.7	17.0±1.0
CL-35	12.6±1.1	15.0±2.1	15.8±1.1	15.1±0.9
CL-36	12.8±0.5	15.5±2.1	16.9±1.4	15.6±1.9
CL-37	12.7±0.7	14.4±1.5	15.3±0.6	15.3±0.9
CL-38	13.4±2.8	14.4±1.5	15.0±0.6	15.0±1.0
CL-39	10.0±0.7	13.5±0.9	14.2±0.6	14.6±0.9
CL-40	11.6±0.6	14.0±1.1	16.1±0.6	15.3±1.8
CL-41	12.3±0.9	16.7±2.6	16.6±0.5	16.9±1.5
CL-42	12.5±0.8	13.4±1.1	15.1±0.5	15.8±1.1
CL-43	14.2±1.0	15.5±1.4	17.0±0.8	17.0±2.0
CL-44	13.6±1.5	14.1±1.3	16.7±1.4	16.1±1.2
CL-45	13.3±0.7	16.7±1.4	15.4±0.5	15.3±2.2
CL-46	12.7±1.1	ND ^a	14.0±0.6	14.4±1.5
CL-47	13.9±1.7	15.3±1.0	16.8±0.9	16.9±1.2
CL-48	14.7±0.4	16.0±1.3	15.8±0.7	16.8±1.5
CL-49	13.0±2.2	14.5±1.4	14.8±1.2	15.6±1.2
CL-50	13.2±1.6	15.3±1.2	15.9±1.7	14.1±1.0
CL-51	13.5±0.7	13.8±1.2	16.3±0.5	15.7±1.3
CL-52	12.9±0.5	14.6±1.4	15.2±0.7	15.1±1.0
Mean ± s.d.	13.0±1.1	14.6±1.2	15.6±1.2	15.2±1.1

^a ND = No Data. TLDs were lost in the field.

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Table 15. Surface water samples collected at CL-9, analyses for gamma-emitting isotopes. Collection: Monthly.

Sample Description and Activity (pCi/l)			
Period Collected	January	February	March
Lab Code	ND ^a	(2-20-82) CLSW-495	(3-17-82) CLSW-691
Mn-54		<15	<15
Fe-59		<30	<30
Co-58		<15	<15
Co-60		<15	<15
Zn-65		<30	<30
Nb-95		<15	<15
Zr-95		<17	<15
Cs-134		<15	<15
Cs-137		<15	<15
Ba-La-140 ^b		<15	<15

Period Collected	April	May	June
Lab Code	(4-14-82) CLSW-1062	(5-12-82) CLSW-1354	(6-09-82) CLSW-1600
Mn-54	<15	<15	<15
Fe-59	<30	<30	<30
Co-58	<15	<15	<15
Co-60	<15	<15	<15
Zn-65	<30	<30	<30
Nb-95	<15	<15	<15
Zr-95	<22	<17	<20
Cs-134	<15	<15	<15
Cs-137	<15	<15	<15
Ba-La-140 ^b	<15	<15	<15

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Table 15. Continued

Sample Description and Activity (pCi/l)				
Period Collected	July (7-07-82)	August (8-04-82)	September (9-01-82)	
Lab Code	CLSW-1967	CLSW-2252	CLSW-2475	
Mn-54	<15	<15	<15	
Fe-59	<30	<30	<30	
Co-58	<15	<15	<15	
Co-60	<15	<15	<15	
Zn-65	<30	<30	<30	
Nb-95	<15	<15	<15	
Zr-95	<22	<25	<15	
Cs-134	<15	<15	<15	
Cs-137	<15	<15	<15	
Ba-La-140 ^b	<15	<15	<15	

Period Collected	October (10-13-82)	November (11-10-82)	December (12-01-82)	
Lab Code	CLSW-3001	CLSW-3288	CLSW-3514, 15	
Mn-54	<15	<15	<15	
Fe-59	<30	<30	<30	
Co-58	<15	<15	<15	
Co-60	<15	<15	<15	
Zn-65	<30	<30	<30	
Nb-95	<15	<15	<15	
Zr-95	<15	<19	<20	
Cs-134	<15	<15	<15	
Cs-137	<15	<15	<15	
Ba-La-140 ^b	<15	<15	<15	

^a ND = No Data. Sample not collected, lake frozen.

^b Ba-La-140 minimum sensitivity is at counting time.

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Table 16. Surface water samples collected at CL-10, analyses for gamma-emitting isotopes. Collection: Monthly.

Sample Description and Activity (pCi/l)			
Period Collected	January	February	March
Lab Code	ND ^a	(2-20-82) CLSW-496	(3-17-82) CLSW-692
Mn-54		<15	<15
Fe-59		<30	<30
Co-58		<15	<15
Co-60		<15	<15
Zn-65		<30	<30
Nb-95		<15	<15
Zr-95		<17	<17
Cs-134		<15	<15
Cs-137		<15	<15
Ba-La-140 ^b		<15	<15
Period Collected	April	May	June
Lab Code	(4-14-82) CLSW-1063	(5-12-82) CLSW-1355	(6-09-82) CLSW-1601
Mn-54	<15	<15	<15
Fe-59	<30	<30	<30
Co-58	<15	<15	<15
Co-60	<15	<15	<15
Zn-65	<30	<30	<30
Nb-95	<15	<15	<15
Zr-95	<15	<15	<15
Cs-134	<15	<15	<15
Cs-137	<15	<15	<15
Ba-La-140 ^b	<15	<15	<15

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Table 16. Continued

Sample Description and Activity (pCi/l)				
Period Collected	July (7-07-82)	August (8-04-82)	September (9-01-82)	
Lab Code	CLSW-1968	CLSW-2253	CLSW-2476,7	
Mn-54	<15	<15	<15	
Fe-59	<30	<30	<30	
Co-58	<15	<15	<15	
Co-60	<15	<15	<15	
Zn-65	<30	<30	<30	
Nb-95	<15	<15	<15	
Zr-95	<15	<15	<15	
Cs-134	<15	<15	<15	
Cs-137	<15	<15	<15	
Ba-La-140 ^b	<15	<15	<15	

Period Collected	October (10-13-82)	November (11-10-82)	December (12-01-82)	
Lab Code	CLSW-3002	CLSW-3289	CLSW-3516	
Mn-54	<15	<15	<15	
Fe-59	<30	<30	<30	
Co-58	<15	<15	<15	
Co-60	<15	<15	<15	
Zn-65	<30	<30	<30	
Nb-95	<15	<15	<15	
Zr-95	<15	<23	<19	
Cs-134	<15	<15	<15	
Cs-137	<15	<15	<15	
Ba-La-140 ^b	<15	<15	<15	

^a ND = No Data. Sample not collected.

^b Ba-La-140 minimum sensitivity is at counting time.

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Table 17. Surface water samples collected at CL-13, analyses for gamma-emitting isotopes. Collection: Monthly.

Sample Description and Activity (pCi/l)				
Period Collected	January (1-30-82)	February (2-20-82)	March (3-17-82)	
Lab Code	CLSW-494	CLSW-497	CLSW-693	
Mn-54	<15	<15	<15	
Fe-59	<37	<30	<30	
Co-58	<15	<15	<15	
Co-60	<15	<15	<15	
Zn-65	<30	<30	<30	
Nb-95	<15	<15	<15	
Zr-95	<22	<17	<22	
Cs-134	<15	<15	<15	
Cs-137	<15	<15	<15	
Ba-La-140 ^b	<20	<15	<15	

Period Collected	April (4-14-82)	May (5-12-82)	June (6-09-82)	
Lab Code	CLSW-1064	CLSW-1356	CLSW-1602	
Mn-54	<15	<15	<15	
Fe-59	<30	<30	<30	
Co-58	<15	<15	<15	
Co-60	<15	<15	<15	
Zn-65	<30	<30	<30	
Nb-95	<15	<15	<15	
Zr-95	<15	<17	<15	
Cs-134	<15	<15	<15	
Cs-137	<15	<15	<15	
Ba-La-140 ^b	<15	<15	<15	

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Table 17. Continued

Sample Description and Activity (pCi/l)			
Period Collected	July (7-07-82)	August (8-04-82)	September (9-01-82)
Lab Code	CLSW-1969	CLSW-2254	CLSW-2478
Mn-54	<15	<15	<15
Fe-59	<30	<30	<30
Co-58	<15	<15	<15
Co-60	<15	<15	<15
Zn-65	<30	<30	<30
Nb-95	<15	<15	<15
Zr-95	<20	<17	<15
Cs-134	<15	<15	<15
Cs-137	<15	<15	<15
Ba-La-140 ^b	<15	<15	<15

Period Collected	October (10-13-82)	November (11-10-82)	December (12-01-82)
Lab Code	CLSW-3003	CLSW-3290	CLSW-3517
Mn-54	<15	<15	<15
Fe-59	<30	<30	<30
Co-58	<15	<15	<15
Co-60	<15	<15	<15
Zn-65	<30	<30	<30
Nb-95	<15	<15	<15
Zr-95	<15	<15	<20
Cs-134	<15	<15	<15
Cs-137	<15	<15	<15
Ba-La-140 ^b	<15	<15	<15

^a ND = No Data. Sample not collected.

^b Ba-La-140 minimum sensitivity is at counting time.

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Table 18. Surface water samples, analysis for tritium. Collection: Quarterly.

Collection	CL-9	
Period	Lab Code	Tritium (pCi/l)
<u>CL-9</u>		
1st Quarter, 1982	CLSW-916	<300
2nd Quarter, 1982	1760	<300
3rd Quarter, 1982	2695	<300
4th Quarter, 1982	3846,7	<300
Annual mean \pm s.d.		<300
Collection	CL-10	
Period	Lab Code	Tritium (pCi/l)
<u>CL-10</u>		
1st Quarter, 1982	CLSW-917	<300
2nd Quarter, 1982	1760	<300
3rd Quarter, 1982	2696	<300
4th Quarter, 1982	3848	<300
Annual mean \pm s.d.		<300
Collection	CL-13	
Period	Lab Code	Tritium (pCi/l)
<u>CL-13</u>		
1st Quarter, 1982	CLSW-918	<300
2nd Quarter, 1982	1762	<300
3rd Quarter, 1982	2697	330 \pm 140
4th Quarter, 1982	2849	<300
Annual mean \pm s.d.		330 \pm 140

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Table 19. Well water samples collected at CL-7, analysis for gross beta and gamma-emitting isotopes. Collection: Monthly.

Sample Description and Activity (pCi/l)		
Period Collected	January - August ^a	September - October ^b
Lab Code		
Gross beta		
Mn-54		
Fe-59		
Co-58		
Co-60		
Zn-65		
Nb-95		
Zr-95		
Cs-134		
Cs-137		
Ba-La-140		
Period Collected	November (11-24-82)	December (12-01-82)
Lab Code	CLWW-3518	CLWW-3519
Gross beta	4.1±2.1	<3.3
Mn-54	<15	<15
Fe-59	<30	<30
Co-58	<15	<15
Co-60	<15	<15
Zn-65	<30	<30
Nb-95	<15	<15
Zr-95	<17	<20
Cs-134	<15	<15
Cs-137	<15	<15
Ba-La-140	<15	<15

^a Well not operational.

^b Not collected because collector does not have the special wrench needed to turn the faucet on.

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Table 20. Well water samples collected at CL-12, analysis for gross beta and gamma-emitting isotopes. Collection: Monthly.

Sample Description and Activity (pCi/l)			
Period Collected	January - August ^a		September (9-01-82)
Lab Code			CLWW-2479
Gross beta			<3.6
Mn-54			<15
Fe-59			<30
Co-58			<15
Co-60			<15
Zn-65			<30
Nb-95			<15
Zr-95			<15
Cs-134			<15
Cs-137			<15
Ba-La-140			<15
Period Collected	October (10-13-82)	November (11-10-82)	December (12-01-82)
Lab Code	CLWW-3004,5	CLWW-3291	CLWW-3520
Gross beta	<5.0	<9.1	<6.6
Mn-54	<15	<15	<15
Fe-59	<30	<30	<30
Co-58	<15	<15	<15
Co-60	<15	<15	<15
Zn-65	<30	<30	<30
Nb-95	<15	<15	<15
Zr-95	<15	<17	<20
Cs-134	<15	<15	<15
Cs-137	<15	<15	<15
Ba-La-140	<15	<15	<15

^a Well not operational.

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Table 20A. Well water samples, analysis for tritium. Collection: Quarterly.

Collection Period	CL-7	
	Lab Code	Tritium (pCi/l)
1st Quarter, 1982 ^a		
2nd Quarter, 1982 ^a		
3rd Quarter, 1982 ^b		
4th Quarter, 1982	CLWW-3850	<300

Collection Period	CL-12	
	Lab Code	Tritium (pCi/l)
1st Quarter, 1982 ^a		
2nd Quarter, 1982 ^a		
3rd Quarter, 1982	CLWW-2479	<300
4th Quarter, 1982	CLWW-3851	<300

^a Well not operational.

^b Not collected because collector does not have the special wrench needed to turn the faucet on.

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Table 21. Fish samples, analysis for gamma-emitting isotopes.
Collection: Semi-annually.

Sample Description and Activity (pCi/g wet)		
Location	Clinton Lake Site No. 19	Clinton Lake Site No. 19
Lab Code	CLF-53	CLF-85
Date Collected	6-16-82	9-07-82
Type	Largemouth Bass	Largemouth Bass
Portion	Flesh	Flesh
B-7	<0.20	<0.59
K-40	3.53±0.40	4.61±0.69
Co-58	<0.019	<0.063
Co-60	<0.020	<0.051
Nb-95	<0.033	<0.091
Zr-95	<0.060	<0.11
Ru-103	<0.022	<0.072
Ru-106	<0.039	<0.039
Cs-134	<0.022	<0.047
Cs-137	<0.020	<0.048
Ce-141	<0.067	<0.11
Ce-144	<0.11	<0.26

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Table 22. Bottom sediments samples, analysis for gamma-emitting isotopes.
Collection: Semi-annually.

Sample Description and Activity (pCi/g dry)		
Location	CL-7 (Clinton Open Water)	CL-7 (Clinton Open Water)
Lab Code	CLBS-32,33	CLBS-62
Date Collected	6-16-82	9-07-82
Be-7	<0.57	<0.71
K-40	20.13±0.78	19.72±1.30
Co-58	<0.039	<0.067
Co-60	<0.053	<0.064
Nb-95	<0.053	<0.067
Zr-95	<0.13	<0.17
Ru-103	<0.095	<0.19
Ru-106	<0.51	<0.42
Cs-134	<0.078	<0.078
Cs-137	0.532±0.037	0.391±0.055
Ce-141	<0.15	<0.16
Ce-144	<0.29	<0.34
Location	CL-10 (Clinton Open Water)	CL-10 (Clinton Open Water)
Lab Code	CLBS-34	CLBS-63
Date Collected	6-16-83	9-07-82
Be-7	1.98±0.46	<0.99
K-40	20.19±1.10	19.64±1.40
Co-58	<0.047	<0.057
Co-60	<0.070	<0.11
Nb-95	<0.079	<0.12
Zr-95	<0.10	<0.096
Ru-103	<0.11	<0.16
Ru-106	<0.45	<0.53
Cs-134	<0.15	<0.095
Cs-137	0.881±0.065	1.07±0.087
Ce-141	<0.16	<0.25
Ce-144	<0.37	<0.43

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Table 23 Shoreline sediment samples, analysis for gamma-emitting isotopes. Collection: Semi-annually.

Sample Description and Activity (pCi/g wet)		
Location	CL-7 (Near Shore)	CL-7 (Near Shore)
Lab Code	CLSS-30	CLSS-60
Date Collected	6-16-82	9-07-82
Be-7	<0.20	<0.37
K-40	9.65±0.63	9.35±0.61
Co-58	<0.023	<0.023
Co-60	<0.034	<0.011
Nb-95	<0.028	<0.037
Zr-95	<0.043	<0.079
Ru-103	<0.056	<0.051
Ru-106	<0.28	<0.25
Cs-134	<0.029	<0.033
Cs-137	<0.034	<0.034
Ce-141	<0.093	<0.082
Ce-144	<0.14	<0.15
Location	CL-10 (Near Shore)	CL-10 (Near Shore)
Lab Code	CLSS-31	CLSS-61
Date Collected	6-16-82	9-07-82
Be-7	<0.26	<0.33
K-40	9.78±0.67	9.28±0.58
Co-58	<0.028	<0.029
Co-60	<0.042	<0.031
Nb-95	<0.022	<0.031
Zr-95	<0.074	<0.051
Ru-103	<0.047	<0.047
Ru-106	<0.23	<0.22
Cs-134	<0.037	<0.034
Cs-137	<0.034	<0.037
Ce-141	<0.081	<0.085
Ce-144	<0.15	<0.13

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Table 24. Slime samples, analysis for gamma-emitting isotopes.
Collection: Semi-annually.

Sample Description and Activity (pCi/g wet)		
Location	CL-7	CL-7
Lab Code	CLSL-17	CLSL-35
Date Collected	6-16-82	9-07-82
Be-7	1.07±0.34	<2.79
K-40	1.24±0.44	<5.6 ^a
Co-58	<0.057	<0.19
Co-60	<0.047	<0.40
Nb-95	<0.042	<0.29
Zr-95	<0.071	<0.47
Ru-103	<0.070	<0.19
Ru-106	<0.29	<1.71
Cs-134	<0.047	<0.26
Cs-137	<0.040	<0.26
Ce-141	<0.099	<0.29
Ce-144	<0.22	<1.43
Location	CL-10	CL-10
Lab Code	CLSL-18	CLSL-36
Date Collected	6-16-82	9-07-82
Be-7	<0.56	<1.47
K-40	1.48±0.66	4.30±2.10
Co-58	<0.074	<0.19
Co-60	<0.054	<0.13
Nb-95	<0.054	<0.19
Zr-95	<0.12	<0.19
Ru-103	<0.073	<0.19
Ru-106	<0.45	<1.50
Cs-134	<0.076	<0.11
Cs-137	<0.047	<0.13
Ce-141	<0.11	<0.25
Ce-144	<0.26	<0.51

^a High LLD due to small sample size.

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Table 25. Green leafy vegetables and tuberous vegetables, analysis for gamma emitting isotopes.
Collection: Annually at time of harvest.

Sample Description and Activity (pCi/g wet)			
Location	CL-11	CL-18	CL-18
Lab Code	CLVE-27	CLVE-29	CLVE-31
Date Collected	8-11-82	8-11-82	8-11-82
Sample Type	Corn	Cabbage	Tomatoes
I-131 ^b		<0.023	
K-40	2.94±0.0	1.78±0.31	2.89±0.28
Cs-134	<0.034	<0.022	<0.038
Cs-137	<0.034	<0.023	<0.40
Ba-La-140 ^a	<0.044	<0.031	<0.066
Location	CL-11	CL-18	CL-18
Lab Code	CLVE-28	CLVE-30	CLVE-32
Date Collected	8-11-82	8-11-82	8-11-82
Sample Type	Tomatoes	Soybean Plant	Corn
I-131 ^b			
K-40	1.68±0.11	2.24±0.56	2.81±0.22
Cs-134	<0.011	<0.028	<0.028
Cs-137	<0.015	<0.029	<0.038
Ba-La-140 ^a	<0.030	<0.050	<0.072

^a Ba-La-140 minimum sensitivity is at counting time.

^b I-131 analysis required for green leafy vegetables only.

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Table 26. Grass samples, collected at CL-11 in lieu of milk, analysis for Iodine-131 and gamma-emitting isotopes.
Collection: Semi-monthly during grazing season (May-October)
Monthly (November-April)

Sample Description and Activity (pCi/g wet)			
Period Collected	August	August	September
Date Collected	(8-11-82)	(8-24-82)	(9-08-82)
Lab Code	CLG-77	CLG-94	CLG-98
I-131	<0.046	<0.048	<0.10
K-40	4.54±0.89	3.99±0.78	4.22±0.96
Cs-134	<0.028	<0.057	<0.053
Cs-137	<0.031	<0.031	<0.037
Ba-La-140 ^a	<0.058	<0.037	<0.068
Period Collected	September	October	October
Date Collected	(9-22-82)	(10-06-82)	(10-20-82)
Lab Code	CLG-110	CLG-132	CLG-149
I-131	<0.067	<0.062	<0.051
K-40	4.84±0.84	5.68±0.91	3.98±0.72
Cs-134	<0.033	<0.039	<0.040
Cs-137	<0.029	<0.046	<0.068
Ba-La-140 ^a	<0.050	<0.078	<0.056
Period Collected	November	December	
Date Collected	(11-10-82)	(12-01-82)	
Lab Code	CLG-153	CLG-158	
I-131	<0.054	<0.062	
K-40	2.48±03.2	2.11±0.44	
Cs-134	<0.037	<0.033	
Cs-137	<0.034	<0.033	
Ba-La-140 ^a	<0.046	<0.031	

^a Ba-La-140 minimum sensitivity is at counting time.

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Table 27. Grass samples, collected at CL-15 in lieu of milk, analysis for Iodine-131 and gamma-emitting isotopes.
Collection: Semi-monthly during grazing season (May-October)
Monthly (November-April)

Sample Description and Activity (pCi/g wet)			
Period Collected	August	August	September
Date Collected	(8-11-82)	(8-24-82)	(9-08-82)
Lab Code	CLG-78	CLG-95	CLG-99
I-131	<0.051	<0.029	<0.048
K-40	3.90±0.60	4.18±0.55	4.83±0.58
Cs-134	<0.039	<0.026	<0.022
Cs-137	<0.034	<0.033	<0.026
Ba-La-140 ^a	<0.031	<0.037	<0.037
Period Collected	September	October	October
Date Collected	(9-22-82)	(10-06-82)	(10-20-82)
Lab Code	CLG-111	CLG-133	CLG-150
I-131	<0.12	<0.10	<0.050
K-40	5.98±1.03	2.46±0.51	2.72±0.53
Cs-134	<0.078	<0.088	<0.023
Cs-137	<0.095	<0.088	<0.028
Ba-La-140 ^a	<0.051	<0.12	<0.046
Period Collected	November	December	
Date Collected	(11-03-82)	(12-01-82)	
Lab Code	CLG-154	CLG-159	
I-131	<0.059	<0.19	
K-40	1.89±0.45	2.70±0.24	
Cs-134	<0.037	<0.047	
Cs-137	<0.036	<0.045	
Ba-La-140 ^a	<0.050	<0.071	

^a Ba-La-140 minimum sensitivity is at counting time.

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Table 28. Grass samples, collected at CL-16 in lieu of milk, analysis for Iodine-131 and gamma-emitting isotopes.
Collection: Semi-monthly during grazing season (May-October)
Monthly (November-April)

Sample Description and Activity (pCi/g wet)			
Period Collected	August	August	September
Date Collected	(8-11-82)	(8-24-82)	(9-08-82)
Lab Code	CLG-79,80	CLG-96	CLG-100
I-131	<0.045	<0.064	<0.051
K-40	2.74±0.46	3.74±0.77	4.65±0.67
Cs-134	<0.034	<0.037	<0.031
Cs-137	<0.020	<0.040	<0.045
Ba-La-140 ^a	<0.034	<0.065	<0.074
Period Collected	September	October	October
Date Collected	(9-22-82)	(10-06-82)	(10-20-82)
Lab Code	CLG-112,3	CLG-134,5	CLG-151
I-131	<0.13	<0.057	<0.033
K-40	7.23±0.63	5.44±0.50	3.58±0.57
Cs-134	<0.084	<0.050	<0.026
Cs-137	<0.088	<0.053	<0.048
Ba-La-140 ^a	<0.10	<0.093	<0.062
Period Collected	November	December	
Date Collected	(11-03-82)	(12-01-82)	
Lab Code	CLG-155	CLG-160	
I-131	<0.026	<0.047	
K-40	2.18±0.26	2.03±0.46	
Cs-134	<0.015	<0.036	
Cs-137	<0.014	<0.039	
Ba-La-140 ^a	<0.021	<0.043	

^a Ba-La-140 minimum sensitivity is at counting time.

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Table 29. Grass samples, collected at CL-17 in lieu of milk, analysis for Iodine-131 and gamma-emitting isotopes.
Collection: Semi-monthly during grazing season (May-October)
Monthly (November-April)

Sample Description and Activity (pCi/g wet)			
Period Collected	August	August	September
Date Collected	(8-11-82)	(8-24-82)	(9-08-82)
Lab Code	CLG-81	CLG-97	CLG-101,2
I-131	<0.048	<0.019	<0.057
K-40	4.63±0.54	3.41±0.39	4.48±0.49
Cs-134	<0.037	<0.023	<0.056
Cs-137	<0.025	<0.020	<0.043
Ba-La-140 ^a	<0.015	<0.040	<0.034
Period Collected	September	October	October
Date Collected	(9-22-82)	(10-06-82)	(10-20-82)
Lab Code	CLG-114	CLG-136	CLG-152
I-131	<0.076	<0.13	<0.074
K-40	5.09±0.37	6.05±0.12	4.57±0.83
Cs-134	<0.046	<0.043	<0.028
Cs-137	<0.054	<0.088	<0.037
Ba-La-140 ^a	<0.075	<0.11	<0.034
Period Collected	November	December	
Date Collected	(11-03-82)	(12-01-82)	
Lab Code	CLG-156,7	CLG-161	
I-131	<0.042	<0.084	
K-40	1.96±0.39	1.73±0.30	
Cs-134	<0.020	<0.030	
Cs-137	<0.019	<0.030	
Ba-La-140 ^a	<0.043	<0.038	

^a Ba-La-140 minimum sensitivity is at counting time.

Appendix A
Crosscheck Program Results

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Appendix A

Crosscheck Program Results

The Nuclear Sciences Department of Hazleton Environmental Sciences has participated in interlaboratory comparison (crosscheck) programs since the formulation of its quality control program in December 1971. These programs are operated by agencies which supply environmental-type samples (e.g., milk or water) containing concentrations of radionuclides known to the issuing agency but not to participant laboratories. The purpose of such a program is to provide an independent check on the laboratory's analytical procedures and to alert it to any possible problems.

Participant laboratories measure the concentrations of specified radionuclides and report them to the issuing agency. Several months later, the agency reports the known values to the participant laboratories and specifies control limits. Results consistently higher or lower than the known values or outside the control limits indicate a need to check the instruments or procedures used.

The results in Table A-1 were obtained through participation in the environmental sample crosscheck program for milk and water samples during the period 1975 through 1982. This program has been conducted by the U. S. Environmental Protection Agency Intercomparison and Calibration Section, Quality Assurance Branch, Environmental Monitoring and Support Laboratory, Las Vegas, Nevada.

The results in Table A-2 were obtained for thermoluminescent dosimeters (TLD's) during the period 1976, 1977, 1979, 1980, and 1981 through participation in the Second, Third, Fourth, and Fifth International Intercomparison of Environmental Dosimeters under the sponsorships listed in Table A-2.

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Table A-1. U.S. Environmental Protection Agency's crosscheck program, comparison of EPA and Hazleton ES results for milk and water samples, 1975 through 1982^a.

Lab Code	Sample Type	Date Coll.	Analysis	Concentration in pCi/l ^b	
				HES Result $\pm 2\sigma$ ^c	EPA Result $\pm 3\sigma$, n=1 ^d
STM-40	Milk	Jan. 1975	Sr-89	<2	0 \pm 15
			Sr-90	73 \pm 2.5	75 \pm 11.4
			I-131	99 \pm 4.2	101 \pm 15.3
			Cs-137	76 \pm 0.0	75 \pm 15
			Ba-140	<3.7	0 \pm 15.0
			K(mg/l)	1470 \pm 5.6	1510 \pm 228
STW-45	Water	Apr. 1975	Cr-51	<14	0
			Co-60	421 \pm 6	425 \pm 63.9
			Zn-65	487 \pm 6	497 \pm 74.7
			Ru-106	505 \pm 16	497 \pm 74.7
			Cs-134	385 \pm 3	400 \pm 60.0
			Cs-137	468 \pm 3	450 \pm 67.5
STW-47	Water	Jun. 1975	H-3	1459 \pm 144	1499 \pm 1002
STW-48	Water	Jun. 1975	H-3	2404 \pm 34	2204 \pm 1044
STW-49	Water	Jun. 1975	Cr-51	<14	0
			Co-60	344 \pm 1	350 \pm 53
			Zn-65	330 \pm 5	327 \pm 49
			Ru-106	315 \pm 7	325 \pm 49
			Cs-134	291 \pm 1	304 \pm 46
			Cs-137	387 \pm 2	378 \pm 57
STW-53	Water	Aug. 1975	H-3	3317 \pm 64	3200 \pm 1083
STW-54	Water	Aug. 1975	Cr-51	223 \pm 11	225 \pm 38
			Co-60	305 \pm 1	307 \pm 46
			Zn-65	289 \pm 3	281 \pm 42
			Ru-106	346 \pm 5	279 \pm 57
			Cs-134	238 \pm 1	256 \pm 38
			Cs-137	292 \pm 2	307 \pm 46
STW-58	Water	Oct. 1975	H-3	1283 \pm 80	1203 \pm 988

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Table A-1. (continued)

Lab Code	Sample Type	Date Coll.	Analysis	Concentration in pCi/l ^b	
				HES Result $\pm 2\sigma$ ^c	EPA Result $\pm 3\sigma$, n=1 ^d
STM-61	Milk	Nov. 1975	Sr-90	68.9 \pm 2.1	74.6 \pm 11.2
			I-131	64.6 \pm 3.8	75 \pm 15
			Cs-137	75.6 \pm 20	75 \pm 15
			Ba-140	<3.7	0
			K(Mg/l)	1435 \pm 57	1549 \pm 233
STW-63	Water	Dec. 1975	H-3	1034 \pm 39	1002 \pm 972
STW-64	Water	Dec. 1975	Cr-51	<14	0
			Co-60	221 \pm 1	203 \pm 30.5
			Zn-65	215 \pm 6	201 \pm 30.2
			Ru-106	171 \pm 9	181 \pm 27.2
			Cs-134	198 \pm 2	202 \pm 30.3
			Cs-137	152 \pm 4	151 \pm 22.7
STW-68	Water	Feb. 1976	H-3	1124 \pm 31	1080 \pm 978
STW-78	Water	Jun. 1976	H-3	2500 \pm 44	2502 \pm 1056
STW-84	Water	Aug. 1976	H-3	3097 \pm 21	3100 \pm 1080
STM-91	Milk	Nov. 1976	I-131	83 \pm 0.6	85 \pm 15
			Ba-140	<4	0
			Cs-137	12 \pm 1.7	11 \pm 15
			K(mg/l)	1443 \pm 31	1510 \pm 228
STW-93	Water	Dec. 1976	Cr-51	105 \pm 15	104 \pm 15
			Co-60	<4	0
			Zn-65	97 \pm 4	102 \pm 15
			Ru-106	87 \pm 3	99 \pm 15
			Cs-134	85 \pm 4	93 \pm 15
			Cs-137	103 \pm 4	101 \pm 15
STW-94	Water	Dec. 1976	H-3	2537 \pm 15	2300 \pm 1049
STM-97	Milk	Mar. 1977	I-131	55 \pm 2.5	51 \pm 15
			Ba-140	<6	0
			Cs-137	34 \pm 1	29 \pm 15
			K(mg/l)	1520 \pm 35	1550 \pm 233
STW-101	Water	Apr. 1977	H-3	1690 \pm 62	1760 \pm 1023

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Table A-1. (continued)

Lab Code	Sample Type	Date Coll.	Analysis	Concentration in pCi/l ^b	
				HES Result $\pm 2\sigma$ ^c	EPA Result $\pm 3\sigma$, n=1 ^d
STM-130	Milk	May 1977	Sr-89	38 \pm 2.6	44 \pm 15
			Sr-90	12 \pm 2.1	10 \pm 4.5
			I-131	59 \pm 2.1	50 \pm 15
			Ba-140	53 \pm 4.4	72 \pm 15
			Cs-137	14 \pm 1.2	10 \pm 15
			K(mg/l)	1533 \pm 21	1560 \pm 234
STW-105	Water	Jun. 1977	Cr-51	<14	0
			Co-60	29 \pm 1	29 \pm 15
			Zn-65	74 \pm 7	74 \pm 15
			Ru-106	64 \pm 8	62 \pm 15
			Cs-134	41 \pm 1	44 \pm 15
			Cs-137	35 \pm 3	35 \pm 15
STW-107	Water	Jun. 1977	Ra-226	4.7 \pm 0.3	5.1 \pm 2.42
STW-113	Water	Aug. 1977	Sr-89	13 \pm 0 ^e	14 \pm 15
			Sr-90	10 \pm 2 ^e	10 \pm 4.5
STW-116	Water	Sep. 1977	Gross Alpha	12 \pm 6	10 \pm 15
			Gross Beta	32 \pm 6	30 \pm 15
STW-118	Water	Oct. 1977	H-3	1475 \pm 29	1650 \pm 1017
STW-119	Water	Oct. 1977	Cr-51	132 \pm 14	153 \pm 24
			Co-60	39 \pm 2	38 \pm 15
			Zn-65	51 \pm 5	53 \pm 15
			Ru-106	63 \pm 6	74 \pm 15
			Cs-134	30 \pm 3	30 \pm 15
			Cs-137	26 \pm 1	25 \pm 15
STW-136	Water	Feb. 1978	H-3	1690 \pm 270	1680 \pm 1020
STW-137	Water	Feb. 1978	Cr-51	<27	0
			Co-60	36 \pm 2	34 \pm 15
			Zn-65	32 \pm 4	29 \pm 15
			Ru-106	41 \pm 2	36 \pm 15
			Cs-134	47 \pm 2	52 \pm 15
			Cs-137	<2	0

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Table A-1. (continued)

Lab Code	Sample Type	Date Coll.	Analysis	Concentration in pCi/l ^b	
				HES Result $\pm 2\sigma$ ^c	EPA Result $\pm 3\sigma$, n=1 ^d
STW-138g	Water	Mar. 1978	Ra-226 Ra-228	5.4 \pm 0.1 NA ^f	5.5 \pm 0.6 16.7 \pm 2.5
STW-150	Water	Apr. 1978	H-3	2150 \pm 220	2220 \pm 1047
STW-151	Water	Apr. 1978	Gross Alpha Gross Beta Sr-89 Sr-90 Co-60 Cs-134 Cs-137	20 \pm 1 56 \pm 4 19 \pm 2 8 \pm 1 19 \pm 3 16 \pm 1 <2	20 \pm 15 59 \pm 15 21 \pm 15 10 \pm 4.5 20 \pm 15 15 \pm 15 0
STM-152	Milk	Apr. 1978	Sr-89 Sr-90 I-131 Cs-137 Ba-140 K(mg/l)	85 \pm 4 8 \pm 1 78 \pm 1 29 \pm 3 <11 1503 \pm 90	101 \pm 15 9 \pm 4.5 82 \pm 15 23 \pm 15 0 1500 \pm 225
STW-154g	Water	May 1978	Gross Alpha Gross Beta	12 \pm 1 21 \pm 4	13 \pm 15 18 \pm 15
STW-157g	water	Jun. 1978	Ra-226 Ra-228	4.0 \pm 1.0 NA ^f	3.7 \pm 0.6 5.6 \pm 0.8
STW-159g	Water	Jul. 1978	Gross Alpha Gross Beta	19 \pm 3 28 \pm 3	22 \pm 6 30 \pm 5
STW-162	Water	Aug. 1978	H-3	1167 \pm 38	1230 \pm 990
STW-165g	Water	Sep. 1978	Gross Alpha Gross Beta	4 \pm 1 13 \pm 1	5 \pm 5 10 \pm 5

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Table A-1. (continued)

Lab Code	Sample Type	Date Coll.	Analysis	Concentration in pCi/lb	
				HES Result $\pm 2\sigma$ c	EPA Result $\pm 3\sigma$, n=1 ^d
STW-167	Water	Oct. 1978	Gross Alpha	19 \pm 2	19 \pm 15
			Gross Beta	36 \pm 2	34 \pm 15
			Sr-89	9 \pm 1	10 \pm 15
			Sr-90	4 \pm 0	5 \pm 2.4
			Ra-226	5.5 \pm 0.3	5.0 \pm 2.4
			Ra-228	NA ^f	5.4 \pm 2.4
			Cs-134	10 \pm 1	10 \pm 15
			Cs-137	15 \pm 1	13 \pm 15
STW-170	Water	Dec. 1978	Ra-226	11.5 \pm 0.6	9.2 \pm 1.4
			Ra-228	NA ^f	8.9 \pm 4.5
STW-172	Water	Jan. 1979	Sr-89	11 \pm 2	14 \pm 15
			Sr-90	5 \pm 2	6 \pm 4.5
STW-175	Water	Feb. 1979	H-3	1344 \pm 115	1280 \pm 993
STW-176	Water	Feb. 1979	Cr-51	<22	0
			Co-60	10 \pm 2	9 \pm 15
			Zn-65	26 \pm 5	21 \pm 15
			Rn-106	<16	0
			Cs-134	8 \pm 2	6 \pm 15
			Cs-137	15 \pm 2	12 \pm 15
STW-178	Water	Mar. 1979	Gross Alpha	6.3 \pm 3	10 \pm 15
			Gross Beta	15 \pm 4	16 \pm 15
STW-195g	Water	Aug. 1979	Gross Alpha	6.3 \pm 1.2	5 \pm 5
			Gross Beta	42.7 \pm 7.0	40 \pm 4
STW-193	Water	Sep. 1979	Sr-89	5.0 \pm 1.2	3.0 \pm 1.5
			Sr-90	25.0 \pm 2.7	28.0 \pm 4.5
STW-196	Water	Oct. 1979	Cr-51	135 \pm 5.0	113 \pm 18
			Co-60	7.0 \pm 1.0	6 \pm 5
			Cs-134	7.3 \pm 0.6	7 \pm 15
			Cs-137	12.7 \pm 1.2	11 \pm 15
STW-198	Water	Oct. 1979	H-3	1710 \pm 140	1560 \pm 1111

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Table A-1. (continued)

Lab Code	Sample Type	Date Coll.	Analysis	Concentration in pCi/l ^b	
				HES Result $\pm 2\sigma$ ^c	EPA Result $\pm 3\sigma$, n=1 ^d
STW-199	Water	Oct. 1979	Gross Alpha	16.0 \pm 3.6	21 \pm 15
			Gross Beta	36.3 \pm 1.2	49 \pm 15
			Sr-89	10.7 \pm 0.6	12 \pm 15
			Sr-90	5.7 \pm 0.6	7 \pm 15
			Ra-226	11.1 \pm 0.3	11 \pm 5
			Ra-228	1.6 \pm 0.7	0
			Co-60	35.0 \pm 1.0	33 \pm 15
			Cs-134	50.7 \pm 2.3	56 \pm 15
			Cs-137	<3	0
STW-206	Water	Jan. 1980	Gross Alpha	19.0 \pm 2.0	30.0 \pm 8.0
			Gross Beta	48.0 \pm 2.0	45.0 \pm 5.0
STW-208	Water	Jan. 1980	Sr-89	6.1 \pm 1.2	10.0 \pm 0.5
			Sr-90	23.9 \pm 1.1	25.5 \pm 1.5
STW-209	Water	Feb. 1980	Cr-51	112 \pm 14	101 \pm 5.0
			Co-60	12.7 \pm 2.3	11 \pm 5.0
			Zn-65	29.7 \pm 2.3	25 \pm 5.0
			Ru-106	71.7 \pm 1.5	51 \pm 5
			Cs-134	12.0 \pm 2.0	10 \pm 5.0
			Cs-137	30.0 \pm 2.7	30 \pm 5.0
STW-210	Water	Feb. 1980	H-3	1800 \pm 120	1750 \pm 340
STW-211	Water	March 1980	Ra-226	15.7 \pm 0.2	16.0 \pm 2.4
			Ra-228	3.5 \pm 0.3	2.6 \pm 0.4
STM-217	Milk	May 1980	Sr-89	4.4 \pm 2.6 ⁹	5 \pm 5
			Sr-90	10.0 \pm 1.0	12 \pm 1.5
STW-221	Water	June 1980	Ra-226	2.0 \pm 0.0	1.7 \pm 0.8
			Ra-228	1.6 \pm 0.1	1.7 \pm 0.8

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Table A-1. (continued)

Lab Code	Sample Type	Date Coll.	Analysis	Concentration in pCi/l ^b	
				HES Result $\pm 2\sigma$ ^c	EPA Result $\pm 3\sigma$, n=1 ^d
STW-223	Water	July 1980	Gross Alpha Gross Beta	31 \pm 3.0 44 \pm 4	38 \pm 5.0 35 \pm 5.0
STW-224	Water	July 1980	Cs-137 Ba-140 K-40 I-131	33.9 \pm 0.4 <12 1350 \pm 60 <5.0	35 \pm 5.0 0 1550 \pm 78 0
STW-225	Water	Aug. 1980	H-3	1280 \pm 50	1210 \pm 329
STW-226	Water	Sept. 1980	Sr-89 Sr-90	22 \pm 1.2 12 \pm 0.6	24 \pm 8.6 15 \pm 2.6
STW-228	Water	Sept. 1980	Gross Alpha Gross Beta	NA ^f 22.5 \pm 0.0	32.0 \pm 8.0 21.0 \pm 5.0
STW-235	Water	Dec. 1980	H-3	2420 \pm 30	2240 \pm 604
STW-237	Water	Jan. 1981	Sr-89 Sr-90	13.0 \pm 1.0 24.0 \pm 0.6	16 \pm 8.7 34 \pm 2.9
STM-239	Milk	Jan. 1981	Sr-89 Sr-90 I-131 Cs-137 Ba-140 K-40	<210 15.7 \pm 2.6 30.9 \pm 4.8 46.9 \pm 2.9 <21 1330 \pm 53	0 20 \pm 3.0 26 \pm 10.0 43 \pm 9.0 0 1550 \pm 134
STW-240	Water	Jan. 1981	Gross alpha Gross beta	7.3 \pm 2.0 41.0 \pm 3.1	9 \pm 5.0 44 \pm 5.0
STW-243	Water	Mar. 1981	Ra-226 Ra-228	3.5 \pm 0.06 6.5 \pm 2.3	3.4 \pm 0.5 7.3 \pm 1.1

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Table A-1. (continued)

Lab Code	Sample Type	Date Coll.	Analysis	Concentration in pCi/lb	
				HES Result $\pm 2\sigma$ c	EPA Result $\pm 3\sigma$, n=1d
STW-245	Water	Apr. 1981	H-3	3210 \pm 115	2710 \pm 355
STW-249	Water	May 1981	Sr-89	51 \pm 3.6	36 \pm 8.7
			Sr-90	22.7 \pm 0.6	22 \pm 2.6
STW-251	Water	May 1981	Gross alpha	24.0 \pm 5.29	21 \pm 5.25
			Gross beta	16.1 \pm 1.9	14 \pm 5.0
STW-252	Water	Jun. 1981	H-3	2140 \pm 95	1950 \pm 596
STW-255	Water	Jul. 1981	Gross alpha	20 \pm 1.5	22 \pm 9.5
			Gross beta	13.0 \pm 2.0	15 \pm 8.7
STW-259	Water	Sep. 1981	Sr-89	16.1 \pm 1.0	23 \pm 5
			Sr-90	10.3 \pm 0.9	11 \pm 1.5
STW-265	Water	Oct. 1981	Gross alpha	71.2 \pm 19.1	80 \pm 20
			Gross beta	123.3 \pm 16.6	111 \pm 5.6
			Sr-89	14.9 \pm 2.0	21 \pm 5
			Sr-90	13.1 \pm 1.7	14.4 \pm 1.5
			Ra-226	13.0 \pm 2.0	12.7 \pm 1.9
STW-269	Water	Dec. 1981	H-3	2516 \pm 181	2700 \pm 355
STW-270	Water	Jan. 1982	Sr-89	24.3 \pm 2.0	21.0 \pm 5.0
			Sr-90	9.4 \pm 0.5	12.0 \pm 1.5
STW-273	Water	Jan. 1982	I-131	8.6 \pm 0.6	8.4 \pm 1.5
STW-275	Water	Feb. 1982	H-3	1580 \pm 147	1820 \pm 342
STW-276	Water	Feb. 1982	Cr-51	<61	0
			Co-60	26.0 \pm 3.7	20 \pm 5
			Zn-65	<13	15 \pm 5
			Ru-106	<46	20 \pm 5
			Cs-134	26.8 \pm 0.7	22 \pm 5
			Cs-137	29.7 \pm 1.4	23 \pm 5
STW-277	Water	Mar. 1982	Ra-226	11.9 \pm 1.9	11.6 \pm 1.7
STW-278	Water	Mar. 1982	Gross alpha	15.6 \pm 1.9	19 \pm 5
			Gross beta	19.2 \pm 0.4	19 \pm 5

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Table A-1. (continued)

Lab Code	Sample Type	Date Coll.	Analysis	Concentration in pCi/l ^b	
				HES Result $\pm 2\sigma$ ^c	EPA Result $\pm 3\sigma$, n=1 ^d
STW-280	Water	Apr. 1982	H-3	2690 \pm 80	2860 \pm 360
STW-281	Water	Apr. 1982	Gross alpha	75 \pm 7.9	85 \pm 21
			Gross beta	114.1 \pm 5.9	106 \pm 5.3
			Sr-89	17.4 \pm 1.8	24 \pm 5
			Sr-90	10.5 \pm 0.6	12 \pm 1.5
			Ra-226	11.4 \pm 2.0	10.9 \pm 1.5
			Co-60	<4.6	0
STW-284	Water	May 1982	Gross alpha	31.5 \pm 6.5	27.5 \pm 7
			Gross beta	25.9 \pm 3.4	29 \pm 5
STW-285	Water	June 1982	H-3	1970 \pm 1408	1830 \pm 340
STW-286	Water	June 1982	Ra-226	12.6 \pm 1.5	13.4 \pm 3.5
			Ra-228	11.1 \pm 2.5	8.7 \pm 2.3
STW-287	Water	June 1982	I-131	6.5 \pm 0.3	4.4 \pm 0.7
STW-290	Water	Aug. 1982	H-3	3210 \pm 140	2890 \pm 619
STW-291	Water	Aug. 1982	I-131	94.6 \pm 2.5	87 \pm 15
STW-292	Water	Sept 1982	Sr-89	22.7 \pm 3.8	24.5 \pm 8.7
			Sr-90	10.9 \pm 0.3	14.5 \pm 2.6
STW-296	Water	Oct. 1982	Co-60	20.0 \pm 1.0	20 \pm 8.7
			Zn-65	32.3 \pm 5.1	24 \pm 8.7
			Cs-134	15.3 \pm 1.5	19.0 \pm 8.7
			Cs-137	21.0 \pm 1.7	20.0 \pm 8.7
STW-297	Water	Oct. 1982	H-3	2470 \pm 20	2560 \pm 612
STW-298	Water	Oct. 1982	Gross alpha	32 \pm 30	55 \pm 24
			Gross beta	81.7 \pm 6.1	81 \pm 8.7
			Sr-89	<2	0
			Sr-90	14.1 \pm 0.9	17.2 \pm 2.6
			Cs-134	<2	1.8 \pm 8.7
			Cs-137	22.7 \pm 0.6	20 \pm 8.7
			Ra-226	13.6 \pm 0.3	12.5 \pm 3.2
			Ra-228	3.9 \pm 1.0	3.6 \pm 0.9

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Table A-1. (continued)

Lab Code	Sample Type	Date Coll.	Analysis	Concentration in pCi/l ^b	
				HES Result $\pm 2\sigma$ ^c	EPA Result $\pm 3\sigma$, n=1 ^d
STW-301	Water	Nov. 1982	Gross alpha Gross beta	12.0 \pm 1.0 34.0 \pm 2.7	19.0 \pm 8.7 24.0 \pm 8.7
STW-302	Water	Dec. 1982	I-131	40.0 \pm 0.0	37.0 \pm 10

^aResults obtained by the Nuclear Sciences Department of Hazleton Environmental Sciences as a participant in the environmental sample crosscheck program operated by the Intercomparison and Calibration Section, Quality Assurance Branch, Environmental Monitoring and Support Laboratory, U.S. Environmental Protection Agency, (EPA), Las Vegas, Nevada.

^bAll results are in pCi/l, except for elemental potassium (K) data which are in mg/l.

^cUnless otherwise indicated, the HES results given as the mean $\pm 2\sigma$ standard deviations for three determinations.

^dUSEPA results are presented as the known values \pm control limits of 3σ for n=1.

^eMean $\pm 2\sigma$ standard deviations of two determinations.

^fNA = Not analyzed.

^gAnalyzed but not reported to the EPA.

Table A-2. Crosscheck program results, thermoluminescent dosimeters (TLD's).

Lab Code	TLD Type	Measurement	mR		
			Hazleton Result $\pm 2\sigma^a$	Known Value	Average $\pm 2\sigma^d$ (all participants)
2nd International Intercomparison ^b					
115-2 ^b	CaF ₂ :Mn Bulb	Gamma-Field	17.0 \pm 1.9	17.1 ^c	16.4 \pm 7.7
		Gamma-Lab	20.8 \pm 4.1	21.3 ^c	18.8 \pm 7.6
3rd International Intercomparison ^e					
115-3 ^e	CaF ₂ :Mn Bulb	Gamma-Field	30.7 \pm 3.2	34.9 \pm 4.8 ^f	31.5 \pm 3.0
		Gamma-Lab	89.6 \pm 6.4	91.7 \pm 14.6 ^f	86.2 \pm 24.0
4th International Intercomparison ^g					
115-4 ^g	CaF ₂ :Mn Bulb	Gamma-Field	14.1 \pm 1.1	14.1 \pm 1.4 ^f	16.0 \pm 9.0
		Gamma-Lab (Low)	9.3 \pm 1.3	12.2 \pm 2.4 ^f	12.0 \pm 7.6
		Gamma-Lab (High)	40.4 \pm 1.4	45.8 \pm 9.2 ^f	43.9 \pm 13.2
5th International Intercomparison ^h					
115-5A ^h	CaF ₂ :Mn Bulb	Gamma-Field	31.4 \pm 1.8	30.0 \pm 6.0 ⁱ	30.2 \pm 14.6
		Gamma-Lab at beginning	77.4 \pm 5.8	75.2 \pm 7.6 ⁱ	75.8 \pm 40.4
		Gamma-Lab at the end	96.6 \pm 5.8	88.4 \pm 8.8 ⁱ	90.7 \pm 31.2

Table A-2. (Continued)

Lab Code	TLD Type	Measurement	mR		Average $\pm 2\sigma$ ^d (all participants)
			Hazleton Result $\pm 2\sigma$ ^a	Known Value	
115-58 ^h	LiF-100 Chips	Gamma-Field	30.3 \pm 4.8	30.0 \pm 6 ⁱ	30.2 \pm 14.6
		Gamma-Lab at beginning	81.1 \pm 7.4	75.2 \pm 7.6 ⁱ	75.8 \pm 40.4
		Gamma-Lab at the end	85.4 \pm 11.7	88.4 \pm 8.8 ⁱ	90.7 \pm 131.2

^aLab result given is the mean $\pm 2\sigma$ standard deviations of three determinations.

^bSecond International Intercomparison of Environmental Dosimeters conducted in April of 1976 by the Health and Safety Laboratory (GASL), New York, New York, and the School of Public Health of the University of Texas, Houston, Texas.

^cValue determined by sponsor of the intercomparison using continuously operated pressurized ion chamber.

^dMean $\pm 2\sigma$ standard deviations of results obtained by all laboratories participating in the program.

^eThird International Intercomparison of Environmental Dosimeters conducted in summer of 1977 by Oak Ridge National Laboratory and the School of Public Health of the University of Texas, Houston, Texas.

^fValue $\pm 2\sigma$ standard deviations as determined by sponsor of the intercomparison using continuously operated pressurized ion chamber.

^gFourth International Intercomparison of Environmental Dosimeters conducted in summer of 1979 by the School of Public Health of the University of Texas, Houston, Texas.

^hFifth International Intercomparison of Environmental Dosimeter conducted in fall of 1980 at Idaho Falls, Idaho and sponsored by the School of Public Health of the University of Texas, Houston, Texas and Environmental Measurements Laboratory, New York, New York, U.S. Department of Energy.

ⁱValue determined by sponsor of the intercomparison using continuously operated pressurized ion chamber.

Appendix B
Data Reporting Conventions

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Data Reporting Conventions

1.0. All activities are decay corrected to collection time.

2.0. Single Measurements

Each single measurement is reported as follows:

$$x \pm s$$

where x = value of the measurement;

$s = 2$ counting uncertainty (corresponding to the 95% confidence level).

In cases where the activity is found to be below the lower limit of detection L it is reported as

$$<L$$

where L = is the lower limit of detection based on 4.66σ uncertainty for a background sample.

3.0. Duplicate Analyses

3.1. Individual results: $x_1 \pm s_1$
 $x_2 \pm s_2$

Reported result: $x \pm s$

where $x = (1/2) (x_1 + x_2)$

$$s = (1/2) s_1^2 + s_2^2$$

3.2. Individual results: $<L_1$

$$<L_2$$

Reported result: $<L$

where L = lower of L_1 and L_2

3.3. Individual results: $x \pm s$

$$<L$$

Reported result: $x \pm s$ if $x \leq L$;

$<L$ otherwise

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4.0. Computation of Averages and Standard Deviations

- 4.1 Averages and standard deviations listed in the tables are computed from all of the individual measurements over the period averaged; for example, an annual standard deviation would not be the average of quarterly standard deviations. The average \bar{x} and standard deviations of a set of n numbers x_1, x_2, \dots, x_n are defined as follows:

$$\bar{x} = \frac{1}{n} \sum x$$

$$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}}$$

- 4.2 Values below the highest lower limit of detection are not included in the average.
- 4.3 If all of the values in the averaging group are less than the highest LLD, the highest LLD is reported.
- 4.4 If all but one of the values are less than the highest LLD, the single value x and associated two sigma error is reported.
- 4.5. In rounding off, the following rules are followed:
- 4.5.1. If the figure following those to be retained is less than 5, the figure is dropped, and the retained figures are kept unchanged. As an example, 11.443 is rounded off to 11.44.
- 4.5.2 If the figure following those to be retained is greater than 5, the figure is dropped, and the last retained figure is raised by 1. As an example, 11.446 is rounded off to 11.45.
- 4.5.3. If the figure following those to be retained is 5, and if there are no figures other than zeros beyond the five, the figure 5 is dropped, and the last-place figure retained is increased by one if it is an odd number or it is kept unchanged if an even number. As an example, 11.435 is rounded off to 11.44, while 11.425 is rounded off to 11.42.

Appendix C
Sampling Program and Locations

Table C-1. Sample collection and analysis program for the Clinton Power Station.

Sample Type	Sampling Location	Coll. Freq. ^a	Coll. Start Date	Duration of Preop. Program	Type of Analysis	Anal. Freq. ^d	No. of Anal. for 3 years Preop. Oper.		Comments
1. Air Particulates	CL-1 CL-2 CL-3 CL-4 CL-6 CL-7 CL-8 CL-11	W	1/82	1 yr.	Gross Beta Gamma Isot.	W Q	416 32	416 32	Continuous sampling Gross beta weekly, composite (by location) for gamma isotopic quarterly.
2. Airborne Iodine	CL-1 CL-2 CL-3 CL-4 CL-6 CL-7 CL-8 CL-11	W	- ^b	6 mo.	I-131	W	208	416	Continuous sampling. Analyze weekly for I-131. Collection to start 6 months before fuel loading.
3. TLD	CL-1 CL-2 CL-3 CL-4 CL-6 CL-7 CL-8 CL-11 CL-21-52	Q	4/80	2 yrs.	Ambient Gamma	Q	328	164	Integrated gamma dose quarterly.
4. Milk	CL-11 CL-15 CL-16 CL-17	M	8/82 ^c	1 yr.	I-131 Gamma Isot.	SM M	28 48	72 48	Semi-monthly collection during grazing period (May-October) monthly otherwise. Start analysis for I-131 in October 1982. I-131 analysis on all samples, gamma isotopic monthly.
5. Drinking Water	CL-14	H	- ^d	1 yr.	I-131 Gross Beta. Gamma Isot. Tritium	SM M M Q	 12 12 4	 12 12 4	Hourly aliquots composited into semi-monthly, monthly and quarterly composites. Analyze semi-monthly for I-131 only if contamination is suspected or when the dose calculated from the consumption of the water is greater than 1 mrem per year.

Table C-1. (continued)

Sample Type	Sampling Location	Coll. Freq. ^a	Start Date	Duration of Preop. Program	Type of Analysis	Anal. Freq. ^a	No. of Anal. for 3 years		Comments
							Preop.	Oper.	
6. Well Water	CL-7 CL-12	M	9/82	1 yr.	Gross Beta.	M	24	24	Gamma isotopic and gross beta monthly. Tritium on quarterly composite.
					Gamma Isot.	M	24	24	
					Tritium	Q	8	8	
7. Surface Water	CL-9 CL-10 CL-13	M	1/82	1 yr.	Gamma Isot.	M	36	36	Gamma isotopic monthly. Tritium on quarterly composite.
					Tritium	Q	12	12	
8. Green Leafy Vegetables and Tuberous Veg.	CL-11 CL-18	A	8/82	1 yr.	Gamma Isot.	A	4	4	At time of harvest.
9. Bottom Sediments	CL-7 CL-10	SA	5/80	2 yrs.	Gamma Isot.	SA	8	4	Gamma Isotopic semi-annually
10. Shoreline Sediments	CL-7 CL-10	SA	5/80	2 yrs.	Gamma Isot.	SA	8	4	Gamma isotopic semi-annually
11. Slime	CL-7 CL-10	SA	5/80	2 yrs.	Gamma Isot.	SA	8	4	Gamma isotopic semi-annually
12. Fish	CL-19	SA	5/80	2 yrs.	Gamma Isot.	SA	4	2	Gamma isotopic on edible portion only, semi-annually.

^a Collection and analysis frequencies are coded as follows:
H=Hourly; SM=Semi-Monthly; M=Monthly; Q=Quarterly; SA=Semi-Annually; A=Annually.

^b Collection will start six months before fuel loading.

^c Grass collected in lieu of milk.

^d Sampling will commence twelve months prior to fuel loading.