

PILGRIM NUCLEAR POWER STATION

ENVIRONMENTAL RADIATION MONITORING PROGRAM REPORT NO. 15

JANUARY 1 THROUGH DECEMBER 31, 1982

ISSUED: APRIL 1983

**BY: NUCLEAR OPERATIONS SUPPORT DEPARTMENT
ENVIRONMENTAL AND RADIOLOGICAL
HEALTH AND SAFETY GROUP**

BOSTON EDISON COMPANY

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PILGRIM NUCLEAR POWER STATION
Environmental Radiation Monitoring Program
REPORT NO. 15
January 1, 1982 through December 31, 1982

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1. Introduction and Summary

This report presents a summary of the results of measurements of direct radiation and radioactivity in environmental media in the vicinity of the Pilgrim Nuclear Power Station - Unit 1 (PNPS-1) and at selected control locations for the period January 1 - December 31, 1982. The results of this Program indicate that PNPS-1 has had a negligible and most often immeasurably small impact on the environment in the vicinity of the plant. Conservatively, estimated doses resulting from the measured highest station mean concentrations are typically less than 1% of the doses resulting from naturally occurring radionuclides and residual fallout from atmospheric nuclear weapons testing.

Estimates of concentrations of radionuclides in vegetation and milk and estimates of dose to man, as quoted in this report, were made using methods similar to those described in Regulatory Guide 1.109 and 1.111.

The performance record of the PNPS-1 for the calendar year of 1982 reflects an average capacity factor of 56.0%. Monthly capacity factors are given in Table I-1.

A tabulation of radioactive effluents from the PNPS-1 is provided in Appendix B for the 1982 calendar year.

There were no Anomalous Measurement Reports made for the calendar year of 1982.

Essentially, all samples required by the PNPS-1 Technical Specifications were collected on schedule. The only exceptions were the unavailability of two milk sample locations, and two air sampling locations until the third quarter of 1982 plus occasional failures of the air samplers. In addition, a total of four TLDs were found to be missing from their field locations during 1982.

These incidents affected only about 5% of the total number of samples scheduled for collection.

Both Plimoth Plantation and Plymouth County Farm were unavailable as milk sampling locations during 1982. Plimoth Plantation informed Boston Edison in January 1981 that milk producing animals would no longer be available as they disposed of their cow. This situation had not changed for 1982. The Plymouth County Farm has not been available as a milk sampling station since 1979 as they had sold all of their cows. Recently, the Plymouth County Farm began to reparticipate in the Program in December, 1982.

The two air sampling stations which became unavailable during 1981 were the Plymouth Center and Cleft Rock sites. The Cleft Rock air sampling station was lost during the second quarter of 1981 (between 4/6/81 -4/14/81) when vandals destroyed the equipment and protective facilities. The communications tower at the site was also heavily damaged. Full operation of the Cleft Rock (actually Pine Hills) air sampling station site was reinitiated on 7/12/82.

The Plymouth Center air sampling station (Old Fire House on Main Street) was lost during the third quarter of 1981 (between 7/28/81 - 8/4/81) when a private individual bought the Old Fire House. The individual declined to participate in the Program. A search for a suitable public building in the Plymouth Center area was then initiated. Full operation of the Plymouth Center air sampling station site was reinitiated on 7/12/82 at the Plymouth Town Hall.

TABLE I-1
PNPS-1
CAPACITY FACTORS
1982
 (Based on 670 MWe)

<u>Month</u>	<u>Percent Capacity</u>
January	0.0
February	0.0
March	0.0
April	44.1
May	80.1
June	87.5
July	97.2
August	75.7
September	68.3
October	39.9
November	88.9
December	87.1
Average	56.0

II. Description of the Monitoring Program

The Radiological Monitoring Program conducted in accordance with the PNPS-1 Technical Specification is included as Appendix D. The program is essentially identical to that conducted during 1981 and incorporates supplemental provisions as specified in the Settlement Agreement between the Massachusetts Wildlife Federation and Boston Edison Company, June 9, 1977². The exceptions to the program are as follows:

- 1) There is no TLD station at Saquish Neck since the Mass Wildlife Federation has not yet provided a means for placement and retrieval of the TLD as prescribed by the agreement noted above.
- 2) There is no longer a milk producing cow at Plimoth Plantation. The Plymouth County Farm location was unavailable since 1979 but has recently been reinstated into the Program (December 1982), and the Plimoth Plantation location has been unavailable since 1981. The nearest cow location is at the Plymouth County Farm, which is 3.5 miles from PNPS in the West sector.
- 3) There is no longer a Karbott Farm. Vegetable samples are now collected at the two nearest gardens near the W and ESE site boundaries.

The 1982 site Census conducted according to Technical Specification requirements determined that there are several vegetable gardens near the site boundary in the W-WNW and SE-ESE sectors (see Appendix E). In the ESE sector, the nearest garden is at the J. B. Work residence (0.6 miles ESE). A sample of pumpkin leaves were collected on 9/4/82. In the west direction, the location of the nearest observed garden of approximately 500 square feet was at the residence of M. Lloyd Evans (0.7 miles W). A sample of rhubarb was collected from this location on 9/27/82.

In addition to the above, a sample of lettuce was obtained from the Whipple Farm (1.5 miles SSW) on 9/14/82, and a sample of rhubarb was collected from the Hoton Residence (2.5 miles SE) on 9/27/82.

The 1982 Census indicates that 5 goats are located at the Lloyd residence on Long Pond Road, however they are miniature goats (not full size) and the milk is used for personal consumption only. Two goats were located at the Raymond residence but are no longer available at this location. During 1982 every effort was made to identify and locate milk-producing animals in the near vicinity (5 miles) of PNPS-1. The Plymouth County Farm (3.5 miles W) agreed to reparticipate in the Environmental Program and sampling was reinitiated in December of 1982. The Plimoth Plantation declined to participate in the Program. The only other available milk-producing cow within 5 miles of PNPS is located on Beaver Dam Road (2.5 miles S) and is owned by C. Mann. Mr. Mann provided one milk sample (October 1982) for the remainder of the year, and stated that milk samples will be provided in accordance with the Environmental Program starting in the spring of 1983.

In perspective, cows and goat locations within a 5 mile radius of PNPS-1 are rare and transitory at best. It is extremely unlikely that the cow-milk pathway could be responsible for even small doses to any member of the general public.

III. Results and Analyses

This section summarizes the results of the analyses of environmental media samples in compliance with the monitoring program described in Appendix D. The section is divided into sub-sections, each of which describes a particular media or potential exposure pathway.

The results of analyses conducted on environmental media are maintained in a computerized data file which constitutes a data base used for statistical analyses by a computer code entitled ERMAP³.

ERMAP calculates a set of statistical parameters for each radionuclide whose concentration is reported in a given environmental medium. This set of statistical parameters includes separate analyses for (1) the indicator stations, (2) the control stations, and (3) the station having the highest annual mean concentration. For each of these three groups of data, ERMAP calculates:

- 1) the mean value of all measured concentrations;
- 2) the square root of the mean square deviation (this is an estimate of the sample variance);
- 3) the lowest and highest calculated concentrations;
- 4) the number of positive measurements divided by the total number of measurements;

Entries listed under the heading LLD* are the mean of all LLD values, where each LLD equals 4.67 times the standard error of the associated background measurement.

*Lower Limit of Detection

The results of ERMAP are provided in each subsection for the appropriate media. In addition, plots of measured concentration as a function of sampling time are included for certain isotopes in certain media in an effort to simplify interpretation of the results.

Sample station identification numbers used by the ERMAP program are provided in Table III-A-1.

TABLE III-A-1

Sample Station Identification Codes

<u>Media</u>	<u>Station Code Number</u>	<u>Station Location</u>
Air Particulate and Iodine Filters	00	Warehouse (0.03 mi-SSE)
	01	Rocky Hill Road (0.8 mi-SE)
	03	Rocky Hill Road (0.3 mi-WNW)
	06	Property Line (0.34 mi-NW)
	07	Pedestrian Bridge (0.14 mi-N)
	08	Overlook Area (0.03 mi-W)
	09	East Breakwater (0.35 mi-ESE)
	10	Cleft Rock (0.9 mi-S)
	15	Plymouth Center (4.0 mi-W-WNW)
	17	Manomet Substation (2.5 mi-SSE)
	21	East Weymouth (control-21 mi-NW)
Waterborne	11	Discharge Canal
	17	Bartlett Pond (1.7 mi-SE)
	23	Power Point (control 7.8 mi-NNW)
Shellfish	11	Discharge Canal Outfall
	12	Plymouth Harbor
	13	Duxbury Bay
	15	Manomet Point
	24	Marshfield (Control)
Algae (Irish Moss)	11	Discharge Canal Outfall
	15	Manomet Point
	22	Ellisville (Control)
Lobster (Arthropods)	11	Vicinity of Discharge Canal Offshore
	15/99	Offshore (Control)
	25	Scituate (Control)
Fish	2	Round Hill Point-Offshore-(Control)
	11	Vicinity of Discharge Canal
	21	Auto Trawl Station-Offshore-(Control)
	22	Offshore-(Control)
	28	Cataumet, Bourne-(Control)
	29	Priest Cove-Offshore-(Control)
Sediment	11	Rocky Point
	12	Plymouth Harbor
	13	Duxbury Bay
	14	Plymouth Beach
	15	Manomet Point
	24	Marshfield (Control)

TABLE III-A-1 (Continued)

<u>Media</u>	<u>Station Code Number</u>	<u>Station Location</u>
Milk	11	Plymouth County Farm (3.5 mi-W)
	21	Whitman Farm (Control-21 mi-NW)
	22	King Residence (Control-12 mi-W)
	28	Beaver Dam Road (2.5 mi-S)
Cranberries	13	Manomet Point Bog (2.5 mi-SE)
	14	Bartlett Road Bog (2.8 mi-SSE/S)
	23	Pine Street Bog (Control-17 mi-WNW)
Vegetation	11	Plymouth County Farm (3.5 mi-W)
	16	Work Residence (0.6 mi-ESE)
	17	Evans Garden (0.7 mi-W)
	27	Bridgewater Farm (Control-20 mi-W)
	43	Whipple Farm (1.5 mi-SSW)
	45	Hoton Residence (2.5 mi-SE)
Beef Forage	11	Plymouth County Farm (3.5 mi-W)
	15	Plimoth Plantation (2.2 mi-W)
	21	Whitman Farm (Control-21 mi-NW)
	27	Bridgewater Farm (Control-20 mi-W)

III. A. Air Particulate Filters

Sample collection systems consisting of a cellulose particulate filter and a charcoal filter cartridge are used to collect particulate matter and iodine isotopes respectively. Analyses of the particulate filters for beta radiation is performed weekly. In addition, quarterly composite particulate samples are analysed for gamma emitting isotopes. Table III-A-2 presents the results of the ERMAP for air particulate analyses. (The station identification numbers correspond to the locations identified in Table III-A-1.)

For ease of interpretation of these measurements, a plot of gross beta activity vs. time for all indicator stations is provided in Figure III-A-1 and for the control station in Figure III-A-2.

Positive measurements of specific isotopes characteristic of reactor operation (ie., Cs-137 and Co-60) were observed in the quarterly composite samples. An indication of the presence of Co-60 (Co-60 peak) was observed at the Overlook (Station 08-0.03 mi-W) during the first quarter, and Cs-137 was observed at Cleft Rock (Station 10-0.9 mi-S) during the fourth quarter and at East Weymouth (Station 21-21 mi-NW) during the first quarter. Only the positive indication of Co-60 at the Overlook was due to the effluents of PNPS-1. Both positive measurements of Cs-137 were due to atmospheric fallout from previous weapons testing - there was a lack of Cs-134 at Cleft Rock which would have indicated that the effluents of PNPS-1 were the cause, and East Weymouth is a control station.

However, even if an individual were to breathe air with the Co-60 concentration (3.4×10^{-4} pCi/m³), the maximum exposed individual would receive an annual dose of less than 0.00003 mrem to the total body and 0.009 mrem to the maximum exposed organ (Infant-Lung).

In consideration of the natural background dose rate of 80 to 100 mrem/year, there was clearly no significant environmental effect observed in the air particulate media as a result of the operation of PNPS-1.

PROGRAM 1

 OFFSITE ENVIRONMENTAL RADIOLOGICAL MONITORING 03/05/80. PAGE 5
 SUMMARY FOR THE PERIOD 12/21/80 - 12/31/80

MEDIUM AIR PARTICULATE FILTERS

UNIT: PCU/CM

RADIOISOTOPES (NO. ANALYSES) (NON-ROUTINE)	NOMINAL LLD	INDICATING STATION MEAN, RANGE, AND NO. DETECTED*	STATION	HIGHEST STATION MEAN, RANGE, AND NO. DETECTED**	CONTROL LOCATION MEAN, RANGE, AND NO. DETECTED**
GR-A (55) (0)	2.0E-03	(4.7 ± .3)E -3 (-1.7 - 5.9)E -3 #(89/896)A	21	(6.5 ± .9)E -3 (-1.2 - 2.5)E -2 #(10/ 55)A	(6.5 ± .9)E -3 (-1.2 - 2.5)E -2 #(10/ 55)A
GR-B (55) (1)	4.0E-03	(2.0 ± .1)E -2 (-1.8 - 3.8)E -2 #(44/240)B	21	(3.0 ± .7)E -2 (-1.4 - 420.0)E -3 #(53/ 55)A	(3.0 ± .7)E -2 (-1.4 - 420.0)E -3 #(53/ 55)A
DE-7 (50) (0A)	2.0E-02	(0.9 ± .3)E -2 (-1.9 - 3.9)E -2 #(80/ 92)A	07	(9.0 ± 1.2)E -2 (2.6 - 11.9)E -2 #(6/ 7)A	(-9.3 ± 5.7)E -1 (-3.8 - 1.1)E 0 #(5/ 6)A
A-40 (50) (0)	4.0E-02	(4.4 ± 3.4)E -3 (-2.9 - 8.9)E -2 #(8/ 92)A	21	(2.3 ± 2.2)E 2 (1.0 - 4200.0)E -3 #(3/ 6)A	(2.3 ± 2.2)E 2 (1.0 - 4200.0)E -3 #(3/ 6)A
CR-51 (50) (0)	2.0E-02	(1.3 ± 17.8)E -4 (-0.3 - 3.9)E -2 #(0/ 92)A	21	(1.5 ± 1.5)E 0 #(0/ 6)A	(1.5 ± 1.5)E 0 (-9.0 - 8810.0)E -3 #(0/ 6)A
MN-50 (50) (0)	2.0E-03	(0.9 ± 22.1)E -3 (-2.9 - 6.1)E -3 #(0/ 92)A	21	(1.1 ± 1.1)E -1 #(0/ 6)A	(1.1 ± 1.1)E -1 (-2.0 - 4200.0)E -3 #(0/ 6)A
CO-57 (50) (0)	1.0E-03	(1.1 ± 1.1)E -4 (-1.9 - 3.1)E -3 #(0/ 92)A	03	(5.3 ± 5.1)E -4 #(0/ 9)A	(-7.4 ± 7.5)E -2 (-4.5 - .0)E -1 #(0/ 6)A
CO-50 (50) (0)	2.0E-03	(-3.8 ± 185.9)E -6 (-4.4 - 3.7)E -3 #(0/ 92)A	21	(4.8 ± 4.7)E -2 #(0/ 6)A	(4.8 ± 4.7)E -2 (-2.2 - 200.0)E -3 #(0/ 6)A
FE-59 (50) (0)	3.0E-03	(-4.8 ± 5.5)E -4 (-1.9 - 1.2)E -2 #(0/ 92)A	21	(7.5 ± 7.5)E -2 #(0/ 6)A	(7.5 ± 7.5)E -2 (-1.9 - 452.0)E -3 #(0/ 6)A

- * NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT
- ** THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. >0.01MPCU) IS INDICATED WITHIN A ()

 TABLE III-A-2
 ERMAT RESULTS
 AIR PARTICULATE FILTERS

PILOTIN 1

OFFSITE ENVIRONMENTAL RADIOLOGICAL MONITORING
SUMMARY FOR THE PERIOD 12/21/81 - 12/31/82

AS/03/10. PAGE 4

MEASUREMENT PARTICULATE FILTERS

UNITS: PCU/CO. M

NATIONUCLIDES (INL. ANALYSES) (NLN=ROUTINE)	NOMINAL LLD	INDICATOR STATIONS MEAN, RANGE, AND NO. DETECTED**	HIGHEST STATION MEAN, RANGE, AND NO. DETECTED**	CONTROL LOCATIONS MEAN, RANGE, AND NO. DETECTED**
CU-60 (5A) (0)	2.0E-03	1-0.6 + 3.41E +0 (-1.4 - .21E +2 OF 07 5218	09 1 3.1 + 4.83E +0 (- 0/ 610	1-3.0 + 1.03E +1 (-2.7 - .03E 0 (- 0/ 610
Zn-65 (5A) (0)	4.0E-03	1 1.2 + 4.17E +0 (-7.4 - 0.01E +3 OF 07 5218	10 1 2.4 + 2.13E +3 (- 0/ 310	1-5.1 + 5.13E +1 (-3.1 - .03E 0 (- 0/ 610
ZR-95 (5A) (0)	1.0E-03	1 1.0 + .41E +3 (-5.6 - 11.4E +3 OF 07 5218	15 1 3.5 + 3.33E +3 (- 0/ 310	1-2.7 + 2.73E +1 (-1.6 - .03E 0 (- 0/ 610
NR-95 (5A) (0)	1.0E-02	1 3.2 + 1.43E +0 (-2.1 - 4.33E +3 OF 07 5218	00 1 1.4 + .03E +3 (- 0/ 610	1-1.0 + 1.03E +1 (-1.1 - .03E 0 (- 0/ 610
AG-110A (5A) (0)	2.0E-03	1-3.3 + 1.03E +3 (-4.5 - 3.03E +2 OF 07 5218	10 1 2.5 + 1.23E +3 (- 0/ 310	1-2.4 + 2.43E 0 (-1.1 - .03E 1 (- 0/ 610
RU-103 (5A) (0)	2.0E-03	1 1.4 + 10.03E +5 (-3.6 - 4.43E +3 OF 07 5218	00 1 4.3 + 7.13E +4 (- 0/ 610	1-0.5 + 0.03E +2 (-3.4 - .03E +1 (- 0/ 610
HU-106 (5A) (0)	2.0E-02	1-2.0 + 2.43E +5 (-0.7 - 3.53E +2 OF 07 5218	21 1 4.5 + 9.63E +1 (- 0/ 610	1 4.5 + 9.63E +1 (-4.7 - 5710.03E +0 (- 0/ 610
I-131 (5A) (0)	1.0E-03	1 3.3 + 2.73E +4 (-3.5 - 0.43E +3 OF 07 5218	21 1 2.1 + 2.13E +1 (- 0/ 610	1 2.1 + 2.13E +1 (-2.7 - 12500.03E +0 (- 0/ 610
CS-134 (5A) (0)	2.0E-03	1-2.0 + 1.63E +0 (-0.4 - 3.73E +3 OF 07 5218	00 1 3.0 + 7.33E +0 (- 0/ 610	1-1.1 + 1.13E +1 (-0.5 - .03E +1 (- 0/ 610
CS-137 (5A) (0)	2.0E-03	1 4.5 + 7.53E +4 (-4.9 - 7.13E +3 OF 17 5218	21 1 1.1 + 1.13E 0 (-5.1 - 8000.03E +3 (- 2/ 610	1 1.1 + 1.13E 0 (-5.1 - 8000.03E +3 (- 2/ 610

- * NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT
** THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E., >510M) IS INDICATED WITHIN *C

TABLE III-A-2
CONTINUED

PILGRIM I

OFFSITE ENVIRONMENTAL RADIOLOGICAL MONITORING
SUMMARY FOR THE PERIOD 12/21/81 - 12/31/82

A3/03/80. PAGE 2

MEDIUM AIR PARTICULATE FILTERS

UNITS: PCI/CU. M

RAIIONUCLIDES (NO. ANALYSES) (NON-ROUTINE)*	NOMINAL LLD	INDICATOR STATION MEAN, RANGE, AND NO. DETECTED**	STATION	HIGHEST STATION MEAN, RANGE, AND NO. DETECTED**	CUMUL. LOCATIONS MEAN, RANGE, AND NO. DETECTED**
GA-140 (5A) (0)	5.1E-03	(1.4 0 7)E -3 (-2.2 - 1.5)E -2 0/ 0/ 92)0	21	(2.2 0 4.1)E -2 0/ 0/ 0)0	(2.2 0 2.1)E -2 (-0.7 - 1290.0)E -0 0/ 0/ 0)0
CE-141 (5A) (0)	3.0E-03	(2.5 0 2.5)E -4 (-5.4 - 4.0)E -3 0/ 0/ 92)0	21	(4.2 0 4.2)E -1 0/ 0/ 0)0	(4.2 0 4.2)E -1 (-3.5 -25200.0)E -0 0/ 0/ 0)0
CE-144 (5A) (0)	2.0E-02	(5.0 0 01.2)E -1 (-2.1 - 1.3)E -2 0/ 0/ 92)0	21	(7.2 0 7.2)E -1 0/ 0/ 0)0	(7.2 0 7.2)E -1 (-0.4 - 4310.0)E -3 0/ 0/ 0)0
TH-228 (5A) (0)	9.0E-03	(-1.4 0 10.3)E -4 (-2.2 - 2.2)E -2 0/ 0/ 92)0	10	(7.5 0 7.0)E -3 0/ 0/ 0)0	(-7.0 0 7.0)E -1 (-0.8 - .0)E 0 0/ 0/ 0)0

- * NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT
** THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. POSITIVE) IS INDICATED WITHIN * () *.

TABLE III-A-2
CONTINUED

FIGURE III-A-1
GROSS BETA ACTIVITY
AIR PARTICULATES
INDICATOR STATIONS

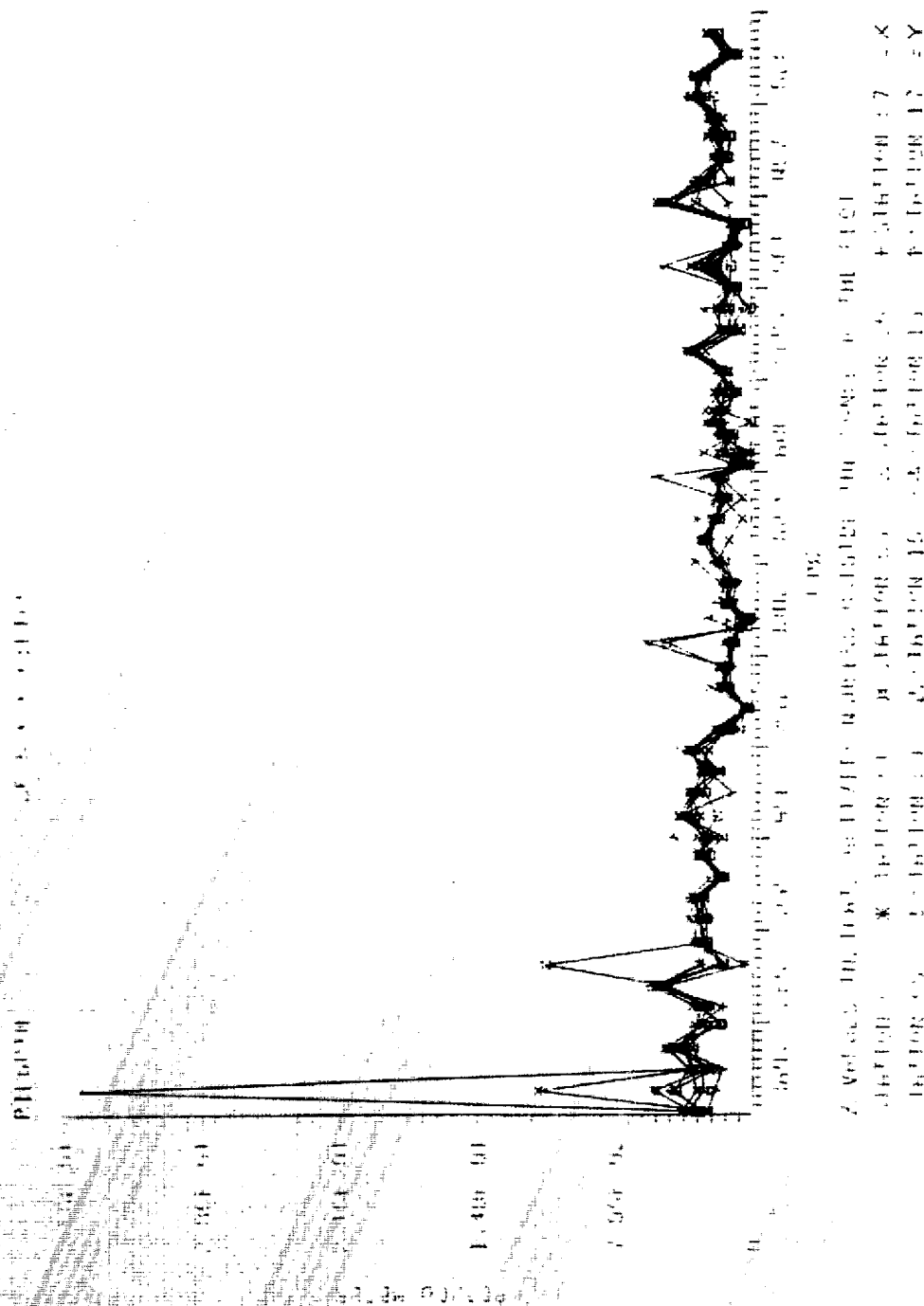


FIGURE III-A-2
GROSS BETA ACTIVITY
AIR PARTICULATES
CONTROL STATION

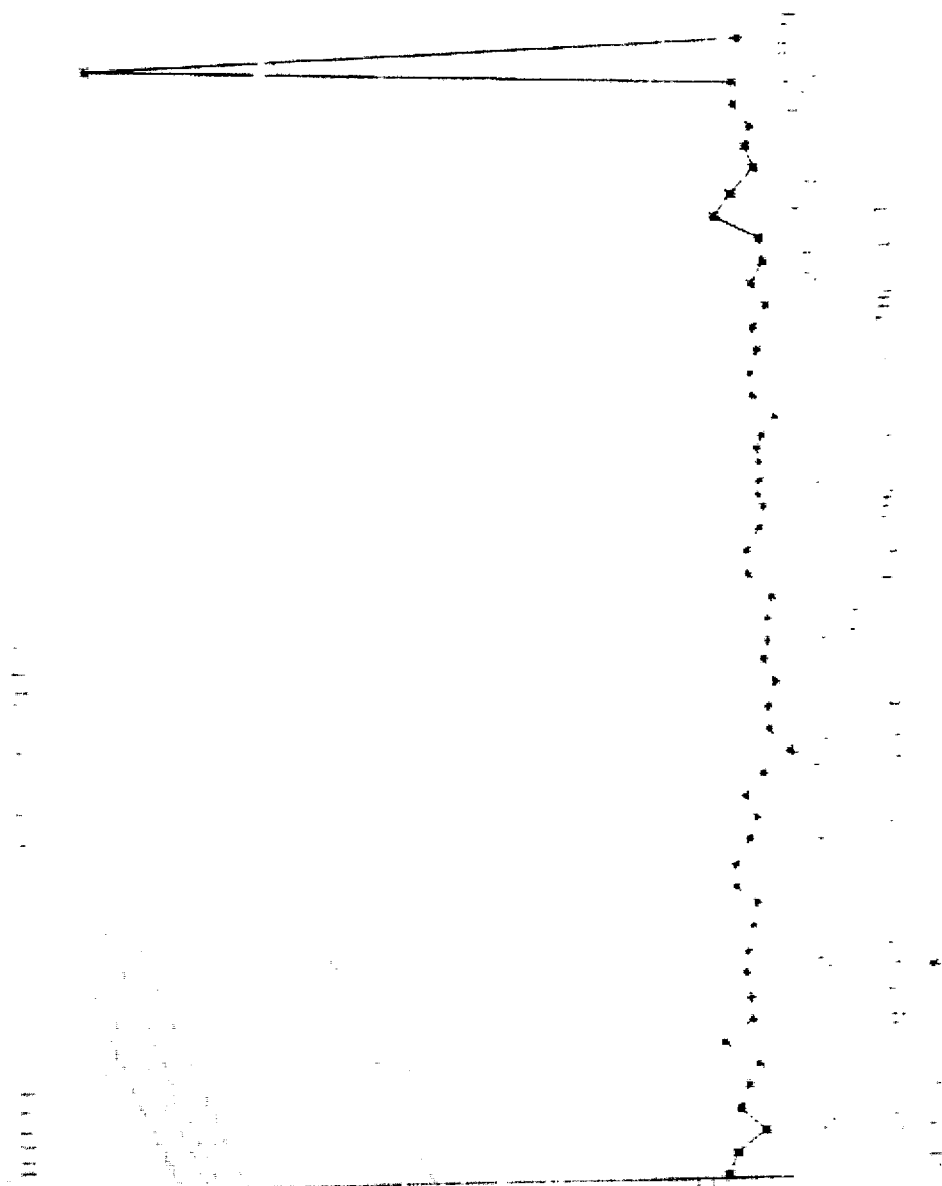


FIGURE III-A-3
CONCENTRATIONS OF Ce-144
AIR PARTICULATES
INDICATOR STATIONS

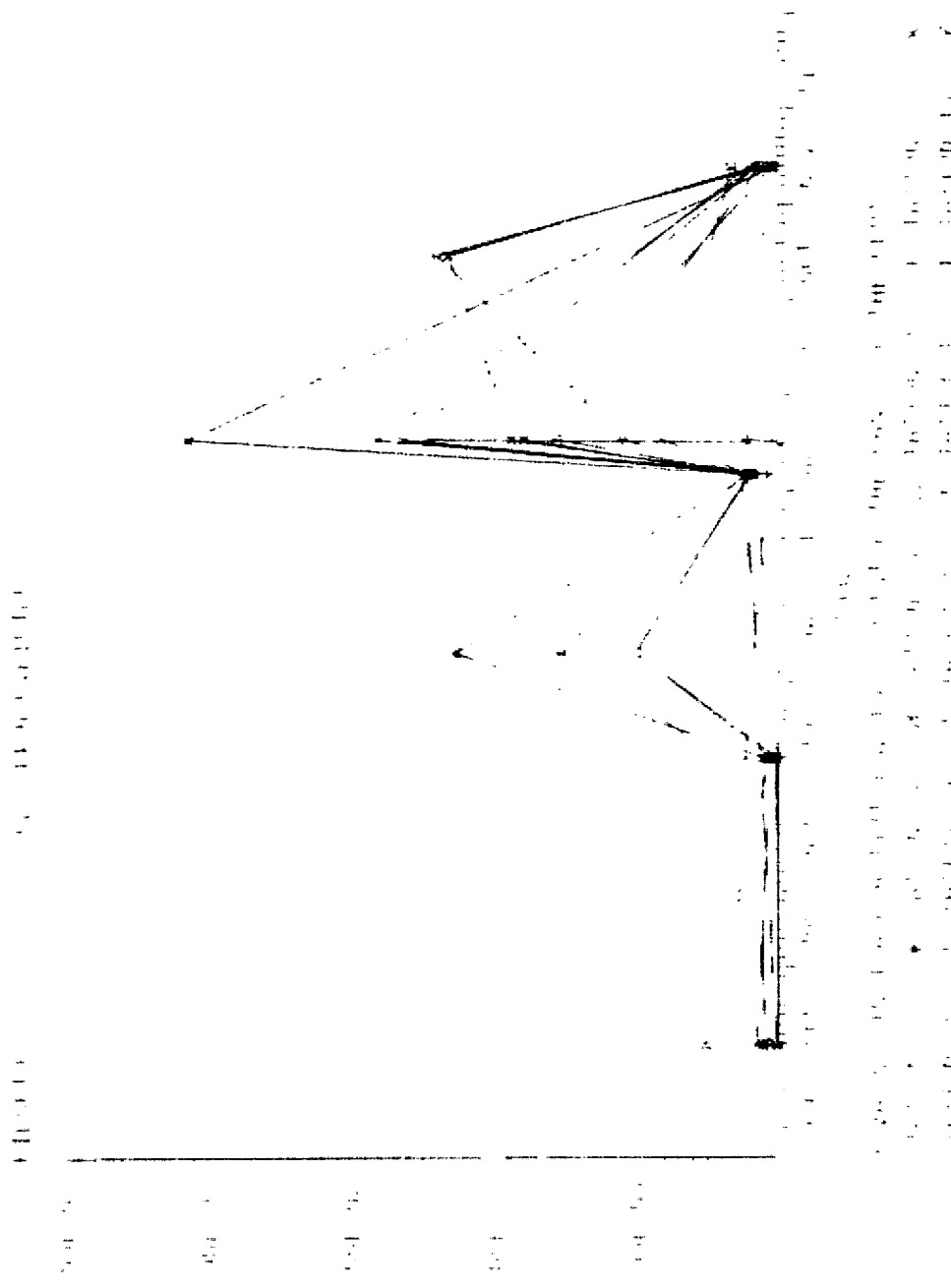


FIGURE III-A-4
CONCENTRATIONS OF Ce-144
AIR PARTICULATES
CONTROL STATION

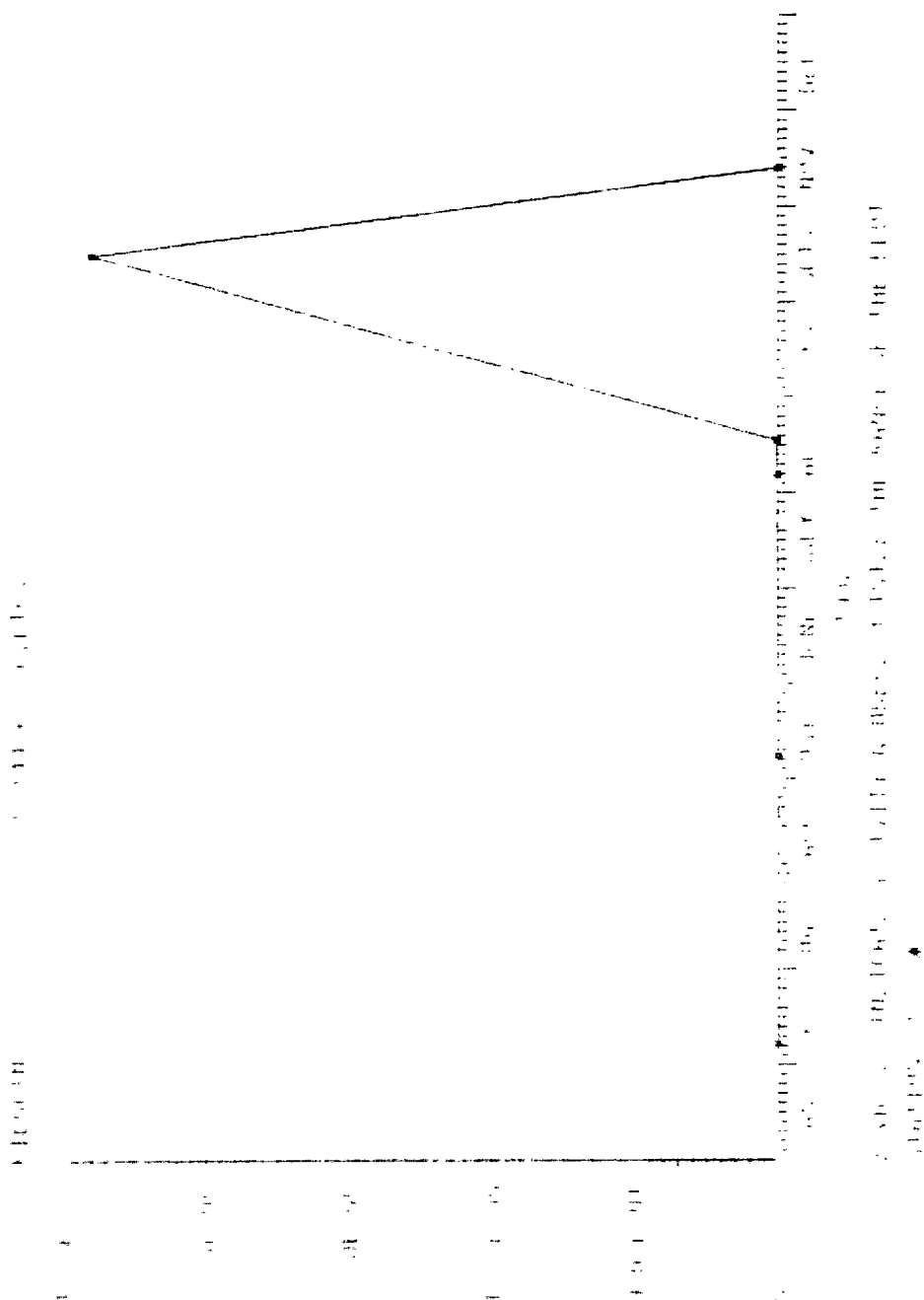


FIGURE III-A-5
CONCENTRATIONS OF Ce-141
AIR PARTICULATES
INDICATOR STATIONS

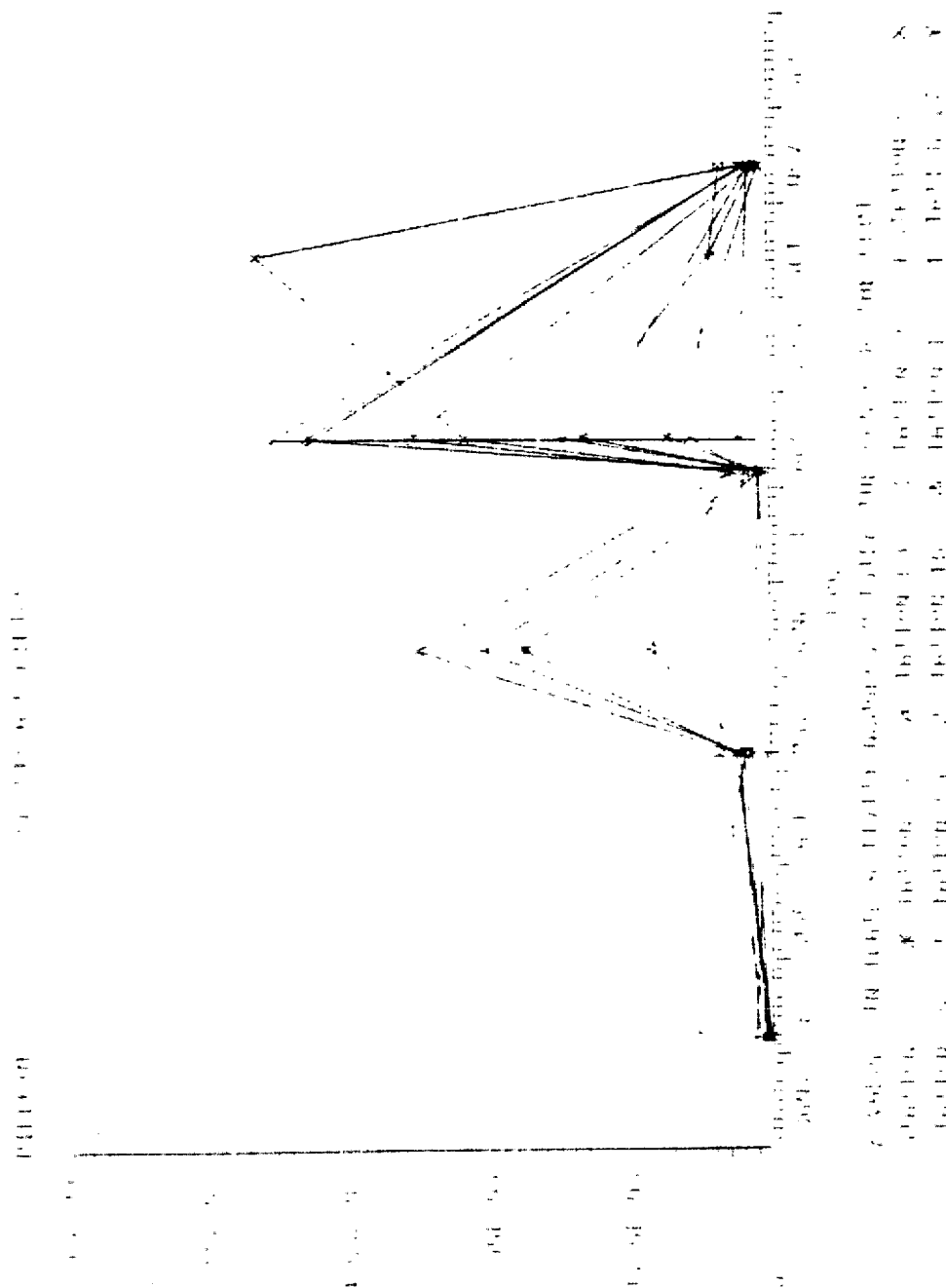


FIGURE III-A-6
CONCENTRATIONS OF Ce-141
AIR PARTICULATES
CONTROL STATION

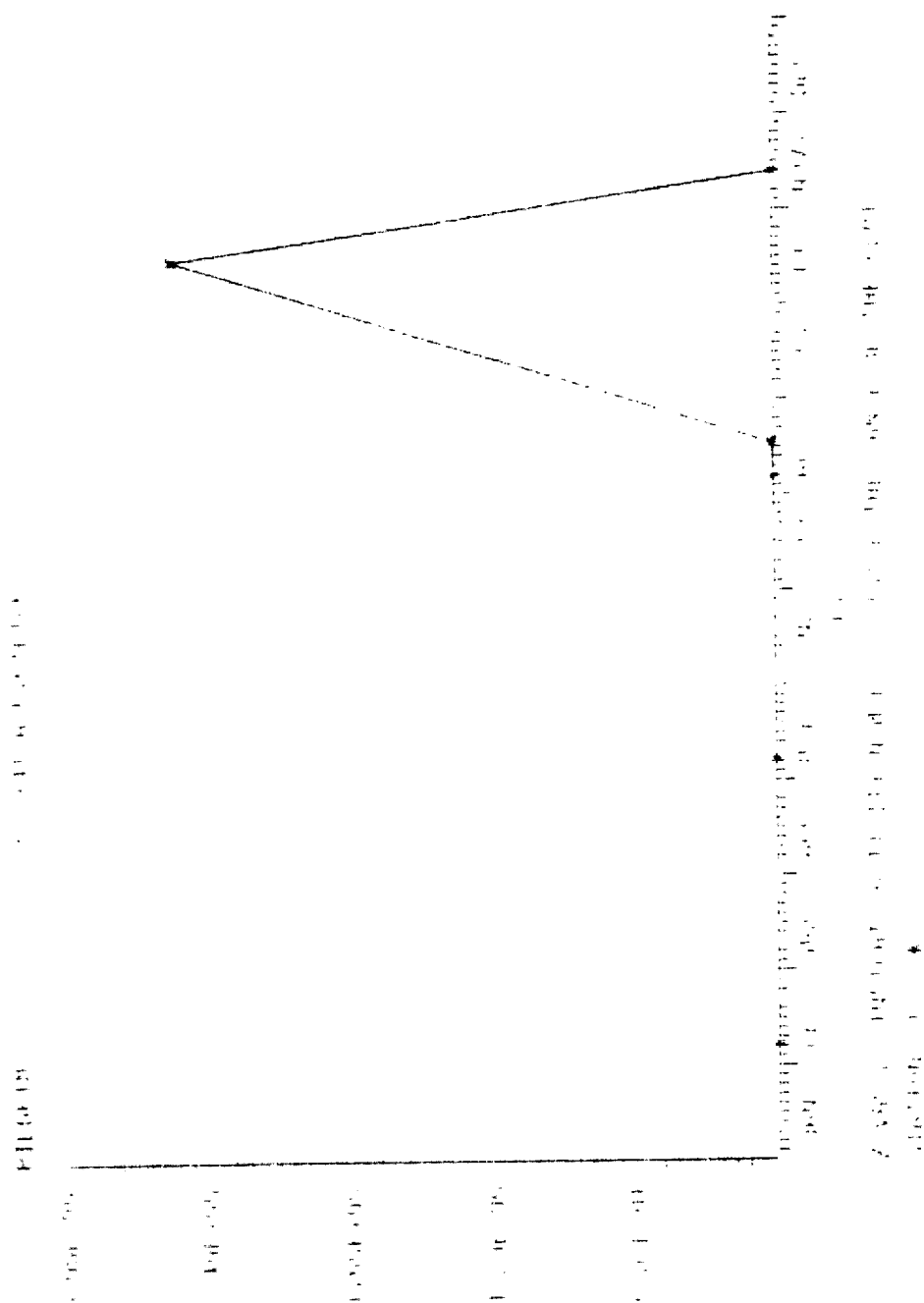


FIGURE III-A-7
CONCENTRATIONS OF Ru-103
AIR PARTICULATES
INDICATOR STATIONS

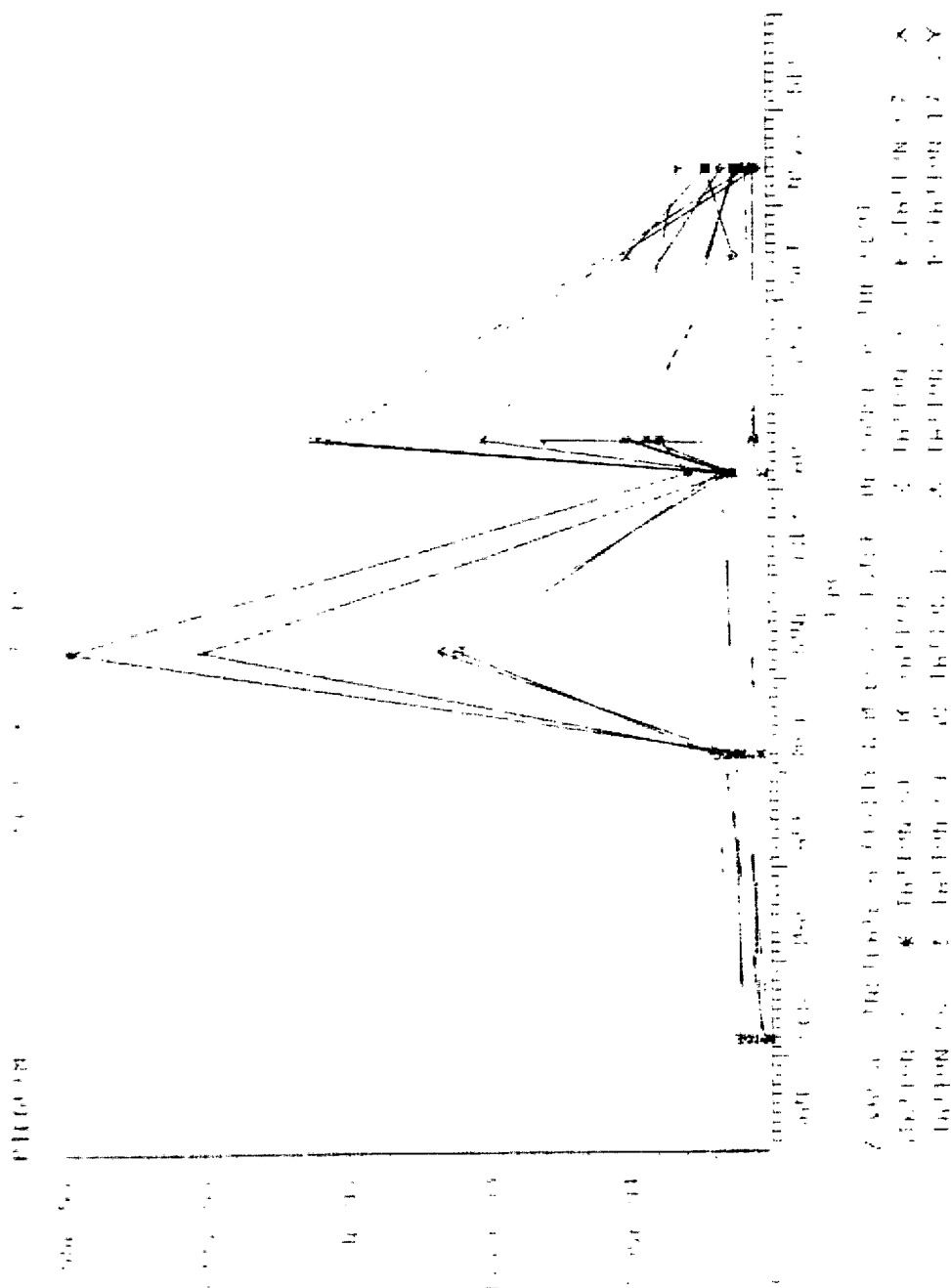


FIGURE 111-A-8
CONCENTRATIONS OF Ru-103
AIR PARTICULATES
CONTROL STATION

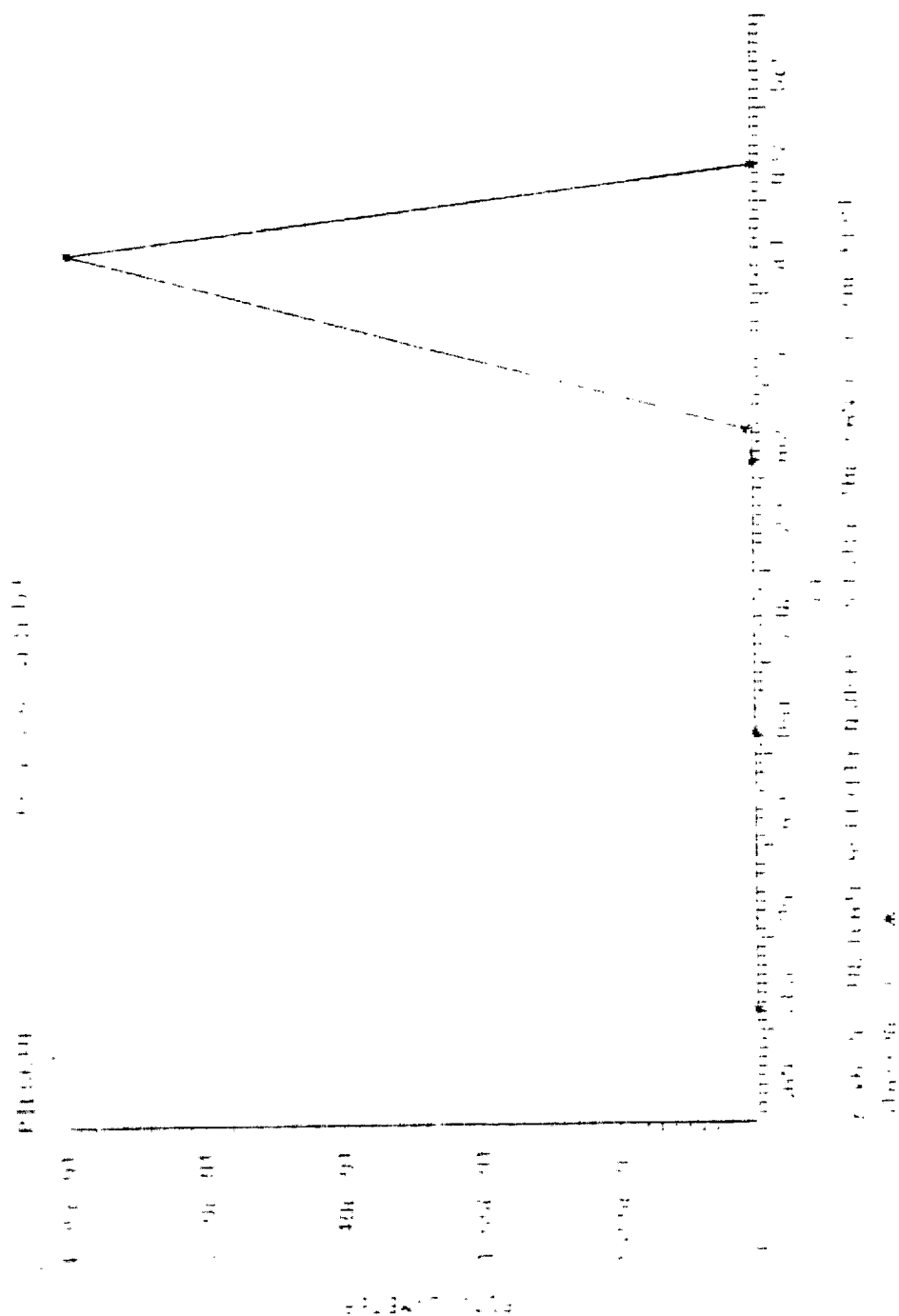


FIGURE III-A-9
CONCENTRATIONS OF Zr-95
AIR PARTICULATES
INDICATOR STATIONS

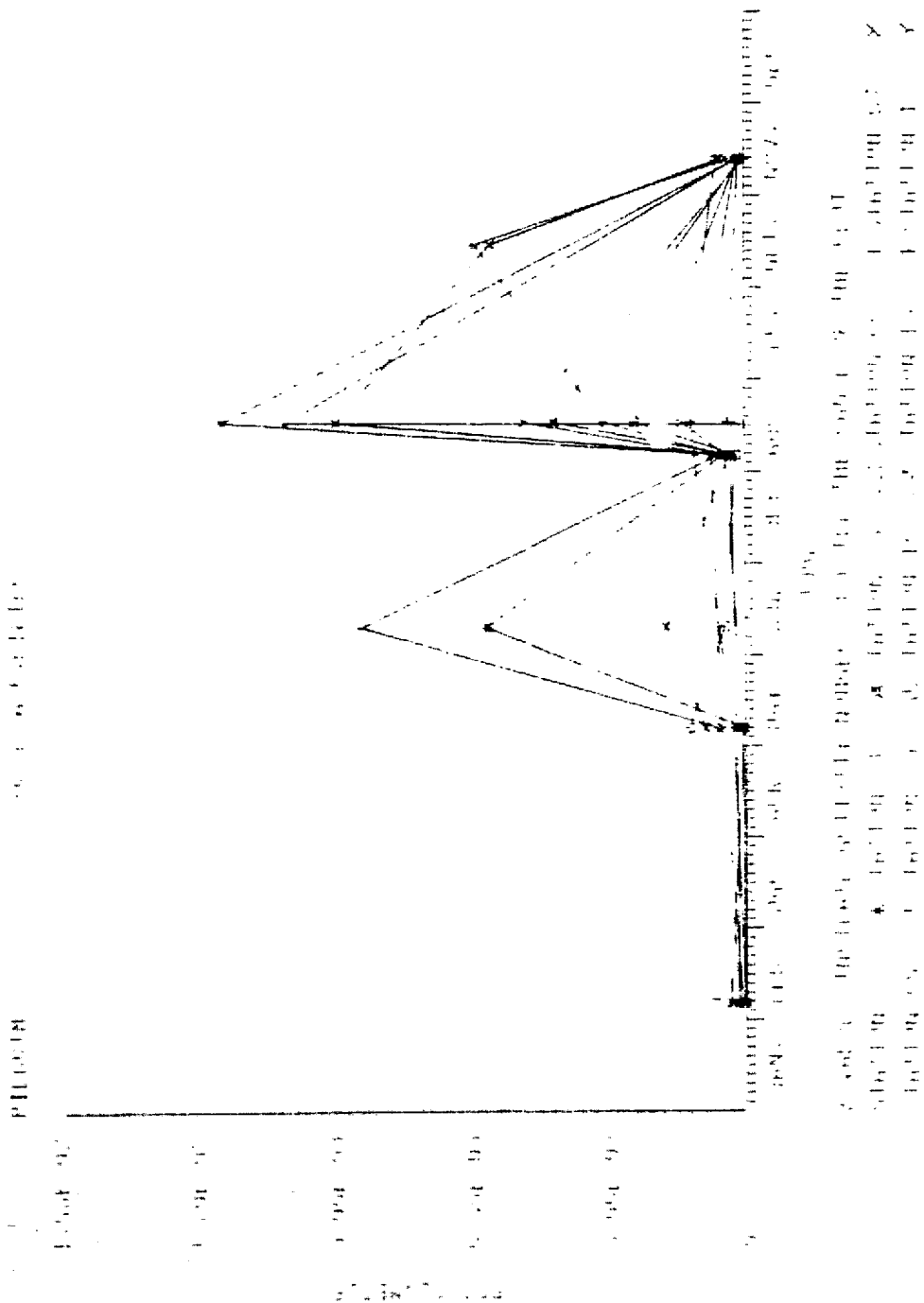


FIGURE III-A-10
CONCENTRATIONS OF Zr-95
AIR PARTICULATES
CONTROL STATION

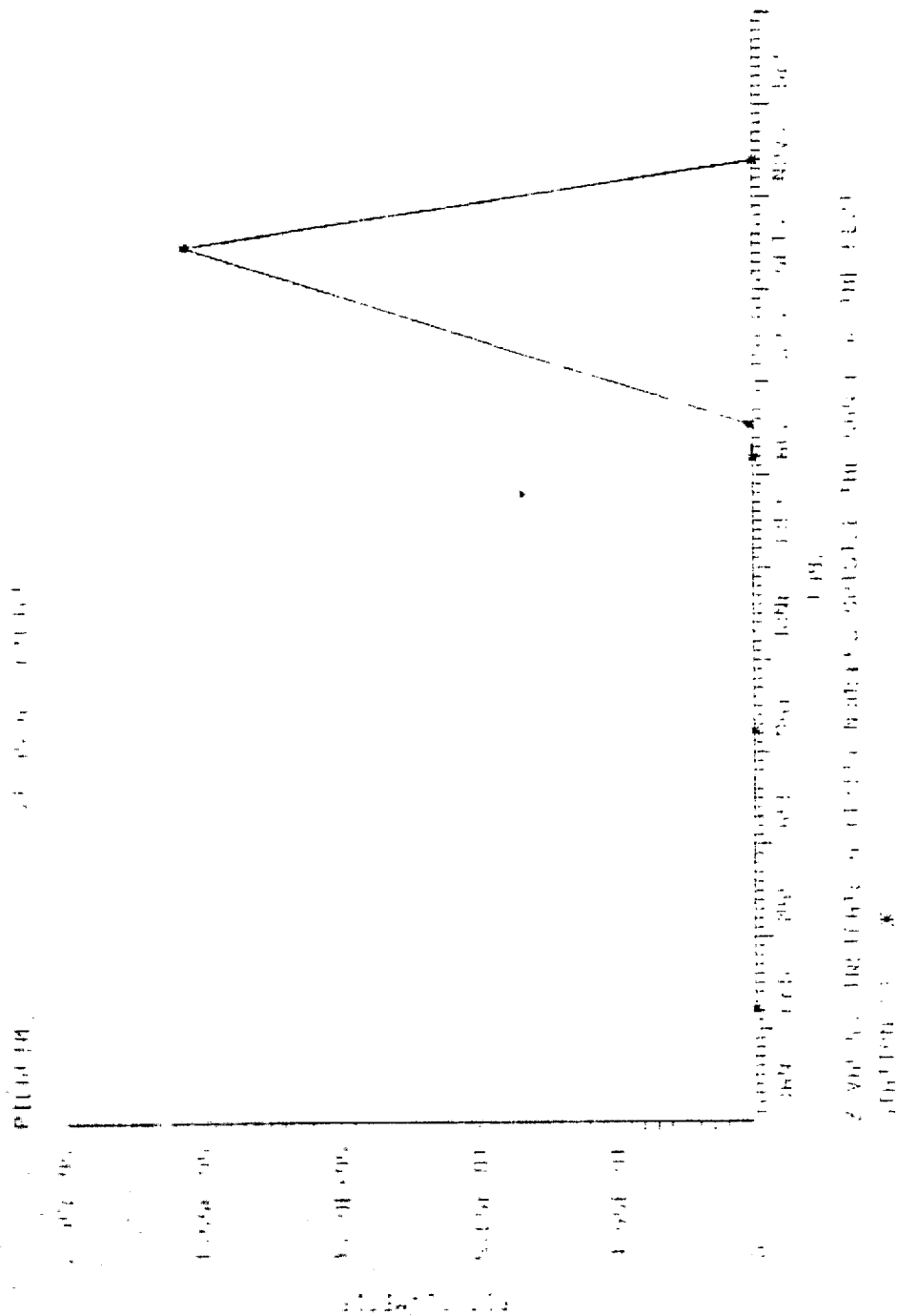


FIGURE III-A-11
CONCENTRATIONS OF Nb-95
AIR PARTICULATES
INDICATOR STATIONS

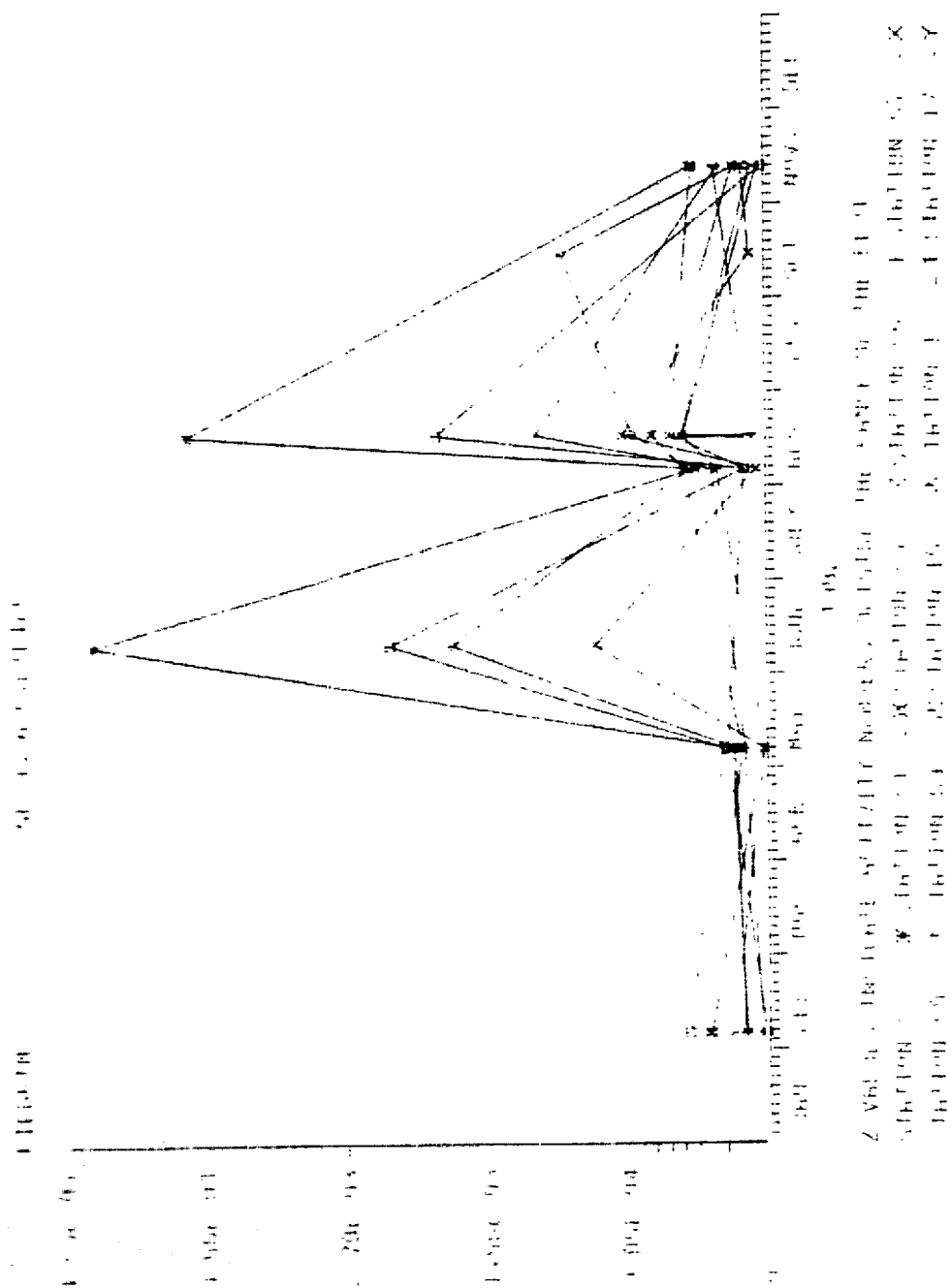
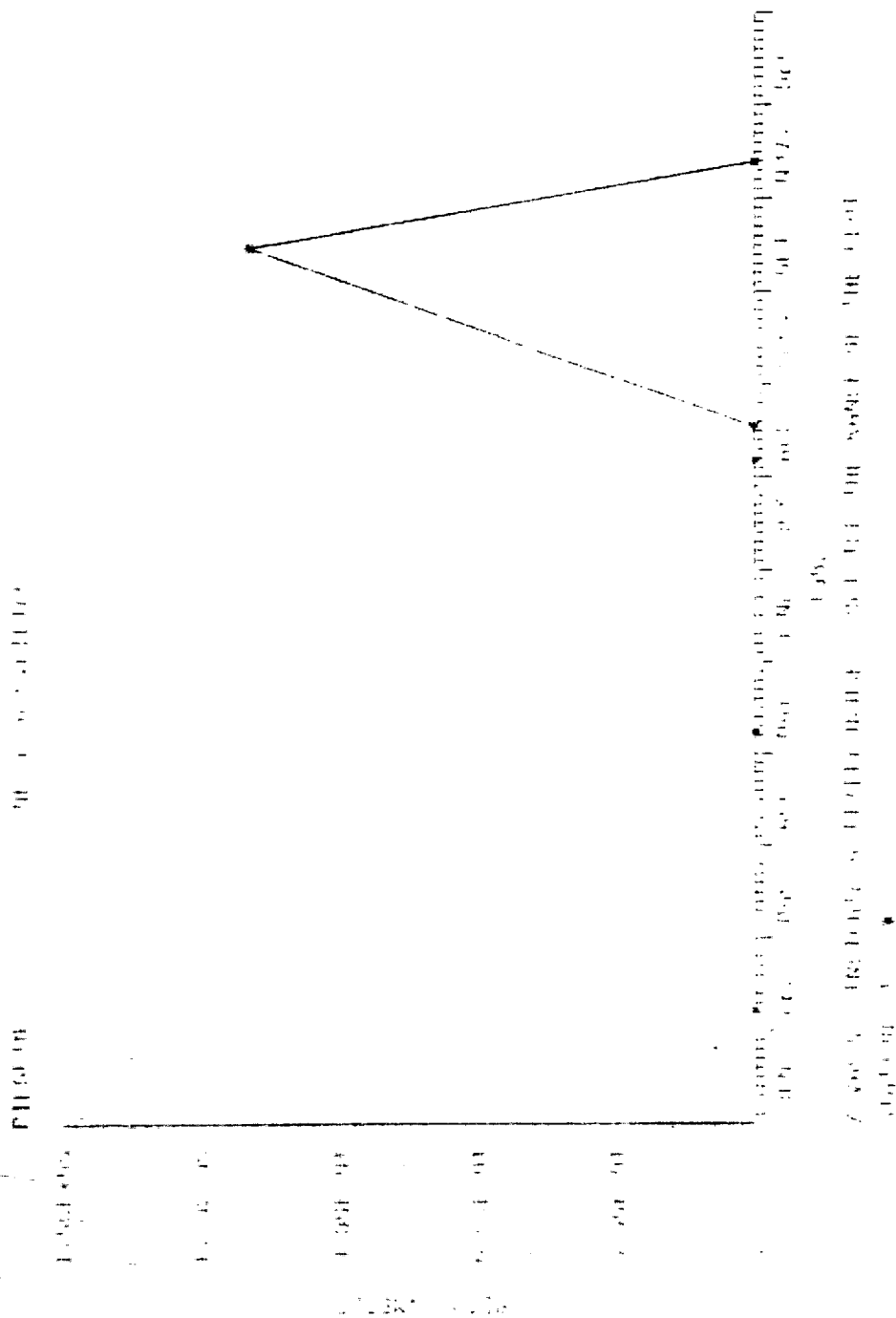


FIGURE III-A-12
CONCENTRATIONS OF Nb-95
AIR PARTICULATES
CONTROL STATION



III. B. Iodine

The same sample collection systems used to collect airborne particulates are used to collect gaseous iodine on a charcoal filter cartridge. The cartridge is removed and analyzed for I-131 weekly. The results of the ERMAP program for this media are provided in Table III-B-1. It is not apparent from this table that the mean value of the calculated concentrations for the indicator stations is greater than the mean value for the control station. The results of these analyses are presented graphically in Figure III-B-1 for the indicator stations and Figure III-B-2 for the control station.

There was clearly no significantly environmental effect observed in the airborne gaseous iodine collection media as a result of operation of PNPS-1.

The Yankee Atomic Environmental Laboratory determined that Co-60, an activation product often associated with releases from nuclear facilities, and abnormally high levels of normally present Cs-137, were present on the charcoal cartridges from PNPS-1 and another sponsor company. The manufacturer of the cartridges is Nuclear Consulting Services (NUCON) and the affected lot and batch numbers to date are lot 002 and batch 02.

This fact originally came to light during mid October 1982 when the analysis of seventy percent of the charcoal cartridges submitted weekly by PNPS-1 showed positive ⁶⁰Co concentrations (~ 90 dpm/cartridge). PNPS-1 charcoal cannisters had been used during the week in question. Analysis of six unused cannisters from the newly instituted material confirmed the presence and quantity of ⁶⁰Co and ¹³⁷Cs.

Analyses of charcoal cannisters subsequently submitted were conducted by high resolution gamma spectrometry, rather than the screening methodology, pending the outcome of negotiations between the sponsor company and NUCON. During the early part of January, 1983, this exact set of circumstances was repeated for a second sponsor company. At this time, the Laboratory contacted NUCON directly to ascertain the cause of the problem.

NUCON's representative indicated that their analysis of samples from the affected batch and from the raw materials used to prepare the batch confirmed the presence and levels of ^{60}Co . The basic material used to make the charcoal is coconut shell which has been fired, charred, ground and refired in the presence of steam to provide activated sites on the charcoal. This material is then purchased by NUCON and subjected to further testing and processing. The raw material under investigation was purchased by NUCON from the Phillipines. NUCON postulates that radioactive fallout from previous Chinese nuclear weapons testing is just entering the food web (coconuts) and is responsible for the presence of the ^{60}Co and abnormally high levels of ^{137}Cs .

Since the majority of charcoal of this type originates from the Southeast Asian region, it is most probable that all manufacturers of charcoal cannisters will eventually be faced with this contamination problem. The test data developed by NUCON for each batch of charcoal relative to the efficiencies of collection for various ^{131}I species remains valid.

PILGRIM 1

OFFSITE ENVIRONMENTAL RADIOLOGICAL MONITORING 03/03/16. PAGE 11
SUMMARY FOR THE PERIOD 12/21/01 - 12/31/02

MEDIUM CHARCOAL FILTERS

UNITS: PC/CU, M

RADIONUCLIDES (HL, ANALYSES) (HL=HODVINE)S	NOMINAL LLD	INDICATOR STATIONS MEAN, RANGE, AND NO. DETECTED**	STAT	HIGHEST STATION MEAN, RANGE, AND NO. DETECTED**	CONTROL LOCATIONS MEAN, RANGE, AND NO. DETECTED**
1-131 (45) (0)	3.0E-03	(-2.2 * 1.01E -3 (-1.1 - 1.2)E -1 (0/44)*)	00	(-6.2 * 13.01E -4 (0/ 50)*)	(-1.9 * 1.71E -3 (-3.4 - 3.41E -2 (0/ 55)*)

- * NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD (IF THE REPORT
** THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. DETECTA) IS INDICATED WITHIN A ()%.

TABLE III-B-1
ERMAR RESULTS
CHARCOAL CARTRIDGES

FIGURE III-B-1
CONCENTRATIONS OF I-131
CHARCOAL FILTER
INDICATOR STATIONS

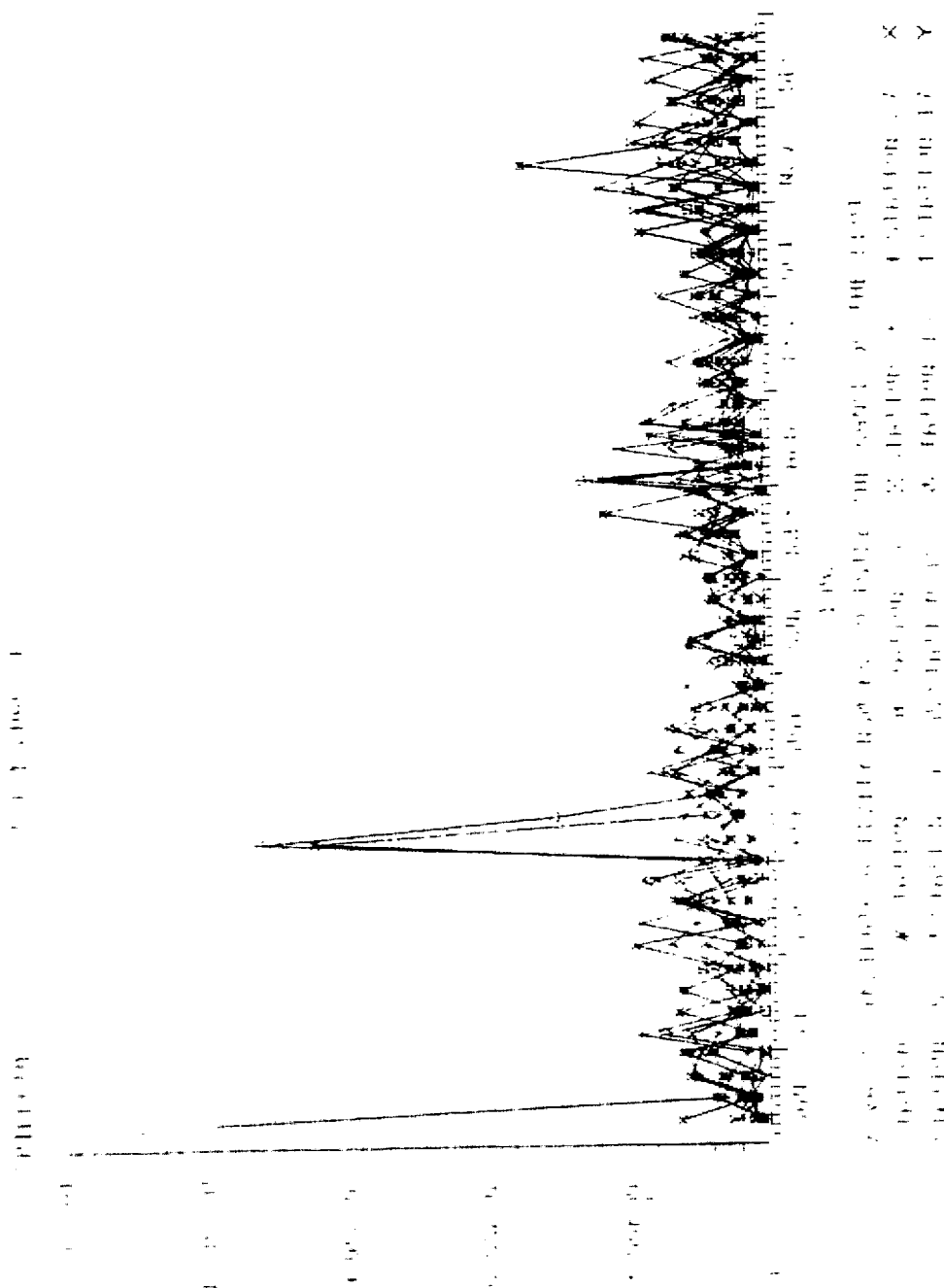
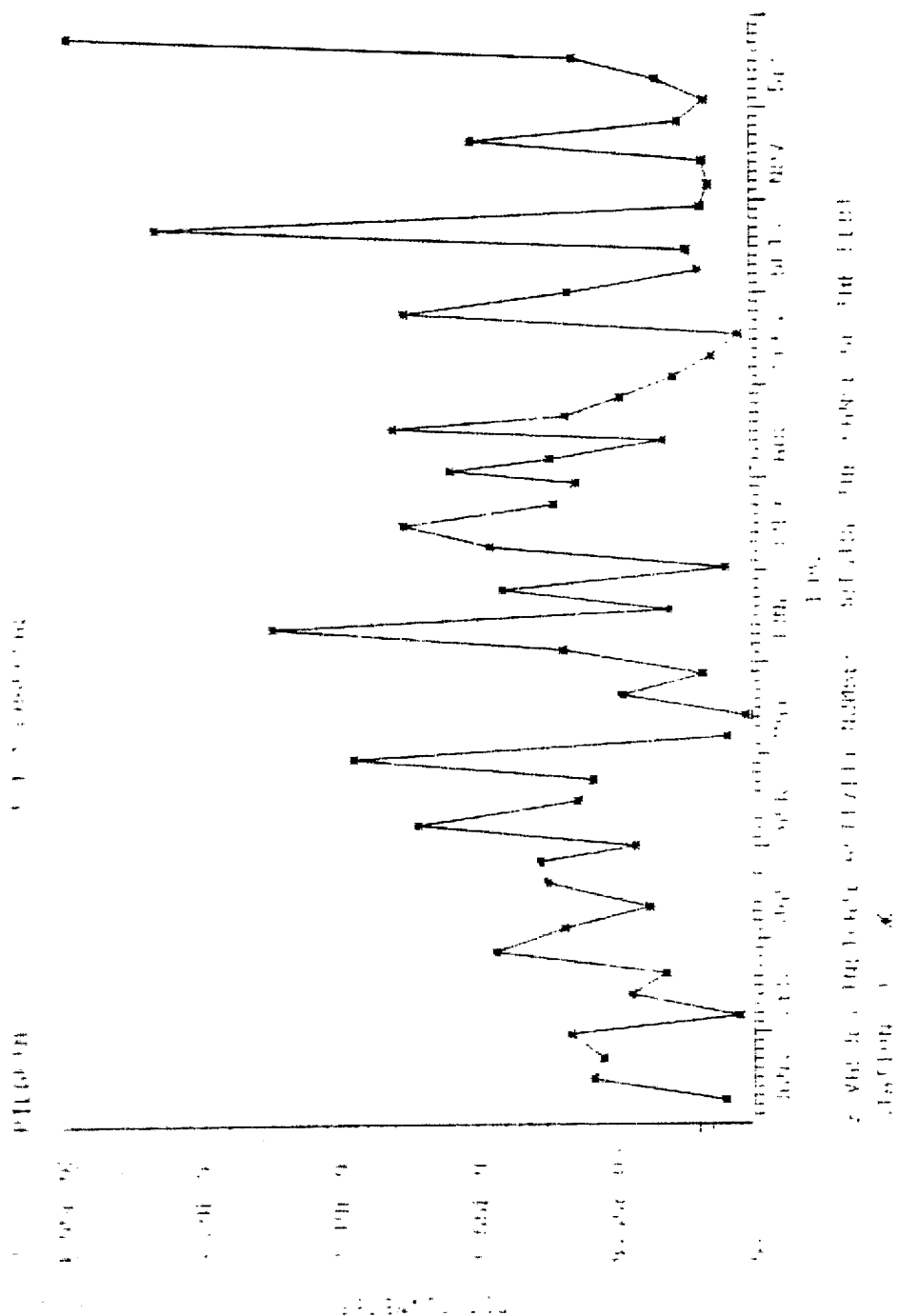


FIGURE III-B-2
CONCENTRATIONS OF I-131
CHARCOAL FILTERS
CONTROL STATION



III. C. Soil

Soil surveys at eleven locations are required once every three years in compliance with the revised Technical Specifications which went into effect on April 19, 1977. These in-situ surveys were conducted during May, October and December of 1982. The results of these surveys are included in Appendix C of this report.

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III. D Direct Radiation

1. Continuous Thermoluminescent Dosimetry

Thermoluminescent dosimeters (TLD) of the $\text{CaSO}_4(\text{Dy})$ type are used to record direct gamma radiation from all sources including direct and scattered radiation from Nitrogen-16 in the turbine building, and cosmic and other natural and artificial gamma radiation. TLD's are installed at the locations identified in Table III-D-1.

Tables III-D-2 through III-D-5 show quarterly average doses from direct gamma radiation in $\mu\text{R/hr}$ at these stations.

In addition to average doses for each TLD for each readout period, geographic regional average doses for sectors of different nearness are computed; viz, in immediate proximity to PNPS, more distant but near the site boundary, up to several miles away - "neighborhood", and far away (background). Each set of data show consistent trends; the near plant dosimeters (QA, PB, PA, WS) stand out among all readings and have an average above the dose rates further away. The next region has a lower average dose rate, and beyond 0.7 mile (distant neighborhood and background) the dose rates are statistically consistent.

In all cases, the near plant levels are distinctly higher than those off-site and off-site dose rates are not significantly sensitive to distance variations beyond the site itself. Thus, beyond the "exclusion area" (for this purpose, the 0.25-0.7 mile region), dose rates show no significant plant effect; populated areas are therefore beyond the limits of elevated dose rates.

2. Field Survey

A gamma exposure survey of Plymouth Beach and Priscilla/White Horse Beach was conducted during June of 1982. The results of this most recent survey are in agreement with the last five beach surveys conducted for 1981, 1980, 1979, 1978 and 1977. In addition, a comprehensive soil survey of 11 locations was conducted during the spring and fall of 1982. This study included both gamma exposure rate measurements and in-situ gamma spectrometry analysis for each location. Laboratory soil analyses were also conducted for selected locations. The results of this study are presented in Appendix C. The latest gamma exposure survey was conducted using a Reuter Stokes RS-111 high pressure ion chamber (HPCI). Serial Number 4-1656. The design and calibration of this instrument were described in the above report.⁴

The present survey was designed to detect differences in the external exposure rate encountered at beaches near the plant (Plymouth and Priscilla/White Horse) and a control location (Duxbury). The detector's calibration was checked before each measurement.

The data (Table III-D-7) indicate that the exposure rates at Plymouth Beach (behind Berts Restaurant) and Priscilla/White Horse Beach are not significantly greater than the exposure rates measured at the control station in Duxbury. The small differences are likely due to the presence of granite beach stones which are essentially absent at the Duxbury location.

It has been demonstrated that proximity to beach stones results in higher exposure rates than in sandy areas (see Annual Report No. 10).

This survey indicates that the natural background exposure rate at beaches near Pilgrim Station is, probably 6-9 uR/hr. These results are in complete agreement with similar measurements performed in Maine⁵, where the natural background exposure rate at shoreline locations was found to vary between 6.6 and 14.5 uR/hr. These exposure rates were also found to vary directly with the size and proximity of granite outcroppings⁵.

These latest measurements are also in agreement with the soil survey mentioned earlier. The results of that survey indicate that off-site dose rates have a range of 9.3 to 10.5 uR/hr with an average of 9.7 uR/hr.

THERMOLUMINESCENT DOSIMETER LOCATIONS

Surveillance Stations				Station Specification				
Near Plant (0-0.16 miles)	Exclusion Area (0.23-0.7)	Distant Neighborhood (0.98-6.5 miles)	Background (8-21 miles)	Station Code	Rise Pkg.	Item No.	Distance (miles)	Direction
Overlook Area • Warehouse • Pedestrian Bridge Public Parking Area				DA	11-2	9	0.09	M-WM
				DB	11-2	23	0.16	B-SSE
				DM	11-2	0	0.15	NNW
				PA	11-2	3	0.16	NN-MMM
	Property Line Property Line Subst Gradedwater Property Line Property Line (SW) Property Line Property Line Property Line Property Line Property Line Property Line (West) Rocky Hill Road (West) Microwave Tower Clark Wick Area Rocky Hill Road (East) May Shore Drive			A	11-2	1	0.25	M-WM
				P	11-2	2	0.27	NNN-MM
				SB	11-2	10	0.31	ESE
				B	11-2	13	0.32	SSE
				H	11-2	6	0.33	SW
				I	11-2	3	0.33	M-WM
				PL	11-2	24	0.34	NNN-MM
				D	11-2	1	0.37	NN-MMM
				L	11-2	22	0.40	SSE-SSE
				MB	11-2	13	0.43	SE
				C	11-2	11	0.44	2SE-BL
				G	11-2	4	0.44	W
				MM	11-2	10	0.53	NNW
				MT	11-2	14	0.55	S-SM
				CA	11-1	3	0.63	S-SM
				EA	11-2	21	0.68	BL
	Emerison Road Property Line Property Line (South) White Horse Road Property Line Manomet Point Manomet Elem. School Manomet Substation South Plymouth Plymouth Beach Plymouth Center North Plymouth Scandinavian Shores (Rue) College Pond			BD	11-1	6	0.70	M-WM
				BM	11-2	13	0.97	SSE
				J	11-2	19	1.21	B-SSE
				K	11-2	17	1.23	S
				MI	11-2	16	1.31	SSE
				X	11-2	20	1.32	B-SSE
				MP	11-1	8	2.25	E-ESE
				MS	11-1	9	2.50	SE
				NS	11-1	10	2.50	SSE
				SP	11-1	5	3.00	NNW
				ND	11-1	11	3.50	SE-SSE
				PC	11-1	4	4.50	M-WM
				NP	11-1	3	5.50	NNW
				SS	11-1	1	6.25	NW
				CP	11-1	12	6.50	SW
						Shawmut Airport (Pty) Cudaville Sub. (Sag) Kington Substation East Maymouth	BA	11-1
CS	11-1	13	10.00				S-SSE	
KS	11-1	2	10.00				NNW	
EW	11-1	15	23.00				NW	

These suggested dry upstating issues.
 These suggested issues that I would not believe.

TABLE III-D-2
GAMMA EXPOSURE (TLD) DATE FOR QUARTER #1 1982

<u>TLD No.</u>	<u>Station</u>	<u>Micror/ Hour</u>	<u>+-</u>	<u>2 Sigma</u>
229	CP	4.16	+-	0.96
225	CR	7.97	+-	2.67
230	CS	5.22	+-	1.54
231	ER	4.63	+-	1.51
232	EW	4.00	+-	1.08
233	KS	4.41	+-	1.45
234	MB	3.55	+-	1.12
235	ME	6.46	+-	1.75
236	MP	5.11	+-	1.35
237	MS	4.73	+-	1.26
238	NP	4.59	+-	1.31
ND*	PC	ND	+-	ND
240	SA	2.68	+-	0.68
241	SP	5.91	+-	2.26
242	SS	3.95	+-	1.02
243	WR	4.64	+-	1.39
244	BD	5.32	+-	1.28
245	EB	4.84	+-	1.55
246	EM	2.92	+-	0.68
247	MT	4.06	+-	0.97
248	OA	6.95	+-	2.13
249	PA	5.07	+-	1.73
250	PB	8.32	+-	2.60
251	WH	3.75	+-	1.39
252	A	4.52	+-	1.29
253	B	4.02	+-	1.73
254	C	ND	+-	ND
255	D	7.73	+-	2.08
256	E	3.65	+-	0.98
257	F	5.01	+-	1.44
258	G	4.52	+-	1.05
259	H	8.11	+-	1.91
260	I	4.34	+-	1.17
261	J	4.17	+-	1.04
262	K	3.23	+-	1.10
224	L	9.42	+-	3.43
263	PL	4.38	+-	1.09
205	WS	16.38	+-	6.00
264	HB	4.94	+-	1.55
266	RL	2.04	+-	0.61
239	RL	2.75	+-	0.85

Geographic Regional Averages this period are:

Near Plant (0-.16 mi)	9.18	+-	2.36
Exclusion Area (.25-.68 mi)	5.54	+-	0.49
Distant Neighborhood (.7-6.5 mi)	4.39	+-	0.38
Background (8-21 mi)	4.08	+-	0.82

*ND - No Data due to missing TLD.

TABLE III-D-3
GAMMA EXPOSURE (TLD) DATA FOR QUARTER #2 1982

<u>TLD No.</u>	<u>Station</u>	<u>Micror/ Hour</u>	<u>+ -</u>	<u>2 Sigma</u>
277	CP	8.16	+-	2.20
278	CR	8.89	+-	3.07
279	CS	ND*	+-	ND*
280	ER	6.14	+-	1.98
281	EW	8.30	+-	2.02
282	KS	6.45	+-	1.69
283	MB	6.17	+-	1.82
284	ME	9.33	+-	2.54
285	MP	7.19	+-	2.20
286	MS	8.28	+-	2.33
287	NP	8.47	+-	2.41
288	PC	4.60	+-	1.16
289	SA	5.89	+-	1.79
290	SP	6.80	+-	2.26
291	SS	7.42	+-	2.08
292	WR	11.22	+-	3.26
293	BD	8.53	+-	2.75
294	EB	8.18	+-	2.52
295	EM	8.70	+-	2.38
296	MT	9.55	+-	2.31
297	OA	22.51	+-	8.67
298	PA	8.73	+-	2.19
301	PB	17.49	+-	6.79
302	WH	12.49	+-	3.64
303	A	7.93	+-	2.31
304	B	8.94	+-	3.23
305	C	11.10	+-	3.84
306	D	9.10	+-	2.75
307	E	7.59	+-	1.90
308	F	7.11	+-	2.43
309	G	9.16	+-	2.44
310	H	15.97	+-	4.08
311	I	8.98	+-	2.85
312	J	8.88	+-	3.17
313	K	7.89	+-	2.38
314	L	7.66	+-	2.22
315	PL	7.29	+-	2.43
316	WS	10.83	+-	3.40
317	HB	8.37	+-	4.19
318	RL	2.12	+-	0.56
319	RL	1.88	+-	0.71

Geographic Regional Averages this period are:

Near Plant (0-.16 mi)	14.89	+-	3.91
Exclusion Area (.25-.68 mi)	9.10	+-	0.79
Distant Neighborhood (.7-6.5 mi)	8.03	+-	0.67
Background (8-21 mi)	6.87	+-	1.59

*ND - No data due to missing TLD

TABLE III-D-4
GAMMA EXPOSURE (TLD) DATA FOR QUARTER #3 1982

<u>TLD No.</u>	<u>Station</u>	<u>Micror/ Hour</u>	<u>+ -</u>	<u>2 Sigma</u>
229	CP	3.98	+ -	7.45
225	CR	15.52	+ -	2.89
230	CS	6.82	+ -	3.10
231	ER	6.91	+ -	2.40
232	EW	11.84	+ -	2.00
233	KS	8.14	+ -	3.29
234	MB	13.37	+ -	4.93
235	ME	16.43	+ -	3.67
236	MP	10.91	+ -	3.57
237	MS	20.77	+ -	3.90
238	NP	14.11	+ -	5.35
265	PC	7.62	+ -	2.05
240	SA	15.40	+ -	2.68
241	SP	12.91	+ -	4.27
242	SS	10.28	+ -	2.27
243	WR	17.15	+ -	3.21
244	BD	10.42	+ -	1.65
245	EB	10.10	+ -	1.66
246	EM	13.00	+ -	2.78
247	MT	13.21	+ -	3.28
248	OA	30.99	+ -	7.50
249	PA	11.26	+ -	3.07
250	PB	22.81	+ -	3.36
251	WH	10.98	+ -	2.84
252	A	8.42	+ -	2.81
253	B	8.28	+ -	1.97
336	C	5.33	+ -	1.68
255	D	11.19	+ -	3.58
256	E	10.19	+ -	2.21
257	F	8.58	+ -	2.33
258	G	14.49	+ -	4.03
259	H	11.43	+ -	4.57
260	I	10.93	+ -	2.31
261	J	11.22	+ -	2.30
262	K	9.95	+ -	1.56
224	L	16.23	+ -	3.53
263	PL	11.75	+ -	2.08
205	WS	26.60	+ -	7.75
264	HB	9.97	+ -	3.19
266	RL	1.84	+ -	0.14
239	RL	1.98	+ -	0.41

Geographic Regional Averages this period are:

Near Plant (0-.16 mi)	22.92	+ -	3.90
Exclusion Area (.25-.68 mi)	11.22	+ -	0.78
Distant Neighborhood (.7-6.5 mi)	11.74	+ -	1.03
Background (8-21 mi)	10.55	+ -	1.87

TABLE III-D-5
GAMMA EXPOSURE (TLD) DATA FOR QUARTER #4 1982

<u>TLD No</u>	<u>Station</u>	<u>Micror/ Hour</u>	<u>+ -</u>	<u>2 Sigma</u>
27	CP	7.06	+ -	1.54
278	CR	8.57	+ -	3.04
346	CS	6.50	+ -	1.77
280	ER	10.84	+ -	2.99
281	EW	8.62	+ -	1.73
282	KS	8.55	+ -	2.11
283	MB	9.25	+ -	3.24
284	ME	ND*	+ -	ND
285	MP	7.59	+ -	2.76
286	MS	9.28	+ -	2.36
287	NP	8.21	+ -	1.76
288	PC	6.01	+ -	1.55
289	SA	6.87	+ -	1.90
290	SP	6.61	+ -	1.78
291	SS	7.26	+ -	1.77
292	WR	9.85	+ -	2.10
293	BD	11.04	+ -	3.62
294	EB	7.77	+ -	2.65
295	EM	9.03	+ -	2.58
296	MT	9.44	+ -	3.56
297	OA	22.97	+ -	4.97
298	PA	7.30	+ -	1.43
301	PB	17.60	+ -	6.02
302	WH	7.38	+ -	2.96
303	A	11.49	+ -	3.82
304	B	11.15	+ -	3.63
305	C	ND*	+ -	ND
306	D	8.08	+ -	3.75
307	E	6.82	+ -	1.66
308	F	10.21	+ -	3.26
309	G	7.73	+ -	2.36
310	H	12.89	+ -	3.80
311	I	9.31	+ -	3.75
312	J	8.19	+ -	2.16
313	K	6.28	+ -	2.21
314	L	7.01	+ -	1.58
315	PL	10.31	+ -	3.88
316	WS	14.03	+ -	3.66
317	HB	8.81	+ -	4.41
333	RL	2.33	+ -	0.51
334	RL	2.18	+ -	0.52

Geographic Regional Averages this period are:

Near Plant (0-.16 mi)	15.47	+ -	2.91
Exclusion Area (.25-.68 mi)	9.56	+ -	0.92
Distant Neighborhood (.7-6.5 mi)	7.86	+ -	0.68
Background (8-21 mi)	7.63	+ -	1.26

*ND - No data due to missing TLD

QUARTERLY AVERAGES FOR GAMMA EXPOSURE RATES

STATION	1ST QUARTER MICROR/HR		2ND QUARTER MICROR/HR		3RD QUARTER MICROR/HR		4TH QUARTER MICROR/HR	
CP	4.14	0.94	8.14	2.20	3.98	7.45	7.06	1.54
CR	7.97	2.67	8.89	3.07	15.52	2.89	8.57	3.64
CS	5.22	1.54	0.00	0.00	6.82	3.10	6.50	1.77
ER	4.83	1.51	8.14	1.98	6.91	2.40	10.84	2.99
EW	4.00	1.08	8.30	2.02	11.84	2.00	8.42	1.73
KS	4.41	1.45	6.45	1.69	8.14	3.29	8.55	2.11
NB	3.55	1.12	6.17	1.82	13.37	4.93	9.25	3.24
NE	4.46	1.75	9.33	2.54	16.43	3.67	0.00	0.00
NP	5.11	1.35	7.19	2.20	10.91	3.57	7.52	2.74
NS	4.73	1.24	8.28	2.33	20.77	3.90	9.28	2.34
NP	4.59	1.31	8.47	2.41	14.11	5.35	8.21	1.74
PC	0.00	0.00	4.60	1.16	7.62	2.05	6.01	1.55
SA	2.68	0.68	5.86	1.79	15.40	2.68	6.87	1.90
SP	5.91	2.24	6.80	2.24	12.91	4.27	6.61	1.78
SS	3.95	1.02	7.42	2.08	10.28	2.27	7.26	1.77
WR	4.44	1.39	11.22	3.24	17.15	3.21	9.85	2.10
BD	5.32	1.28	8.53	2.75	10.42	1.65	11.04	3.62
EB	4.84	1.55	8.18	2.52	10.10	1.66	7.77	2.65
EM	2.92	0.68	8.70	2.38	11.00	2.78	9.03	2.58
MT	4.06	0.97	9.55	2.31	13.21	3.28	9.44	3.56
OA	6.95	2.13	22.51	8.67	30.99	7.50	22.97	4.97
PA	5.07	1.73	8.73	2.19	11.24	3.07	7.30	1.43
PB	8.32	2.60	17.49	6.79	22.81	3.36	17.60	6.02
WH	3.75	1.39	12.49	3.64	10.98	2.84	7.38	2.94
A	4.58	1.29	7.93	2.31	8.42	2.81	11.49	3.82
B	4.02	1.73	8.94	3.23	8.28	1.97	11.15	3.63
C	0.00	0.00	11.10	3.84	5.33	1.68	0.00	0.00
D	7.73	2.08	9.10	2.75	11.19	3.58	8.08	3.75
E	3.65	0.98	7.59	1.90	10.19	2.21	6.82	1.66
F	5.01	1.44	7.11	2.43	8.58	2.33	10.21	3.26
G	4.52	1.05	9.16	2.44	14.49	4.03	7.73	2.36
H	8.11	1.91	15.97	4.00	11.43	4.57	12.89	3.80
I	4.34	1.17	8.98	2.85	10.93	2.31	9.31	3.75
J	4.17	1.04	8.80	3.17	11.22	2.30	8.19	2.16
K	3.23	1.10	7.89	2.38	9.95	1.56	6.28	2.21
L	9.42	3.43	7.66	2.22	16.23	3.53	7.01	1.58
PL	4.38	1.09	7.29	2.43	11.75	2.08	10.31	3.88
WS	16.38	6.00	10.83	3.40	26.60	7.75	14.03	3.66
NB	4.94	1.55	8.37	4.19	9.97	3.19	8.81	4.41
RL	2.04	0.61	2.12	0.56	1.84	0.14	2.33	0.51
RL	2.75	0.85	1.80	0.71	1.98	0.41	2.18	0.52

TABLE III-D-6
QUARTERLY AVERAGE
EXPOSURE RATES
1982

TABLE III-D-7
1982 DIRECT RADIATION SURVEY RESULTS

<u>Location</u>	<u>Exposure Rate (uR/Hr)</u>	<u>Beach Terrain</u>
White Horse Beach (near Hill P. Avenue)	7.3 ± 0.5	Sand with large amount of course gravel, granite boulders near beach area.
White Horse Beach (in back of Blue Sail Bar)	6.4 ± 0.5	Sandy with small amount of gravel.
Plymouth Beach (outer beach)	5.7 ± 0.4	Sandy
Plymouth Beach (inner beach)	6.1 ± 0.4	Sandy
Plymouth Beach (behind Berts Restaurant)	8.7 ± 0.4	Sandy, with large amounts of course gravel, granite boulders near beach area.
Duxbury Beach (Control) (ocean side)	6.9 ± 0.3	Sandy with course gravel.

III. E Waterborne

Samples of seawater are collected at three locations, the Station Discharge Canal, (Station 11), Bartlett Pond (Station 17 - 1.7 mi - SE) and Powder Point (Station 23 - 7.8 mi - NNW). The Discharge Canal sample is collected by a continuously compositing sampler which extracts a sample of about 20 ml of water from the Discharge Canal every one-half hour. Grab samples are taken weekly from each of the other two locations.

The results of the ERMAPP program for seawater samples are presented in Table III-E-1.

There were no positive measurements of isotopes characteristic of reactor operation observed at any of the three sampling locations. The only positive measurements observed were due to naturally occurring isotopes (K-40 and AcTh-228).

Therefore, there was clearly no significant environmental effect observed in the seawater media as a result of the operation of PNPS-1.

PILGRIM 1

 OFFSHORE ENVIRONMENTAL RADIOLOGICAL MONITORING AS/03/10, PAGE 30
 SUMMARY FOR THE PERIOD 12/28/81 - 12/31/82

MEDIUM WATER - SEA			UNITS: PCS/LITER		
RAIIONUCLIDES (NO. ANALYSES) (NON-ROUTINE)	NOMINAL LLN	INDICATOR STATIONS MEAN, RANGE, AND NO. DETECTED**	STA.	HIGHEST STATION MEAN, RANGE, AND NO. DETECTED**	CONTROL LOCATIONS MEAN, RANGE, AND NO. DETECTED**
DE-7 (37) (0)	0.0E+01	(0.0 - 12.2)E -1 (-9.7 - 13.9)E 0 #(07 25)A	11	(2.0 - 1.0)E 0 #(07 13)A	(2.1 - 1.0)E 0 (-5.4 - 0.1)E 0 #(07 12)A
K-40 (37) (0)	2.0E+02	(1.0 - 3.3)E 2 (-1.2 - 33.3)E 1 #(137 85)A	13	(3.1 - 0.0)E 2 (2.0 - 3.3)E 2 #(137 13)A	(2.7 - 1.1)E 2 (1.9 - 3.2)E 2 #(127 12)A
CR-91 (37) (0)	1.7E+01	(-1.3 - 1.4)E 0 (-1.3 - 1.3)E 1 #(07 25)A	11	(-5.3 - 21.5)E -1 #(07 13)A	(-9.3 - 10.0)E -1 (-1.0 - 7.7)E 1 #(07 12)A
HM-54 (37) (0)	0.	(0.7 - 10.5)E -2 (-1.9 - 1.9)E 0 #(07 25)A	11	(1.2 - 2.3)E -1 #(07 13)A	(-2.9 - 1.0)E -1 (-1.0 - 5.5)E 0 #(07 12)A
CO-57 (37) (0)	1.5E+00	(0.4 - 15.2)E -2 (-3.1 - 1.3)E 0 #(07 25)A	11	(2.2 - 2.0)E -1 #(07 13)A	(-1.0 - 22.4)E -2 (-1.9 - 1.0)E 0 #(07 12)A
CO-58 (37) (0)	0.	(-3.7 - 1.5)E -1 (-1.4 - 1.2)E 0 #(07 25)A	17	(-4.1 - 23.7)E -2 #(07 12)A	(-2.3 - 2.4)E -1 (-1.5 - 1.5)E 0 #(07 12)A
FE-59 (37) (0)	1.0E+01	(4.2 - 2.0)E -1 (-3.0 - 2.9)E 0 #(07 25)A	17	(0.9 - 0.6)E -1 #(07 12)A	(-7.0 - 0.1)E -1 (-3.3 - 2.7)E 0 #(07 12)A
CO-60 (37) (0)	0.	(-2.0 - 1.0)E -1 (-1.0 - 1.3)E 0 #(07 25)A	11	(5.2 - 21.1)E -2 #(07 13)A	(-4.2 - 2.0)E -1 (-1.7 - 1.4)E 0 #(07 12)A
ZN-65 (37) (0)	0.	(3.0 - 20.0)E -2 (-8.1 - 2.3)E 0 #(07 25)A	17	(1.0 - 2.0)E -1 #(07 12)A	(-3.9 - 0.0)E -1 (-3.0 - 1.0)E 0 #(07 12)A

- * NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT
- ** THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. SIGMA) IS INDICATED WITHIN # () A.

 TABLE III-E-1
 ERMAT RESULTS
 WATERBORNE

MEDIUM WATER & SEA

UNITS: PC/LITER

RADIONUCLIDES (NO. ANALYSES) (NON-ROUTINE)	NOMINAL LLO	INDICATOR STATIONS MEAN, RANGE, AND NO. DETECTED**	HIGHEST STATION MEAN, RANGE, AND NO. DETECTED**	CONTROL LOCATIONS MEAN, RANGE, AND NO. DETECTED**
2R-98 (37) (0)	1.0E+01	(-4.0 + 29.8)E -2 (-1.0 + 2.9)E 0 * (0/ 25) *	23 (-4.5 + 2.8)E -1 * (0/ 12) *	(-4.5 + 2.8)E -1 (-1.7 + 2.0)E 0 * (0/ 12) *
NR-98 (37) (0)	2.	(-5.7 + 14.2)E -2 (-1.5 + 1.4)E 0 * (0/ 25) *	21 (-7.1 + 2.4)E -1 * (0/ 12) *	(-2.1 + 2.4)E -1 (-4.2 + 20.0)E -1 * (0/ 12) *
AD-110 (37) (0)	1.4E+01	(-8.3 + 11.2)E -1 (-1.1 + 1.5)E 1 * (0/ 24) *	17 (-7.0 + 14.9)E -1 * (0/ 12) *	(-7.8 + 14.4)E -1 (-1.1 + 1.5)E 1 * (0/ 12) *
RU-103 (37) (0)	0.	(-4.8 + 2.0)E -1 (-2.3 + 1.5)E 0 * (0/ 25) *	23 (-4.8 + 1.8)E -1 * (0/ 12) *	(-4.8 + 1.8)E -1 (-1.3 + 1.8)E 0 * (0/ 12) *
RU-106 (37) (0)	0.0E+01	(-2.4 + 12.5)E -1 (-1.4 + 1.5)E 1 * (0/ 25) *	11 (-3.0 + 15.2)E -1 * (0/ 12) *	(-2.6 + 1.4)E 0 (-1.2 + 1.0)E 1 * (0/ 12) *
I-131 (37) (0)	0.	(-4.3 + 50.8)E -2 (-3.5 + 2.9)E 0 * (0/ 25) *	23 (-7.0 + 52.3)E -2 * (0/ 12) *	(-7.0 + 52.3)E -2 (-3.1 + 3.3)E 0 * (0/ 12) *
CS-134 (37) (0)	0.	(-3.2 + 1.1)E -1 (-1.5 + 1.8)E 0 * (0/ 25) *	23 (-1.8 + 1.8)E -1 * (0/ 12) *	(-1.8 + 1.8)E -1 (-1.1 + 1.4)E 0 * (0/ 12) *
CS-137 (37) (0)	0.	(-5.9 + 15.5)E -2 (-1.3 + 1.2)E 0 * (0/ 25) *	11 (-2.1 + 1.7)E -1 * (0/ 12) *	(-1.9 + 22.2)E -2 (-1.5 + 1.2)E 0 * (0/ 12) *
BA-100 (37) (0)	1.5E+01	(-3.0 + 3.0)E -1 (-3.4 + 3.1)E 0 * (0/ 25) *	11 (-2.8 + 2.4)E -1 * (0/ 12) *	(-7.0 + 4.0)E -1 (-2.8 + 2.5)E 0 * (0/ 12) *
CE-141 (37) (0)	2.0E+01	(-5.1 + 2.1)E -1 (-1.3 + 2.8)E 0 * (0/ 24) *	23 (-1.5 + 1.3)E 0 * (0/ 12) *	(-1.5 + 1.3)E 0 (-3.7 + 100.0)E -2 * (0/ 12) *

* NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT
** THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. POSITIVE) IS INDICATED WITHIN * () *

TABLE III-E-1
CONTINUED

PILGRIM 1

OPPOSITE ENVIRONMENTAL RADIOLOGICAL MONITORING 12/03/62 PAGE 10
SUMMARY FOR THE PERIOD 12/01/61 - 12/31/62

MEDIUM WATER - SEA		UNITS: PCI/LITER			
RADIUNUCLIDES (NO. ANALYSES) (NON-ROUTINE)*	NOMINAL LLD	INDICATOR STATIONS MEAN, RANGE, AND NO. DETECTED**	STATION	HIGHEST STATION MEAN, RANGE, AND NO. DETECTED**	CONTROL LOCATIONS MEAN, RANGE, AND NO. DETECTED**
CE-144 (37) (0)	0.0E+00	(7.4 ± 12.1)E -1 (-1.3 - 1.1)E 1 0 (0/ 25)0	11	(1.9 ± 1.6)E 0 0 (0/ 13)0	(-4.3 ± 15.2)E +1 (-1.2 - 0.4)E 1 0 (0/ 12)0
TH-238 (17) (0)	1.0E+01	(3.0 ± 6.7)E -1 (-0.1 - 9.4)E 0 0 (0/ 25)0	17	(3.7 ± 6.7)E +1 0 (0/ 12)0	(-2.2 ± 9.2)E +1 (-2.4 - 8.1)E 0 0 (0/ 12)0
H-3 (10) (0)	0.0E+01	(2.1 ± 9.0)E 1 (-2.2 - 2.3)E 2 0 (0/ 11)0	11	(2.9 ± 9.3)E 1 0 (0/ 4)0	(3.8 ± 80.4)E 0 (-2.1 - 1.3)E 2 0 (0/ 4)0

- * NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT
** THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. SIGNIFICANT) IS INDICATED WITHIN 4()0.

TABLE III-E-1
CONTINUED

III. F. Shellfish

Shellfish are normally sampled quarterly from 5 locations, the Station Discharge Canal, Duxbury Bay, Manomet Point, Plymouth Harbor and Marshfield. The results of the ERMAD program for shellfish are presented in Table III-F-1. It is clear from this table that there have been positive measurements of a few isotopes (Mn-54, Zn-65, and Co-60) in the Discharge Canal. In addition there have been positive measurements of Be-7 and Co-60 at Manomet Point; Be-7, Cs-137 and Co-60 at Plymouth Harbor; and, Be-7 at the control station in Marshfield.

The observed concentrations of Zn-65, Co-60 and Mn-54 are most probably the result of PNPS-1 liquid releases. However, the observed concentrations of Be-7 (mussel body, first quarter-Plymouth Harbor) and Cs-137 (soft-shell clam shell, second-quarter-Plymouth Harbor) are probably due to fallout from previous weapons testing.

However, even if a person were to consume the maximum annual quantity of seafood (5 kilograms/year) with the highest mean concentrations of Zn-65, Co-60 and Mn-54, they would receive a dose of less than 0.002 mrem to the total body and about 0.01 mrem to the most restrictive organ (Adult, GI-LLI).

When compared to the natural background dose rate of 80-100 mrem/year, there was clearly no significant environmental impact observed in shellfish as a result of the operations of PNPS-1.

The mussel shells for the years of 1981 and 1982, although collected appropriately for these years, were not analyzed. This was due to an administrative error. This error was identified in late 1982 at which time the Yankee Atomic Environmental Laboratory was

notified and instructed to analyze the 1981 and 1982 mussel shell samples. In addition, a review was made of the mussel shell sample data for the years of 1977-1980. This review identified that all except one mussel shell sample had been analyzed. Although mussel shell samples are to be collected and analyzed on a semi-annual basis from the control station (Green Harbor, Marshfield), only one mussel shell sample was analyzed during 1980. However, the 1980 mussel shell samples had already been disposed of and could not be analyzed at this point in time.

The results of the analyses reports indicated positive measurements of Co-60 in all of the mussel shell samples for 1981 and 1982 which were collected at the Discharge Canal Outfall Area (indicator station). The analyses results of the shells collected from the indicator station during the first and second quarter of 1981 indicate that Co-60 concentrations of 45.7 pCi/kg and 69.4 pCi/kg existed in the shells at the time of collection. Under the Technical Specifications in effect at that time these results would have been considered anomalous (greater than 10 times the control station lower limit of detection). Under current Technical Specifications, these results are not anomalous since they are below the current reporting level for Co-60 of 1×10^4 pCi/kg.

Although there has been an inordinate amount of time between sample collection and analyses, we believe it is appropriate to use the current Technical Specifications reporting criteria, since this represents a more meaningful assessment of environmental impact.

The presence of Co-60 in the above samples are undoubtedly due to liquid effluents from PNPS-1. Since mussel shells are not a consumable food product, there is no potential impact on man from this media.

PILGRIM 1

OFFSITE ENVIRONMENTAL RADIOLOGICAL MONITORING AS/03/IN. PAGE 24
SUMMARY FOR THE PERIOD 12/21/81 - 12/31/82

UNITS: PC/1000 Bq

MEDIUM AMPLIFISM

RAI (UNCLINDED) (INC. ANALYSES) (INC. ROUTINE)	NOMINAL LLD	INDICATOR STATION MEAN, RANGE, AND NO. OF DETECTIONS	STATION	HIGHEST STATION MEAN, RANGE, AND NO. OF DETECTIONS	COUNTDOWN LOCATION MEAN, RANGE, AND NO. OF DETECTIONS
DE-7 (36) (0)	.2	(1.4E 3 1.4E 1 (-7.2 - 35.4E 1 # (5/ 20)E	12	(1.2E 3 3.4E 1 (-1.1 - 35.0E 1 # (1/ 10)E	(2.2E 3 6.0E 1 (-2.1 - 50.2E 1 # (1/ 7)E
H-40 (36) (0)	.5	(1.2E 3 1.1E 3 (1.8 - 21.8E 2 # (20/ 20)E	15	(1.8E 3 2.1E 3 (1.2 - 1.9E 3 # (8/ 4)E	(1.4E 3 2.2E 2 (1.4 - 15.0E 2 # (7/ 7)E
CR-51 (36) (0)	3.2E+02	(-1.0E 3 1.0E 2 (-8.8 - 1.6E 3 # (0/ 20)E	12	(1.5E 3 1.6E 2 # (0/ 10)E	(-2.5E 3 3.7E 1 (-2.5 - .3E 2 # (0/ 7)E
MN-50 (36) (1)	2.0E+02	(1.7E 3 8.4E -1 (-9.8 - 12.0E 0 # (1/ 20)E	12	(1.2E 3 2.1E 0 # (0/ 10)E	(-2.8E 3 4.4E -1 (-1.5 - 1.7E 0 # (0/ 7)E
CI-57 (36) (0)	3.5E+01	(1.7E 3 3.0E -1 (-4.1 - 6.0E 0 # (0/ 20)E	12	(1.5E 3 .4E 0 # (0/ 10)E	(2.2E 3 1.0E -1 (-1.7 - 4.5E -1 # (0/ 7)E
CU-50 (36) (0)	2.0E+02	(2.1E 3 8.1E -1 (-7.7 - 15.4E 0 # (0/ 20)E	11	(1.8E 3 10.0E -1 # (0/ 10)E	(2.4E 3 9.4E -1 (-2.3 - 4.4E 0 # (0/ 7)E
FE-50 (36) (0)	3.0E+01	(-2.8E 3 8.2E 0 (-2.0 - .9E 2 # (0/ 20)E	13	(1.2E 3 4.3E 0 # (0/ 5)E	(-5.8E 3 2.8E 0 (-2.2 - .0E 1 # (0/ 7)E
CU-60 (36) (11)	2.0E+02	(1.8E 3 2.4E 0 (-6.5 - 45.0E 0 # (11/ 20)E	11	(2.1E 3 .4E 1 (2.1 - 45.0E 0 # (9/ 10)E	(-6.6E 3 6.4E -1 (-3.0 - 2.4E 0 # (0/ 7)E
ZN-65 (36) (0)	6.7E+01	(-1.6E 3 1.6E 0 (-3.2 - 1.1E 1 # (1/ 20)E	11	(2.6E 3 1.1E 0 (-1.5 - 6.5E 0 # (1/ 10)E	(1.8E 3 4.0E -1 (-7.7 - 23.2E -1 # (0/ 7)E

- * NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT
** THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. >SIGMA) IS INDICATED WITHIN 61 %.

TABLE III-F-1
ERMAR RESULTS
SHELLFISH

MEDIUM: GMPLETON

UNIT(S) PC1/KG NET

RAW (UNCLINED (NL, ANALYSES) (NON-ROUTINE))	NOMINAL LLD	INDICATION STATIONS MEAN, RANGE, AND NO. DETECTED**	STATION	HIGHEST STATION MEAN, RANGE, AND NO. DETECTED**	CONTINUED LOCATION MEAN, RANGE, AND NO. DETECTED**
2H-95 (36) (0)	4.0E+02	(5.5 + 2.01E 0 (-7.8 - 37.41E 0 #(0/ 20)*)	13	(2.0 + .71E 1 #(0/ 5)*)	(5.5 + 7.51E -1 (-2.4 - 3.01E 0 #(0/ 7)*)
4H-95 (36) (0)	3.4E+01	(2.4 + 1.31E 0 (-1.1 - 2.01E 1 #(0/ 20)*)	13	(4.9 + 5.01E 0 #(0/ 5)*)	(2.0 + 1.71E 0 (-1.0 - 11.51E 0 #(0/ 7)*)
AG-110M (36) (0)	2.5E+02	(-8.7 + 60.31E -1 (-1.1 - .41E 2 #(0/ 20)*)	11	(5.7 + 3.11E 0 #(0/ 10)*)	(-2.3 + 21.01E -1 (-0.7 - 7.01E 0 #(0/ 7)*)
HU-103 (36) (0)	2.0E+02	(4.0 + 2.61E 0 (-0.5 - 71.71E 0 #(0/ 20)*)	12	(0.0 + 7.11E 0 #(0/ 10)*)	(-1.0 + 5.31E -1 (-2.4 - 1.01E 0 #(0/ 7)*)
HU-104 (36) (0)	.2	(2.4 + 10.41E 0 (-1.3 - 2.01E 2 #(0/ 20)*)	12	(4.1 + 14.71E 0 #(0/ 10)*)	(-7.4 + 0.11E 0 (-3.8 - .71E 1 #(0/ 7)*)
I-131 (36) (0)	0.	(2.7 + 2.41E 0 (-1.3 - 2.01E 2 #(0/ 20)*)	11	(7.0 + 1.01E 0 #(0/ 10)*)	(2.7 + 2.71E 5 (-4.8 - 2.01E 0 #(0/ 7)*)
CB-134 (36) (0)	2.0E+02	(-2.1 + .81E 0 (-1.3 - .71E 1 #(0/ 20)*)	24	(-3.8 + 2.71E -1 #(0/ 7)*)	(-3.8 + 2.71E -1 (-1.4 - .51E 0 #(0/ 7)*)
CB-137 (36) (1)	2.0E+02	(0.9 + 0.01E -1 (-1.3 - 1.31E 1 #(1/ 20)*)	13	(2.4 + 4.41E 0 #(0/ 5)*)	(5.5 + 4.41E -1 (-0.2 - 20.01E -1 #(0/ 7)*)
BA-140 (36) (0)	0.0E+02	(-1.4 + 1.11E 5 (-3.1 - .01E 6 #(0/ 20)*)	15	(-3.5 + 2.31E 0 #(0/ 4)*)	(-2.1 + 2.11E 3 (-1.5 - .01E 4 #(0/ 7)*)
CE-141 (36) (0)	4.0E+02	(4.7 + 3.11E 1 (-1.4 - 41.01E 1 #(0/ 20)*)	12	(0.0 + 0.21E 1 #(0/ 10)*)	(5.0 + 2.71E 0 (-1.3 - 17.71E 0 #(0/ 7)*)

* NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT
** THE FRACTION OF SAMPLE ANALYSED VIOLATING DETECTABLE MEASUREMENTS (I.E. >5SIGMA) IS INDICATED WITHIN #.

TABLE III-F-1
CONTINUED

PILGRIM I

OFFSITE ENVIRONMENTAL RADIOLOGICAL MONITORING
SUMMARY FOR THE PERIOD 12/21/81 - 12/31/82

15/03/18, PAGE 26

MELIUMS ONFLF75M

(UNIT) MELIUMS DET

RAUIMUC(L)NES (NO. ANALYSES) NOMINAL (NONROUTINE)4 LLN	INDICATION STATION MEAN, RANGE, AND NO. DETECTED**	HIGHEST STATION MEAN, RANGE, AND NO. DETECTED**	CONTINUAL LOCATION MEAN, RANGE, AND NO. DETECTED**
CE-100 (36) (0)	.2 (8.0 + 39.7)E -1 (-9.8 - 9.4)E 1 *(0/ 29)0	13 (7.5 + 21.4)E 0 (-1.0 - 1.0)E 1 *(0/ 5)0	(-5.3 + 3.3)E 0 (-1.0 - 1.0)E 1 (-1.0 - 1.0)E 1 *(0/ 7)0
IN-220 (36) (0)	2.0E-02 (1.5 + 1.5)E 1 (-1.9 - 11.7)E 1 *(5/ 29)0	13 (2.5 + 2.4)E 1 (-1.9 - 11.7)E 1 (-1.9 - 11.7)E 1 *(1/ 5)0	(1.4 + 1.5)E 1 (-4.4 - 307.0)E -1 (-4.4 - 307.0)E -1 *(4/ 7)0

* NONROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER
THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT
** THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS
(I.E. POSITIVE) IS INDICATED WITHIN OF 10.

3-47

TABLE III-F-1
CONTINUED

III. G. Algae (Irish Moss)

Algae, referred to as Irish Moss or *Chondrus Crispus*, is sampled quarterly at three locations, the PNPS Discharge Canal, Manomet Point and Ellisville. The results of the ERMAP program for Algae are presented in Table III-G-1.

It is clear from this table that there have been positive measurements of Be-7, Co-60 and Mn-54 at the Discharge Canal. In addition, there have been positive measurements of Be-7 and Co-60 at Manomet Point (Station 15-3 miles SE); and Be-7 at the control station of Ellisville (Station 22-8 mi-SSE).

The measured concentrations of Co-60, and Mn-54 at the Discharge Canal are certainly due to liquid effluents from PNPS-1. The observed concentrations of Co-60 at Manomet Point are most probably the result of PNPS-1 liquid releases. There were no positive measurements of reactor operations related isotopes at the control station in Ellisville, approximately eight miles away.

It is important to note that due to processing and market dilution, the presence of the Co-60, and Mn-54 concentrations do not represent a significant potential source of dose to the general public. In fact, even direct human consumption of Algae (which to our knowledge, does not occur) with the highest mean concentrations would result in a dose rate of less than 0.04 mrem/yr to the total body and about 0.05 mrem/yr to the most sensitive organ (Adult-GI-LLI, using the models presented in Regulatory Guide 1.109) and assuming consumption of 5 kg/year of unprocessed material.

When compared with the natural background dose rate of 80-100 mrem/yr, there was clearly no significant environmental impact observed in Algae as a result of the operation of PNPS-1.

UNIT:01 PCT/KG NET

MEDIUM VEGETATION - AQUATIC

RAUIONUCLEIDES (NO. ANALYSES) (N/N=ROUTINE) ¹	NOMINAL LLD	INDICATOR STATION MEAN, RANGE, AND NO. DETECTED ²	STA ³	HIGHEST STATION MEAN, RANGE, AND NO. DETECTED ²	CONTROL LOCATIONS MEAN, RANGE, AND NO. DETECTED ²
HE-3 (10) (0)	.2	(1.6 ± .3)E 2 (.8 - 30.2)E 1 #(0/ 0)0	11	(2.0 ± .9)E 2 (1.1 - 3.0)E 2 #(0/ 0)0	(3.3 ± .3)E 0 (2.0 - 10.9)E 1 #(3/ 0)0
H-3 (10) (0)	.5	(3.7 ± 1.1)E 1 (3.4 - 12.4)E 1 #(0/ 0)0	11	(7.3 ± 1.9)E 3 (4.1 - 12.0)E 3 #(0/ 0)0	(5.0 ± .4)E 3 (4.0 - 5.0)E 3 #(0/ 0)0
CR-51 (10) (0)	~1.0-100	(~1.5 ± 1.4)E 1 (~7.3 - 3.6)E 1 #(0/ 0)0	15	(~0.2 ± 20.0)E 0 (0/ 0)0	(~9.0 ± 14.3)E 0 (~5.1 - 1.5)E 1 #(0/ 0)0
MN-54 (10) (1)	2.0E-02	(~4.4 ± 1.5)E 0 (~0.0 - 119.0)E -1 #(1/ 0)0	11	(7.0 ± 1.7)E 0 (3.9 - 11.7)E 0 #(1/ 0)0	(~1.2 ± 1.1)E 0 (~5.0 - 1.3)E 0 #(0/ 0)0
CU-67 (10) (0)	~1.0-100	(~0.8 ± 3.3)E -1 (~2.4 - .3)E 0 #(0/ 0)0	22	(0.9 ± 0.6)E -1 (0/ 0)0	(1.0 ± 0.6)E -1 (~1.0 - 2.7)E 0 #(0/ 0)0
CU-68 (10) (0)	2.0E-02	(~4.9 ± 7.5)E -1 (~2.7 - 3.5)E 0 #(0/ 0)0	11	(~0.1 ± 11.3)E -1 (0/ 0)0	(~4.2 ± 1.0)E 0 (~7.7 - 0.0)E 0 #(0/ 0)0
FE-59 (10) (0)	3.0E+01	(~4.0 ± 0.1)E 0 (~0.9 - 20.2)E 0 #(0/ 0)0	11	(1.1 ± .7)E 1 (0/ 0)0	(3.4 ± 3.1)E 0 (~3.4 - 10.0)E 0 #(0/ 0)0
CU-60 (10) (0)	2.0E-02	(~4.0 ± 1.2)E 1 (2.0 - 96.0)E 0 #(0/ 0)0	11	(~6.0 ± 1.5)E 1 (3.4 - 9.7)E 1 #(0/ 0)0	(3.3 ± 2.1)E 0 (~2.0 - 5.0)E 0 #(0/ 0)0
ZN-65 (10) (0)	~1.0-100	(~0.9 ± 12.9)E -1 (~7.8 - 5.2)E 0 #(0/ 0)0	15	(1.3 ± 1.4)E 0 (0/ 0)0	(~7.4 ± 11.1)E 0 (~3.4 - 1.3)E 1 #(0/ 0)0

- * NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT
** THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (Y.F. DESIGNA) IS INDICATED WITHIN 01 00.

TABLE III-G-1
ERMAP RESULTS
ALGAE

PILGRIM I

OFFSITE ENVIRONMENTAL RADIOLOGICAL MONITORING AS/03/80, PAGE 31
SUMMARY FOR THE PERIOD 12/21/81 - 12/31/82

MEDIUM VEGETATION - AQUATIC

UNIT80 PC12/80 NE1

RADIOISOTOPES (NU. ANALYSES) (NUN=ROUTINE)A	NOMINAL LLD	INDICATOR STATION MEAN, RANGE, AND NO. DETECTED*	STA.	HIGHEST STATION MEAN, RANGE, AND NO. DETECTED**	CONTINUAL LOCATION MEAN, RANGE, AND NO. DETECTED**
IR-99 (12) (0)	4.0E-02	(3.6 + 1.0)E 0 (9.8 - 806.0)E -2 #(0/ 1)A	11	(3.9 + 1.4)E 0 #(0/ 4)A	(-5.5 + 3.1)E 0 (-1.3 - 1.1)E 1 #(0/ 4)A
NO-99 (12) (1)	-1.0-100	(5.0 + 1.0)E 0 (-2.7 - 23.0)E 0 #(1/ 1)A	15	(6.4 + 5.7)E 0 (-2.4 - 23.0)E 0 #(1/ 4)A	(1.9 + 1.0)E 0 (-2.2 - 5.0)E 0 #(0/ 4)A
AG-110M (12) (0)	-1.0-100	(-1.8 + 6.9)E 0 (-2.7 - 2.0)E 1 #(0/ 1)A	11	(-7.6 + 12.5)E 0 #(0/ 4)A	(-3.0 + 1.0)E 1 (-0.5 - 1.9)E 1 #(0/ 4)A
HU-103 (12) (0)	2.0E-02	(-2.0 + 12.9)E -3 (-0.9 - 6.0)E 0 #(0/ 1)A	15	(1.4 + 2.7)E 0 #(0/ 4)A	(0.3 + 23.7)E -1 (-3.9 - 7.4)E 0 #(0/ 4)A
HU-106 (12) (0)	.2	(-1.0 + 13.0)E 0 (-4.6 - 7.5)E 1 #(0/ 1)A	11	(2.5 + 1.0)E 1 #(0/ 4)A	(-0.5 + 23.7)E 0 (-4.7 - 5.5)E 1 #(0/ 4)A
I-131 (12) (0)	0.	(6.0 + 2.4)E 0 (-0.2 - 12.9)E 0 #(0/ 1)A	11	(7.1 + 2.0)E 0 #(0/ 4)A	(-3.9 + 9.0)E 0 (-3.0 - 1.4)E 1 #(0/ 4)A
CS-134 (12) (0)	2.0E-02	(-3.7 + 1.3)E 0 (-0.5 - 3.9)E 0 #(0/ 1)A	22	(-1.4 + 2.0)E 0 #(0/ 4)A	(-1.4 + 2.0)E 0 (-5.4 - 2.5)E 0 #(0/ 4)A
CS-137 (12) (0)	2.0E-02	(3.3 + 1.0)E 0 (5.1 - 46.0)E -1 #(0/ 1)A	11	(3.5 + 1.0)E 0 #(0/ 4)A	(2.0 + 1.2)E 0 (0.1 - 59.7)E -1 #(0/ 4)A
BA-140 (12) (0)	0.0E-02	(-0.5 + 29.1)E +1 (-0.2 - 10.3)E 0 #(0/ 1)A	11	(1.1 + 5.7)E 0 #(0/ 4)A	(-2.2 + 5.3)E 0 (-1.4 - 1.5)E 1 #(0/ 4)A
CE-146 (12) (0)	0.0E-02	(4.1 + 26.0)E +1 (-7.9 - 7.2)E 0 #(0/ 1)A	22	(4.4 + 2.0)E 0 #(0/ 4)A	(4.4 + 2.0)E 0 (-2.4 - 9.4)E 0 #(0/ 4)A

* NONROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT
** THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (S.F. SIGMA) IS INDICATED WITHIN # ()

TABLE III-G-1
CONTINUED

PILGRIM I

OFFSITE ENVIRONMENTAL RADIOLOGICAL MONITORING
SUMMARY FOR THE PERIOD 12/21/81 - 12/31/82

AS/US/IN. PAGE 32

MEDIUM VEGETATION - AQUATIC

UNIT: PC/UG NET

RADIOISOTOPES (INC. ANALYSED) (NONROUTINE)*	NOMINAL LLD	INDICATOR STATIONS MEAN, RANGE, AND NO. DETECTED**	STA	HIGHEST STATION MEAN, RANGE, AND NO. DETECTED**	CONTROL LOCATIONS MEAN, RANGE, AND NO. DETECTED**
CE-140 (18) (1)	.2	(1-1 4 (-1.5 - 4.2)E 1 + (1/ 4)E	15	(1-1 4 (-1.5 - 4.2)E 1 + (1/ 4)E	(1-2 4 (-2.4 - 2.9)E 1 + (0/ 4)E
TH-228 (18) (8)	2.0E+02	(2.4 4 (7.4 - 92.0)E 0 + (3/ 4)E	27	(4.0 4 (1.2 - 4.5)E 1 + (1/ 4)E	(4.0 4 (1.2 - 4.5)E 1 + (1/ 4)E

- * NONROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT
- ** THE FRACTION OF SAMPLE ANALYSED YIELDING DETECTABLE MEASUREMENTS (I.E. SIGMA) IS INDICATED WITHIN A ()

TABLE III-G-1
CONTINUED

III. H. Lobster (Arthropods)

Lobster samples are collected four times per season at two locations, the vicinity of the Discharge Canal Outfall area and at a distant point off-shore. The results of the ERMAP program for Lobsters are presented in Table III-H-1. These results are unremarkable in that there were no positive measurements of any isotopes other than K-40 in either the indicator or the control samples (K-40 is a naturally occurring isotope). Therefore, there is no evidence of any environmental impact on this media as a result of the operation of PNPS-1.

TABLE III-H-1

ERMAP RESULTS

LOBSTER

PILGRIM I OFFSHORE ENVIRONMENTAL RADIOLOGICAL MONITORING 03/03/80. PAGE 8
SUMMARY FOR THE PERIOD 12/21/81 - 12/31/82

UNIT:1 MC124G SET

MEDIUM AMPHIBIOUS			INDICATOR STATION		STAS	HIGHEST STATION		CONTROL LOCATION	
RADIONUCLIDES (NO. ANALYSED) (N/N=ROUTINE)6	NOMINAL L/D		MEAN, RANGE, AND NO. DETECTED			MEAN, RANGE, AND NO. DETECTED		MEAN, RANGE, AND NO. DETECTED	
DE-7 (4) (0)	.2		(5.7 + 8.3)E 1 (-1.2 - 1.0)E 2 #(0/ 3)6		11	(5.7 + 8.3)E 1 #(0/ 3)6		(-1.1 + .7)E 2 (-1.1 - 0.0)E 2 #(0/ 1)6	
HR-40 (4) (0)	.5		(2.3 + .7)E 3 (2.1 - 2.0)E 3 #(3/ 3)6		11	(2.3 + .2)E 3 (2.1 - 2.0)E 3 #(3/ 3)6		(2.0 + .2)E 3 #(1/ 1)6	
CR-51 (4) (0)	1.2E+02		(4.1 + 9.5)E 1 (-1.2 - 18.0)E 1 #(0/ 3)6		11	(4.1 + 9.5)E 1 #(0/ 3)6		(4.1 + 7.2)E 1 #(0/ 1)6	
HR-54 (4) (0)	2.0E+02		(2.2 + 8.2)E 0 (-7.3 - 18.5)E 0 #(0/ 3)6		11	(2.2 + 8.2)E 0 #(0/ 3)6		(-1.8 + .4)E 1 (-1.8 - 0.0)E 1 #(0/ 1)6	
CU-57 (4) (0)	8.5E+01		(5.0 + 5.0)E 0 (5.5 - 108.0)E -1 #(0/ 3)6		12	(1.2 + .7)E 1 #(0/ 1)6		(1.2 + .7)E 1 #(0/ 1)6	
CU-58 (4) (0)	2.0E+02		(-5.3 + 5.4)E 0 (-1.2 - .6)E 1 #(0/ 3)6		11	(-5.3 + 5.6)E 0 #(0/ 3)6		(-1.1 + .9)E 1 (-1.1 - 0.0)E 1 #(0/ 1)6	
FE-59 (4) (0)	3.0E+01		(-7.5 + 12.2)E 0 (-3.1 + 1.0)E 1 #(0/ 3)6		12	(3.9 + 18.7)E 0 #(0/ 1)6		(3.9 + 18.7)E 0 #(0/ 1)6	
CU-60 (4) (0)	2.0E+02		(-9.8 + 5.5)E 0 (-1.8 - .1)E 1 #(0/ 3)6		12	(-9.0 + 13.1)E 0 #(0/ 1)6		(-9.0 + 13.1)E 0 (-9.0 - 0.0)E 0 #(0/ 1)6	
ZN-65 (4) (0)	6.7E+01		(1.1 + 1.2)E 1 (-2.1 - 35.0)E 0 #(0/ 3)6		11	(1.1 + 1.2)E 1 #(0/ 3)6		(1.3 + 18.2)E 0 #(0/ 1)6	

- * NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT
- ** THE FRACTION OF SAMPLE ANALYSED YIELDING DETECTABLE MEASUREMENTS (I.E. SIGNIFICANT) IS INDICATED WITHIN # () %.

MEDIUM ANTIMONYDING

UNIT: PCISAG 001

NAL/UNCLINED (NL, ANALYSED) (NL, ROUTINE)	NOMINAL LLD	INDICATOR STATION MEAN, RANGE, AND NO. DETECTED**	HIGHEST STATION MEAN, RANGE, AND NO. DETECTED**	CONTINUAL LOCATIONS MEAN, RANGE, AND NO. DETECTED**
STATION				
ZR-95 (0) (0)	4.0E+02	(0.0 + 12.1)E 0 (-0.7 - 32.0)E 0 #(0/ 3)0	11 (0.0 + 12.1)E 0 #(0/ 3)0	(-3.3 + 1.7)E 1 (-3.3 - 0.0)E 1 #(0/ 1)0
NO-95 (0) (0)	3.9E+01	(1.0 + 5.9)E 0 (-0.0 - 12.3)E 0 #(0/ 3)0	12 (0.1 + 0.8)E 0 #(0/ 1)0	(0.1 + 0.8)E 0 #(0/ 1)0
AG-110M (0) (0)	2.9E+02	(-0.0 + 92.3)E 0 (-1.9 - 0.0)E 2 #(0/ 3)0	11 (-0.0 + 92.3)E 0 #(0/ 3)0	(-7.1 + 7.1)E 1 (-7.1 - 0.0)E 1 #(0/ 1)0
HU-103 (0) (0)	2.0E+02	(-0.1 + 0.4)E 0 (-1.9 - 2.3)E 1 #(0/ 3)0	12 (-2.0 + 7.0)E 0 #(0/ 1)0	(-2.0 + 7.0)E 0 (-2.0 - 0.0)E 0 #(0/ 1)0
HU-106 (0) (0)	.2	(-2.0 + 2.0)E 1 (-0.0 - 1.9)E 1 #(0/ 3)0	12 (0.0 + 7.0)E 1 #(0/ 1)0	(0.0 + 7.0)E 1 #(0/ 1)0
I-131 (0) (0)	0.	(3.0 + 3.5)E 1 (-3.1 - 7.0)E 1 #(0/ 3)0	11 (3.0 + 3.5)E 1 #(0/ 3)0	(-5.0 + 10.7)E 0 (-5.0 - 0.0)E 0 #(0/ 1)0
CS-136 (0) (0)	2.0E+02	(4.5 + 90.1)E -1 (-1.5 - 1.0)E 1 #(0/ 3)0	11 (4.5 + 90.1)E -1 #(0/ 3)0	(-0.3 + 7.0)E 0 (-0.3 - 0.0)E 0 #(0/ 1)0
CS-137 (0) (0)	2.0E+02	(-0.0 + 39.0)E -1 (-0.0 - 0.0)E 0 #(0/ 3)0	12 (1.5 + 0.9)E 1 #(0/ 1)0	(1.5 + 0.9)E 1 #(0/ 1)0
HA-140 (0) (0)	0.0E+02	(1.5 + 2.1)E 1 (-0.0 - 96.1)E 0 #(0/ 3)0	11 (1.5 + 2.1)E 1 #(0/ 3)0	(-1.3 + 13.5)E 0 (-1.3 - 0.0)E 0 #(0/ 1)0
CE-141 (0) (0)	4.0E+02	(0.7 + 9.2)E 0 (-1.0 - 27.4)E 0 #(0/ 3)0	11 (0.7 + 9.2)E 0 #(0/ 3)0	(-7.0 + 13.3)E 0 (-7.0 - 0.0)E 0 #(0/ 1)0

* NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT
** THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS [I.E. 0.010000] IS INDICATED WITHIN A 30.

TABLE III-H-1
CONTINUED

PILGRIM I

 DEFENSE ENVIRONMENTAL RADIOLOGICAL MONITORING 12/03/82. PAGE 10
 SUMMARY FOR THE PERIOD 12/21/81 - 12/31/82

MEDIUM: ANTIMONY		UNIT: PC/KG WT			
WADJUNUC (08)	NOMINAL	INDICATOR STATION MEAN, RANGE, AND NO. DETECTED**	STATION	HIGHEST STATION MEAN, RANGE, AND NO. DETECTED**	CONTROL LOCATION MEAN, RANGE, AND NO. DETECTED**
(NLN-HOUTING) LL					
CE-144 (4)	.2	(-1.1 - 4.9)E 1	12	(2.5 - 4.9)E 1	(2.5 - 4.9)E 1
(6)		(-1.3 - .01E 2		(0/ 1)E	(0/ 1)E
		(0/ 3)E			
TH-228 (1)	2.0E-02	(-3.2 - 27.1)E 0	12	(3.0 - 5.9)E 1	(3.0 - 5.9)E 1
(6)		(-3.4 - 5.1)E 1		(0/ 1)E	(0/ 1)E
		(0/ 3)E			

- * NON-ROUTING REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT
- ** THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. SIGNIFICANT) IS INDICATED WITHIN * () %.

 TABLE III-H-1
 CONTINUED

III. 1. Fish

Fish samples of Bottom Oriented (Group I) and Near Bottom (Group II) species are collected quarterly in the vicinity of the Discharge Canal Outfall. In addition, samples of Anadromous (Group III) and Coastal Migratory (Group IV) species are collected when in season, in this same area. Lastly, a sample from each group is collected once per year at a distant location offshore.

The result of the ERMAP program of fish are presented in Table III-I-1. There was a positive measurement of Cs-137 at the indicator station (Discharge Canal - Station 11) and one at a control station (Truro - Station -98).

A salmon sample collected on 1/7/82 at the Discharge Canal Outfall Area, and a striped bass sample collected on 10/21/82 at a control station (Truro) both indicated a positive measurement of Cs-137. Both salmon and striped bass are in the Group III category (Anadromous). The control station sample (striped bass) measurement was about three times higher than the indicator station (salmon) measurement, which indicates that the Cs-137 is most likely from a source other than PNPS-1. Even if an individual were to consume the maximum annual quantity of fish (21 kilograms/year) with the highest mean concentration of Cs-137, they would receive a dose of less than 0.07 mrem to the total body and about 0.01 mrem to the most restrictive organ (Adult-Liver).

Therefore, there is little evidence of any environmental impact on this media as a result of the operation of PNPS-1.

PILGRIM I

OFFSHORE ENVIRONMENTAL RADIOLOGICAL MONITORING 03/03/16. PAGE 10
SUMMARY FOR THE PERIOD 12/21/81 - 12/31/82

UNIT: PLI/AG NET

NET/UNIT FISH	HAZARDOUS (NL, ANALYSED) (NONROUTINE)*	NOMINAL LLD	INDICATION STATIONS MEAN, RANGE, AND NO. DETECTED**	STATION	HIGHEST STATION MEAN, RANGE, AND NO. DETECTED**	CUMUL. LOCATION MEAN, RANGE, AND NO. DETECTED**
BE-7	(39) (0)	.2	(1.0 + 1.01E 1 (-0.6 - 11.91E 1 #(07 27)E	98	(9.1 + 0.43E 1 #(0/ 13)E	(9.4 + 19.13E 0 (-7.5 - 9.13E 1 #(0/ 8)E
KN-40	(39) (0)	.5	(3.2 + .13E 3 (2.5 - 8.03E 3 #(277 27)E	98	(3.0 + .23E 3 #(1/ 13)E	(3.0 + .43E 3 (2.1 - 3.93E 3 #(8/ 8)E
CR-51	(39) (0)	3.2E+02	(-1.1 + 1.43E 1 (-1.9 - 1.03E 2 #(07 27)E	98	(1.4 + .73E 2 #(07 13)E	(4.2 + 2.43E 1 (-0.8 - 14.23E 1 #(0/ 8)E
HN-54	(39) (0)	8.0E+02	(1.0 + 1.83E 0 (-1.7 - 1.03E 1 #(07 27)E	98	(0.4 + 7.73E 0 #(0/ 13)E	(1.4 + 3.73E 0 (-1.0 - 1.73E 1 #(0/ 8)E
CU-57	(39) (0)	2.9E+01	(-5.8 + 12.03E -1 (-1.5 - 1.13E 1 #(07 27)E	99	(5.2 + 0.23E 0 #(0/ 21)E	(-1.4 + 2.33E 0 (-1.0 - 1.33E 1 #(0/ 8)E
CU-58	(39) (0)	2.0E+02	(-7.7 + 18.23E -1 (-1.0 - 1.33E 1 #(07 27)E	12	(1.7 + 3.33E 0 #(0/ 2)E	(-1.4 + 1.03E 0 (-1.0 - .03E 1 #(0/ 8)E
FE-59	(39) (0)	3.0E+01	(-1.7 + 4.03E 0 (-4.9 - 5.33E 1 #(07 27)E	98	(1.3 + 1.83E 1 #(07 13)E	(3.2 + 5.13E 0 (-2.5 - 1.73E 1 #(0/ 8)E
CU-60	(39) (0)	2.0E+02	(-4.3 + 19.83E -1 (-1.8 - 1.43E 1 #(07 27)E	11	(2.7 + 210.53E -2 #(0/ 25)E	(-7.4 + 2.43E 0 (-1.0 - .43E 1 #(0/ 8)E
ZN-65	(39) (0)	4.7E+01	(-8.6 + 340.33E -2 (-2.5 - 9.33E 1 #(07 27)E	98	(1.0 + 1.73E 1 #(0/ 13)E	(4.5 + 5.73E 0 (-3.1 - 2.13E 1 #(0/ 8)E

* NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT
** THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. >SIGMA) IS INDICATED WITHIN # ()

TABLE III-1-1
ERMAR RESULTS
FISH

FIGURE 1

OFFSITE ENVIRONMENTAL RADIOLOGICAL MONITORING AS/03/10. PAGE 19
SUMMARY FOR THE PERIOD 12/21/81 - 12/31/82

MEASURED FIEM			UNIT: PC/AC WEI		
HAU(UNCL)IDEN (NO. ANALYSES) (NUM-RUNTIME)34	NOMINAL LLO	INDICATOR STATIONS MEAN, RANGE, AND NO. DETECTIONS	STAG	HIGHST STATION MEAN, RANGE, AND NO. DETECTIONS	CONTINUED LOCATION MEAN, RANGE, AND NO. DETECTIONS
IR-95 (35) (0)	8.0E+02	(3.0 ± 240.21E -2 (-2.8 = 2.4)E 1 #(0/ 27)0	13	(4.3 ± 26.02E -1 (-2.9 = 2.4)E 1 #(0/ 25)0	(-4.8 ± 5.21E 0 (-2.9 = 1.4)E 1 #(0/ 8)0
NR-98 (35) (0)	3.9E+01	(-1.3 ± 17.03E -1 (-1.5 = 2.0)E 1 #(0/ 27)0	22	(6.7 ± 0.41E 0 (-0.7 = 2.1)E 0 #(0/ 21)0	(-4.4 ± 33.73E -1 (-1.2 = 1.3)E 1 #(0/ 8)0
AG-110H (35) (0)	2.5E+02	(1.3 ± 1.03E 1 (-1.3 = 2.5)E 2 #(0/ 27)0	22	(5.0 ± .03E 1 (-0.7 = 2.1)E 0 #(0/ 2)0	(2.7 ± 33.53E 0 (-2.0 = .9)E 2 #(0/ 8)0
HU-103 (35) (0)	2.0E+02	(-1.3 ± 1.41E 0 (-1.8 = .9)E 1 #(0/ 27)0	99	(4.5 ± 1.33E 0 (-0.7 = 2.1)E 0 #(0/ 2)0	(2.0 ± 3.13E 0 (-3.6 = 1.1)E 1 #(0/ 8)0
HU-106 (35) (0)	.2	(2.0 ± 1.41E 1 (-1.8 = 1.9)E 2 #(0/ 27)0	12	(6.7 ± 5.41E 1 (-0.7 = 2.1)E 0 #(0/ 2)0	(2.2 ± 15.53E 0 (-7.6 = 5.1)E 1 #(0/ 8)0
I-131 (35) (0)	0.	(-1.6 ± 1.93E 1 (-4.7 = .8)E 2 #(0/ 27)0	99	(3.4 ± 2.23E 1 (-0.7 = 2.1)E 0 #(0/ 2)0	(-1.2 ± 13.23E 0 (-5.6 = 5.0)E 1 #(0/ 8)0
CS-134 (35) (0)	2.0E+02	(-3.1 ± 14.23E -1 (-1.4 = 1.9)E 1 #(0/ 27)0	99	(5.7 ± 1.03E 0 (-0.7 = 2.1)E 0 #(0/ 2)0	(9.7 ± 26.23E -1 (-1.3 = .8)E 1 #(0/ 8)0
CS-137 (35) (0)	2.0E+02	(6.2 ± 1.63E 0 (-1.5 = 1.9)E 1 #(1/ 27)0	98	(4.5 ± .93E 1 (-0.7 = 2.1)E 0 #(1/ 1)0	(1.4 ± .53E 1 (-3.0 = 45.13E 0 #(1/ 8)0
HA-140 (35) (0)	8.0E+02	(-1.9 ± 3.13E 0 (-2.5 = 5.5)E 1 #(0/ 27)0	98	(5.4 ± 12.43E 0 (-0.7 = 2.1)E 0 #(0/ 1)0	(-6.6 ± 8.03E 0 (-5.4 = 2.4)E 1 #(0/ 8)0
CE-141 (35) (0)	4.0E+02	(5.0 ± 4.13E 0 (-3.2 = 7.1)E 1 #(0/ 27)0	22	(1.1 ± .93E 1 (-0.7 = 2.1)E 0 #(0/ 2)0	(5.3 ± 6.03E 0 (-1.8 = 7.4)E 1 #(0/ 8)0

* NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT
** THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. >3SIGMA) IS INDICATED WITHIN # ()

TABLE III-I-1

CONTINUED

3-60

PILGRIM I

OFFSITE ENVIRONMENTAL RADIOLOGICAL MONITORING AS/01/16. PAGE 20
SUMMARY FOR THE PERIOD 12/21/81 - 12/31/82

UNITS: PLI/G LET

MEDIUM FISH

HAUIONUCLIDES (NO. ANALYSED) (NON-ROUTINE)*	NOMINAL LLO	INDICATOR STATIONS MEAN, RANGE, AND NO. DETECTED**	STATION	HIGHEST STATION MEAN, RANGE, AND NO. DETECTED**	CONTROL LOCATIONS MEAN, RANGE, AND NO. DETECTED**
CE-144 (36) (0)	.2	(3.6 ± 7.5)E 0 (-0.7 ± 7.9)E 1 # (0 / 27)#	12	(1.2 ± .9)E 1 # (0 / 23)#	(-2.1 ± 1.4)E 1 (-0.9 ± 4.3)E 1 # (0 / 8)#
TH-238 (36) (8)	2.0E+02	(-0.8 ± 9.1)E 0 (-0.1 ± 4.5)E 1 # (0 / 27)#	48	(4.0 ± 3.1)E 1 # (0 / 13)#	(0.4 ± 10.7)E 0 (-5.4 ± 5.0)E 1 # (0 / 43)#

- * NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE HEATER
THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT
** THE FRACTION OF SAMPLE ANALYSED YIELDING DETECTABLE MEASUREMENTS
(I.E. POSITIVE) IS INDICATED WITHIN THE #.

CONTINUED

TABLE III-1-1

III. J. Sediments

Sediment samples are taken semi-annually at five indicator stations including Rocky Point, Plymouth Harbor, Duxbury Bay, Plymouth Beach and Manomet Point and a control sample is taken from Marshfield.

There is a detailed subdivision of individual sample cores in which samples are sectioned into 2 cm increments during the first half of the year (this applies to all locations except Plymouth Beach and Marshfield), and samples are sectioned into 5 cm increments during the second half of the year.

The surface and alternate sections are analyzed for gamma emitting isotopes. In addition, the surface section from each core and a mid-depth section from Rocky Point and Plymouth Harbor are analyzed for Pu-238 and Pu-239, 240.

The results of the ERMAP program for sediments are presented in Table III-J-1. It is clear from this table that Cs-137 was observed in a sediment sample (5-10 cm) taken from Rocky Point (Station 11) which is near the Discharge Canal Outfall. This sample was collected on 10/29/82. Previous samples collected from the same location on 5/26/82 showed no evidence of any isotopes characteristic of reactor operation. The observation of Cs-137 at the 5-10 cm level was most likely due to liquid releases from PNPS-1. The only other noteworthy values are the measured concentrations of Cs-137 at Plymouth Harbor for both sediment samples and an observation of a Co-60 peak (4-6 cm) in the sample collected on 5/10/82;

Cs-137 at Marshfield for both sediment samples; and Ce-144, Ce-141, Be-7, Cs-137 and an observation of a Co-60 peak in Duxbury Bay samples collected on 5/25/82 and Cs-137 in the samples collected on 10/22/82. The concentrations of Cs-137 may be explained by the fact that the sediment samples taken at Duxbury have a silty character not common to the other samples. The Plymouth Harbor sediment is very similar to Duxbury Bay. It may be that the nature of the Duxbury sediment is such that certain materials are retained more strongly than others. This theory is supported by the fact that the Duxbury indicator station also had the highest mean concentration of K-40, an isotope which is chemically similar to Cs-137. In addition, a Co-60 peak was detected during the first half of 1982 in the 4-6 cm level at Plymouth Harbor and in the 0-2 cm and 4-6 cm level at Duxbury Bay. Since Co-60 was not detected during the second half of the year, the observation is most probably a transient effect. The measured concentrations of Ce-144, Ce-141, and Be-7 at Duxbury Bay, and to some extent Cs-137 at Duxbury Bay, Plymouth Harbor and Marshfield, are attributed to the fission products related to fallout from previous weapons testing.

Analyses for plutonium isotopes in sediment samples were performed by the EAL Corporation (formally LFE Environmental Analyses Laboratories) in Richmond, California. The results of these analyses are presented in Table III-J-2. There is no apparent trend in these data to indicate that the PNPS-1 is contributing measurably to levels of Pu-238 or 239, 240 in the environment since levels of plutonium at Rocky Point are among the lowest measured at any location.

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FLIGHT 1		OFFSITE ENVIRONMENTAL RADIOLOGICAL MONITORING		A3/05/10, PAGE 47	
		SUMMARY FOR THE PERIOD 12/21/01 - 12/31/02			
MEDIUM SEDIMENT/SILT		UNIT: PCI/KG GWT			
NUCLIDES (NL=ANALYSES) (NL=ROUTINE)*	NOMINAL LLD	INDICATOR STATION MEAN, RANGE, AND NO. DETECTED**	STATION	HIGHEST STATION MEAN, RANGE, AND NO. DETECTED**	CONTROL LOCATION MEAN, RANGE, AND NO. DETECTED**
DE-7 (7A) (5)	.2	(0.7 + 3.5)E 1 (-1.3 - 22.2)E 2 #(3/ 67)%	13	(2.3 + 2.0)E 2 (-1.3 - 22.2)E 2 #(2/ 11)%	(-1.7 + 2.3)E 1 (-1.1 - 1.0)E 2 #(0/ 11)%
DE-10 (7B) (0)	.5	(1.0 + .0)E 0 (0.7 - 17.9)E 3 #(0/ 67)%	13	(1.5 + .0)E 4 (1.0 - 1.8)E 4 #(11/ 11)%	(0.0 + .2)E 3 (7.5 - 9.5)E 3 #(11/ 11)%
CR-51 (7B) (0)	3.7E+02	(-1.7 + 1.7)E 1 (-3.9 - 3.3)E 2 #(0/ 67)%	11	(1.5 + 3.0)E 1 #(0/ 13)%	(-1.1 + .3)E 2 (-3.3 - .3)E 2 #(0/ 11)%
MN-58 (7B) (0)	2.0E+02	(2.2 + 1.3)E 0 (-0.0 - 2.7)E 1 #(0/ 67)%	11	(4.5 + 1.9)E 0 #(0/ 13)%	(-2.2 + 19.9)E -1 (-4.7 - 7.4)E 0 #(0/ 11)%
CU-57 (7A) (0)	1.0E+01	(-2.4 + 68.8)E -2 (-1.8 - 1.2)E 1 #(0/ 67)%	20	(3.3 + 1.2)E 0 #(0/ 11)%	(3.3 + 1.2)E 0 (-5.5 - 9.5)E 0 #(0/ 11)%
CO-58 (7A) (0)	2.0E+02	(-2.1 + 1.4)E 0 (-3.8 - 2.0)E 1 #(0/ 67)%	15	(1.4 + 4.9)E 0 #(0/ 11)%	(0.2 + 15.4)E -1 (-1.4 - 1.0)E 1 #(0/ 11)%
FE-59 (7A) (0)	5.0E+01	(-0.6 + 3.3)E 0 (-7.7 - 7.3)E 1 #(0/ 67)%	12	(3.2 + 4.6)E 0 #(0/ 11)%	(-7.0 + 3.2)E 0 (-2.1 - 1.0)E 1 #(0/ 11)%
CO-60 (7B) (1)	2.0E+02	(3.7 + 2.1)E 0 (-2.6 - 10.0)E 1 #(17/ 67)%	14	(7.1 + 5.6)E 0 (-2.3 - 10.0)E 1 #(1/ 21)%	(-1.4 + 391.7)E -2 (-2.5 - 1.6)E 1 #(0/ 11)%
ZN-65 (7A) (0)	0.0E+01	(2.0 + 3.1)E 0 (-5.5 - 6.2)E 1 #(0/ 67)%	14	(0.1 + 7.2)E 0 #(0/ 21)%	(-2.8 + 4.5)E 0 (-2.3 - 2.0)E 1 #(0/ 11)%

- * NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT
- ** THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. ASSIGNA) IS INDICATED WITHIN %.

TABLE III-J-1
ERMAP RESULTS
SEDIMENT

PILGRIM I

 OFFSHORE ENVIRONMENTAL RADIOLOGICAL MONITORING 11/03/10, PAGE 20
 SUMMARY FOR THE PERIOD 12/21/01 - 12/31/02

UNITS: MCI/KG DWT

MEASUREMENT/STATION		NOMINAL LLD	INDICATOR STATIONS MEAN, RANGE, AND NO. DETECTED**		STATION	HIGHEST STATION MEAN, RANGE, AND NO. DETECTED**		CONTROL LOCATIONS MEAN, RANGE, AND NO. DETECTED**	
NUCLIDE	ANALYSES		MEAN	RANGE		MEAN	RANGE	MEAN	RANGE
ZH-05	(7A) (0)	4.0E-02	(3.9 + (-9.8 - (0 OF 073)	3.03E 0 4.53E 1	13	(1.1 + (-0.7 - (0 OF 113)	.73E 1	(1.0 + (-2.1 - (0 OF 113)	5.31E 0 4.43E 1
NO-05	(7B) (0)	3.1E+01	(3.6 + (-4.2 - (0 OF 073)	1.93E 0 4.93E 1	13	(1.5 + (-1.2 - (0 OF 113)	.53E 1 4.03E 1	(2.4 + (-1.3 - (0 OF 113)	3.23E 0 2.23E 1
AG-110M	(7A) (0)	1.9E+02	(-1.1 + (-2.7 - (0 OF 073)	1.03E 1 2.03E 2	12	(2.2 + (-0.7 - (0 OF 113)	1.43E 1	(-1.4 + (-1.2 - (0 OF 113)	1.43E 1 .73E 2
HU-103	(7A) (0)	2.0E-02	(3.4 + (-3.3 - (0 OF 073)	15.23E -1 3.03E 1	12	(4.1 + (-0.7 - (0 OF 113)	1.93E 0	(-1.3 + (-1.7 - (0 OF 113)	3.33E 0 2.03E 1
HU-100	(7B) (0)	.2	(-5.0 + (-2.2 - (0 OF 073)	4.43E 0 1.93E 2	13	(1.7 + (-0.7 - (0 OF 113)	2.03E 1	(-3.1 + (-1.4 - (0 OF 113)	1.53E 1 .43E 2
I-131	(7A) (0)	0.	(-2.4 + (-7.3 - (0 OF 073)	1.63E 1 4.23E 2	24	(0.1 + (-0.7 - (0 OF 113)	0.33E 1	(0.1 + (-3.4 - (0 OF 113)	0.33E 1 59.03E 1
CB-124	(7A) (0)	2.0E-02	(-5.1 + (-3.2 - (0 OF 073)	1.13E 0 1.03E 1	12	(-1.7 + (-0.7 - (0 OF 113)	1.03E 0	(-2.1 + (-1.0 - (0 OF 113)	3.53E 0 2.23E 1
CB-137	(7A) (0)	2.0E-02	(2.5 + (-1.6 - (0 OF 073)	.53E 1 14.03E 1	13	(0.0 + (5.0 - (11 OF 113)	.03E 1 14.03E 1	(1.7 + (-4.0 - (0 OF 113)	.43E 1 47.03E 0
HA-140	(7A) (0)	4.0E-02	(-4.3 + (-2.1 - (0 OF 073)	.83E 1 1.03E 2	19	(-3.4 + (-0.7 - (0 OF 213)	1.23E 1	(-9.1 + (-3.6 - (0 OF 113)	3.73E 1 .13E 2
CE-141	(7B) (1)	4.0E-02	(1.6 + (-4.5 - (0 OF 073)	.33E 1 7.43E 1	12	(2.0 + (-0.7 - (0 OF 113)	.03E 1	(1.0 + (-1.9 - (0 OF 113)	.43E 1 3.43E 1

* NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT
 ** THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. MAXIMAL) IS INDICATED WITHIN () %.

TABLE III-J-1

CONTINUED

PILOT 1

OFFSITE ENVIRONMENTAL RADIOLOGICAL MONITORING AS/03/10, PAGE 29
SUMMARY FOR THE PERIOD 12/21/81 - 12/31/82

MEDIUMS BENZENE/MLT		UNITS: PCI/MG CMV			
RADIUNUCLIDES (NO. ANALYSES) (NON-ROUTINE)*	NOMINAL LLD	INDICATION STATISTICS MEAN, RANGE, AND NO. DETECTED**	STATION	HIGHEST STATION MEAN, RANGE, AND NO. DETECTED**	CONTROL LOCATIONS MEAN, RANGE, AND NO. DETECTED**
CE-144 (78) (1)	.2	(-1.4 + .81E 1 (-2.3 - 2.71E 2 * (1/ 87) *	13	(9.5 + 29.21E 0 (-1.1 - 2.71E 2 * (1/ 11) *	(-2.4 + 1.41E 1 (-8.4 + 5.01E 1 * (0/ 11) *
TH-234 (78) (0)	2.0E-02	(3.2 + .21E 2 (5.0 + 82.01E 1 * (57/ 87) *	13	(6.6 + .11E 2 (4.1 - 0.31E 2 * (11/ 11) *	(2.0 + .21E 2 (1.0 - 1.01E 2 * (11/ 11) *

- * NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT
** THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. SIGNAL) IS INDICATED WITHIN * () *

TABLE III-J-1
CONTINUED

TABLE III-J-2
RESULTS OF SEDIMENT ANALYSES
FOR PLUTONIUM

<u>Location</u>	<u>Depth cm</u>	<u>Results</u>	
		<u>pCi/Kg (dry) \pm % Error (1σ) (a)</u>	<u>238 239,240</u>
		<u>Pu</u>	<u>Pu</u>
Duxbury	0-2	1.73 \pm 16%	40.7 \pm 5%
Duxbury	16-18	2.80 \pm 19%	54.4 \pm 6%
Plymouth Harbor	0-2	0.48 \pm 28%	11.4 \pm 6%
Rocky Point	0-2	0.24 \pm 39%	3.44 \pm 9%
Rocky Point	16-18	0.44 \pm 27%	3.48 \pm 11%
Manomet Point	0-2	0.21 \pm 50%	2.54 \pm 10%
Marshfield-Control	0-5	0.17 \pm 38%	2.55 \pm 9%

(a) If the result is zero, the error is in pCi/Kg

(b) Sample analyses for mid-depth sample at Plymouth Harbor not available as of this date.

III. K. Milk

Milk samples were collected at essentially two locations during 1982, the King Residence (Station 22-12 mi-W) and the Whitman Farm (Station 21-21 mi-NW). As stated in Section II, one sample was collected from Beaver Dam Road (Station 28-2.5 mi-S) in October and one sample was collected from Plymouth County Farm (Station 11-3.5 mi W) in December. The milk samples from the Plymouth County Farm have been collected without interruption into 1983. The milk samples from Beaver Dam Road will be collected on a scheduled basis starting in the spring of 1983. Thus, although there was no dependable indicator station (within 5 miles) for milk near PNPS-1 during 1982, it is expected that there will be two dependable indicator stations for 1983. This was confirmed in the 1982 Census (see Appendix E). Milk sampling from the King Residence was interrupted during the later half of 1982. The King Residence provides milk from two sources, a cow and a goat. The cow gave birth to a calf between 7/11/82 and 8/5/82. A milk sample from the cow was unavailable during the week of July 18, 1982 and samples were not available on a scheduled basis until the week of October 10, 1982.

When available, samples were collected semi-monthly when animals are on pasture and monthly at other times.

The results of the ERMAP program for the milk media are presented in Table III-K-1. The results of analyses for Cs-137 and Sr-90 are presented graphically in Figures III-K-1 and III-K-2 respectively.

The highest mean concentration of Sr-90 occurred at Beaver Dam Road and the highest mean concentration of Sr-89 occurred at the Whitman Farm. However, there were no positive measurements made of either Sr-89 or Sr-90, there were only indications of the presence of Sr-90 (activity greater than three times the standard deviation). Station releases for this period exhibited a Sr-89/Sr-90 ratio of about 1/200 and therefore it is unlikely that PNPS-1 is the major source of the indicator station activity since the measured Sr-89/Sr-90 was at most 1/10.

In the case of Cs-137, the highest mean value of concentration occurred at the King Residence (12 mi - W). As can be seen in Figure III-K-1, the Cs-137 concentration for the King Residence - cow peaks in late June. This increase in Cs-137 parallels the pregnancy of the cow very well. It is not uncommon to find marked increase of Cs-137 associated with a cows pregnancy, and this was most likely the cause.

In addition, the measured average concentration of Cs-137, Sr-90 and Sr-89 were all greater than 1,000,000 times in excess of the concentrations expected to be present based on measured releases from PNPS-1 and the conservative dose estimation methodology described in Regulatory Guide 1.109 and 1.111. In other words, PNPS-1 probably contributed much less than 0.01% of the measured concentration of Sr-90, Sr-89 and Cs-137 in milk at the indicator stations. Since the King Residence is greater than 10 miles from PNPS-1, it is highly unlikely that PNPS-1 contributed to the measured concentration of Cs-137 at this location. The remainder of the measured cesium and strontium radioactivity is unquestionably due to atmospheric fallout resulting from atmospheric weapons testing.

When compared with the natural background dose rate of 80 to 100 mrem/year, there was clearly no significant environmental impact on the milk media as a result of operation of PNPS-1.

PILGRIM 1

 OPPOSITE ENVIRONMENTAL RADIOLOGICAL MONITORING 12/03/10, PAGE 41
 SUMMARY FOR THE PERIOD 12/21/01 - 12/31/02

UNITS: PCI/LITER

MEDIUM MSLR		INDICATOR STATION MEAN, RANGE, AND NO. DETECTED**	STA?	HIGHEST STATION MEAN, RANGE, AND NO. DETECTED**	CONTROL LIMITATIONS MEAN, RANGE, AND NO. DETECTED**
RAIUMUC(10E) (NO. ANALYSES) (NCH=ROUTINE)*	NOMINAL LTD				
SR=89 (41) (0)	A.	(11.9 + 0.0)E -1 (-9.9 - 2.1)E -1 # (0 / 21)	21	(8.7 + 1.1)E -1 # (0 / 18)	(3.6 + 1.1)E -1 (-2.4 - 1.4)E 0 # (0 / 39)
SR=90 (41) (0)	A.	(10.0 + 7.2)E 0 (2.8 - 17.2)E 0 # (2 / 21)	28	(1.7 + .1)E 1 # (1 / 11)	(3.4 + .1)E 0 (1.0 - 10.1)E 0 # (30 / 39)
UE=7 (41) (0)	0.0E+01	(-2.2 + 9.2)E 0 (-7.3 - 3.0)E 0 # (0 / 21)	11	(3.0 + 5.3)E 0 # (0 / 11)	(-1.5 + 1.0)E 0 (-2.0 - 1.3)E 1 # (0 / 39)
K=40 (41) (0)	2.0E+02	(1.4 + .1)E 3 (1.3 - 1.4)E 3 # (2 / 21)	11	(1.4 + .0)E 3 # (1 / 11)	(1.4 + .0)E 3 (1.1 - 1.7)E 3 # (39 / 39)
CR=51 (41) (0)	-1.0E+00	(-5.6 + 2.5)E 0 (-8.1 - 0.0)E 0 # (0 / 21)	22	(5.9 + 14.8)E -1 # (0 / 21)	(-4.0 + 13.4)E -1 (-2.5 - 1.3)E 1 # (0 / 39)
MN=54 (41) (0)	A.	(4.5 + 4.7)E -1 (-1.9 - 12.9)E -2 # (0 / 21)	11	(0.3 + 0.8)E -1 # (0 / 11)	(-2.2 + 1.3)E -1 (-3.2 - 1.2)E 0 # (0 / 39)
CU=57 (41) (0)	-1.0E+00	(-1.1 + 1.0)E -1 (-2.0 - 0.0)E -1 # (0 / 21)	22	(2.8 + 11.7)E -2 # (0 / 21)	(4.3 + 10.8)E -3 (-2.0 - 1.0)E 0 # (0 / 39)
CO=58 (41) (0)	0.	(5.1 + 4.8)E -1 (2.8 - 10.3)E -2 # (0 / 21)	28	(0.9 + 0.0)E -1 # (0 / 11)	(-2.4 + 1.7)E -1 (-2.6 - 2.1)E 0 # (0 / 39)
FE=59 (41) (0)	1.0E+01	(1.5 + 4.9)E -1 (-3.3 - 6.4)E -1 # (0 / 21)	11	(0.4 + 17.0)E -1 # (0 / 11)	(1.1 + 3.1)E -1 (-2.8 - 4.1)E 0 # (0 / 39)

- * NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT
- ** THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E., SIGMA) IS INDICATED WITHIN < >.

 TABLE III-K-1
 ERMAR RESULTS
 MILK

PILGRIM I

OFFSITE ENVIRONMENTAL RADIOLOGICAL MONITORING 12/03/10, PAGE 22
SUMMARY FOR THE PERIOD 12/21/01 - 12/31/02

MEDIUM MLLA			UNIT(S) PCI/LITER		
RADIONUCLIDES (INC. ANALYSES) (NLM=ROUTINE)*	NOMINAL LLD	INDICATOR STATION MEAN, RANGE, AND NO. DETECTED**	STATION	HIGHEST STATION MEAN, RANGE, AND NO. DETECTED**	CONTROL LOCATION MEAN, RANGE, AND NO. DETECTED**
CU-60 (41) (0)	N.	(-9.3 - 19.3)E -1 (-2.3 - .4)E 0 *(0/ 2)*	1	(0.1 - 4.8)E -1 (0/ 1)*	(-3.3 - 1.5)E -1 (-2.4 - 1.7)E 0 *(0/ 39)*
Zn-65 (41) (0)	-1.0-100	(1.1 - 8.5)E 0 (-1.4 - 3.0)E 0 *(0/ 2)*	11	(3.0 - 2.0)E 0 (0/ 1)*	(-3.4 - 4.0)E -1 (-3.8 - 4.7)E 0 *(0/ 39)*
ZR-95 (21) (0)	1.0E+01	(-1.0 - 19.7)E -2 (-1.7 - 1.3)E -1 *(0/ 2)*	21	(3.3 - 4.5)E -1 (0/ 16)*	(1.0 - 2.4)E -1 (-5.4 - 3.5)E 0 *(0/ 39)*
MO-95 (41) (0)	-1.0-100	(-2.3 - 3.4)E -1 (-5.9 - 1.2)E -1 *(0/ 2)*	22	(5.3 - 1.5)E -1 (0/ 21)*	(3.0 - 1.1)E -1 (-1.5 - 1.0)E 0 *(0/ 39)*
AG-110M (41) (0)	-1.0-100	(3.4 - 5.3)E 0 (-1.7 - 0.0)E 0 *(0/ 2)*	28	(9.0 - 0.8)E 0 (0/ 1)*	(0.0 - 13.0)E -1 (-1.9 - 2.3)E 1 *(0/ 39)*
HU-103 (41) (0)	N.	(-1.1 - .8)E 0 (-1.6 - 0.0)E 0 *(0/ 2)*	28	(-0.9 - 2.9)E -1 (0/ 1)*	(-1.1 - .11)E 0 (-2.0 - .9)E 0 *(0/ 39)*
RU-106 (41) (0)	0.0E+01	(-5.0 - 4.7)E 0 (-9.7 - 0.0)E 0 *(0/ 2)*	21	(-1.1 - 140.0)E -2 (0/ 18)*	(-1.4 - 1.2)E 0 (-3.0 - 1.3)E 1 *(0/ 39)*
I-131 (41) (0)	.5	(1.4 - 2.0)E -2 (-1.0 - 0.2)E -2 *(0/ 2)*	28	(4.2 - 5.7)E -2 (0/ 1)*	(0.3 - 0.1)E -1 (-1.3 - 1.0)E -1 *(0/ 39)*
CS-134 (41) (0)	9.	(4.1 - 4.0)E -1 (0.8 - 95.2)E -2 *(0/ 2)*	11	(9.5 - 7.0)E -1 (0/ 1)*	(-5.5 - 1.4)E -1 (-3.3 - .0)E 0 *(0/ 39)*
CS-137 (41) (0)	9.	(1.0 - 1.2)E 1 (4.2 - 27.9)E 0 *(2/ 2)*	28	(2.8 - .1)E 1 (1/ 1)*	(1.4 - .1)E 1 (1.2 - 1170.0)E -1 *(34/ 39)*

- * NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT
** THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. >SIGMA) IS INDICATED WITHIN * (1/ 39)*

TABLE III-K-1
CONTINUED

PILGRIM I

OFFSITE ENVIRONMENTAL RADIOLOGICAL MONITORING 12/21/81 - 12/31/82
SUMMARY FOR THE PERIOD 12/21/81 - 12/31/82

UNITS: PC/LITER

MEDIUM: MILK		INDICATOR STATIONS		HIGHEST STATION		CONTROL LOCATIONS	
RADIOISOTOPES (NO. ANALYSES) (NON-ROUTINE)*	NOMINAL LLD	MEAN, RANGE, AND NO. DETECTED**	STATION	MEAN, RANGE, AND NO. DETECTED**	STATION	MEAN, RANGE, AND NO. DETECTED**	STATION
UA-140 (41) (0)	1.5E+01	(-9.4 - 10.3)E -1 (-2.0 - .0)E 0 #(0/ 2)4	28	(4.7 - 108.0)E -2 #(0/ 1)0	28	(-5.0 - 2.1)E -1 (-3.7 - 4.3)E 0 #(0/ 39)0	28
CE-141 (41) (0)	2.0E+01	(1.2 - .7)E 0 (4.9 - 10.3)E -1 #(0/ 2)2	28	(1.9 - 1.3)E 0 #(0/ 1)0	28	(2.3 - 2.0)E -1 (-2.5 - 2.0)E 0 #(0/ 39)0	28
CE-144 (41) (0)	6.0E+01	(-1.2 - 3.5)E 0 (-4.7 - 2.3)E 0 #(0/ 2)2	28	(2.3 - 4.9)E 0 #(0/ 1)0	28	(-2.6 - 05.4)E -2 (-4.6 - 11.0)E 0 #(0/ 39)0	28
TH-228 (41) (0)	1.0E+01	(3.7 - 1.1)E 0 (2.7 - 4.0)E 0 #(0/ 2)2	28	(4.0 - 3.4)E 0 #(0/ 1)0	28	(3.9 - 0.0)E -1 (-7.0 - 14.2)E 0 #(0/ 39)0	28

- * NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT
** THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. SIGMA) IS INDICATED WITHIN # ()

TABLE III-K-1

CONTINUED

FIGURE III-K-1
CONCENTRATIONS OF Cs-137 in MILK
ALL STATIONS

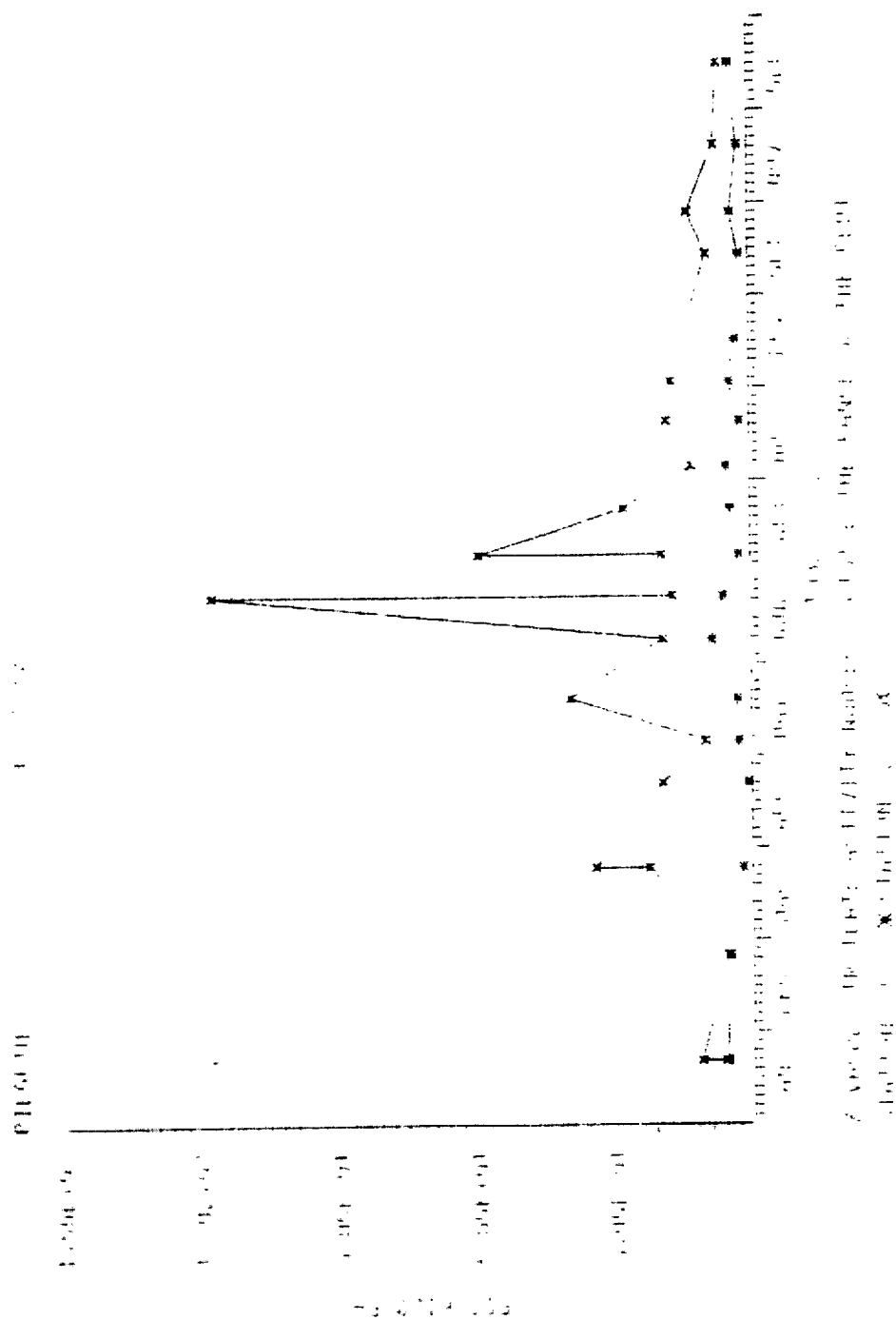
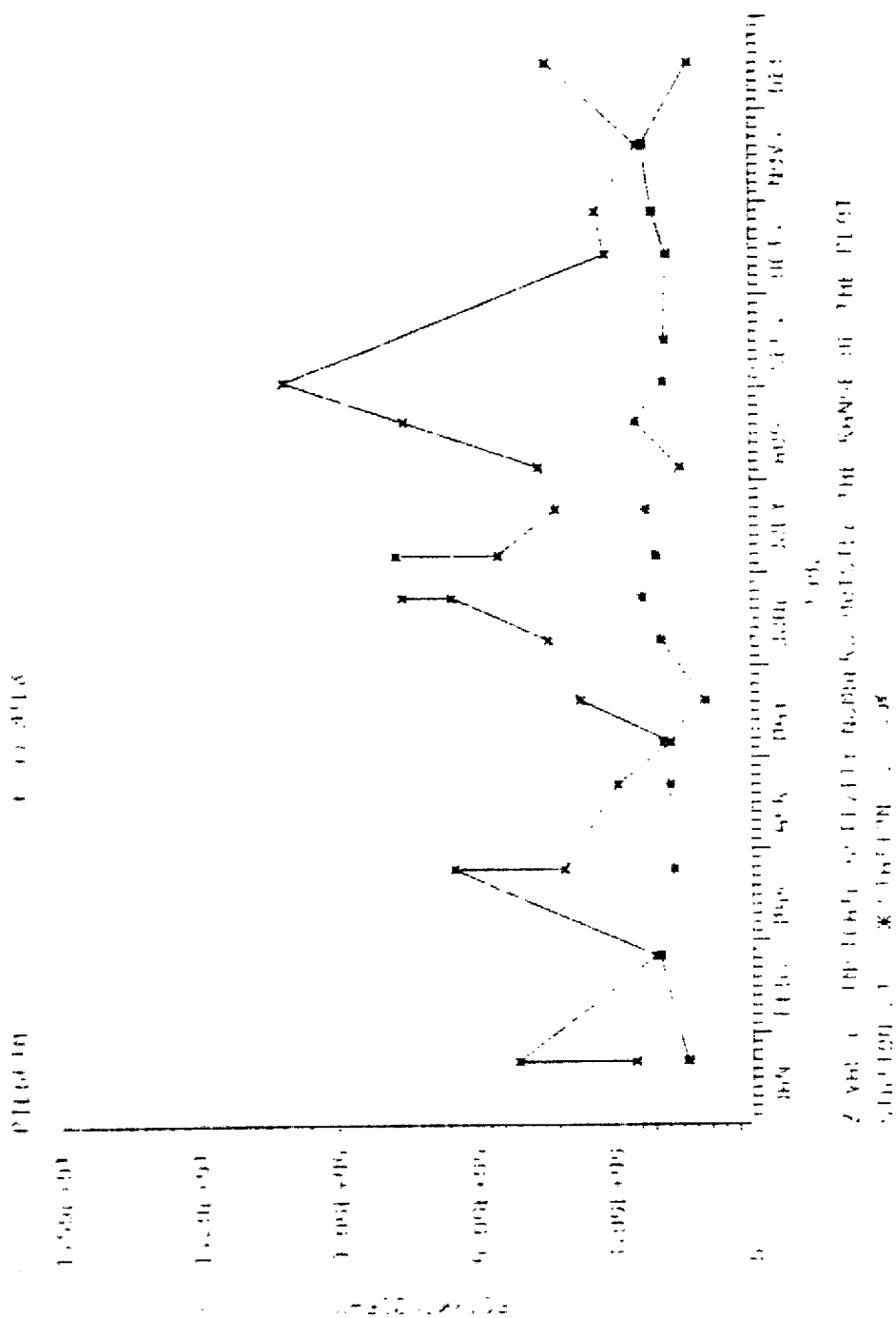


FIGURE III-K-2
CONCENTRATIONS OF Sr-90 in MILK
ALL STATIONS



III. L. Cranberries

Cranberries are collected from three locations, the Manomet Point Bog (2.5 mi-SE-Station 13), the Bartlett Road Bog (2.8 mi-SSE/S Station 14) and the Pine Street Bog (17 mi - WNW - Station 23) at the time of harvest. The results of the ERMAP program for this media are presented in Table III-L-1. The only man-made radionuclide detected was Cs-137 which appeared in all of the sample locations. A comprehensive study of cesium uptake in cranberries was performed during 1978. The results of this study are published in the 1978 Environmental Radiation Monitoring Program Report No. 11. This report identified fallout from previous nuclear weapons testing as the primary source of cesium in cranberries. In addition, this report indicated that cesium uptake in cranberries can be increased when conditions of low soil potassium occur, as cesium is a chemical congener of potassium. The results of this study and the fact that no other reactor related isotopes were measured above LLD in cranberry samples makes it extremely unlikely that there was any environmental impact on cranberries due to operation of PNPS-1, but rather that the measured concentration was due to fallout from previous weapons testing and a lack of adequate potassium in the soil.

WILLOW I

OFFSITE ENVIRONMENTAL RADIOLOGICAL MONITORING 03/03/16. PAGE 12
SUMMARY FOR THE PERIOD 12/21/01 - 12/31/02

UNITS: PC/KG NET

MEDICINE BAY CRABBERIES

NUCLIDE (ML ANALYSES) (MLN=ROUTINE)	NOMINAL LTD	INDICATOR STATION MEAN, RANGE, AND NO. DETECTED	STA	HIGHEST STATION MEAN, RANGE, AND NO. DETECTED	CENTRAL LOCATION MEAN, RANGE, AND NO. DETECTED
DE-7 (3) (0)	.2	(3.9 - 3.7)E 1 (2.2 - 70.4)E 0 #(07 2)E	13	(7.7 - 0.2)E 1 #(07 1)E	(1.9 - 3.9)E 1 #(07 1)E
AR-40 (3) (0)	.5	(5.4 - 3.3)E 2 (4.1 - 9.8)E 2 #(27 2)E	23	(5.9 - 4.9)E 2 #(17 1)E	(5.9 - 4.9)E 2 #(17 1)E
CR-51 (3) (0)	3.2E+02	(-2.8 - 1.0)E 1 (-3.3 - 0.0)E 1 #(07 2)E	13	(-1.2 - 0.0)E 1 #(07 1)E	(-1.3 - 3.0)E 1 (-1.3 - 0.0)E 1 #(07 1)E
HN-54 (3) (0)	8.0E+02	(-2.7 - 3.0)E 0 (-5.6 - 3.3)E 0 #(07 2)E	23	(2.7 - 0.4)E 0 #(07 1)E	(2.7 - 0.4)E 0 #(07 1)E
CU-57 (3) (0)	2.5E+01	(5.4 - 4.0)E 0 (10.0 - 109.0)E -1 #(07 2)E	13	(1.0 - 4.9)E 1 #(07 1)E	(4.2 - 3.3)E 0 #(07 1)E
CO-58 (3) (0)	8.0E+02	(1.6 - 2.0)E 0 (-4.2 - 30.1)E -1 #(07 2)E	14	(3.6 - 4.5)E 0 #(07 1)E	(-1.7 - 4.5)E 0 (-1.7 - 0.0)E 0 #(07 1)E
FE-54 (3) (0)	3.0E+01	(-2.1 - 3.1)E 0 (-4.1 - 1.0)E 0 #(07 2)E	14	(1.0 - 0.1)E 0 #(07 1)E	(-2.6 - 0.4)E 0 (-2.6 - 0.0)E 0 #(07 1)E
CU-60 (3) (0)	8.0E+02	(-2.4 - 05.3)E -1 (-9.8 - 9.2)E 0 #(07 2)E	13	(9.2 - 11.1)E 0 #(07 1)E	(-0.1 - 0.4)E 0 (-0.1 - 0.0)E 0 #(07 1)E
ZN-65 (3) (0)	0.7E+01	(2.7 - 4.7)E 0 (-6.0 - 11.4)E 0 #(07 2)E	13	(1.1 - 1.0)E 1 #(07 1)E	(4.1 - 10.0)E 0 #(07 1)E

- * NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE RESULT
** THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. SIGMA) IS INDICATED WITHIN A# 1=.

TABLE III-L-1
ERMAT RESULTS
CRABBERIES

PILOTIN 1

OFFSHORE ENVIRONMENTAL RADIOLOGICAL MONITORING 03/03/10, PAGE 13
SUMMARY FOR THE PERIOD 12/21/81 - 12/31/82

UNITS: PC1/KG NET

MEDIUM RUM CRANBERRIES

NAV/UNCL/IDEB (NL ANALYSIS) (NCH/ROUTINE)	NOMINAL LLD	INDICATOR STATION MEAN, RANGE, AND NO. DETECTED	STA.	HIGHEST STATION MEAN, RANGE, AND NO. DETECTED	COUNT/LICATION MEAN, RANGE, AND NO. DETECTED
ZH=95 (S) (O)	4.0E+02	(-7.3 + 9.2)E 0 (-1.6 - 1.2)E 1 # (0/ 2) =	23	(-6.1 + 7.7)E 0 # (0/ 1) =	(-6.1 + 7.7)E 0 # (0/ 1) =
NU=95 (S) (O)	3.0E+01	(-4.5 + 3.2)E 0 (-1.8 - 7.7)E 0 # (0/ 2) =	14	(-2.7 + 5.0)E 0 # (0/ 1) =	(-1.1 + 4.2)E 0 # (0/ 1) =
AG=110M (S) (O)	2.5E+02	(-8.6 + 3.4)E 1 (-0.5 - 0.0)E 1 # (0/ 2) =	18	(-6.7 + 40.5)E 0 # (0/ 1) =	(-9.4 + 3.0)E 1 (-9.4 - 0.0)E 1 # (0/ 1) =
HU=103 (S) (O)	2.0E+02	(-6.7 + 8.5)E 0 (-1.1 - 0.0)E 1 # (0/ 2) =	23	(-7.5 + 5.0)E 0 # (0/ 1) =	(-1.5 + 5.0)E 0 # (0/ 1) =
HU=106 (S) (O)	.2	(-1.1 + 11.1)E 1 (-1.2 - 1.0)E 2 # (0/ 2) =	14	(-1.0 + .4)E 2 # (0/ 1) =	(-6.4 + 4.3)E 1 (-6.4 - 0.0)E 1 # (0/ 1) =
I=131 (S) (O)	0.	(-1.0 + 12.9)E 0 (-1.5 - 1.1)E 1 # (0/ 2) =	13	(-1.1 + 1.2)E 1 # (0/ 1) =	(-3.1 + 40.3)E -1 # (0/ 1) =
CB=134 (S) (O)	2.0E+02	(-1.2 + .5)E 1 (-2.0 - 0.0)E 1 # (0/ 2) =	23	(-4.3 + 4.5)E 0 # (0/ 1) =	(-4.3 + 4.5)E 0 # (0/ 1) =
CB=137 (S) (I)	2.0E+02	(-1.2 + 1.0)E 2 (-2.2 - 22.1)E 1 # (2/ 2) =	13	(-2.2 + .2)E 2 # (1/ 1) =	(-2.1 + .7)E 1 # (1/ 1) =
UA=140 (S) (O)	8.0E+02	(-3.0 + .9)E 0 (-2.0 - 3.9)E 0 # (0/ 2) =	14	(-3.9 + 7.0)E 0 # (0/ 1) =	(-6.1 + 7.4)E 0 (-6.1 - 0.0)E 0 # (0/ 1) =
CE=141 (S) (O)	4.0E+02	(-1.1 + .3)E 1 (-8.5 - 14.0)E 0 # (0/ 2) =	13	(-1.4 + 1.0)E 1 # (0/ 1) =	(-3.1 + 6.3)E 0 # (0/ 1) =

* NON-NU/IDEB REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT
** THE FRACTION OF SAMPLE ANALYSES EXCEEDING DETECTABLE MEASUREMENTS (I.E. POSITIVE) IS INDICATED WITHIN # ()

TABLE III-L-1
CONTINUED

PILGRIM I

OFFSITE ENVIRONMENTAL RADIOLOGICAL MONITORING 12/03/80. PAGE 14
SUMMARY FOR THE PERIOD 12/21/81 - 12/31/82

UNITS: PC/KG NET

MEIUMI FUND CHANNELS

RADIOISOTOPES (NL. ANALYSES) (NL. ROUTINE) -----	NOMINAL LLD -----	INDICATION STATIONS MEAN, RANGE, AND NO. DETECTED** -----	STATION	HIGHEST STATION MEAN, RANGE, AND NO. DETECTED** -----	CONTROL LOCATIONS MEAN, RANGE, AND NO. DETECTED** -----
CE-134 (3) (8)	.8	(-2.2 - 3.2)E 1 (-9.8 - 1.0)E 1 # 0/ 218	14	(10.0 - 25.9)E 0 # 0/ 134	(-2.8 - 2.5)E 1 (-2.5 - 0.0)E 1 # 0/ 134
TH-232 (3) (8)	2.0E-02	(1.9 - 28.4)E 0 (-2.0 - 3.0)E 1 # 0/ 218	14	(3.8 - 1.0)E 1 # 0/ 134	(2.8 - 2.3)E 1 # 0/ 134

- * NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT
- ** THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. >5SIGMA) IS INDICATED WITHIN × 1%.

TABLE III-L-1
CONTINUED

III. M. Vegetation

Samples of tuberous and green leafy vegetables were collected at the time of harvest at six locations, Plymouth County Farm (3.5 mi-W), Bridgewater Farm (20 mi-W), the Evans Residence (0.7 mi - W), the Work Residence (0.6 mi - ESE), the Whipple Farm (1.5 mi - SSW), and the Hoton Residence (2.5 mi - SE). The results of the ERMAP program for this media are presented in Table III-M-1.

The only isotopes observed (other than naturally occurring AcTh-228 (peak) and K-40) was Be-7 and Cs-137. Positive measurements of Cs-137 were detected in vegetation samples from the Evans residence (rhubarb, (18.4 pCi/kg)) and the Whipple Farm (lettuce, (31.9 pCi/kg)). The absence of Cs-134 at both of these locations and the fact that measured Cs-137 concentrations are greater than 1,000,000 times what would be expected at these locations based on releases from PNPS-1, strongly indicates that fallout, not PNPS-1, is the primary source of this Cs-137. Therefore, it is extremely unlikely that there was any environmental impact on vegetation due to the operation of PNPS-1.

PROGRAM 1

OFFSITE ENVIRONMENTAL RADIOLOGICAL MONITORING
SUMMARY FOR THE PERIOD 12/21/81 - 12/31/82

12/03/86, PAGE 15

UNITS: PCI/AG NET

MEDIUM FUNGUS/GAMOPH GROUPS

RADIOISOTOPES (MC, ANALYSES) (NOMINAL VALUE)	NOMINAL LD	INDICATION STATIONS MEAN, RANGE, AND NO. DETECTED**	STATION	HIGHEST STATION MEAN, RANGE, AND NO. DETECTED**	CONTROL LOCATIONS MEAN, RANGE, AND NO. DETECTED**
HE-3 (10) (3)	.2	(4.4 ± 0.01E 1 (-3.5 - 25.4)E 1 # 37 718	10	(2.4 ± .31E 2 # (1/ 11)	(-2.5 ± 4.71E 1 (-1.2 - .4)E 2 # (0/ 31)
K-40 (10) (0)	.5	(2.7 ± .43E 3 (1.1 - 5.0)E 3 # (7) 718	11	(3.0 ± 1.13E 3 (1.3 - 5.01E 3 # (3/ 31)	(1.4 ± .41E 3 (0.6 - 21.4)E 2 # (3/ 31)
CR-51 (10) (0)	3.2E+02	(1.2 ± 1.43E 1 (-3.3 - 7.3)E 1 # (0/ 718	43	(7.3 ± 4.31E 1 # (0/ 11)	(0.3 ± 35.7)E 0 (-4.8 - 7.7)E 1 # (0/ 31)
MM-54 (10) (0)	2.0E+02	(-1.0 ± 16.5)E -1 (-8.6 - 5.4)E 0 # (0/ 718	10	(5.0 ± 3.6)E 0 # (0/ 11)	(6.0 ± 16.7)E -1 (-2.7 - 2.0)E 0 # (0/ 31)
CO-67 (10) (0)	2.5E+01	(1.1 ± 1.31E 0 (-3.0 - 5.5)E 0 # (0/ 718	43	(4.5 ± 3.6)E 0 # (0/ 11)	(-2.2 ± 1.9)E 0 (-5.0 - .9)E 0 # (0/ 31)
CU-68 (10) (0)	2.0E+02	(-1.4 ± 2.11E 0 (-1.1 - .5)E 1 # (0/ 718	27	(6.5 ± 3.8)E 0 # (0/ 31)	(6.5 ± 3.8)E 0 (-1.1 - 11.1)E 0 # (0/ 31)
FE-59 (10) (0)	3.0E+01	(-5.7 ± 2.2)E 0 (-1.6 - .2)E 1 # (0/ 718	27	(-3.9 ± 64.9)E -1 # (0/ 31)	(-3.9 ± 64.9)E -1 (-1.1 - 1.1)E 1 # (0/ 31)
CO-60 (10) (0)	2.0E+02	(2.4 ± 11.2)E -1 (-5.5 - 2.9)E 0 # (0/ 718	45	(2.3 ± 0.6)E 0 # (0/ 11)	(-3.1 ± 5.5)E 0 (-1.2 - .7)E 1 # (0/ 31)
ZN-65 (10) (0)	6.7E+01	(3.0 ± 46.1)E -1 (-1.6 - 1.9)E 1 # (0/ 718	43	(1.9 ± 1.3)E 1 # (0/ 11)	(-5.6 ± 5.7)E 0 (-1.5 - .4)E 1 # (0/ 31)

- * NON-HOUSTON REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT
- ** THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. SIGMA) IS INDICATED WITHIN # (3).

TABLE III-M-1
ERMAT RESULTS
VEGETATION

PILOT 1

DEFENSE ENVIRONMENTAL RADIOLOGICAL MONITORING 12/03/82 PAGE 16
SUMMARY FOR THE PERIOD 12/21/81 - 12/31/82

MEDIUM RIND/GARDEN CRUPS

UNITED PLANTING NET

MONITORING LINE# (H.C. ANALYSES) (NON-ROUTINE)*	NOMINAL LLO	INDICATOR STATION MEAN, RANGE, AND NO. DETECTED**	STATION	HIGHEST STATION MEAN, RANGE, AND NO. DETECTED**	COUNTING LOCATION MEAN, RANGE, AND NO. DETECTED**
2R-95 (10) (0)	4.0E-02	(2.4 - 3.8)E 0 (-7.9 - 21.2)E 0 # (0/ 7) *	17	(2.1 - .73)E 1 # (0/ 1) *	(4.3 - 3.8)E 0 (7.4 - 127.0)E -1 # (0/ 3) *
NR-95 (10) (0)	3.4E-01	(1.1 - 1.2)E 0 (-3.1 - 9.9)E 0 # (0/ 7) *	10	(5.9 - 4.2)E 0 # (0/ 1) *	(2.1 - 3.5)E 0 (-1.4 - 9.0)E 0 # (0/ 3) *
40-110 (10) (0)	2.5E-02	(-2.4 - 4.8)E 0 (-8.0 - 2.6)E 1 # (0/ 7) *	45	(2.0 - 3.6)E 1 # (0/ 1) *	(-1.0 - 2.7)E 1 (-4.3 - 4.4)E 1 # (0/ 3) *
NU-103 (10) (0)	2.0E-02	(7.7 - 16.0)E -1 (-7.6 - 9.4)E 0 # (0/ 7) *	43	(3.0 - 4.4)E 0 # (0/ 1) *	(2.0 - 6.3)E 0 (-8.0 - 14.7)E 0 # (0/ 3) *
NU-106 (10) (0)	.2	(-2.7 - 2.0)E 1 (-1.2 - .3)E 2 # (0/ 7) *	17	(2.2 - 3.2)E 1 # (0/ 1) *	(1.1 - 1.4)E 1 (-6.8 - 38.4)E 0 # (0/ 3) *
I-131 (10) (0)	0.	(-1.7 - 2.2)E 0 (-9.3 - 7.2)E 0 # (0/ 7) *	43	(7.2 - 7.6)E 0 # (0/ 1) *	(-1.4 - 54.0)E -1 (-9.1 - 9.6)E 0 # (0/ 3) *
CB-134 (10) (0)	2.0E-02	(-4.4 - 1.1)E 0 (-9.6 - .4)E 0 # (0/ 7) *	27	(1.8 - 7.1)E 0 # (0/ 1) *	(1.8 - 7.1)E 0 (-4.3 - 15.0)E 0 # (0/ 3) *
CB-137 (10) (0)	2.0E-02	(8.0 - 5.2)E 0 (-8.1 - 31.9)E 0 # (0/ 7) *	43	(3.2 - .7)E 1 # (0/ 1) *	(9.5 - 6.1)E 0 (-1.2 - 20.0)E 0 # (0/ 3) *
NA-140 (10) (0)	8.0E-02	(1.2 - 8.4)E 0 (-2.4 - 1.0)E 1 # (0/ 7) *	45	(6.0 - 6.0)E 0 # (0/ 1) *	(7.0 - 45.3)E -1 (-7.3 - 8.4)E 0 # (0/ 3) *
CE-141 (10) (0)	4.0E-02	(6.4 - 2.5)E 0 (-5.3 - 14.0)E 0 # (0/ 7) *	17	(1.4 - .6)E 1 # (0/ 1) *	(1.1 - .7)E 1 (3.3 - 45.6)E 0 # (0/ 3) *

* NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE PERIOD
** THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. >3SIGMA) IS INDICATED WITHIN # () %.

TABLE III-M-1
CONTINUED

REPLIM 1

OFFSITE ENVIRONMENTAL RADIOLOGICAL MONITORING 03/03/76 PAGE 17
SUMMARY FOR THE PERIOD 12/21/75 - 12/31/75

MEDIUM FUND/SAFETY GROUPS

UNIT: PC/NG WL

HAZARDOUS (INC. ANALYSED) (NLM-NUMBER)	NOMINAL LLO	INDICATOR STATION MEAN, RANGE, AND NO. DETECTED**	STATION	HIGHEST STATION MEAN, RANGE, AND NO. DETECTED**	CENTRAL LOCATION MEAN, RANGE, AND NO. DETECTED**
LE-140 (10) (0)	.2	(-7.3 - 9.9)E 0 (-3.5 - 4.3)E 1 OF 0/ 7)	10	(-4.3 - 2.1)E 1 OF 0/ 1)	(-1.2 - 2.9)E 1 (-4.4 - 5.0)E 1 OF 0/ 3)
TH-220 (10) (0)	2.0E-02	(-2.2 - .9)E 1 (-9.1 - 11.4)E 0 OF 0/ 7)	10	(-4.3 - 2.0)E 1 OF 0/ 1)	(-1.4 - 1.7)E 1 (-1.0 - 4.4)E 1 OF 0/ 3)

- * NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN 10X (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPLY
- ** THE FRACTION OF SAMPLE ANALYSED YIELDING DETECTABLE MEASUREMENTS (I.E. ABNORMAL) IS INDICATED WITHIN OF 10.

TABLE III-M-1
CONTINUED

III. N. Forage

Beef Forage is collected from three locations annually, the Plymouth County Farm (3.5 mi - W - Station Number 11), Whitman Farm (21 mi-NW - Station Number 21) and Bridgewater Farm (20 mi-W-Station Number 27). The results of the ERMAP program for the media are presented in Table III-N-1. The following positive measurements were made: Be-7 at the Plymouth County Farm; Be-7 at the Bridgewater Farm; and, Be-7 and Cs-137 at the Whitman Farm. All of the above nuclides are attributable to fission products related to fallout from previous atmospheric weapons testing.

The only positive measurement of Cs-137 occurred at the Whitman Farm. The Whitman Farm is a control station and is located 21 miles-NW from PNPS-1, thus the source of this Cs-137 is due to fallout from previous atmospheric weapons testing. Therefore, it is extremely unlikely that there was any environmental impact on forage due to operation of PNPS-1.

FIGURE 1 OFFSITE ENVIRONMENTAL RADIOLOGICAL MONITORING 03/03/10, PAGE 33
SUMMARY FOR THE PERIOD 12/21/01 - 12/31/02

MEDIUM VEGETATION - TERRESTRIAL

UNITS: PCI/MG NET

NAI/UNCL/IDED (NL ANALYSES) (NL-ROUTINE)*	NOMINAL LLO	INDICATOR STATISTICS MEAN, RANGE, AND NO. DETECTION	STATION	HIGHEST STATION MEAN, RANGE, AND NO. DETECTION	CENTRAL LOCATIONS MEAN, RANGE, AND NO. DETECTION
ME-7 (3) (0)	.2	(3.5 + .51E 3 # (1/ 13)	11	(3.5 + .51E 3 # (1/ 13)	(1.9 + .31E 3 (1.0 - 2.41E 3 # (2/ 23)
ME-40 (3) (0)	.5	(1.1 + .11E 4 (1.0 - 1.11E 4 # (1/ 13)	11	(1.1 + .11E 4 (1.0 - 1.11E 4 # (1/ 13)	(7.1 + 1.01E 3 (5.5 - 8.71E 3 # (2/ 23)
CR-51 (1) (0)	-1.0-100	(1.3 + 15.01E 1 # (0/ 13)	11	(1.3 + 15.01E 1 # (0/ 13)	(-1.0 + .71E 2 (-1.7 - 0.01E 2 # (0/ 23)
MN-54 (3) (0)	2.0E-02	(2.1 + 1.51E 1 # (0/ 13)	11	(2.1 + 1.51E 1 # (0/ 13)	(9.2 + 8.71E 0 (5.0 - 179.01E -1 # (0/ 23)
CU-57 (3) (0)	-1.0-100	(1.0 + 1.01E 1 # (0/ 13)	11	(1.0 + 1.01E 1 # (0/ 13)	(6.7 + 1.41E 0 (5.5 - 8.01E 0 # (0/ 23)
CO-58 (3) (0)	2.0E-02	(6.4 + 16.11E 0 # (0/ 13)	11	(6.4 + 16.11E 0 # (0/ 13)	(-1.7 + 1.01E 1 (-3.0 - .11E 1 # (0/ 23)
FE-59 (3) (0)	3.0E+01	(1.6 + 3.81E 1 # (0/ 13)	21	(4.3 + 2.71E 1 # (0/ 13)	(4.4 + 34.21E 0 (-2.6 - 4.31E 1 # (0/ 23)
CO-60 (3) (0)	2.0E-02	(1.3 + 23.21E 0 # (0/ 13)	27	(4.6 + 20.71E 0 # (0/ 13)	(2.6 + 2.11E 0 (4.8 - 46.21E -1 # (0/ 23)
ZN-65 (3) (0)	-1.0-100	(-1.7 + 3.41E 1 (-1.7 - 0.01E 1 # (0/ 13)	27	(3.5 + 3.01E 1 # (0/ 13)	(1.4 + 2.11E 1 (-7.5 - 35.11E 0 # (0/ 23)

* NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT
** THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. SIGMA) IS INDICATED WITHIN # ()

TABLE III-N-1
ERMAP RESULTS
FORAGE

PERLUM 1

OFFSHORE ENVIRONMENTAL RADIOLOGICAL MONITORING 03/03/80. PAGE 30
SUMMARY FOR THE PERIOD 12/21/81 - 12/31/82

MEDIUM VEGETATION - TERRESTRIAL

UNITED PERCENTAGE

RADIUMUCLINES (MC, ANALYSES) (NLH, ROUTINE)	NOMINAL LLD	INDICATOR STATIONS MEAN, RANGE, AND NO. DETECTED	STA.	HIGHEST STATION MEAN, RANGE, AND NO. DETECTED	CONTROL LOCATIONS MEAN, RANGE, AND NO. DETECTED
2H-95 (3) (0)	0.0E+02	(-2.0 + 3.2)E 1 (-2.0 - 0.0)E 1 #(0/ 1)A	21	(3.3 + 27.1)E 0 (0/ 1)A	(2.4 + 1.0)E 0 (1.4 - 3.4)E 0 #(0/ 2)A
4H-95 (3) (0)	-1.0-100	(-2.7 + 1.0)E 1 (-2.7 - 0.0)E 1 #(0/ 1)A	21	(2.0 + 13.4)E 0 (0/ 1)A	(-0.4 + 11.0)E 0 (-1.0 - 3.1)E 1 #(0/ 2)A
4G-110 (3) (0)	-1.0-100	(-1.9 + 1.0)E 2 (-1.9 - 0.0)E 2 #(0/ 1)A	27	(1.4 + 1.1)E 2 (0/ 1)A	(2.5 + 13.4)E 1 (-1.1 - 1.0)E 2 #(0/ 2)A
4U-101 (3) (0)	2.0E+02	(1.9 + 1.0)E 1 (0/ 1)A	11	(1.9 + 1.6)E 1 (0/ 1)A	(-0.2 + 1.0)E 0 (-7.2 - 0.0)E 0 #(0/ 2)A
4U-100 (3) (0)	.2	(-1.3 + 1.0)E 2 (-1.3 - 0.0)E 2 #(0/ 1)A	21	(9.7 + 12.4)E 1 (0/ 1)A	(4.5 + 1.2)E 1 (3.3 - 5.7)E 1 #(0/ 2)A
1-131 (3) (0)	0.	(1.4 + 0.5)E 1 (0/ 1)A	11	(1.4 + 0.5)E 1 (0/ 1)A	(-7.2 + 15.0)E 0 (-2.3 - 0.0)E 1 #(0/ 2)A
CB-134 (3) (0)	2.0E+02	(-2.8 + 1.5)E 1 (-2.8 - 0.0)E 1 #(0/ 1)A	21	(9.5 + 13.2)E 0 (0/ 1)A	(-7.3 + 10.7)E 0 (-1.8 - 3.1)E 1 #(0/ 2)A
CB-137 (3) (0)	2.0E+02	(3.5 + 1.0)E 1 (0/ 1)A	21	(4.8 + 1.4)E 1 (1/ 1)A	(4.3 + 2.5)E 1 (1.7 - 0.8)E 1 #(1/ 2)A
HA-140 (3) (0)	0.0E+02	(-0.5 + 41.7)E 0 (-0.5 - 0.0)E 0 #(0/ 1)A	27	(4.0 + 2.5)E 1 (0/ 1)A	(2.7 + 2.2)E 1 (5.1 - 40.4)E 0 #(0/ 2)A
CE-141 (3) (0)	4.0E+02	(9.6 + 2.5)E 1 (0/ 1)A	11	(5.6 + 2.5)E 1 (0/ 1)A	(-2.0 + 1.4)E 1 (-3.4 - 0.0)E 1 #(0/ 2)A

* NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT
** THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. POSITIVE) IS INDICATED WITHIN # ()A.

TABLE III-N-1
CONTINUED

PILGRIM 3

OFFSITE ENVIRONMENTAL RADIOLOGICAL MONITORING 03/03/10, PAGE 35
SUMMARY FOR THE PERIOD 12/21/01 - 12/31/02

MEDIUM VEGETATION - TERRESTRIAL

UNITS: PC/KG NET

RADIOISOTOPES (NG, ANALYSES) (NON-ROUTINE)*	NOMINAL LLD	INDICATOR STATIONS MEAN, RANGE, AND NO. DETECTED**	STA.	HIGHEST STATION MEAN, RANGE, AND NO. DETECTED**	CONTROL LOCATIONS MEAN, RANGE, AND NO. DETECTED**
CE-144 (3) (0)	.2	(-0.6 + 7.3)E 1 (-0.6 + 0.0)E 1 0/ 0/ 110	21	(3.3 + 5.6)E 1 0/ 0/ 110	(2.3 + 3.0)E 1 (1.3 + 3.3)E 1 0/ 0/ 210
TH-232 (3) (0)	0.0E+02	(-0.2 + 7.2)E 1 (-0.2 + 0.0)E 1 0/ 0/ 110	21	(1.5 + .6)E 2 0/ 0/ 110	(1.0 + .5)E 2 (5.3 + 15.1)E 1 0/ 0/ 210

- * NON-ROUTINE REFERS TO THE NUMBER OF SEPARATE MEASUREMENTS WHICH WERE GREATER THAN TEN (10) TIMES THE AVERAGE BACKGROUND FOR THE PERIOD OF THE REPORT
** THE FRACTION OF SAMPLE ANALYSES YIELDING DETECTABLE MEASUREMENTS (I.E. SIGNIFICANT) IS INDICATED WITHIN A ()%.

CONTINUED

TABLE III-N-1

IV.

References

1. Regulatory Guide 1.109 - CALCULATION OF ANNUAL DOSES TO MAN
FROM ROUTINE RELEASES OF REACTOR EFFLUENTS FOR THE PURPOSE OF
EVALUATING COMPLIANCE WITH 10 CFR PART 50, APPENDIX I -
Revision 1, October 1977
2. SETTLEMENT AGREEMENT BETWEEN MASSACHUSETTS WILDLIFE FEDERATION
AND BOSTON EDISON COMPANY RELATING TO OFFSITE RADIOLOGICAL
MONITORING - June 9, 1977
3. Yankee Atomic Electric Company - Program "ERMAP", Version 3.1 -
January 9, 1979, Author - J. E. Vossahlik
4. Memorandum, Yankee Atomic Electric Company, 1982 Annual Direct
Radiation Survey, REG 124/82, August 1982, C. A. Pierno.
5. Memorandum, Yankee Atomic Electric Company, Reg. 211/76,
A. E. Desrosiers
6. Report on Accumulation of Cesium - 137 in Cranberries, March
1979 Yankee Atomic Electric Company, M. Strum

APPENDIX A - ANOMALOUS MEASUREMENT REPORTS

There were no Anomalous Measurement Reports
for the year of 1982.

APPENDIX B - Radioactive Effluents

EFFLUENT AND WASTE DISPOSAL SEMI-ANNUAL REPORT

Supplemental Information
January - June 1982

Facility Pilgrim Nuclear Power Station Licensee DPR-35

1. Regulatory Limits

- a. Fission and activation gases: $\frac{Q_s}{0.25/\bar{E}} + \frac{Q_v}{0.10/\bar{E}} \leq 1$
- b. Iodines 20Ci/Quarter
- c. Particulates, half-lives > 8 days: $13(1.8E4Q_s + 1.8E5Q_v) \leq 1$
- d. Liquid effluents: 10Ci/Quarter

2. Maximum Permissible Concentration

Provide the MPCs used in determining allowable release rates or concentrations.

- a. Fission and activation gases: } 10 CFR 20
b. Iodines: } Appendix B
c. Particulates, half-lives > 8 days: } Table II
d. Liquid effluents: H-3 = 1×10^{-5} μ Ci/ml; all rest, 10 CFR 20, Appendix B, Table II

3. Average Energy

Provide the average energy (\bar{E}) of the radionuclide mixture in releases of fission and activation gases, if applicable
MS=0.324; RBV=0.503

4. Measurements and Approximations of Total Radioactivity

Provide the methods used to measure or approximate the total radioactivity in effluents and the methods used to determine radionuclide composition.

- a. Fission and activation gases: } GeLi
b. Iodines: } Isotopic
c. Particulates: } Analysis
d. Liquid effluents: }

5. Batch Releases

Provide the following information relating to batch releases of radioactive materials in liquid and gaseous effluents

a. Liquid

1. Number of batch releases 121
2. Total time period for batch releases 192.92hrs
3. Maximum time period for a batch release - 7.75hrs
4. Average time period for batch releases 1.59hrs
5. Minimum time period for a batch release - 0.25hrs
6. Average stream flow during periods of release of effluent into a flowing stream 1.90E+5GPM

b. Gaseous (Not Applicable)

6. Abnormal Releases

- a.
- b. None

TABLE 1A
EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT
GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES
 January - June 1982

Unit	Quarter 1	Quarter 2	Est. Total Error, %
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A. Fission and activation gases

1. Total release	Ci	-	3.55E+3	2.50E+1
2. Average release rate for period	$\mu\text{Ci/sec}$	-	4.52E+2	
3. Percent of Technical Specification limit	%	-	6.92E-2	

B. Iodines

1. Total iodine-131	Ci	-	3.97E-3	2.54E+1
2. Average release rate for period	$\mu\text{Ci/sec}$	-	5.05E-4	
3. Percent of Technical Specification limit	%	-	1.99E-1	

C. Particulates

1. Particulates with half-lives > 8 days	Ci	$< 3.68\text{E}-4$	4.26E-3	3.05E+1
2. Average release rate for period	$\mu\text{Ci/sec}$	$< 4.73\text{E}-5$	5.42E-4	
3. Percent of Technical Specification limit	%	$< 8.39\text{E}-3$	6.98E-2	
4. Gross alpha radioactivity	Ci	$< 4.52\text{E}-7$	$< 5.61\text{E}-7$	

D. Tritium

1. Total release	Ci	2.34E0	5.92E0	3.20E+1
2. Average release rate for period	$\mu\text{Ci/sec}$	3.01E-1	7.52E-1	
3. Percent of Technical Specification limit	%	-	-	

TABLE 1B
EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT (1982)
GASEOUS EFFLUENTS – ELEVATED RELEASE
January - June 1982

CONTINUOUS MODE

BATCH MODE

Nuclides Released	Unit	Quarter	Quarter	Quarter	Quarter
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1. Fission gases

krypton-85	Ci	-	1.37E-2		
krypton-85m	Ci	-	2.93E+2		
krypton-87	Ci	-	6.55E+1		
krypton-88	Ci	-	3.62E+2		
xenon-133	Ci	-	2.28E+3		
xenon-135	Ci	-	2.61E+2		
xenon-135m	Ci	-	<6.06E+0		
xenon-138	Ci	-	<2.38E+1		
xenon-131m	Ci	-	-		
xenon-137	Ci	-	-		
xenon-133m	Ci	-	4.28E+1		
Total for period	Ci	-	3.33E+3		

2. Iodines

iodine-131	Ci	-	2.53E-3		
iodine-133	Ci	-	7.90E-3		
iodine-135	Ci	-	<6.55E-3		
Total for period	Ci	-	<1.70E-2		

3. Particulates

strontium-89	Ci	< 6.32E-7	5.16E-4		
strontium-90	Ci	< 6.26E-8	5.50E-6		
cesium-134	Ci				
cesium-137	Ci	<1.04E-5	1.14E-5		
barium-lanthanum-140	Ci		1.57E-3		
chromium-51	Ci				
manganese-54	Ci	8.90E-6	2.90E-6		
cobalt-58	Ci				
iron-59	Ci				
cobalt-60	Ci	< 7.86E-5	3.00E-5		
zinc-65	Ci				
zirconium-niobium-95	Ci				
cerium-141	Ci				
cerium-144	Ci				
ruthenium-103	Ci				
ruthenium-106	Ci				

TABLE 1C
EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT (1982)
GASEOUS EFFLUENTS - GROUND LEVEL RELEASE
 January - June 1982

Nuclides Released	Unit	CONTINUOUS MODE		BATCH MODE	
		Quarter	Quarter	Quarter	Quarter

1. Fission gases

krypton-85	Ci	-	1.01E-5		
krypton-85m	Ci	-	2.47E+1		
krypton-87	Ci	-	2.51E+0		
krypton-88	Ci	-	4.55E+1		
xenon-133	Ci	-	4.19E+1		
xenon-135	Ci	-	1.07E+2		
xenon-135m	Ci	-	-		
xenon-138	Ci	-	-		
Total for period	Ci	-	2.22E+2		

2. Iodines

iodine-131	Ci	-	1.44E-3		
iodine-133	Ci	-	6.50E-3		
iodine-135	Ci	-	<1.02E-2		
Total for period	Ci	-	<1.81E-2		

3. Particulates

strontium-89	Ci	1.64E-5	1.46E-3		
strontium-90	Ci	4.76E-7	1.44E-6		
cesium-134	Ci	1.17E-6			
cesium-137	Ci	2.42E-5	3.67E-5		
barium-lanthanum-140	Ci		3.95E-4		
manganese-54	Ci	1.08E-5	5.88E-6		
cobalt-58	Ci				
iron-59	Ci				
cobalt-60	Ci	2.16E-4	2.27E-4		
zinc-65	Ci				
zirconium-niobium-95	Ci				
cerium-141	Ci				
ruthenium-103	Ci				
ruthenium-106	Ci				

TABLE 2A
EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT (1982)
LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES
 January - June 1982

Unit	Quarter 1	Quarter 2	Est. Total Error, %
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A. Fission and activation products

1. Total release (not including tritium, noble gases, or alpha)	Ci	5.72E-1	1.44E-1	3.00E+1
2. Average diluted concentration during period	$\mu\text{Ci/ml}$	8.91E-8	7.58E-8	
3. Percent of applicable limit	%	5.72E0	1.44E0	

B. Tritium

1. Total release	Ci	5.26E0	1.99E-1	3.00E+1
2. Average diluted concentration during period	$\mu\text{Ci/ml}$	8.19E-7	1.05E-7	
3. Percent of applicable limit	%	8.19E0	1.05E0	

C. Dissolved and entrained gases

1. Total release	Ci	-	-	-
2. Average diluted concentration during period	$\mu\text{Ci/ml}$	-	-	
3. Percent of applicable limit	%	-	-	

D. Gross alpha radioactivity

1. Total release	Ci	$< 1.44\text{E-}4$	$< 1.73\text{E-}5$	4.00E+1
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E. Volume of waste released (prior to dilution)	liters	1.61E6	1.10E5	2.00E+1
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F. Volume of dilution water used during period	liters	6.42E9	1.90E9	2.00E+1
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TABLE 2B
EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT (1982)

LIQUID EFFLUENTS

January - June 1982

CONTINUOUS MODE

BATCH MODE

Nuclides Released	Unit	Quarter	Quarter	Quarter	Quarter
strontium-89	Ci			6.70E-4	1.89E-3
strontium-90	Ci			4.17E-4	1.65E-4
cesium-134	Ci			1.46E-2	7.42E-4
cesium-137	Ci			1.08E-1	6.60E-3
iodine-131	Ci			-	2.25E-6
cobalt-58	Ci			2.54E-3	8.23E-4
cobalt-60	Ci			2.44E-1	7.00E-2
iron-59	Ci			4.27E-5	3.06E-6
zinc-65	Ci			4.28E-3	1.20E-3
manganese-54	Ci			2.61E-2	1.01E-2
chromium-51	Ci			-	1.20E-5
zirconium-niobium-95	Ci			5.16E-4	6.74E-4
molybdenum 99- technetium 99m	Ci			-	-
barium-lanthanum-140	Ci			-	4.96E-5
cerium-141	Ci			1.65E-5	-
iodine-133	Ci			-	2.70E-6
cerium-144	Ci			-	1.75E-5
silver-110m	Ci			-	-
iron-55	Ci			1.47E-1	2.43E-2
unidentified	Ci			2.40E-2	2.72E-2
Total for period (above)	Ci			5.72E-1	1.44E-1
xenon-133	Ci			-	-
xenon-135	Ci			-	-

TABLE 3

EFFLUENT AND WASTE DISPOSAL SEMI-ANNUAL REPORT (1982)
SOLID WASTE AND IRRADIATED FUEL SHIPMENTS
JANUARY - JUNE 1982

A. SOLID WASTE SHIPPED OFF SITE FOR BURIAL OR DISPOSAL. (Not irradiated fuel.)

1. TYPE OF WASTE	UNIT	6 MONTH PERIOD	EST. TOTAL ERROR %
a. Spent resins, filter sludges, evaporator bottoms, etc.	m ³ Ci	97.299 123.60353	N/A N/A
b. Dry compressible waste, contaminated equipment, etc.	m ³ Ci	1539.11 10.67373	N/A N/A
c. Irradiated components, control rods, etc.	m ³ Ci	NONE	N/A
d. Other (Describe) Miscellaneous low-level waste	m ³ Ci	NONE	N/A

2. ESTIMATE OF MAJOR NUCLIDE COMPOSITION. (By Type of Waste)

		%	E(Curies)
a. Spent Resins, Filter	Sr90	.522	.64564
Sludges, Evap. Bottoms,	Sr89	19.972	24.68618
Diatomaceous Earth, Etc.	Fe55	12.697	15.69454
	Cs134	4.156	5.13671
	Cs137	26.327	32.54062
	Co58	1.220	1.50773
	Mn54	2.712	3.35228
	Zn65	.450	.55669
	Co60	31.633	39.09916
	La-140	.019	.02323
	Ba-140	.005	.00623
	I-131	.004	.00494
	Cr-51	.283	.34958
	TOTALS	100.000	123.60353

		%	E(Curies)
b. Dry Compressible Waste	Co60	50.24	5.36260
Contaminated Equipment	Co58	7.63	.81467
	Cs137	22.48	2.39956
	Cs134	6.75	.72011
	Fe55	1.75	.18635
	Fe59	1.14	.12171
	Sr89	.12	.01328
	Sr90	.01	.00027
	Zn65	.23	.02488
	Mn54	9.65	1.03030
	TOTALS	100.00	10.67373

c. N/A

d. N/A

3. SOLID WASTE DISPOSITION

<u>Number of Shipments</u>	<u>Mode of Transportation</u>	<u>Destination</u>
20	Tractor Trailer	Richland, Wash.
32	Tractor Trailer	Barnwell, S.C.

8. IRRADIATED FUEL SHIPMENTS (Disposition)

<u>Number of Shipments</u>	<u>Mode of Transportation</u>	<u>Destination</u>
NONE	N/A	N/A

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT

Supplemental Information

July-December 1982

Facility Pilgrim Nuclear Power Station

Licensee

DPR-35

1. Regulatory Limits

- a. Fission and activation gases $\frac{Q_s}{0.25/\bar{E}} + \frac{Q_v}{0.10/\bar{E}} = \leq 1$
- b. Iodines 20Ci per quarter
- c. Particulates, half-lives \gg days $13(1.8E4Q_s + 1.8E5Q_v) \leq 1$
- d. Liquid effluents 10Ci per quarter

2. Maximum Permissible Concentration

Provide the MPC's used in determining allowable release rates or concentrations

- a. Fission and activation gases } 10 CFR 20
- b. Iodines } Appendix B
- c. Particulates, half-lives \gg days } Table II
- d. Liquid effluents H-3 = 1×10^{-5} μ Ci/ml; all rest, 10 CFR 20, Appendix B, Table II

3. Average Energy

Provide the average energy (\bar{E}) of the radionuclide mixture in releases of fission and activation gases, if applicable. $\bar{E} = 1$ Mev

MS = 0.304 & 0.287; RBV = 0.391 & 0.494 (3rd & 4th quarter)

4. Measurements and Approximations of Total Radioactivity

Provide the methods used to measure or approximate the total radioactivity in effluents and the methods used to determine radionuclide composition

- a. Fission and activation gases } GeLi
- b. Iodines } Isotopic
- c. Particulates } Analysis
- d. Liquid effluents }

5. Batch Releases

Provide the following information relating to batch releases of radioactive materials in liquid and gaseous effluents

a. Liquid

1. Number of batch releases 77
2. Total time period for batch releases 87.48hrs
3. Maximum time period for a batch release - 4.08hrs
4. Average time period for batch releases 1.14hrs
5. Minimum time period for a batch release - 0.33hrs
6. Average stream flow during periods of release of effluent into a flowing stream 3.05E+5 GPM

b. Gaseous (Not Applicable)

6. Abnormal Releases

- a. None
- b. None

TABLE 1A
EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT
GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES
 July-December 1982

Unit	Quarter (3)	Quarter (4)	Est. Total Error, %
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A. Fission and activation gases

1. Total release	Ci	< 1.07E+4	< 5.19E+3	2.49E+1
2. Average release rate for period	μCi/sec	< 1.35E+3	< 6.53E+2	
3. Percent of Technical Specification limit	%	< 1.77E-1	< 8.25E-2	

B. Iodines

1. Total iodine-131	Ci	1.03E-2	9.32E-3	2.51E+1
2. Average release rate for period	μCi/sec	1.30E-3	1.17E-3	
3. Percent of Technical Specification limit	%	5.15E-1	4.66E-1	

C. Particulates

1. Particulates with half-lives > 8 days	Ci	8.20E-3	8.01E-3	3.03E+1
2. Average release rate for period	μCi/sec	1.03E-3	1.01E-3	
3. Percent of Technical Specification limit	%	9.67E-2	8.72E-2	
4. Gross alpha radioactivity	Ci	< 5.14E-7	< 4.50E-7	

D. Tritium

1. Total release	Ci	4.90E0	5.93E0	3.30E+1
2. Average release rate for period	μCi/sec	6.16E-1	7.46E-1	
3. Percent of Technical Specification limit	%	-	-	

TABLE 1B
EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT (1982)
GASEOUS EFFLUENTS – ELEVATED RELEASE

July-December 1982

CONTINUOUS MODE

BATCH MODE

Nuclides Released	Unit	Quarter (3)	Quarter (4)	Quarter	Quarter
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1. Fission gases

krypton-85	Ci	1.62E-2	1.60E-2		
krypton-85m	Ci	7.69E+2	5.47E+2		
krypton-87	Ci	< 1.87E+2	< 4.58E+1		
krypton-88	Ci	8.99E+2	4.99E+2		
xenon-133	Ci	4.51E+3	3.07E+3		
xenon-135	Ci	3.73E+3	7.36E+2		
xenon-135m	Ci	< 1.54E+1	< 9.26E0		
xenon-138	Ci	< 3.75E+1	< 3.90E+1		
xenon-131m	Ci	-	-		
xenon-137	Ci	-	-		
xenon-133m	Ci	1.30E+2	8.49E+1		
Total for period	Ci	< 1.03E+4	5.03E+3		

2. Iodines

iodine-131	Ci	4.66E-3	6.53E-3		
iodine-133	Ci	1.68E-2	2.24E-2		
iodine-135	Ci	< 1.22E-2	< 1.48E-2		
Total for period	Ci	< 3.37E-2	< 4.37E-2		

3. Particulates

strontium-89	Ci	1.62E-3	2.78E-3		
strontium-90	Ci	1.73E-5	1.83E-5		
cesium-134	Ci	8.15E-6	2.61E-6		
cesium-137	Ci	7.38E-5	5.76E-5		
barium-lanthanum-140	Ci	3.55E-3	2.68E-3		
chromium-51	Ci	-	-		
manganese-54	Ci	1.28E-5	3.65E-6		
cobalt-58	Ci	-	2.09E-6		
iron-59	Ci	-	-		
cobalt-60	Ci	1.55E-4	3.97E-5		
zinc-65	Ci	-	-		
zirconium-niobium-95	Ci	-	-		
cerium-141	Ci	-	-		
cerium-144	Ci	-	1.53E-5		
ruthenium-103	Ci	-	-		
ruthenium-106	Ci	2.70E-5	-		

TABLE 1C
EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT (1982)
GASEOUS EFFLUENTS - GROUND LEVEL RELEASE

July-December 1982

Nuclides Released	Unit	CONTINUOUS MODE		BATCH MODE	
		Quarter	Quarter	Quarter	Quarter
		(3)	(4)		

1. Fission gases

krypton-85	Ci	< 1.49E-5	5.03E-6		
krypton-85m	Ci	< 3.46E+1	1.21E+1		
krypton-87	Ci	< 9.16E0	< 4.07E0		
krypton-88	Ci	< 1.55E+1	2.43E+1		
xenon-133	Ci	1.41E+2	5.99E+1		
xenon-135	Ci	1.86E+2	5.86E+1		
xenon-135m	Ci	-	-		
xenon-138	Ci	-	-		
Total for period	Ci	< 3.86E+2	< 1.59E+2		

2. Iodines

iodine-131	Ci	5.66E-3	2.79E-3		
iodine-133	Ci	2.63E-2	1.18E-2		
iodine-135	Ci	4.26E-2	2.10E-2		
Total for period	Ci	7.46E-2	3.56E-2		

3. Particulates

strontium-89	Ci	1.29E-3	1.53E-3		
strontium-90	Ci	2.55E-6	2.53E-6		
cesium-134	Ci	1.89E-6	4.46E-6		
cesium-137	Ci	6.64E-5	2.14E-5		
barium-lanthanum-140	Ci	1.24E-3	7.85E-4		
manganese-54	Ci	1.25E-5	1.31E-6		
cobalt-58	Ci	-	3.74E-6		
iron-59	Ci	-	-		
cobalt-60	Ci	1.29E-4	5.90E-5		
zinc-65	Ci	-	-		
zirconium-niobium-95	Ci	-	-		
cerium-141	Ci	-	-		
ruthenium-103	Ci	-	-		
ruthenium-106	Ci	-	2.60E-5		

TABLE 2A
EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT (1982)
LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES

JULY-December 1982

Unit	3rd Quarter	4th Quarter	Est. Total Error, %
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A. Fission and activation products

1. Total release (not including tritium, noble gases, or alpha)	Ci	3.09E-2	1.25E-1	2.98E+1
2. Average diluted concentration during period	$\mu\text{Ci/ml}$	7.39E-9	6.65E-8	
3. Percent of applicable limit	%	3.09E-1	1.25E0	

B. Tritium

1. Total release	Ci	8.29E-4	4.55E-1	3.00E+1
2. Average diluted concentration during period	$\mu\text{Ci/ml}$	1.98E-10	2.42E-7	
3. Percent of applicable limit	%	1.98E-3	2.42E0	

C. Dissolved and entrained gases

1. Total release	Ci	-	5.39E-3	3.98E+1
2. Average diluted concentration during period	$\mu\text{Ci/ml}$	-	2.87E-9	
3. Percent of applicable limit	%	-	-	

D. Gross alpha radioactivity

1. Total release	Ci	$\leq 6.60\text{E-}6$	$\leq 1.65\text{E-}5$	4.01E+1
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E. Volume of waste released (prior to dilution)	liters	8.47E+4	2.01E+5	2.00E+1
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F. Volume of dilution water used during period	liters	4.18E+9	1.88E+9	2.00E+1
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TABLE 2B
EFFLUENT AND WASTE DISPOSAL SEMI-ANNUAL REPORT (1982)

LIQUID EFFLUENTS

July-December 1982

CONTINUOUS MODE

BATCH MODE

Nuclides Released	Unit	3rd Quarter	4th Quarter	Quarter	Quarter
strontium-89	Ci	1.64E-5	2.10E-5		
strontium-90	Ci	4.70E-5	7.78E-5		
cesium-134	Ci	3.30E-4	7.05E-4		
cesium-137	Ci	3.73E-3	9.65E-3		
iodine-131	Ci	5.87E-6	4.12E-5		
cobalt-58	Ci	4.42E-5	1.96E-3		
cobalt-60	Ci	8.67E-3	3.66E-2		
iron-59	Ci	3.49E-6	5.30E-4		
zinc-65	Ci	5.09E-5	5.37E-5		
manganese-54	Ci	6.49E-4	3.74E-3		
chromium-51	Ci	4.02E-5	6.57E-3		
zirconium-niobium-95	Ci	-	1.21E-6		
molybdenum 99- technetium 99m	Ci	-	5.71E-5		
barium-lanthanum-140	Ci	1.03E-6	4.38E-5		
cerium-141	Ci	2.14E-6	1.10E-4		
iodine-133	Ci	-	3.04E-6		
cerium-144	Ci	-	-		
silver-110m	Ci	-	8.01E-4		
iron-55	Ci	1.28E-2	2.41E-2		
unidentified	Ci	4.49E-3	3.95E-2		
Total for period (above)	Ci	3.09E-2	1.25E-1		
xenon-133	Ci	-	2.18E-3		
xenon-135	Ci	-	3.21E-3		

TABLE 3

EFFLUENT AND WASTE DISPOSAL SEMI-ANNUAL REPORT (1982)
SOLID WASTE AND IRRADIATED FUEL SHIPMENTS
JULY - DECEMBER 1982

A. SOLID WASTE SHIPPED OFF SITE FOR BURIAL OR DISPOSAL. (not irradiated fuel)

1. TYPE OF WASTE	UNIT	6 MONTH PERIOD	EST. TOTAL ERROR %
a. Spent resins, filter sludges, evaporator bottoms, etc.	m ³ Ci	99.007 819.10	N/A N/A
b. Dry compressible waste, contaminated equipment, etc.	m ³ Ci	547.666 5.14564	N/A N/A
c. Irradiated components, control rods, etc.	m ³ Ci	none none	N/A N/A
d. Other (describe) Miscellaneous low-level waste	m ³ Ci	none none	N/A N/A

2. ESTIMATE OF MAJOR NUCLIDE COMPOSITION. (by type of waste)

		%	E(Curies)
a. Spent Resins, Filter	Co-60	41.324	338.48620
Sludges, Evaporator	Co-58	3.864	31.65107
Bottoms, etc.	Cs-137	13.426	109.97068
	Cs-134	1.489	12.19371
	Fe-55	11.164	99.44832
	Fe-59	.597	4.89055
	I-131	.464	3.79925
	I-133	.070	.57668
	La-140	.220	1.80569
	Ba-140	.019	.15592
	Sr-89	15.478	126.78505
	Sr-90	.345	2.82477
	Sr-91	.003	.02146
	Tc-99m	.040	.32557
	Zn-65	.723	5.92615
	Mn-54	4.614	37.79740

2. ESTIMATE OF MAJOR NUCLIDE COMPOSITION. (by type of waste)

CONTINUED

		%	E(Curies)
a. Spent Resins, Filter Sludges, Evap. Bottoms, Diatomaceous Earth, etc. continued	Nb-95	.002	.01495
	Cr-51	6.090	49.88606
	Ag-110m	< .001	.00641
	Ce-141	.030	.24916
	Ru-103	.014	.11290
	Sr-92	.001	.00691
	Sb-124	.010	.08267
	Xe-133	< .001	.00034
	Xe-135	.004	.03266
	Mo-99	.007	.05629
	TOTAL:	100.000	819.10682

		%	E(Curies)
b. Dry Compressible Waste, Contaminated Equipment	Co-60	17.46	.89843
	Co-58	6.32	.32546
	Cs-137	6.04	.31058
	Cs-134	1.65	.08565
	Fe-59	1.17	.06038
	I-131	2.74	.14116
	Ba-140	3.76	.19341
	Zn-65	.86	.04430
	Mn-54	3.39	.17448
	Cr-51	56.60	2.91179
	TOTAL:	100.000	5.14564

c. N/A

d. N/A

3. SOLID WASTE DISPOSITION

<u>Number of Shipments</u>	<u>Mode of Transportation</u>	<u>Destination</u>
37	Tractor Trailer	Barnwell, S.C.
2	Tractor Trailer	Richland, Wash.

4. IRRADIATED FUEL SHIPMENTS (Disposition)

<u>Number of Shipments</u>	<u>Mode of Transportation</u>	<u>Destination</u>
none	N/A	N/A

160 FT TOWER - 33 FT EL

33.0 FT WIND DATA

7/1/82 - 9/31/82

STABILITY CLASS A-- DELTA T LESS THAN -1.9 DEG C PER 100 METERS

CLASS FREQUENCY (PERCENT) = 44.89

WIND DISTRIBUTION SUMMARY

SPEED(MPH)	N	NNE	NE	ENE	E	ESE	SE	DIRECTION SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
-CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CALM- 3.5	0	9	0	6	3	0	0	3	0	3	0	0	0	0	0	0	24
(1)	0.0	1.2	0.0	0.8	0.4	0.0	0.0	0.4	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	3.3
(2)	0.0	0.5	0.0	0.4	0.2	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	1.5
3.6- 7.5	12	6	9	6	15	45	54	21	15	30	12	6	18	27	18	33	327
(1)	1.6	0.8	1.2	0.8	2.0	6.1	7.3	2.8	2.0	4.1	1.6	0.8	2.4	3.7	2.4	4.5	44.3
(2)	0.7	0.4	0.5	0.4	0.9	2.7	3.3	1.3	0.9	1.8	0.7	0.4	1.1	1.6	1.1	2.0	19.9
7.6-12.5	6	3	0	0	0	0	6	12	9	75	87	48	45	24	3	3	321
(1)	0.8	0.4	0.0	0.0	0.0	0.0	0.8	1.6	1.2	10.2	11.8	6.5	6.1	3.3	0.4	0.4	43.5
(2)	0.4	0.2	0.0	0.0	0.0	0.0	0.4	0.7	0.5	4.6	5.3	2.9	2.7	1.5	0.2	0.2	19.5
12.6-18.5	9	6	0	0	0	0	0	0	0	33	15	3	0	0	0	0	66
(1)	1.2	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5	2.0	0.4	0.0	0.0	0.0	0.0	8.9
(2)	0.5	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.9	0.2	0.0	0.0	0.0	0.0	4.0
18.6-24.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OVER-24.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ALL SPEEDS	27	24	9	12	18	45	60	36	24	141	114	57	63	51	21	36	738
(1)	3.7	3.3	1.2	1.6	2.4	6.1	8.1	4.9	3.3	19.1	15.4	7.7	8.5	6.9	2.8	4.9	100.0
(2)	1.6	1.5	0.5	0.7	1.1	2.7	3.6	2.2	1.5	8.6	6.9	3.5	3.8	3.1	1.3	2.2	44.9

(1)-PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE

(2)-PERCENT OF ALL GOOD OBSERVATIONS FOR THE PERIOD

NUMBER OF GOOD OBSERVATIONS ON THIS PAGE= 738

CALM=WIND SPEED LESS THAN 1.00MPH

Distribution of Wind Directions
and Speeds for the 33 Ft. Level
of the 160 Ft. Tower

TABLE 4A-1

APPENDIX C - 1982 Soil Survey

Results of Boston Edison In Situ Gamma Spectrometry Soil Analysis for 1982

Introduction

In compliance with Boston Edison's Technical Specifications for radiological monitoring of the environment, in situ gamma spectrometry analyses were performed at eleven sites during May, October and December of 1982. In addition to the gamma spectrometry, which employs a Ge(Li) "downlooker" detector in accordance with Reference 1, measurements were taken with a pressurized ion chamber (PIC) to assess the total exposure rates, and soil core samples were taken at five of the stations to confirm the in situ results.

At all eleven stations, by far the major contributors to the exposure rate due to soil were naturally occurring radionuclides and Cs-137, which is a result of fallout from weapons testing. A small amount of Co-60 was present in the soil at one site. These results are summarized in Tables 1-12, and the original data is on permanent file at the Environmental Laboratory.

Methodology

In situ gamma spectrometry was performed at each of the eleven locations, along with PIC measurements for comparison. When possible, a soil sample was also taken for laboratory gamma analysis.

In situ gamma spectrometry is a convenient and efficient technique used to evaluate the radioactive constituents of the soil. Using assumptions concerning the soil composition and distribution of the radionuclide of interest, the exposure rate and activity concentration of that radionuclide can be calculated. This is done using the spectrum obtained with an unshielded Ge(Li) detector placed above the ground, together with detector specific parameters such as efficiency. The radionuclides of interest are fallout and plant related fission and activation products, as well as those which occur naturally. In evaluating the activity concentration and exposure rate for a given radionuclide, a parameter describing depth distribution, α/ρ , must be evaluated. For naturally occurring radionuclides a value of zero is assumed, implying no increase or decrease in the concentration with soil depth. For radionuclides present only on the surface, such as those from fresh fallout, a value of infinity is used. (This value is also used for calculations of apparent activity concentrations and exposure rates for those radionuclides not found during the peak search.) For man-made radionuclides found in the soil and not believed to be recently deposited, an exponential distribution is assumed with $\alpha/\rho = .206$. This value is a good compromise between deep distribution and surface deposition; and laboratory analysis usually confirms that these radionuclides are present throughout the first six inches of soil implying a period of migration. This procedure of in situ gamma spectrometry is explained in detail in Reference 2.

The PIC measurement, which includes all components of the exposure rate, not just terrestrial, is used to evaluate how much of the total exposure rate can be explained by the in situ results together with the cosmic contribution. At control stations, away from the plant's influence, the PIC measurement is used to check the in situ results, as one would expect the terrestrial exposure rate, calculated using the in-situ methodology, together with the cosmic contribution to closely approximate the PIC results.

When possible soil core samples are also taken and analyzed at the laboratory to confirm the presence or absence of radionuclides in the soil which have been identified in the in situ analysis. In this way, the source term is identified as soil or unknown. In the latter case, the in situ calculations are not valid and results are not reported. In addition, analysis of the different core sections aids in defining the depth distribution of the radionuclide.

Results

Tables 1-11 contain the results from the in situ gamma analysis for the eleven sites. (It should be noted that in August the Ge(Li) detector was repaired to remedy increasingly poor resolution. The poor resolution was not a problem in the measurements conducted during May; and prior to analysis of the remaining three sites, the operating characteristics of the detector were carefully checked with the result that recalibration following the repair was deemed unnecessary for in situ analysis (Reference 3).) Each table lists the apparent exposure rate and activity concentration for each of thirteen fission and activation products, as well as for three naturally occurring radionuclides. LLD values were not calculated for nuclides with more than one peak, as in these cases all of the peaks found were used to calculate the total exposure rate and activity concentration for that nuclide (or series). Table 12 contains all positive in situ results as well as PIC measurements for comparison.

With two exceptions, all exposure rates due to activity within the soil are more than 95 percent resulting from natural radiation. The remainder is almost entirely due to Cs-137 which is considered to be a result of weapons testing and is found throughout the environment. The first exception is high Cs-137 concentration at site 10, resulting in 17 percent of the total exposure rate due to soil. The activity concentration for Cs-137 at this site is greater than five times the average value for the other stations. The most probable explanation for this is that the detector may have been placed over a local accumulation point of debris, and therefore the fallout related Cs-137 was present in a higher than average concentration. It should be noted that sites considerably closer to the plant showed only typical environmental levels of Cs-137, and the high concentration is therefore not likely to be plant related. The second case in which the exposure rate due to soil was more than 5 percent related to fission or activation products, was at station 7 where Co-60 was identified during in situ analysis, and confirmed by Laboratory soil analysis. The activity concentration was calculated to be 305 ± 7 pCi/kg, assuming a value for α/ρ equal to .206, while Laboratory analysis resulted in a value of 224 ± 13 pCi/kg. The value for α/ρ is likely to be greater than .206, i.e. the distribution of Co-60 was more planar, as it was not found in the 2"-4" core section. This increase in α/ρ would result in a lower value for activity concentration more in line with the Laboratory results. In any case, the exposure rate due to Co-60 was calculated to be less than 1 μ R/hr.

Cobalt-60 was identified at three additional sites, but could not be confirmed by Laboratory soil analysis (there was no core sample submitted for site 00). As the source term was therefore unknown for these sites, the exposure rates which were calculated assuming soil to be the source term, are not valid and were not listed in Table 12. It should also be noted that Zr-95 was detected at two sites at levels at or below LLD, but these results could not be confirmed by soil analysis at the Laboratory.

The PIC measurements agreed well with the in situ results, when a cosmic component of 3.6 μ R/hr (Reference 4) was added, with a few notable exceptions. Sites 00, 07 and 08 showed relatively high PIC measurements which could not be explained with the Ge(Li) results. These sites are all within 0.15 miles of the plant so that the higher than background exposure rates were most likely a result of some source term other than soil.

References

- (1) Yael Procedure Number 510, Rev. 1, "Identification and Quantitative Determination of Radionuclides in Soil by Gamma-Ray In-Situ Spectrometry."
- (2) HASL-258, "In-Situ Ge(Li) and NaI(Tl) Gamma-Ray Spectrometry," September 1972.
- (3) Yael Memo ELG 265/82 "Intrinsic Efficiency Check on Ge(Li) Detector No. 1."
- (4) "Cosmic-Ray Ionization in the Lower Atmosphere," Wayne M. Londer and Harold Beck, Journal of Geophysical Research, Vol. 17, No. 19, October 1, 1966.

TABLE 1

LOCATION: WAREHOUSE

LOCATION#: 00

COUNT TIME: 6000sec

COUNT DATE: 05/27/82

InSitu COUNTING RESULTS

NUCLIDE ID	EXPOSURE RATE microR/hr	CONCENTRATION picoCi/Kgram
NAME	EXPOSURE+-1-SIGMA RATE	CONC +- 1-SIGMA
	LLD	LLD
Ce-144	(-22+- 15) E-4	(-100+- 68) E 0
Ce-141	(3+- 13) E-4	(3+- 14) E 0
I-131	(9+- 34) E-4	(12+- 46) E-1
Sb-125	(1+- 11) E-3	(1+- 13) E 0
Ru-103	(47+- 40) E-4	(45+- 38) E-1
Ba-140	(29+- 57) E-4	(7+- 13) E 0
Ru-106	(-2+- 13) E-3	(-5+- 79) E 0
* Cs-137	(1565+- 94) E-4	(295+- 17) E 0
Zr-95	(74+- 85) E-4	(40+- 46) E-1
Db-95	(-22+- 50) E-4	(11+- 26) E 1
Mn-54	(118+- 53) E-4	(54+- 24) E-1
* Co-60	(707+- 21) E-3	(2102+- 64) E-1
La-140	(21+- 11) E-3	(27+- 14) E-1
* K-40	(2714+- 33) E-3	(1516+- 21) E 1
* Th-232	(2138+- 63) E-3	(750+- 22) E 0
* U-238	(1305+- 48) E-3	(761+- 26) E 0

Notes:

* Activity greater than 3*standard deviation

+ Peak is found

---- LLD is not calculated

TABLE 2

LOCATION: ROCKY HILL RD.

LOCATION#: 01

COUNT TIME: 6000sec

COUNT DATE: 05/27/82

InSitu COUNTING RESULTS

NUCLIDE ID	EXPOSURE RATE microR/hr	CONCENTRATION picoCi/Kgram		
NAME	EXPOSURE +- 1-SIGMA RATE	LLD	CONC +- 1-SIGMA	LLD
Ce-144	(-29+- 96) E-5	330E-5	(-13+- 43) E 0	150E 0
Ce-141	(-32+- 86) E-5	300E-5	(-35+- 92) E-1	320E-1
I-131	(-13+- 25) E-4	88E-4	(-17+- 34) E-1	120E-1
Sb-125	(164+- 89) E-4	320E-4	(19+- 10) E 0	36E 0
Ru-103	(15+- 31) E-4	110E-4	(14+- 29) E-1	110E-1
Ba-140	(31+- 46) E-4	170E-4	(7+- 11) E 0	39E 0
Ru-106	(6+- 10) E-3	39E-3	(12+- 23) E 0	82E 0
* Cs-137	(1630+- 76) E-4	230E-4	(296+- 14) E 0	41E 0
Zr-95	(121+- 71) E-4	250E-4	(65+- 39) E-1	130E-1
Nb-95	(-31+- 42) E-4	150E-4	(-16+- 22) E-1	72E-1
Mn-54	(78+- 46) E-4	150E-4	(36+- 19) E-1	68E-1
Co-60	(30+- 11) E-3	40E-3	(39+- 15) E-1	52E-1
La-140	(5+- 10) E-3	38E-3	(7+- 13) E-1	48E-1
* K-40	(2212+- 34) E-3	42E-3	(1236+- 19) E 1	27E 1
* Th-232	(2252+- 59) E-3	-----	(799+- 21) E 0	-----
* U-238	(1346+- 41) E-3	-----	(740+- 23) E 0	-----

Notes:

* Activity greater than 3x standard deviation

: Peak is found

--- LLD is not calculated

TABLE 3

LOCATION: ROCKY HILL RD. (W)

LOCATION#: 03

COUNT TIME: 6000sec

COUNT DATE: 12/15/82

InSitu COUNTING RESULTS

NUCLIDE ID	EXPOSURE RATE microR/hr		CONCENTRATION picoCi/Kgram	
NAME	EXPOSURE ± 1-SIGMA RATE	LLD	CONC ± 1-SIGMA	LLD
Ce-144	(-10+- 12) E-4	43E-4	(-43+- 53) E 0	190E 0
Ce-141	(-3+- 11) E-4	30E-4	(-8+- 11) E 0	41E 0
I-131	(-24+- 31) E-4	110E-4	(-33+- 42) E-1	150E-1
Sb-125	(-27+- 24) E-4	340E-4	(-3+- 11) E 0	32E 0
Ru-103	(-55+- 33) E-4	120E-4	(-52+- 32) E-1	120E-1
Da-140	(-47+- 47) E-4	130E-4	(-11+- 11) E 0	41E 0
Ru-106	(-2+- 11) E-3	40E-3	(-4+- 24) E 0	89E 0
*+ Cs-137	(-513+- 55) E-4	160E-4	(-1123+- 100) E-1	220E-1
Zr-95	(-42+- 73) E-4	260E-4	(-23+- 40) E-1	140E-1
Nb-95	(-7+- 42) E-4	120E-4	(-12+- 53) E-1	150E-1
Mn-54	(-100+- 45) E-4	160E-4	(-45+- 20) E-1	71E-1
Co-60	(-24+- 12) E-3	44E-3	(-31+- 16) E-1	56E-1
La-140	(-19+- 11) E-3	38E-3	(-25+- 14) E-1	49E-1
*+ K-40	(-2494+- 35) E-3	44E-3	(-1373+- 20) E 1	24E 1
*+ Th-232	(-2470+- 57) E-3	-----	(-976+- 20) E 0	-----
*+ U-238	(-1170+- 35) E-3	-----	(-643+- 17) E 0	-----

Notes:

* Activity greater than 3*standard deviation

+ Peak is found

----- LLD is not calculated

TABLE 4

LOCATION: PLY. CENTER

LOCATION#: 04

COUNT TIME: 6000sec

COUNT DATE: 10/07/82

InSitu COUNTING RESULTS

NUCLIDE ID	EXPOSURE RATE microR/hr	CONCENTRATION picoCi/Kgram		
NAME	EXPOSURE+-1-SIGMA RATE	LLD	CONC +- 1-SIGMA	LLD
Ce-144	(-5+- 12) E-4	43E-4	(-22+- 53) E 0	170E 0
Ce-141	(-17+- 10) E-4	57E-4	(-18+- 11) E 0	40E 0
I-131	(-56+- 31) E-4	110E-4	(-76+- 43) E-1	160E-1
Sb-125	(-5+- 96) E-4	350E-4	(-1+- 11) E 0	39E 0
Ru-103	(-22+- 34) E-4	120E-4	(-21+- 32) E-1	120E-1
Ba-140	(-19+- 49) E-4	180E-4	(-4+- 11) E 0	41E 0
Ru-106	(-6+- 11) E-3	40E-3	(-14+- 24) E 0	89E 0
* Cs-137	(-2763+- 74) E-4	160E-4	(-302+- 14) E 0	30E 0
Zr-95	(-10+- 75) E-4	270E-4	(-5+- 40) E-1	150E-1
Nb-95	(-164+- 46) E-4	170E-4	(-84+- 23) E-1	80E-1
Mn-54	(-45+- 60) E-4	210E-4	(-50+- 67) E-1	240E-1
Co-60	(-3+- 12) E-3	45E-3	(-4+- 15) E-1	50E-1
La-140	(-13+- 14) E-3	52E-3	(-41+- 43) E-1	160E-1
* K-40	(-2382+- 34) E-3	43E-3	(-1331+- 19) E-1	24E-1
* Th-232	(-2414+- 55) E-3	-----	(-856+- 19) E 0	-----
* U-238	(-1571+- 37) E-3	-----	(-863+- 21) E 0	-----

Notes:

* Activity greater than 3*standard deviation

+ Peak is found

----- LLD is not calculated

TABLE 5

LOCATION: PROPERTY LINE

LOCATION#: 06

COUNT TIME: 6000sec

COUNT DATE: 05/26/82

InSitu COUNTING RESULTS

NUCLIDE ID		EXPOSURE RATE microR/hr		CONCENTRATION picoCi/Kgram	
NAME	EXPOSURE+/-1-SIGMA RATE	LLD	CONC +/- 1-SIGMA	LLD	
Ce-144	(4+- 12) E-4	43E-4	(15+- 54) E 0	190E 0	
Ce-141	(-8+- 11) E-4	37E-4	(-8+- 11) E 0	42E 0	
I-131	(25+- 31) E-4	110E-4	(34+- 42) E-1	150E-1	
Sb-125	(212+- 95) E-4	340E-4	(25+- 11) E 0	38E 0	
Ru-103	(38+- 32) E-4	120E-4	(36+- 31) E-1	110E-1	
Ba-140	(-34+- 47) E-4	170E-4	(-8+- 11) E 0	40E 0	
Ru-106	(15+- 11) E-3	39E-3	(33+- 24) E 0	85E 0	
* Cs-137	(1072+- 82) E-4	250E-4	(344+- 15) E 0	46E 0	
Zr-95	(140+- 72) E-4	250E-4	(76+- 39) E-1	140E-1	
Nb-95	(33+- 41) E-4	150E-4	(17+- 21) E-1	76E-1	
Mn-54	(115+- 60) E-4	210E-4	(127+- 57) E-1	230E-1	
* Co-60	(39+- 12) E-3	44E-3	(50+- 16) E-1	56E-1	
La-140	(3+- 11) E-3	41E-3	(3+- 14) E-1	52E-1	
* K-40	(2103+- 34) E-3	54E-3	(1178+- 12) E 1	30E 1	
* Th-232	(2320+- 60) E-3	-----	(823+- 21) E 0	-----	
* U-238	(1295+- 42) E-3	-----	(712+- 23) E 0	-----	

Notes:

* Activity greater than 3*standard deviation

+ Peak is found

----- LLD is not calculated

TABLE 6

LOCATION: PEDESTRIAN BRIDGE

LOCATION#: 07

COUNT TIME: 6000sec

COUNT DATE: 05/26/82

InSitu COUNTING RESULTS

NUCLIDE ID	EXPOSURE RATE microR/hr	CONCENTRATION picoCi/Kgram		
NAME	EXPOSURE+-1-SIGMA RATE	LLD	CONC +- 1-SIGMA	LLD
Ce-144	(5+- 15) E-4	52E-4	(23+- 67) E 0	230E 0
Ce-141	(-10+- 13) E-4	46E-4	(-11+- 14) E 0	50E 0
I-131	(49+- 35) E-4	120E-4	(65+- 47) E-1	160E-1
Sb-125	(28+- 12) E-3	42E-3	(32+- 13) E 0	48E 0
Ru-103	(37+- 40) E-4	140E-4	(35+- 38) E-1	140E-1
Ba-140	(40+- 52) E-4	210E-4	(9+- 14) E 0	50E 0
Ru-106	(14+- 13) E-3	47E-3	(31+- 29) E 0	100E 0
*+ Cs-137	(113+- 80) E-4	250E-4	(206+- 14) E 0	46E 0
* Zr-95	(280+- 89) E-4	310E-4	(151+- 48) E-1	170E-1
Nb-95	(79+- 52) E-4	180E-4	(40+- 27) E-1	75E-1
Mn-54	(61+- 55) E-4	200E-4	(28+- 25) E-1	90E-1
*+ Co-60	(989+- 23) E-3	97E-3	(3051+- 70) E-1	300E-1
La-140	(-17+- 11) E-3	41E-3	(-21+- 14) E-1	52E-1
*+ K-40	(2143+- 34) E-3	55E-3	(1197+- 19) E 1	31E 1
*+ Th-232	(2211+- 61) E-3	-----	(784+- 22) E 0	-----
*+ U-238	(1267+- 46) E-3	-----	(696+- 25) E 0	-----

Notes:

* Activity greater than 3*standard deviation

+ Peak is found

----- LLD is not calculated

TABLE 7

LOCATION: OVERLOOK

LOCATION#: 08

COUNT TIME: 6000sec

COUNT DATE: 05/26/82

InSitu COUNTING RESULTS

NUCLIDE ID	EXPOSURE RATE microR/hr		CONCENTRATION picoCi/Kgram	
NAME	EXPOSURE+-1-SIGMA RATE	LLD	CUNC +- 1-SIGMA	LLD
Ce-144	(-25+- 21) E-4	78E-4	(-111+- 96) E 0	350E 0
Ce-141	(-13+- 19) E-4	69E-4	(-20+- 20) E 0	74E 0
I-131	(-46+- 51) E-4	180E-4	(-64+- 70) E-1	250E-1
Sb-125	(11+- 15) E-3	54E-3	(12+- 17) E 0	61E 0
Ru-103	(-56+- 54) E-4	190E-4	(-53+- 51) E-1	190E-1
Ba-140	(-6+- 75) E-4	270E-4	(-1+- 17) E 0	63E 0
Ru-106	(-25+- 17) E-3	63E-3	(-55+- 38) E 0	140E 0
*+ Cs-137	(1031+- 07) E-4	280E-4	(127+- 16) E 0	51E 0
Zr-95	(8+- 11) E-3	41E-3	(43+- 61) E-1	220E-1
Nb-95	(-65+- 67) E-4	240E-4	(-34+- 35) E-1	130E-1
Mn-54	(80+- 99) E-4	350E-4	(9+- 11) E 0	39E 0
*+ Co-60	(957+- 27) E-3	110E-3	(2759+- 82) E-1	350E-1
La-140	(-29+- 18) E-3	69E-3	(-37+- 23) E-1	88E-1
*+ K-40	(2607+- 41) E-3	91E-3	(1458+- 23) E 1	51E 1
*+ Th-232	(2052+- 73) E-3	-----	(728+- 26) E 0	-----
*+ U-238	(1210+- 55) E-3	-----	(665+- 30) E 0	-----

Notes:

* Activity greater than 3*standard deviation

+ Peak is found

----- LLD is not calculated

TABLE 8

LOCATION: EAST BREAKWATER

LOCATION#: 09

COUNT TIME: 6000sec

COUNT DATE: 05/27/82

InSitu COUNTING RESULTS

NUCLIDE ID	EXPOSURE RATE microR/hr		CONCENTRATION picoCi/Kgram	
NAME	EXPOSURE+-1-SIGMA RATE	LLD	CONC +- 1-SIGMA	LLD
Ce-144	(6+- 12) E-4	43E-4	(27+- 54) E 0	190E 0
Ce-141	(12+- 11) E-4	38E-4	(13+- 11) E 0	41E 0
I-131	(-17+- 31) E-4	110E-4	(-23+- 42) E-1	150E-1
Gb-125	(-31+- 95) E-4	350E-4	(-3+- 11) E 0	39E 0
Ru-103	(39+- 34) E-4	120E-4	(37+- 32) E-1	110E-1
Ba-140	(50+- 49) E-4	180E-4	(12+- 11) E 0	41E 0
Ru-106	(1+- 11) E-3	41E-3	(3+- 25) E 0	89E 0
* Cs-137	(1060+- 69) E-4	210E-4	(182+- 13) E 0	39E 0
* Zr-95	(269+- 72) E-4	250E-4	(145+- 39) E-1	130E-1
Nb-95	(7+- 44) E-4	160E-4	(4+- 23) E-1	82E-1
Mn-54	(-14+- 46) E-4	170E-4	(-7+- 21) E-1	76E-1
Co-60	(33+- 13) E-3	47E-3	(43+- 17) E-1	61E-1
La-140	(0+- 11) E-3	40E-3	(-1+- 14) E-1	51E-1
*+ K-40	(2766+- 38) E-3	57E-3	(1345+- 21) E 1	32E 1
*+ Th-232	(2467+- 63) E-3	-----	(875+- 22) E 0	-----
*+ U-238	(1357+- 44) E-3	-----	(746+- 24) E 0	-----

Notes:

* Activity greater than 3*standard deviation

+ Peak is found

----- LLD is not calculated

TABLE 9

LOCATION: CLEFT ROCK

LOCATION#: 10

COUNT TIME: 6000sec

COUNT DATE: 05/28/82

InSitu COUNTING RESULTS

NUCLIDE ID	EXPOSURE RATE		CONCENTRATION	
	microR/hr		picoCi/Kgram	
NAME	EXPOSURE+-1-SIGMA RATE	LLD	CONC +- 1-SIGMA	LLD
Ce-144	(95+- 99) E-5	340E-5	(43+- 44) E 0	150E 0
Ce-141	(86+- 88) E-5	310E-5	(72+- 95) E-1	330E-1
I-131	(23+- 27) E-4	92E-4	(31+- 36) E-1	130E-1
Sb-125	(108+- 96) E-4	350E-4	(12+- 11) E 0	37E 0
Ru-103	(26+- 33) E-4	120E-4	(25+- 31) E-1	110E-1
Ba-140	(-5+- 47) E-4	170E-4	(-1+- 11) E 0	40E 0
Ru-106	(28+- 11) E-3	37E-3	(61+- 23) E 0	82E 0
*+ Cs-137	(942+- 12) E-3	25E-3	(1713+- 22) E 0	46E 0
Zr-95	(110+- 65) E-4	230E-4	(59+- 35) E-1	120E-1
Nb-95	(25+- 38) E-4	140E-4	(13+- 20) E-1	70E-1
Mn-54	(-27+- 41) E-4	150E-4	(-12+- 19) E-1	69E-1
Co-60	(19+- 11) E-3	41E-3	(24+- 15) E-1	53E-1
La-140	(-56+- 96) E-4	360E-4	(-7+- 12) E-1	46E-1
*+ K-40	(1677+- 30) E-3	48E-3	(937+- 17) E 1	27E 1
*+ Th-232	(1952+- 55) E-3	-----	(692+- 20) E 0	-----
*+ U-238	(917+- 37) E-3	-----	(505+- 21) E 0	-----

Notes:

* Activity greater than 3*standard deviation

+ Peak is found

----- LLD is not calculated

TABLE 10

LOCATION: EAST WEYMOUTH

LOCATION#: 15

COUNT TIME: 6000sec

COUNT DATE: 10/07/82

InSitu COUNTING RESULTS

NUCLIDE ID		EXPOSURE RATE microR/hr		CONCENTRATION picoCi/Kgram	
NAME	EXPOSURE+-1-SIGMA RATE	LLD	CONC +- 1-SIGMA	LLD	
Ce-144	(-9+- 12) E-4 *	43E-4	(-39+- 54) E 0	190E 0	
Ce-141	(0+- 11) E-4	38E-4	(0+- 11) E 0	41E 0	
I-131	(-52+- 32) E-4	120E-4	(-71+- 43) E-1	160E-1	
Sb-125	(274+- 26) E-4	340E-4	(31+- 11) E 0	39E 0	
Ru-103	(-4+- 34) E-4	120E-4	(-4+- 33) E-1	120E-1	
Ru-140	(-18+- 42) E-4	180E-4	(4+- 12) E 0	42E 0	
Ru-106	(0+- 12) E-3	42E-3	(1+- 25) E 0	92E 0	
*+ Cs-137	(2726+- 82) E-4	220E-4	(496+- 15) E 0	39E 0	
Zr-95	(170+- 74) E-4	260E-4	(92+- 40) E-1	140E-1	
Nb-95	(-38+- 47) E-4	170E-4	(-19+- 24) E-1	87E-1	
Mn-54	(129+- 46) E-4	160E-4	(59+- 21) E-1	73E-1	
Co-60	(-8+- 13) E-3	49E-3	(-10+- 17) E-1	63E-1	
La-140	(25+- 10) E-3	36E-3	(32+- 13) E-1	46E-1	
*+ K-40	(3007+- 39) E-3	48E-3	(1680+- 22) E 1	27E 1	
*+ Th-232	(2570+- 60) E-3	-----	(911+- 21) E 0	-----	
*+ U-238	(1435+- 38) E-3	-----	(708+- 21) E 0	-----	

Notes:

* Activity greater than 3x standard deviation

+ Peak is found

----- LLD is not calculated

TABLE 11

LOCATION: MANOMET SUB STA.

LOCATION#: 17

COUNT TIME: 6000sec

COUNT DATE: 05/28/82

InSitu COUNTING RESULTS

NUCLIDE ID	EXPOSURE RATE microR/hr		CONCENTRATION picoCi/Kgram	
NAME	EXPOSURE +-1-SIGMA RATE	LLD	CONC +- 1-SIGMA	LLD
Ce-144	(62+- 93) E-5	320E-5	(29+- 42) E 0	150E 0
Ce-141	(136+- 84) E-5	290E-5	(146+- 90) E-1	310E-1
I-131	(14+- 24) E-4	85E-4	(19+- 33) E-1	120E-1
Sb-125	(-102+- 87) E-4	320E-4	(-12+- 10) E 0	37E 0
Ru-103	(10+- 31) E-4	110E-4	(10+- 29) E-1	110E-1
Ba-140	(-51+- 45) E-4	170E-4	(-12+- 11) E 0	39E 0
Ru-106	(21+- 10) E-3	36E-3	(45+- 22) E 0	79E 0
*+ Cs-137	(2128+- 64) E-4	43E-4	(307+- 12) E 0	7.8E 0
Zr-95	(111+- 67) E-4	240E-4	(60+- 36) E-1	130E-1
Nb-95	(-38+- 40) E-4	140E-4	(-20+- 20) E-1	74E-1
Mn-54	(11+- 41) E-4	150E-4	(5+- 19) E-1	67E-1
Co-60	(8+- 11) E-3	39E-3	(10+- 14) E-1	51E-1
La-140	(70+- 97) E-4	360E-4	(9+- 12) E-1	45E-1
*+ K-40	(2033+- 32) E-3	47E-3	(1136+- 18) E 1	26E 1
*+ Th-232	(2210+- 58) E-3	-----	(784+- 20) E 0	-----
*+ U-238	(1280+- 39) E-3	-----	(703+- 21) E 0	-----

Notes:

* Activity greater than 3*standard deviation

+ Peak is found

----- LLD is not calculated

TABLE 12

1982 In Situ Results
Comparison of Ge(Li) In Situ and Ion Chamber Results

Location Site No.	(Distance in Miles from Plant)	Positive Ge(Li) In Situ Results (μ R/Hr)					Total*	Ion Chamber (μ R/Hr)
		U-238	Th-232	K-40	Cs-137	Other		
00	Warehouse (0.03 SSE)	1.38	2.14	2.71	0.156	(a)	10.7	13.8
01	Rockyhill Rd. (E) (0.8 SE)	1.35	2.25	2.21	0.163	-	9.6	9.4
03	Rockyhill Rd. (W) (0.3 WNW)	1.17	2.47	2.49	0.062	-	9.8	9.8
04	Plymoth Center (4.5 WNW)	1.57	2.41	2.38	0.276	-	10.2	9.9
06	Property Line (0.34 NW)	1.30	2.32	2.11	0.189	(a)	9.5	10.5
07	Pedestrial Bridge (0.14 N)	1.27	2.21	2.14	0.113	.989 (bc)	10.3	13.8
08	Overlook (0.03 W)	1.21	2.05	2.61	0.108	(a)	9.6	37.8
09	East Breakwater (0.35 ESE)	1.36	2.47	2.77	0.100	(c)	10.3	10.4
10	Cleft Rock (0.9 S)	0.92	1.95	1.68	0.942	-	9.1	9.4
15	East Weymoth (23 NW)	1.44	2.57	3.01	0.273	-	10.9	10.5
17	Manomet Substation (2.5 SE)	1.28	2.21	2.03	0.213	-	9.3	9.3

* Total Includes 3.6 μ R/Hr cosmic contribution.

(a) Co-60 found in in situ but not confirmed by lab soil analysis and therefore not included in total.

(b) Co-60 found in in situ and confirmed by lab soil analysis.

(c) Zr-95 found in in situ but not confirmed by lab soil analysis and therefore not included in total.

APPENDIX D - Radiological Environmental Monitoring Program

APPENDIX D

4.8.D Environmental Monitoring Program

An environmental monitoring program shall be conducted as follows:

1. Environmental samples shall be selected and analyzed according to Table 4.8.1 at the locations described in Tables 4.8.2 and 4.8.3 and shown in Figures 4.8.1, 4.8.2 and 4.8.3.
2. Analytical techniques used shall be such that the detection capabilities in Table 4.8.4 are achieved.
3. A census of gardens producing fresh leafy vegetables for human consumption (e.g., lettuce, spinach, etc.) shall be conducted near the end of the growing season to determine or verify the location of the garden (available for sampling) yielding the highest calculated thyroid dose. This census is limited to gardens having an area of 500 square feet or more and shall be conducted under the following conditions as necessary to meet the above requirement:
 - a. Within a 1-mile radius of the plant site, enumeration by a door-to-door, or equivalent counting technique.
 - b. If no milk-producing animals are located in the vicinity of the site, as determined by item 4 below, the census described in item 3a above shall be extended to a distance of 5 miles from the site.

If the census indicates the existence of a garden at a location yielding a calculated thyroid dose greater than that from the previously sampled garden, the new location shall replace the garden previously having the maximum calculated iodine concentration. Also, any location from which fresh leafy vegetables can no longer be obtained may be dropped from the surveillance program as long as the NRC is notified in writing, as soon as possible that such vegetables are no longer grown or no longer available at that location.

4. A census of animals producing milk for human consumption shall be conducted at or near the middle of the grazing season to determine or verify the location yielding the highest calculated annual average thyroid dose. The census shall be conducted under the following conditions as necessary to meet the above requirement:
 - a. Within a 1-mile radius from the plant site or within the 15 mrem/yr isodose line, whichever is larger, enumeration by a door-to-door or equivalent, counting technique.
 - b. Within a 5-mile radius for cows and for goats, enumeration derived from referenced information from county agricultural agents or other reliable sources.

If it is learned from this census that animals are present at a location which yields a calculated thyroid dose greater than from previously sampled animals, the new location shall be added to the surveillance program as soon as practicable. The sampling location having the lowest calculated dose may then be dropped from the surveillance program at the end of the grazing season during which the census was conducted. Also, any location from which milk can no longer be obtained may be dropped from the surveil-

lance program as long as the NRC is notified in writing, as soon as practicable, that milk-producing animals are no longer present, or milk samples are no longer available at that location.

5. Deviations are permitted from the required sampling schedule if specimens are unobtainable due to hazardous conditions, seasonal unavailability or to malfunction of automatic sampling equipment. In the event of equipment malfunction, every reasonable effort shall be made to complete corrective action prior to the end of the next sampling period. Any significant deviations from the sampling schedule shall be explained in the annual report.
6. Detailed written procedures, including applicable check lists and instructions, shall be prepared and followed for all activities involved in carrying out the environmental monitoring program. Procedures shall include sampling, data recording and storage, instrument calibration, measurements and analyses, and actions to be taken when anomalous measurements are discovered.

Procedures shall be prepared for insuring the quality of program results, including analytical measurements. These procedures will identify the responsible organizations, include purchased services (e.g., contractual lab), include independent audits, and include systems (such as participation in IAEA and/or NBS intercalibration exercises and submission of "blind" quality control samples for analyses by the contractors) to identify and correct deficiencies, investigate anomalous or suspect results, and review and evaluate program results and reports. **

ES 3.8.D and 4.8.D Environmental Monitoring Program

An Environmental radiological monitoring program is conducted to verify the adequacy of in-plant controls on the release of radioactive materials. The program is designed to detect radioactivity concentrations which could result in radiation doses to individuals not exceeding the levels set forth in 10CFR50 Appendix I.

An example of this is the detection of I-131 in milk. Calculational Models (Regulatory Guide 1.109 March 1976) have shown that a constant concentration of 3.5 pCi I-131 per liter milk would result in a dose of 15 millirem to the thyroid of an infant consuming that milk for a year. Allowing for an open grazing season of six months, and a maximum of two half-lives between event and sampling, the lower limit of detection at time of sampling must be 2 pCi/l ($3.5 \times 12/6 \times 1/4 = 1.8$).

A supplemental monitoring program for sediments and mussels has been incorporated into the basic program (see notes f and g to Table 4.8.1) as a result of an agreement with the Massachusetts Wildlife Federation. This supplemental program is designed to provide information on radioactivity levels at substantially higher sensitivity levels in selected samples to verify the adequacy (or, alternatively, to provide a basis for later modifications) of the long-term marine sampling schedules. As part of the supplemental program, analysis of mussels for isotopes of plutonium will be performed if radiocesium activity should exceed 200 pCi/Kgm in the edible portions. **

**supplemental provision

The 200 pCi/Kgm radiocesium "action level" is based on calculations which showed that if radiocesium from plant releases reached this level, plutonium could possibly appear at levels of potential interest.* The calculations also showed that the dose delivered from these levels of plutonium would not be a significant portion of the total dose attributable to liquid effluents.

The program was also designed to be consistent, wherever applicable with Regulatory Guide 4.8 (Issued for comment December 1975). The following exceptions to the generic recommendations stated in Regulatory Guide 4.8 are justified due to site specific considerations:

1. The required detection capability for I-131 in milk is about twice the value suggested in Regulatory Guide 4.8. The justification for the higher value is presented in the second paragraph of this section. This is a conservative estimate of the capability of the milk surveillance program to detect concentrations at the appropriate annual dose level since the annual dose is proportional to the annual average concentration in milk. The detection limit for a group of samples is less than that for a single sample and is inversely proportional to the square root of the number of samples. The conservatism in this case is approximately $\sqrt{12}$, or about a factor of 3.
2. Air particulates are not analyzed for radiostrontium. The program instead calls for this analysis in milk samples. This is justified because the air-cow-milk exposure pathway can be better monitored at Pilgrim after the very low level releases of radiostrontium are reconcentrated in cow's milk (Ref. 1).
3. Soils and sediments are not routinely analyzed for Sr-90, but rather the analysis is done on a contingency basis. The rationale behind this is that Sr-90 will not contribute to long-term radionuclide buildup until the more abundant gamma emitting nuclides appear in relatively large concentrations. Both Items 2 and 3 reflect the fact that in 3 1/2 years of operation, Pilgrim Station liquid releases of Sr-90 have amounted to only 1/1000 of the Sr-90 inventory in Cape Cod Bay water (from weapons testing fallout) and about 4/1000,000 of the direct deposition on the Bay. Also, gaseous releases of Sr-90 have been only 1/100,000 of the terrestrial Sr-90 inventory within five miles of the station (Ref. 1).
4. Surveys are conducted annually, if necessary, to determine appropriate locations for sampling of leafy vegetables and milk. The objective of these surveys is to ensure that the environmental samples are representative of realistic food chain pathways, considering local conditions. Results of the monitoring program will be used as "benchmarks" to verify calculational models used to predict the consequences of effluent releases from the station. The models can then be employed to predict doses attributable to radiation deposition at any other location of interest. The combination of monitoring results and calculational model predictions is a practical method of demonstrating compliance with 10CFR50 Appendix I. This approach does not require (nor is it always practical) that environmental media always be sampled from the "worst case" locations: although sensitivity of the monitoring results might be improved by sampling from locations which are reasonably close to "worst case" conditions.

* in measurable quantities having a potential dose (human food chain) significance comparable to other nuclides if present at their detection limits.

Verification of the appropriate milk sampling locations on an annual basis is satisfactory as there are very few locations suitable for the grazing of dairy herds in the vicinity of the plant (Ref. 2). This situation makes it unlikely the location of the nearest dairy herd (3.5 miles-W) will change.

5. Annual sampling of beef forage (in place of beef) is adequate because beef cattle are not raised commercially in the vicinity of the site. However, dairy cows from the Plymouth County Farm are periodically sold for beef. Feed (hay) from this location will be sampled to monitor this potential pathway for ingestion of radioactivity. If beef cattle feeding on local forage are found at locations closer to the site, forage samples from the closer location will replace the sample from the County Farm.
6. Groundwater flow at the plant site is into Cape Cod Bay; therefore, terrestrial monitoring of groundwater is not included in this program.
7. Poultry sampling is not performed because poultry in Plymouth County feed almost exclusively on imported grain and are usually raised under shelter.
8. Field gamma isotopic surveys are conducted to monitor radioactivity in soil in lieu of laboratory analysis of soil samples. The technique has several advantages over laboratory analysis. First, analysis can be performed on the same plot of land from survey to survey, and radioactivity build-up at the location can be accurately determined. Secondly, gamma exposure rate is determined directly from this technique: hence compliance with 10CFR50 Appendix I levels can be investigated directly rather than indirectly through soil sampling.

References:

1. Wrenn, M.E., "Review of Sr-90 Releases from Pilgrim 1 Nuclear Plant and a Comparison with Extant Environmental Levels", 1976.
2. Pilgrim Station Unit #2 PSAR, Appendix 11F, pp. 11FC-11 and 11A, amended June 15, 1976.

TABLE 4.8.1

OPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

<u>Exposure Pathway or Sample Type</u>	<u>Locations (Direction-Distance) from Reactor</u>	<u>Sampling and Collection Frequency</u>	<u>Type and Frequency of Analysis</u>
AIRBORNE			
Particulates	11 (see Table 4.8.2)	Continuous sampling over one week	Gross beta radioactivity at least 24 hours after filter change. (a) Quarterly composite (by location) for gamma isotopic. (b)
☪ Radiiodine	11 (see Table 4.8.2)	Continuous sampling with canister collection weekly	Analyze weekly for I-131
Soil	11 (see Table 4.8.2)	Once per three years	Field gamma isotopic. (c)
DIRECT	20 (see Table 4.8.3)	Quarterly	Gamma exposure quarterly.
	Plymouth Beach and Priscilla/White Horse Beach	Annually (Spring)	Gamma exposure survey.*
WATERBORNE			
	Discharge Canal Bartlett Pond (SE-1.7 mi.) Powder Point (NHM-7.8 mi.)(d)	Continuous Composite Sample Weekly grab sample Weekly grab sample	Gamma isotopic (b) monthly; and composite for H-3 analysis quarterly. (c).
AQUATIC			
Shellfish	Discharge outfall Duxbury Bay Manomet Pt. Plymouth or Kingston Harbor Marshfield (d)	Quarterly (at approximate 3-month intervals)	Gamma isotopic (b); also see note (f). *

* Note (f) and beach surveys are supplemental provision.

TABLE 4.B.1
(Cont'd)

<u>Exposure Pathway or Sample Type</u>	<u>Locations (Direction-Distance) from Reactor</u>	<u>Sampling and Collection Frequency</u>	<u>Type and Frequency of Analysis</u>
Irish Moss	Discharge out fall Manomet Pt. Ellisville (d)	Semi-annually	Gamma isotopic (b)
Lobster	Vicinity of discharge point Offshore (d)	Four times per season Once per season	Gamma isotopic (b) on edible portions.
Fish	Vicinity of discharge point Offshore (d)	Quarterly, Groups I and II (e) In season, Groups III and IV (e) Annually, each group	Gamma isotopic (b) on edible portions (e)
Sediments	Rocky Point Plymouth Harbor Duxbury Bay Plymouth Beach Manomet Pt. Marshfield (d)	Semi-annually	Gamma isotopic (b) (c), see also note (g) *
INGESTION (Terrestrial)			
Milk	Plymouth County Farm (W-3.5 mi.)(h); Whitman Farm (NW-21 mi.) (d)	Semi-monthly during periods when animals are on pasture, other- wise monthly	Gamma isotopic (b) Sr-89, 90 monthly; radioiodine analysis all samples.
Cranberries	Manomet Pt. Bog (SE-2.6 mi.) Bartlett Rd. Bog (SSE/S-2.8 mi.) Pine St. Bog (WM-17 mi.) (d)	At time of harvest	Gamma isotopic (b) on edible portions.

*Note (g) is supplemental provision

TABLE 4.8.1
(Cont'd)

<u>Exposure Pathway or Sample Type</u>	<u>Locations (Direction-Distance) from Reactor</u>	<u>Sampling and Collection Frequency</u>	<u>Type and Frequency of Analysis</u>
Tuberous and green leafy vegetables	Karbott Farm (SSE-2.0 mi.) (h) Bridgewater Farm (W-20 mi.) (d)	At time of harvest	Gamma isotopic (b) on edible portions.
Beef Forage	Plymouth County Farm (W-3.5 mi.) (h)	Annually	Gamma isotopic (b)

Notes

- (a) If gross beta radioactivity is greater than 10 times the control value, gamma isotopic will be performed on the sample.
- (b) Gamma isotopic means the identification and quantification of gamma-emitting radionuclides that may be attributable to the effluents from the facility.
- (c) If integrated gamma activity (less K-40) is greater than 10 times the control value (less K-40), strontium-90 analysis will be performed on the sample.
- (d) Indicates control location.
- (e) Fish analyses will be performed on a minimum of 2 sub-samples, consisting of approximately 400 grams each from each of the following groups:

I. Bottom Oriented	II. NearBottom Distribution	III. Anadromous	IV. Coastal Migratory
Winter flounder	Tautog	Alewife	Bluefish
Yellowtail flounder	Cunner	Rainbow smelt	Atlantic herring
	Atlantic cod	Striped bass	Atlantic menhaden
	Pollock		Atlantic mackerel
	Hakes		

- (f)* Mussel samples from four locations (immediate vicinity of discharge outfall, Manomet Pt., Plymouth or Kingston Harbor, and Green Harbor in Marshfield) will be analyzed quarterly as follows:

One kilogram wet weight of mussel bodies, including fluid within shells will be collected. Bodies will be reduced in volume by drying at about 100°C. Sample will be compacted and analyzed by GE(Li) gamma spectrometry or alternate technique, if necessary, to achieve a sensitivity** of 5 pCi/kg for Cs-134, Cs-137, Co-60, Zn-65 and Zr-95 and 15 pCi/kg for Ce-144.

The mussel shell sample from one location (the location nearest the discharge canal unless otherwise specified pursuant to licensee's agreement with Mass. Wildlife Federation) will be analyzed each quarter. One additional mussel shell sample (from the Green Harbor location, unless otherwise specified pursuant to licensee's agreement with Mass Wildlife Federation) will be analyzed semi-annually. Unscrubbed shells to be analyzed will be dried, processed, and analyzed similarly to the mussel bodies.

Because of the small volume reduction in pre-processing of shells, sensitivities attained will be less than that for mussel bodies. The equipment and counting times to be employed for analyses of shells will be the same or comparable to that employed for mussel bodies so that the reduction in sensitivities (relative to those for mussel bodies) will be strictly limited to the effects of poorer geometry related to lower sample volume reduction. Shell samples not scheduled for analysis will be reserved (unscrubbed) for possible later analysis, depending upon recommendations of the review committee.

* Supplemental provision.

**All sensitivity values to be determined in accordance with footnote (a) to Table 4.8.4., viz., LLD at 95% confidence level on K_{α} ; 50% confidence level on K_{β} (See HASL-300 for definitions).

Notes (Cont'd)

If radiocesium (Cs-134 and Cs-137) activity exceeds 200 pCi/kg (wet) in mussel bodies, these samples will be analyzed by radiochemical separation, electrodeposition, and alpha spectrometry for radioisotopes of plutonium, with a sensitivity of 0.4 pCi/kg.

- (g)* Sediment samples from four locations (Manomet Pt., Rocky Pt., Plymouth Harbor, and head of Duxbury Bay) will be analyzed once per year (preferably early summer) as follows:

Cores will be taken to depths of 30-cm, minimum depth wherever sediment conditions permit by a hand-coring sampling device. If sediment conditions do not permit 30-cm deep cores, the deepest cores achievable with a hand-coring device will be taken. In any case, core depths will not be less than 14-cm. Core samples will be sectioned into 2-cm increments, and surface and alternate increments analyzed, others reserved. Sediment sample volumes (determined by core diameter and/or number of individual cores taken from any single location) and counting technique will be sufficient to achieve sensitivities of 30 pCi/kg dry sediment for Cs-134, Cs-137, Co-60, Zn-65, and Zr-95 and 150 pCi/kg for Cs-144. In any case individual core diameters will not be less than 2 inches.

The top 2-cm section from each core will be analyzed for Pu isotopes (Pu-238, Pu-239, 240) using radiochemical separations, electrodeposition, and alpha spectrometry with target sensitivity of 25 pCi/kg dry sediment. Two additional core slices per year (mid-depth slice from core samples taken at Rocky Point and Plymouth Harbor, unless otherwise specified pursuant to licensee's agreement with Mass Wildlife Federation) will be similarly analyzed.

- (h) These locations may be altered in accordance with results of surveys discussed in paragraphs 4.8.D-3 and 4.8.D-4.

* Supplemental provision

TABLE 4.B.2

AIR PARTICULATES, GASEOUS RADIOIODINE AND SOTL SURVEILLANCE STATIONS

<u>Sampling Location</u> <u>(Sample Designation)</u>	<u>Distance and</u> <u>Direction from Reactor</u>
Offsite Stations	
East Weymouth (EW) *	23 miles NW *
Plymouth Center (PC)	4.5 miles W-WNW
Manomet Substation (MS)	2.5 miles SE
Cleft Rock Area (CR)	0.9 miles S
Onsite Stations	
Rocky Hill Road (ER)	0.8 miles SE
Rocky Hill Road (WR)	0.3 miles W-WNW
Overlook Area (OA)	0.03 miles W
Property Line (PL)	0.34 miles NW
Pedestrian Bridge (PB)	0.14 miles N
East Breakwater (EB)	0.35 miles ESE
Warehouse (WS)	0.03 miles SSE

* Control Station

TABLE 4.8.3EXTERNAL GAMMA EXPOSURE SURVEILLANCE STATIONS (TLD)

<u>Dosimeter Location (Designation)</u>	<u>Distance and Direction from Station</u>
Offsite Stations	
East Weymouth (EW)*	23 miles NW *
Kingston (KS)	10 miles WNW
Sagamore (CS)	10 miles SSE-S
Plymouth Airport (SA)	8 miles WSW
North Plymouth (NP)	5.5 miles WNW
Plymouth Center (PC)	4.5 miles W-WNW
South Plymouth (SP)	3 miles WSW
Manomet (MS)	2.5 miles SSE
Manomet (MB)	2.5 miles SE
Manomet (MP)	2.25 miles ESE-S
Cleft Rock Area (CR)	0.9 miles S
Saquish Neck (SN)**	4.6 miles NNW ***
Onsite Stations	
Rocky Hill Road (ER)	0.8 miles SE
Microwave Tower (MT)	0.38 miles S
Rocky Hill Road (WR)	0.3 miles W-WNW
Rocky Hill Road (B)	0.26 miles SSE
Property Line (H)	0.21 miles SSW
Property Line (I)	0.14 miles W
Public Parking Area (PA)	0.07 miles N-NNE
Overlook Area (OA)	0.03 miles W

* Control Station

** Data from this surveillance station is subject to detector maintenance and retrieval by a private party not subject to control by the licensee. Therefore, the requirement to maintain this station is contingent on station availability and maintenance by the outside party.

*** Supplemental provision

TABLE 4.8.4

(d)

DETECTION CAPABILITIES FOR ENVIRONMENTAL SAMPLE ANALYSIS

Analysis	Lower Limit of Detection (a)				
	Water pCi/l	Airborne particulate or gas - pCi/M ³	Wet solids pCi/Kg	Dry solids pCi/Kg	Milk pCi/l
Gross beta	2	1×10^{-2}			
H-3	330				
Mn-54	15		130	60	
Fe-59	30		260	120	
Co-58,60	15	2×10^{-2}	130	60	
Zn-65	30		260	120	
Sr-89	10		40		10
Sr-90	2		8	150	2
Zr/Nb-95	10				
I-131		7×10^{-2}	80(b)		2 (c)
Cs-134,137	15	1×10^{-2}	80	150	15
Ba/La-140	15				15

(a) The nominal lower limits of detection at the 95% confidence level (defined in the ERDA Health and Safety Laboratory procedures manual, HASL-300).

(b) Applies only to analysis of green leafy vegetables.

(c) Sensitivity with 25% error at the 95% confidence level.

(d) This table applies to all analyses other than those for which higher sensitivities apply in accordance with Notes (f) and (g) to Table 4.8.1.

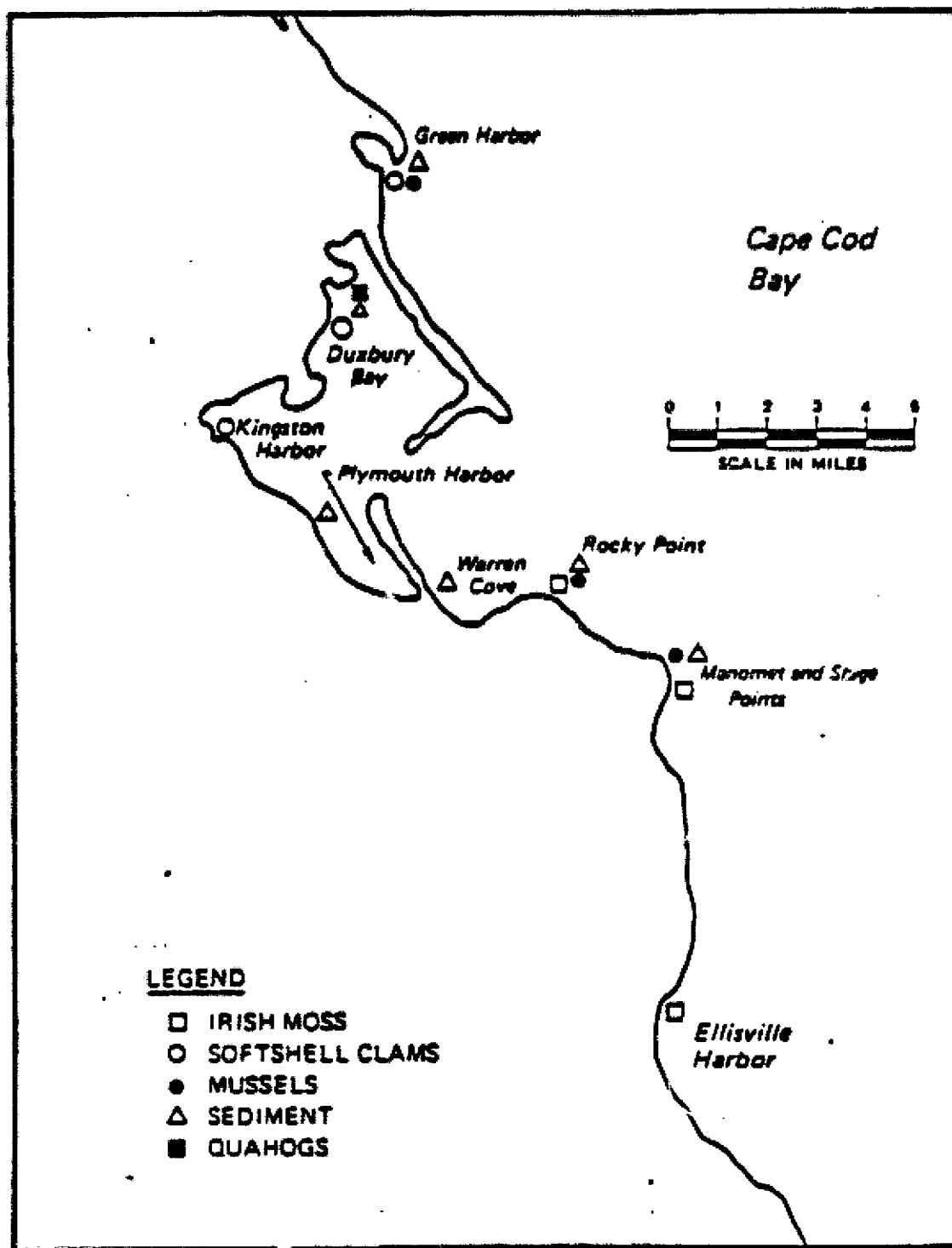


Figure 4.8-1 Typical Mollusc, Algae and Sediment Sampling Stations

6.9.C Unique Reporting Requirements

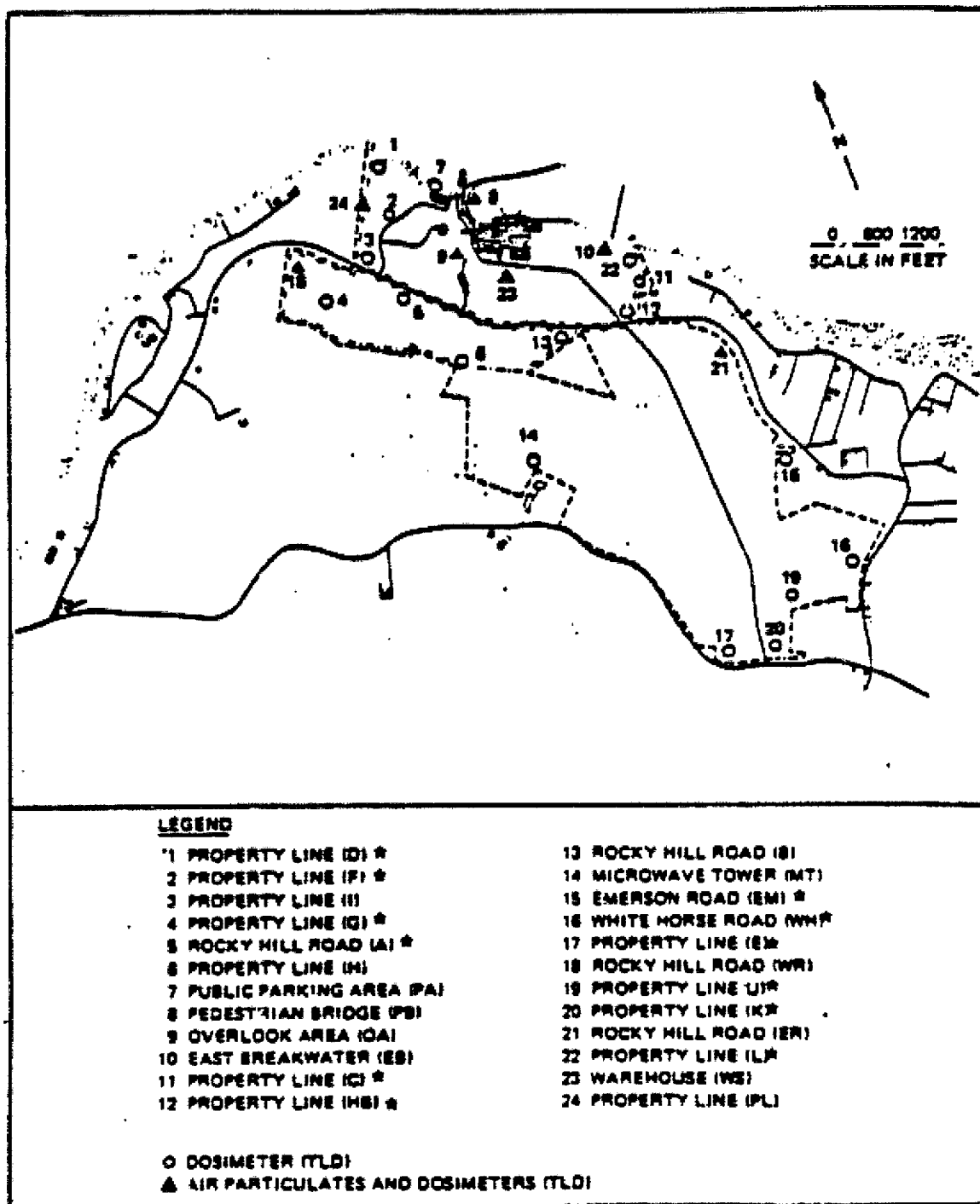
2. Environmental Program Data

- a. **Annual Report.** A report on the radiological environmental surveillance program for the previous 12 months of operation shall be submitted to the Director of the NRC Regional Office (with a copy to the Director, Office of Nuclear Reactor Regulation) as a separate document within 90 days after January 1 of each year. The reports shall include summaries, interpretations, and statistical evaluation of the results of the radiological environmental surveillance activities for the report period, including a comparison with preoperational studies, operational controls (as appropriate), and previous environmental surveillance reports, and an assessment of the observed impacts of the plant operation on the environment. The reports shall also include the results of any land use surveys which affect the choice of sample locations. If harmful effects or evidence of irreversible damage are detected by the monitoring, the licensee shall provide an analysis of the problem and a proposed course of action to alleviate the problem.

Results of all radiological environmental samples shall be summarized and tabulated on an annual basis. In the event that some results are not available within the 90-day period, the report shall be submitted, noting and explaining the reasons for the missing results. The missing data shall be submitted as soon as possible in a supplementary report.

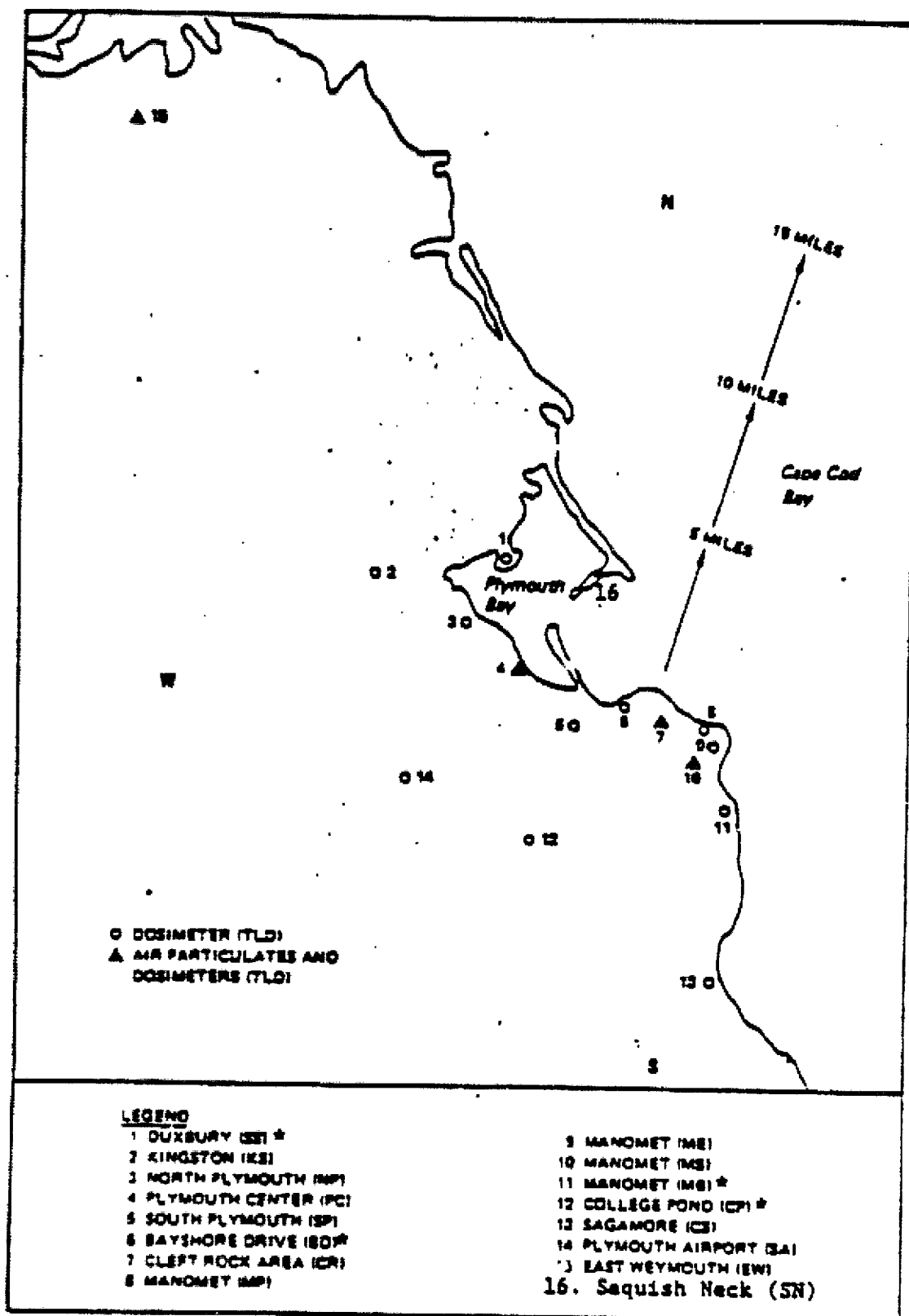
- b. **Anomalous measurement report.** If radioactivity in an indicator medium from an off-site location is found and confirmed at a level exceeding ten times the control station value, a written report shall be submitted to the Director of the NRC Regional Office (with a copy to the Director, Office of Nuclear Reactor Regulation) within 10 days after confirmation.** This report shall include an evaluation of any release conditions, environmental factors, or other aspects necessary to explain the anomalous result.

** A confirmatory reanalysis of the original, a duplicate, or a new sample may be desirable, as appropriate. The results of the confirmatory analysis shall be completed at the earliest time consistent with the analysis, but in any case within 30 days of receipt of the anomalous result.



*additional station not required by Specification 4.8.D.1

Figure 4.8.2 Location of Onsite Monitoring Stations



*additional stations not required by Specification 4.8.D.1

Figure 4.8.3 Location of Offsite Monitoring Stations

TABLE 6.9.C-1

REPORTING LEVELS FOR RADIOACTIVITY CONCENTRATIONS IN ENVIRONMENTAL SAMPLES

Reporting Levels

Analysis	Water (pCi/l)	Airborne Particulate or Gases (pCi/M)	Fish, Mussels (pCi/Kg, wet)	Milk (pCi/l)	Vegetables (pCi/kg, wet)
H-3	2×10^4				
Mn-54	1×10^3		3×10^4		
Fe-59	4×10^2		1×10^4		
Co-58	1×10^3		3×10^4		
Co-60	3×10^2		1×10^4		
Zn-65	3×10^2		2×10^4		
Zr-95	4×10^2				
I-131	2	0.9		3	1×10^2
C-134	30	10	1×10^3	60	1×10^3
Cs-137	50	20	2×10^3	70	2×10^3
Ba-140	2×10^2			3×10^2	

APPENDIX E - 1982 Garden & Milk-Producing
Animal Survey

OFFICE MEMORANDUM

341

To: T. L. Sisson Prepared by: C. E. Bowman *C.E. Bowman*
 Date: Oct. 22, 1982 Reviewed by: _____
 Approved by: _____

RECORD CATEGORY
UNIT APPLICABILITY
PAPER FILE NUMBER

2

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RECORD TYPE: *A4.08*

QA ☒ NO QA ☐

KEYWORDS: *1982 Annual Census*

CONTROLLED DISTRIBUTION?

YES ☐ NO ☒

COMPONENT #: _____

Q-LIST #: _____

RMS CONTROL *2201869*

1982 GARDEN & MILK-PRODUCING ANIMAL CENSUS

As required by the PNPS Environmental Technical Specification, the 1982 Garden & Milk-Producing Animal Census was conducted on 9/14/82 in a street by street search of the area within 1 mile of PNPS.

The existence of gardens near the site boundaries of 0.7 miles West and 0.6 miles ESE was confirmed. These gardens are the closest and largest in the near vicinity (1 mile) of PNPS, and are less than 500 ft.² They do represent conservative garden locations for sampling analyses and dose calculation. With the assistance of Mr. Robert Tis, vegetation samples were collected from four locations. Only two of these locations are within one mile of PNPS. A sample of pumpkin leaves was collected from the J. Work Residence (0.6 miles ESE) of John Alden Road on 9/14/82, and lettuce was obtained from the Whipple Farm (1.5 miles SSW) off of Doten Road also on 9/14/82. Rhubarb samples were collected from both the Lloyd-Evans Residence (0.7 miles West) on Gate Road and the Hoton Residence (2.5 miles SE) near the Manomet Bird Observatory on 9/27/82. A vegetation sample was collected from the Hoton Residence at their request.

In addition, no cows or goats or structures which would indicate the presence of such animals within 1 mile of PNPS were found. The Plymouth Animal Inspector was contacted and sent a listing of animals in Plymouth. The location of cows and goats are as follows:

Owner	Animals	Location	Status
Charlie Mann	1 Heifer	State Road	Agreed to participate in Environmental Program.
Nancy Lloyd	5 Goats	Long Pond Road	Goats are miniature in size and don't provide a large enough sample.
Warren Raymond	2 Goats	Off White Horse Road	Goats no longer at this location.
Fred Wood	1 Cow	Federal Furnace Road	Location is greater than 5 miles from PNPS.
John Davis	1 Heifer * 2 Beef Cows	Beaver Dam Road	See Charlie Mann
Pilgrim Plantation	2 Cows	Warren Avenue	Declined to participate in Environmental Program.

* Mr. Mann's heifer is located on Mr. Davis' property.

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OFFICE MEMORANDUM

To _____ Prepared by _____
 Date Oct. 22, 1982 Reviewed by _____
 cc _____
 Nuclear Records Center
 ERHS #82-136 Approved by _____

RECORD CATEGORY
UNIT APPLICABILITY
PNPS FILE NUMBER

Title:

-2-

In addition to the above individuals being contacted by Mr. Robert Tis at my request, the Plymouth County Farm was also contacted. They have agreed to participate in the Environmental Program.

In conclusion, the 1982 Census identified two indicator stations available for milk sampling: the Plymouth County Farm (3.5 miles W), and Mr. Mann's heifer located on Beaver Dam Road (2.5 miles S). The first milk sample from Mr. Mann's heifer is scheduled to be collected in late October, and the first milk sample from the Plymouth County Farm is expected to be obtained in November.

GARDEN CENSUS FORM

No. Streets Surveyed 30

Date 9/14/82

Street Name	House Number	Garden, 500 ft ²	Leafy Vegetables	Distance and Azimuth	Initials
712 ROAD (L. V. Evans Residence)	N/A	< 500 ft ²	Lettuce	0.7 miles W	CEB
JOHN ALDEN ROAD (J. Work Residence)	393	< 500 ft ²	Pumpkin Leaves	0.6 miles ESE	CEB
INTERSECTION OF CLIFFORD ROAD AND DOTEN ROAD (Whipple Farm)	N/A	> 500 ft ²	Lettuce	1.5 miles SSW	CEB

MILK ANIMAL CENSUS FORM

No. Streets Surveyed 30 Date 9/14/82

Street Name	House Number	No. of Animals	Type of Animals	Owner	Distance and Azimuth	Initials
-------------	--------------	----------------	-----------------	-------	----------------------	----------

None of the streets surveyed had cows or goats or structures which would indicate the presence of such animals

CEB

Paul Whipple Dotan Road	15 Beefalo 1 Sheep
Sandra Sharp 311 Carver Road	3 Pigs
Charlie Mann State Road	1 Heifer
Kenny Craig Beach Street	1 Sow
John Almeida White Oak Drive	5 Pigs
Gerald Sheehan Hedge Road	16 Black Angus
Nancy Lloyd Long Pond Road	5 Goats
Oscar Bettencourt 12 Savery Lane	3 Black Angus
Warren Raymond Off White Horse Road	2 Goats
Frank Shaw R.F.D. #8 Old Sandwich Rd.	5 Sows
George Almeida 221 South Pond Road	12 Swine
Fred Wood Federal Furnace Road	1 Cow
Milton Wood Braley Lane	2 Sows 2 steers
John Davis Beaver Dam Road	1 Heifer 1 Swine 2 Beef Cows
Pilgrim Plantation Warren Avenue	2 Cows