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PILGRIM NUCLEAR STATION

PREOPERATIONAL

ENVIRONMENTAL RADIATION SURVEY PROGRAM

Summary Report through August 31, 1970

for
Boston Edison Co.
Boston, Mass.

January, 1971

ICN/Tracerlab
Chemical and Radioisotope Division
International Chemical and Nuclear Corp.
1601 Trapelo Road, Waltham, Massachusetts 02154

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1.0 INTRODUCTION

A pre-operational environmental radiation surveillance program is being performed in relation to the Pilgrim Nuclear Power Station located in Plymouth, Massachusetts for the Boston Edison Company. The survey has been designed to establish existing levels of radioactivity in various types of samples of the environment. Levels observed after initiation of operation of the station will be compared to these values to determine the effect of the facility on the radioactivity in the environment. This report summarizes the results obtained through August 31, 1970.

Samples are obtained by Boston Edison Company personnel and are forwarded to an independent laboratory for analysis. The analyses resulting in the data presented in this report were performed by ICN/Tracerlab which also prepared the report.

2.0 DISCUSSION OF RESULTS

2.1 Air Surveillance

This section discusses the results obtained for air particulate samples and gamma dose rate measurement.

2.1.1 Air Particulates

Air particulate gross beta activity showed the seasonal variation which is normally observed in this hemisphere. Low values in winter are followed by increasing values in spring generally reaching a broad maximum in June, July and August. This is usually followed by a gradual decline during the fall and early winter. The gross gamma values indicated the same trend.

The comparative monthly averages show no significant differences between the on-site, off-site and reference areas which will permit valid intercomparison of data between areas.

2.1.2 Gamma Dose Rate

The values for gamma dose rate are approximately the expected values for this geographical area. The lack of response to very low gamma energies would

tend to make the values lower than data measured using ion chambers or scintillation detectors. This is of no significance in evaluating the effect of plant operation. There is somewhat more variability between the data than desirable, however the use of new dosimeters at some locations and the stabilization of dosimeter assignment should cause this to improve.

2.2 Aquatic Surveillance

Results for domestic and recreational water, sea water and marine life analyses are discussed below.

2.2.1 Domestic and Recreational Water

The gross beta and ^{90}Sr values observed for well water samples were generally comparable to each other and significantly lower than the surface water samples. This is to be anticipated since the surface water is effected by fallout, both by direct deposition and by accumulation of runoff from the watershed. Gamma peaks of unknown origin at approximately 0.32 MeV were observed in both June well samples which were the only recent such samples computer processed.

The three ponds exhibit essentially comparable levels of activity. Great Pond gross beta values may be slightly higher. ^{90}Sr values continued in the 1 pCi/l range.

2.2.2 Seawater

Seawater data from the Pilgrim site showed consistent values throughout. The variability in gross beta results are probably due to the small aliquot used because of the high solids content.

2.2.3 Marine Life

Irish moss samples from 1970 are somewhat higher in gross beta and gross gamma activity than observed previously. There is also a large difference between the gross gamma and ^{90}Sr values obtained for samples from Rocky Point and Manomet Point. Additional sampling is being carried out to determine whether the

two locations are comparable.

A gamma peak at 0.76 MeV, possibly due to ^{95}Zr, was observed in both Irish moss samples and to a lesser extent in the rockweed samples.

Within the sample types, fish and lobster yielded results which were generally similar except for the high ^{90}Sr value in the June 1970 lobster from Rocky Point and the high ^{137}Cs value found in the April 1970 fish sample. The reason for these differences is not known.

2.3 Terrestrial Surveillance

Milk and crop analysis results are discussed below.

2.3.1 Milk

Milk results are generally as anticipated. The variability between locations is greater than observed when samples composited from large areas are used and is probably due to the specific conditions prevailing at each farm. The presence or absence of ^{140}Ba and ^{131}I will be most valuable in evaluating future data. No change in the sampling program is indicated.

2.3.2 Crops

Cranberries from both 1968 and 1969 show consistent gross beta, ^{90}Sr and ^{137}Cs values. ^{137}Cs is significant and was readily observed in the gamma spectra of all of the samples. The presence of ^{137}Cs at the levels seen is probably related to the relatively high potassium concentration in cranberries.

Lettuce and cabbage samples from Plymouth and Bridgewater were similar for 1970. The cabbage sample from Plymouth in 1969 showed a significantly higher ^{90}Sr value than seen in the 1970 samples.

Winter feed samples were comparable between both farms in all values except the higher gross gamma result for the sample from Bridgewater. Major peaks at 0.76 MeV, possibly due to ^{95}Zr, and lesser peaks at 0.40 MeV, possibly due to ^{106}Ru were observed in both samples.

3.0 SUMMARY

Results from the pre-operational environmental site survey program through August 1970 indicate that the selection of sampling locations, sampling frequency and sample types will permit establishment of baseline activity levels and the validity of reference locations.

Where possible problems do exist e.g. Irish moss and gamma dose rate, program modifications to resolve the problems are already being implemented.

The program in general is satisfactory.

4.0 ANALYTICAL PROCEDURES

The procedures outlined in this section are used in sample analysis and dose rate measurement. The details of the procedures have been omitted where they are not important in evaluating the analytical results. Counting procedures are given in section 5.0.

4.1 Air Particulate Samples

4.1.1 Gross Beta

The filter paper (Gelman Type A glass fiber) is placed on a 2 inch diameter planchet and beta counted. The air volume sampled is measured using the volume indicated on the sampler meter and correcting to the true sample volume by means of the vacuum reading obtained at the start and end of the sampling period.

4.1.2 Gross Gamma

The filter papers representing one months collection from a given location are rolled together and placed in a vial for gamma well counting.

4.2 Water Samples

4.2.1 Gross Beta

Water samples are evaporated in a beaker and transferred to a 1 inch diameter planchet with the aid of dilute acid. The sample is evaporated to dryness, weighed to permit self absorption correction and counted in a low level beta counter.

4.2.2 Gross Gamma

Gross gamma activity is determined by placing the untreated sample in a Marinelli beaker and counting on a multichannel gamma ray spectrometer. The net gamma count rate between 80 keV and 2.0 MeV is used to calculate the gross gamma activity.

4.2.3 Gamma Spectrum

The gamma spectrum is measured as described above for gross gamma. The data are computer processed to accentuate photopeaks. Identification of nuclides is done by the analyst from the computer output using the observed energies.

4.2.4 Strontium-90

Strontium carrier and strontium-85 spike are added to an acidified aliquot of the unfiltered sample. The sample is evaporated to a smaller volume and made basic. Strontium is precipitated as strontium carbonate. The carbonate is dissolved and strontium is precipitated twice as the nitrate. The nitrates are dissolved, the sample is scavenged with iron hydroxide and barium and radium are removed as the chromates. Strontium carbonate is then precipitated, dissolved in dilute acid and counted for strontium-85 activity to determine the chemical yield. Yttrium carrier is then added and the sample is stored for two weeks to allow for yttrium grow-in.

Yttrium is separated and purified by successive hydroxide precipitations. The final hydroxide precipitate is dissolved and yttrium oxalate precipitated. The filtered oxalate is converted to the oxide by ignition, weighed and mounted for counting in the low level beta counter.

4.2.5 Tritium

An aliquot of the sample is acidified and distilled. A portion of the distilled sample is introduced into liquid scintillation counting solution and counted for tritium content in a refrigerated liquid scintillation counter.

4.3 Crops

4.3.1 Gross Beta

A weighed aliquot of the raw sample is wet ashed using nitric acid. The wet ashed sample is ashed in a muffle furnace at 600° C overnight. An aliquot of the ashed sample is transferred to a 2 inch diameter planchet for beta counting.

4.3.2 Gross Gamma

An aliquot of the untreated sample is placed into a Marinelli beaker and counted for gross gamma activity as described above in section 4.2.2.

4.3.3 Gamma Spectrum

The gamma spectra of crop samples are measured as described above in section 4.2.3.

4.3.4 Strontium-90

Strontium carrier, cesium carrier and strontium-85 spike are added to an aliquot of untreated sample. The sample is then wet ashed using nitric acid followed by ashing in a muffle furnace at 600° C. The resulting ash is digested in dilute nitric acid several times and any insoluble residue removed by filtration. Cesium is separated by precipitation using ammonium phosphomolybdate. Strontium is separated from the supernate of the cesium precipitate by precipitation as the oxalate. The oxalate is converted to carbonate by ignition. The remainder of the procedure is as described above under section 4.2.4.

4.3.5 Cesium-137

The cesium phosphomolybdate precipitate obtained from the strontium procedure above is dissolved and the cesium precipitated as the cobaltinitrite. The precipitate is dissolved and cesium precipitated as the chloroplatinate which is filtered, weighed and mounted for counting in a low level beta counter.

4.4 Marine Life

4.4.1 Gross Beta

Gross beta radioactivity is measured as described above in section 4.3.1.

4.4.2 Gross Gamma

Gross gamma radioactivity is measured as described above in section 4.2.2.

4.4.3 Gamma Spectrum

The gamma spectrum is measured as described above in section 4.2.3.

4.4.4 Strontium-90

Strontium-90 is determined as described above in section 4.3.4.

4.4.5 Cesium-137

Cesium radioactivity is determined as described above in section 4.3.5.

4.4.6 Manganese-54, Cobalt-58, Cobalt-60, Zinc-65

Manganese, cobalt and zinc carriers are added to an aliquot of the untreated sample which is then wet ashed. The wet ashed sample is then dry ashed in a muffle furnace at 600° C. The resulting ash is leached several times by boiling with 6N hydrochloric acid. The final hydrochloric acid solution is made 9N and the sample is passed through an ion exchange column. Manganese is eluted using 6N hydrochloric acid. Cobalt is eluted using 4N hydrochloric acid. The column is washed with water and zinc is eluted with water made just basic with ammonium hydroxide.

Cobalt is separated from the eluate as the hydroxide. The precipitate is dissolved, scavenged with ferric hydroxide and cobalt re-precipitated as the hydroxide after removing excess ammonium by boiling. The precipitate is dissolved and cobalt precipitated as the cobaltinitrite which is weighed and mounted for gamma counting.

The manganese fraction is boiled down several times with nitric acid and the manganese precipitated as the dioxide using sodium bromate. The precipitate is dissolved and manganese precipitated with ammonium phosphate. The precipitate is filtered, weighed and mounted for gamma counting.

The zinc is separated from the zinc fraction by precipitation as the hydroxide. The precipitate is dissolved and scavenged with ferric hydroxide. The acidity of the solution is adjusted and zinc precipitated as zinc mercuric thio-

cyanate which is then filtered, weighed and mounted for gamma counting.

4.5 Seawater

4.5.1 Gross Beta

An aliquot of the unfiltered seawater sample is evaporated into a 2 inch diameter planchet wich is beta counted.

4.5.2 Gross Gamma

Gross gamma is determed as described above in section 4.2.2.

4.5.3 Gamma Spectrum

Gamma spectra of seawater samples are measured as described above in section 4.2.3.

4.5.4 Tritium

Tritium is measured in seawater samples as described above in section 4.2.5.

4.5.5 Strontium-90

Strontium carrier, cesium carrier and strontium-85 spike are added to an unfiltered aliquot of the sample. Cesium is separated from the sample as the phosphomolybdate and strontium separated from the supernate as the oxalate. The oxalate is converted to carbonate by ignition. The remainder of the strontium procedure is as given above in section 4.2.4.

4.5.6 Cesium-137

The cesium which has been separated from the sample as the phosphomolybdate is treated as given above in section 4.3.5.

4.5.7 Manganese-54, Cobalt-58, Cobalt-60, Zinc-65

Manganese, cobalt and zinc carriers are added to an aliquot of the unfiltered sample. The sample is boiled down using dilute hydrochloric acid and treated several times with 9N hydrochloric acid. Residual salts are removed by filtration and the filtrate is put through an ion exchange column.

The remainder of the procedures are as given above in section 4.4.6.

4.5.8 Fractional Gross Beta

An aliquot of the sample is acidified and filtered. The filter paper containing the insoluble material which is designated as fraction I is transferred to a 2 inch planchet for beta counting.

Strontium, zinc, iron, nickel, cobalt and cesium carriers are added to the filtrate, the solution is made basic and the sulfides are precipitated. The precipitate is filtered, ignited and transferred to a planchet for beta counting. This fraction is designated fraction II.

The filtrate is acidified and the volume reduced by boiling. Carbonates are precipitated from a basic solution, converted to nitrates, dissolved and re-precipitated as carbonates. The precipitate is filtered and transferred to a planchet for beta counting. This precipitate is fraction III.

The filtrate is made basic, ammonium phosphomolybdate added and a precipitate is formed by acidifying the solution. The precipitate is dissolved, the solution buffered and cobaltinitrites precipitated. The precipitate is filtered, ignited and transferred to a planchet for beta counting. This fraction is fraction IV.

4.6 Milk

4.6.1 Strontium-90

Strontium, barium and cesium carriers and strontium-85 spike are added to an aliquot of the raw sample which is then wet ashed. The sample is then ashed in a muffle furnace at 600° C. The resulting ash is acid leached and any residue removed by filtration. Cesium is separated from the filtrate as the phosphomolybdate. Strontium and barium are then precipitated as the oxalates from the cesium filtrate. The oxalate is converted to carbonate by ignition. The remainder of the strontium

procedure is as given in section 5.2.4 except that the barium chromate precipitate is retained for barium analysis as described below.

4.6.2 Cesium-137

The cesium phosphomolybdate precipitate is dissolved and treated as described in section 4.3.5.

4.6.3 Barium-140

The barium chromate precipitate is dissolved in acid and the chloride precipitated with an HCl-ether mixture. The precipitate is dissolved and barium precipitated as the sulfate. The precipitate is filtered, weighed and mounted for counting in the low level beta counter.

4.6.4 Iodine 131

Iodine carrier is added to an aliquot from the sample which has been made basic with sodium hydroxide. Sodium bisulfite is then added and the sample evaporated to dryness under a heat lamp. The sample is then ashed in a muffle furnace and the ash digested with a very slightly basic sodium hydroxide solution. Residual solids are removed by filtration.

Iodine is extracted into carbon tectrachloride from the filtrate after oxidizing and acidification. The organic phase is washed, the iodine reduced with sulphurous acid and back extracted into the aqueous phase. Silver iodide is precipitated from the acidified aqueous phase. The precipitate is filtered, weighed and mounted for counting in the low level beta counter.

4.7 Gamma Dose Rate

Gamma dose rates are measured using EG&G TL-15 dosimeters. Dosimeters are placed at the point of interest for one month or six months periods. After exposure they are returned to the laboratory for read-out. Control dosimeters are used during distribution and pick up of the dosimeters to permit correction for any

extraneous radiation received by the dosimeter during transit. Sufficient dosimeters are used such that there is always at least one dosimeter at a given sampling site at all times.

The average gamma dose rate for the period of exposure is calculated from the measured accumulated dose and the exposure time after correction for the dose received by the control dosimeters. Dosimeter calibration is against cobalt-60 or cesium-137.

5.0 COUNTING PROCEDURES AND EQUIPMENT

The detectors used are described in detail since they are most significant. Supporting electronics are standard and are mentioned only briefly.

5.1 Gross Beta

The detector used for gross beta measurement is a Tracerlab FD-2 gas flow counter with a FDW-2 Mono Mol window approximately 150 ug/cm^2 thick. The window diameter is approximately 2 inches. An automatic sample changer (Tracerlab SC-100) is used and positions the sample approximately 1 cm from the counter window.

Argon-methane proportional counting gas or helium-isobutane Geiger gas is used depending on the desired mode of operation.

Samples are counted at least twice for a total accumulated time of at least 60 minutes. A counter standard is included in each set of samples counted to insure proper counter operation. Counter efficiencies are based on ^{90}Sr-^{90}Y in equilibrium.

5.2 Low-Level Beta

The low-level beta flow counters are Isotopes Inc. Model LLD. These consist of a guard counter with a 4 1/2" x 4 1/2" x 3/8" counting volume positioned directly above the sample counter which has a 1 1/4" diameter counting volume and a height of 5/16". A manual sample changer places the sample, which is 3/4" diameter

approximately 2 mm from the counter window.

The guard and sample counters are operated in anti-coincidence. Both use helium-isobutane Geiger gas.

Counter efficiency is determined using a ^{90}Y, ^{131}I or ^{140}Ba-La standard. ^{90}Y is counted as soon as possible after milking and always within 4 hours. At least two counts are taken within the first 48 hours and additional counts are obtained on the third and fifth day. These data are plotted and examined to insure decay with the proper half-life. If necessary additional points are obtained.

Similar procedures are followed for ^{131}I and ^{140}Ba-La except that longer intervals are taken between counts due to the longer half-life.

5.3 Gamma Well

For gamma well counting a Tracerlab P-51 LW-1 detector is used. This consists of a 2" x 2" cylindrical NaI(Tl) scintillation crystal with a 23/32" diameter x 1 9/16" deep well, an RCA 6342A photomultiplier and the required socket assembly. Pulses are fed through a two-channel analyzer set to accept counts from the major photopeak(s) of the nuclide being counted in one channel and all pulses greater than 30 keV in the other. The channel ratio is used as a purity check. Standardization is against the nuclide of interest.

5.4 Gross Gamma, Gamma Spectrum

These are measured using a 3' x 3' NaI(Tl) scintillation crystal coupled to a photomultiplier. Pulses are fed into a Nuclear Data Model 130A 512 channel analyzer using 256 channels. The spectrum is printed out digitally by channel. For gross gamma, the counts in the spectrum between 80 keV and 2.0 MeV are summed.

Gamma spectrum analysis is performed by computer processing of the data using a program which subtracts linear portions of the net spectrum thereby accentuating non-linear portions i.e. photopeaks. Output is signal-to-noise ratio as a function

of channel number. Energy and nuclide identification is performed by the analyst. Semi-quantitative estimates of the amount of activity can be made from the signal-to-noise ratio.

5.5 Liquid Scintillation

The sample aliquot is introduced into a 25 ml low background glass vial containing scintillation solution. Samples are counted against a tritium standard in a Packard Tri-Carb Scintillation Spectrometer Model 3003 which is cooled to 3-5° C.

6.0 ANALYTICAL SENSITIVITIES AND SAMPLE SIZE USED

The sensitivities which generally can be attained using the procedures given in section 5.0 are listed below by sample type and type of analysis. The values are determined both by the counting error and by the efficiency of the procedure.

The percentage error quoted is valid where the counting error is not limiting and reflects the overall uncertainty of the type of analysis being performed.

The sensitivities given for specific nuclides depends to some extent on the presence of other nuclides in the sample such as cobalt-60 and cobalt-58. The values given are typical for the generally encountered situation.

Sample Type	Analysis	Detection Limit	Aliquot	% Error
Air Particulate	Gross Beta	4×10^{-3} pCi/m^3	10,800 ft^3	±10
	Gross Gamma	3×10^{-2} cpm/m^3(a)	10,800 ft^3	±10
Non-Saline Water	Gross Beta	1 pCi/l	1000 ml	±10
	Gross Gamma	10 cpm/l(b)	1000 ml	±10
	Gamma Spectrum	(c)	1000 ml	
	Strontium-90	0.5 pCi/l	1000 ml	±15
	Tritium	2.5 pCi/ml	2 ml	±10
Crops, Marine Life	Gross Beta	0.2 pCi/g	20 g	±10
	Gross Gamma	0.01 cpm/g(b)	1000 g	±10
	Gamma Spectrum	(c)	1000 g	
	Strontium-90	0.005 pCi/g	100 g	±10
	Cesium-137	0.05 pCi/g	100 g	±10
	Manganese-54	0.1 pCi/g	100 g	±20
	Cobalt-58	0.1 pCi/g	100 g	±20
	Cobalt-60	0.1 pCi/g	100 g	±20
	Zinc-65	0.1 pCi/g	100 g	±20
Seawater	Gross Beta	60 pCi/l	30 g	±20
	Fractional Gross Beta	5 pCi/l	500 ml	±20
	Gross Gamma	10 cpm/l(b)	1000 ml	±10
	Gamma Spectrum	(c)	1000 ml	
	Tritium	2.5 pCi/ml	2 ml	±10
	Strontium-90	0.5 pCi/l	1000 ml	±15
	Cesium-137	1 pCi/l	1000 ml	±15
	Manganese-54	5 pCi/l	1000 ml	±20
	Cobalt-58	5 pCi/l	1000 ml	±20
	Cobalt-60	5 pCi/l	1000 ml	±20
	Zinc-65	5 pCi/l	1000 ml	±20

Sample Type	Analysis	Detection Limit	Aliquot	% Error
Milk	Strontium-90	0.5 pCi/l	1000 ml	±15
	Cesium-137	1 pCi/l	1000 ml	±15
	Barium-140	5 pCi/l	1000 ml	±15
	Iodine-131	5 pCi/l	1000 ml	±15
	Gamma Dose Rate	1 uR/hr	1 month exposure	±10

(a) In the counter used, 1 cpm corresponds to 1.5 pCi of cesium-137.

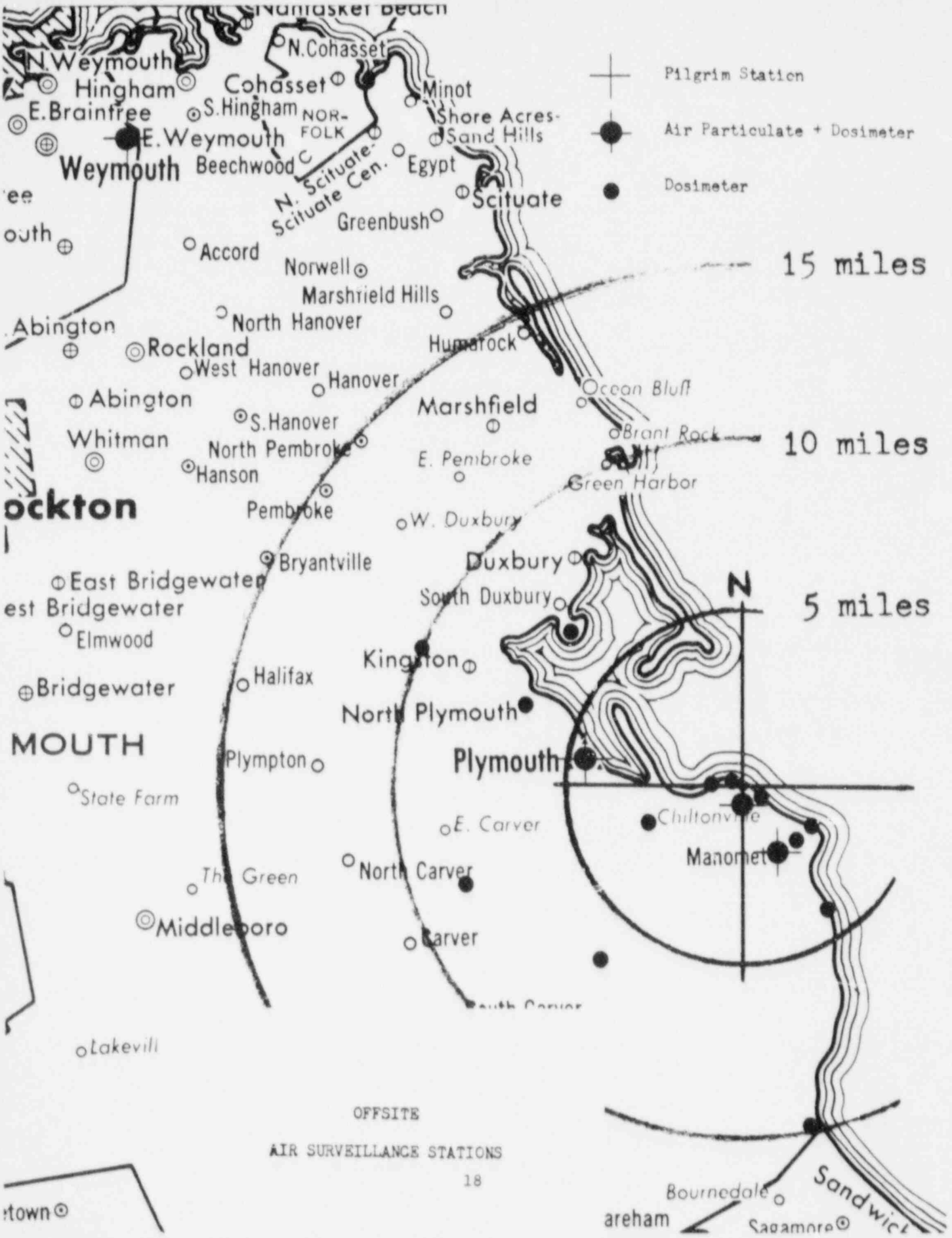
(b) In the counter used, 1 cpm corresponds to 4.5 pCi of cesium-137.

(c) Sensitivity depends on the specific nuclide and the presence of interfering nuclides. A typical sensitivity is 30 pCi/sample counted.

7.0 DATA

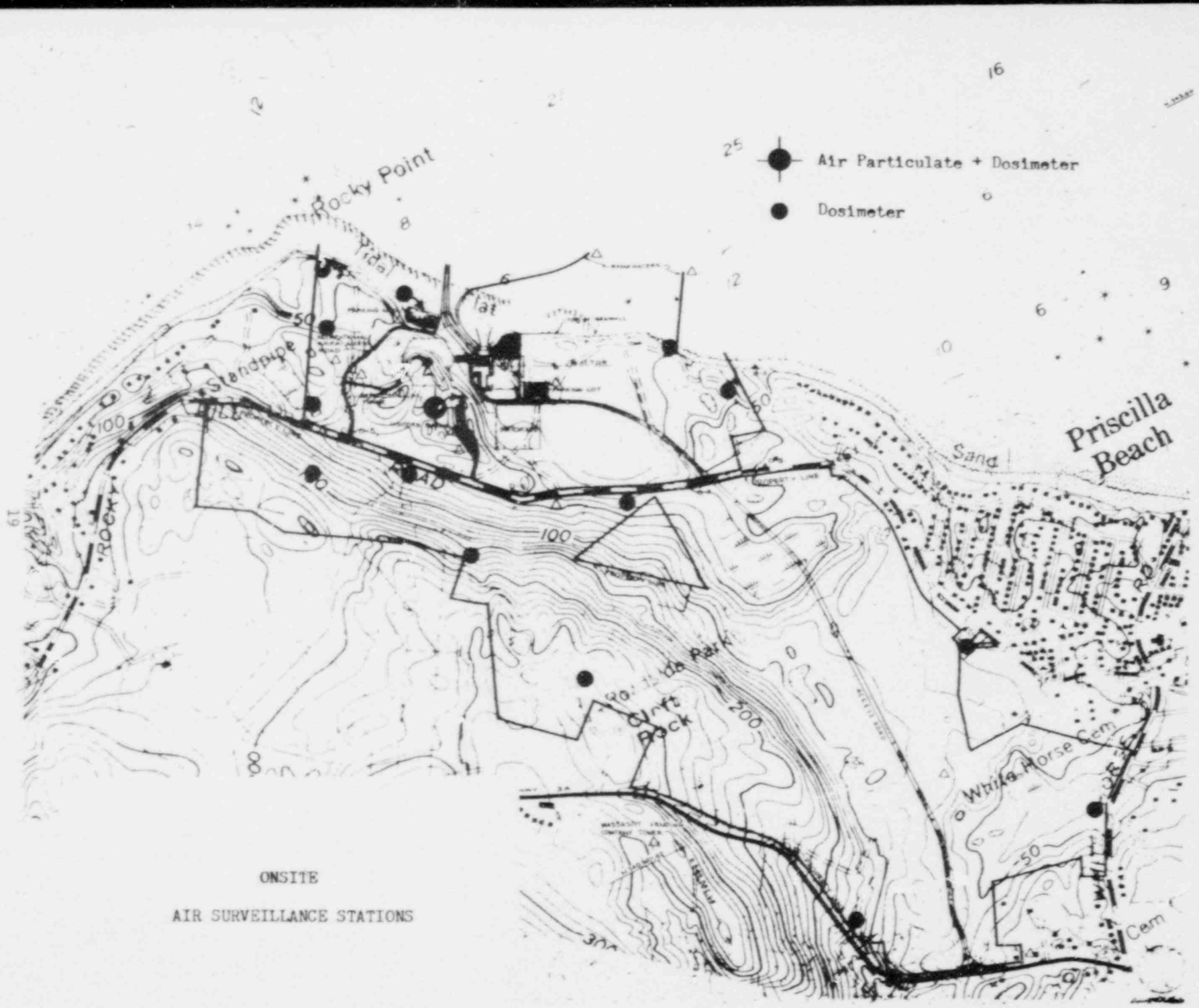
Data are presented under major divisions of air surveillance, aquatic surveillance and terrestrial surveillance.

Sampling locations are shown on the maps following.



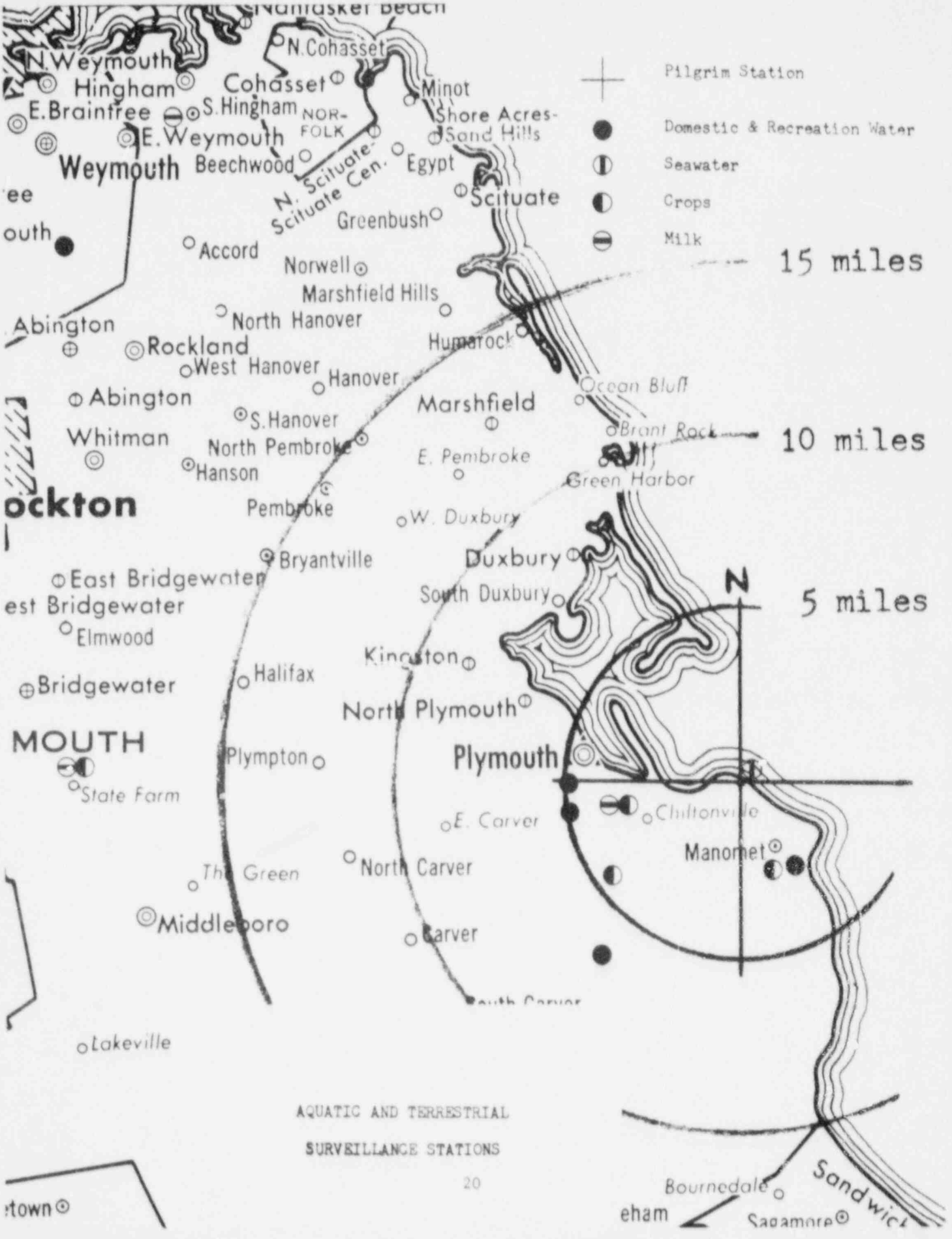
OFFSITE

AIR SURVEILLANCE STATIONS



ONSITE

AIR SURVEILLANCE STATIONS



AQUATIC AND TERRESTRIAL

SURVEILLANCE STATIONS

7.1 Air Surveillance

Data pertinent to air surveillance are given as follows:

Table IA Comparative Monthly Values for Gross Beta Radioactivity

Table 1B Comparative Monthly Values for Gross Beta Radioactivity

Table IIA East Weymouth Gross Beta Radioactivity

Table IIB Plymouth Center Gross Beta Radioactivity

Table IIC Cleft Rock Area Gross Beta Radioactivity

Table IID Manomet Substation Gross Beta Radioactivity

Table IIE Overlook Area Gross Beta Radioactivity

Table III Monthly Composites Gross Gamma Radioactivity

Table IVA Monthly Average Dose Rate Off-Site

Table IVB Monthly Average Dose Rate On-Site

Figure 1 Comparative Monthly Values, Gross Beta Radioactivity, Air Particulates

TABLE IA

AIR PARTICULATES

COMPARATIVE MONTHLY VALUES FOR GROSS BETA RADIOACTIVITY

(Concentrations in pCi/m^3)

Means

Collection Period 1970	Reference (EW)	Off-Site (PC)	(CR)	(MS)	On-Site (OA)	RAN Data* (A)	(B)
March	0.16	0.16	0.16	(a)	0.18	0	1
April	0.19	0.20	0.20	0.21	0.18	1	1
May	0.33	0.33	0.33	0.36	0.39	1	1
June	0.43	0.43	0.42	0.50	0.48	1	1
July	0.46	0.46	0.46	0.44	0.48	1	1
August	0.34	0.32	0.31	0.34	0.32		

* Radiation Alert Network, U. S. Public Health Service. Data are reported to nearest integer.

EW - East Weymouth
PC - Plymouth Center
CR - Cleft Rock Area
MS - Manomet Substation
OA - Overlook Area
A - Winchester, Mass.
B - Providence, R. I.

(a) Station not yet in operation

TABLE 1B

AIR PARTICULATES

COMPARATIVE MONTHLY VALUES FOR GROSS BETA RADIOACTIVITY

(Concentrations in pCi/m^3)

Collection Period 1970	Reference (EW)		Off-Site (PC)		Off-Site (CR)		Off-Site (MS)		On-Site (OA)	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
March	0.13	0.20	0.14	0.18	0.14	0.20	(a)	(a)	0.14	0.19
April	0.15	0.23	0.13	0.26	0.14	0.24	0.15	0.26	0.14	0.23
May	0.26	0.42	0.28	0.41	0.24	0.40	0.23	0.45	0.32	0.44
June	0.25	0.60	0.27	0.63	0.27	0.61	0.30	0.66	0.29	0.72
July	0.34	0.63	0.35	0.55	0.36	0.58	0.34	0.58	0.38	0.58
August	0.20	0.46	0.20	0.43	0.20	0.37	0.19	0.49	0.21	0.48

(a) Station not yet in operation

TABLE IIA

AIR PARTICULATES

EAST WEYMOUTH

Gross Beta Radioactivity

Collection Period	pCi/m^3	Collection Period	pCi/m^3
2.17-2.24.70	0.16 ± 0.02	5.26-6.2.70	0.27 ± 0.03
2.24-3.3.70	0.13 ± 0.02	6.2-6.9.70	0.25 ± 0.03
3.3-3.10.70	0.15 ± 0.02	6.9-6.15.70	0.35 ± 0.04
3.10-3.17.70	0.13 ± 0.02	6.15-6.23.70	0.53 ± 0.06
3.17-3.24.70	0.15 ± 0.02	6.23-6.30.70	0.60 ± 0.06
3.24-4.2.70	0.20 ± 0.02	6.30-7.7.70	0.34 ± 0.04
4.2-4.7.70	0.23 ± 0.03	7.7-7.14.70	0.63 ± 0.07
4.7-4.14.70	0.17 ± 0.02	7.14-7.23.70	0.46 ± 0.05
4.14-4.21.70	0.15 ± 0.02	7.23-7.30.70	0.42 ± 0.05
4.21-4.28.70	0.22 ± 0.03	7.30-8.5.70	0.41 ± 0.05
4.28-5.6.70	0.26 ± 0.03	8.5-8.11.70	0.46 ± 0.05
5.6-5.12.70	0.36 ± 0.04	8.11-8.19.70	0.36 ± 0.04
5.12-5.20.70	0.33 ± 0.04	8.19-8.25.70	0.25 ± 0.03
5.20-5.26.70	0.42 ± 0.05	8.25-9.1.70	0.20 ± 0.02

TABLE IIB

AIR PARTICULATES

PLYMOUTH CENTER

Gross Beta Radioactivity

Collection Period	pCi/m^3	Collection Period	pCi/m^3
2.17-2.24.70	0.16 ± 0.02	5.26-6.2.70	0.41 ± 0.05
2.24-3.3.70	0.13 ± 0.02	6.2-6.9.70	0.27 ± 0.03
3.3-3.10.70	0.16 ± 0.02	6.9-6.15.70	0.32 ± 0.04
3.10-3.17.70	0.14 ± 0.02	6.15-6.23.70	0.51 ± 0.06
3.17-3.24.70	0.17 ± 0.02	6.23-6.30.70	0.63 ± 0.07
3.24-4.1.70	0.18 ± 0.02	6.30-7.7.70	0.35 ± 0.04
4.1-4.7.70	0.23 ± 0.03	7.7-7.14.70	0.55 ± 0.06
4.7-4.14.70	0.16 ± 0.02	7.14-7.23.70	0.41 ± 0.05
4.14-4.21.70	0.13 ± 0.02	7.23-7.29.70	0.52 ± 0.06
4.21-4.28.70	0.26 ± 0.03	7.29-8.5.70	0.35 ± 0.04
4.28-5.6.70	0.28 ± 0.03	8.5-8.11.70	0.43 ± 0.05
5.6-5.12.70	0.31 ± 0.04	8.11-8.19.70	0.36 ± 0.04
5.12-5.20.70	0.30 ± 0.03	8.19-8.25.70	0.26 ± 0.03
5.20-5.26.70	0.36 ± 0.04	8.25-9.1.70	0.20 ± 0.02

TABLE IIC

AIR PARTICULATES

CLEFT ROCK AREA

Gross Beta Radioactivity

Collection Period	pCi/m^3	Collection Period	pCi/m^3
2.17-2.24.70	0.16 ± 0.02	5.26-6.2.70	0.40 ± 0.04
2.24-3.3.70	0.14 ± 0.02	6.2-6.9.70	0.28 ± 0.03
3.3-3.10.70	0.14 ± 0.02	6.9-6.15.70	0.27 ± 0.03
3.10-3.17.70	0.14 ± 0.02	6.15-6.23.70	0.51 ± 0.06
3.17-3.24.70	0.16 ± 0.02	6.23-6.30.70	0.61 ± 0.07
3.24-4.1.70	0.20 ± 0.02	6.30-7.7.70	0.36 ± 0.04
4.1-4.7.70	0.24 ± 0.03	7.7-7.14.70	0.58 ± 0.06
4.7-4.14.70	0.18 ± 0.02	7.14-7.23.70	0.40 ± 0.05
4.14-4.21.70	0.14 ± 0.02	7.23-7.29.70	0.49 ± 0.05
4.21-4.28.70	0.24 ± 0.03	7.29-8.5.70	0.37 ± 0.04
4.28-5.6.70	0.24 ± 0.03	8.5-8.11.70	0.36 ± 0.04
5.6-5.12.70	0.38 ± 0.04	8.11-8.19.70	0.33 ± 0.04
5.12-5.20.70	0.30 ± 0.03	8.19-8.25.70	0.27 ± 0.03
5.20-5.26.70	0.35 ± 0.04	8.25-9.1.70	0.20 ± 0.02

TABLE IID

AIR PARTICULATES

MANOMET SUBSTATION

Gross Beta Radioactivity

Collection Period	pCi/m^3	Collection Period	pCi/m^3
3.24-4.1.70	0.19 ± 0.02	6.18-6.23.70	0.63 ± 0.07
4.1-4.7.70	0.25 ± 0.03	6.23-6.30.70	0.66 ± 0.07
4.7-4.14.70	0.16 ± 0.02	6.30-7.7.70	.34 ± 0.04
4.14-4.21.70	0.15 ± 0.02	7.7-7.14.70	0.58 ± 0.06
4.21-4.28.70	0.26 ± 0.03	7.14-7.23.70	0.42 ± 0.05
4.28-5.6.70	0.23 ± 0.03	7.23-7.29.70	0.42 ± 0.05
5.6-5.12.70	0.38 ± 0.04	7.29-8.5.70	0.49 ± 0.05
5.12-5.20.70	0.32 ± 0.04	8.5-8.11.70	0.42 ± 0.05
5.20-5.26.70	0.40 ± 0.04	8.11-8.19.70	0.36 ± 0.04
5.26-6.2.70	0.45 ± 0.05	8.19-8.25.70	0.24 ± 0.03
6.2-6.9.70	0.30 ± 0.03	8.25-9.1.70	0.19 ± 0.02
6.9-6.18.70	0.40 ± 0.04		

TABLE IIE

AIR PARTICULATES

OVERLOOK AREA

Gross Beta Radioactivity

Collection Period	pCi/m^3	Collection Period	pCi/m^3
2.19-2.24.70	0.15 ± 0.02	5.26-6.2.70	0.44 ± 0.05
2.24-3.3.70	0.12 ± 0.02	6.2-6.9.70	0.29 ± 0.03
3.3-3.10.70	0.15 ± 0.02	6.9-6.15.70	0.32 ± 0.04
3.10-3.17.70	0.14 ± 0.02	6.15-6.23.70	0.58 ± 0.06
3.17-3.24.70	0.18 ± 0.02	6.23-6.30.70	0.72 ± 0.08
3.24-4.1.70	0.19 ± 0.02	6.30-7.7.70	0.38 ± 0.04
4.1-4.7.70	0.23 ± 0.03	7.7-7.14.70	0.58 ± 0.06
4.7-4.14.70	0.16 ± 0.02	7.14-7.23.70	0.44 ± 0.05
4.14-4.21.70	0.14 ± 0.02	7.23-7.29.70	0.53 ± 0.06
4.21-4.28.70	(a)	7.29-8.5.70	0.39 ± 0.04
4.28-5.6.70	(a)	8.5-8.11.70	0.48 ± 0.05
5.6-5.12.70	0.40 ± 0.04	8.11-8.19.70	0.24 ± 0.03
5.12-5.20.70	0.32 ± 0.04	8.19-8.25.70	0.29 ± 0.03
5.20-5.26.70	0.40 ± 0.04	8.25-9.1.70	0.21 ± 0.03

(a) No sample

TABLE III

AIR PARTICULATES

Monthly Composites

Gross Gamma Radioactivity
(Concentrations in cpm/m^3)

Collection Period 1970	Reference	Off-Site			On-Site
	(EW)	(PC)	(CR)	(MS)	(OA)
March	$(3 \pm 2)10^{-2}$	$(3 \pm 2)10^{-2}$	$(3 \pm 2)10^{-2}$	(a)	$(4 \pm 2)10^{-2}$
April	$(5 \pm 2)10^{-2}$	$(5 \pm 2)10^{-2}$	$(5 \pm 2)10^{-2}$	$(5 \pm 2)10^{-2}$	$(5 \pm 2)10^{-2}$
May	$(9 \pm 2)10^{-2}$	$(10 \pm 2)10^{-2}$	$(9 \pm 2)10^{-2}$	$(10 \pm 2)10^{-2}$	$(13 \pm 2)10^{-2}$
June	$(10 \pm 2)10^{-2}$	$(10 \pm 2)10^{-2}$	$(9 \pm 2)10^{-2}$	$(11 \pm 2)10^{-2}$	$(7 \pm 2)10^{-2}$
July	$(12 \pm 2)10^{-2}$	$(11 \pm 2)10^{-2}$	$(8 \pm 2)10^{-2}$	$(12 \pm 2)10^{-2}$	$(13 \pm 2)10^{-2}$
August	$(12 \pm 2)10^{-2}$	$(9 \pm 2)10^{-2}$	$(12 \pm 2)10^{-2}$	$(10 \pm 2)10^{-2}$	$(13 \pm 2)10^{-2}$

(a) Station not yet in operation

TABLE IVA

MONTHLY AVERAGE DOSE RATE[a]
uR/hr

Off-Site

Station	March	April	May	June	July	August
East Weymouth	9.2	8.3	(b)	7.4	8.8	9.5
Kingston	6.8	8.7	6.5	7.1	8.1	7.5
Sagamore	7.8	8.7	7.4	8.5	(b)	9.4
Plymouth	(c)				6.2(d)	5.7
Duxbury						6.8
Plymouth						6.6
North Plymouth				7.9	7.2	8.5
Plymouth Center	7.8	6.5	7.1	6.0	6.4	8.8
South Plymouth	7.9	8.6	7.6	8.4	9.8	9.1
Manomet						5.3
Manomet	8.1	8.9	8.6	8.4	9.7	9.3
Manomet			7.4	8.6	9.3	8.5
Manomet				8.3	5.8	6.4
Cleft Rock Area	7.1	7.4	7.4	6.5	9.0	7.7
Rocky Hill Road				7.1	9.2	6.8
Bayshore Drive						7.7
Rocky Hill Road				9.2	7.2	9.2

(a) Net dose rate after subtraction of 6.6 uR/hr dose rate inherent in dosimeter.

(b) Instrument malfunction

(c) Where no value is given, dosimeter was not in place during period.

(d) June and July

TABLE IVB

MONTHLY AVERAGE DOSE RATE[a]
uR/hr

On-Site

Station	March	April	May	June	July	August
Overlook Area	7.0	8.3	8.1	6.8	10.4	6.8
Public Parking Area	(c)	9.7	9.8	7.7	9.1	7.1
Rocky Hill Road, SW		7.2	7.8	6.3	7.4	6.7
Rocky Hill Road, SSE		8.0	8.0	6.8	8.3	7.8
East Breakwater						10.4
Microwave Tower		7.0	5.3	7.3	13.0	6.7
Property Line, ESE to SE						5.5
Property Line, SE to SSE				7.6		6.8
Property Line, SE to SSE				9.3	8.4	11.5
Property Line, SSE to S		6.2	6.6	5.9	(b)	6.0
Property Line, SSW			6.9	8.5	9.1	9.7
Property Line, WSW			6.5		10.4(d)	7.4
Property Line, W		7.1	6.7	5.9	9.4	5.4
Property Line, NW			7.1	8.0	9.1	
Property Line, NNW			8.0	6.4	9.6	10.3

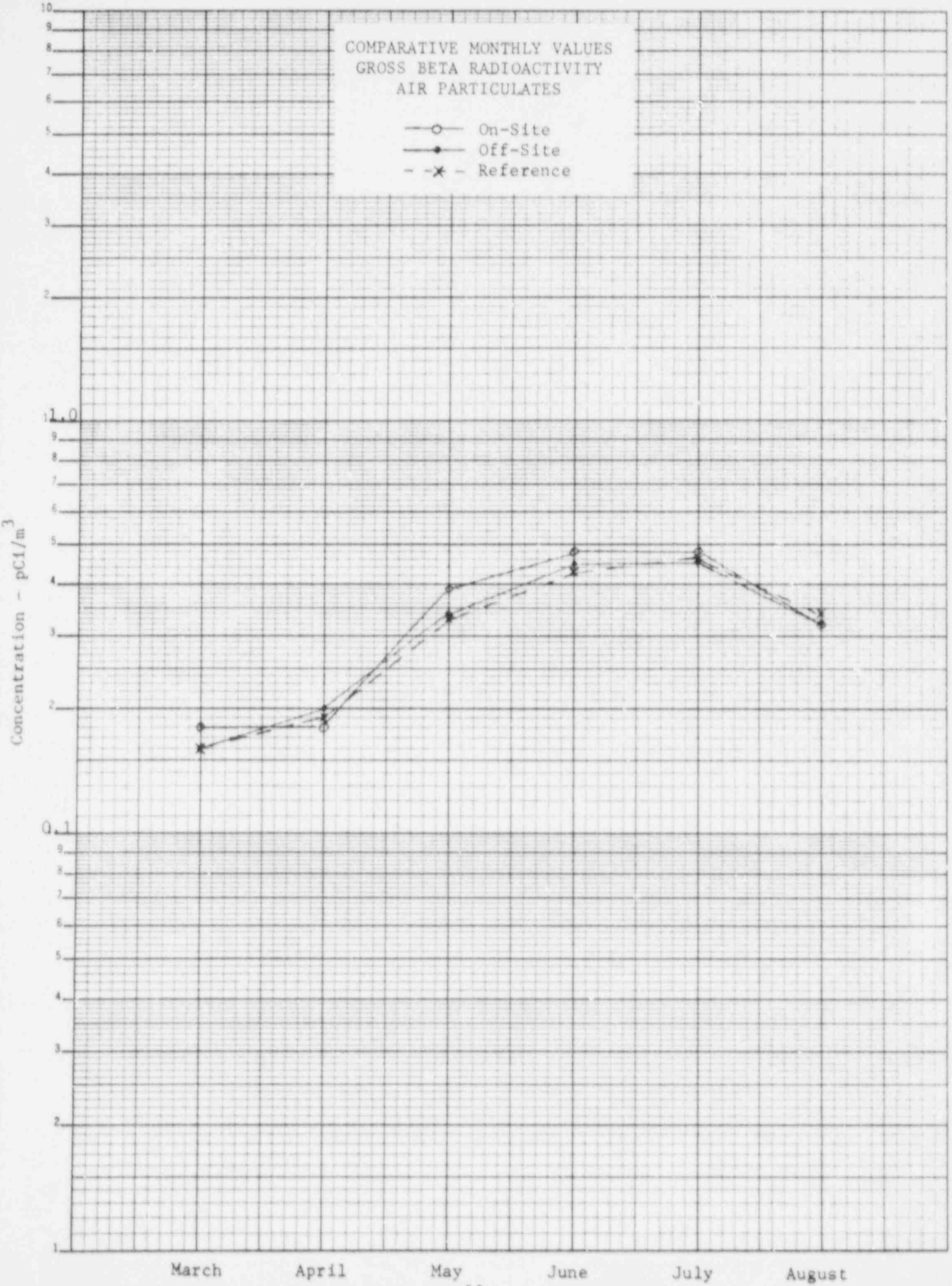
(a) Net dose rate after subtraction of 6.6 uR/hr dose rate inherrent in dosimeter

(b) Instrument malfunction

(c) Where no value is given, dosimeter was not in place during period.

(d) June and July

FIGURE 1


COMPARATIVE MONTHLY VALUES
GROSS BETA RADIOACTIVITY
AIR PARTICULATES
On-Site
Off-Site
Reference
Concentration - pCi/m3
10
9
8
7
6
5
4
3
2
1.0
9
8
7
6
5
4
3
2
0.1
9
8
7
6
5
4
3
2
1
March
April
May
June
July
August

7.2 Aquatic Surveillance

Data from the aquatic surveillance samples are presented as follows:

Table V Domestic and Recreational Water

Figure 2 Domestic and Recreation Water - Gross Beta

Figure 3 Domestic and Recreation Water - Strontium-90

Table VIA Seawater

Table VII Marine Life

TABLE V

DOMESTIC AND RECREATIONAL WATER

Location	Collection Date	Gross Beta pCi/L	Gross Gamma* cpm/L	^{90}Sr pCi/L	^{3}H pCi/ml
Little South Pond	8.28.68	6.3 ± 0.5	30 ± 10	0.8 ± 0.2	
	8.27.69	6.6 ± 1.0	< 10	1.6 ± 0.5	< 2.5
	9.24.69	6.0 ± 1.0	17 ± 10	< 0.5	< 2.5
	10.21.69	4.2 ± 1.0	< 10	< 0.5	< 2.5
	11.20.69	4.7 ± 1.0	< 10	< 0.5	< 2.5
	12.22.69	8.0 ± 1.0	< 10	< 0.8 ± 0.5(a)	< 2.5
	2.17.70	3.5 ± 1.0	< 10	1.1 ± 0.5	< 2.5
	3.24.70	5.3 ± 1.0	< 10	1.1 ± 0.5	< 2.5
	4.21.70	5.5 ± 1.0	< 10	< 0.5	< 2.5
	5.20.70	13.4 ± 1.0	< 10	< 0.5	< 2.5
	6.23.70	5.6 ± 1.0	< 10	0.8 ± 0.5	< 2.5
	7.29.70	3.8 ± 1.0	< 10	1.3 ± 0.5	< 2.5
	8.19.70	4.2 ± 1.0	27 ± 10	0.6 ± 0.5	< 2.5
College Pond	11.21.69	4.8 ± 1.0	12 ± 10	< 0.5	< 2.5
	3.24.70	5.8 ± 1.0	< 10	1.3 ± 0.5	< 2.5
	4.28.70	11.4 ± 1.0	< 10	< 0.5	< 2.5
	5.20.70	8.6 ± 1.0	< 10	1.3 ± 0.5	< 2.5
	6.23.70	7.4 ± 1.0	< 10	1.0 ± 0.5	< 2.5
	7.31.70	3.8 ± 1.0	20 ± 10	1.1 ± 0.5	< 2.5
	8.19.70	4.8 ± 1.0	14 ± 10	0.8 ± 0.5	< 2.5

* One (1) cpm is equivalent to 4.5 pCi if activity is assumed due to ^{137}Cs.

(a) Yttrium fraction did not exhibit normal decay.

TABLE V cont.

DOMESTIC AND RECREATIONAL WATER

Location	Collection Date	Gross Beta pCi/L	Gross Gamma* cpm/L	^{90}Sr pCi/L	^{3}H pCi/ml
Lout Pond Well	8.27.69	2.5 ± 1.0	13 ± 10	< 0.5	< 2.5
	9.24.69	5.4 ± 1.0	< 10	< 0.5	< 2.5
	10.21.69	5.2 ± 1.0	< 10	< 0.5	< 2.5
	11.20.69	1.9 ± 1.0	< 10	< 0.5	< 2.5
	12.22.69	7.5 ± 1.0	< 10	< 0.5	< 2.5
	1.22.70	1.5 ± 1.0	< 10	< 0.5	< 2.5
	2.17.70	2.2 ± 1.0	< 10	< 0.5	< 2.5
	3.24.70	1.3 ± 1.0	18 ± 10	< 0.5	< 2.5
	4.21.70	1.8 ± 1.0	< 10	< 0.5	< 2.5
	5.20.70	2.7 ± 1.0	< 10	< 0.5	< 2.5
	6.23.70	2.6 ± 1.0	52 ± 10	< 0.5	< 2.5
	7.29.70	1.7 ± 1.0	< 10	< 0.5	< 2.5
	8.19.70	< 1.0	< 10	< 0.5	< 2.5
Manomet Well	8.28.68	< 2.0	< 10	< 0.5	
	8.27.69	3.5 ± 1.0	< 10	< 0.5	< 2.5
	9.24.69	2.8 ± 1.0	< 10	< 0.5	< 2.5
	10.21.69	3.0 ± 1.0	< 10	< 0.5	< 2.5
	11.20.69	1.1 ± 1.0	< 10	< 0.5	< 2.5
	12.22.69	4.4 ± 1.0	12 ± 10	< 0.5	< 2.5
	1.22.70	1.1 ± 1.0	12 ± 10	0.8 ± 0.5	< 2.5
	2.17.70	1.9 ± 1.0	< 10	< 0.5	< 2.5

* One (1) cpm is equivalent to 4.5 pCi if activity is assumed due to ^{137}Cs.

TABLE V cont.

DOMESTIC AND RECREATIONAL WATER

Location	Collection Date	Gross Beta pCi/L	Gross Gamma* cpm/L	^{90}Sr pCi/L	^{3}H pCi/ml
Manomet Well	3.24.70	2.4 ± 1.0	12 ± 10	<0.5	<2.5
	4.21.70	1.5 ± 1.0	12 ± 10	<0.5	<2.5
	5.20.70	1.3 ± 1.0	<10	<0.5	<2.5
	6.23.70	1.5 ± 1.0	42 ± 10	<0.5	<2.5
	7.29.70	1.9 ± 1.0	<10	<0.5	<2.5
	8.19.70	1.1 ± 1.0	<10	<0.5	<2.5
Great Pond-South Weymouth	8.28.68	<2.0	40 ± 10	1.4 ± 0.1	
	8.27.69	6.3 ± 1.0	<10	<0.5	<2.5
	9.24.69	7.6 ± 1.0	<10	1.3 ± 0.5	<2.5
	10.21.69	8.9 ± 1.0	<10	1.2 ± 0.5	<2.5
	11.20.69	6.5 ± 1.0	13 ± 10	<0.5	<2.5
	12.22.69	2.8 ± 1.0	<10	<0.8 ± 0.5(a)	<2.5
	1.22.70	5.9 ± 1.0	<10	1.3 ± 0.5	<2.5
	2.17.70	6.7 ± 1.0	<10	1.3 ± 0.5	<2.5
	3.25.70	7.3 ± 1.0	<10	<0.5	<2.5
	4.22.70	8.7 ± 1.0	<10	1.3 ± 0.5	<2.5
	5.20.70	11.1 ± 1.0	<10	1.0 ± 0.5	<2.5
	6.23.70	8.6 ± 1.0	<10	1.1 ± 0.5	<2.5
	7.31.70	11.1 ± 1.0	<10	1.1 ± 0.5	<2.5
	8.19.70	7.9 ± 1.0	<10	0.6 ± 0.5	<2.5

* One (1) cpm is equivalent to 4.5 pCi if activity is assumed due to ^{137}Cs.

(a) Yttrium fraction did not exhibit normal decay.

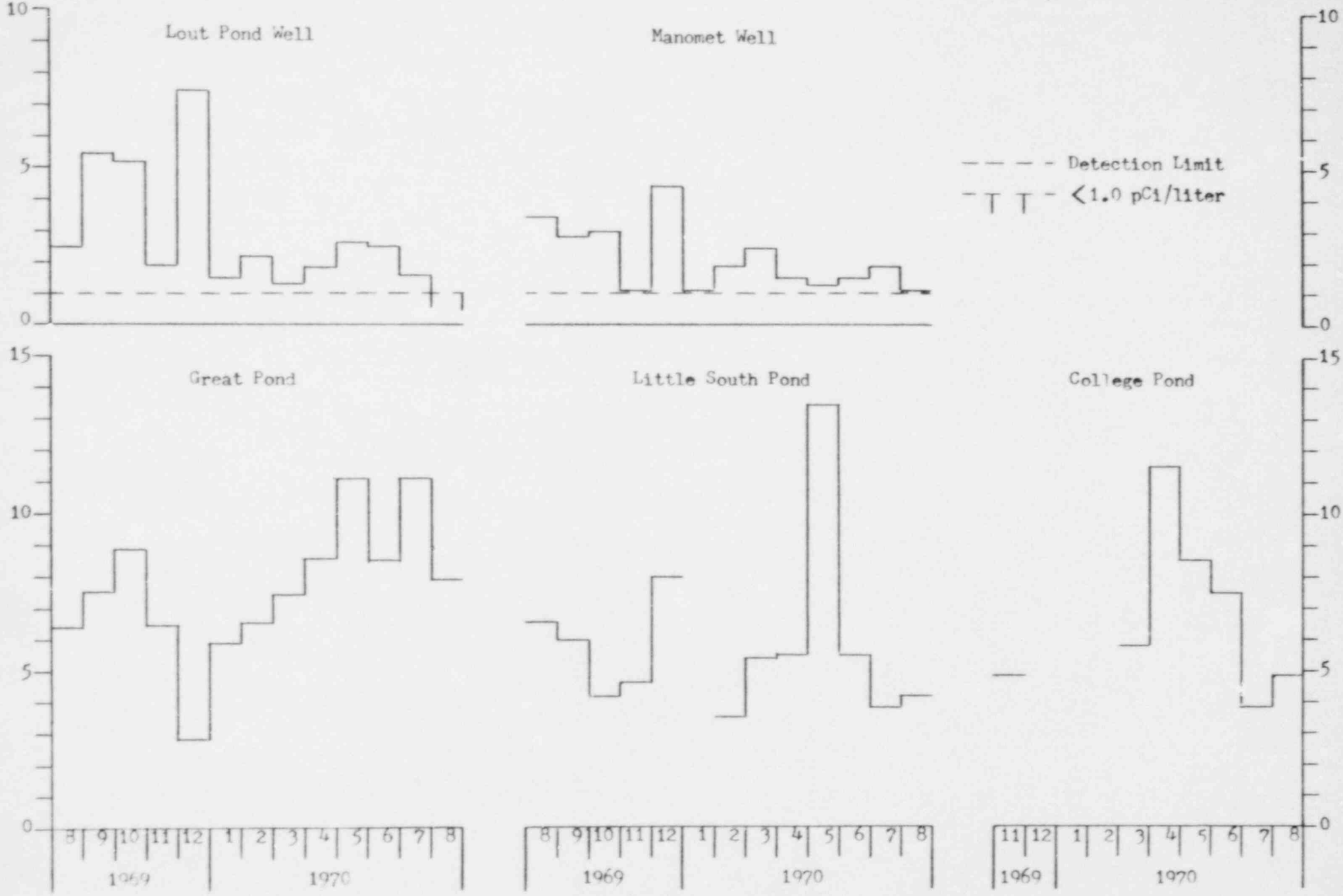


FIGURE 2: DOMESTIC & RECREATION WATER
Gross Beta (pCi/liter)

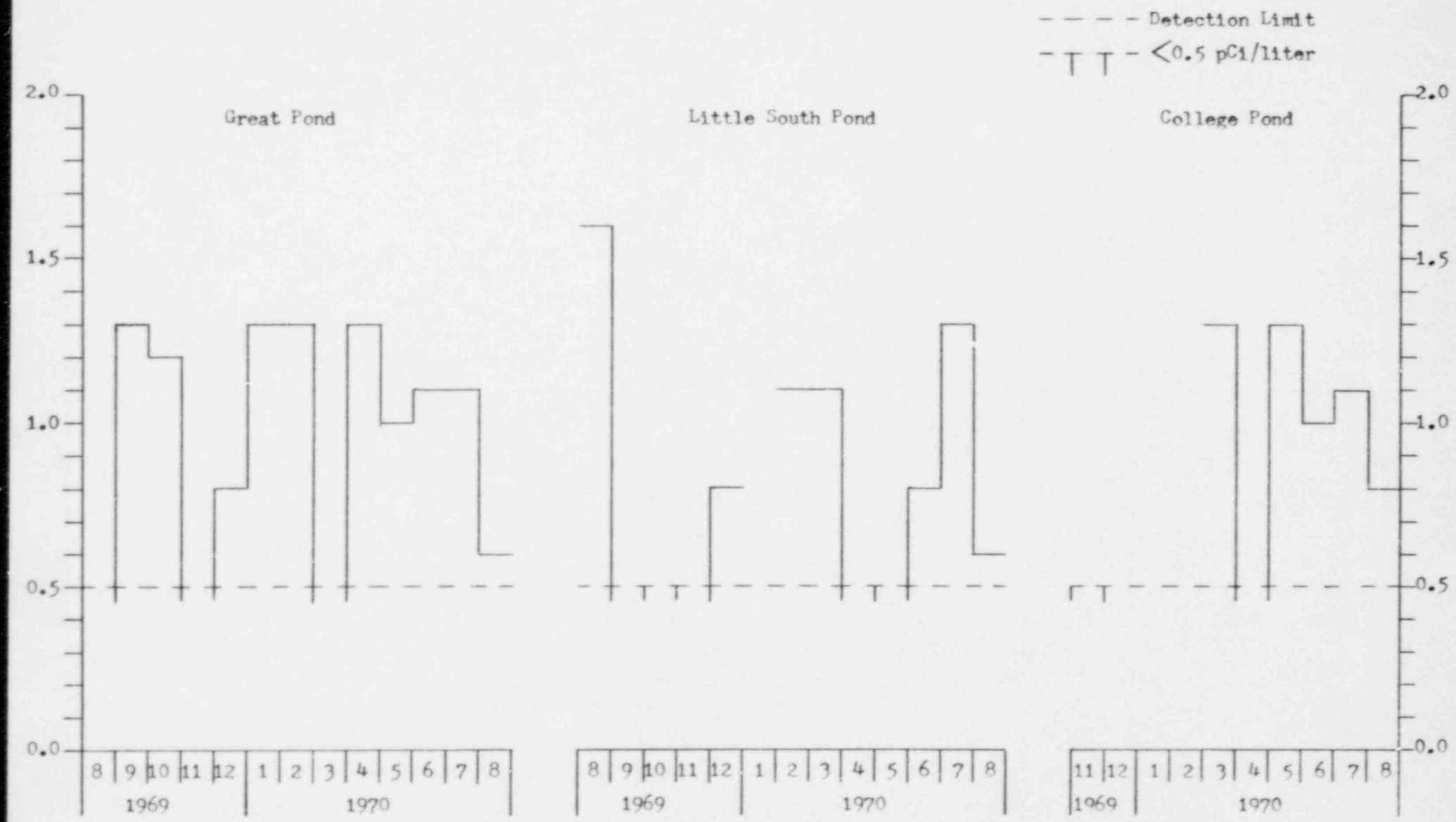


FIGURE 3: DOMESTIC & RECREATION WATER

Strontium-90 (pCi/liter)

TABLE VIA

SEAWATER

Location	Collection Date	Gross Beta pCi/l	Fractional Gross Beta pCi/L Frac. I	II	III	IV	Gross Gamma* cpm/l	^{3}H pCi/ml
Pilgrim Site	8.27.69	63 ± 12	< 5	< 5	< 5	< 5	< 10	< 2.5
	9.24.69		< 5	< 5	< 5	< 5	< 10	< 2.5
	10.21.69	291 ± 20	< 5	< 5	< 5	< 5	< 10	< 2.5
	11.20.69		< 5	< 5	< 5	< 5	< 10	< 2.5
	Quarterly Composite		< 5	< 5	< 5	< 5	< 10	< 2.5
	12.22.69		< 5	< 5	< 5	< 5	< 10	< 2.5
	1.28.70		< 5	< 5	< 5	< 5	< 10	< 2.5
	2.17.70		< 5	< 5	< 5	< 5	< 10	< 2.5
	Quarterly Composite		< 5	< 5	< 5	< 5	< 10	< 2.5
	3.25.70		< 5	8 ± 5	< 5	< 5	< 10	< 2.5
	4.21.70		< 5	8 ± 5	< 5	< 5	< 10	< 2.5
	5.20.70	< 5	8 ± 5	8 ± 5	< 5	< 5	< 10	< 2.5
	Quarterly Composite		< 5	7 ± 5	< 5	< 5	< 10	< 2.5
	6.23.70		< 5	5 ± 5	7 ± 5	7 ± 5	< 10	< 2.5
	7.29.70		< 5	5 ± 5	< 5	< 5	< 10	< 2.5
	8.26.70	< 5	< 5	< 5	6 ± 5	7 ± 5	< 10	< 2.5
	Quarterly Composite		< 5	< 5	< 5	< 5	19 ± 10	< 2.5

* One (1) cpm is equivalent to 4.5 if activity is assumed due to ^{137}Cs.

TABLE VIB

SEAWATER

(Concentrations in pCi/L)

Location	Collection Date	^{90}Sr	^{137}Cs	^{54}Mn	$^{58,60}Co$	^{65}Zn
Pilgrim Site	Aug.-Oct. 1969 Composite	<0.5	2 ± 1	<5	<5	<5
	Dec. 1969-Feb. 1970 Composite	<0.5	<1	<5	<5	<5
	March-May 1970 Composite	<0.5	<1	<5	9 ± 5	<5
	June-Aug. 1970 Composite	<0.5	0.20 ± 0.01*	<5	<5	<5

* Volume analyzed: 18.93 liters

TABLE VII

MARINE LIFE

Sample Type	Location	Collection Date	Gross Beta pCi/gm	Gross Gamma* cpm/gm	^{90}Sr pCi/gm	^{137}Cs pCi/gm	^{54}Mn pCi/gm	$^{58,60}Co$ pCi/gm	^{65}Zn pCi/gm
Lobster	Manomet Point	8.27.68	0.4 ± 0.1	0.02 ± 0.03	<0.005	<0.05	(a)	<0.1	<0.1
Lobster	Pilgrim Site	11.7.69	4.3 ± 0.2	0.01 ± 0.01	0.028 ± 0.005	<0.05	<0.1	<0.1	<0.1
Lobster	Rocky Point	5.15.70	1.7 ± 0.2	0.03 ± 0.01	0.019 ± 0.005	<0.05	<0.1	<0.1	<0.1
Lobster	Rocky Point	6.19.70	2.1 ± 0.2	0.04 ± 0.01	0.232 ± 0.005	<0.05	<0.1	<0.1	<0.1
Fish	Manomet Point	8.27.68	3.3 ± 0.2	4.1 ± 3.0	<0.005	<0.05	(a)	<0.1	<0.1
Fish	Manomet Point	8.27.68	3.2 ± 0.3	6.6 ± 3.0	<0.005	<0.05	(a)	<0.1	<0.1
Fish	Manomet Point	8.29.68	6.2 ± 0.2	6.6 ± 3.0	<0.005	<0.05	(a)	<0.1	<0.1
Fish	Manomet Point	9.10.68	2.5 ± 0.3	5.6 ± 3.0	<0.005	<0.05	(a)	<0.1	<0.1
Fish	Pilgrim Site	11.7.69	4.0 ± 0.7	0.10 ± 0.01	0.006 ± 0.005	<0.05	<0.1	<0.1	<0.1
Fish	Pilgrim Site	4.1.70	2.2 ± 0.2	0.07 ± 0.01	<0.005	0.60 ± 0.08	<0.1	<0.1	<0.1
Fish	Pilgrim Site	7.1.70	4.1 ± 0.5	0.04 ± 0.01	0.035 ± 0.005	<0.05	<0.1	<0.1	<0.1
Irish Moss	Pilgrim Site	9.2.68	8.5 ± 0.8	0.14 ± 0.03	(a)	(a)	(a)	(a)	(a)
Irish Moss	Pilgrim Site	10.21.69	5.2 ± 0.2	0.09 ± 0.01	<0.005	0.09 ± 0.05	<0.1	<0.1	<0.1
Irish Moss	Rocky Point	6.19.70	6.9 ± 0.4	0.76 ± 0.01	0.063 ± 0.005	0.09 ± 0.05	<0.1	<0.1	<0.1
Irish Moss	Manomet Point	6.29.70	11.0 ± 0.6	0.15 ± 0.01	0.017 ± 0.005	<0.05	<0.1	<0.1	<0.1
Rockweed	Pilgrim Site	4.1.70	4.2 ± 0.2	0.07 ± 0.01	0.018 ± 0.005	0.33 ± 0.16	<0.1	<0.1	<0.1
Rockweek	Pilgrim Site	4.1.70	4.0 ± 0.2	0.06 ± 0.01	0.012 ± 0.005	0.74 ± 0.11	<0.1	<0.1	<0.1

* One (1) cpm is equivalent to 4.5 pCi if activity is assumed due to ^{137}Cs.

(a) Sample not analyzed for this nuclide

7.3 Terrestrial Surveillance

Terrestrial surveillance data are presented as follows:

Table VIII Milk

Figure 4 Milk: Cesium-137

Figure 5 Milk: Strontium-90

Table IX Crops

TABLE VIII

MILK

(Concentrations in pCi/l)

Location	Collection Date	^{137}Cs	^{90}Sr	^{140}Ba-La	^{131}I
Hingham	9.3.68	26.4 ± 0.4	6.7 ± 0.2	(a)	(a)
	8.28.69	14 ± 1	7.4 ± 0.5	(a)	(a)
	10.7.69	9 ± 1	6.9 ± 1.4	(a)	(a)
	10.21.69	16 ± 1	9.9 ± 0.5	(a)	(a)
	11.20.69	23 ± 1	9.3 ± 0.5	(a)	(a)
	12.22.69	24 ± 1	14.3 ± 1.3	(a)	(a)
	1.28.70	20 ± 1	9.8 ± 0.5	< 5	< 5
	2.19.70	18 ± 1	7.4 ± 0.5	< 5	< 5
	3.24.70	9 ± 1	5.6 ± 0.5	< 5	< 5
	4.28.70	9 ± 1	16.2 ± 0.8	< 5	< 5
	5.20.70	9 ± 1	7.6 ± 0.5	< 5	< 5
	6.22.70	56 ± 1	16.9 ± 0.6	< 5	< 5
	7.70 (b)				
	8.31.70	18 ± 1	11. ± 0.5	< 5	< 5
Bridgewater	6.23.70	14 ± 1	8.0 ± 1.0	≤ 9 ± 5(c)	< 5
	7.29.70	10 ± 1	7.1 ± 0.6	< 5	< 5
	8.18.70	9 ± 1	8.7 ± 0.5	< 5	< 5

(a) Sample not analyzed for this nuclide.

(b) No sample taken.

(c) Sample did not show normal decay.

TABLE VIII cont.

MILK

(Concentrations in pCi/l)

Location	Collection Date	^{137}Cs	^{90}Sr	^{140}Ba-La	^{131}I
Plymouth	8.28.68	9.3 ± 0.9	7.2 ± 0.3	(a)	(a)
	8.28.69	12 ± 1	7.8 ± 0.5	(a)	(a)
	9.24.69	15 ± 1	9.0 ± 0.5	(a)	(a)
	10.21.69	19 ± 1	10.4 ± 0.8	(a)	(a)
	11.20.69	17 ± 2	12.2 ± 0.5	(a)	(a)
	12.22.69	18 ± 1	7.7 ± 0.5	(a)	(a)
	1.22.70	14 ± 1	5.6 ± 0.5	< 5	< 5
	2.19.70	16 ± 1	7.2 ± 0.5	< 5	< 5
	3.24.70	16 ± 1	6.6 ± 0.5	< 5	< 5
	4.22.70	13 ± 1	4.7 ± 0.8	< 5	< 5
	5.19.70	21 ± 1	12.8 ± 0.5	< 5	< 5
	6.22.70	23 ± 1	9.3 ± 0.8	< 5	< 5
	7.31.70	21 ± 1	11.8 ± 0.5	< 5	< 5
	8.19.70	22 ± 1	17.6 ± 0.5	< 5	< 5

(a) Sample not analyzed for this nuclide.

FIGURE 4 - MILK: Cesium-137 (pCi/liter)

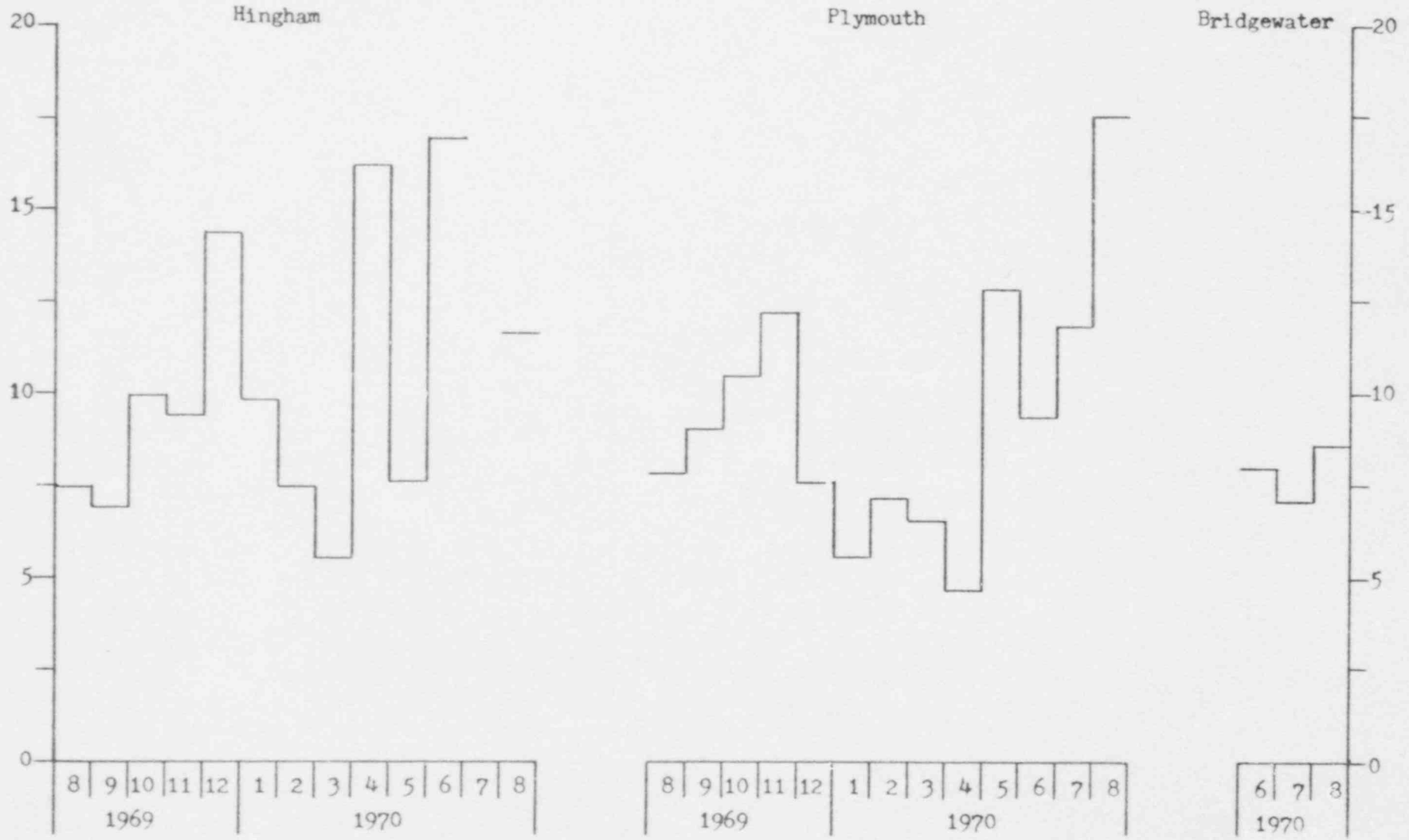


FIGURE 5: MILK

Strontium-90 (pCi/Liter)

TABLE IX

CROPS

Sample Type	Location	Collection Date	Gross Beta pCi/gm	Gross Gamma* cpm/gm	^{90}Sr pCi/gm	^{137}Cs pCi/gm
Cranberries	Manomet	9.13.68	0.6 ± 0.2	0.04 ± 0.03	(a)	0.186 ± 0.019
Cranberries	Manomet	9.19.69	0.8 ± 0.2	0.09 ± 0.01	0.052 ± 0.005	0.14 ± 0.05
Cranberries	Plymouth	9.13.68	0.9 ± 0.2	0.06 ± 0.03	(a)	0.165 ± 0.017
Cranberries	Plymouth	10.6.69	1.2 ± 0.2	0.05 ± 0.01	0.036 ± 0.005	0.19 ± 0.05
Potatoes	Plymouth	9.5.69	5.7 ± 0.2	0.07 ± 0.01	< 0.005	< 0.05
Cabbage	Plymouth	9.5.69	6.9 ± 0.2	0.08 ± 0.01	1.259 ± 0.007	< 0.05
Cabbage	Plymouth	7.7.70	4.9 ± 0.2	0.03 ± 0.01	0.059 ± 0.005	< 0.05
Cabbage	Bridgewater	6.18.70	1.5 ± 0.2	0.02 ± 0.01	0.063 ± 0.005	< 0.05
Lettuce	Plymouth	6.18.70	2.1 ± 0.2	0.03 ± 0.01	0.023 ± 0.005	< 0.05
Lettuce	Bridgewater	6.18.70	2.0 ± 0.2	0.01 ± 0.01	0.021 ± 0.005	< 0.05
Hay	Plymouth	2.19.70	17.1 ± 0.4	0.18 ± 0.01	0.913 ± 0.040	0.29 ± 0.05
Hay	Plymouth	6.18.70	16.6 ± 0.4	0.70 ± 0.01	0.658 ± 0.006	0.05 ± 0.05
Hay	Bridgewater	7.7.70	17.1 ± 0.4	0.68 ± 0.01	0.956 ± 0.005	0.26 ± 0.05

* One (1) cpm is equivalent to 4.5 pCi if activity is assumed due to ^{137}Cs.

(a) Sample not analyzed for Sr-90.