PREFACE

This annual report of the 1980 Radiological Environmental Monitoring Program for Three Mile Island Nuclear Station Unit 1 and 2 satisfies the reporting requirements of both Unit 1 and Unit 2 as shown in their respective Environmental Technical Specifications.

TABLE OF CONTENTS

	Page
PREFACE	i
TABLE OF CONTENTS	ii
LIST OF TABLES AND FIGURES	iii
SUMMARY	v
INTRODUCTION	1
GENERAL SITE INFORMATION	3
PROGRAM	4
Objectives	4
Design	4
Exceptions	5
RESULTS AND DISCUSSIONS	11
Aquatic Monitoring	11
Surface/Drinking Water	11
Groundwater	25
Aquatic Biota and Sediments	25
Atmospheric Environment	27
Air Particulates	27
Air Iodine	31
Special Monitoring	31
Precipitation	31
Terrestrial Environmental	33
Milk	33
Green Leafy Vegetables and Fruit	35
DIRECT RADIATION	36
ASSESSMENT OF IMPACT	39
Tritium Dose Assessment	39
CONCLUSIONS	41
REFERENCES	43
APPENDIX A: Sampling Locations and Descriptions	
APPENDIX B: LLD Exceptions	
APPENDIX C: Results of Environmental Monitoring of the Chinese Nuclear Weapons Test	
APPENDIX D: Environmental Monitoring of the Unit 2 Reactor Building Purge	

TABLE OF CONTENTS (cont'd)

Page

APPENDIX E: Changes Effected in the 1980 REMP

APPENDIX F: Dairy Census

APPENDIX G: REMP Sample Collection and Analysis Methods

APPENDIX H: EPA Cross-Check Results

APPENDIX I: Groundwater Monitoring Program

LIST OF TABLES

Table	Title	Page
1	Synopsis of the 1980 Operational REMP	6
2	Deviations from the AI/AP Sampling Program	10
3	Summary of Radionuclide Concentrations in Environmental Samples From TMINS for 1980	12
4	Surface/Drinking Water Samples and Analysis During 1980	19
5	Annual Average Iodine-131 Concentrations for Drinking Water Stations During 1980	20
6	Annual Average Tritium Concentrations for Surfaces and Drinking Water Stations During 1980	21
7	Monthly Gross Beta Activity in Precipitation Samples During 1980	32
8	Estimated Radiation Dose Equivalents to the General Populace	41

LIST OF FIGURES

Figure	Title	Page
1	Average Tritium Concentrations in the Susquehanna River in the vicinity of TMI from 1974-1980	23
2	Average Gross Beta Concentrations-Air Particulates-in the Vicinity of TMI from 1974-1980	29
3	Average Gamma Dose Rate in the Vicinity of TMI from 1974-1980	37

SUMMARY

This report contains the results of the operational radiological environmental monitoring program (REMP) conducted by Metropolitan Edison/GPU at Three Mile Island Nuclear Station (TMINS) during the period of January 1 through December 31, 1980.

The program was designed to meet the Environmental Technical Specifications (ETS) for TMINS Unit 1 and TMINS Unit 2.

Samples taken during 1980 from the aquatic, atmospheric, and terrestrial environments and direct radiation measurements were analyzed. The results are included in this report. Table 1 is the synopsis of the operational Radiological Environmental Monitoring Program for TMINS.

The aquatic environmental sampling program consisted of the analyses of 2569 surface water samples from 13 locations, of 55 fish samples from 16 locations, and of 10 sediment samples from 6 locations. Ichthyological Associates was unable to locate any aquatic vegetation, which was suitable for analysis, upstream or downstream of the TMINS discharge in the second half of 1980. Samples were collected during July 1980 at 2 locations with 2 samples analyzed.

The atmospheric environmental sampling program included the analyses of 430 air particulate samples and 432 air iodine samples from 8 locations, and of 57 precipitation samples from 5 locations.

The terrestrial environmental sampling program consisted of the analyses of 468 milk samples from 5 locations, and of 7 green leafy vegetable samples from 7 locations.

Direct radiation immersion dose measurements using TLDs were monitored at 73 locations during the 4 quarterly periods of 1980 for a total of 275 analyses. Monthly immersion dose measurements were also taken from 20 locations for a total of 230 monthly analyses.

From this study, elevated activities were detected in several pathways as a result of the October 1980 atmospheric nuclear test by the People's Republic of China (see Appendix C). The elevated radionuclide concentrations resulting from the Chinese nuclear test affected both the indicator and background locations and can thus be attributed to sources other than TMINS operation.

Based on comparisons between indicator and background stations, investigations were initiated on several data sets during 1980. These investigations included: (a) 1 aquatic sediment analysis for strontium-90, (b) goat milk samples from 1 location for strontium-90 and iodine-131, (c) gross beta analysis from 3 precipitation, air particulate locations and surface water sample stations, (d) tritium analysis from 3 surface water and 1 drinking water stations, and (e) iodine-131 analysis from 5 surface and 6 drinking water stations. Results of these investigations suggested that the tritium concentrations in the 3 surface water stations and 1 drinking water station could have originated in part from TMI.

Two significant events occurred during 1980 that required environmental assessment. On June 28, 1980, venting of the Unit 2 Containment Building atmosphere commenced and continued through to July 11, 1980. Intensified monitoring conducted by Metropolitan/GPU and various local, state, and Federal agencies revealed no environmental impacts resulted from the venting of approximately 44,000 Curies of krypton-85. Additionally, the People's Republic of China conducted an atmospheric test of a nuclear weapon on October 16, 1980. Results of environmental monitoring conducted by

Metropolitan Edison/GPU demonstrated that an increase in activity in certain environmental media samples were attributable to fallout from this weapon test.

The direct radiation immersion dose measurements taken during the 1980 study period, indicated only natural background environmental radiation levels were detected.

The sample locations chosen and analysis performed on the various media are more than adequate for detecting any environmental perturbation whether TMI related or externally caused, for all signficant pathways.

It is concluded that the Three Mile Island Nuclear Station did not produce any significant changes in the environment during the 1980 study period.

INTRODUCTION

On January 18, 1973, the United States Nuclear Regulatory Commission published Regulatory Guide 4.1 (26) which set forth what it considered to be an acceptable program for monitoring radioactivity in the environs of nuclear power plants. Criteria presented in this position document and subsequent revisions (27) included data gathering relative to the pre-operational environmental status of the power plant site and further allowed for monitoring programs relative to the operational phase of the plant.

Metropolitan Edison/GPU initiated a preoperational radiological environmental monitoring program (REMP) around the Three Mile Island area in 1968 which continued up to June 1974 when initial criticality for TMI Unit 1 was achieved. From June 1974 to the present, the REMP has been considered to be the operational phase pursuant to United States Nuclear Regulatory Commission Regulatory Guide 4.1.

Preoperational data for Unit 2 is considered as that obtained from 1968 to Unit 2's initial criticality on March 28, 1978. The operational phase consists of the time period from March 28, 1978 when initial criticality was reached to the present.

On March 28, 1979, an accident in the Unit 2 reactor resulted in the cessation of operation which has continued through the present 1980 investigational period. Additionally, Unit 1 had been out of service for purposes of refueling at the time of the Unit 2 accident and has remained out of service throughout the investigation period. Data on the preoperational phases as well as operational periods prior to 1980 have been presented in previous documents (2, 3, 4, 5, 6, 22, 23, 25).

This report presents the type and number of samples analyzed, the analyses performed and the data generated by the TMINS REMP for the period of January 1, 1980 through December 31, 1980. Interpretation of the data where applicable is also presented.

GENERAL SITE INFORMATION

Three Mile Island is the site of two nuclear power units of the pressurized water reactor (PWR) type. The station consists of two reactors; Unit 1, rated at 871 MWe and Unit 2 rated at 959 MWe.

The station is located on Three Mile Island in the Susquehanna River in Dauphin County, ten miles southeast of Harrisburg, PA. The average flow of the river at this point is 34,000 cfs (12). The site consists of an 814 acre tract on Three Mile Island and several smaller adjacent islands. The general climatic conditions are characterized by a mild continental-type climate with little severe weather. Agriculture is the largest land usage in the area (45%) with emphasis on poultry, dairy cattle, and field crops(8).

More specific information on the demography, meteorology and land use characteristics of the local areas may be found in the Environmental Report (9), Environmental Statement (10), Final Safety Analysis Report for TMI-2 (11), the Environmental Report Supplement II (12), and the FS FES (NUREG-0112) (21).

REMP Description

For the operational phase of the REMP, radioanalytical data are collected for comparison to that generated in preoperational and prior operational phases. Differences between these periods are compared to determine whether any station related effects have occurred over the monitoring periods.

PROGRAM

Objectives

The objectives of the operational radiological environmental program are:

1. To fullfill the obligations of the Radiological Environmental Surveillance sections of the Environmental Technical Specifications for TMI 1 and TMI 2 (1, 23).
2. To determine whether any significant increases in the environmental concentrations of radionuclides has occurred in critical pathways.
3. To detect any buildup of long-lived radionuclides in the environment.
4. To detect any change in ambient gamma radiation levels.
5. To verify that TMINS operations have had no detrimental effects on the health of the public or on the environment.

This report provides information for the Metropolitan Edison/GPU, regulatory agencies, and the public record toward these objectives.

Design

In order to meet the stated objectives, an appropriate operational REMP was developed by Metropolitan Edison/GPU. Samples for the operational REMP are taken from the aquatic, atmospheric, and terrestrial environments. Samples of various media are selected to obtain data for the evaluation of the radiation dose to man and other important organisms. Sample types are based on (1) established critical pathways for the transfer of radionuclides through the environment to man, and (2) experience gained during the pre-operational and operational phases. Sampling locations were determined from site meteorology, Susquehanna River hydrology, local demography, and land use.

Sampling locations are divided into two classes - indicator and control. Indicator stations are those which are expected to manifest station effects, if any exist; control samples are collected at locations which are believed to be unaffected by station operations. Fluctuations in the levels of

radionuclides and direct radiation at indicator stations are evaluated with respect to analogous fluctuations at control stations. Indicator station data are also evaluated relative to background characteristics established prior to station operations. Additional samples beyond those required by the Environmental Technical Specifications were collected and analyzed. Results were included with the Technical Specification data and are presented in this report.

The analysis of samples and the analytical data generated during the program are routinely evaluated by the TMI Environmental Controls staff. Further review of REMP and analytical data are performed by cognizant laboratories under contract to TMI and the TMI Environmental Controls staff with respect to current regulatory trends and operating experience. The analytical procedures and quality control methods utilized by the REMP analytical laboratory are detailed in reference (13, 14, 15).

Table 1 summarized information on the Three Mile Island Nuclear Station's operational REMP. Appendix A explains the sample coding system which specifies sample type and relative locations. Table A-1 gives the pertinent information on individual sampling locations, while Figures A-1, A-2, and A-3 depict their geographical locations.

Exceptions to the 1980 REMP

The operational REMP for TMI-1 and TMI-2 were conducted in accordance with their respective Environmental Technical Specifications (ETS). Deviations from this REMP (Table 3.0 and Table 3.2-2 of Unit 1 and Unit 2 ETS, respectively) occurred during this period.

Due to the paucity of aquatic vegetation in the vicinity of TMINS, no samples were obtained for the second half of 1980.

Table 1

SYNOPSIS OF THE OPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
FOR THREE MILE ISLAND NUCLEAR STATION

Sample Type	Number of Sampling Locations	Collection Frequency	Number of Samples Collected	Type Analysis	Analysis Frequency	Number of Samples Analyzed*
Surface Water/ Drinking Water/	13	Daily	2315	H-3	Daily	1
		Weekly	83	I-131	Daily	1902
		Monthly	7	Gr-Beta	Weekly Composite	274
		Biweekly	164	Gamma	Weekly Composite	275
				H-3	Weekly Composite	276
				Gr-Beta	Monthly Composite	117
				I-131	Monthly Composite	7
				Gamma	Monthly Composite	128
				H-3	Monthly Composite	135
				H-3	Quarterly Composite	40
				Sr-89	Monthly Composite	6
				Sr-89	Quarterly Composite	33
				Sr-90	Quarterly Composite	33
				I-131	Biweekly	130
				I-131	Weekly	13
				Gr-Alpha	Biweekly	2
				Gr-Alpha	Monthly	4
				Gr-Alpha	Weekly	23
				Sr-90	Monthly	6

* Number of Samples does not include duplicate analys's.

Table 1 (cont'd)

SYNOPSIS OF THE OPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
FOR THREE MILE ISLAND NUCLEAR STATION

Sample Type	Number of Sampling Locations	Collection Frequency	Number of Samples Collected	Type Analysis	Analysis Frequency	Number of Samples Analyzed*
Effluent Water	1	Daily	181	Gr-Beta	Daily	176
		Monthly	3	Gamma	Daily	176
		Biweekly	5	H-3	Daily	178
				I-131	Daily	171
				Gamma	Monthly Composite	4
				H-3	Monthly Composite	11
				I-131	Monthly Composite	2
				Sr-89	Monthly Composite	9
				Sr-90	Monthly Composite	9
				Sr-89	Quarterly Composite	1
				Sr-90	Quarterly Composite	1
				Gr-Alpha	Daily	155
				Gr-Alpha	Monthly Composite	11
				I-131	Biweekly Composite	5
				I-131	Weekly Composite	1
				Gr-Beta	Biweekly Composite	2
				Gr-Beta	Monthly Composite	4
Air Particulate	8	Weekly	430	Gr-Beta	Weekly	430
				Gamma	Monthly Composite	24
				Gamma	Quarterly Composite	32
				Sr-90	Quarterly Composite	8
				Gr-Alpha	Quarterly Composite	8

* Number of Samples Analyzed does not include duplicate analyses.

Table 1 (cont'd)

SYNOPSIS OF THE OPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM FOR THREE MILE ISLAND NUCLEAR STATION

Sample Type	Number of Sampling Locations	Collection Frequency	Number of Samples Collected	Type Analysis	Analysis Frequency	Number of Samples Analyzed*
Air Iodine	8	Weekly	432	I-131	Weekly	432
Precipitation	5	Monthly	50	Gr-Beta	Monthly Composite	48
		Bimonthly	5	Gamma	Monthly Composite	25
		3 Week	1	H-3	Monthly Composite	20
		9 Day	1	I-131	Monthly Composite	25
				Gamma	Quarterly Composite	15
				H-3	Quarterly Composite	15
				Sr-89	Semiannual Composite	5
				Sr-90	Semiannual Composite	5
Milk	5	Biweekly	59	I-131	Daily	20
		Weekly	140	I-131	Weekly	159
		3 Day	4	I-131	Semimonthly	40
		2 Day	4	Gamma	Weekly	169
		Daily	12	Gamma	Semimonthly	40
				Sr-89	Quarterly Composite	20
				Sr-90	Quarterly Composite	20
Fish	16	Semiannually	55**	Gamma	Semiannual Composite	8
				Sr-89	Semiannual Composite	8
				Sr-90	Semiannual Composite	8
Auqatic Sediment	6	Semiannually	10	Gamma	Semiannual Composite	10
				Sr-89	Semiannual Composite	10
				Sr-90	Semiannual Composite	10

* Number of Samples Analyzed does not include duplicate analyses.
** Samples composited into indicator and background samples.

Table 1 (cont'd)

SYNOPSIS OF THE OPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING SYSTEM
FOR THREE MILE ISLAND NUCLEAR STATION

Sample Type	Number of Sampling Locations	Collection Frequency	Number of Samples Collected	Type Analysis	Analysis Frequency	Number of Samples Analyzed
Aquatic Plants	2	Semiannually	2	Gamma	Semiannual Composite	2
Green Leafy Vegetables	7	Annually	7	Gamma	Annual Composite	7
Fruits	2	Annually	4	Gamma	Annual Composite	4
Dosimeters (TLD)	20	Monthly	244	Gamma Immersion Dose	Monthly	230
	73	Quarterly	279	Gamma Immersion Dose	Quarterly	275

* Number of Samples Analyzed does not include duplicate analyses.

Air particulate samples were not collected at two stations during certain sampling periods due to instrument malfunction. Table 2 presents problems encountered relative to air particulate sample collection. Since unit malfunctions also affect air iodine samples, Table 2 also reflects deviations from the air iodine sampling program.

Table 2

DEVIATIONS IN THE AI/AP SAMPLING PROGRAM DURING 1980

Station	Date	Comment
12B1	2/23 - 3/1	No sample - unit malfunction
	9/30 - 10/7	No sample - unit malfunction
7F1	3/22 - 3/29	No sample - unit malfunction
	3/29 - 4/5	No sample - unit malfunction
	4/5 - 4/12	No sample - unit malfunction

Insufficient precipitation during January and February prevented sample collection at all monitoring stations. Lack of sufficient sample at all stations in June for complete analysis resulted in June and July samples being composited. The lack of precipitation samples during January and February prevented the performance of first quarter gamma scan analysis and semiannual strontium 89 and 90 analysis although a second quarter composite was analyzed for these two isotopes.

Frozen river conditions in the first and fourth quarters prevented Technical Specification TLD station 14S2, 16A1, and 10B1 from being collected.

Monthly gamma scans at drinking water stations for January through May were replaced with weekly analysis to June then monthly to the end of the year. First and second quarter tritium at drinking water station 7G1 were replaced with weekly analysis to June then monthly through the end of the year.

Quarterly strontium-89 and 90 were performed on untreated water at station 7G' for the first and second quarter. Monthly iodine-131 at drinking water stations 15G1 and 7G1 were replaced with weekly analysis to June 1980 then semimonthly composite analysis through December 31, 1980.

Alternate stations to those in the respective Technical Specifications were sampled for green leafy vegetables and aquatic sediments during 1980 due to the lack of sample material at the designated locations.

Analysis which did not meet the requisite analytical LLD's are presented in Appendix B, Table B-1.

Results and Discussions

The averages and ranges of analytical results for the 1980 REMP are summarized in Table 3. Results for each type of sample taken were grouped according to the analysis performed and segregated by indicator and control stations. Where applicable, the location with the highest annual mean for a particular analysis is also presented.

Aquatic Environment

Surface/Drinking Water

Surface water samples were collected from the requisite Technical Specification stations 9A2, 9B1, 7G1, and 15F1 during the 1980 investigation period (see Table A-1 for location description). Monitoring points 9A2 and 9B1 are taken as weekly grab samples while monitoring points 7G1 and 15F1 are collected as biweekly composites. Additional surface water samples are collected at locations 1C3, 6G3, 8E2, 8C2, 10S1, and at both Unit 1 and Unit 2 intakes.

TABLE 3-1

SUMMARY OF RADIONUCLIDE CONCENTRATIONS IN ENVIRONMENTAL SAMPLES FROM THREE MILE ISLAND NUCLEAR STATION
1980

Sample Type	Analysis	Lower Limit of Detection*	Indicator Locations Mean**	Range	# of LLD's/ # of Analyses	# of Positives/ # of Analyses	Control Locations Mean**	Range	# of LLD's/ # of Analyses	# of Positives/ # of Analyses	Unit	# of Nonroutine Reportable Measurements
Surface/ Drinking Water	I-131	0.5	0.38	<0.1-6.4	1467/1517	50/1517	0.41	<0.1-3.9	547/589	42/589	pCi/ℓ	0
	H-3	330	154	<100.0-630.0	26/364	338/364	151	<80.0-270.0	8/120	112/120	pCi/ℓ	0
	Gr-β	2.0	3.0	<0.6-9.6	22/294	272/294	3.7	<1.0-9.8	1/115	114/115	pCi/ℓ	0
	Gr-α	2.0	---	---	---	---	---	<0.8-6.0	27/29	2/29	pCi/ℓ	0
	Sr-89	1.0	---	<2.0-<5.0	28/28	0/28	---	<2.0-<5.0	11/11	0/11	pCi/ℓ	0
	Sr-90	1.0	---	<0.4-<1.0	28/28	0/28	---	<0.3-<1.0	10/11	1/11	pCi/ℓ	0
	K-40	80.0	---	<70.0-<300.0	292/292	0/292	---	<70.0-<300.0	110/111	1/111	pCi/ℓ	0
	Cs-137	6.0	---	<3.0-<9.0	292/292	0/292	---	<3.0-<9.0	111/111	0/111	pCi/ℓ	0
	Ra-226	80.0	---	<60.0-<300.0	292/292	0/292	---	<60.0-<300.0	111/111	0/111	pCi/ℓ	0
	Th-228	8.0	---	<5.0-22.4	289/292	3/292	---	<5.0-<20.0	110/111	1/111	pCi/ℓ	0
Effluent Water	I-131	0.5	0.51	0.1-3.1	153/179	26/179	---	---	---	---	pCi/ℓ	0
	H-3	330	598	90.0-3540.0	1/192	191/192	---	---	---	---	pCi/ℓ	0
	Gr-β	2.0	5.1	<1.0-24.0	1/182	181/182	---	---	---	---	pCi/ℓ	0
	Gr-α	2.0	---	0.76-21.0	146/166	20/166	---	---	---	---	pCi/ℓ	0
	Sr-89	1.0	---	<1.0-<4.0	10/10	0/10	---	---	---	---	pCi/ℓ	0
	Sr-90	1.0	0.54	0.4-0.7	2/10	8/10	---	---	---	---	pCi/ℓ	0
	Th-228	8.0	---	<8.0-20.9	194/197	3/197	---	---	---	---	pCi/ℓ	0
	Ra-226	80.0	---	<80.0-<200.0	195/197	2/197	---	---	---	---	pCi/ℓ	0
	Cs-137	6.0	---	<4.0-<8.0	195/197	2/197	---	---	---	---	pCi/ℓ	0
	K-40	80.0	---	<70.0-<200.0	196/197	1/197	---	---	---	---	pCi/ℓ	0
Air Particulates	Gr-β	0.01	0.017	<0.002-0.85	9/255	246/255	0.021	<0.004-0.062	1/152	151/152	pCi/m^3	0
	Sr-90	0.0001	0.00009	<0.00005-0.00014	3/4	1/4	0.00012	<0.0001-0.00014	2/4	2/4	pCi/m^3	0
	Gr-α	0.002	0.0014	0.00071-0.0031	0/4	4/4	0.0018	0.0006-0.0038	1/4	3/4	pCi/m^3	0
	Cs-137	0.01	---	<0.0002-0.00047	31/32	1/32	---	<0.0002-0.0008	20/24	4/24	pCi/m^3	0
	Be-7	5.0	0.026	<0.01-0.05	2/32	30/32	0.041	0.02-0.08	0/24	24/24	pCi/m^3	0
	K-40	10.0	---	<0.003-0.016	30/32	2/32	---	<0.004-0.02	23/24	1/24	pCi/m^3	0
	Zr-95	3.0	---	<0.0002-0.0041	29/32	3/32	---	<0.0002-0.0042	20/24	4/24	pCi/m^3	0
	Ru-103	2.0	---	<0.0002-0.005	29/32	3/32	---	<0.0003-0.004	21/24	3/24	pCi/m^3	0
	Ce-141	3.0	---	<0.0002-0.0048	29/32	3/32	---	<0.0003-0.0048	22/24	2/24	pCi/m^3	0

TABLE 3-1 (cont'd)

SUMMARY OF RADIONUCLIDE CONCENTRATIONS IN ENVIRONMENTAL SAMPLES FROM THREE MILE ISLAND NUCLEAR STATION
1980

Sample Type	Analysis	Lower Limit of Detection*	Indicator Locations Mean**	Range	# of LLD's/ # of Analyses	# of Positives/ # of Analyses	Control Locations Mean**	Range	# of LLD's/ # of Analyses	# of Positives/ # of Analyses	Unit	# of Nonroutine Reportable Measurements
Air Iodine	I-131	0.07	---	<0.007-<0.02	255/255	0/255	---	<0.01-<0.02	151/151	0/151	pCi/m^3	0
Precipitation	I-131	0.5	---	<0.2-<0.5	20/20	0/20	---	<0.2-<0.4	5/5	0/5	pCi/l	0
	Gr-B	2.0	7.15	1.3-36.0	0/37	37/37	9.77	<0.8-44.0	1/11	10/11	pCi/l	0
	Th-228	8.0	---	<2.0-<20.0	30/32	2/32	---	1.9-<10.0	7/8	1/8	pCi/l	0
	Ra-226	80.0	---	<20.0-<200.0	29/30	1/30	---	<10.0-<200.0	10/10	0/10	pCi/l	0
	H-3	330	149.3	80.0-420.0	6/28	22/28	130	<100.0-180.0	2/7	5/7	pCi/l	0
	Be-7	50.0	---	<20.0-93.4	26/30	4/30	---	<10.0-76	9/10	1/10	pCi/l	0
	Sr-89	5.0	---	<2.0-<4.0	4/4	0/4	---	<3.0	1/1	0/1	pCi/l	0
	Sr-90	1.0	---	<0.4-<0.7	4/4	0/4	---	<0.4	1/1	0/1	pCi/l	0
Milk	I-131	0.8	0.39	<0.1-4.2	175/179	4/179	---	<0.1-<0.5	45/45	0/45	pCi/l	0
	Sr-89	5.0	---	<2.0-<5.0	16/16	0/16	---	<3.0-<5.0	4/4	0/4	pCi/l	0
	Sr-90	1.0	4.33	2.6-10.0	0/15	15/15	4.35	2.9-5.7	0/4	4/4	pCi/l	0
	K-40	80.0	1316.1	934-1910	0/184	184/184	1255.7	1030-1880	0/46	46/46	pCi/l	0
	Cs-137	15.0	---	<6.0-15.3	173/184	11/184	---	<6.0-12.7	45/46	1/46	pCi/l	0
	Cs-134	15.0	---	<5.0-<10.0	184/184	0/184	---	<5.0-<10.0	46/46	0/46	pCi/l	0
	Ba-140	15.0	---	<6.0-<10.0	184/184	0/184	---	<6.0-<10.0	46/46	0/46	pCi/l	0
	La-40	15.0	---	<6.0-<10.0	184/184	0/184	---	<6.0-<10.0	46/46	0/46	pCi/l	0
	Th-228	10.0	---	6.5-<10.0	183/184	1/184	---	---	46/46	0/46	pCi/l	0
Fish	Sr-90	0.009	0.0095	<0.0009-0.019	1/4	3/4	0.0143	<0.001-0.032	2/4	2/4	pCi/gm(wet)	0
	Sr-89	0.002	---	<0.002-<0.01	4/4	0/4	---	<0.002-<0.02	4/4	0/4	pCi/gm(wet)	0
	K-40	0.4	3.735	1.85-7.31	0/4	4/4	3.535	2.92-4.46	0/4	4/4	pCi/gm(wet)	0
	Cs-137	0.02	0.065	0.026-0.148	0/4	4/4	0.033	<0.019-<0.05	2/4	2/4	pCi/gm(wet)	0
	Th-228	0.009	0.0438	<0.009-<0.1	3/4	1/4	0.0373	<0.01-<0.07	3/4	1/4	pCi/gm(wet)	0

TABLE 3-1 (cont'd)

SUMMARY OF RADIONUCLIDE CONCENTRATIONS IN ENVIRONMENTAL SAMPLES FROM THREE MILE ISLAND NUCLEAR STATION
1980

Sample Type	Analysis	Lower Limit of Detection*	Indicator Locations				Control Locations				Unit	# of Nonroutine Reportable Measurements
			Mean**	Range	# of LLD's / # of Analyses	# of Positives/ # of Analyses	Mean**	Range	# of LLD's/ # of Analyses	# of Positives/ # of Analyses		
Aquatic Sediment	Sr-90	5.0	---	<0.002-0.003	5/6	1/6	<0.002	---	4/4	0/4	pCi/gm(dry)	0
	Cs-137	0.15	0.57	0.14-1.25	0/6	6/6	0.18	0.131-0.25	0/4	4/4	pCi/gm(dry)	0
	Sr-89	0.006	---	<0.006-<0.02	6/6	0/6	---	<0.006-<0.008	4/4	0/4	pCi/gm(dry)	0
	K-40	0.4	10.06	7.97-13	0/6	6/6	9.18	7.69-10.8	0/4	4/4	pCi/gm(dry)	0
	Th-228	0.02	1.17	0.867-1.4	0/6	6/6	1.06	0.88-1.35	0/4	4/4	pCi/gm(dry)	0
	Ra-226	0.1	1.49	0.8-2.04	2/6	4/6	1.29	0.904-1.7	1/4	3/4	pCi/gm(dry)	0
	Be-7	0.5	---	<0.5-0.75	5/6	1/6	---	<0.5-<0.6	4/4	0/4	pCi/gm(dry)	0
	Ag-110m	0.07	0.1	<0.07-0.25	4/6	2/6	---	---	4/4	0/4	pCi/gm(dry)	0
	Cs-134	0.5	0.120	<0.05-0.25	3/6	3/6	---	<0.05-<0.07	4/4	0/4	pCi/gm(dry)	0
Aquatic Plants	Cs-137	---	<0.1	---	1/1	0/1	0.115	---	0/1	1/1	pCi/gm(wet)	0
	K-40	---	4.05	---	0/1	1/1	<2.0	---	1/1	0/1	pCi/gm(wet)	0
	Be-7	---	<1.00	---	1/1	0/1	1.93	---	0/1	1/1	pCi/gm(wet)	0
	H-3	---	230	---	0/1	1/1	520	---	0/1	1/1	pCi/gm(wet)	0
Green Leafy Vegetables	Be-7	0.1	0.26	<0.1-0.45	2/5	3/5	0.55	<0.2-0.89	1/2	1/2	pCi/gm(wet)	0
	K-40	0.4	5.49	1.86-10.5	0/5	5/5	6.10	4.77-7.43	0/2	2/2	pCi/gm(wet)	0
Fruit	K-40	---	1.24	0.72-1.76	0/2	2/2	1.005	0.72-1.29	0/2	2/2	pCi/gm(wet)	0
Immersion Dose	γ	as per USNRC Reg. Guide 4.13	5.73	2.7-12.4	---	---	6.7	3.8-14.1	---	---	mrem/mo	0

* Technical Specification LLD's are given where applicable.
** Means not calculated if the number of values above LLD were less than 25% of the total number of analysis. A 2% criteria was used in the case of iodine-131 values

TABLE 3-2

SUMMARY OF RADIONUCLIDE CONCENTRATIONS IN ENVIRONMENTAL SAMPLES FROM THREE MILE ISLAND NUCLEAR STATION
1980

Sample Type	Analysis	Location with the Highest Annual Mean					# of LLD's/ # of Analyses	# of Positives/ # of Analyses	Units	# of Nonroutine Reportable Measurements
			Name	Distance and Direction*	Mean	Range				
Surface/ Drinking Water	I-131	9B1	Above York Haven Dam	1.5 mi SE on TMI	0.89	0.2-6.4	12/22	10/22	pCi/ℓ	0
	H-3	9B1	Above York Haven Dam	1.5 mi SE on TMI	195	140.0-420.0	0/16	16/16	pCi/ℓ	0
	Gr-β	7G1	Columbia (surface water)	15 mi SE of TMI	5.43	1.9-33.0	0/37	37/37	pCi/ℓ	0
	Gr-α	13S2	Unit 1 Intake Bldg.	On Site	---	<2.0-<6.0	3/3	0/3	pCi/ℓ	0
	Sr-89	7G1	Columbia (surface water)	15 mi SE of TMI	---	<2.0-<5.0	4/4	0/4	pCi/ℓ	0
	Sr-90	9A2	Susquehanna River	0.5 mi S of TMI	---	<0.8-<1.0	2/2	0/2	pCi/ℓ	0
		9B1	Above York Haven Dam	1.5 mi SE of TMI	---	<0.8- <1.0	2/2	0/2	pCi/ℓ	0
	K-40	1C3	Swatara Creek, Middletown	2.3 mi N of TMI	---	<70.0-<130.0	42/43	1/43	pCi/ℓ	0
	Cs-137	---	---	---	---	---	---	---	pCi/	0
	Ra-226	---	---	---	---	---	---	---	pCi/ℓ	0
	Th-228	9A2	S Parking Lot TMI	0.5 mi on TMI	---	<8.0-22.4	1/12	1/12	pCi/ℓ	0
Effluent Water	I-131	---	---	---	---	---	---	---	pCi/ℓ	0
	H-3	---	---	---	---	---	---	---	pCi/ℓ	0
	Gr-β	---	---	---	---	---	---	---	pCi/ℓ	0
	Gr-α	---	---	---	---	---	---	---	pCi/ℓ	0
	Sr-89	---	---	---	---	---	---	---	pCi/ℓ	0
	Sr-90	---	---	---	---	---	---	---	pCi/ℓ	0
	Th-228	---	---	---	---	---	---	---	pCi/ℓ	0
	Ra-226	---	---	---	---	---	---	---	pCi/ℓ	0
	Cs-137	---	---	---	---	---	---	---	pCi/ℓ	0
	K-40	---	---	---	---	---	---	---	pCi/ℓ	0
Air Particulates	Gr-β	15G1	W Fairview Substation	15 mi NW of TMI	0.027	0.01-0.081	0/51	51/51	pCi/m^3	0
	Sr-90	---	---	---	---	---	---	---	pCi/m^3	0
	Gr-α	---	---	---	---	---	---	---	pCi/m^3	0
	Cs-134	---	---	---	---	---	32/32	0/32	pCi/m^3	0
	Cs-137	15G1	W Fairview Substation	15 mi NW of TMI	0.00068	<0.0004-0.00092	1/4	3/4	pCi/m^3	0
	Be-7	15G1	W Fairview Substation	15 mi NW of TMI	0.05	0.02-0.07	0/4	4/4	pCi/m^3	0
	K-40	12B1	Goldsboro	1.6 mi SW of TMI	0.063	<0.0007-0.025	3/4	1/4	pCi/m^3	0
	Zr-95	12B1	Goldsboro	1.6 mi SW of TMI	0.0026	<0.001-0.022	3/4	1/4	pCi/m^3	0
	Ru-103	12B1	Goldsboro	1.6 mi SW of TMI	0.0032	<0.001-0.0031	2/4	2/4	pCi/m^3	0
	Ce-141	5A1	Observation Center	0.4 mi E of TMI	0.002	<0.0006-0.0024	3/4	1/4	pCi/m^3	0

TABLE 3-2 (cont'd)

SUMMARY OF RADIONUCLIDE CONCENTRATIONS IN ENVIRONMENTAL SAMPLES FROM THREE MILE ISLAND NUCLEAR STATION
1980

Sample Type	Analysis	Location with the Highest Annual Mean					# of LLD's/ # of Analyses	# of Positives/ # of Analyses	Units	# of Nonroutine Reportable Measurements
		Name	Distance and Direction*	Mean	Range					
Air Iodine	I-131	15G1 W Fairview Substation	15 mi NW of TMI	---	<0.02-<0.08		51/51	0/51	pCi/m^3	0
Precipitation	I-131	---	---	---	---		---	---	---	0
	Gr-β	7F1 Drager Farm	9.9 mi SE of TMI	12.87	1.2-88.0		0/9	9/9	pCi/l	0
	Th-228	1C1 Middletown Substation	2.6 mi N of TMI	14.16	4.3-<20.0		7/8	1/8	pCi/l	0
	Ra-226	1C1 Middletown Substation	2.6 mi N of TMI	111.77	35.3-<200.0		2/3	1/3	pCi/l	0
	Be-7	8C1 Falmouth Collins Sub.	2.3 mi SSE of TMI	63.3	39.9-93.4		5/8	3/8	pCi/l	0
	H-3	7F1 Drager Farm	9.9 mi SE of TMI	225.7	<110.0-420.0		2/7	5/7	pCi/l	0
Milk	I-131	1B1 Hardison Goat Farm	1.2 mi N of TMI	0.6	<0.2-4.2		42/46	4/46	pCi/l	0
	Sr-89	---	---	---	---		---	---	pCi/l	0
	Sr-90	1B1 Hardison Goat Farm	1.2 mi N of TMI	7.2	3.6-10.0		0/4	4/4	pCi/l	0
	K-40	1B1 Hardison Goat Farm	1.2 mi N of TMI	1548.3	1080.0-1910.0		0/46	46/46	pCi/l	0
	Cs-137	1B1 Hardison Goat Farm	1.2 mi N of TMI	---	<6.0-15.3		40/46	6/46	pCi/l	0
	Cs-134	---	---	---	---		---	---	pCi/l	0
	Ba-140	---	---	---	---		---	---	pCi/l	0
	La-40	---	---	---	---		---	---	pCi/l	0
	Th-228	1B1 Hardison Goat Farm	1.2 mi N	---	6.5-<10.0		45/46	1/46	pCi/l	0
Fish	Sr-90	Background	Above Discharge	0.0143	<0.001-0.032		2/4	2/4	pCi/gm(wet)	0
	Sr-89	Background	Above Discharge	0.0103	<0.002-<0.02		4/4	0/4	pCi/gm(wet)	0
	K-40	Indicator	Below Discharge	3.735	1.85-7.31		0/4	4/4	pCi/gm(wet)	0
	Cs-137	Indicator	Below Discharge	0.065	0.026-0.148		1/4	3/4	pCi/gm(wet)	0
	Th-228	Indicator	Below Discharge	0.0438	<0.009-<0.01		3/4	1/4	pCi/gm(wet)	0

TABLE 3-2 (cont'd)

SUMMARY OF RADIONUCLIDE CONCENTRATIONS IN ENVIRONMENTAL SAMPLES FROM THREE MILE ISLAND NUCLEAR STATION
1980

Sample Type	Analysis	Location with the Highest Annual Mean			Mean	Range	# of LLD's/ # of Analyses	#of Positives/ # of Analyses	Units	# of Nonroutine Reportable Measurements
			Name	Distance and Direction*						
Aquatic Sediment	Sr-90	9B1	Susquehanna River	0.7 mi S of TMI	0.0025	<0.002-0.003	1/2	1/2	pCi/gm(dry)	0
	Cs-137	9B1	Susquehanna River	0.7 mi S of TMI	0.997	0.744-1.25	0/2	2/2	pCi/gm(dry)	0
	Sr-89	11A1	Susquehanna River	0.5 mi SW of TMI	<0.02	---	1/1	0/1	pCi/gm(dry)	0
	K-40	9B1	Susquehanna River	0.7 mi S of TMI	12.0	11.0-13.0	0/2	2/2	pCi/gm(dry)	0
	Th-228	9B1	Susquehanna River	0.7 mi S of TMI	1.395	1.39-1.4	0/2	2/2	pCi/gm(dry)	0
	Ra-226	10A1	Susquehanna River	0.5 mi SSW of TMI	1.74	--	0/1	1/1	pCi/gm(dry)	0
	Be-7	9B1	Susquehanna River	0.7 mi S of TMI	<0.7	---	2/2	0/2	pCi/gm(dry)	0
	Ag-110m	9B1	Susquehanna River	0.7 mi S of TMI	0.16	<0.07-0.25	1/2	1/2	pCi/gm(dry)	0
	Cs-134	9B1	Susquehanna River	0.7 mi S of TMI	0.20	0.157-0.25	0/2	2/2	pCi/gm(dry)	0
Aquatic Plants	Cs-137	1A2	Susquehanna River	0.7 mi N of TMI	0.154	---	0/1	1/1	pCi/gm(dry)	0
	K-40	10B1	Susquehanna River	0.7 mi SSW of TMI	4.05	4.05	0/1	1/1	pCi/gm(dry)	0
	Be-7	1A2	Susquehanna River	0.7 mi N of TMI	1.93	1.93	0/1	1/1	pCi/gm(dry)	0
	H-3	1A2	Susquehanna River	0.7 mi N of TMI	520	520	0/1	1/1	pCi/gm(dry)	0
Green Leafy Vegetables	Be-7	1F2	North Union Street	6.5 mi N of TMI	0.89	---	0/1	1/1	pCi/gm(dry)	0
	K-40	14C1	Fisher Farms	2.7 WNW of TMI	10.5	---	0/1	1/1	pCi/gm(dry)	0
Fruit	K-40	1F2	Masonic Homes	5.2 ESE of TMI	1.24	0.72-1.76	0/2	2/2	pCi/gm(dry)	0
Immersion Dose	γ	7G1	Columbia	15 mi SE of TMI	9.1	6.9-13.9	---	---	mrem/mo	0

* Distance measured from the reactor complex centerline.

Environmental Technical Specification stations for drinking water are given as locations 7G1, and 7G1 and 15F1 for Unit 1 and Unit 2, respectively. Additional drinking water stations designated 7G3 (Lancaster), 7G2 (Wrightsville), 9G2 (York), and 8E2 (Brunner Island) are also incorporated into the TMI REMP.

In response to the continued shutdown of both TMI Unit 1 and TMI Unit 2 during the 1980 investigation period, the sampling regimes were reduced during the second half of the year. Table 4 reflects the changes effected in the sampling and analysis frequencies during the 1980 monitoring year. It should be noted that stations 9A2, 9B1, and 6G3 are collected as grab samples while the remainder of the stations are collected by automatic compositor (drinking water stations 7G1 and 7G3 remain as a daily hand composite prepared by the City of Lancaster and Columbia technicians).

Although the overall regime was reduced, the monitoring program exceeds the maximum technical specification requirements in number of stations monitored, collection and analysis frequency and types of analysis performed. All changes effected in the 1980 REMP are detailed in Appendix E. Changes include alterations in technical and nontechnical specification programs.

Of the 2106 surface and drinking water samples analyzed for iodine-131, 92 were above the LLD (lower limit of detection) of 0.5 pCi/liter. Fifty of these positive values were noted in the indicator stations and forty-two in the control points.

Comparisons between the annual means of the indicator and control stations indicates no difference i.e. 0.38 and 0.41 pCi/liter for indicator and control stations, respectively. The appearance of iodine-131 in control stations suggests inputs upstream of Three Mile Island. The highest annual average iodine-131 location was surface water station 9B1 approximately 1.5 miles southeast of TMI containment. The range for this station for the 1980 monitoring period was 0.2-6.4 pCi/liter iodine-131.

Table 4

SURFACE/DRINKING WATER SAMPLE AND ANALYSIS FREQUENCY DURING 1980

	Collection Frequency	Dates	Analysis	Analysis Frequency	Dates
Auto Composite Samples	Daily	1/1/80 - 6/15/80	I-131	Daily	1/1/80 - 6/15/80
			I-131	Semimonthly	6/15/80 - 12/31/80
	Semimonthly Composite	6/15/80 - 12/31/80	Gamma	Weekly Composite Monthly Composite	1/1/80 - 6/15/80
			Gamma	Monthly Composite	6/15/80 - 12/31/80
			H-3	Weekly Composite Monthly Composite Quarterly Composite	1/1/80 - 6/15/80
			H-3	Monthly Composite Quarterly Composite	6/15/80 - 12/31/80
			Sr-89,90	Quarterly Composite	1/1/80 - 12/31/80
			Gr-Beta	Weekly Composite Monthly Composite	1/1/80 - 12/31/80
			Gr-Beta	Monthly Composite	6/15/80 - 12/31/80
Grab Samples	Weekly	1/1/80 - 6/15/80	I-131	Weekly Semimonthly Weekly	1/1/80 - 6/15/80 6/15/80 - 8/1/80 8/1/80 - 12/31/80
	Semimonthly	6/15/80 - 8/1/80	Gamma	Monthly Composite	1/1/80 - 12/31/80
	Weekly	8/1/80 - 12/31/80(a)	H-3	Monthly Composite Quarterly Composite	1/1/80 - 12/31/80

(a) 6G3 remained on semimonthly collection frequency

The highest annual average iodine-131 concentration occurring at a drinking water station occurred at 7G2 (Wrightsville Water Company) (Table 5).

Table 5

ANNUAL AVERAGE IODINE-131 CONCENTRATION FOR DRINKING WATER STATIONS DURING 1980
(pCi/liter)

Station	Annual Average	Range
15F1 (Background)	0.36	0.2-1.3
8E1	0.36	0.1-1.0
7G1	0.36	0.2-1.0
7G3	0.36	0.2-1.1
9G2	0.36	0.2-0.7
7G2	0.40	0.1-3.2

The highest value obtained from this sampling location occurred during the period of December 31, 1979 to January 7, 1980. Values ranged from <0.5 to 3.2 pCi/liter. During the same period iodine-131 values ranged from <0.3 to 1.4 pCi/liter and <0.4 to 2.3 pCi/liter for the TMI intake and discharge, respectively. Background stations ranged from 0.1 to 3.9 pCi/liter reflecting the contributions from sources upstream of TMI. None of the iodine-131 data obtained from the surface and drinking water stations during 1980 reached reportable values. The annual average iodine-131 concentrations at all drinking water stations were an order of magnitude below the EPA drinking water standard of 3.0 pCi/liter as averaged over the yearly reporting period.

Tritium values over the year for all stations ranged from <80 to 630 pCi/liter. The average tritium values for all stations are presented in Table 6.

Table 6

ANNUAL AVERAGE TRITIUM CONCENTRATIONS FOR

SURFACE AND DRINKING WATER STATIONS DURING 1980

Station	SW/DW[(a)]	Average Concentration (pCi/ℓ)	Range (pCi/ℓ)
1C3 (control)	SW	152	80-240
15F1 (control)	SW/DW	155	100-270
13S2 (control)	SW	147	100-260
8E1	DW	148	100-420
8E1	SW	141	100-260
7G1	SW	168	100-400
7G1	DW	148	100-290
8C2	SW	154	100-350
7G3	DW	165	100-630
9G2	DW	146	100-220
7G2	DW	130	100-220
9A2	SW	186	100-370
9B1	SW	195	140-420
6C3 (control)	SW	128	100-190

(a) SW = surface water; DW = finished drinking water

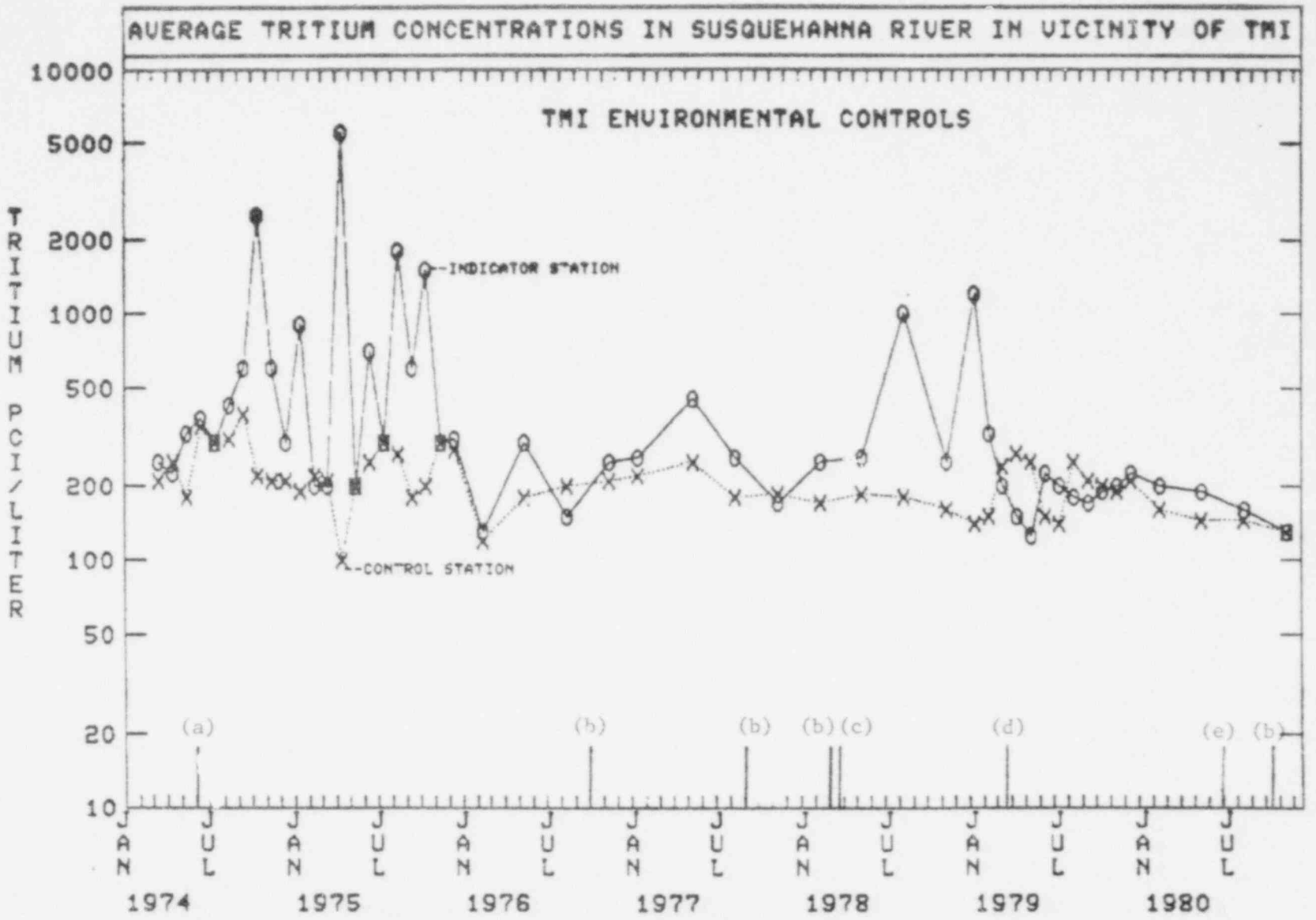
As noted in Table 6, surface water station 9B1 (1.5 south of the TMI discharge) had the highest average annual tritium concentration of all sampling locations. The drinking water station with the highest average tritium concentration was 7G1 (Columbia) with 168.8 pCi/liter of tritium, slightly above background average of 151 pCi/liter. The single highest tritium value obtained from the drinking water stations during 1980, occurred in the June monthly composite sample at Lancaster (630 pCi/liter). Tritium values at the TMI intake and discharge for this same period were 120.0 and 300 pCi/liter, respectively.

Surface water samples collected during March at station 9A2 were above background for tritium. Analysis of the monthly composite revealed tritium values of 370 ± 110 pCi/liter as compared to the background value of 130 ± 14 pCi/liter. Samples from surface water stations 7G1 (Columbia) and 8C2 (York Haven Hydro Station) for the month of June were also above background with values of 400 ± 120 and 350 ± 90

pCi/liter, respectively. Background values for the same time period were 170 ± 28 pCi/liter. Only one drinking water station, 7G3, exhibited tritium concentration above background during 1980. The same monthly composite for 7G3 and the background stations were 630 ± 80 and 150 ± 80 pCi/liter, respectively. Although none of the tritium values obtained during the 1980 monitoring period attained reportable levels, investigations were made into the probable cause of greater than background levels of tritium noted above. Figure 1 depicts the average tritium concentrations in the Susquehanna River from 1974 through 1980. The results of these investigations suggested TMI as being a possible contributor.

Results of the gross beta activity indicated no difference between indicator and background station over the 1980 reporting period. Background stations averaged 3.7 pCi/liter over the 1980 monitoring period while indicator stations averaged 3.0 pCi/liter. Effluent water from Three Mile Island averaged 5.1 pCi/liter over the 1980 period and ranged from 1.0 to 24 pCi/liter for gross beta activity. Values for 1980 are generally equal to or less than those noted in previous years, i.e. 1979 - 3.0 pCi/liter and 1978 - 4.3 pCi/liter. None of the values obtained during 1980 reached reportable levels although investigations were initiated on six values obtained from three surface water stations. Gross beta activity for station 9B1 in February was 6.3 ± 0.1 pCi/liter compared to background levels of 2.8 ± 0.3 pCi/liter. Effluent gross beta activity for this period averaged 3.9 pCi/liter. Gross beta activity at station 7G1 for March, July, and October were 13.0 ± 2.0, 8.7 ± 1.3, and 11.0 ± 1.0 pCi/liter, respectively. These compared to background levels of 4.4 ± 1.8, 5.0 ± 0.2, and 2.8 ± 1.8 for the respective time periods. Examination of effluent averages for each of these time intervals gave values for the investigational periods of 6.9 ± 1.1. 8.3 ± 1.2, and 3.7 ± 10. Strontium

Figure 1



(a) TMI-1 Initial Criticality
(b) Chinese Nuclear Detonations
(c) TMI-2 Initial Criticality
(d) TMI-2 Accident
(e) TMI-2 Reactor Building Purge

analysis for the first and third quarters at 7G1 were less than the lower limits of detection (LLD) of 1.0 pCi/liter for strontium-89 and 90. Analysis of strontium-89 and 90 analysis from the plant discharge for the periods under investigation indicate that these isotopes were not the contributing factors in the slightly elevated gross beta activities noted. The monthly analysis conducted on station 6G3 were above control stations values obtained upstream of the TMI discharge. Analysis for this time period were 6.1 $\pm$ 1.2 pCi/liter at location 6G3 and 3.3 $\pm$ 1.3 for the control locations. Station 6G3 is located on Chickies Creek and is not influenced by discharges from TMI. Consequently, this station serves as an additional background station for monitoring points below Chickies Creek, and the elevated values are due to sources other than TMI such as local hospital and municipal waste treatment discharges or atmospheric fallout. It should be noted that the contributions from 6G3 would impact sample point 7G1 and the values obtained at this location during March, July, and October may reflect the background component from Chickies Creek in addition to the natural river background. The natural fluctuation in Susquehanna River gross beta activity for the years 1980, 1979, and 1978 ranged from <1.0 to 9.8 pCi/liter, <1.0 to 14.0 pCi/liter, and 2.1 to 13.0 pCi/liter, respectively. The values obtained from stations 9B1, 7G1, and 6G3 all fall within this natural background fluctuation.

Data analysis of surface/drinking water stations for strontium-89 and 90 during 1980 revealed that no values above the analysis LLD were detected for any of the indicator stations. Only one positive value for strontium-90 was noted in a control station above the TMI intake.

Gamma spectral analysis of the surface and drinking water samples collected revealed only naturally occurring K-40 and Th-228 in both indicator and control stations.

Gross alpha analysis of surface water samples were all LLD for indicator stations with two positive values obtained in the control stations upstream from TMI.

Groundwater

Pursuant to a request from the Nuclear Regulatory Agency, groundwater monitoring was initiated around the Unit 2 power block area in January of 1980. Initially, eight monitoring stations were installed and sampled weekly for tritium and gamma emitting radionuclides. Seven additional stations were added in May.

A complete report, relative to this monitoring program, is presented in Appendix I.

Aquatic Biota and Sediments

Representative fish species were obtained in July and October of 1980. Gamma spectral analysis revealed natural occurring K-40 and Th-228 from both indicator and control stations and Cs-137 in four indicator and two control samples. The average cesium values for the year were 0.065 and 0.033 pCi/gram for the indicator and background stations, respectively, and are considered to be consistent with natural background levels resulting from past fallout excursions.

Strontium-89 and 90 analysis for indicator stations yielded no positive strontium-89 values and three positive strontium-90 results. Control stations analysis were negative for strontium-89 with two positive strontium-90 values. The indicator station average for strontium-90 was 0.0095 pCi/gram while the control stations average was 0.0143 pCi/gram. The single highest strontium-90 concentration was noted in the control locations upstream of TMI and had a value of 0.032 pCi/gram. All of these

values are consistent with background levels and the preoperational strontium-90 levels of 0.045 pCi/gram.

Aquatic vegetation was collected only once during 1980 due to the paucity of sampling material. Gamma spectral analysis of plant material revealed naturally occurring K-40 and Be-7 in indicator and control stations, respectively. Low level cesium was noted in the control stations and is consistent with background fallout levels. Tritium analysis were positive for both indicator and control stations with the control station being higher than the indicator, i.e. 230 $\pm$ 90 vs 520 $\pm$ 110 pCi/gram.

Aquatic sediment samples were obtained during July and October of 1980. One positive strontium-90 value was obtained during 1980. Monitoring point 9B1 gave a positive value of 0.0025 $\pm$ 0.0009 pCi/gram in July. Subsequent samples were negative as were all strontium-89 for both indicator and background station analysis during 1980. The positive strontium value is well below the preoperational mean of 0.39 $\pm$ 0.45 pCi/gram and is considered to be within natural fallout values. Gamma spectral analysis revealed naturally occurring K-40, Th-228, and Ra-226 in both indicator and control station. Cesium-134, cesium-137 and silver +110m was also detected. All samples contained positive cesium-137 levels, ranging from 0.013 pCi/gram at background station 1A2 to 1.25 pCi/gram at indicator station 9B1. Cesium-134 values range from LLD levels at background stations 1A2 and 7A1 and indicator stations 11A1 and 10B1 to positive levels of 0.14 to 0.25 pCi/gram at indicator stations 9B1 and 10A1. Silver -110m values range from LLD levels at background stations 1A2 and 7A1 and indicator stations 9B1 (July only), 11A1, and 10B1 to positive levels of 0.07 to 0.25 pCi/gram at indicator stations 10A1 and 9B1 (October only). Preoperational levels of cesium-137 were 0.430 $\pm$ 0.29 pCi/gram.

Effluent data from May 1980 showed positive low levels of cesium-134, cesium-137, and silver -110m. These levels, while positive, were close to analysis LLD's. In light of this, it is possible that a component of the sediment radioactivity is related to TMI activities. It should be noted that elevated radiocontaminants were detected in several environmental samples as a result of the atmospheric tests conducted by the People's Republic of China in October 1980 (see Appendix C). These data suggest that atmospheric fallout could have also contributed to the positive values noted above.

Atmospheric Environment

Monitoring of the atmospheric environment around Three Mile Island is conducted through analyzing air particulate filers, charcoal cartridges, and precipitation samples. Air particulate and air iodine samples are collected at eight locations with low volume air samplers. Air particulate samples are collected on filters in tandem with charcoal (flow through) cartridges for collecting air iodine samples. Air volumes are measured with dry gas meters and recorded. Both air particulate and iodine samples are collected weekly.

Precipitation is collected utilizing 12-inch diameter funnels that drain into 5 gallon polyethene bottles. Samples are collected monthly.

Air Particulates

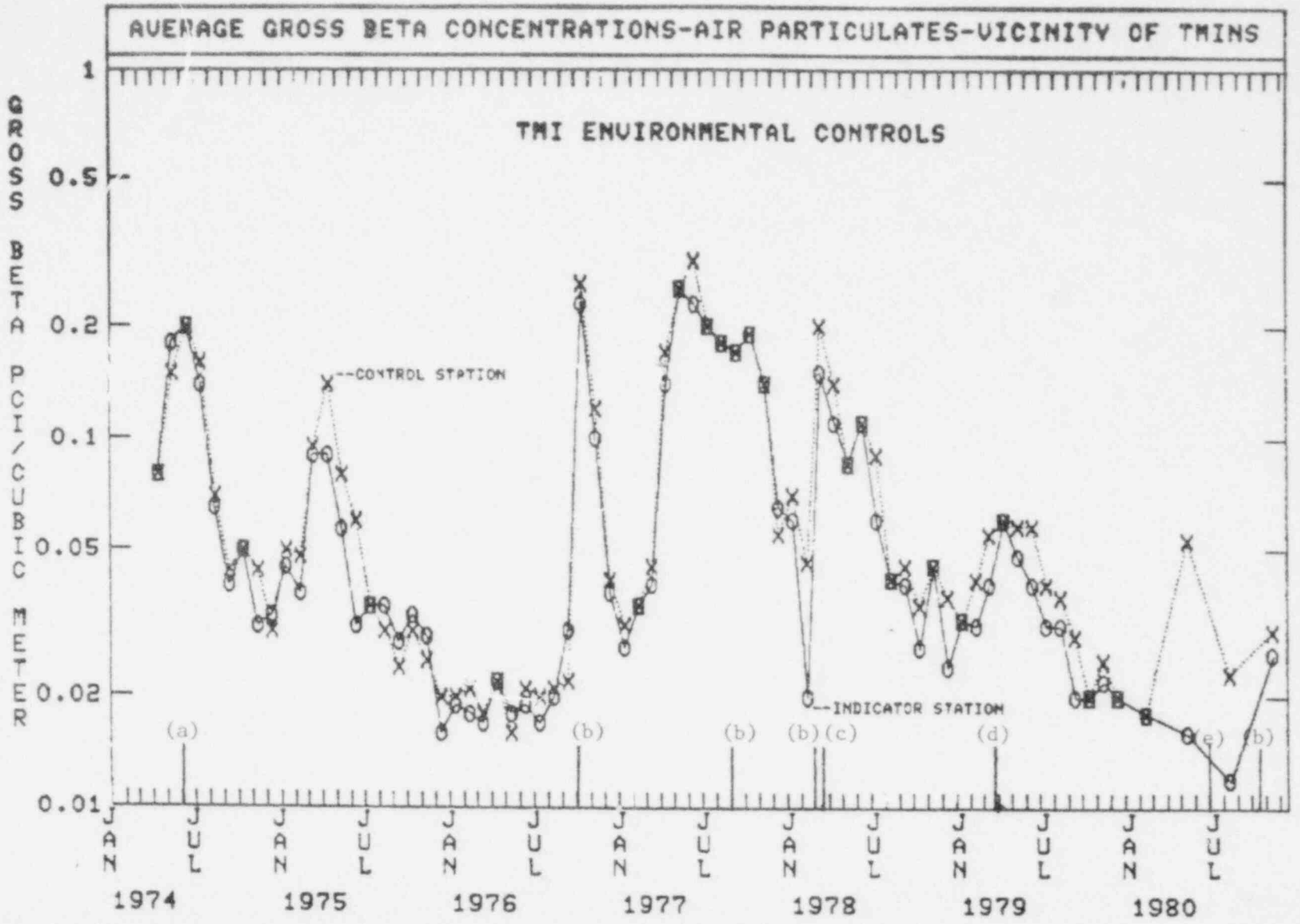
All air particulate samples are analyzed weekly for gross beta activity then composited by indicator vs control stations for monthly gamma spectral analysis. Quarterly composites of each individual station are analyzed for gamma emitting radionuclides and then composited for gross alpha and strontium-90 analysis by indicator and control locations.

Results of the gross beta analysis provided comparisons between indicator and background stations for the year as well as comparisons between locations in relation to temporal and spatial differences. The annual average mean for all indicator stations was 0.017 pCi/m^3 as compared to 0.021 pCi/m^3 for all background locations. The station with the highest annual average gross beta activity was background station 15G1 (West Fairview) with 0.027 pCi/m^3 gross beta activity. These values compare to the annual average preoperational mean of 0.15 pCi/m^3. The general trend noted in previous years is presented in Figure 2.

Statistical analysis of the gross beta values obtained during the 1980 reporting period indicated that while there were no significant difference between indicator and background stations nor any spatial difference at the 99% confidence interval, a temporal difference was noted at the 95% confidence interval. Increases in gross beta activity was noted at all monitoring locations during November and December. The increase, noted at all indicator and background stations, is considered to be a result of the atmospheric testing conducted by the People's Republic of China on October 16, 1980. A further discussion of the monitoring and data collected in relation to the atmospheric fallout resulting from this test, is presented in Appendix C and elsewhere in this report.

Gamma scan analysis for indicator and background stations during the 1980 monitoring period resulted in one positive cesium-137 value for the combined indicator composite sample in August. Background composites for the same isotopes were positive for the May, June, July, and August composites. The yearly average mean for indicator stations

Figure 2



(a) TMI-1 Initial Criticality
(b) Chinese Nuclear Detonations
(c) TMI-2 Initial Criticality
(d) TMI-2 Accident
(e) TMI-2 Reactor Building Purge

of 4.68×10^{-4} pCi/m^3 was less than the background value of 6.76×10^{-4} pCi/m^3 by a factor of approximately 1.4. All positive values were approximately an order of magnitude below the preoperational mean of 4.0×10^{-3} pCi/m^3. These results are considered to be indicative of natural background.

Gamma scans for indicator stations were positive for Ru-103 in November and Ru-103, Zr-95 and Ce-141 in October. Similarly, background stations were positive for Ru-103 and Ce-141 in November and Ru-103, Zr-95, Ce-141 and naturally occurring K-40 and Be-7 in December. The appearance of these isotopes are coincident to the atmospheric fallout noted in several environmental media during this time period as a result of the Chinese weapons test.

Quarterly composite analysis of each monitoring station for gamma emitting isotopes were positive for naturally occurring K-40 at two stations for the second quarter Third quarter analysis for station 12B1 was positive for Ru-103 while fourth quarter analysis for stations 1C1, 12B1, and 15G1 were positive for Ru-103. Additionally, monitoring stations 1S2, 12B1, and 15G1 were positive for Zr-95 and station 5A1 was positive for Ce-141 during the fourth quarter. The spatial and temporal distribution of these isotopes further support the environmental appearance of atmospheric fallout due to the Chinese weapons test. Similar appearance of these isotopes were noted in 1978 as a result of similar weapons testing programs conducted by the People's Republic of China (23).

Analysis for strontium-90 were conducted during the four quarters of 1980. Results from indicator stations ranged from $<5.0 \times 10^{-5}$ to 1.4×10^{-4} pCi/m^3. Background stations ranged from $<1.0 \times 10^{-4}$ to 1.4×10^{-4} pCi/m^3. Comparisons between indicator and control annual averages

revealed that the indicator stations were approximately an order pf magnitude less than the control stations; 8.7×10^{-5} vs 1.2×10^{-4} pCi/m^3. Both of these values, however, are below those previously reported for either 1978 or 1979, and are considered to be well within natural background levels of residual atmospheric fallout.

An average gross alpha activity of indicator and background stations for 1980 were 1.4×10^{-3} and 1.8×10^{-3} pCi/m^3, respectively. There appears to be no difference between indicator and background stations and both values are within natural background activity levels.

Air Iodine

Analysis of weekly air iodine samples from each of the eight monitoring locations were all less than the analytical LLI of 0.07 pCi/m^3. Consequently, there are no environmental implications associated with this radioisotope.

Special Monitoring

In response to the reactor building purge in June and July, additional monitoring efforts were effected. A complete description of these activities and a discussion of the data obtained is presented in Appendix D.

Precipitation

Monthly samples from the five precipitation stations were analyzed for gross beta activity. Activity levels for both indicator and control stations were generally higher during January and February (only background station 15G1 during January and February and indicator station 8C1 in February yielded sufficient sample for analysis) then decreased through the remainder of the year, until December. December's gross beta activity, for all stations, increased substantially from that noted during the previous 11

months. This increase is attributed to atmospheric fallout from the Chinese weapons test conducted in October of 1980. Gross beta activity levels prior to December were below the preoperational mean of 22 pCi/liter while December values were noticably higher (Table 7).

Table 7

MONTHLY GROSS BETA ACTIVITY IN PRECIPITATION DURING 1980
(pCi/liter)

Station	J	F	M	A	M	J-J	A	S	O	N	D
15G1*	22.0	15.0	5.4	4.8	4.6	3.6	3.5	1.5	0.8	2.3	44.0
8C1	IS	16.0	3.4	4.8	5.4	5.5	2.6	5.4	1.3	5.5	36.0
1C1	IS	IS	1.2	1.9	2.9	1.9	2.5	2.2	1.4	5.0	29.0
5A1	IS	IS	1.0	6.0	8.0	6.9	5.7	6.9	3.7	4.1	24.0
7F1	IS	IS	1.3	4.1	5.3	3.5	7.3	1.2	2.3	2.8	88.0

* Background station.
IS Insufficient sample.

The elevated levels at all stations during December are indicative of atmospheric fallout attributable to the weapons test noted elsewhere in this report and discussed in Appendix C.

Analysis of precipitation samples for iodine-131 were all below the analytical LLD of 0.5 pCi/liter.

Yearly average tritium analysis results on precipitation samples were below the preoperational mean of 370 $\pm$ 170 pci/liter. The indicator station mean of 149 pCi/liter was below the preoperational mean by a factor of 2.6 while the control mean of 130 pCi/liter was lower by a factor of 2.8. The range of tritium values for indicator stations was 80 to 420 pCi/liter while background stations ranged from <100 to 180 pCi/liter. The highest value obtained at any monitoring location was 420 pCi/liter at indicator station 7F1 for the month of February. This is considered to be within the preoperational range of 200 to 540 pCi/liter.

Only naturally occurring Th-228, Ra-226, and Be-7 were found in precipitation samples when analyzed for gamma emitting radionuclides.

Semiannual analysis of precipitation samples for the second half of 1980 for strontium-89 and 90 gave no values above the analytical sensitivity of 1.0 pCi/liter. Lack of sufficient precipitation during early 1980 prevented semiannual analysis of the first half of 1980. Strontium analysis were performed on a second quarter composite sample. The results of t s analysis was unavailable at the time of this writing.

Terrestrial Environment

The terrestrial environment around TMINS was examined by analyzing samples of milk from five locations on a weekly then semimonthly basis during 1980. Additionally, green leafy vegetable and fruit samples were obtained from six and two locations, respectively.

Milk

Milk samples were collected weekly from January through July 1980 then reduced to semimonthly from August through December.

Results of iodine-131 analysis for the weekly and semimonthly samples were below the analytical LLD of 0.5 pCi/liter throughout the 1980 monitoring period except for station 1B1. All results from station 1B1 were LLD from January through the third week of October. From October 30 to December 4, 1980 positive iodine-131 values were obtained ranging from 1.5 $\pm$ 0.1 to 4.2 $\pm$ 0.3 pCi/liter. The elevated values (presented in Table 3, Appendix C) coincided with the detection of atmospheric fallout from the October 16 Chinese weapons test and first appeared in samples obtained on October 30 (3.2 $\pm$ 0.2 pCi/liter). The values peaked to 4.2 $\pm$ 0.3 pCi/liter on November 20 and decli to less than 0.3 pCi/liter by

December 18.

Effluent data for Unit 1 and Unit 2 during the time periods of October, November, and December revealed that iodine-131 released from Unit 1 and Unit 2 was less than the detectable limit of 1.0 pCi/m^3. It is therefore reasonable to assume that the positive iodine-131 values noted at monitoring station 1B1 were a result of the Chinese nuclear weapons test. The detection of iodine-131 at this particular location and not in others located equidistant from TMI is attributed to the collection of goats' milk at this monitoring point as opposed to cows' milk at the others. Goats have a tendency to concentrate iodine-131 by approximately an order of magnitude greater than do cows (18) and consequently smaller environmental concentrations of iodine-131 may be detected. The actual environmental levels, however, must be reduced by this concentration factor.

Analysis of milk samples for gamma emitting radionuclides were conducted on weekly samples from January 1 to July 24 and semimonthly samples from August through the end of December. Results of these analysis revealed the presence of naturally occurring K-40 in all samples. Average yearly means for indicator and control stations were 1316 and 1256 pCi/liter, respectively. Sporatic low level cesium-137 values were obtained during the sampling year but no spatial or temporal correlations were evident. Positive values were noted occassionally in both indicator and control stations.

Quarterly strontium-89 and 90 analysis revealed only background levels of strontium-90 and no strontium-89. Yearly indicator and background averages of 4.33 and 4.35 pCi/liter strontium-90, respectively were not considered different from the preoperational mean of 4.9 pCi/liter.

Green Leafy Vegetables and Fruit

Analysis of vegetation samples for gamma emitting radionuclides revealed only naturally occurring K-40 and Be-7.

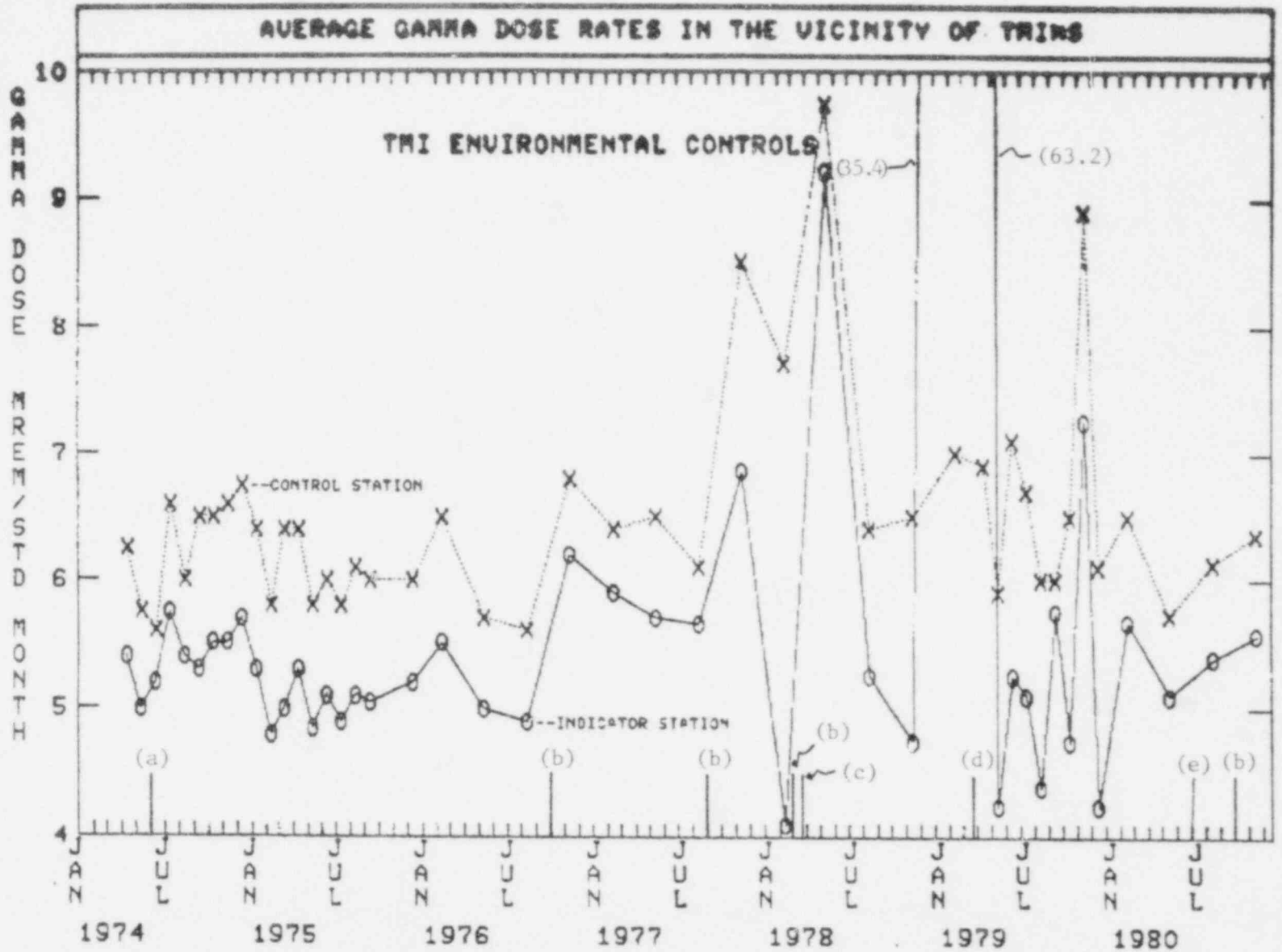
All samples were LLD for iodine-131.

DIRECTION RADIATION

The ambient radiation levels in the area around Three Mile Island were determined with energy compensated calcium sulfate (DY) thermoluminescent dosimeters (TLD). Immersion dose data are collected at 73 locations, on a quarterly basis, ranging in distance from 0.1 miles to 21.1 miles. In addition, monthly data are obtained from 20 of the 73 quarterly locations. All data were normalized to a standard month to eliminate the differences in exposure periods. Exposure rates (mR/mo) are considered numerically equal to dose rates (mrem/mo) in this report.

Average gamma dose rates in the vicinity of TMINS from 1974 through 1980 are presented in Figure 3. Data obtained from 435 TLD readings from the indicator station during 1980, give an annual average dose rate of 5.7 mrem/standard month while control stations averaged 6.7 mrem/standard month. These compare to 1978 results of 5.7 mrem/standard month and 7.6 mrem/standard month for indicator and background stations, respectively. The station with the highest annual average was control station 7G1 which is located approximately 15.0 miles southeast of TMI. The annual average dose rate for this location was 9.1 mrem/standard month. Monthly TLD readings for all stations in June, July, August, and September were generally higher than other months of the year. This was due to improper operation of the annealing oven during these time periods. This is supported by quality control badges of the 20 monthly stations which remained within the dose rates measured prior to this period. Quality control badges are annealed independent of TMI placed badges. Additionally, quarterly TLDs, annealed prior to the oven malfunctions, did not manifest these increased readings. Readings at all monthly stations returned to typical background levels in October and the remainder of 1980 after recalibration

Figure 3



(a) TMI-1 Initial Criticality
(b) Chinese Nuclear Detonations
(c) TMI-2 Initial Criticality
(d) TMI-2 Accident
(e) Reactor Building Purge

of the annealing oven.

All readings recorded during 1980 were found to be within normal background levels.

ASSESSMENT OF IMPACT

The aquatic, terrestrial, and atmospheric environs around TMINS were continuously monitored by Metropolitan Edison/GPU during 1980. The REMP, as designed, was conducted in a manner that would permit detection of increases in radiocontaminants in the environment.

Of the environmental media sampled and pathways monitored, only the aquatic environment demonstrated increases in radioactive materials that may have been contributed by TMI activities. The increases in tritium concentrations at drinking water station 7G3 during June are in part, considered to have originated from the TMI discharge. The elevated tritium values noted in surface water station 9A2 in March and at stations 7G1 and 8C2 during June were within the preoperational range of 60.0 to 920 pCi/liter. These values will be treated as having originated, in part, from TMI since concomitant background levels at the time of sampling were lower.

Tritium Dose Assessment

Utilizing the criteria set forth in NRC Regulatory Guide 1.109 (18), the potential dose resulting from consumption of drinking water and fish containing 480 pCi/liter of tritium (630 pCi/liter less the 150 pCi/liter background contribution) to the maximally exposed individual are as follows: infant - 0.0036 mrem, child - 0.0083 mrem, teen - 0.0075 mrem, and adult - 0.01 mrem.

A similar calculation was performed using the tritium concentration noted at surface water station 7G1. The tritium concentration noted in June of 400 pCi/liter, results in a potential dose of 0.0023 mrem, 0.0039 mrem, 0.0036 mrem, and 0.00[illegible] mrem, to the maximally exposed infant,

child, teen, and adult, respectively. The assessment was based on a 250 pCi/liter tritium concentration since it was assumed that 150 pCi/liter was contributed by river background.

Calculations for stations 9A2 and 8C2 were lower and are not presented.

All doses are inconsequential when compared to the estimated background radiation levels of 116 mrem/year in the Three Mile Island vicinity (19).

CONCLUSIONS

The REMP conducted from January 1, 1980 through December 31, 1980 was performed in accordance with the Environmental Technical Specifications for TMI Unit 1 and Unit 2. The objectives of the program were met.

Although other possible dose pathways to man were considered in the environs around TMI, only tritium, in one drinking water station, and three surface water stations were considered to have had the potential of originating from TMI. The radiation dose to the populace from ambient gamma radiation, as measured by thermoluminescent dosimeters, averaged 69.6 mrem/yr and showed no evidence of a TMINS contribution during the 1980 monitoring period. The radiation dose to the general populace due to exposure from artificial and natural sources is presented in Table 8.

TABLE 8

ESTIMATED RADIATION DOSES EQUIVALENTS TO THE GENERAL POPULACE

Source of Exposure	Annual Dose in mrem/yr (20)
Medical	78
Cosmic Radiation	28
External Terrestrial	26
Radionuclies in the body (K-40)	19
Global fallout	4
Total	155

It can be concluded from the 1980 monitoring program that activities related to TMI Unit 1 and Unit 2 did not significantly alter the radio-

logical characteristics of the TMINS environs. Furthermore, the radionuclides observed in the environment were principally due to background radioactivity and global fallout from the October 16 Chinese nuclear weapons test.

REFERENCES

(1) Metropolitan Edison Company. "Three Mile Island Nuclear Station - Technical Specifications," Appendix B. DPR 50, 1974.

(2) Radiation Management Corporation. "Three Mile Island Nuclear Generating Station - Preoperational Radiological Environmental Monitoring Program." RMC-TR-75-17, 1975.

(3) Radiation Management Corporation. "Three Mile Island Nuclear Station - Radiological Environmental Monitoring Program - First Operational Period." RMC-TR-75-02, 1975.

(4) Radiation Management Corporation. "Three Mile Island Nuclear Station 1975 Semiannual Report." RMC-TR-75-02, 1975.

(5) Radiation Management Corporation. "Radiological Environmental Monitoring Report for the Three Mile Island Nuclear Station 1975 Semiannual Report II, July 1 through December 31." RMC-TR-76-01, February 1976.

(6) Radiation Management Corporation. "Radiological Environmental Monitoring Report for the Three Mile Island Nuclear Station 1976 Annual Report for the Three Mile Island Nuclear Station 1976 Annual Report, January 1 through December 31." RMC-TR-77-01.

(7) United States Department of the Interior-Geological Survey. "Water Resources Data for Pennsylvania, Part 1." 1973.

(8) Radiation Management Corporation. "Three Mile Island Nuclear Generating Station - Agricultural Land Use Survey." RMC-TR-75-1.

(9) Metropolitan Edison Company. "Environmental Report, Operating License Stage - Three Mile Island Nuclear Station Unit 1 and Unit 2," 1971.

(10) United States Atomic Energy Commission. "Final Environmental Statement - Three Mile Island Nuclear Generating Stations Units 1 and 2." Docket Nos. 50-289 and 50-320, 1972.

(11) Metropolitan Edison Company, Jersey Central Power and Light Company, Pennsylvania Electric Company. "Final Safety Analysis Report - Three Mile Island Nuclear Station Unit 2." Docket No. 53-320, 1974.

(12) Metropolitan Edison Company, Jersey Central Power and Light Company, Pennsylvania Electric Company. "Environmental Report Supplement II, Three Mile Island Nuclear Station." Docket No. 50-320, February 1975.

(13) Radiation Management Corporation. "Analytical and Quality Control Program." RMC-TM-75-3, 1975.

(14) Teledyne Isotopes, "Environmental Radiation Analysis Quality Control Manual." IWL-00520361, 1975.

(15) Teledyne Isotopes. "Procedures and Quality Assurance Handbook." IWL-00320365, 1975.

(16) U. S. Environmental Protection Agency. "Radiological Quality of the Environment in the United States, 1977." EPA 520/1-77-009, September 1977.

(17) Donald T. Oakley. "Natural Radiation Exposure in the United States." U. S. Environmental Protection Agency, ORP/SID 72-1, June 1972.

(18) United States Nuclear Regulatory Commission. 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," October 1977.

(19) Ad Hoc Population Assessment Group. "Population Dose and Health Impact of the Accident at the Three Mile Island Nuclear Station." May 10, 1979, Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402 (Stock No. 017-001-00408-1).

(20) "The Effects on Populations of Exposure to Low Levels of Ionizing Radiation" (BIER report). National Academy of Sciences, 1980.

(21) Final Supplement to the Final Environmental Statement related to operation of TMINS, Unit 2, Docket 3-20, 1976.

(22) Teledyne Isotopes. "Metropolitan Edison Company, Radiological Environmental Monitoring Report", 1977 Annual Report.

(23) Teledyne Isotopes. "Metropolitan Edison Company, Radiological Environmental Monitoring Report", 1978 Annual Report.

(24) Metropolitan Edison Company, "Three Mile Island Nuclear Station, Unit 2, Technical Specifications." Appendix A. DPR 73, 1978.

(25) Metropolitan Edison Company, Operational Radiological Environmental Monitoring Report for 1979. May 1980.

(26) United States Nuclear Regulatory Guide 4.1. "Programs for Monitoring Radioactivity in the Environs of Nuclear Power Plants", January, 1973.

(27) United States Nuclear Regulatory Guide 4.1. "Programs for Monitoring Radioactivity in the Environs of Nuclear Power Plants", Revision 1. April 1975.

Appendix A

Sampling Locations and Descriptions

TABLE A-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM STATION LOCATIONS

SAMPLE MEDIUM	LOCATION CODE	MAP NUMBER	DISTANCE (miles)	AZIMUTH	DESCRIPTION
AP,AI,ID	1S2	1	0.4	0°	N of site, North Weather Station
ID	2S2	2	0.7	28	NNE of site on light pole in middle of North Bridge
ID	4S2	3	0.3	71	ENE of site on top of dike, East Fence
ID	5S2	4	0.2	95	E of site on top of dike, East Fence
ID	8S1	5	0.4	167	SSE of site
ID	9S2	6	0.8	184	S of site at South Beach of Three Mile Island
EW	10S1	7	-	-	On site, RML-7 Station Discharge
ID	10S2	8	0.4	200	SSW of site
ID	11S1	9	0.1	221	SW of site, west of Mechanical Draft Towers on dike
ID	13S1	10	0.4	270	W of site on Shelley Island
SW	13S2A & B	11	0.1	270	On site, Station Intakes (Units 1 & 2)
ID	14S2	12	0.4	293	WNW of site on Shelley Island
ID	15S1	13	0.5	317	NW of site on Shelley Island
ID	16S1	14	0.2	340	NNW of site at gate in fence on west side of Three Mile Island, North boat dock
AQP & AQS	1A1	15	0.7	1	N of site
AQS	1A2	16	0.7	0	N of site at north tip of Three Mile Island
ID	3A1	17	0.6	35	NE of site on Route 441
ID	4A1	18	0.5	65	ENE of site on Laurel Road
AP,AI,RW,ID	5A1	19	0.4	100	E of site on north side of Observation Center Building
ID	6A1	20	0.5	117	ESE of site on light pole on Route 441
AQS	7A1	21	0.3	137	SE of site
ID	7A3	22	0.6	143	SE of site on Route 441
SW,AQP	9A2	23	0.5	188	S of site below Discharge Pipe
AQS	10A1	24	0.8	202	SSW of site
AQS	11A1	25	0.5	225	SW of site
ID	11A2	26	0.5	221	SW of site on Beech Island
ID	16A1	17	0.4	332	NNW of site on Kohr Island
MG	1B1	28	1.2	5	N of site, farm along Route 441
M,FPL	4B1	29	1.1	65	ENE of site, farm west of Gingrich Road
M,FPL	7B3	30	1.6	125	SE of site, farm on the east side of Conewago Creek
SW,AQF,AQS,AQP	9B1	31	1.5	178	S of site above York Haven Dam
AQS,ID	15B1	32	1.1	210	SSW of site on south beach of Shelley Island
ID	11B1	33	1.9	227	SW of site on Route 262
AP,AI,ID	12B1	34	1.6	253	WSW of site adjacent to Fishing Creek, Goldsboro Air Station
ID	13B1	35	1.2	261	W of site at Goldsboro Marina
ID	14B1	36	1.4	290	WNW of site on Still House Road

TABLE A-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM STATION LOCATIONS (cont'd)

SAMPLE MEDIUM	LOCATION CODE	MAP NUMBER	DISTANCE (miles)	AZIMUTH	DESCRIPTION
ID	15B1	37	1.8	304	NW of site on Still House Road
AQF	16B1	38	1.1	337	NNW of site below Fall Island
AP,AI,ID,RW	1C1	39	2.6	355	N of site at Middletown Substation
SW	1C3	40	2.3	347	N of site at Swatara Creek
AP,AI,RW.ID	8C1	41	2.3	159	SSE of site at Falmouth-Collins Substation
SW	8C2	42	2.3	165	SSE of site, York Haven Hydro
M,FPL	14D1	43	3.7	233	WNW of site, farm
ID	1E4	44	4.3	3	N of site on Vine Street exit from Route 283
ID	2E1	45	4.8	18	NNE of site, School House Lane and Miller Road
ID	3E3	46	4.5	42	NE of site on Kennedy Lane
ID	4E5	47	4.9	62	ENE of site on Beagle Road
ID	5E1	48	4.6	81	E of site, North Market Street and Zaeger Road
ID	6E6	49	4.6	115	ESE of site on Amosite Road
ID	7E6	50	4.8	131	SE of site, Bainbridge and Risser Roads
SW	8E1	51	4.1	160	SSE of site on Brunner Island
ID	8E2	52	4.1	155	SSE of site at Guard Shack on Brunner Island
ID	9E1	53	4.9	182	S of site on Canal Road, Conewago Heights
ID	10E3	54	5.0	200	SSW of site on Conewago Creek Road, Shrinestown
ID	11E3	55	4.1	228	SW of site, Stevens and Wilson Roads
ID	12E4	56	4.3	245	WSW of site, Lewisberry and Roxberry Roads, Newberrytown
ID	13E1	57	4.9	268	W of site, Yocumtown and Old Trail Roads
ID	14E4	58	4.9	281	WNW of site, Route 262 and Beinhower Road
ID	15E1	59	5.0	313	NW of site on Lumber Street, Highspire
ID	16E1	60	4.9	339	NNW of site, Spring Garden Drive and Route 441
ID	2F1	61	9.3	18	NNE of site, West Areba Avenue and Mill Street, Hershey
ID	3F1	62	7.2	48	NE of site, Shenks Church on School House Road
ID	4F1	63	8.5	72	ENE of site on Mt. Gretna Road, Bellaire
ID	5F1	64	6.8	85	E of site on Hummelstown Street, Elizabethtown
FPF	5F2	65	5.1	100	E of site, orchard
ID	6F1	66	9.4	113	ESE of site, Donegal Springs Road, Donegal Springs
AP,AI,RW,ID	7F1	67	9.8	127	SE of site at farm off Engle's Tollgate Road
ID	8F1	68	7.4	163	SSE of site on Saginaw Road, Starview
ID	9F1	69	6.5	177	S of site on Maple Street, Manchester
ID	10F1	70	7.4	196	SSW of site, Coppenhaffer Road and Route 295, Zion's View
ID	11F1	71	8.0	225	SW of site on Andersontown Road, Andersontown
ID	12F1	72	8.6	242	WSW of site on Alpine Road, Maytown

TABLE A-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM STATION LOCATIONS (cont'd)

SAMPLE MEDIUM	LOCATION CODE	MAP NUMBER	DISTANCE (miles)	AZIMUTH	DESCRIPTION
II	13F1	73	7.8	260	W of site on Route 382, ½ mile north of Lewisberry
ID	14F1	74	8.0	292	WNW of site on Evergreen Road, Reeser's Summit
SW,ID	15F1	75	8.5	308	NW of site across from parking lot of Steelton Water Co.
ID	16F1	76	8.1	340	NNW of site on Derry Street, Rutherford Heights
M,FPL	2G1	77	10.5	9	NNE of site, farm on Route 39, Hummelstown
ID	3G1	78	16.9	47	NE of site on Cumberland Street, Lebanon
ID	4G1	79	10.0	63	ENE of site, Route 241
ID	6G2	80	21.1	113	ESE of site, Steel Way and Loop Roads, Lancaster
SW	6G3	81	12.6	122	ESE of site, Chickies Creek
SW,ID	7G1	82	14.4	124	SE of site at Columbia Water Treatment Plant
SW	7G2	83	13.6	128	SE of site, Wrightsville Water Treatment Plant
SW	7G3	84	14.8	124	SE of site, Lancaster Water Treatment Plant
ID	8G1	85	13.2	157	SSE of site, Orchard and Stonewood Roads, Wilshire Hills
AP,AI,ID	9G1	86	12.6	180	S of site in Met. Ed. York Load Dispatch Station
SW	9G2	87	14.7	178	S of site, York
ID	10G1	88	12.7	204	SSW of site, Alta Vista and Fox Run Roads, Weiglestown
ID	11G1	89	11.7	225	SW of site on west side of Route 74, Mt. Royal
ID	12G1	90	11.9	237	WSW of site westside of Rt. 74 in front of Earth Crafts, Rossville
FPF	12G2	91	11.0	239	WSW of site on west side of Route 74, Rossville
ID	13G1	92	13.2	276	W of site, Orchard Lane and Hertzler Road, Mt. Allen
ID	13G2	93	10.4	274	W of site, Lisburn Road and Main Street, Lisburn
ID	14G1	94	12.2	300	WNW of site on Erford Road, in front of Penn Harris Motel, Camp Hill
AP,AI,RW,ID	15G1	95	15.0	306	NW of site at West Fairview Substation
ID	15G2	96	11.5	307	NW of site, Penn and Forster Streets, Harrisburg
ID	16G2	97	11.2	330	NNW of site, Route 22 and Colonial Road, Colonial Park
AQF	Indicator	-	-	-	All locations where fish were caught below the discharge were grouped together and referred to as "Indicator" I.E. Sectors 11 and geographically below
AQF	Control	-	-	-	All locations where fish were caught above the discharge were grouped together and referred to as "Control" I.E. Sectors 12 and geographically above.

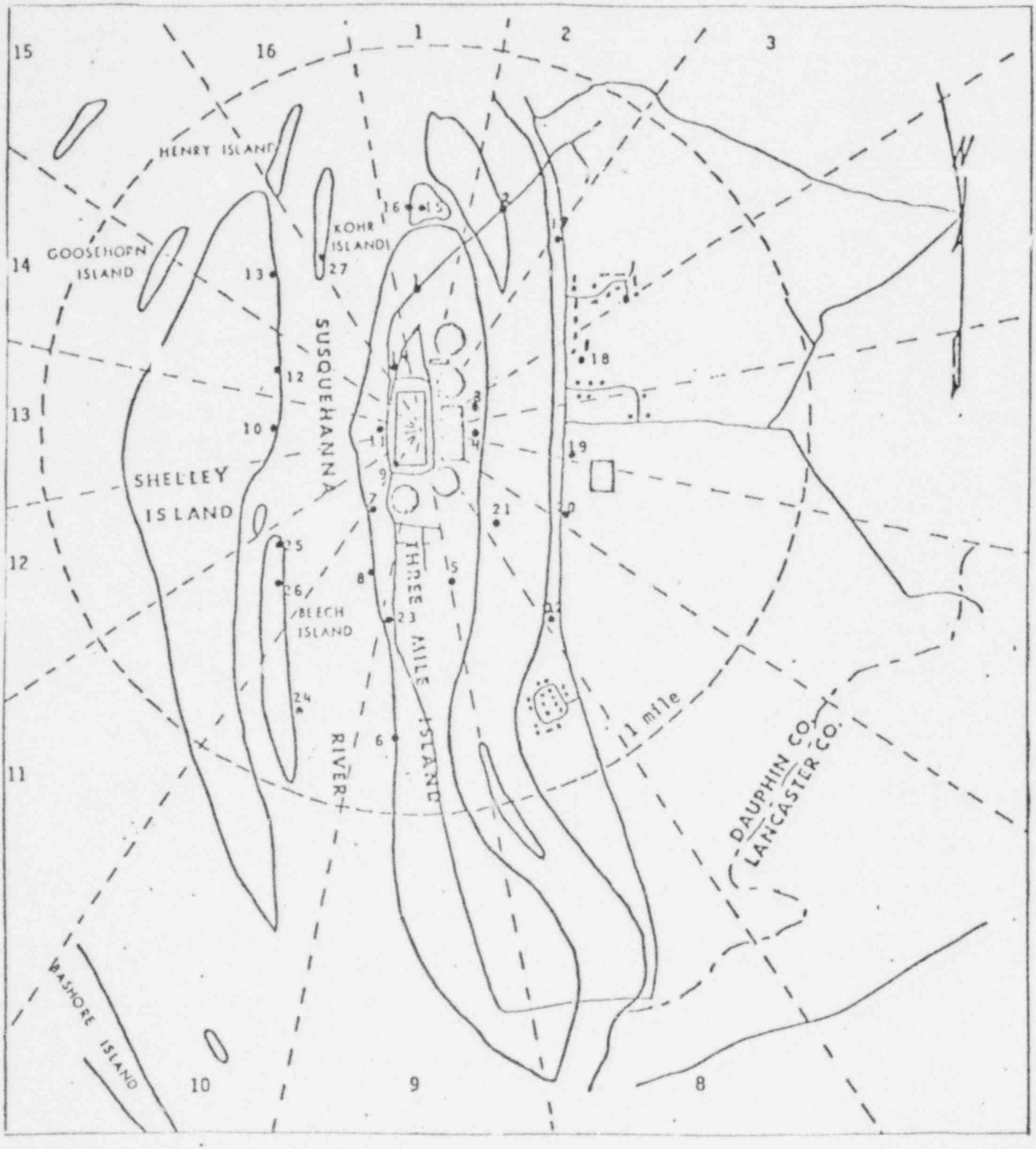


Figure A-1

THREE MILE ISLAND NUCLEAR STATION
LOCATION OF RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM (REMP)
STATIONS WITHIN 1 MILE OF THE SITE

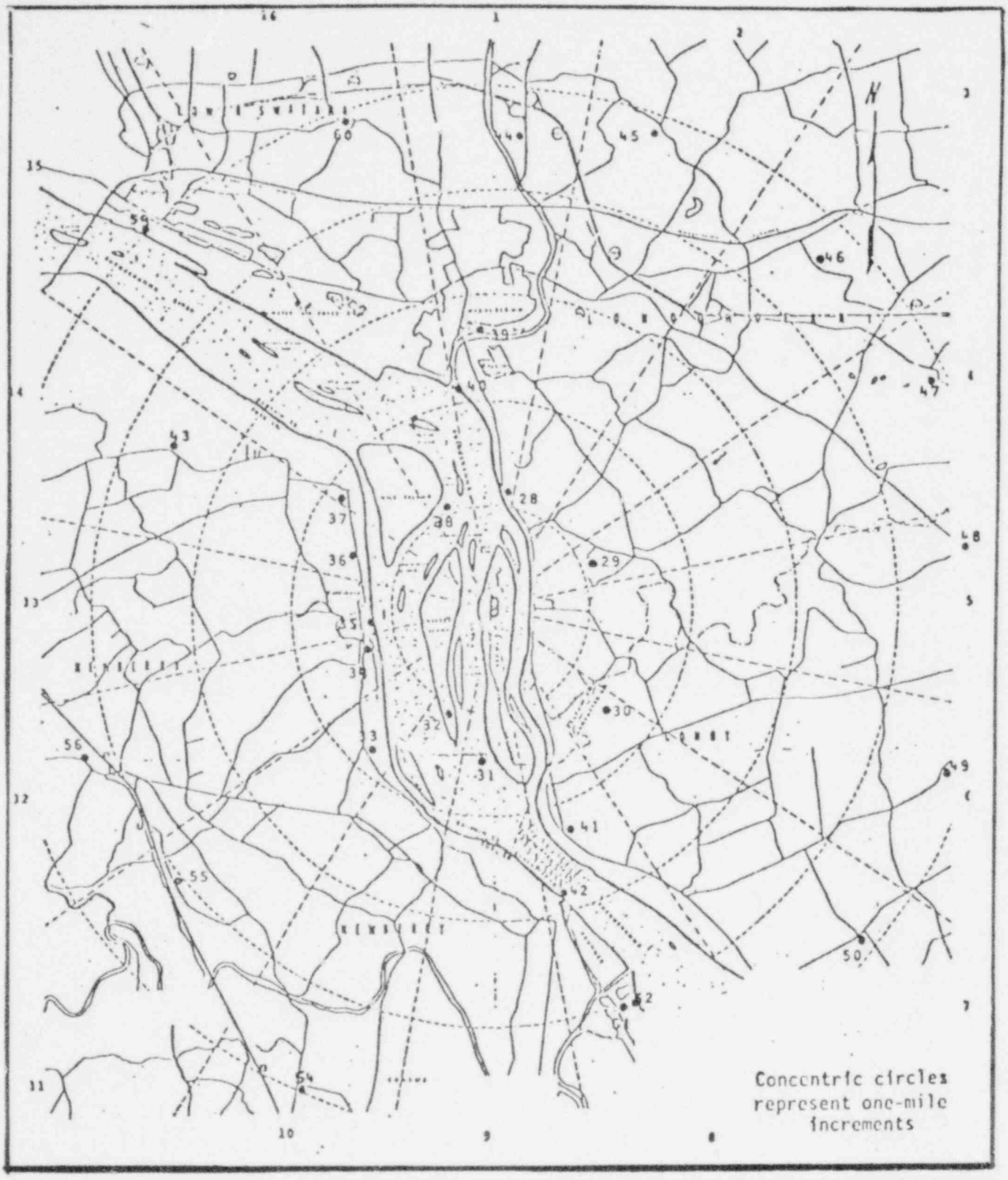


Figure A-2

THREE MILE ISLAND NUCLEAR STATION
LOCATION OF RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM (REMP)
STATIONS WITHIN 5 MILES OF THE SITE

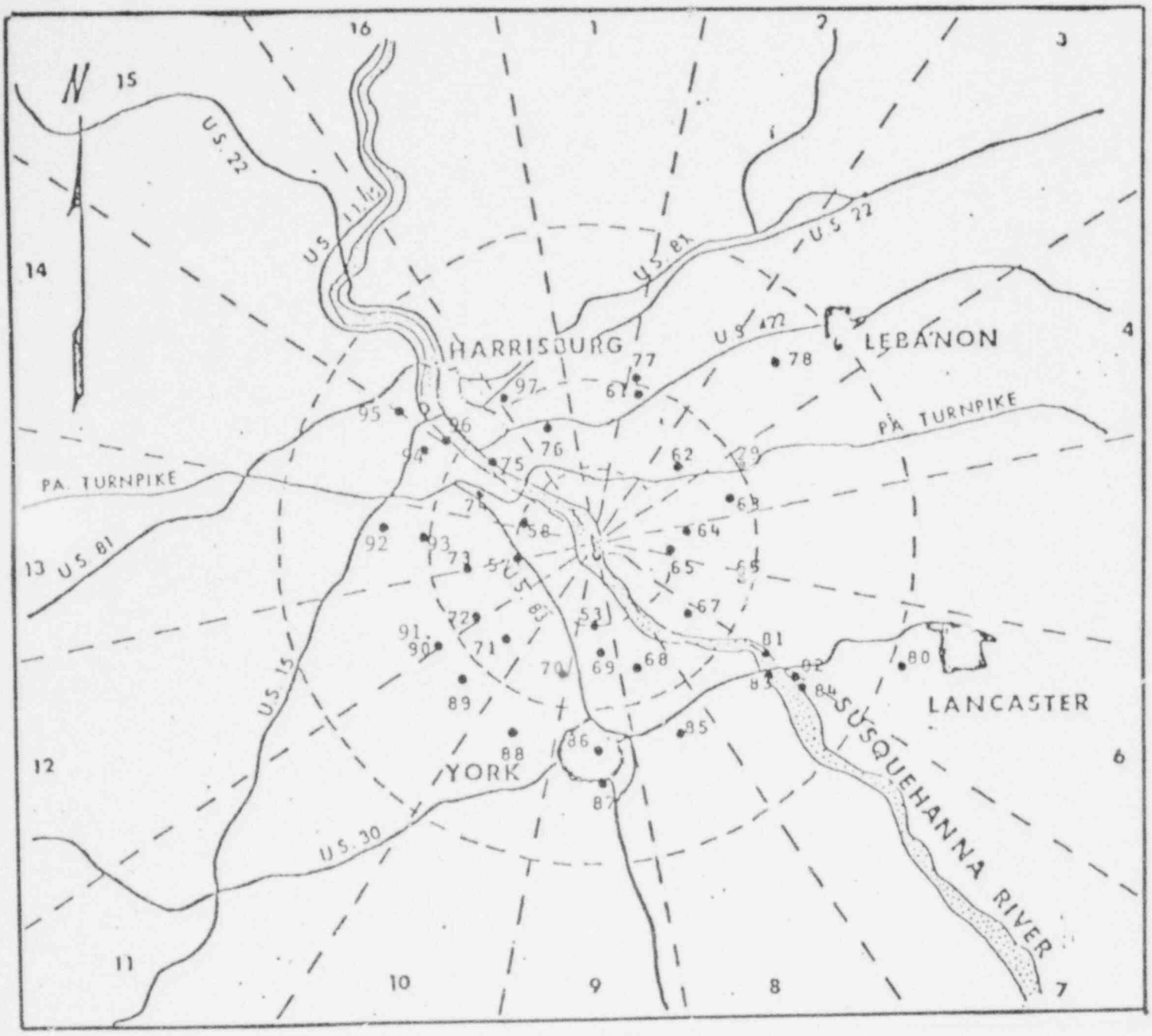


Figure A-3

THREE MILE ISLAND NUCLEAR STATION
LOCATION OF RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM (REMP)
STATIONS GREATER THAN 5 MILES FROM THE SITE BOUNDARIES

Appendix B

LLD Exceptions

Table B-1

ETS ANALYTICAL RESULTS WHICH FAILED TO MEET THE REQUIRED LOWER LIMITS OF DETECTION DURING 1980

Sample Media	Analysis	Required LLD	Number of Samples Out of Compliance	Comments
Food/Garden Crops	I-131	25.0 pCi/Kg (wet)	4	Late delivery to Laboratory
Fish	Sr-90	5.0 pCi/Kg (wet)	1	Delay between sample delivery and analysis
Air Iodine	I-131	0.07 pCi/m^3	10	Due to sampler malfunction
Air Particulate	Gross Beta	0.01 pCi/m^3	1	Due to sampler malfunction
Milk	Ba-140	15.0 pCi/ℓ	1	
Aquatic Vegetation	Gamma Scan	--	1	Insufficient sample
Drinking Water	I-131	0.5 pCi/ℓ	2	Delay in delivery to laboratory
	Ba-140	15.0 pCi/ℓ	20	Delay between sample delivery and analysis
Surface Water	Ba-140	15.0 pCi/ℓ	8	Delay between sample delivery and analysis
Precipitation	Ba-140	15.0 pCi/ℓ	3	Delay between sample delivery and analysis

Appendix C

Results of Environmental Monitoring Of The Chinese Nuclear Weapons Test

ENVIRONMENTAL RADIOACTIVITY IN THE VICINITY OF THREE MILE ISLAND ATTRIBUTABLE TO THE 1980 CHINESE NUCLEAR BOMB TEST

The Chinese conducted an atmospheric nuclear bomb test on October 16, 1980. Since that time, radioactivity levels in selected environmental samples collected in the vicinity of TMI have increased, consistent with increased levels of worldwide fallout.

Specifically, higher than normal levels of radioactivity have been detected in TMINS REMP air particulate, goat milk, and precipitation samples. These results as well as data from gamma monitoring stations in the TMI area are discussed below.

Air Particulate

Gross beta activity increased in November air particulate samples and increased further in December samples (Figure C-1). The increase in activity was noted at both control and indicator stations, with the control stations showing somewhat higher activity levels (Table C-1).

Gamma activity, characteristic of short-lived fission products, was also detected in November and December air particulate samples (Table C-2). Gamma levels were essentially the same in control and indicator samples.

Fourth quarter air particulate gross alpha and Sr-90 levels were unchanged from levels found earlier in the year. All air iodine samples collected in November and December contained less than LLD levels of I-131 (approximately 0.04 pCi/m^3).

Goat Milk

Milk I-131 activity levels increased at one station (Hardison's goat farm)during November (Figure C-2 and Table C-3). Other November milk samples (cows' milk) from farms in the TMI area contained I-131 levels below analysis LLD's (<0.3 pCi/ℓ).

The difference in goat and cow milk I-131 levels is approximately an order of magnitude, consistent with the difference in estimated iodine milk transport factors between the two species (NRC Reg. Guide 1.109).

Goat milk I-131 activity decreased to LLD levels in December. No I-131 was detected in the December cows' milk. No unusual gamma activity was detected in any of the November and December milk samples.

Precipitation

Precipitation gross beta activity levels were higher by an order of magnitude in December than in November (Table C-3). While it was suggested by the analysis laboratory that these higher activity levels were related to the presence of particulate contamination in the samples, it seems more probable that the activity increases were the result of a systematic effect, e.g. fallout from the Chinese test. The lack of a discernable geographic pattern in the gross beta data is consistent with this hypothesis.

No unusual levels of gamma, tritium, Sr-89, or Sr-90 activity were detected in the November and December precipitation samples.

Gamma Exposure Levels

Special environmental gamma monitoring stations were established in the TMI area soon after the Chinese test was announced. These stations included gamma rate environmental monitors and TLD badges (IOM, Monitoring Activities Associated with the Recent Chinese Weapon Test and Preliminary Results, WER-625, October 23, 1980). The monitoring was terminated on December 12, after it became apparent that fallout levels in the TMI area were not of sufficient magnitude to register on these instruments (Table C-4). The TMINS REMP TLD measurements from this time period also show no marked increase in gamma exposure levels (Tables C-7 and C-8).

Two permanently mounted gamma rate monitors (at station 5A1 and 15D1) have continued to gather data to the present time (Table C-5). No sustained increase in background gamma levels are apparent in this data, although transient increased coinciding with local precipitation were noted.

Conclusions

Increased levels of radioactivity in REMP air particulate, goat, milk, and precipitation samples collected in late 1980 are likely the result of fallout from a Chinese nuclear bomb test conducted October 16, 1980. Measurements of environmental gamma exposures indicate that fallout levels in the TMI area were quite low and did not reach levels experienced in the United States prior to the implementation of the nuclear testban treaty.

FIGURE C-1

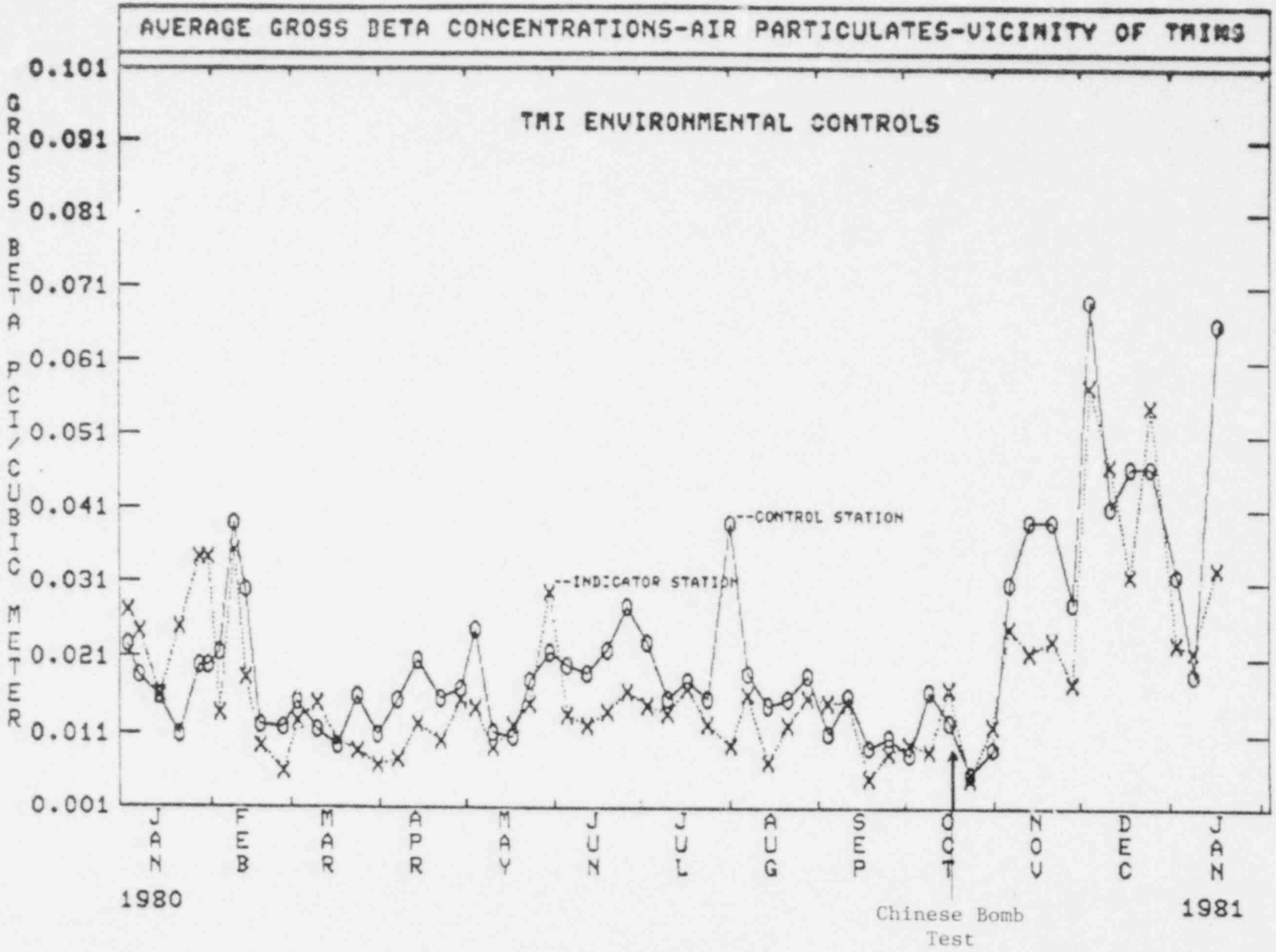

AVERAGE GROSS BETA CONCENTRATIONS-AIR PARTICULATES-VICINITY OF TMINS
TMI ENVIRONMENTAL CONTROLS
GROSS BETA PCI/CUBIC METER
0.101
0.091
0.081
0.071
0.061
0.051
0.041
0.031
0.021
0.011
0.001
--CONTROL STATION
--INDICATOR STATION
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
JAN
1980
1981
Chinese Bomb Test

FIGURE C-2

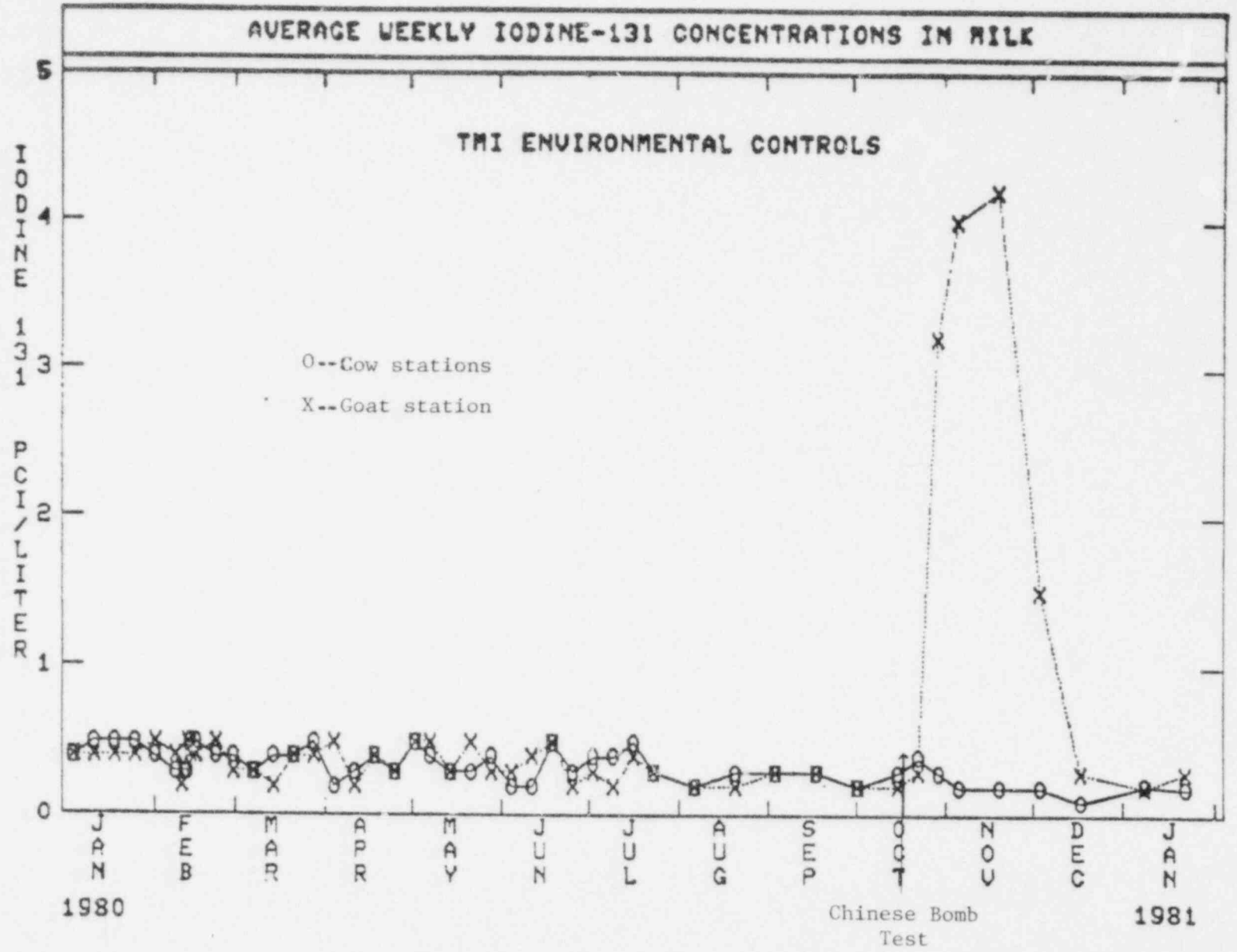

AVERAGE WEEKLY IODINE-131 CONCENTRATIONS IN MILK
TMI ENVIRONMENTAL CONTROLS
IODINE 131 PCI/LITER
0
1
2
3
4
5
O--Cow stations
X--Goat station
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
JAN
1980
1981
Chinese Bomb Test

TABLE C-1

GROSS BETA ACTIVITY IN TMINS REMP AIR PARTICULATE SAMPLES

Station Type	Monitoring Period		
	October	November	December
Control	0.013±0.007*	0.031±0.014	0.061±0.017
Indicator	0.009±0.006	0.019±0.011	0.031±0.021

* Average ± standard deviation, pCi/m^3.

TABLE C-2

GAMMA ACTIVITY IN TMINS REMP AIR PARTICULATE SAMPLES

Station Type	Monitoring Period	Activity (pCi/m^3) Zr-95	Ru-103	Ce-141
Control	October	<LLD*	<LLD*	<LLD*
	November	<LLD	1.6±0.6 E-3**	2.0±0.6 E-3
	December	3.0±0.7 E-3	3.9±0.5 E-3	3.1±0.6 E-3
Indicator	October	<LLD	<LLD	<LLD
	November	<LLD	6.1±0.3 E-4	<LLD
	December	4.1±0.9 E-3	4.8±0.6 E-3	3.4±0.9 E-3

* Typical LLD's: <4 E-4 pCi/m^3.
** Average ± 2 standard deviations.

TABLE C-3

IODINE-131 ACTIVITY IN TMINS REMP MILK SAMPLES

Station	I-131 Activity, pCi/liter					
	October 23	October 30	November 6	November 20	December 4	December 18
4B1 - Alwine Farm	<0.3	<0.2	<0.2	<0.2	<0.2	<0.2
7B3 - Becker Farm	<0.4	<0.4	<0.1	<0.2	<0.1	<0.2
14D1 - Fisher Farm	NS*	<0.3	<0.2	<0.3	<0.2	<0.2
2G1 - Oellig Farm	<0.4	<0.3	<0.2	<0.2	<0.2	<0.1
1B1 - Hardison Farm	<0.3	3.2±0.2	4.0±0.3	4.2±0.3	1.5±0.1	<0.3

*No sample collected

TABLE C-4

GROSS BETA ACTIVITY IN TMINS REMP PRESIPITATION SAMPLES

Station	Station Type	Monitoring Period		
		October	November	December
15G1	Control	<0.8*	2.3±0.8**	44±3
1C1	Indicator	1.4±0.6	5.0±0.9	29±2
5A1		3.7±0.8	4.1±0.9	24±2
7F1		2.3±0.7	2.8±0.8	88±4
8C1		1.3±0.6	5.5±1.0	36±2

* pCi/liter.
** Average ± 2 standard deviations.

TABLE C-5

SPECIAL GAMMA MONITORING STATIONS

Station	Location	From TMI Distance	From TMI Azimuth	Monitoring Period	Gamma Rate Gamma Measurements Range	Gamma Rate Gamma Measurements Average	Teledyne TLD Gamma Measurements
2F2	Walsh Residence	9.5 mi	22.5°	10/20-11/6	8-14 µR/hr	10 µR/hr	7.7±0.4 µR/hr*
				11/6-11/25	8-13	10	9.1±0.0
				11/25-12/9	8-13	10	8.8±0.5
5A1	TMI Ob. Center	0.4	91	10/20-11/6	6-9	7	6.5±0.2
				11/6-11/25	6-10	7	8.1±1.6
				11/25-12/9	6-9	7	7.5±0.2
7F1	Drager Farm	9.9	128	10/20-11/6	10-14	12	10.0±0.2
				11/6-11/25	10-17	12	10.8±0.1
				11/25-12/9	10-15	12	10.2±0.4
13G3	Ressler Residence	16.0	265	10/20-11/6	9-13	10	7.1±0.4
				11/6-11/25	9-13	10	8.6±0.3
				11/25-12/9	9-13**	11	7.9±0.2
15D1	EC, 44 Luke Drive	3.5	320	10/20-11/6	7-12	10	8.1±2.2
				11/6-11/25	8-12	9	8.0±0.3
				11/25-12/9	8-11	9	6.6±0.5
16G3	Baker Residence	14.0	327	10/20-11/6	---	---	7.8±0.2
				11/6-11/25	---	---	8.8±0.2
				11/25-12/9	---	---	8.7±0.0

* Equipment malfunction 11/25-12/2, no data recorded.

** Average ± standard deviation of 2 badges per station period.

TABLE C-6

PERMANENT GAMMA RATE MONITORING STATIONS

Station	Monitoring Period	Range	Average
5A1	10/20 - 11/6	6-9 µR/hr	7 µR/hr
	11/6 - 11/25	6-10	7
	11/25 - 12/9	6-9	7
	12/9 - 12/16	6-9	7
	12/16 - 12/23	ND*	ND
	12/23 - 12/30	6-10	7
	12/30 - 1/6	6/9	7
	1/6 - 1/13	6-9	7
15D1	10/20 - 11/6	7-12	10
	11/6 - 11/25	8-12	9
	11/25 - 12/9	8-11	9
	12/9 - 12/16	8-12	10
	12/16 - 12/23	8-11	9
	12/23 - 12/30	8-12	9
	12/30 - 1/6	8-11	9
	1/6 - 1/13	8-11	9

*No Data, equipment malfunction

TABLE C-7

GAMMA EXPOSURE LEVELS FROM
QUARTERLY TMINS REMP MEASUREMENTS

Station Type	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
Control	8.9±2.4*	7.8±1.5	8.4±1.5	8.9±1.8
Indicator	7.7±1.6	7.0±1.2	7.4±1,4	7.6±1.1

* Average ± standard deviation, μR/hr.

TABLE C-8

GAMMA EXPOSURE LEVELS FROM
MONTHLY TMINS REMP TLD MEASUREMENTS

Station Type	Monitoring Period		
	October	November	December
Control	9.8±1.6*	8.1±1.6	8.5±1.3
Indicator	6.8±0.9	6.1±1.2	6.1±1.0

* Average ± standard deviation, μR/hr.

Appendix D

E..vironmental Monitoring Of The Unit-2 Reactor Building Purge

METROPOLITAN EDISON'S ENVIRONMENTAL MONITORING ACTIVITIES CONDUCTED DURING THE KRYPTON-85 VENTING AT THREE MILE ISLAND, UNIT-2

by

W. E. Riethle
M. H. McBride
G. G. Baker

TMI Environmental Controls Group, GPU Nuclear

November 1980

ABSTRACT

Extensive environmental monitoring was conducted by Met-Ed/GPU personnel during the July 1980 krypton-85 venting from the Unit-2 reactor building at the Three Mile Island Nuclear Station. The monitoring data gathered at that time shows that the NRC off-site dose and dose rate guidelines of 15 mrem and 3 mrem/hr beta-skin dose were not exceeded during the venting. Measured radiation levels at off-site locations were in fact much lower than these limits, often by several orders of magnitude.

INTRODUCTION

From June 28, 1980 to July 11, 1980, approximately 44,000 Ci of krypton-85 were vented from the Unit-2 reactor building at the Three Mile Island Nuclear Station (TMINS) to the atmosphere[1]. The routine Met-Ed/GPU environmental monitoring program was expanded during this period to help insure adequate control of the venting and to provide the means for assessing off-site radiation doses from the vented material.

The venting environmental monitoring program was designed to obtain data in the following three areas:

1) Off-site dose rates during venting. During the venting, two mobile monitoring teams and one mobile monitoring laboratory were directed to off-site locations where the vented material was considered likely to touch down, based on meteorological conditions and MIDAS computer projections. The teams recorded all radiation measurements and notified the Met-Ed/GPU Environmental Command Center (ECC) via radio of any measurements above normal background levels.

2) Off-site integrated doses from vented krypton-85. Cryogenic air sampling stations were established in the vicinity of TMI to collect air samples containing the vented krypton. The krypton levels in these samples were used to estimate integrated beta-skin doses and gamma-whole body doses from the vented gas. In addition, concurrent measurements of nonpenetrating radiation were made with thermoluminescent dosimeters (TLDs) at a large number (i.e. 103) of off-site locations.

3) Release of radiocontaminants during the krypton venting. Measurements from off-site gamma monitors, radiometric analyses of routine environmental samples and TLD measurements of penetrating radiation were used to study the level of radiocontaminants in the vented krypton.

MONITORING METHODS

Mobile Monitoring

During venting, mobile monitoring measurements were made at various locations in the vicinity of TMI. Personnel shift changes were made in the field so that monitoring capabilities were available 24 hours a day while venting was in progress. Monitoring locations were selected by the Environmental Monitoring Shift Coordinator at the ECC, based on real-time meteorological data and Meteorological Information and Dose Assessment System (MIDAS) computer projections of plume dispersion. Monitoring instructions and results were relayed between the ECC and the monitoring teams by radio. The MIDAS computer program is based on the gaussian plume dispersion model outlined in the Nuclear Regulatory Commission document, Regulatory Guide 1.111.

Mobile monitoring teams measured krypton beta dose rates with portable GM survey instruments. These instruments were calibrated by exposure to known concentrations of krypton-85 and had an estimated lower limit of detection (LLD) of 10^6 pCi/m^3, krypton-85. The teams were also equipped with high pressure ionization chamber environmental gamma monitors.

The mobile laboratory measured beta dose rates with an air sampling proportional counter and the GM survey instruments described above. The proportional counter was calibrated with krypton-85 and had an estimated LLD of 3×10^4 pCi/m^3. The laboratory was also equipped with the following gamma detectors: one plastic scintillation detector with beta shield and two high pressure ionization chamber environmental gamma monitors. In addition, the laboratory gathered meteorological data from sensors attached to a 30-foot collapsible tower.

Krypton (Air) Sampling Stations

Cryogenic air samplers were placed at eight locations in the vicinity of TMI (see Figure A1). These devices collect atmospheric gases at a constant rate by cooling and condensing air to liquid nitrogen temperatures. The samples are subsequently stored at room temperature after collection. Station locations were selected based on historical meteorology and local demography. Composite air samples were collected once a week and analyzed by a commercial laboratory for krypton-85 content. The LLD of this krypton-85 analysis is currently under study. Independent measurements support the accuracy of the analysis in the range 10^3 to 10^5 pCi/m^3, krypton-85.

TLD Measurements

Three TLD systems were deployed during the venting. System-1 TLD badges, $CaSO_4$(Dy) phosphor with plastic and copper shielding, are sensitive to penetrating radiation and were changed monthly (20 stations) or quarterly (73 stations) as specified in the TMI Radiological Environmental Monitoring Program (REMP) procedures (see Figures A2-A4 and Table A2). System-2 TLD badges, $CaSO_4$(TM) phosphor with plastic and "metal alloy" shielding, are also sensitive to penetrating radiation and were changed monthly. These badges were located at ten of the System-1 TLD stations. System-3 TLD badges, sensitive to both penetrating ($CaSO_4$(Tm) phosphor with plastic and lead shielding) and nonpentrating ($LiBO_7$(Cu) phosphors unshielded and shielded by plastic) radiation, were located at all System-1 stations (73) and at 30 additional special stations (see Figures A5 and A6 and Table A3). System-3 Badges were exposed only during the venting period.

Real-Time Environmental Gamma Monitors

High pressure ionization chamber environmental gamma monitors were installed at ten locations in the vincinity of TMI (Figures A7 and A8 and Table A4). Recorded exposure rates were collected and analyzed for evidence of unusual gamma activity each day during the venting period.

REMP Measurements

Routine samples were collected under the TMI REM-Program during June and July and were subsequently assayed for radioactivity by commercial laboratories. The locations of those REMP stations associated with airborne pathways are shown in the Appendix. This report includes results from eight air particulate/air iodine stations, five milk sampling stations, and five precipitation collection stations. Various media were sampled weekly, monthly, or quarterly as required by the station's technical specifications.

Off-Site Dose Rates

During the 14 days of mobile monitoring, almost all field measurements were consistent with normal background radiation levels (see Table 1). The highest dose rate (15 min at 1 mrem/hr) was measured at station 5A1, TMI Observation Center, on July 3, 1980 from 2346 to 0001 hrs. While measured dose rates on July 3, 1980 were well below the NRC venting guideline of 3 mrem/hr, off-site beta skin dose, the venting release rate was nonetheless lowered for much of the day. Positive dose rate measurements were detected close to TMI from June 28 to July 9, and decreased rapidly with increasing distance from the Island.

Integrated Off-Site Radiation Doses

Cryogenic air sampling was conducted for 15 days (see Table 2). Estimates of beta-skin and gamma-whole body doses assumed the krypton-85 dose factors found in NRC Regulatory Guide 1.109. The beta-skin dose estimates ranged from 0.03 mrem (12B1, Goldsboro) to 1.8 mrem (5A1, TMI Observation Center). Gamma doses were lower than the respective beta-skin doses by a factor of 83 (0.00004 mrem to 0.02 mrem). These doses are well below the NRC venting guidelines of 15 mrem beta-skin dose and 5 mrem gamma-whole body dose.

System-3 TLD measurements were made at 103 stations for 14 days (see Table 3). The theoretical LLD for nonpenetrating radiation of the System-3 TLD badges is estimated at 5.3 mrem, beta-skin dose from krypton-85. Only two stations recorded statistically significant doses above this theoretical LLD, 7.3±0.0 mrem at station 6A1 and 8.1±7.3 mrem at station 4S2. Both of these dose measurements include a natural background component,

estimated at 2 to 4 mrem. No penetrating radiation exposures attributable to the vented krypton were recorded by the System-3 badges.

Computer projections from the MIDAS model of the maximum integrated doses were made for each sector from the vented krypton (see Table 4.) The projected beta-skin doses ranged from 0.11 mrem (sector 11) to 4.5 mrem (sector 6). Projected gamma doses ranged from 0.0027 mrem (sector 12) to 0.0045 mrem (sector 6).

Real-Time Environmental Gamma Measurements

The average background radiation levels recorded by the high pressure ionization chamber environmental gamma monitors during venting ranged from 6 to 12 μR/hr, depending on station location. Of the 35 peaks greater than 2 μR/hr above background recorded during the venting period, 24 were attributed to atmospheric washout caused by local precipitation (see Table 5). Three additional peaks (registed at station 2A1, TMI north gate) were correlated to radwaste shipments from TMI. One peak (at 7F1 on July 5) is of uncertain origin, but the predominant wind direction (NE) of that period seems to make a connection with the TMI vented material unlikely.

The remaining seven peaks were recorded on July 1, 3, and 4 at two stations relatively close to TMI, 5A1 (TMI Observation Center) and 14S2 (East Shelley Island). Local wind conditions during these periods suggest a possible connection between these peaks and the TMI venting. These peaks were similar in size to the natural background peaks caused by local precipitation.

Air Particulate

The results of the anlyses of air particulate samples are shown on Tables 6 and 7. Gross beta activities in samples collected during venting are comparable to levels recorded earlier in the year. The positive values indicated by the gamma scans are consistent with natural radionuclide levels.

Air Iodine

Weekly analysis of air iodine samples for iodine-131 are presented in Table 8. All values were less than the LLD of this analysis, consistent with normal background levels.

Precipitation

Analysis of precipitation for gross beta and gamma activity are presented in Table 9. The analysis results are consistent with preventing values and within the range of normal background levels.

Milk

Samples taken from the five monitoring locations around TMI were analyzed for iodine-131, gamma, and strontium-89 and 90 activity. Results of these analyses are presented in Tables 10, 11, and 12 respectively. All values were within the range of normal background levels.

TLD Gamma Exposure Data

Monthly and quarterly TLD data which include the venting period are presented in Tables 13 and 14. Data from earlier monitoring periods are also shown for comparison.

The gamma levels re orded by the monthly System-1 TLD badges in June and July were higher by several mR than levels recorded earlier in the year. This increase was most likely due to the fact that no compensation was made for transit exposures in the June and July Teledyne measurements. Transit exposures (typically 1 to 3 mR) are normally subtracted from the System-1 gross exposure measurements. Difficulties with the transit badges in June and July, however, led to inaccurate transit exposure estimates which were not subtracted from the badge readings. This conclusion is supported by the fact that neither System-2 nor System-3 badges showed increased gamma levels during June and July. Quarterly TLD data also show no increase in gamma levels during the venting interval.

CONCLUSIONS

The Met-Ed/GPU environmental monitoring results support the following conclusions:

1) Off-site dose rates from the vented material did not exceed the NRC venting guideline of 3 mrem/hr, beta-skin dose and 1 mrem/hr, whole body dose.

2) Field measurements indicate that an individual located at the closest habitable site to TMI, the TMI Observation Center, could have received up to 1.8 mrem incremental beta-skin dose and 0.02 mrem incremental gamma dose from the vented Krypton 85. Persons living in the nearest population center to TMI, Goldsboro, could have received up to 0.03 mrem incremental beta-skin dose and 0.0004 mrem incremental gamma dose. These doses are well below the NRC guidelines of 15 mrem beta-skin dose and 5 mrem whole body gamma dose.

3) No significant amounts of plume radiocontaminants were detected off-site.

REFERENCE

[1] P. Babel, T. Menzel: Reactor Building Purge - Analysis of the Measurement of Vented Activity, GPU Service Technical Data Report 182, September 25, 1980.

TABLE 1

SUMMARY OF POSITIVE MOBILE MONITORING MEASUREMENTS

Sector [a]	Direction From TMI	Number of 15-Min Field Measurements Above Background	Range[b] (mrem/hr above background)
1	N	4	0.02-0.08
2	NNE	21	0.01-0.4
3	NE	2	0.1 -0.2
4	ENE	7	0.2 -0.3
5	E	31	0.02-1
6	ESE	41	0.01-0.6
7	SE	1	0.2
8	SSE	3	0.1 -0.3
9	S	0	-
10	SSW	0	-
11	SW	2	0.01-0.02
12	WSW	0	-
13	W	0	-
14	WNW	0	-
15	NW	0	-
16	NNW	0	-
		Total: 112	

a) Each sector originates at TMI and extends radially in the direction indicated. The monitoring period extended from June 28 to July 11.

b) Measurements were made without probe shielding and are assumed to represent predominantly beta radiation.

TABLE 2

DOSE ESTIMATES BASED ON KR-85 LEVELS IN CRYOGENIC AIR SAMPLES

Station	Distance From TMI	Sampling Time	Average Kr-85 Concentration	Estimated Beta-Skin Dose	Estimated Gamma Dose
1S2	0.4 mi	6/26-7/11	9.2±1.0 E 3 pCi/m^3	4.7±0.5 E-1 mrem	5.7±0.6 E-3 mrem
5A1	0.4	6/27-7/11	3.6±0.5 E 4	1.8±0.3 E 0	2.2±0.3 E-2
12B1	1.6	6/27-7/11	6.1±0.9 E 2	3.1±0.5 E-2	3.7±0.6 E-4
8C1	2.3	6/27-7/11	2.3±0.3 E 3	1.1±0.1 E-1	1.3±0.2 E-3
1C1	2.6	6/27-7/11	1.8±0.2 E 3	9.1±1.0 E-2	1.1±0.1 E-3
7F1*	9.8	6/27-7/4	4.0±0.8 E 1	1.1±0.5 E-3	1.3±0.6 E-5
6G4	11.4	6/27-7/11	1.0±0.1 E 3	5.2±0.5 E-2	6.2±0.6 E-4
9G1	12.6	6/27-7/11	9.0±0.1 E 2	4.5±0.2 E-2	5.4±0.2 E-4

* Sampler not in operation from 7/4 - 7/11.

TABLE 3

TMI SYSTEM - 3 TLD DATA

Station	Monitoring Period	Total Measured Exposures and Doses[a] (Not Corrected for Background)	
		Penetrating Exposure	Nonpenetrating Dose
1S2	6/28 - 7/11	3.3±0.4 mR	4.8±5.4 mrem
1C1	6/27 - 7/11	2.5±0.4	3.4±7.8
1D1	6/28 - 7/11	3.6±0.9	1.3±2.5
1E4	6/27 - 7/11	3.3±0.6	1.7±4.1
1F1	6/28 - 7/11	3.3±1.6	0.9±2.1
1F2	6/28 - 7/11	2.7±0.6	0.5±0.9
2S2	6/27 - 7/11	2.9±0.5	2.8±3.1
2B1	6/28 - 7/11	3.2±1.2	1.8±2.6
2E1	6/28 - 7/11	3.5±1.3	1.8±3.2
2F1	6/28 - 7/11	3.5±0.9	0.2±0.8
3A1	6/27 - 7/11	3.0±0.7	1.4±3.6
3B2	6/28 - 7/11	3.9±1.0	0
3C1	6/28 - 7/11	3.5±0.8	3.6±5.3
3E3	6/28 - 7/11	3.6±1.4	1.6±5.6
3F1	6/28 - 7/11	4.5±1.1	3.0±6.8
3G1	6/28 - 7/11	3.1±1.2	3.6±8.4
4S2	6/28 - 7/11	3.2±1.3	8.1±7.3
4A1	6/27 - 7/11	2.8±0.4	0.8±1.2
4C1	6/28 - 7/11	3.5±1.2	1.1±2.7
4E5	6/28 - 7/11	4.0±1.5	1.3±2.6
4F1	6/28 - 7/11	4.7±0.6	4.5±8.4
4G1	6/28 - 7/11	3.6±0.9	0.7±2.8
5S2	6/28 - 7/11	2.8±0.4	8.1±8.6
5A1	6/27 - 7/11	2.8±0.9	1.6±2.6
5B1	6/28 - 7/11	3.6±0.5	2.0±4.9
5D1	6/28 - 7/11	3.5±0.5	1.8±4.6
5E1	6/28 - 7/11	3.3±0.8	2.3±5.5
5F1	6/28 - 7/11	3.8±1.3	1.6±2.8
6A1	6/28 - 7/4	1.1±0.2	2.4±3.9
	7/4 - 7/11	2.7±1.7	3.1±2.5
	6/28 - 7/11	2.9±0.4	7.3±0.0
6B1	6/28 - 7/4	1.4±0.4	1.9±3.9
	7/4 - 7/11	2.3±0.7	2.1±0.4
	6/28 - 7/11	3.4±0.4	4.8±7.1

TABLE 3 (cont'd)

Station	Monitoring Period	Total Measured Exposures and Doses (Not Corrected for Background)	
		Penetrating Exposure	Nonpenetrating Dose
6D1A	6/28 - 7/4	1.1±0.2 mR	1.6±2.5 mrem
	7/4 - 7/11	3.2±0.5	0.3±0.7
	6/28 - 7/11	4.6±0.8	3.0±8.5
6D1B	6/28 - 7/11	3.5±1.2	2.5±4.0
6E6	6/27 - 7/4	1.7±0.4	1.1±1.1
	7/4 - 7/11	2.5±0.6	0.9±2.5
	6/27 - 7/11	4.6±0.8	3.0±8.5
6F1	6/28 - 7/11	5.0±0.9	5.5±6.8
6G2	6/28 - 7/11	4.5±0.4	3.9±5.4
7A3	6/27 - 7/11	2.6±1.6	1.1±3.0
7B3	6/28 - 7/11	3.3±1.0	2.2±4.7
7C1	6/28 - 7/11	4.4±0.4	4.5±5.8
7E6	6/28 - 7/11	3.7±0.4	3.0±5.7
7F1	6/28 - 7/11	4.1±1.5	1.0±3.7
7F2	6/28 - 7/11	3.1±0.7	0.5±2.0
7G1	6/28 - 7/11	2.6±0.7	2.2±3.2
8S1	6/28 - 7/11	2.9±0.5	4.9±10.6
8S2[b]	5/22 - 7/11	32.8±4.0	9.1±16.3
8B1	6/28 - 7/11	2.3±0.7	1.8±3.4
8C1	6/28 - 7/11	3.2±0.5	3.5±5.4
8E2	6/28 - 7/11	2.2±0.4	1.6±3.2
8F1	6/28 - 7/11	4.3±0.9	6.3±6.4
8G1	6/28 - 7/11	3.2±0.6	2.0±3.7
9S2	6/28 - 7/11	3.3±0.6	2.5±5.0
9C1	6/28 - 7/11	3.6±0.4	3.6±12.6
9D1	-	-	-
9E1	6/28 - 7/11	3.2±0.4	3.0±2.5
9F1	6/28 - 7/11	2.7±0.6	2.7±6.3
9G1	6/28 - 7/11	3.2±0.4	1.5±3.5
10S2	6/28 - 7/11	2.6±0.7	0
10B1	6/27 - 7/4	1.4±0.3	2.4±3.2
	7/4 - 7/11	2.1±0.4	1.9±1.1
	1/27 - 7/11	3.3±0.2	1.1±3.2
10C1	6/28 - 7/11	2.5±0.4	0
10E3	6/28 - 7/11	3.4±0.4	2.3±3.5
10F1	6/27 - 7/11	3.4±1.6	0.3±1.0
10G1	6/28 - 7/11	2.9±0.5	1.2±4.1

TABLE 3 (cont'd)

Station	Monitoring Period	Total Measured Exposures and Doses (Not Corrected for Background)	
		Penetrating Exposure	Nonpenetrating Dose
16S1	6/28 - 7/11	3.4±0.4 mR	2.6±3.9 mrem
16A1	6/27 - 7/4	1.4±0.2	2.0±2.9
	7/4 - 7/11	1.9±0.2	4.1±1.1
	6/27 - 7/11	2.6±0.4	3.1±6.7
16B1	6/27 - 7/4	1.8±1.2	0.5±0.0
	7/4 - 7/11	2.1±0.1	0.9±2.5
	6/27 - 7/11	3.9±1.0	2.4±6.7
16C1	6/28 - 7/11	2.8±1.0	2.9±5.4
16D1	6/28 - 7/11	3.4±1.4	2.8±4.4
16E1	6/27 - 7/11	3.0±0.7	1.6±3.0
16F1	6/28 - 7/11	3.4±0.4	1.3±3.3
16F2	6/28 - 7/11	3.4±0.6	3.0±3.0
16G1	6/28 - 7/11	3.1±1.0	2.8±5.2

a) Values represent average ± 2 standard deviations of readings from either 2 or 4 TLD badges, depending on the length of the monitoring period. Nonpenetrating doses were calculated from gross measurements using an empirical krypton-85 calibration factor, 2.5 mrem skin dose/mR exposure.

b) The average reading ± 2 standard deviations on element-1 of 4 badges was 30.5 ± 3.9 mR (nonpenetrating radiation plus penetrating radiation), suggesting the nonpenetrating radiation dose was minimal. The elevated penetrating radiation exposure recorded at this station was attributed to radiation from a nearby on-site radioactive waste area.

TABLE 4

MIDAS COMPUTER PROJECTIONS OF RADIATION DOSES
FROM VENTED KRYPTON-85

Sector[a]	Direction From TMI	Maximum Projected Beta-Skin Dose		Maximum Projected Gamma-Whole Body Dose	
1	N	1.8 E 0	mrem @ 1.2 mi	2.7 E-2	mrem @ 0.4 mi
2	NNE	2.6 E 0	0.4	3.5 E-2	0.4
3	NE	1.8 E 0	0.4	2.7 E-2	0.4
4	ENE	1.7 E 0	0.9	1.5 E-2	0.4
5	E	2.3 E 0	0.6	2.7 E-2	0.4
6	ESE	4.5 E 0	0.4	4.5 E-2	0.4
7	SE	2.3 E 0	0.4	2.3 E-2	0.4
8	SSE	1.9 E 0	0.4	1.9 E-2	0.4
9	S	1.5 E 0	0.4	2.6 E-2	0.4
10	SSW	9.7 E-1	0.4	1.1 E-2	0.4
11	SW	1.1 E-1	0.6	3.6 E-3	0.4
12	WSW	2.3 E-1	1.2	2.7 E-3	0.6
13	W	6.2 E-1	0.4	1.1 E-2	0.4
14	WNW	4.0 E-1	0.4	4.3 E-3	0.4
15	NW	8.4 E-1	1.2	1.2 E-3	0.4
16	NNW	5.4 E-1	1.2	5.8 E-3	0.4

a) Each sector originates at TMI and extends radially in the direction indicated.

TABLE 5

REAL-TIME ENVIRONMENTAL GAMMA MONITORING DATA

Date	Time	Station	Radiation Increase Above Background (μR/hr)	Time of Recorded Precipitation	Comment
6/28/80	1638-1800	2A1	4.0	1950	Normal Background
	1815-2015	1C1	3.0		Normal Background
	1831-2006	14S2	4.0		Normal Background
	1900-2054	8C1	4.0		Normal Background
	1908-2030	9B1	4.0		Normal Background
	1900-2100	5A1	3.0		Normal Background
	1919-2142	7F1	3.0		Normal Background
	1848-2015	13B1	4.0		Normal Background
	1900-2030	15D1	3.0		Normal Background
6/29/80	0340-0543	8C1	2.0	0350	Normal Background
	0345-0630	9B1	2.0		Normal Background
	2045-2300	6D1	2.0		Normal Background
	2040-2240	8C1	3.0	2040	Normal Background
	2053-2145	9B1	2.0		Normal Background
	2100-2300	7F1	4.0		Normal Background
6/30/80	1915[a]	2A1	490.0[b]	None Recorded	Waste Shipment
7/1/80	1025-1040	5A1	3.0	None Recorded	Possibly Related to Venting
7/3/80	0935-1000	14S2	3.0	None Recorded	Possibly Related to Venting
	1722-1800	5A1	2.0		Possibly Related to Venting
	2130-2155	5A1	7.0		Possibly Related to Venting
	2215-2230	5A1	2.5		Possibly Related to Venting
	2300-2400	5A1	4.0		Possibly Related to Venting
7/4/80	0245-0300	5A1	3.0	None Recorded	Possibly Related to Venting
7/5/80	0600-0820	7F1	2.0	None Recorded	Normal Background[c]
7/7/80	1230[a]	2A1	5.0	None Recorded	Waste Shipment
	1710-1725[a]	2A1	2.0		Waste Shipment

TABLE 5 cont'd

REAL-TIME ENVIRONMENTAL GAMMA MONITORING DATA

Date	Time	Station	Radiation Increase Above Background (μR/hr)	Time of Recorded Precipitation	Comment
7/8/80	0631-1045	7F1	4.0	0550	Normal Background
	0645-1000	9B1	4.0	0631	Normal Background
	0650-1220	1C1	4.0		Normal Background
	0700-1000	6D1	3.0		Normal Background
	0717-1034	15D1	3.0		Normal Background
	0745-1030	2A1	3.0		Normal Background
	0753-1038	13B2	3.0		Normal Background
	0600-1130	8C1	4.0		Normal Background
	0700-1000	14S2	3.0		Normal Background

a) Station 2A1 located at TMI north gate.

b) Three minute peak.

c) Meteorological measurements indicate the wind did not blow from TMI towards station 7F1 during this monitoring period (i.e. 0500 to 0900).

TABLE 6

GROSS BETA ACTIVITY IN AIR PARTICULATE SAMPLES
TMI REMP

Station	Gross Beta Activity (pCi/m^3) 6/24-7/1	7/1-7/8	7/8-7/15	Average 1/1-6/24
1S2	2.1±0.3 E-2	9.3±2.6 E-3	1.8±0.3 E-2	1.7±1.4 E-2
1C1	1.2±0.2 E-2	2.2±0.4 E-2	7.6±3.1 E-3	1.3±0.7 E-2
5A1	1.1±0.3 E-2	<2.0 E-2	1.9±0.3 E-2	1.7±1.2 E-2
7F1	9.3±2.9 E-3	9.3±4.9 E-3	1.3±0.4 E-2	2.2±3.7 E-2
8C1	1.2±0.3 E-2	1.8±3.2 E-3	6.6±3.1 E-3	1.4±1.4 E-2
9G1	3.7±0.4 E-2	2.0±0.3 E-2	1.6±0.3 E-2	1.8±0.9 E-2
12B1	2.7±0.3 E-2	2.1±0.3 E-2	1.7±0.3 E-2	2.0±1.2 E-2
15G1	3.7±0.4 E-2	2.5±0.4 E-2	1.8±0.4 E-2	2.0±0.9 E-2

TABLE 7

GAMMA, GROSS ALPHA, AND STRONTIUM 90 ACTIVITY
IN AIR PARTICULATE SAMPLES, TMI REMP

	Quarterly Composite (3/29 - 7/1)			Monthly Composite	
Station	Gamma Scan[a] (pCi/m^3)	Gross Alpha Activity (pCi/m^3)	Strontium 90 (pCi/m^3)	Gamma Scan (pCi/m^3) 6/3 - 7/1	7/1 - 7/29
1S2	Be-7, 1.8±0.4 E-2				
1C1	Be-7, 2.3±0.3 E-2	Composite of Indicator Stations[b]		Composite of Indicator Stations[b]	
5A1	Be-7, 2.8±0.3 E-2	7.1±5.3 E-4	<5.0 E-5	Be-7, 4.5±0.5 E-2	Be-7, 3.6±0.4 E-2
7F1	Be-7, 3.9±0.9 E-2 Cs-137, 1.4±0.7 E-3				
8C1	Be-7, 1.3±0.3 E-2	Composite of Background Stations[c]		Composite of Background Stations[c]	
9G1	Be-7, 3.8±0.5 E-2	<6.0 E-4	<1.0 E-4	Be-7, 6.5±0.7 E-2	Be-7, 8.2±0.8 E-2
12B1	Be-7, 4.8±0.6 E-2			Cs-137, 8.3±4.4 E-4	Cs-137, 7.2±4.2 E-4
15G1	Be-7, 3.0±0.8 E-2 Cs-137, 9.2±5.3 E-4				

a) Only species present in concentrations above analysis LLD are reported in the Table. The gamma scan analyses were specific for the following radionuclides: Be-7, K-40, Mn-54, Co-58, Fe-59, Co-60, Zn-65, Zr-95, Ru-103, Ru-106, I-131, Cs-134, Cs-137, Ba-140, Ce-141, Ce-144, Ra-226, Th-228.

b) Indicator stations: 1S2, 12B1, 5A1, 8C1, 1C1.

c) Background stations: 7F1, 9G1, 15G1.

TABLE 8

ANALYSIS RESULTS OF AIR IODINE SAMPLES
TMI REMP

Station	Sampling Period[a] 6/24-7/1	7/1-7/8	7/8-7/15
1S2	<2.0 E-2	<2.0 E-2	<2.0 E-2
1C1	<2.0 E-2	<3.0 E-2	4.0 E-2
5A1	<3.0 E-2	<2.0 E-1[b]	< 0 E-2
7F1	<2.0 E-2	<4.0 E-2	<4. E-2
8C1	<2.0 E-2	<3.0 E-2	<3.0 -2
9G1	<2.0 E-2	<2.0 E-2	<3.0 E-2
12B1	<2.0 E-2	<2.0 E-2	<3.0 E-2
15G1	<3.0 E-2	<3.0 E-2	<3.0 E-2

a) Values represent pCi I-131 per cubic meter of air and are equivalent to analysis LLD's.

b) Sampler malfunction during sample period.

TABLE 9

ANALYSIS RESULTS OF PRECIPITATION
SAMPLES COLLECTED NEAR TMI

Station	Gross Beta Activity[a] (pCi/liter) June/July Composite	Average March thru May	Quarterly Gamma Scan[b]
1C1	1.9±0.7	2.0±0.1	<LLD
5A1	6.9±1.0	5.0±3.6	<LLD
7F1	3.5±0.8	3.6±2.1	<LLD
8C1	5.5±0.9	4.5±1.0	<LLD
15G1	3.6±0.8	4.9±0.4	<LLD

a) Average ± standard deviation.

b) <LLD indicates the following radionuclides concentrations were below analysis LLD's for Be-7, K-40, Mn-54, Co-58, Fe-59, Co-60, Zn-65, Zr-95, Ru-103, Ru-106, I-131, Cs-134, Cs-137, Ba-140, Ce-141, Ce-144, Ra-226, Th-228. Monitoring period extends from April through July, 1980.

TABLE 10

IODINE-131 CONTENT OF MILK SAMPLES
TMI REMP

Station	Location	Sample Date[a] 6/26	7/3	7/10	7/17	7/24
1B1	Hardison Farm	<0.2	<0.3	<0.2	<0.4	<0.3
2G1	Oellig Farm	<0.3	<0.4	<0.4	<0.5	<0.3
4B1	Alwine Farm	<0.2	<0.2	<0.3	<0.4	<0.3
7B3	Becker Farm	<0.2	<0.3	<0.3	<0.5	<0.2
14D1	Fisher Farm	<0.2	<0.4	<0.3	<0.5	<0.4

a) Values represent pCi I-131 per liter and are equivalent to analysis LLD's.

TABLE 11

GAMMA ACTIVITY IN MILK SAMPLES
TMI REMP

Gamma Scan[a] (pCi/liter)

Station	6/26	7/3	7/10	7/17	7/10-7/24[b]
1B1	K-40, 1.7±0.6 E 3 Cs-137, 1.3±0.6 E 1	K-40, 1.9±0.2 E 3	K-40, 1.7±0.2 E 3	K-40, 1.8±0.2 E 3	K-40, 1.7±0.2 E 3
2G1	K-40, 1.2±0.1 E 3	K-40, 1.2±0.1 E 3	K-40, 1.4±0.1 E 3	K-40, 1.2±0.1 E 3	K-40, 1.4±0.1 E 3
4B1	K-40, 1.6±0.2 E 3	K-40, 1.3±0.1 E 3	K-40, 1.2±0.1 E 3	K-40, 1.4±0.1 E 3	K-40, 1.3±0.1 E 3
7B3	K-40, 1.2±0.1 E 3	K-40, 1.2±0.1 E 3	K-40, 1.4±0.1 E 3	K-40, 1.3±0.1 E 3	K-40, 1.3±0.1 E 3
14D1	K-40, 1.1±0.4 E 3	K-40. 1.3±0.1 E 3	K-40, 1.3±0.1 E 3	K-40, 1.2±0.1 E 3	K-40, 1.3±0.1 E 3

a) Only species present in concentrations above analysis LLD are reported (average ± standard deviation) in the Table. The gamma scan analysis was specific for the following radionuclides: Be-7, K-40, Mn-54, Co-58, Fe-59, Co-60, Zn-65, Zr-95, Ru-103, Ru-106, Cs-134, Cs-137, Ba-140, Ce-141, Ce-144, Ra-226, Th-228.

b) Composite sample.

TABLE 12

STRONTIUM-89 AND 90 CONTENT OF MILK SAMPLES
TMI REMP

Station	Sr-89 (pCi/liter)		Sr-90 (pCi/liter)	
	Venting Period[a]	Prior to Venting[b]	Venting Period[a]	Prior to Venting[b]
1B1	<2.0	<3.5	6.7±0.5	6.8±4.5
2G1	<4.0	<4.0	2.9±0.6	5.4±0.4
4B1	<2.0	<2.5	2.6±0.3	3.0±0.6
7B3	<2.0	<3.5	1.8±0.4	3.0±0.4
14D1	<3.0	<3.0	5.3±0.8	2.7±0.1

a) Quarterly composite, May through July.

b) Average LLD's ± standard deviations from two quarterly composites: November 1979 through January 1980 and February 1980 through April 1980.

TABLE 13

MONTHLY TLD DATA
GAMMA EXPOSURE

Station	System-1[a] (mR) June[b]	System-1[a] (mR) July[b]	System-1[a] (mR) Average Jan-May	System-2[a] (mR) June	System-2[a] (mR) July	System-2[a] (mR) Average Jan-May	System-3[b,c] (mR)
1S2	8.8±0.1	9.8±0.5	5.6±1.2	5.4±0.1	6.6±0.3	6.5±0.7	6.6±0.4
1C1	8.5±0.2	7.5±0.3	4.8±0.8	-	-	-	5.4±0.4
2S2	8.1±0.1	8.0±0.2	5.0±1.2	-	-	-	6.2±0.5
4S2	8.1±0.1	9.9±0.3	5.2±1.1	4.7±0.4	6.0±0.2[d]	5.5±1.0	6.4±1.3
4A1	8.8±0.1	12.4±1.8	5.7±1.2	-	-	-	6.0±0.4
4G1	9.4±0.1	8.5±0.3	6.2±1.4	6.5±0.2	7.4±0.4	6.8±0.8	7.2±0.9
5S2	8.1±0.1	8.1±0.2	5.1±1.2	4.4±0.1	5.9±0.3	5.9±0.6	5.6±0.4
5A1	8.5±0.1	8.8±0.3	5.6±0.8	5.1±0.2	6.7±0.4	6.2±0.5	6.0±1.0
7F1	11.9±0.2	11.2±0.2	8.8±1.4	7.1±0.4	9.0±0.2	8.9±1.2	8.2±1.5
7G1	11.8±0.2	11.8±0.5	9.0±1.5	-	-	-	5.2±0.4
8C1	7.6±0.1	7.3±0.1	4.8±1.5	4.0±0.2	4.9±0.4	5.0±0.5	6.6±0.6
9S2	9.0±0.1	10.0±1.0	6.0±1.4	-	-	-	6.6±0.6
9G1	9.7±0.2	11.7±1.5	6.8±1.3	-	-	-	6.4±0.4
10B1	9.8±0.1	10.1±0.2	5.7±1.2	-	-	-	6.6±0.2
11S1	8.9±0.1	11.2±0.9	6.3±2.0	5.4±0.3	6.4±0.5	6.6±0.5	6.4±0.4
12B1	8.4±0.2	9.6±0.7	5.4±1.2	-	-	-	5.4±0.7
14S2	e	8.9±0.3	3.2±0.6	-	-	-	3.0±0.6
15G1	9.7±0.2	11.7±1.5	6.8±1.3	5.7±0.3	7.2±0.4	6.6±0.7	6.4±0.4
16S1	9.4±0.2	8.9±0.4	6.0±1.3	5.5±0.3	6.6±0.2	6.8±0.7	6.8±0.4
16A1	7.9±0.1	7.6±0.2	3.6±0.5	-	-	-	2.8±0.2

a) Values represent average ± standard deviation of badge phosphor readings. Gross measurements are corrected for transit exposures, except as noted.
b) Not corrected for transit exposure.
c) Values represent extrapolations from a two-week to a monthly monitoring period.
d) One phosphor not read due to reader malfunction.
e) Station vandalized, no badges recovered.

TABLE 14

QUARTERLY TLD DATA
GAMMA EXPOSURE

Station	1st Quarter January through March, 1980	2nd Quarter April through June, 1980	3rd Quarter July through September, 1980
1S2	22.5±2.6 mR	15.7±0.4 mR	22.1±2.0 mR
1C1	22.5±1.3[b]	12.7±0.6	12.0±0.5
1E4	15.8±0.8	16.5±0.3	16.8±0.3
2S2	21.0±4.8	12.4±0.4	17.5±0.4
2E1	c	16.0±0.3	16.1±0.2
2F1	14.2±0.1	14.5±0.3	14.8±0.7
3A1	14.8±0.3	15.3±0.3	18.1±0.7
3E3	14.9±0.5	15.6±0.4	17.2±0.4
3F1	16.9±0.4[b]	17.3±0.2	c
3G1	15.3±1.6	13.4±0.4	14.5±0.5
4S2	17.4±1.2	13.2±0.4	14.7±0.8
4A1	28.6±6.2	14.8±0.1	15.6±0.2
4E5	18.1±0.4	18.3±0.2	21.4±0.4
4F1	19.0±0.3	19.1±0.6	19.3±0.5
4G1	21.4±1.4	16.5±0.3	19.6±1.2
5S2	16.4±1.2	13.1±0.2	16.5±1.0
5A1	23.9±4.8	14.5±0.2	21.1±3.7
5E1	16.3±0.3	14.8±0.1	17.7±0.7
5F1	17.3±0.6	16.0±0.6	18.0±0.5
6A1	16.4±0.3[b]	14.3±0.4	17.0±0.6
6E6	19.8±0.7	16.4±0.3	19.4±0.2
6F1	18.6±0.1	18.4±0.2	19.0±0.3
6G2	17.0±0.2	16.2±0.3	17.3±0.3

TABLE 14 (cont'd)

Station	1st Quarter January through March, 1980	2nd Quarter April through June, 1980	3rd Quarter July through September, 1980
7A3	18.4±2.9 mR	14.0±0.5 mR	14.4±0.5 mR
7E6	16.5±1.0	14.4±0.5	15.7±1.0
7F1	26.4±0.9[b]	23.6±0.5	24.3±0.7
7G1	28.1±1.4	23.3±0.5	23.9±0.4
8S1	16.7±0.5	13.5±0.4	31.1±0.8
8C1	14.6±1.1	12.7±0.3	11.4±0.2
8E2	12.6±0.5	14.1±0.3	11.4±0.2
8F1	23.5±0.4	26.4±0.2	25.3±1.6
8G1	16.7±0.4	18.2±0.6	16.5±0.3
9S2	20.9±2.6[b]	15.8±0.4	15.3±0.2
9E1	17.6±0.2	17.0±0.6	17.5±0.2
9F1	13.9±0.3	13.5±0.3	14.0±0.3
9G1	26.8±5.0	19.0±0.4	17.9±0.3
10S2	13.6±1.1	12.3±0.3	12.7±0.3
10B1	18.6±0.8	17.8±0.2	17.8±0.3
10E3	21.8±1.0	24.5±0.8	21.8±0.3
10F1	15.9±0.1	16.1±0.1	16.6±0.2
10G1	15.3±0.2	16.3±0.5	14.3±0.2
11S1	26.1±2.8	15.7±0.2	15.6±0.6
11A2	16.6±0.9	[c]	15.3±0.4
11B1	17.8±0.2	16.9±0.2	18.2±0.5
11E3	[d]	13.4±0.3	14.0±0.4
11F1	15.7±0.4	14.9±0.2	15.6±0.5
11G1	16.0±0.1	14.6±1.1	16.9±0.4
12B1	19.2±1.5	12.0±0.1	12.6±0.3
12E4	16.7±0.1	15.7±0.4	15.8±0.4
12F1	19.3±0.8	20.3±0.6	21.4±0.8
12G2	16.4±0.9	14.5±0.3	15.2±0.4

TABLE 14 (cont'd)

Station	1st Quarter January through March, 1980	2nd Quarter April through June, 1980	3rd Quarter July through September, 1980
13S1	15.9±0.6 mR	c	c
13B1	15.8±0.6	14.9±0.1	18.8±1.8
13E1	14.7±0.2	14.1±0.2	17.4±0.5
13F1	15.5±0.3	14.5±0.4	16.0±0.2
13G1	19.8±0.2	20.2±0.4	21.5±0.3
13G2	17.0±1.3	16.3±0.3	18.4±0.4
14S2	11.3±0.4	c	14.5±0.4
14B1	14.2±0.7	13.1±0.2	15.7±0.6
14E4	13.9±0.1	15.6±0.6	14.1±0.4
14F1	12.9±0.2	12.5±0.2	13.5±0.1
14G1	18.1±0.2	17.5±0.2	20.6±0.7
15S1	12.7±0.2	12.4±0.3	14.6±0.7
15B1	16.2±0.3	16.2±0.3	16.9±0.5
15E1	14.0±0.2	13.7±0.6	14.8±0.4
15F1	15.8±0.4	15.1±0.1	16.8±0.3
15G1	22.1±1.9	16.0±0.2	17.2±0.3
15G2	12.9±0.3	12.5±0.2	13.1±0.4
16S1	e	14.3±0.1	14.2±0.2
16A1	12.4±0.4	10.6±0.2	12.4±0.5
16E1	15.3±0.4	14.6±0.3	16.6±0.3
16F1	14.1±0.3	14.0±0.2	15.0±0.4
16G1	12.3±0.2	11.5±0.3	c

a) Values represent average ± standard deviation of System-1 badge phosphor readings.
b) Phosphor outlier (i.e. outside $\bar{X}-3\sigma$ to $\bar{X}+3\sigma$) excluded from badge average.
c) Station vandalized, no badges recovered.
d) Several phosphor outliers, badge reading: 272.2, 37.5, 16.7, 15.3 mR.
e) Several phosphor outliers, badge reading: 77.3, 30.0, 23.0, 21.8 mR.

APPENDIX

TABLE A-1

LOCATIONS OF CRYOGENIC AIR SAMPLING STATIONS
DURING KRYPTON-85 VENTING

Station	Location	From TMI Azimuth	From TMI Distance
1S2	TMI - N. Weather Station	0°	0.4 mi
1C1	Middletown	355	2.6
5A1	Observation Center	100	0.4
6G4	West Donegal	112	11.4
7F1	Marietta	127	9.8
8C1	Falmouth	159	2.3
9G1	York	180	12.6
12B1	Goldsboro	253	1.6

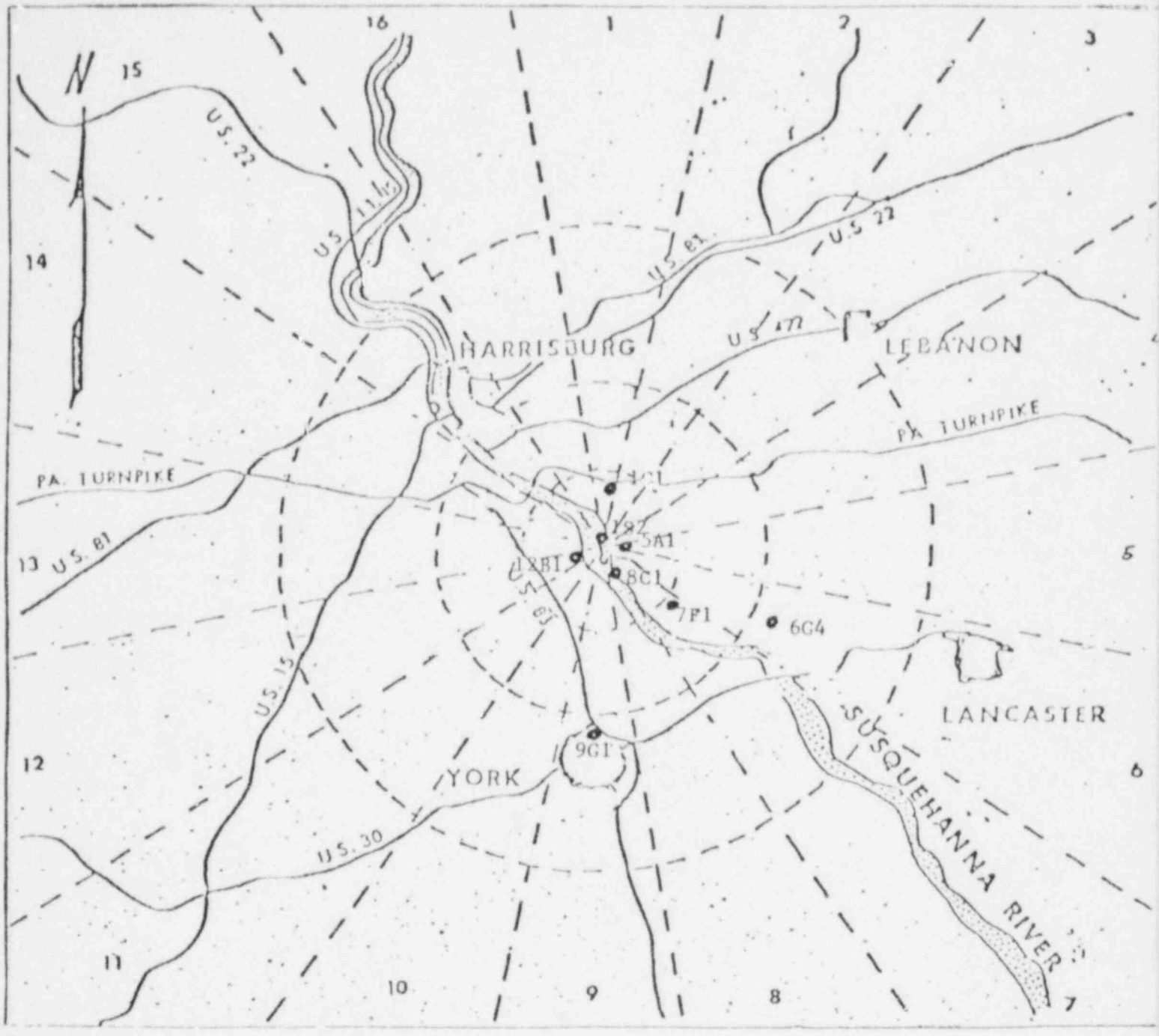


Figure A-1

THREE MILE ISLAND NUCLEAR STATION
LOCATION OF KRYPTON-85 (AIR) SAMPLING STATIONS
GREATER THAN 5 MILES FROM THE SITE BOUNDARIES
DURING THE KRYPTON-85 VENTING

TABLE A-2

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM STATION LOCATIONS

SAMPLE MEDIUM	LOCATION CODE	MAP NUMBER	DISTANCE (miles)	AZIMUTH	DESCRIPTION
AP,AI,ID	1S2	1	0.4	0°	N of site, North Weather Station
ID	2S2	2	0.7	28	NNE of site on light pole in middle of North Bridge
ID	4S2	3	0.3	71	ENE of site on top of dike, East Fence
ID	5S2	4	0.2	95	E of site on top of dike, East Fence
ID	8S1	5	0.4	167	SSE of site
ID	9S2	6	0.8	184	S of site at South Beach of Three Mile Island
EW	10S1	7	-	-	On site, RML-7 Station Discharge
ID	10S2	8	0.4	200	SSW of site
ID	11S1	9	0.1	221	SW of site, west of Mechanical Draft Towers on dike
ID	13S1	10	0.4	270	W of site on Shelley Island
SW	13S2A & B	11	0.1	270	On site, Station Intakes (Units 1 & 2)
ID	14S2	12	0.4	293	WNW of site on Shelley Island
ID	15S1	13	0.5	317	NW of site on Shelley Island
ID	16S1	14	0.2	340	NNW of site at gate in fence on west side of Three Mile Island, North boat dock
AQP & AQS	1A1	15	0.7	1	N of site
AQS	1A2	16	0.7	0	N of site at north tip of Three Mile Island
ID	3A1	17	0.6	35	NE of site on Route 441
ID	4A1	18	0.5	65	ENE of site on Laurel Road
AP,AI,RW,ID	5A1	19	0.4	100	E of site on north side of Observation Center Building
ID	6A1	20	0.5	117	ESE of site on light pole on Route 441
AQS	7A1	21	0.3	137	SE of site
ID	7A3	22	0.6	143	SE of site on Route 441
SW,AQP	9A2	23	0.5	188	S of site below Discharge Pipe
AQS	10A1	24	0.8	202	SSW of site
AQS	11A1	25	0.5	225	SW of site
ID	11A2	26	0.5	221	SW of site on Beech Island
ID	16A1	17	0.4	332	NNW of site on Kohr Island
MG	1B1	28	1.2	5	N of site, farm along Route 441
M,FPL	4B1	29	1.1	65	ENE of site, farm west of Gingrich Road
M,FPL	7B3	30	1.6	125	SE of site, farm on the east side of Conewago Creek
SW,AQF,AQS,AQP	9B1	31	1.5	178	S of site above York Haven Dam
AQS,ID	10B1	32	1.1	2-0	SSW of site on south beach of Shelley Island
ID	11B1	33	1.9	227	SW of site on Route 262
AP,AI,ID	12B1	34	1.6	253	WSW of site adjacent to Fishing Creek, Goldsboro Air Station
ID	13B1	35	1.2	261	W of site at Goldsboro Marina
ID	14B1	36	1.4	290	WNW of site on Still House Road

TABLE A-2

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM STATION LOCATIONS (cont'd)

SAMPLE MEDIUM	LOCATION CODE	MAP NUMBER	DISTANCE (miles)	AZIMUTH	DESCRIPTION
ID	15B1	[illegible]	1.8	304	NW of site on Still House Road
AQF	16B1	38	1.1	337	NNW of site below Fall Island
AP,AI,ID,RW	1C1	39	2.6	355	N of site at Middletown Substation
SW	1C3	40	2.3	347	N of site at Swatara Creek
AP,AI,RW.ID	8C1	41	2.3	159	SSE of site at Falmouth-Collins Substation
SW	8C2	42	2.3	165	SSE of site, York Haven Hydro
M,FPL	14D1	43	3.7	283	WNW of site, farm
ID	1E4	44	4.3	3	N of site on Vine Street exit from Route 283
ID	2E1	45	4.8	18	NNE of site, School House Lane and Miller Road
ID	3E3	46	4.5	42	NE of site on Kennedy Lane
ID	4E5	47	4.9	62	ENE of site on Beagle Road
ID	5E1	48	4.6	81	E of site, North Market Street and Zaeger Road
ID	6E6	49	4.6	115	ESE of site on Amosite Road
ID	7E6	50	4.8	131	SE of site, Bainbridge and Risser Roads
SW	8E1	51	4.1	160	SSE of site on Brunner Island
ID	8E2	52	4.1	155	SSE of site at Guard Shack on Brunner Island
ID	9E1	53	4.9	182	S of site on Canal Road, Conewago Heights
ID	10E3	54	5.0	200	SSW of site on Conewago Creek Road, Shrinestown
ID	11E3	55	4.1	228	SW of site, Stevens and Wilson Roads
ID	12E4	56	4.3	245	WSW of site, Lewisberry and Roxberry Roads, Newberrytown
ID	13E1	57	4.9	268	W of site, Yocumtown and Old Trail Roads
ID	14E4	58	4.9	281	WNW of site, Route 262 and Beinhower Road
ID	15E1	59	5.0	313	NW of site on Lumber Street, Highspire
ID	16E1	60	4.9	339	NNW of site, Spring Garden Drive and Route 441
ID	2F1	61	9.3	18	NNE of site, West Areba Avenue and Mill Street, Hershey
ID	3F1	62	7.2	48	NE of site, Shenks Church on School House Road
ID	4F1	63	8.5	72	ENE of site on Mt. Gretna Road, Bellaire
ID	5F1	64	6.8	85	E of site on Hummelstown Street, Elizabethtown
FPF	5F2	65	5.1	100	E of site, orchard
ID	6F1	66	9.4	113	ESE of site, Donegal Springs Road, Donegal Springs
AP,AI,RW,ID	7F1	67	9.8	127	SE of site at farm off Engle's Tollgate Road
ID	8F1	68	7.4	163	SSE of site on Saginaw Road, Starview
ID	9F1	69	6.5	177	S of site on Maple Street, Manchester
ID	10F1	70	7.4	196	SSW of site, Coppenhaffer Road and Route 295, Zion's View
ID	11F1	71	8.0	225	SW of site on Andersontown Road, Andersontown
ID	12F1	72	8.6	242	WSW of site on Alpine Road, Maytown

TABLE A-2

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM STATION LOCATIONS (cont'd)

SAMPLE MEDIUM	LOCATION CODE	MAP NUMBER	DISTANCE (miles)	AZIMUTH	DESCRIPTION
ID	13F1	73	7.8	260	W of site on Route 382, ½ mile north of Lewisberry
ID	14F1	74	8.0	292	WNW of site on Evergreen Road, Reeser's Summit
SW,ID	15F1	75	8.5	308	NW of site across from parking lot of Steelton Water Co.
ID	16F1	76	8.1	340	NNW of site on Derry Street, Rutherford Heights
M,FPL	2G1	77	10.5	9	NNE of site, farm on Route 39, Hummelstown
ID	3G1	78	16.9	47	NE of site on Cumberland Street, Lebanon
ID	4G1	79	10.0	63	ENE of site, Route 241
ID	6G2	80	21.1	113	ESE of site, Steel Way and Loop Roads, Lancaster
SW	6G3	81	12.6	122	ESE of site, Chickies Creek
SW,ID	7G1	82	14.4	124	SE of site at Columbia Water Treatment Plant
SW	7G2	83	13.6	128	SE of site, Wrightsville Water Treatment Plant
SW	7G3	84	14.8	124	SE of site, Lancaster Water Treatment Plant
ID	8G1	85	13.2	157	SSE of site, Orchard and Stonewood Roads, Wilshire Hills
AP,AI,ID	9G1	86	12.6	180	S of site in Met. Ed. York Load Dispatch Station
SW	9G2	87	14.7	178	S of site, York
ID	10G1	88	12.7	204	SSW of site, Alta Vista and Fox Run Roads, Weiglestown
ID	11G1	89	11.7	225	SW of site on west side of Route 74, Mt. Royal
FPF	12G2	91	11.0	239	WSW of site westside of Rt. 74 in front of Earth Crafts, Rossville
ID	13G1	92	13.2	276	WSW of site on west side of Route 74, Rossville
ID	13G2	93	10.4	274	W of site, Orchard Lane and Hertzler Road, Mt. Allen
ID	14G1	94	12.2	300	W of site, Lisburn Road and Main Street, Lisburn
AP,AI,RW,ID	15G1	95	15.0	306	WNW of site on Erford Road, in front of Penn Harris Motel, Camp Hill
ID	15G2	96	11.5	307	NW of site at West Fairview Substation
ID	16G2	97	11.2	330	NW of site, Penn and Forster Streets, Harrisburg
AQF	Indicator	-	-	-	NNW of site,Route 22 and Colonial Road, Colonial Park All locations where fish were caught below the discharge were grouped together and referred to as "Indicator"I.E. Sectors 11 and geographically below
AQF	Control	-	-	-	All locations where fish were caught above the discharge were grouped together and referred to as "Control" I.E.Sectors 12 and geographically above.

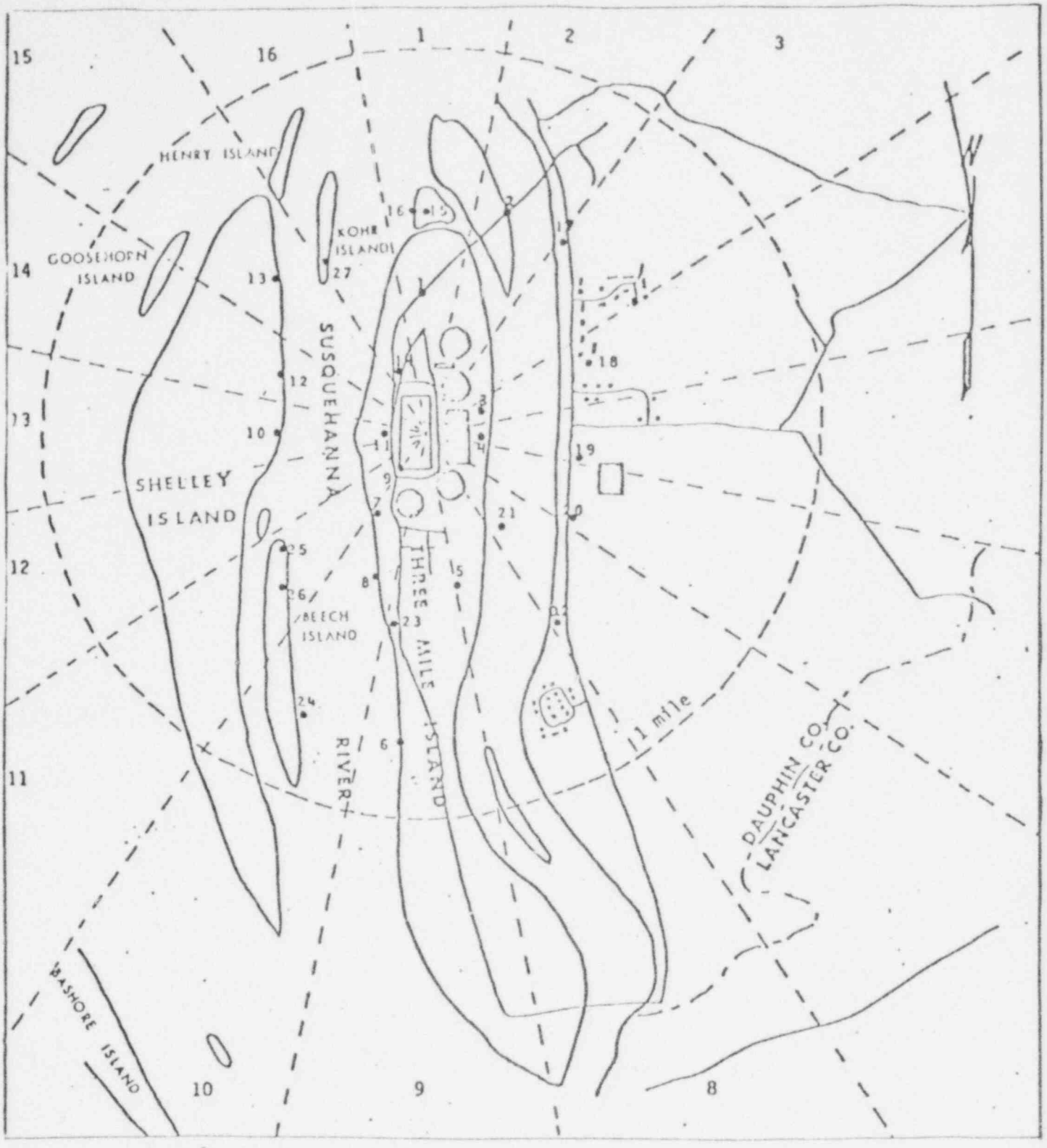


Figure A-2

THREE MILE ISLAND NUCLEAR STATION
LOCATION OF RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM (REMP)
STATIONS WITHIN 1 MILE OF THE SITE

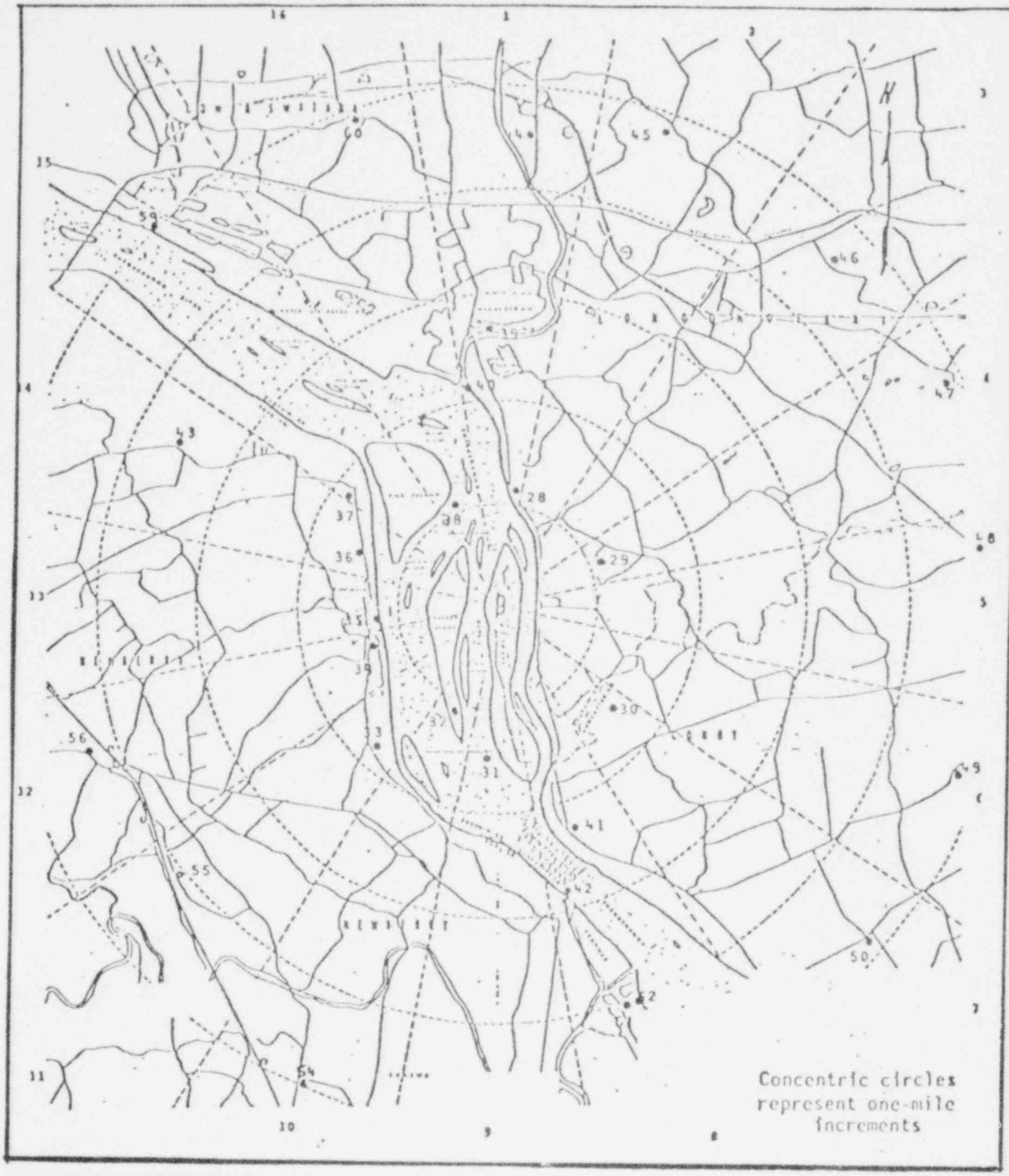


Figure A-3

THREE MILE ISLAND NUCLEAR STATION
LOCATION OF RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM (REMP)
STATIONS WITHIN 5 MILES OF THE SITE

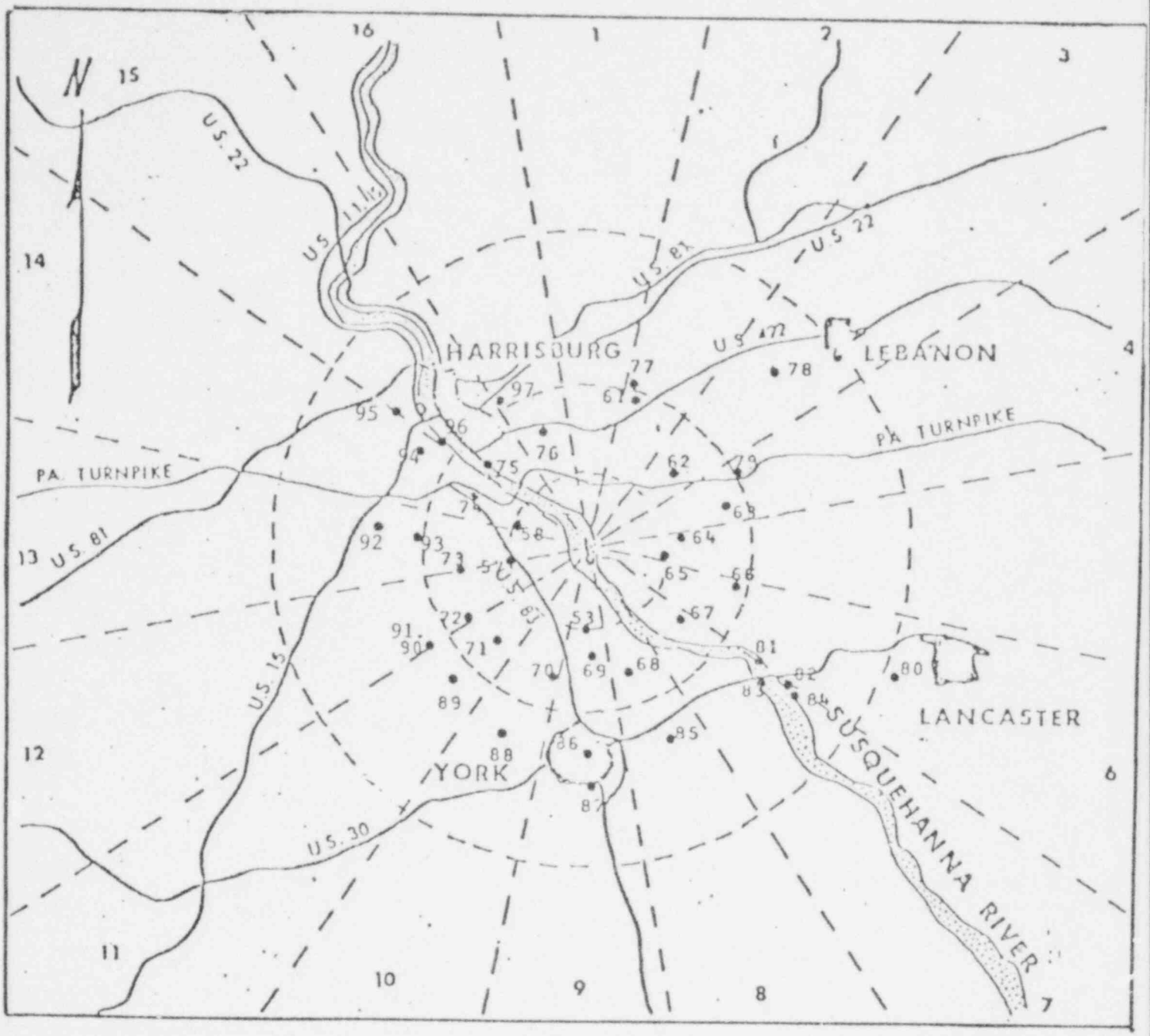


Figure A-4

THREE MILE ISLAND NUCLEAR STATION
LOCATION OF RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM (REMP)
STATIONS GREATER THAN 5 MILES FROM THE SITE BOUNDARIES

TABLE A-3

SPECIAL Kr-85 VENTING TLD LOCATIONS

Sample Medium	Location Code	Map Number	Distance (Miles)	Azimuth	Description
ID	8S2	98	0.4	151	Paint Shed TMI
ID	2B1	99	2.7	22	Olmstead Golf Course NNE
ID	3B2	100	1.3	34	Olmstead Golf Course NE
ID	5B1	101	1.5	90	Conewago Creek
ID	6B1	102	1.5	111	Covered Bridge Road
ID	7B3	103	1.5	129	Becker Farm
ID	8B1	104	1.5	157	N. Gate Railroad Tracks TMI
ID	15B2	105	1.1	315	Lot #12 Hill Island
ID	16B1	106	1.4	337	N.E. Shore Hill Island
ID	3C1	107	2.5	39	Geyer's Church & Brinser Road Intersection
ID	4C1	108	2.5	68	Locust Grove Road and Brinser Road Intersection
ID	7C1	109	2.9	134	Governor's Stable Road & Falmouth Intersection
ID	9C1	110	2.5	186	River Road, York Haven
ID	10C1	111	2.5	203	Cragmoor Road & Rt. 295
ID	12C1	112	2.5	247	Wissler Road & Paddletown Road Intersection
ID	14C1	113	2.5	292	Millers Cemetery
ID	16C1	114	2.5	337	Main Gate, Crawford Station
ID	1D1	115	3.5	355	Middletown Cemetery, Rt. 441
ID	5D1	116	3.2	95	Furnace Hill Road & Bossler Road Intersection
ID	6D1A	117	3.5	109	Longenecker Farm 20 m W of House
ID	6D1B	118	3.6	109	Longenecker Farm 100 m WNW of House

TABLE A-3 (cont'd)

Sample Medium	Location Code	Map Number	Distance (Miles)	Azimuth	Description
ID	9D1	119	3.5	176	Cassel's Church Cemetery
ID	14D1	120	3.5	273	Fisher Farm
ID	15D1	121	3.5	324	44 Luke Drive, Harrisburg Airport
ID	16D1	122	3.5	339	Oddfellow's Home, Rt. 441, Middletown
ID	1F1	123	8.0	0	Hummelstown Substation
ID	1F2	124	5.0	355	Union Street & Fulling Mill Road
ID	7F2	125	6.0	135	Stone Mill Road, Stacktown, PA
ID	12F2	126	6.0	245	Pleasant Drive, Dover, PA
ID	16F2	127	6.0	335	Oberlin Road & Swatara Drive Intersection

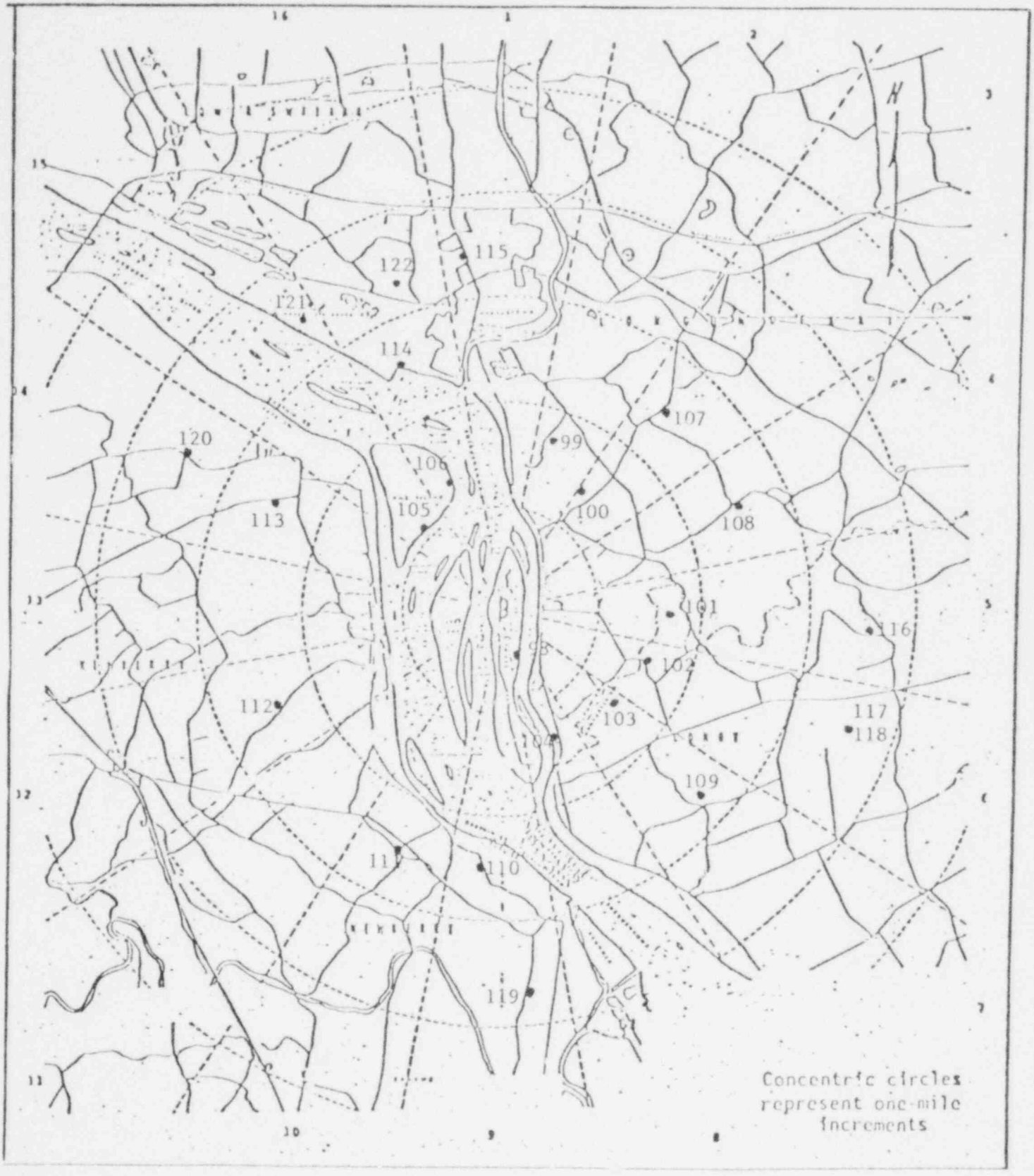


Figure A-5

THREE MILE ISLAND NUCLEAR STATION
LOCATION OF SPECIAL KRYPTON-85 VENTING TLD STATIONS
WITHIN 5 MILES OF THE SITE

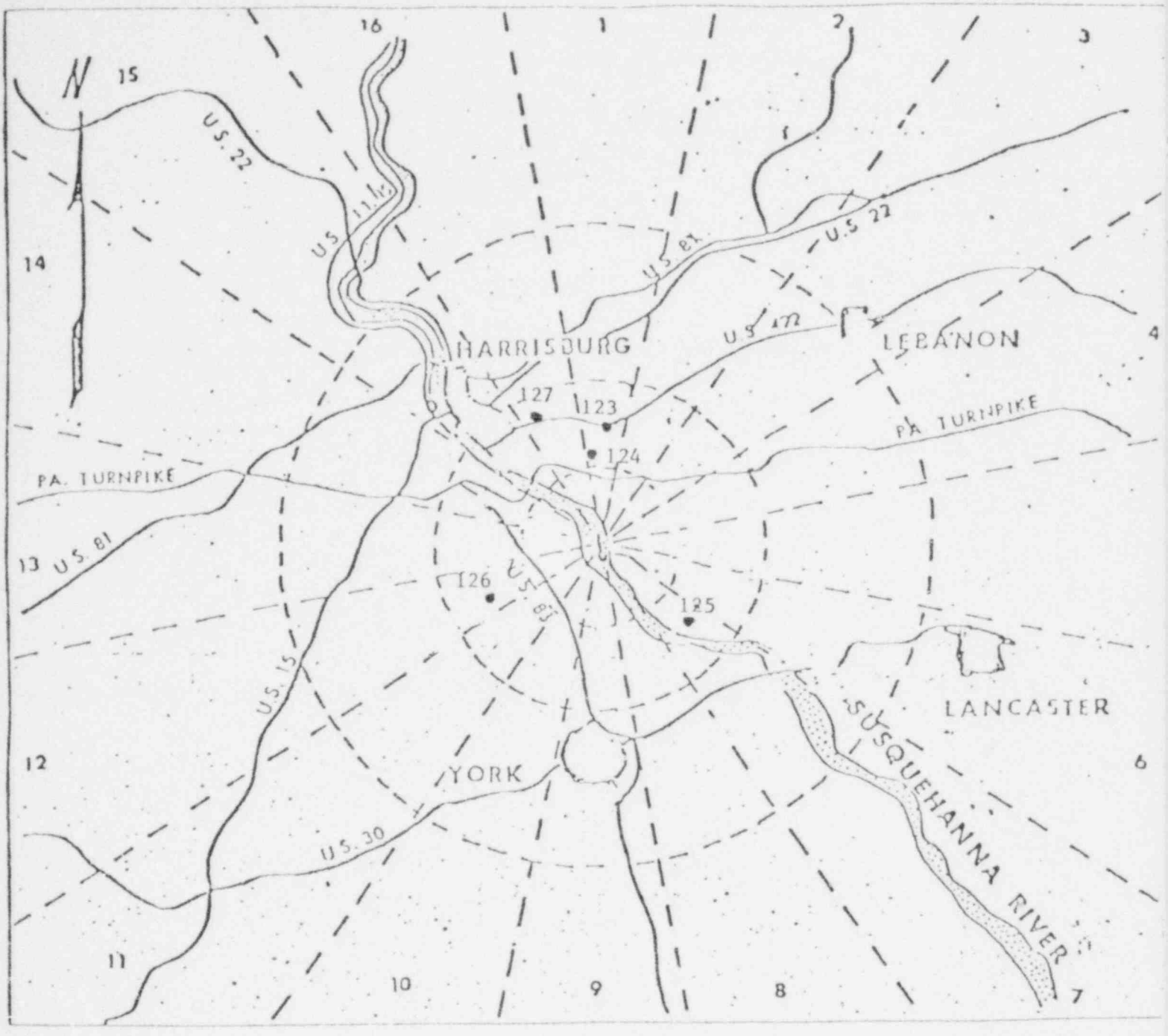


Figure A-6

THREE MILE ISLAND NUCLEAR STATION
LOCATION OF SPECIAL KRYPTON-85 VENTING TLD STATIONS
GREATER THAN 5 MILES FROM THE SITE BOUNDARIES

TABLE A-4

LOCATIONS OF REAL-TIME ENVIRONMENTAL GAMMA MONITORS
DURING KRYPTON-85 VENTING

Station	Location	From TMI Azimuth	From TMI Distance
1C1	Middletown	355°	2.5 mi
2A1	TMI - N. Guard Shack	23	0.4
5A1	Observation Center	100	0.4
6D1	Longenecker Farm	109	3.7
7F1	Marietta	127	9.5
8C1	Falmouth	159	2.2
9B1	TMI - S. End of Island	160	1.4
13B2	Goldsboro Marina	265	1.1
14S2	East Shelley Island	293	0.4
15D1	Harrisburg Airport	324	3.7

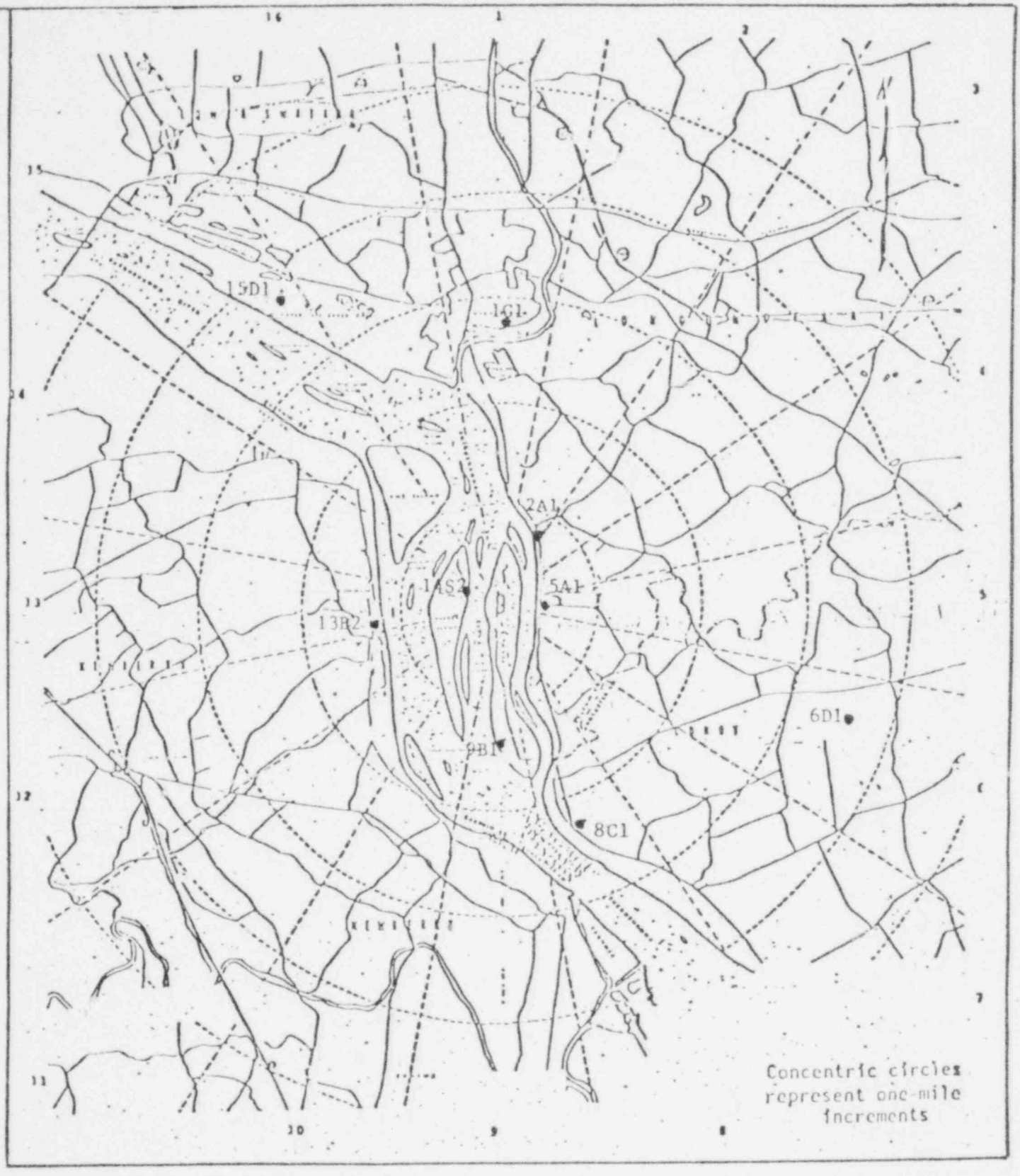


Figure A-7

THREE MILE ISLAND NUCLEAR STATION
LOCATION OF REAL-TIME ENVIRONMENTAL GAMMA MONITORING STATIONS
WITHIN 5 MILES OF THE SITE DURING THE KRYPTON-85 VENTING

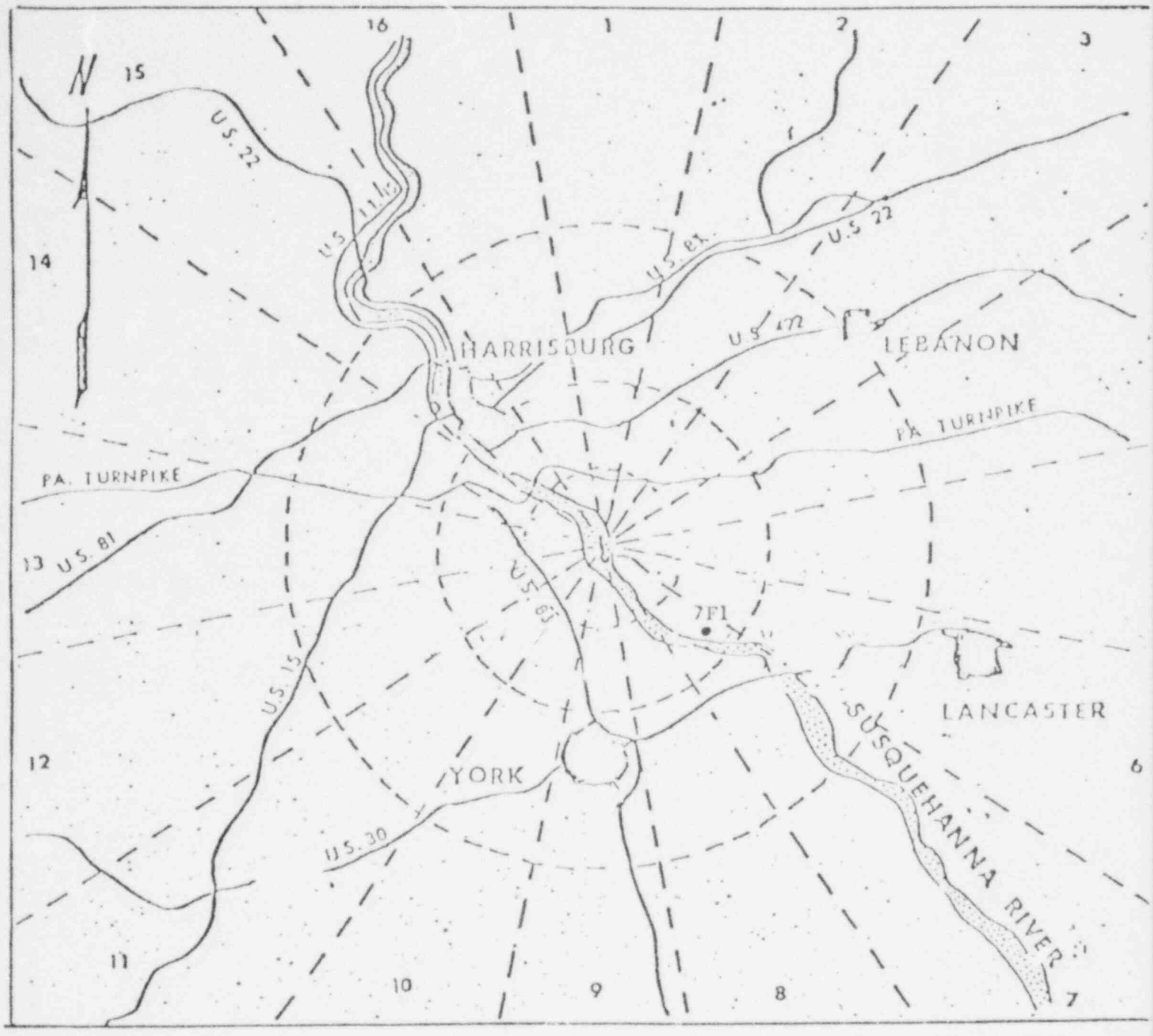


Figure A-8

THREE MILE ISLAND NUCLEAR STATION
LOCATION OF REAL-TIME ENVIRONMENTAL GAMMA MONITORING STATIONS
GREATER THAN 5 MILES FROM THE SITE BOUNDARIES
DURING THE KRYPTON-85 VENTING

Appendix E

Changes Effected In The 1980 REMP

CHRONOLOGY OF CHANGES ENACTED DURING 1980
IN THE THREE MILE ISLAND NUCLEAR STATION
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

5/7/80	First cryogenic air sampler started at station 5A1
5/17/80	Two evacuated air samplers started at stations 15D1 and 10B1
5/19/80	Second cryogenic air sampler started at station 1C1
5/28/80	Three additional cryogenic air samplers started at stations 7F1, 6G4, 9G1
5/29/80	Two additional cryogenic air samplers started at stations 1S2, 8C1
6/7/80	Seven additional evacuated air samplers started at stations 16C1, 13D1, 5F1, 3B1, 2F2, 15G1, and 14S2, making a total of nine stations
6/16/80	Daily water sampling stopped at all stations and put on a biweekly frequency
6/21/80	Final cryogenic air sampler started at station 12B1 bringing total to eight station
7/24/80	Milk sampling reduced in frequency from weekly to biweekly - all stations
8/20/80	Collection frequency at water sampling sites 9A2 and 9B1 increased from biweekly to weekly
9/4/80	All evacuated air sampling stations terminated
9/11/80	QA water collection at stations 1C3, 8C2, and 9G2 terminated. QA sampling at station 9B1 initiated.
9/16/80	Cryogenic air samplers at stations 7F1, 9G1, 6G4, and 1S2 terminated leaving four stations at 12B1, 1C1, 5A1, and 8C1 in operation
10/6/80	Water sampling locations 13S2 divided into 13S2A (Unit 1 intake) and 13S2B (Unit 2 intake) with 13S2B designated a QA station. These two stations placed on automatic compositor collection. 10S1 and 10S1Q station discharge also placed on automatic water compositor collection
10/16/80	All water compositors placed on weekly inspection schedule to insure proper functioning

Appendix F

Annual Dairy Census

TABLE F-1

Polar Coord.	Distance & Direction	Name & Address	Breed	No. Cows	No. Cows Milked	No. Goats	No. Goats Milked	Dairy Used
1B1 (1)	1.02 mi N	Louise Hardison R.D.#1 Rt. 441 Middletown, Pa.	-	-	-	12 (2 Billies) (10 Nannies)	10	Sold Privately
1C1 (2)	2.04 mi N	PA Holstein Assoc. Howard Weiss, Mgr. Reigle Farm Rt. 441 Royalton, Pa.	Cows are periodically kept for a few days to a few weeks for quarantine before shipping to foreign countries. If milked, milk may be shipped to Reading Dairy or used for hog feed if animals were recently treated with antibiotics					
TM-1D1 (3)	3.14 mi N	Paul Lytle 915 Harrisburg Pike Middletown, Pa.	Holstein	185	83	1 (Billy Pet)	-	Harrisburg Dairy
TM-1E3 (4)	4.94 mi N	Art Lutz 3206 Schoolhouse Rd. Middletown, Pa.	No dairy animals now, may obtain a cow or two in the future. Currently have 8-9 head of beef cattle & may obtain more in the future					
TM-1F3 (5)	5.32 mi N	Marlin Pickle 1900 Swatara Creek Rd. Hummelstown, Pa.	Holstein	40 Calves	None Milking	-	-	-
TM-1F5 (6)	5.32 mi N	Bruce Zell R.D.#6 Box 101 Hummelstown, Pa.	Holstein	70.	59	-	-	Hershey Chocolates

TABLE F-1 (cc ıt'd)

Polar Coord.	Distance & Direction	Name & Address	Breed	No. Cows	No. Cows Milked	No. Goats	No. Goats Milked	Dairy Used
TM-2G1 (7)	10.5 mi NNE	Robert Oellig R.D. #4 Hummelstown, Pa.	Holstein	33	31	-	-	Harrisburg Dairy
TM-3C1 (8)	2.28 mi NE	Ira Ruhl 2505 Brinser Rd. Middletown, Pa.	Holstein	20	15	-	-	Hershey Chocolates
TM-3D2 (9)	3.20 mi NE	Samuel Saul 2507 Harrisburg Pike Middletown, Pa.	No dairy animals at present; have 2 head beef cattle					
TM-3C2 (10) *	3.0 mi NE	George Sensenig Brinser Rd. Middletown, Pa.	81 Holstein 2 Guernsey 1 Jersey	84	75	-	-	Interstate Dairy
TM-3E1 (11)	4.37 mi NE	Russel Kennedy Middletown, Pa.	Holstein	200	110	-	-	Interstate Dairy
TM-3E2 (12)	4.09 mi NE	Howard Kopp 1597 Colebrook Rd. Middletown, Pa.	Holstein	200	85	-	-	Interstate Dairy

Table F-1 (cont'd)

Polar Coord.	Distance & Direction	Name & Address	Breed	No. Cows	No. Cows Milked	No. Goats	No. Goats Milked	Dairy Used
TM-4B1 (13)	1.05 mi ENE	Richard Alwine 1611 Gingrich Rd. Middletown, Pa.	Holstein	41	41	-	-	Mt. Joy Coop.
TM-4C1 (14)	2.47 mi ENE	Paul Geyer 3012 Brinser Rd. Middletown, Pa.	Holstein	17 Heffers	0	-	-	-
TM-4E1 (15)	4.37 mi ENE	Karl [illegible]ler 26[illegible] Market St. Elizabethtown, Pa.	Holstein	114	74	-	-	Interstate Dairy
TM-4E2 (16)	4.67 mi ENE	John Hertzler R.D. #2 Elizabethtown, Pa.	Holstein	90	50	-	-	Wengerts Dairy
TM-4E3 (17)	4.49 mi ENE	Mahlen Lehman Elizabethtown, Pa.	Holstein	47	44	-	-	Hershey Chocolates
TM-4E4 (18)	4.18 mi ENE	John R. Book Elizabethtown, Pa.	Holstein	50	43	-	-	Harrisburg Dairy
SD1 (19)	3.47 mi E	Harvey Espenshade R.D. #4 Elizabethtown, Pa.	Holstein	47	41	-	-	Hershey Foods

TABLE F-1 (cont'd)

Polar Coord.	Distance & Direction	Name & Address	Breed	No. Cows	No. Cows Milked	No. Goats	No. Goats Milked	Dairy Used
5E1 (20)	4.01 mi E	Walter Holbleib R.D. #4, Box 186 Elizabethtown, Pa.	-	-	-	1 (Nanny)	0	-
6C1 (21)	2.33 m ESE	Jay Swope R.D. #4 Elizabethtown, Pa.	Holstein	42	25	-	-	Mt. Joy Farmers Coop.
6D1 (22)	3.23 mi ESE	David G. Miller R.D. #4 Elizabethtown, Pa.	Holstein	75	39	-	-	Reading Dairy
6D3 (23)	3.80 mi ESE	Herman L. Zeager R.D. #1 Bainbridge, Pa.	Holstein	102	48	-	-	Hershey Foods
6D4 (24)	3.57 mi ESE	Elmer F. Gruber R.D. #1 Bainbridge, Pa.	Holstein	52	32	-	-	Penn Dairies
6E1 (25)	4.28 mi ESE	Forrey Minnich R.D. #4 Elizabethtown, Pa.	Holstein	3	3 (Home Use Only)	-	-	-
6E3 (26)	5.04 mi ESE	George Baum R.D. #4, Box 160 Elizabethtown, Pa.	Holstein	43	36	-	-	Interstate Dairy

TABLE F-1 (cont'd)

Polar Coord.	Distance & Direction	Name & Address	Breed	No. Cows	No. Cows Milked	No. Goats	No. Goats Milked	Dairy Used
6E4 * (27)	5.04 mi ESE	Dennis Frey R.D. #4, Box 160B Elizabethtown, Pa.	Holstein	38	26	-	-	Hershey Foods
6F4 (28)	5.30 mi ESE	Albert L. Wilson Masonic Homes Elizabethtown, Pa.	Ayrshires	135	119	-	-	Processed & used on site
7B3 (29)	1.43 mi SE	Christion Becker R.D. #4 Elizabethtown, Pa.	Holstein	45	35	-	-	Hershey Foods
7C1 (30)	2.57 mi SE	Cathryn M. Schrall R.D. #4 Bainbridge, Pa.	Jerseys	4	0	1 (Billy)	-	-
7C2 * (31)	2.70 mi SE	George Rosenfeld R.D. #1, Box 242-1 Bainbridge, Pa.	-	-	-	5 (1 Billy) (4 Nannies)	0	-
7E1 (32)	4.10 mi SE	Donald Risser R.D. #1 Bainbridge, Pa	Holstein	260	142	-	-	Mt. Joy Farmers Coop.
7E2 (33)	4.74 mi SE	Menno Gruber R.D. #1 Bainbridge, Pa.	Holstein	55	45	-	-	Hershey Foods

TABLE F-1 (cont'd)

Polar Coord.	Distance & Direction	Name & Address	Breed	No. Cows	No. Cows Milked	No. Goats	No Goats Milked	Dairy Used
7E3 (34)	4.74 mi SE	Daniel Brenneman R.D. #1 Bainbridge, Pa.	Holstein	20	16	-	-	Mt. Joy Farmers Coop.
7E4 (35)	4.03 mi SE	Edward L. Shoop R.D. #1 Bainbridge, Pa.	Holstein	72	72	2 (Wethers)	0	Hershey Foods
7E5 (36)	4.62 mi SE	George Stone R.D. #1 Bainbridge, Pa.	-	-	-	5 (3 Billies) (2 Nannies)	2 Home Use Only	-
7F2 (37)	5.13 mi SE	Lester Hawthorne R.D. #4, Box 159N Elizabethtown, Pa.	Holstein	150	120	-	-	Penn Dairies
8C1 (38)	2.61 mi SSE	Lloyd Gilder R.D. #1, Box 176 Bainbridge, Pa.	-	-	-	3 (1 Billy) (2 Nannies)	2 Home Use Only	-
9D1 (39)	3.60 mi S	Stanley E. Druck R.D. #1 Manchester, Pa.	-	-	-	3 (2 Billies) (1 Nanny)	0	-
9D2 (40)	3.61 mi S	Rodney Stoner R.D. #1 Manchester, Pa.	-	-	-	0 (Sold Goat)	-	-

TABLE F-1 (cont'd)

Polar Coord.	Distance & Direction	Name & Address	Breed	No. Cows	No. Cows Milked	No. Goats	No. Goats Milked	Dairy Used
9D3 (41)	3.63 S	Ronald Laehr R.D. #1 Manchester, Pa.	-	-	-	0 (Sold Goat)	0	-
9D4 (42)	3.88 mi S	Lester Shamber R.D. #1 Manchester, Pa.	-	-	-	0 (Sold Goat)	0	-
10C1 (43)	2.90 mi SSW	Hermen Zirkle R.D. #1, Box 15 York Haven, Pa.	Hereford	50 (Beef Cattle)	-	1 (Billy)	0	-
10D1 (44)	3.14 mi SSW	William Ruby R.D. #1 York Haven, Pa.	-	-	-	1 (Billy)	0	-
10E1 (45)	4.86 mi SSW	Doll Zirkle R.D. #2 Manchester, Pa.	Holstein	32	25	-	-	Interstate Dairy
10E2 (46)	4.91 mi SSW	Joseph Marchione R.D. #2 Manchester, Pa.	-	-	-	0	0	-
11D1 (47)	3.75 mi SW	Richard Fox R.D. #1, Box 318 York Haven, Pa.	-	-	-	3 (2 Billies) (1 Nanny)	0	-

TABLE F-1 (cont'd)

Polar Coord.	Distance & Direction	Name & Address	Breed	No. Cows	No. Cows Milked	No. Goats	No. Goats Milked	Dairy Used
11E1 (48)	4.33 mi SW	Don Sipe R.D. #1 York Haven, Pa.	-	-	-	3 (2 Billies) (1 Nanny)	0	-
12B1 (49)	1.48 mi WSW	Carole Carleton R.D. #2 Box 1 Etters, Pa.	-	-	-	1 (Nanny)	0 Could not Contact Assumed Same	-
12E1 (50)	4.03 WSW	Jacob Wise R.D. #1 York Haven, Pa.	Holstein	1	1 Home Use	1 (Billy)	0	-
12E2 (51)	4.40 mi WSW	Delores Lomman Culhane Rd. R.D. #1 York Haven, Pa.	-	-	-	1 (Billy)	0	-
12E3 (52)	4.76 mi WSW	Preston Witmer R.D. #1 York Haven, Pa.	-	-	-	1 (Nanny)	1 Used as Feed	-
14D1 (53)	3.64 mi WNW	Jeremiah K. Fisher R.D. #1 Etters, Pa.	Holstein 1 Guernsey	41	34	7 (2 Billies) (5 Nannies)	0	Interstate Milk Coop.
14D2 (54)	3.23 mi WNW	Vance K. Fisher 109 Valley Rd. Etters, Pa.	-	-	-	13 (3 Billies) (4 Nannies) (6 Kids)	0	-

TABLE F-1 (cont'd)

Polar Coord.	Distance & Direction	Name & Address	Breed	No. Cows	No. Cows Milked	No. Goats	No. Goats Milked	Dairy Used
14D3 (55)	3.08 mi WNW	Sam Conley R.D. #1 Box 444 Etters, Pa.	Holstein	2	2 Home Use Only	-	-	-
14E2 (56)	4.23 mi WNW	E. S. Whitehill Big Springs Rd. R.D. #1 Etters, Pa.	-	-	-	2 (2 Nannies)	0	-
14E3 (57)	4.60 mi WNW	Robert Naurstil R.D. #3 Etters, Pa.	-	-	-	11 (6 Nannies) (5 Kids)	0	-
* - Indicates new farm this census. NOTE: No. in parenthesis in Polar Coordinate box indicates running total of farms surveyed.			TOTALS	2,410 Total does not include 60 beef cattle.	1,571 Total includes cows for home use.	78 (24 Billies) (41 Nannies) (2 Wethers) (11 Kids)	15	

Appendix G

REMP Sample Collection and Analysis Methods

TABLE G-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

SUMMARY OF SAMPLE COLLECTION AND ANALYSIS METHODS

Analysis	Sample Medium	Sampling* Method	Approximate Sample Size Collected	Procedure Manual Number	Procedure Abstract
Gross Alpha	AP	quarterly composite of weekly or more frequent samples, continuous air sampling through filter paper	13 weeks of filters per sampling site (~3600 Cu.M.)	032-14	sample is leached with nitric acid, filtered, and evaporated onto planchette, low level gas flow proportional counting
Gross Beta	AP	continuous weekly or more frequent air sampling through filter paper	1 filter (~280 Cu.M) if weekly	032-10	low level gas flow proportional counting
	RW,SW,EW	grab or composite sample according to sampling site, various compositing frequencies	4 liters	032-1	sample is evaporated, residue transferred to planchette, and activity measured by low level counting
Gamma Spectroscopy	AP	monthly and quarterly composites of weekly or more frequent samples; continuous air sampling through filter paper	4 weeks or 13 weeks of filters (~1100 or 3600 Cu.M.)	042-5	high resolution Ge(Li) gamma isotopic analysis
	AI	continuous weekly or more frequent air sampling through charcoal cartridges	1 cartridge (~280 Cu.M.)	042-5	high resolution Ge(Li) gamma isotopic analysis
	M	grab or composite sample according to sampling site, various compositing frequencies	8 liters	042-5	high resolution Ge(Li) gamma isotopic analysis
	RW,SW	grab or composite sample according to sampling site, various compositing frequencies	4 liters	042-5	high resolution Ge(Li) gamma isotopic analysis
	MC	grab or composite sample according to sampling site, various compositing frequencies	4 liters	042-5	high resolution Ge(Li) gamma isotopic analysis
	AQF,AQP, AQS,FPL,FPF	grab sample	2 kg	042-5	high resolution Ge(Li) gamma isotopic analysis
Tritium	RW,SW,EW	grab or composite sample according to sampling site, various compositing frequencies	4 liters	052-2	water is converted to hydrogen, methane added, and counted in 1 liter

TABLE G-1 (cont'd)

Analysis	Sample Medium	Sampling* Method	Approximate Sample Size Collected	Procedure Manual Number	Procedure Abstract
I-131	RW,SW,EW	grab or composite sample according to sampling site, various compositing frequencies	4 liters	052-2	anion-exchange, solvent extraction, palladium iodine precipitate, low level gas flow counting
Sr-89,90	AP	quarterly composite of weekly or more frequent samples, continuous air sampling through filter paper	13 weeks of filters per sampling site (~3600 Cu.M.)	032-24	strontium in sample (with carrier) is precipitated as $SrNO_3$ mount, Sr-90 inferred Y-90 on yttrium oxalate mount, low level gas flow counting
	AQF	grab sample	2 kg	032-23	similar to Sr-89,90 AP
	AQS	grab sample	2 kg	032-24	similar to Sr-89,90 AP
	RW,SW,EW	grab or composite sample according to sampling site, various compositing frequencies	4 liters	032-16	similar to Sr-89,90 AP
	M	grab sample or quarterly composite sample	8 liters	032-18	oxalate precipitation of TCA filtrate, barium and iron scavenge, 7 day yttrium ingrowth, Sr-90 on yttrium oxalate mount, low level gas flow counting
	MG	grab sample or quarterly composite sample	4 liters	032-18	oxalate precipitation of TCA filtrate, barium and iron scavenge, 7 day yttrium ingrowth, Sr-90 on yttrium oxalate mount, low level gas flow counting
TLD	ID	dosimeter exchange over various time periods	TLD	342-17	thermoluminescent dosimetry

* Refer to Tables B1 and B2 for a more complete description of the sampling methods used.

APPENDIX H

EPA Cross-Check Results

RESULTS OF LICENSEE PARTICIPATION IN THE ENVIRONMENTAL PROTECTION AGENCY'S ENVIRONMENTAL RADIOACTICITY LABORATORY INTERCOMPARISON STUDIES (CROSS-CHECK) PROGRAM

The Environmental Technical Specifications for Three Mile Island Unit 2 require that the results of licensee participation in the Environmental Protection Agency's Environmental Radioactivity Laboratory Intercomparison Studies (Cross-Check) Program be presented in the annual report.

This section contains results from 1979 that had not been received prior to the submittal of the 1979 Annual REMP Report. Data is supplied through December, 1980, the latest date for which the Environmental Protection Agency has reviewed and returned analysis results.

QUALITY ASSURANCE PROGRAM

INTERCOMPARISON WITH: USEPA (EMSL-LV)

DATE FINAL REPORT MAILED: -

PROGRAM: Sr-89, Sr-90 in Water

COLLECTION DATE: Sept. 7, 1979

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)	EPA RESOLUTION	TI/EPA RATIO	TYPE OF AGREEMENT	
Sr-89 (pCi/liter)	3 ± 5 (A)	L.T. 4 (C)	-	-	0.6	-	AG	
24 participants	6 ± 3 (B)							
Sr-90 (pCi/liter)	28 ± 1.5	20 ± 3	-6.6	-8.9	19	0.71	AG	
43 participants	26 ± 4							
No plots of recent results were received from the USEPA because the plotter is inoperable.								

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

(AG) Agreement

(P) Possible agreement

(D) Disagreement

W.O. No. 3-4796

T.I. Nos. 75251-3

Program 139

ENTERED: 18 June 19[illegible]

II-C-1-679

QUALITY ASSURANCE PROGRAM

INTERCOMPARISON WITH: USEPA (EMSL-LV)

DATE FINAL REPORT MAILED: -

PROGRAM: Performance Evaluation cross-check

COLLECTION DATE: 19 October 1979

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)	EPA RESOLUTION	TI/EPA RATIO	TYPE OF AGREEMENT	
GR-A(pCi/liter)	21 ± 5 (A)	20 ± 1 (C)	-1.3	-0.2	4.2	0.95	AG	
61 participants	24 ± 9 (B)							
GR-B(pCi/liter)	49 ± 5	55 ± 2	2.4	2.1	9.8	1.1	AG	
61 participants	48± 7							
Sr-89 (pCi/liter)	12 ± 5	only two measurements	-	-	-	-	-	
36 participants	13 ± 4							
Sr-90(pCi/liter)	7 ± 1.5	3 ± 1	-4.5	-4.2	4.7	0.43	AG	
39 participants	7 ± 2							
Ra-226 (pCi/liter)	11 ± 1.5	8 ± 0	-2.7	-3.4	7.3	0.73	AG	
39 participants	10 ± 2							

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

(AG) Agreement

(P) Possible agreement

(D) Disagreement.

W.O. No. 3-0405

T.I. Nos. 78264-6

Program 146

ENTERED: 19 June 1980

QUALITY ASSURANCE PROGRAM

INTERCOMPARISON WITH: USEPA (EMSL-LV)

DATE FINAL REPORT MAILED: -

PROGRAM: Performance Evaluation cross-check

COLLECTION DATE: 19 October 1979

NUCLIDE	EPA		TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)	EPA RESOLUTION	TI/EPA RATIO	TYPE OF AGREEMENT	
Ra-228(pCi/liter)	0	(A)	L.T.5 (C) 2 results	-	-	-	-	AG	
- participants		(B)							
Co-60	33 ± 5		32 ± 3	-0.7	-0.3	6.6	0.97	AG	
52 participants	34 ± 6								
Cs-134	56 ± 5		57 ± 4	0.5	0.5	11	1.0	AG	
54 participants	56 ± 6								
Cs-137(pCi/liter)	0		L.T. 6	-	-	-	-	AG	
- participants	13 ± 22								
No plots of recent results were received from the USEPA because their plotter is inoperable.									

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

(AG) Agreement

(P) Possible agreement

(D) Disagreement.

W.O. No. 3-0405

T.I. Nos. 78264-6

Program 146

ENTERED: 19 June 198

II-C-1-69

QUALITY ASSURANCE PROGRAM

INTERCOMPARISON WITH: USEPA (EMSL-LV)

DATE FINAL REPORT MAILED: -

PROGRAM: Milk cross-check

COLLECTION DATE: 2 Nov. 1979

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)	EPA RESOLUTION	TI/EPA RATIO	TYPE OF AGREEMENT	
Sr-89(pCi/liter)	25 ± 5 (A)	30 ± 5 (C)	2.7	1.8	5	1.2	AG	
29 participants	22 ± 7 (B)							
Sr-90(pCi/liter)	17 ± 2	14 ± 2	-2.5	-2.3	8.5	0.82	AG	
33 participants	17 ± 3							
I-131(pCi/liter)	673±32	553±55	-3.6	-4.5	20	0.87	AG	
43 participants	620±60							
Cs-137(pCi/liter)	49±5	54±4	1.4	1.6	9.8	1.1	AG	
42 participants	50±4							
K-40(mg/liter)	1470±73	1245±328	-6.4	-5.3	20	0.85	AG	
40 participants								

No plots of recent results were received from the USEPA because their plotter is inoperable.

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

(AG) Agreement

(P) Possible agreement

(D) Disagreement

W.O. No. 3-0472

T.I. Nos. 78816-8

Program 143

ENTERED: 09 June 19

989-1-C-11-686

QUALITY ASSURANCE PROGRAM

INTERCOMPARISON WITH: USEPA (EMSL-LV)

DATE FINAL REPORT MAILED: _____

PROGRAM: Gross alpha-beta cross-check

COLLECTION DATE: 30 November 1979

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)	EPA RESOLUTION	TI/EPA RATIO	TYPE OF AGREEMENT	
GR-A(pCi/liter)	12 ± 5 (A)	28 ± 9 (C)	5.9	5.5	2.4	AG		
86 participants	11 ± 3 (B)							
GR-B(pCi/liter)	27 ± 5	33 ± 2	1.8	2.0	1.2	AG		
81 participants	28 ± 4							
No plots of recent analyses were received from the USPEA because the plotter is inoperable								

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

(AG) Agreement

(P) Possible agreement

(D) Disagreement.

W.O. No. 3-0666

T.I. Nos. 80167-9

Program 148

ENTERED: 19 June 1980

11-C-1-603

QUALITY ASSURANCE PROGRAM

TERCOMPARISON WITH: USEPA (EMSL-LV)

OGRAM: Iodine in water cross check

DATE FINAL REPORT MAILED: -

COLLECTION DATE: 07 December 1979

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)	EPA RESOLUTION	TI/EPA RATIO	TYPE OF AGREEMENT	
I-131 (pCi/liter)	53 ± 5	55 ± 4 (A)	1.8 (C)	0.8	11	1.04	AG	
42 participants	50 ± 8	(B)						
No plots of recent analyses were received from the USEPA because the plotter is inoperable.								

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

(AG) Agreement

(P) Possible agreement

(D) Disagreement.

W.O. No. 3-0740

T.I. Nos. 80727-9

Program 147

ENTERED: 17 June 1980

QUALITY ASSURANCE PROGRAM

INTERCOMPARISON WITH: USEPA (EMSL-LV)

DATE FINAL REPORT MAILED: —

PROGRAM: AIR FILTER CROSS-CHECK

COLLECTION DATE: 21 December 1979

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)	EPA RESOLUTION	TI/EPA RATIO	TYPE OF AGREEMENT	
GR-A(pCi/filter)	10 ± 5 (A)	14 ± 2 (C)	0.7	1.3	2	1.4	AG	
60 participants	12 ± 4 (B)							
GR-B(pCi/filter)	29 ± 5	33 ± 3	0.2	1.3	5.8	1.1	AG	
61 participants	32 ± 4							
Sr-90(pCi/filter)	9 ± 1.5	8 ± 1	-1.9	-1.5	6	0.89	AG	
21 participants	9 ± 1							
Cs-137(pCi/filter)	10 ± 5	13 ± 3	0.5	1.0	2	1.3	AG	
41 participants	11 ± 3							
No plots with recent analyses have been issued by the USEPA because of malfunction of the plotter.								

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

(AG) Agreement

(P) Possible agreement

(D) Disagreement

W.O. No. 3-0809

T.I. Nos. 81352-4

Program 151

ENTERED: 19 June 1980

II-C-1-c

QUALITY ASSURANCE PROGRAM

INTERCOMPARISON WITH: USEPA (EMSL-LV)

PROGRAM: Strontium in water cross-check

DATE FINAL REPORT MAILED: -

COLLECTION DATE: 4 January 1980

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)	EPA RESOLUTION	TI/EPA RATIO	TYPE OF AGREEMENT
Sr-89 (pCi/liter)	10 ± 5 (A)	10 ± 1 (C)	0.6	0.1	2	1.0	AG
37 participants	9 ± 3 (B)						
Sr-90(pCi/liter)	20 ± 1.5	16 ± 2	-2.7	-4.6	13.3	0.8	AG
43 participants	18 ± 4						
No plots with recent analyses have been issued by the USEPA because of malfunctioning of the plotter.							

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

(AG) Agreement

(P) Possible agreement

(D) Disagreement.

W.O. No. 3-0972

T.I. Nos. 83260-2

Program 153

ENTERED: 19 June 1980

QUALITY ASSURANCE PROGRAM

INTERCOMPARISON WITH: USEPA (EMSL-LV)

DATE FINAL REPORT MAILED:

PROGRAM: Gross alpha, gross beta in water cross-check

COLLECTION DATE: January 18, 1980

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)	EPA RESOLUTION	TI/EPA RATIO	TYPE OF AGREEMENT	
GR-A(pCi/liter)	30 ± 8 (A)	23 ± 7 (C)	-0.4	-1.4	3.8	0.77	AG	
84 participants	25 ± 8 (B)							
GR-B(pCi/liter)	45 ± 5	48 ± 1	0.7	1.2	9	1.07	AG	
87 participants	46 ± 7							

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

(AG) Agreement

(P) Possible agreement

(D) Disagreement.

W.O. No. 3-1058

T.I. Nos. 82856-8

152

ENTERED: June 26, 1980

TELEDYNE ISOTOPES

QUALITY ASSURANCE INTERCOMPARISON STUDY

INTERCOMPARISON WITH: USEPA - EMSL(LV)

PROGRAM: Milk cross-check

COLLECTION DATE: 25 January 1980 W.O. NO. 3-1022

T.I. NOS. 82599-601

DATE SUMMARIZED: 8 July 1980 SEQUENCE NO. 155

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)
Sr-89 (pCi/liter)	10 ± 5 (A)	8 ± 3 (C)	-0.6	-0.6
28 participants	10 ± 3 (B)			
Sr-90 (pCi/liter)	25 ± 1.5	19 ± 1	-4.4	-6.9
29 participants	23 ± 3			
I-131 (pCi/liter)	0.01±0.1	L.T. 8	-	-
49 participants	-			
Cs-137 (pCi/liter)	40 ±5	50 ± 4 *	3.3	3.5
48 participants	41 ±4	* NOT USED IN CALCULATING GRAND AVERAGE		
Ba-140 (pCi/liter)	0.01±0.1	L.T.5	-	-
43 participants	1.3±2.2			
K elem(mg/liter)	1600±80	1637±137	0.8	0.8
42 participants	1585±131			

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

TELEDYNE ISOTOPES

QUALITY ASSURANCE INTERCOMPARISON STUDY

INTERCOMPARISON WITH: USEPA - EMSL(LV)

PROGRAM: Gamma in water cross-check

COLLECTION DATE: 01 February 1980 W.O. NO. 3-1230

T.I. NOS. 83097-9

DATE SUMMARIZED: 28 July 1980 SEQUENCE NO. 156

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)
Cr-51 (pCi/liter)	101 ± 5 (A)	116 ± 24 (C)	5.4	5.2
61 participants	100 ±26 (B)			
Co-60 pCi/liter	11 ± 5	13 ± 3	0.3	0.6
65 participants	12 ± 3			
Zn-65 pCi/liter	25 ± 5	32 ± 6	1.8	2.5
63 participants	27 ± 7			
Ru-106 pCi/liter	51 ± 5	L.T. 40	Not used for calculating average.	
63 participants	48 ± 9			
Cs-134 pCi/liter	10 ± 5	13 ± 4	1.0	1.2
64 participants	10 ± 3			
Cs-137 pCi/liter	30 ± 5	35 ± 7	1.2	1.6
60 participants	31 ± 4			

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

QUALITY ASSURANCE PROGRAM

INTERCOMPARISON WITH: USEPA (EMSL-LV)

DATE FINAL REPORT MAILED: —

PROGRAM: Gross alpha, gross beta in water cross-check

COLLECTION DATE: 21 March 1980

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)	EPA RESOLUTION	TI/EPA RATIO	TYPE OF AGREEMENT	
GR-A(pCi/liter)	13 ± 5 (A)	9 ± 1 (C)	- 1.4	- 1.5	2.6	0.69	AG	
103 participants	13 ± 5 (B)							
GR-B(pCi/liter)	22 ± 5	22 ± 2	- 0.5	0.0	4.5	1.00	AG	
100 participants	23 ± 5							
No plots of these analyses were provided by the USEPA because of breakdown of the plotter.								

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

(AG) Agreement

(P) Possible agreement

(D) Disagreement.

W.O. No. 3-1703

T.I. Nos. 87215-7

Program 158

ENTERED: 30 June 1980

QUALITY ASSURANCE PROGRAM

INTERCOMPARISON WITH: USEPA (EMSL-LV)

DATE FINAL REPORT MAILED: —

PROGRAM: Air filter cross-check

COLLECTION DATE: 28 March 1980

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)	EPA RESOLUTION	TI/EPA RATIO	TYPE OF AGREEMENT	
GR-A (pCi/filter)	15 ± 5 (A)	19 ± 2 (C)	0.5	1.5	3	1.3	AG	
65 participants	18 ± 4 (B)							
GR-B (pCi/filter)	41 ± 5	44 ± 1	0.3	1.0	8	1.07	AG	
66 participants	43 ±17							
Sr-90 (pCi/filter)	10 ± 1.5	9 ± 2	-1.2	-0.8	6.7	0.9	AG	
21 participants	10 ± 2							
Cs-137(pCi/filter)	20 ± 5	31±6	2.6	3.7	4	1.6	AG	
11 participants	23 ± 5							
No plots of these analyses were provided by the USEPA because the breakdown of their plotter								

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

(AG) Agreement

(P) Possible agreement

(D) Disagreement.

W.O. No. 3-1676

T.I. Nos. 87076-8

Program 160

ENTERED: 30 June 1980

QUALITY ASSURANCE PROGRAM

INTERCOMPARISON WITH: USEPA (EMSL-LV)

DATE FINAL REPORT MAILED: —

PROGRAM: Iodine in water cross-check

COLLECTION DATE: 4 April 1980

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)	EPA RESOLUTION	TI/EPA RATIO	TYPE OF AGREEMENT	
I-131(pCi/liter)	44 ± 5 (A)	46 ± 5 (C)	1.0	0.8	8.8	1.05	AG	
49 participants	43 ± 7 (B)							
No plot of this analysis was provided by the USEPA because of the breakdown of their plotter.								

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

(AG) Agreement

(P) Possible agreement

(D) Disagreement

W.O. No. 3-1754

T.I. Nos. 87573-3

Program 139

ENTERED: 30 June 198

II-C-1-703

TELEDYNE ISOTOPES

QUALITY ASSURANCE INTERCOMPARISON STUDY

INTERCOMPARISON WITH: USEPA - EMSL(LV)

PROGRAM: Laboratory Performance Evaluation Study

COLLECTION DATE: 18 April 1980 W.O. NO. 3-1912

T.I. NOS. 88614-6

DATE SUMMARIZED: Amended 28 Aug. 1980 SEQUENCE NO. 168

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)
Gross alpha(pCi/liter)	98 ± 24.5(A)	96 ± 5.5 (c)	0.4	-0.1
56 participants	90 ± 32 (B)			
Gross beta(pCi/liter)	100 ± 5	81 ± 1.4	2.7	-6.6
64 participants	73 ±17			
Sr-89 (pCi/liter)	4 ± 5	3.7±0.1	-0.4	-0.1
42 participants	5 ± 3			
Sr-90 (pCi/liter)	0.001±0.1	L.T.3	Not calculated	
41 participants	2.4 ± 1.2			
Ra-226 (pCi/liter)	16 ± 2.4	13.8 ± 1.5	- 1.3	-1.6
46 participants	15.6±2.0			
See the attached original report sheet for the gamma spectrometry results				
on Co-60, Cs-134 and Cs-137.				
Note: Original results for gross alpha, gross beta, Sr-89, Sr-90 and Ra-226				
were calculated based on undiluted 250 ml sample. Above are results corrected to one liter sample.				

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

TELEDYNE ISOTOPES

QUALITY ASSURANCE INTERCOMPARISON STUDY

INTERCOMPARISON WITH: USEPA - EMSL(LV)

PROGRAM: Tritium in water cross-check

COLLECTION DATE: 11 April 1980 W.O. NO. 3-1871

T.I. NOS. 88289-91

DATE SUMMARIZED: 8 July 1980 SEQUENCE NO. 162

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)
H-3 (pCi/liter)	3400 ± 360 (A)	3440 ± 211 (C)	0.7	0.2
75 participants	3295 ± 292 (B)			

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

ISOTOPES

QUALITY ASSURANCE INTERCOMPARISON STUDY

INTERCOMPARISON WITH: USEPA - EMSL(LV)

PROGRAM: Laboratory Performance Evaluation Study

COLLECTION DATE: 18 April 1980 W.O. NO. 3-1912

T.I. NOS. 88614-6

DATE SUMMARIZED: 21 August 1980 SEQUENCE NO. 168

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)
Gross alpha(pCi/liter	98 ± 24.5(A)	203 ± 12 (C)	8.0	7.4
56 participants	90 ± 32 (B)	NOT USED IN CALCULATING GRAND AVERAGE		
Gross beta (pCi/liter)	100 ± 5	323 ± 6	87	77
64 participants	73 ± 17	NOT USED IN CALCULATING GRAND AVERAGE		
Sr-89 (pCi/liter)	4 ± 5	15 ± 1	3.5	3.7
42 participants	5 ± 3	NOT USED IN CALCULATING GRAND AVERAGE		
Sr-90 (pCi/liter)	0.001±0.1	L.T. 3	-	-
41 participants	2.4±1.2	NOT USED IN CALCULATING GRAND AVERAGE		
Ra-226 (pCi/liter)	16 ±2.4	55 ± 6	29	28
46 participants	15.6 ± 2.0	NOT USED IN CALCULATING GRAND AVERAGE		
Ra-228 (pCi/liter)	21.3 ± 3.2	NO DATA PROVIDED		
35 participants	18.7 ± 3.2			
Co-60 (pCi/liter)	6 ± 5	8 ± 2	0.0	0.8
53 participants	8 ± 3			
Cs-134 (pCi/liter)	8 ± 5	15 ± 1	1.1	2.5
54 participants	12 ± 7			
Cs-137 (pCi/liter)	18 ± 5	18 ± 3	-0.5	-0.1
54 participants	19 ± 4			

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

TELEDYNE ISOTOPES

QUALITY ASSURANCE INTERCOMPARISON STUDY

INTERCOMPARISON WITH: USEPA - EMSL(LV)

PROGRAM: Radionuclides in Milk Cross-check

COLLECTION DATE: 25 April 1980 W.O. NO. 3-2029

T.I. NOS. 89580-2

DATE SUMMARIZED: 21 August 1980 SEQUENCE NO. 165

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)
Sr-89 (pCi/liter)	10 ± 5 (A)	5 ± 1 (C)	- 1.5	- 1.8
35 participants	9 ± 4 (B)			
Sr-90 (pCi/liter)	15 ± 1.5	12 ± 2	- 3.2	- 3.8
38 participants	14 ± 2			
I-131 (pCi/liter)	32 ± 5	23 ± 2	- 3.0	- 3.5
49 participants	32 ± 8			
Cs-137 (pCi/liter)	28 ± 5	34 ± 3	1.8	2.2
53 participants	29 ± 5			
Ba-140 (pCi/liter)	0	L.T. 20	-	-
47 participants	-			
K-40 (mg/liter)	1190±59	1033±23	- 6.3	- 4.6
50 participants	1250±156			

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

TELEDYNE ISOTOPES

QUALITY ASSURANCE INTERCOMPARISON STUDY

INTERCOMPARISON WITH: USEPA - EMSL(LV)

PROGRAM: Strontium in water cross-check

COLLECTION DATE: 2 May 1980 W.O. NO. 3-2063

T.I. NOS. 89802-4

DATE SUMMARIZED: 18 July 1980 SEQUENCE NO. 164

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)
Sr-89(pCi/liter)	5 ± 5 (A)	4 ± 1 (C)	-0.8	-0.5
36 participants	6 ± 2 (B)			
Sr-90(pCi/liter)	12 ± 1.5	8 ± 1	-4.0	-4.6
36 participants	11 ± 2			

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

TELEDYNE ISOTOPES

QUALITY ASSURANCE INTERCOMPARISON STUDY

INTERCOMPARISON WITH: USEPA - EMSL(LV)

PROGRAM: Gross alpha, gross beta in water cross-check

COLLECTION DATE: 16 May 1980 W.O. NO. 3-2167

T.I. NOS. 90529-31

DATE SUMMARIZED: 28 July 1980 SEQUENCE NO. 166

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)
GR-A pCi/liter	23 ± 5 (A)	14 ± 4 (C)	-4.2	-3.2
93 participants	26 ± 7 (B)			
GR-B pCi/liter	14 ± 5	16 ± 1	-0.6	0.8
89 participants	18 ± 4			

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

QUALITY ASSURANCE PROGRAM

INTERCOMPARISON WITH: USEPA (EMSL-LV)

PROGRAM: Air Filters cross-check

DATE FINAL REPORT MAILED: 19 May 1980

COLLECTION DATE:

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)	EPA RESOLUTION	TI/EPA RATIO	TYPE OF AGREEMENT
GR-A(pCi/filter)	10 ± 2 (A)	10 ± 1 (C)	-0.1	0.1	2	1.0	AG
58 participants	11 ± 3 (B)						
GR-B(pCi/filter)	31 ± 5	30 ± 2	-1.1	-0.3	6	0.97	AG
56 participants	33 ± 3						
Sr-90 (pCi/filter)	10 ± 1.5	8 ± 1	-1.4	-2.3	6.7	0.80	AG
20 participants	9 ± 2						
Cs-137 (pCi/filter)	12 ± 5	14 ± 3	0.5	0.8	2.4	1.2	AG
38 participants	13 ± 4						
No plots of recent results were received from the USEPA because their plotter is inoperable							

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

(AG) Agreement

(P) Possible agreement

(D) Disagreement.

W.O. No. 3-0274

T.I. Nos. 77019-21

Program 143

ENTERED: 19 June 1980

TELEDYNE ISOTOPES

QUALITY ASSURANCE INTERCOMPARISON STUDY

INTERCOMPARISON WITH: USEPA - EMSL(LV)

PROGRAM: Gamma in Water Cross-check

COLLECTION DATE: 06 June 1980 W.O. NO. 3-2367

T.I. NOS. 91830-2

DATE SUMMARIZED: 28 August 1980 SEQUENCE NO. 169

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)
Cr-51 (pCi/liter)	13 ± 5 (A)	L.T.70 (C)	Not used for calculations	
59 participants	21 ±20 (B)			
Co-60 (pCi/liter)	5 ± 5	L.T.9	Not used for calculating averages	
64 participants	6 ± 3			
Zn-65 (pCi/liter)	23 ± 5	21 ± 3	-0.9	-0.6
67 participants	24 ± 6			
Ru-106 (pCi/liter)	37 ± 5	L.T.80	Not used for calculating averages	
53 participants	35 ± 6			
Cs-134 (pCi/liter)	11 ± 5	13 ± 1	0.8	0.8
64 participants	11 ± 3			
Cs-137 (pCi/liter)	17 ± 5	19 ± 3	0.4	0.6
65 participants	17 ± 3			

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

TELEDYNE ISOTOPES

QUALITY ASSURANCE INTERCOMPARISON STUDY

INTERCOMPARISON WITH: USEPA - EMSL(LV)

PROGRAM: Tritium in water

COLLECTION DATE: 13 June 1980 W.O. NO. 3-2402

T.I. NOS. 92121-3

DATE SUMMARIZED: 07 August 1980 SEQUENCE NO. 170

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)
H-3 (pCi/liter)	2000±345 (A)	1890±135 (C)	-0.5	-0.6
61 participants	1995±190 (B)			

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

TELEDYNE ISOTOPES

QUALITY ASSURANCE INTERCOMPARISON STUDY

INTERCOMPARISON WITH: USEPA - EMSL(LV)

PROGRAM: Gross Alpha - Beta in water cross-check

COLLECTION DATE: 18 July 1980 W.O. NO. 3-2809

T.I. NOS. 94713-5

DATE SUMMARIZED: SEQUENCE NO. 173

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)
Gross alpha (pCi/liter)	36 ± 9 (A)	40 ± 5 (C)	1.8	0.7
78 participants	30 ±10 (B)			
Gross beta (pCi/liter)	38 ± 5	44 ± 6	1.1	2.0
78 participants	41 ± 7			

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

TELEDYNE ISOTOPES

QUALITY ASSURANCE INTERCOMPARISON STUDY

INTERCOMPARISON WITH: USEPA - EMSL(LV)

PROGRAM: Radionuclides in Milk Cross-check

COLLECTION DATE: 25 July 1980 W.O. NO. 3-2805

T.I. NOS. 94700-94702

DATE SUMMARIZED: 03 Nov. 1980 SEQUENCE NO. 177

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE FCJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)
Sr-89 pCi/liter	55 ± 5 (A)	42 ± 8 (C)	- 1.8	- 4.4
23 participants	48 ±12 (B)			
Sr-90 pCi/liter	17 ±1.5	13 ± 1	- 3.8	- 4.6
25 participants	16 ± 4			
I-131 pCi/liter	0	L.T. 3	—	—
43 participants	8 ±14			
Cs-137 pCi/liter	35 ± 5	37 ± 7	0.2	0.6
42 participants	36 ± 7			
Ba-140 pCi/liter	0	L.T. 8	—	—
40 participants	4 ± 5			
K mg/liter	1550 ± 78	1520± 187	- 1.0	- 0.7
41 participants	1566 ± 255			

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

TELEDYNE ISOTOPES

QUALITY ASSURANCE INTERCOMPARISON STUDY

INTERCOMPARISON WITH: USEPA - EMSL(LV)

PROGRAM: Air Filter Cross-check

COLLECTION DATE: 27 June 1980 W.O. NO. 3-2578

T.I. NOS. 93207-9

DATE SUMMARIZED: 29 Sept. 1980 SEQUENCE NO. 172

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE (C)	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)
Gross alpha(pCi/filter)	24 ± 6(A)	31 ± ? (C)	0.7	1.9
60 participants	28 ± 5(B)			
Gross beta(pCi/filter)	28 ± 5	34 ± 1	-0.2	2.1
59 participants	34 ± 5			
Sr-90(pCi/filter)	8 ± 1.5	8 ± 1	-0.3	0.0
26 participants	8 ± 1			
Cs-137(pCi/filter)	12 ± 5	16 ± 2	0.8	1.5
45 participants	14 ± 3			

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

TELEDYNE ISOTOPES

QUALITY ASSURANCE INTERCOMPARISON STUDY

INTERCOMPARISON WITH: USEPA - EMSL(LV)

PROGRAM: Iodine in water cross-check

COLLECTION DATE: 08 August 1980 W.O. NO. 3-2935

T.I. NOS. 95564-6

DATE SUMMARIZED: 27 October 1980 SEQUENCE NO. 175

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)
I-131 pCi/liter	36 ± 5 (A)	34 ± 2 (C)	- 0.3	- 0.6
48 participants	35 ± 4 (B)			

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

ISOTOPES

QUALITY ASSURANCE INTERCOMPARISON STUDY

INTERCOMPARISON WITH: USEPA - EMSL(LV)

PROGRAM: Tritium in water cross-check

COLLECTION DATE: 15 August 1980 W.O. NO. 3-2956

T.I. NOS. 95655-7

DATE SUMMARIZED: 15 Oct. 1980 SEQUENCE NO. 178

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)
H-3 (pCi/liter)	1210±329(A)	1110±70 (C)	-0.6	-0.3
69 participants	1224±239(B)			

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

TELEDYNE ISOTOPES

QUALITY ASSURANCE INTERCOMPARISON STUDY

INTERCOMPARISON WITH: USEPA - EMSL(LV)

PROGRAM: Strontium in Water Cross-Check

COLLECTION DATE: Sept. 5, 1980 W.O. NO. 3-3232

T.I. NOS. 97371-97373

DATE SUMMARIZED: Dec. 11, 1980 SEQUENCE NO. 183

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)
Sr-89 pCi/liter	24 ± 5 (A)	23 ± 18 (C)	0.4	-0.3
45 participants	22 ± 7 (B)			
Sr-90 pCi/liter	15 ± 1.5(A)	12 ± 9 (C)	-2.9	-3.5
48 participants	14 ± 3 (B)			

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

TELEDYNE ISOTOPES

QUALITY ASSURANCE INTERCOMPARISON STUDY

INTERCOMPARISON WITH: USEPA - EMSL(LV)

PROGRAM: Alpha-beta in water cross-check

COLLECTION DATE: 19 Sept. 1980 W.O. NO. 3-3316

T.I. NOS. 98198-200

DATE SUMMARIZED: 01 Dec. 1980 SEQUENCE NO. 181

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)
Alpha (pCi/liter)	32 ± 8 (A)	– (C)	No data submitted	
78 participants	29 ± 8 (B)			
Beta (pCi/liter)	21 ± 5 (A)	15 ± 1 (C)	-2.9	-2.0
79 participants	24 ± 6 (B)			

To: K. Roach
From: H. Jeter
Subj: EPA Cross Check WO 3-3316

1. We did not report alpha measurements on this water cross check.

2. The mount weights of these samples were less than 0.1 gram. This presents a counting efficiency problem for alpha as explained in my memo of 9 May 1980.

3. I dissolved the deposits and added approximately 0.3 gm Na_2SO_4 to each in order to increase the mount weight. Counting results were erratic. No alpha values were reported because we had no confidence in the results.

4. Subsequent EPA cross checks did not present similar problems.

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

TELEDYNE ISOTOPES

QUALITY ASSURANCE INTERCOMPARISON STUDY

INTERCOMPARISON WITH: USEPA - EMSL(LV)

PROGRAM: Gamma in Water Cross-Check

COLLECTION DATE: Oct. 3, 1980 W.O. NO. 3-3409

T.I. NOS. 98843-98845

DATE SUMMARIZED: Dec. 11, 1980 SEQUENCE NO. 184

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)
Cr-51 pCi/liter	86 ± 5 (A)	82 ± 37 (C)	-1.6	-1.4
67 participants	87 ±15 (B)			
Co-60 pCi/liter	16 ± 5 (A)	19 ± 2 (C)	1.1	1.2
69 participants	16 ± 3 (B)			
Zn-65 pCi/liter	25 ± 5 (A)	27 ± 7.5 (C)	1.0	0.8
68 participants	24 ± 4 (C)			
Ru-106 pCi/liter	46 ± 5 (A)	L.T. 70	Not used for	
66 participants	46 ±10 (C)		Grand Aver.	
Cs-134 pCi/liter	20 ± 5 (A)	21 ± 4.5 (C)	0.8	0.5
68 participants	19 ± 4 (C)			
Cs-137 pCi/liter	12 ± 5 (A)	14 ±13 (C)	0.5	0.7
67 participants	13 ± 3 (C)			

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

QUALITY ASSURANCE PROGRAM

INTERCOMPARISON WITH: USEPA (EMSL-LV)

DATE FINAL REPORT MAILED: -

PROGRAM: Gamma in water cross-check

COLLECTION DATE: 05 October 1979

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)	EPA RESOLUTION	TI/EPA RATIO	TYPE OF AGREEMENT	
Cr-51 (pCi/liter)	113± 6 (A)	136±28 (C)	5.2	6.7	19	1.2	AG	
53 participants	118±22 (B)							
Co-60 (pCi/liter)	6± 5	L.T. 6	T.I. Not used	T.I. Not used	-	-	-	
52 participants	7± 2							
Zn-65 (pCi/liter)	0	L.T. 10	-	-	-	-	AG	
52 participants	3± 1							
Ru-106(pCi/liter)	0	L.T. 40	-	-	-	-	AG	
51 participants	38±14							
Cs-134(pCi/liter)	7± 5	9± 4	0.4	0.6	1.4	1.3	AG	
44 participants	7±2							
Cs-137(pCi/liter)	11±5	13± 3	0.4	0.7	2.2	1.2	AG	
50 participants	12±3							

II-C-1-67

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

(AG) Agreement

(P) Possible agreement

(D) Disagreement

W.O. No. 3-0159

T.I. Nos. 76525-5

Program 158

ENTERED: 18 June 1980

TELEDYNE ISOTOPES

QUALITY ASSURANCE INTERCOMPARISON STUDY

INTERCOMPARISON WITH: USEPA - EMSL(LV)

PROGRAM: Air Filter Cross Checks

COLLECTION DATE: Sept. 26, 1980 W.O. NO. 3-3346

T.I. NOS. 98396-98398

DATE SUMMARIZED: 12/29/80 SEQUENCE NO. 186

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)
Gross Alpha pCi/L	24. ± 5. (A) 25. ± 4. (B)	30. ± 1. (C)	1.6	2.1
Gross Beta pCi/L	10. ± 5. (A) 17. ± 7. (B)	15. ± 1. (C)	-0.7	1.6
Sr-90 pCi/L	0 6. ± 12. (B)	L.T.D.	—	—
Cs-137 pCi/L	10. ± 5. (A) 12. ± 3. (B)	13. ± 3. (C)	0.3	0.9

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

TELEDYNE ISOTOPES

QUALITY ASSURANCE INTERCOMPARISON STUDY

INTERCOMPARISON WITH: USEPA - EMSL(LV)

PROGRAM: Tritium in Water Cross-Check

COLLECTION DATE: 10/10/80 W.O. NO. 3-3448

T.I. NOS. 99088-99090

DATE SUMMARIZED: Jan. 13, 1981 SEQUENCE NO. 185

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)
H-3 pCi/ℓ	3200 ± 360(A)	3170 ± 214 (C)	0.2	-0.1
71 participants	3132 ± 308(B)			

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

TELEDYNE ISOTOPES

QUALITY ASSURANCE INTERCOMPARISON STUDY

INTERCOMPARISON WITH: USEPA - EMSL(LV)

PROGRAM: Milk crosscheck

COLLECTION DATE: 10/31/80 W.O. NO. 3-3637

T.I. NOS. 00414-00416

DATE SUMMARIZED: 1/27/81 SEQUENCE NO. 187

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)
Sr-89 pCi/liter	23.±5. (A)	14.7±14.7 (C)	-1.9	-2.9
35 participants	20.±4. (B)			
Sr-90 pCi/liter	0. (A)	L.T. 2. (C)	-	-
37 participants	2.±3. (B)			
I-131 pCi/liter	18.±5. (A)	11.3±3.6 (C)	-2.8	-2.3
55 participants	19.±7. (B)			
Cs-137 pCi/liter	21.±5. (A)	21.3±6.3 (C)	-0.2	0.1
57 participants	22.±4. (B)			
Ba-140 pCi/liter	0. (A)	L.T. 5. (C)	-	-
50 participants	3.±2. (B)			
	1620±81	~~62 ±14~~		
K mg/ℓ	~~1700.±85.~~ (A)	~~1523.±369.~~ (C)	~~-1.4~~	~~-3.6~~
43 participants	~~1620.±300.~~ (B) 1542 ±174	1523 ± 369	-0.4	-2.1

Correct 1/17 MDEP

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

TELEDYNE ISOTOPES

QUALITY ASSURANCE INTERCOMPARISON STUDY

INTERCOMPARISON WITH: USEPA - EMSL(LV)

PROGRAM: Gross alpha, beta in water

COLLECTION DATE: 11/21/80 W.O. NO. 3-3971

T.I. NOS. 02257 - 02259

DATE SUMMARIZED: 1/26/81 SEQUENCE NO. 188

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)
Gross alpha pCi/liter	16.±5. (A)	27.±21. (C)	3.4	3.8
90 participants	17.±5. (B)			
Gross beta pCi/liter	13.±8.6 (A)	13.±5. (C)	-0.9	-0.1
85 participants	15.±4. (B)			

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

TELEDYNE ISOTOPES

QUALITY ASSURANCE INTERCOMPARISON STUDY

INTERCOMPARISON WITH: USEPA - EMSL(LV)

PROGRAM: I-131 in water

COLLECTION DATE: 12/05/80 W.O. NO. 3-3978

T.I. NOS. 02296 - 02298

DATE SUMMARIZED: 1/26/81 SEQUENCE NO. 190

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)
I-131 pCi/liter	22.±6.(A)	18.6±1.8 (C)	-0.6	-1.0
45 participants	21.±4.(B)			

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

TELEDYNE ISOTOPES

QUALITY ASSURANCE INTERCOMPARISON STUDY

INTERCOMPARISON WITH: USEPA - EMSL(LV)

PROGRAM: Tritium in Urine Cross Check

COLLECTION DATE: Dec. 26, 1980 W.O. NO. 3-4129

T.I. NOS. 03194-03196

DATE SUMMARIZED: 2/26/81 SEQUENCE NO. 189

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)
H-3 pCi/L	3150. ± 360 (A) 2899. ± 486. (B)	2983. ± 205 (C)	0.4	-0.8

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

TELEDYNE ISOTOPES

QUALITY ASSURANCE INTERCOMPARISON STUDY

INTERCOMPARISON WITH: USEPA - EMSL(LV)

PROGRAM: Plutonium in Water Cross Checks

COLLECTION DATE: W.O. NO. 3-3867

T.I. NOS. 01522 - 01524

DATE SUMMARIZED: 3/2/81 SEQUENCE NO. 197

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)
Pu-239 in Water pCi/L	9.1 ± 0.9(A) 7.2 ± 1.5(B)	9.7 ± 4.0(C)	4.8	1.2

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

TELEDYNE ISOTOPES

QUALITY ASSURANCE INTERCOMPARISON STUDY

INTERCOMPARISON WITH: USEPA - EMSL(LV)

PROGRAM: Tritium in Water Cross Checks

COLLECTION DATE: 12/26/80 W.O. NO. 3-4130

T.I. NOS. 03198 - 03200

DATE SUMMARIZED: 2/23/81 SEQUENCE NO. 193

NUCLIDE	EPA	TELEDYNE ISOTOPES CODE #CJ	NORMALIZED GRAND AVERAGE	DEVIATION (KNOWN)
H-3 pCi/L	2240 ± 350(A) 2258 ± 261(B)	2190 ± 92(C)	-0.3	-0.2

(A) Expected laboratory precision (1 sigma, 1 determination)

(B) Grand average ± experimental sigma for participants reporting

(C) Average ± experimental sigma

ppendix I

Three Mile Island Nuclear Station
Groundwater Monitoring Program
1980

Table of Contents

1.0 Introduction

1.1 History
1.2 Location Figure I-1 Monitoring and Observation Wells

2.0 Groundwater Monitoring Data (Teledyne)

2.1 Table I-1 - Tritium Concentrations - Monitoring Wells
2.2 Table I-2 - Tritium Concentrations - Observation Wells
2.3 Graph I-1 thru I-8 - Tritium Concentrations - Monitoring Wells
2.4 Graph I-9 thru I-15 - Tritium Concentrations - Observation Wells
2.5 Table I-3 - Cesium-137 Concentrations - Monitoring Wells
2.6 Table I-4 - Cesium-134 Concentrations - Monitoring Wells
2.7 Table I-5 - Cesium-137 Concentrations - Observation Wells
2.8 Table I-6 - Cobalt-58 Concentrations - Monitoring Wells

3.0 Observation Well Soil Sample Data

3.1 Observation Wells Table I-1A thru I-1J - Core Description and Soil Sample Results

4.0 Quality Assurance Program

4.1 Description
4.2 Table I-7 - EPA Cross-Check Program
4.3 Table I-8 - Tritium Concentrations in Monitoring Wells (April 11, 1980 to April 15, 1980).
4.4 Table I-9 - Gamma Results (Oak Ridge)
4.5 Table I-10 - Gamma Results (TVA)
4.6 Map I-1 - BWST Soil Samples
4.7 Table I-11 - Soil Samples Gamma and Tritium Analysis Results
4.8 Table I-12 - Soil Sample Gamma Analysis Results (Oak Ridge)
4.9 Table I-13 - Soil Sample Gamma Analysis Results

5.0 Chemical Analyses of Groundwater

5.1 Table I-13 - Soil Samples - Gamma Analysis Results (TVA)
5.2 Table I-14 - Acid Extractables, Pesticides, and PCB's
5.3 Table I-15 - Volatile Organics
5.4 Table I-16 - Base/Neutral Extractables
5.5 Table I-17 - Acid Extractables (MW-3)
5.6 Table I-18 - Volatile Organics (MW-3)
5.7 Table I-19 - Pesticides and PCB's (MW-3)
5.8 Table I-20 - Base/Neutral Extractables (MW-3)
5.9 Table I-21 - Total Organic and Total Carbon Analyses (MW-3, MW-6)
5.10 Table I-22 - Results of Semi-Quantitative Spectrographic Analysis (MW-3)
5.11 Table I-23 - Results of Semi-Quantitative Spectrographic Analysis (MW-6)
5.12 Table I-24 and Table I-25 - Gilbert/Commonwealth Results
5.13 Results (cont'd)
5.14 Table I-26 - Analysis of Precipitate

6.0 References

HISTORY OF GROUNDWATER PROGRAM AT TMI

In January 1980, the development of eight wells to monitor groundwater quality at TMI began. Five of the monitoring wells were located around the Unit 2 containment structure with two additional wells placed outside the Unit 2 secured area fence. An eighth well was located at the north end of the Island.

During the development of each monitoring well, groundwater samples were obtained for tritium and gamma isotopic analyses. With the complete installation of the eight monitoring wells in April 1980, groundwater sampling on a weekly basis was initiated.

In addition to the monitoring wells, seven observation wells were drilled during the end of April and beginning of May 1980. Six of the observation wells are located inside the Unit 2 secured area while a seventh is positioned at the south end of the Island.

During the first week of May 1980, the groundwater monitoring program was expanded to include the observation wells as sampling locations. Consequently, fifteen wells are now sampled on a weekly basis to monitor groundwater conditions at TMI.

WELL LOCATIONS

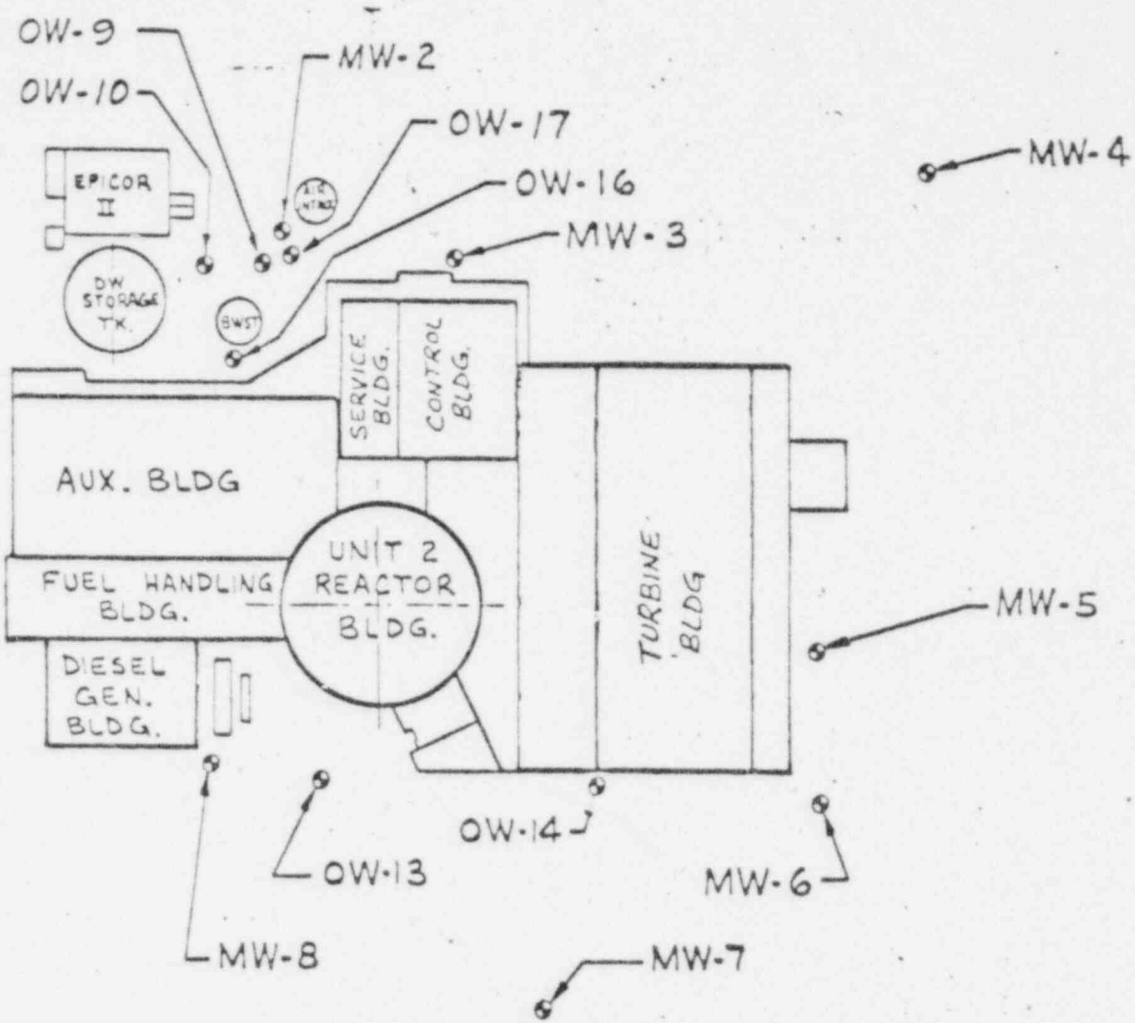


FIGURE 1-1

1.2

COMMENTS:

1. MW-1 LOCATED IN NORTH PARKING LOT @ COORDINATES N 301,460.04 E 2,286,538.94

2. OW-15 LOCATED ON SOUTH END OF ISLAND @ COORDINATES N 292,985.44 E 2,287,765.09

GROUND WATER MONITORING DATA

Explanation of Tritium Levels

Results for all the monitoring well samples obtained from April 11, 1980 to April 19, 1980 were averaged and reported as one value on the April 19, 1980 date. The averaging of the values was done to facilitate the reading of data points on the graphs. The blank spaces on the tritium tables indicate no sample taken.

TABLE I-1

REPORT NO. 1 DATE: February 18, 1981
PAGE 1 OF 3

GPU ENVIRONMENTAL CONTROLS GROUP
TRITIUM CONCENTRATION (PCI/L)

DATE OF SAMPLE	M.W. 1 H-3	+/-	M.W. 2 H-3	+/-	M.W. 3 H-3	+/-	M.W. 4 H-3	+/-	M.W. 5 H-3	+/-	M.W. 6 H-3	+/-	M.W. 7 H-3	+/-	M.W. 8 H-3	+/-
January 25,1980							170	70								
February 20,1980					290	90										
February 25,1980			1530	150												
February 29,1980											280	90				
March 5 ,1980							250	90								
March 7 ,1980															160	80
March 11,1980	200	90														
March 26,1980							200	80					300	80		
March 27,1980					370	80			380	80						
March 27,1980					660	110										
March 28,1980			2500	180							990	130				
March 28,1980											560	130				
April 1 ,1980	990	100														
April 2 ,1980			1550	100	300	80					430	80			870	90
April 2 ,1980			1770	140	240	90					310	80				
April 3 ,1980									290	70						
April 3 ,1980									300	70						
April 9 ,1980	150	90	1530	160	770	110			80	70	330	80	260	90	640	110
April 11,1980																
April 12,1980																
April 13,1980																
April 14,1980																
April 15,1980																
April 16,1980																
April 17,1980																

TABLE I-1 (cont'd)

REPORT NO. : DATE: February 18, 1981
PAGE 2 OF 3

QPU ENVIRONMENTAL CONTROLS GROUP
TRITIUM CONCENTRATION (PCI/L)

DATE	M.W. 1		M.W. 2		M.W. 3		M.W. 4		M.W. 5		M.W. 6		M.W. 7		M.W. 8	
DATE	H-3	+/-	H-3	+/-	H-3	+/-	H-3	+/-	H-3	+/-	H-3	+/-	H-3	+/-	H-3	+/-
April 18,1980																
April 19,1980	190	120	838	320	758	400	284	120	196	160	378	200	352	180	785	420
May 2 ,1980	130	70	490	80	1890	90	360	70	350	70	913	80	310	80	718	100
May 8 ,1980	260	80	910	100	860	90	380	80	260	80	923	90	280	80	638	90
May 16,1980	100	60	670	90	980	100	310	90	130	80	793	100	270	100	578	70
May 23,1980	170	80	880	80	1270	130	520	130	200	80	753	110	300	110	798	110
May 30,1980	140	80	850	90	920	80	820	100	250	90	730	110	290	90	740	130
June 6 ,1980	200	90	950	100	1260	130	670	120	270	90	870	80	380	110	680	120
June 13,1980	220	60	710	80	1230	100	580	80	370	100	588	110	660	110	588	70
June 20,1980	190	80			1430	140	470	120	230	90	640	120	280	90	550	130
June 27,1980	230	110	1480	110	1370	120	490	80	320	80			320	80	410	80
July 7 ,1980	240	120	1310	100	1480	90	450	70	120	60	420	90	440	90	630	90
July 18,1980	160	80	1900	190	1250	130	510	130	250	90	360	110	370	110	800	80
July 25,1980	180	80	2130	210	1350	140	560	130	290	90	413	120	310	110	480	120
July 30,1980	190	80	1930	190	1570	160	390	110	260	90	323	110	330	110	490	120
August 6 ,1980	180	80	2560	260	1650	170	420	120	250	90	370	110	340	110	640	120
August 13,1980	130	80	1360	140	1840	180	440	120	280	90	350	110	250	90	360	110
August 20,1980	130	80	1000	100	1540	190	410	70	240	90	340	110	270	90	490	130
August 27,1980	180	80	3010	300	1210	120	500	130			370	110	310	110	650	120
September 3 ,1980	600	120	3950	400	1470	150	930	90	270	90	370	110	250	90	530	130
September 10,1980	240	80	4480	270	1580	120	1050	100	770	100	430	90	380	70	570	90
September 17,1980	370	80	4380	260	2040	140	970	150	460	90	720	100	740	80	610	100
September 24,1980	920	90	4040	300	2080	130	1030	130	680	90	920	100	470	90	520	90
October 1 ,1980	170	70	4290	260	1960	170	930	100	280	80	300	80	450	80	420	80
October 8 ,1980	190	80	3540	350	1770	180	730	110	290	90	360	110	390	110	410	120

TABLE I-1 (cont'd)

REPORT NO. :

DATE: February 18, 1981
PAGE 3 OF 3

GPU ENVIRONMENTAL CONTROLS GROUP
TRITIUM CONCENTRATION (PCI/L)

DATE	M.W. 1 H-3	+/-	M.W. 2 H-3	+/-	M.W. 3 H-3	+/-	M.W. 4 H-3	+/-	M.W. 5 H-3	+/-	M.W. 6 H-3	+/-	M.W. 7 H-3	+/-	M.W. 8 H-3	+/-
October 15,1980	170	70	3520	530	1770	270	740	120	290	80	340	90	420	100	380	90
October 22,1980	160	70	2920	440	1870	280	780	120	290	80	330	90	450	100	460	100
October 29,1980	160	70	3170	480	1670	250	610	120	300	90	330	90	320	90	470	100
November 5 ,1980	160	70	2080	310	1620	240	570	100	250	80	270	80	290	80	810	140
November 12,1980	160	70	2400	360	2050	310	740	120	190	70	350	90	320	90	510	100
November 19,1980	270	90	2680	290	2250	140	590	100	310	100	540	100	440	130	270	100
November 26,1980	120	70	2950	440	3620	540	310	90	170	70	220	80	260	80	510	100
December 3 ,1980	260	70	3410	230	2120	180	450	70	280	100	320	110	340	70	360	70
December 10,1980	110	70	2750	410	2030	300	470	100	270	80	250	80	230	80	360	90
December 17,1980	130	70	2110	320	2380	360	420	100	300	90	280	80	270	80	420	100
December 24,1980	140	70	2610	390			390	90	310	90	230	80	260	80	380	90
December 31,1980	170	70	2480	370	2220	330	310	90	390	90	340	90	300	90	410	100

TABLE 1-2

REPORT NO. 1 DATE: February 28, 1981
PAGE 1 OF 1

GPU ENVIRONMENTAL CONTROLS GROUP
TRITIUM CONCENTRATION (PCI/L)

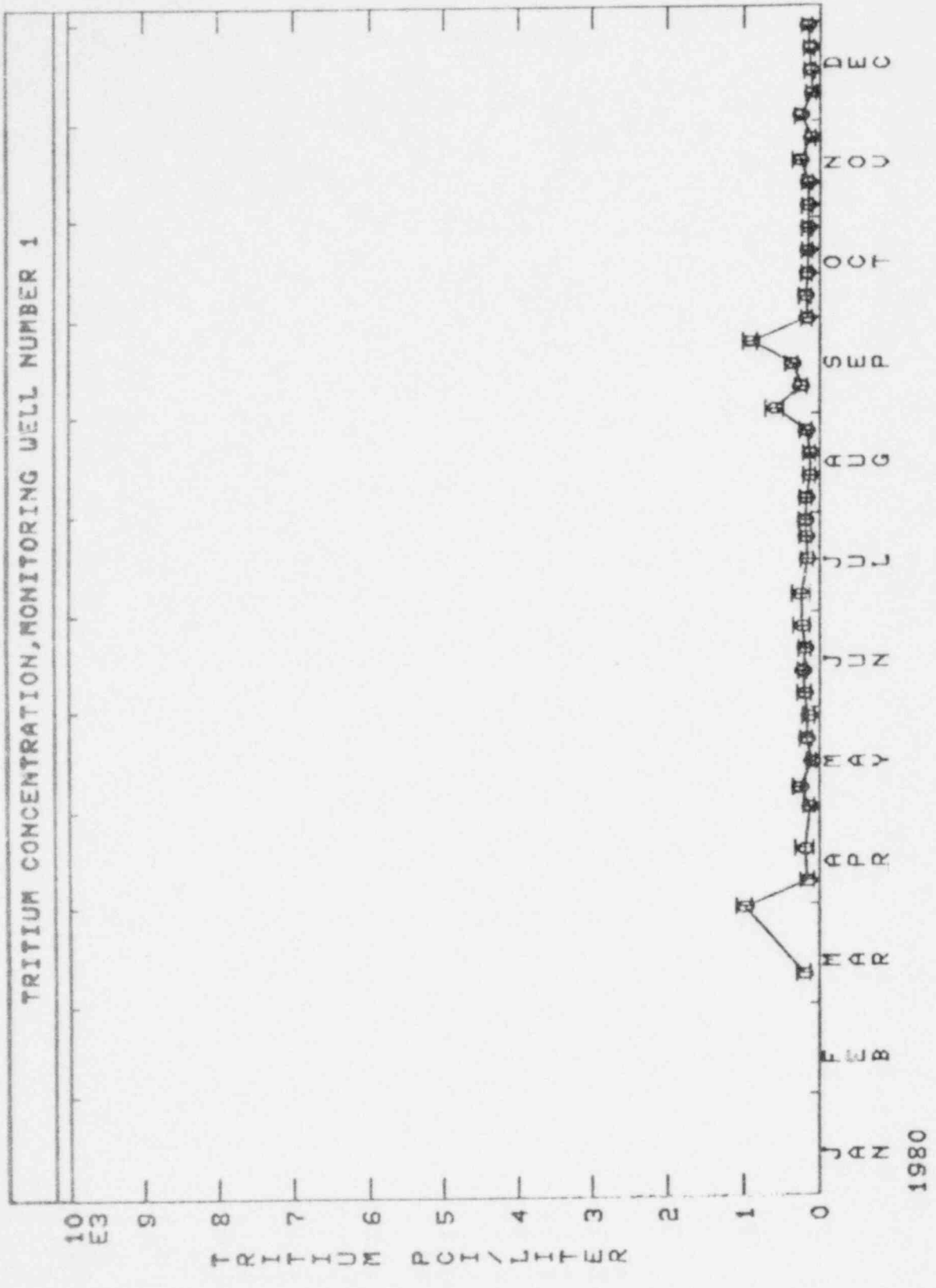
DATE OF SAMPLE	O.W. 9 H-3	+/-	O.W. 10 H-3	+/-	O.W. 12 H-3	+/-	O.J. 14 H-3	+/-	O.J. 15 H-3	+/-	O.L. 16 H-3	+/-	C.W. 17 H-3	+/-
April 25,1980	2610	160	1480	100										
May 2 ,1980	350	90	170	90							1090	110	3210	200
May 8 ,1980	320	70	430	90			1320	120	280	90	1030	110	3220	200
May 16,1980	440	80	350	70	440	70	1280	110			1120	110	3560	220
May 23,1980	290	100	360	110	360	110	1230	120	150	80	950	80	3620	360
May 30,1980	360	110	430	120	400	120	1270	130	130	80	770	110	3500	350
June 6 ,1980	370	110	390	110	340	110	830	80	150	80	770	110	3710	370
June 14,1980	270	100	460	80	300	90	730	90	220	80	590	100	3830	340
June 20,1980	320	110	380	110	350	110	612	120	100	80	820	80	3620	360
June 27,1980	490	80	310	90	390	90	642	100			760	100	3910	260
July 7 ,1980	560	110	910	90	410	80	540	100	210	80	580	90	4180	330
July 18,1980	500	130	680	120	370	110	672	120	150	80	680	120	3630	360
July 25,1980	490	120	340	110	290	90	512	130	140	80	720	110	4630	460
July 30,1980	550	130	880	80	350	110	520	130			710	110	3830	380
August 6 ,1980	410	120			180	80	430	120			700	110	3570	360
August 13,1980	570	130			220	90	440	120			890	90	3540	350
August 20,1980	810	80			420	120	470	120			950	100	3740	370
August 27,1980	2420	240	1900	190	320	110	530	130			960	100	3360	340
September 3 ,1980	910	90	1950	200	340	110	700	110			1100	110	3670	370
September 10,1980	1160	100	230	110	520	120	1030	90			1180	140	4230	280
September 17,1980	1050	100	590	80	400	90	1170	100			1490	110	4080	250
September 24,1980	1320	160	330	70	930	90	1320	110			1610	130	4180	250
October 1 ,1980	1270	100			260	80	730	80			1370	100	4190	280
October 8 ,1980	1260	130			150	80	640	120			1270	130	3830	380
October 15,1980	1200	180	1690	110	510	90	510	100			1270	190	3980	600

TABLE I-2 (cont'd)

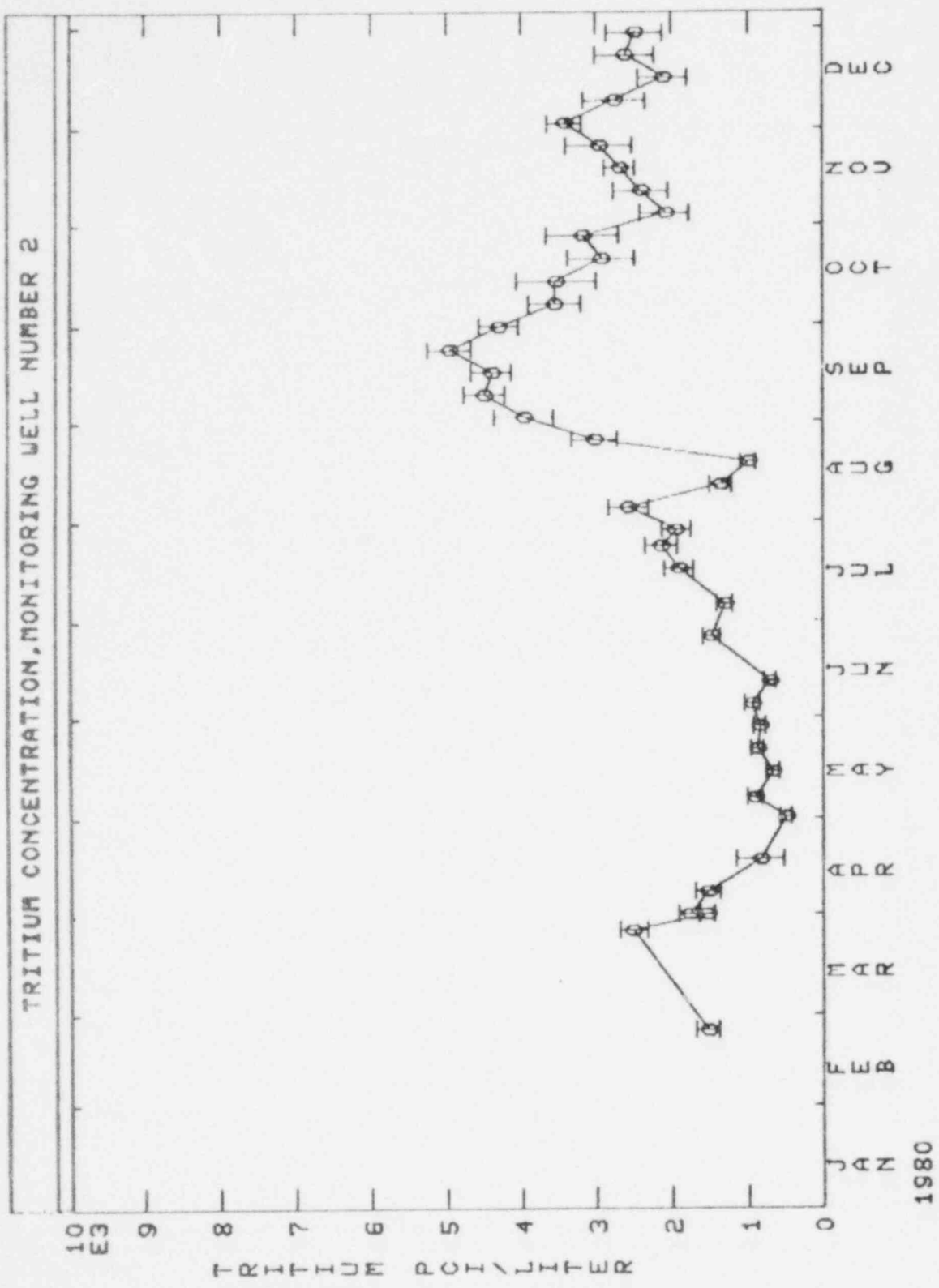
REPORT NO. 1 DATE: February 18, 1981
PAGE 2 OF 2

GPU ENVIRONMENTAL CONTROLS GROUP
TRITIUM CONCENTRATION (PCI/L)

DATE	O.W. 9		O.W. 10		O.W. 13B		O.W. 14		O.W. 16		O.W. 16		O.W. 17	
DATE	H-3	+/-	H-3	+/-	H-3	+/-	H-3	+/-	H-3	+/-	H-3	-/-	H-3	+/-
October 22,1980	2070	310			290	80	550	100			860	140	4370	610
October 29,1980	610	120	360	90	210	80	560	100			1290	190	4170	630
November 5 ,1980	1650	250	1180	170	240	80	460	100			1660	250	3920	590
November 12,1980	1620	240	2670	220	310	50	310	90			1450	220	4140	260
November 19,1980	790	90	2630	160	140	100	500	80			1510	110	4470	290
November 26,1980	340	90	830	140	210	80	330	90			1620	240	4690	700
December 3 ,1980	1040	80	1092	130	340	60	500	100			1560	140	5270	300
December 10,1980	1000	150	1382	202	260	80	370	90					3200	482
December 17,1980	1340	200	1358	228	280	80	390	90					3810	452
December 24,1980	1340	200	1052	168	250	80	470	100					3850	460
December 31,1980	780	120	1392	212	300	50	390	90					3630	540

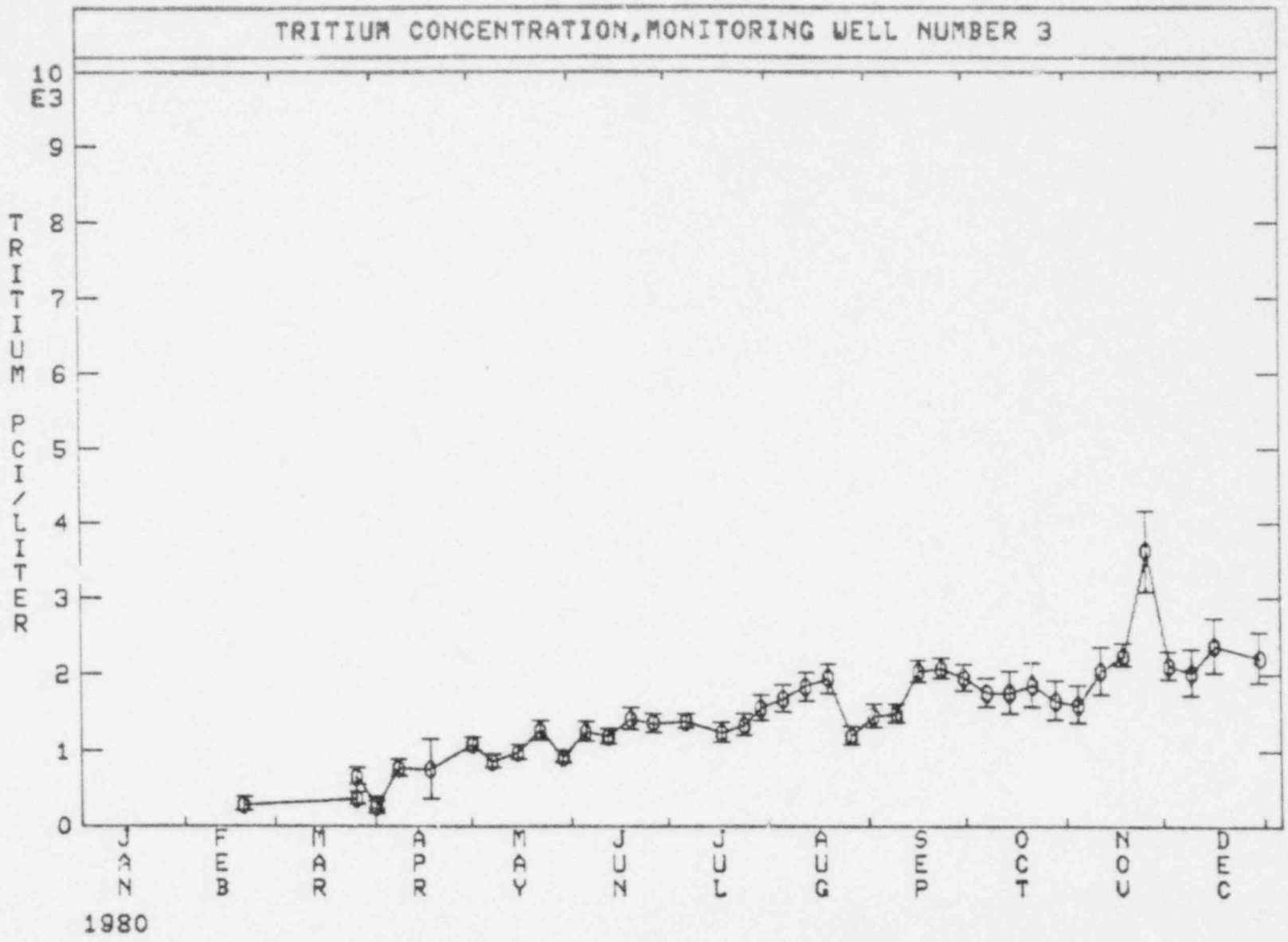

TRITIUM CONCENTRATION, MONITORING WELL NUMBER 1
TRITIUM PCI/LITER
10 E3
9
8
7
6
5
4
3
2
1
0
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1980

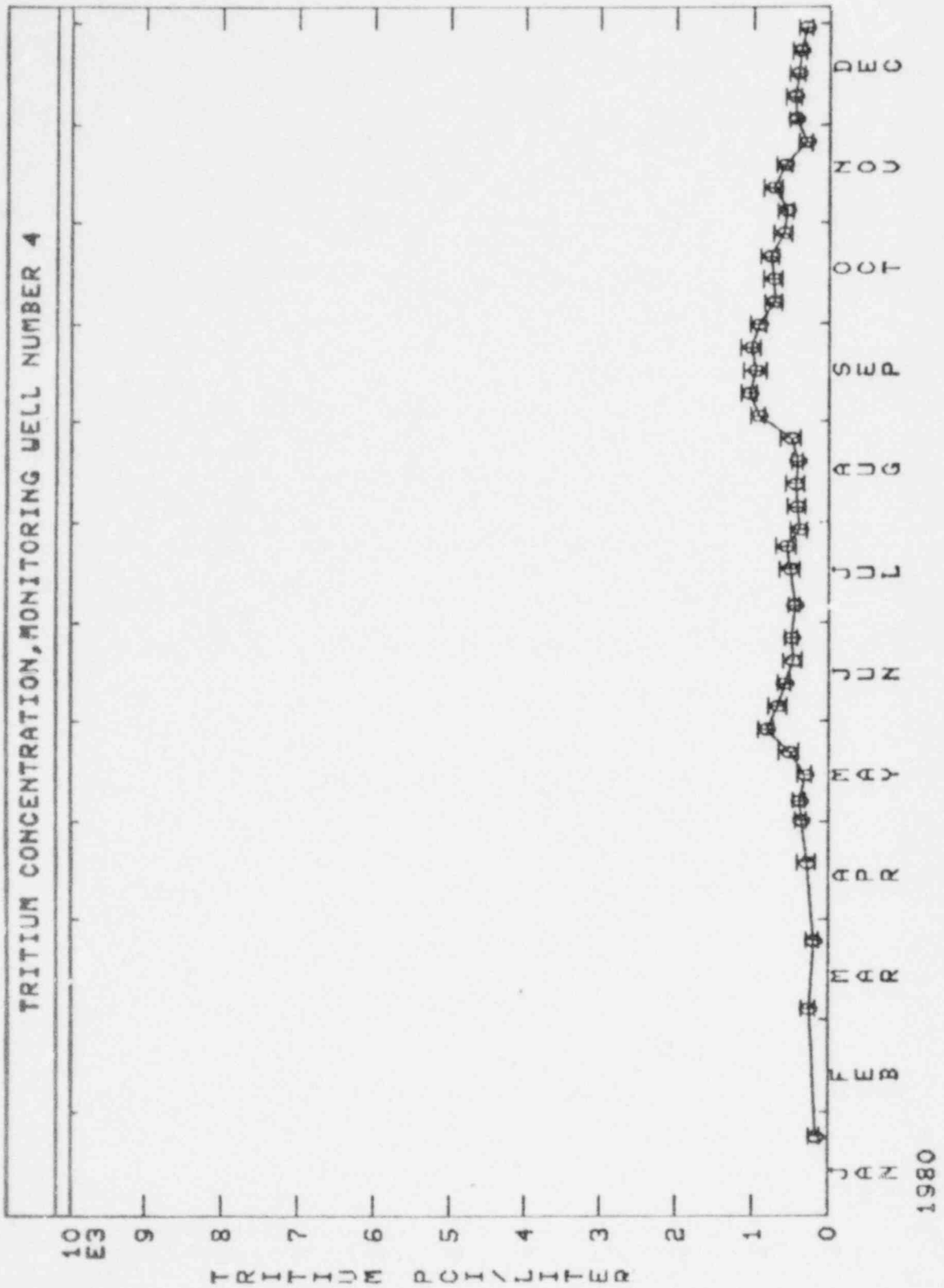
GRAPH I-1


TRITIUM CONCENTRATION, MONITORING WELL NUMBER 2
TRITIUM PCI/LITER
10 E3
9
8
7
6
5
4
3
2
1
0
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1980

GRAPH I-2

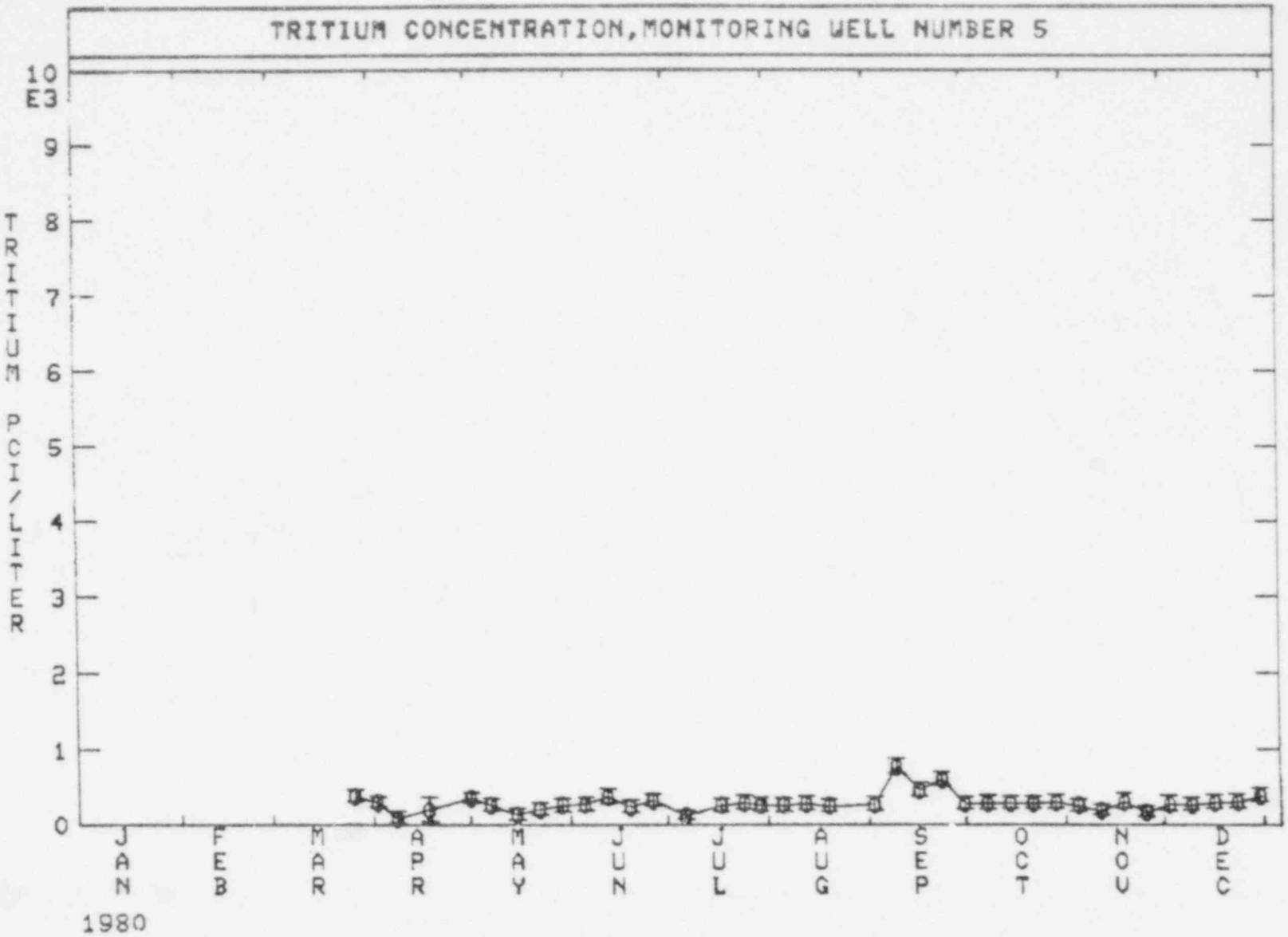
GRAPH I-2 (cont'd)



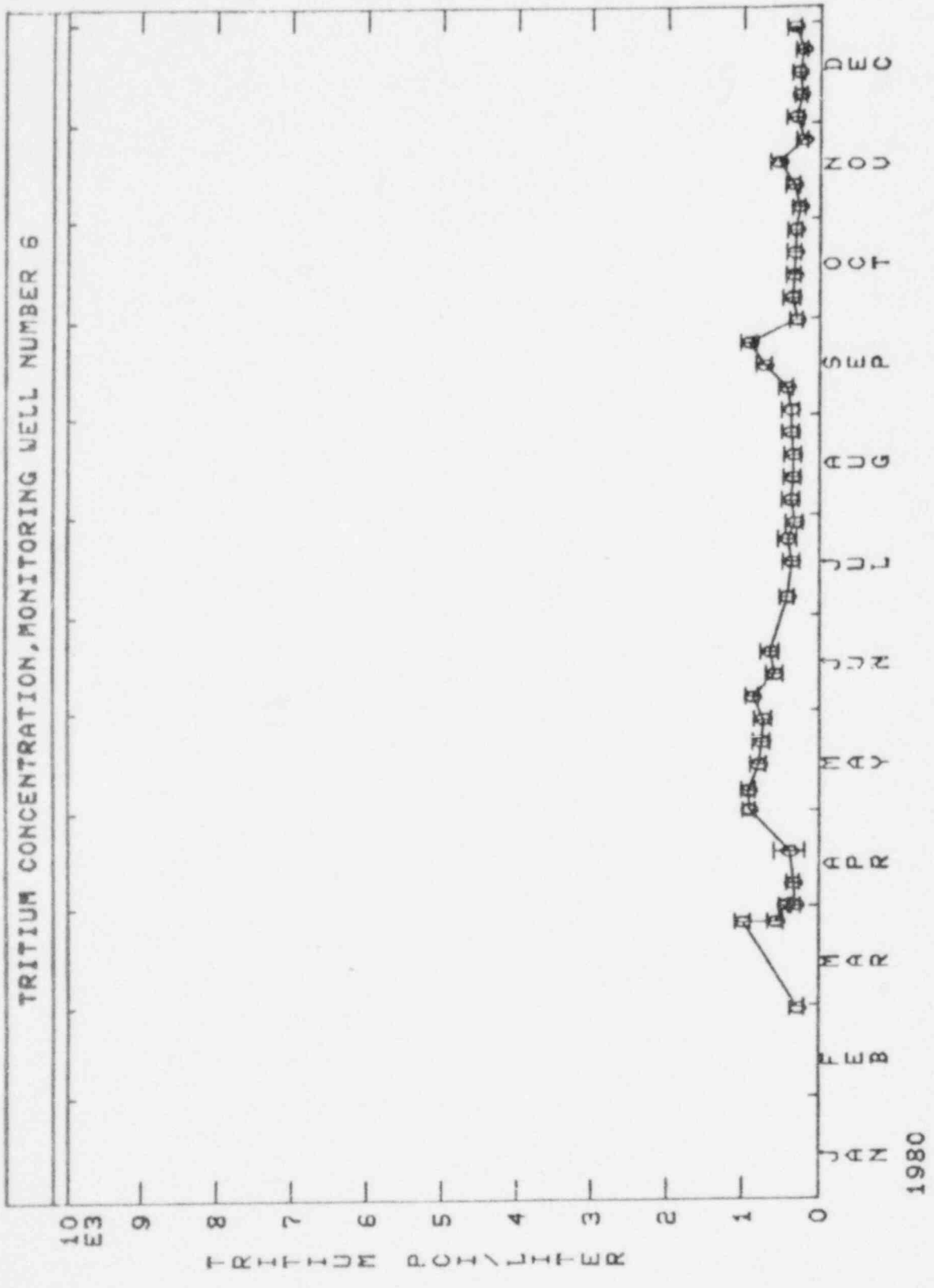

TRITIUM CONCENTRATION, MONITORING WELL NUMBER 4
TRITIUM PCI/LITER
10 E3
9
8
7
6
5
4
3
2
1
0
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1980

GRAPH I-4

GRAPH I-5

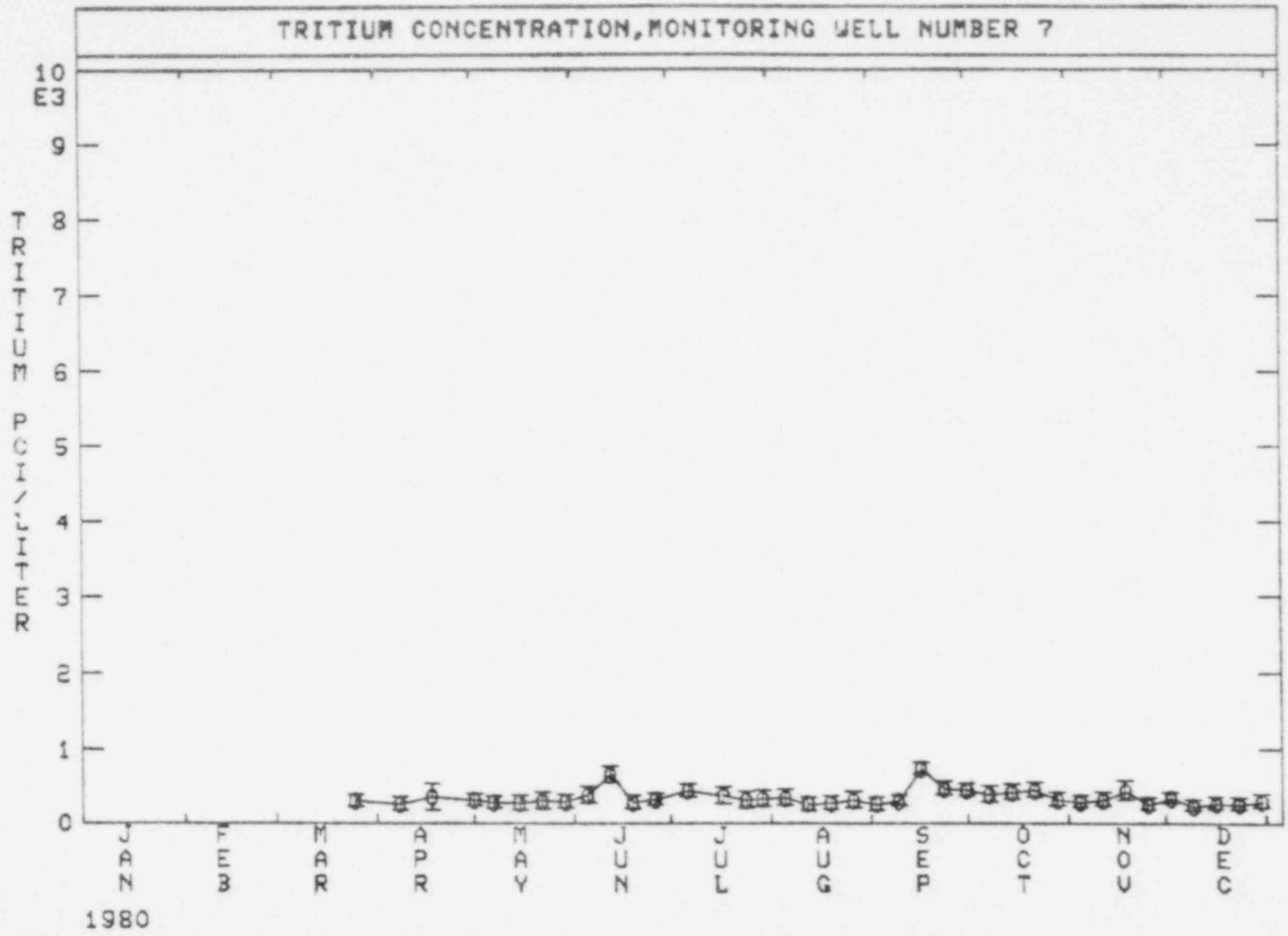

TRITIUM CONCENTRATION, MONITORING WELL NUMBER 5
TRITIUM PCI/LITER
10 E3
9
8
7
6
5
4
3
2
1
0
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1980

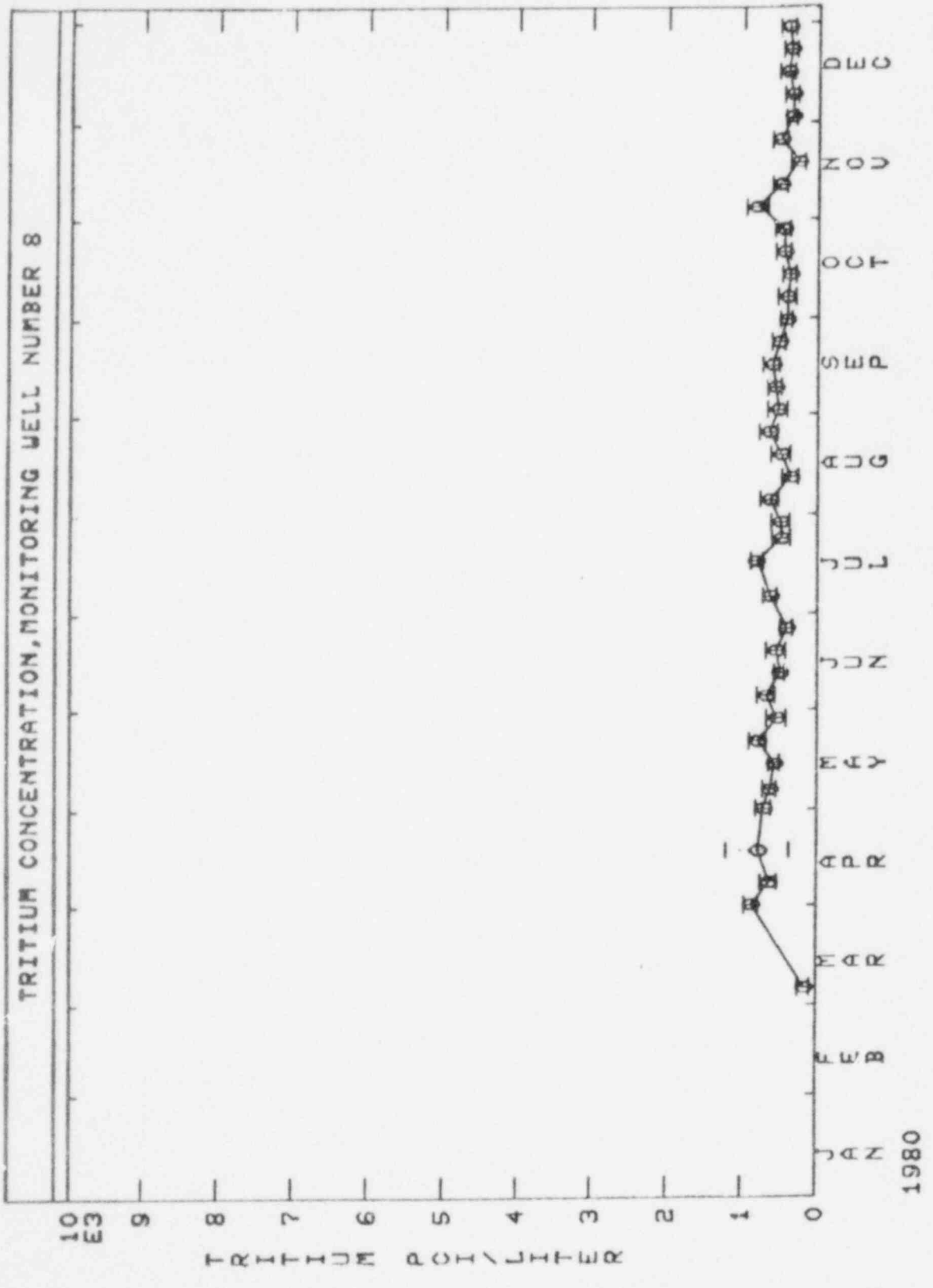
2.3d


TRITIUM CONCENTRATION, MONITORING WELL NUMBER 6
TRITIUM pCi/LITER
10 E3
9
8
7
6
5
4
3
2
1
0
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1980

GRAPH 1-6

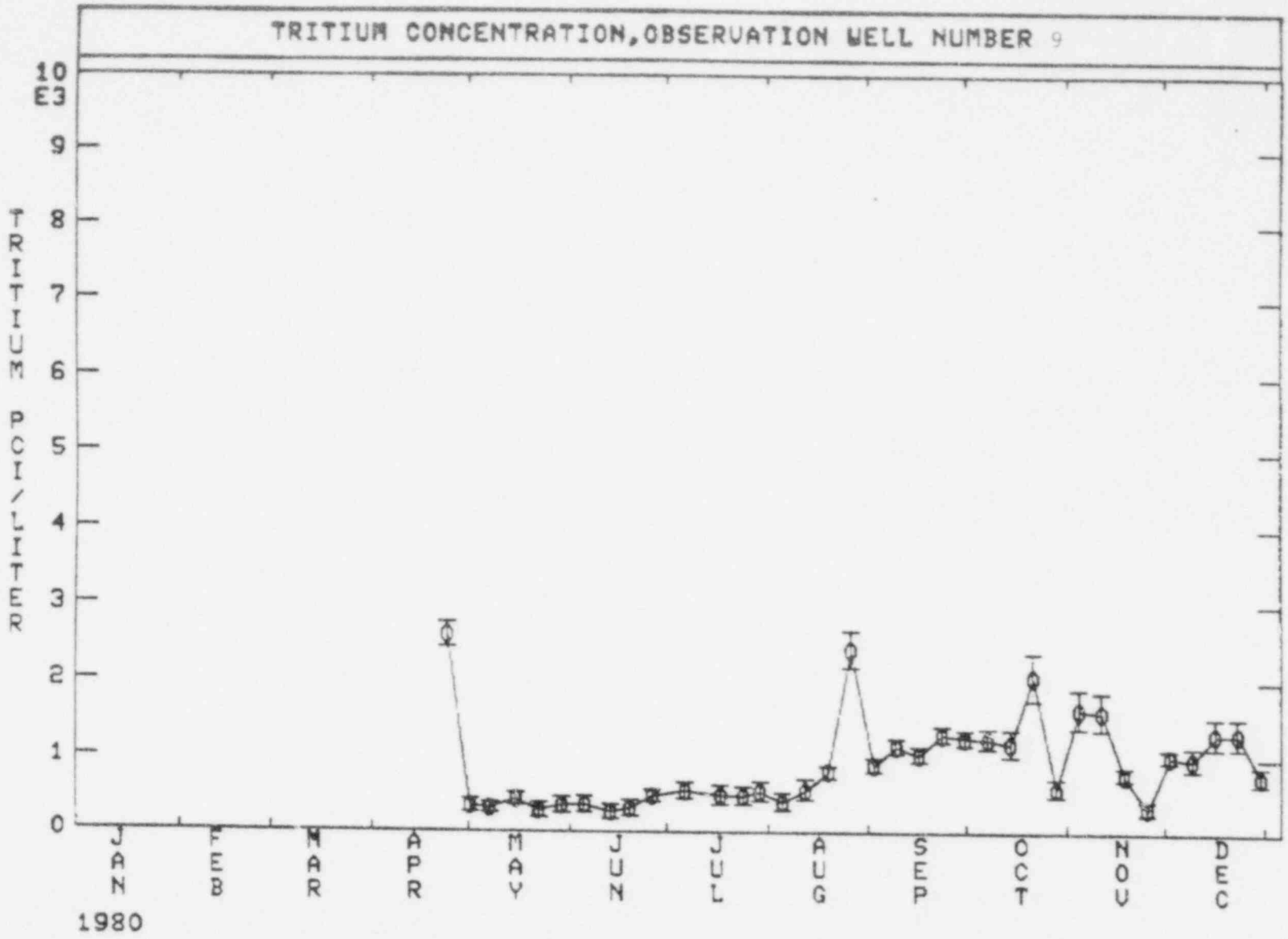
GRAPH I-7


TRITIUM CONCENTRATION, MONITORING WELL NUMBER 7
TRITIUM PCI/LITER
10 E3
9
8
7
6
5
4
3
2
1
0
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1980

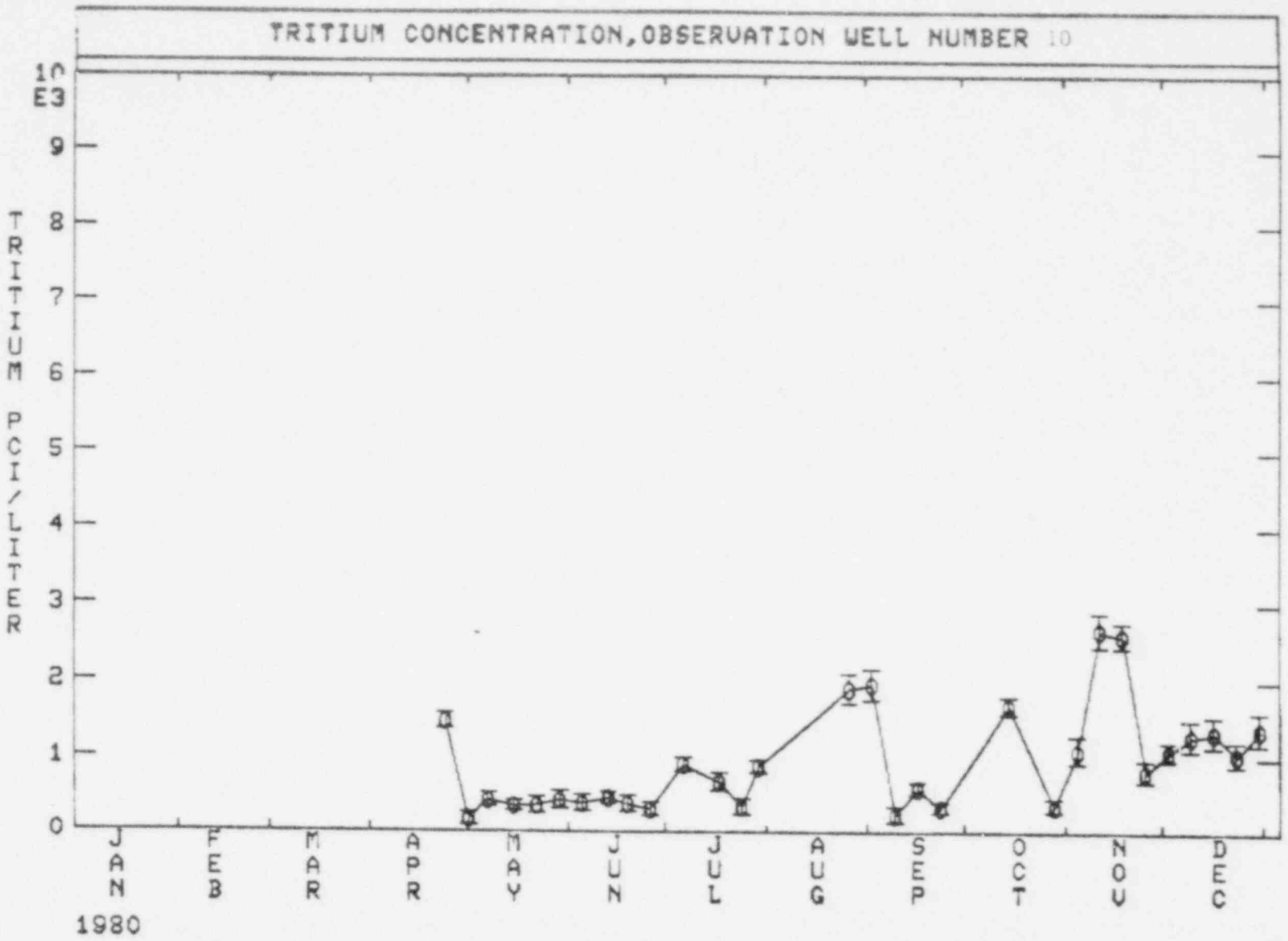

TRITIUM CONCENTRATION, MONITORING WELL NUMBER 8
TRITIUM PICOCURIES PER LITER
10 E3
9
8
7
6
5
4
3
2
1
0
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1980

GRAPH I-8

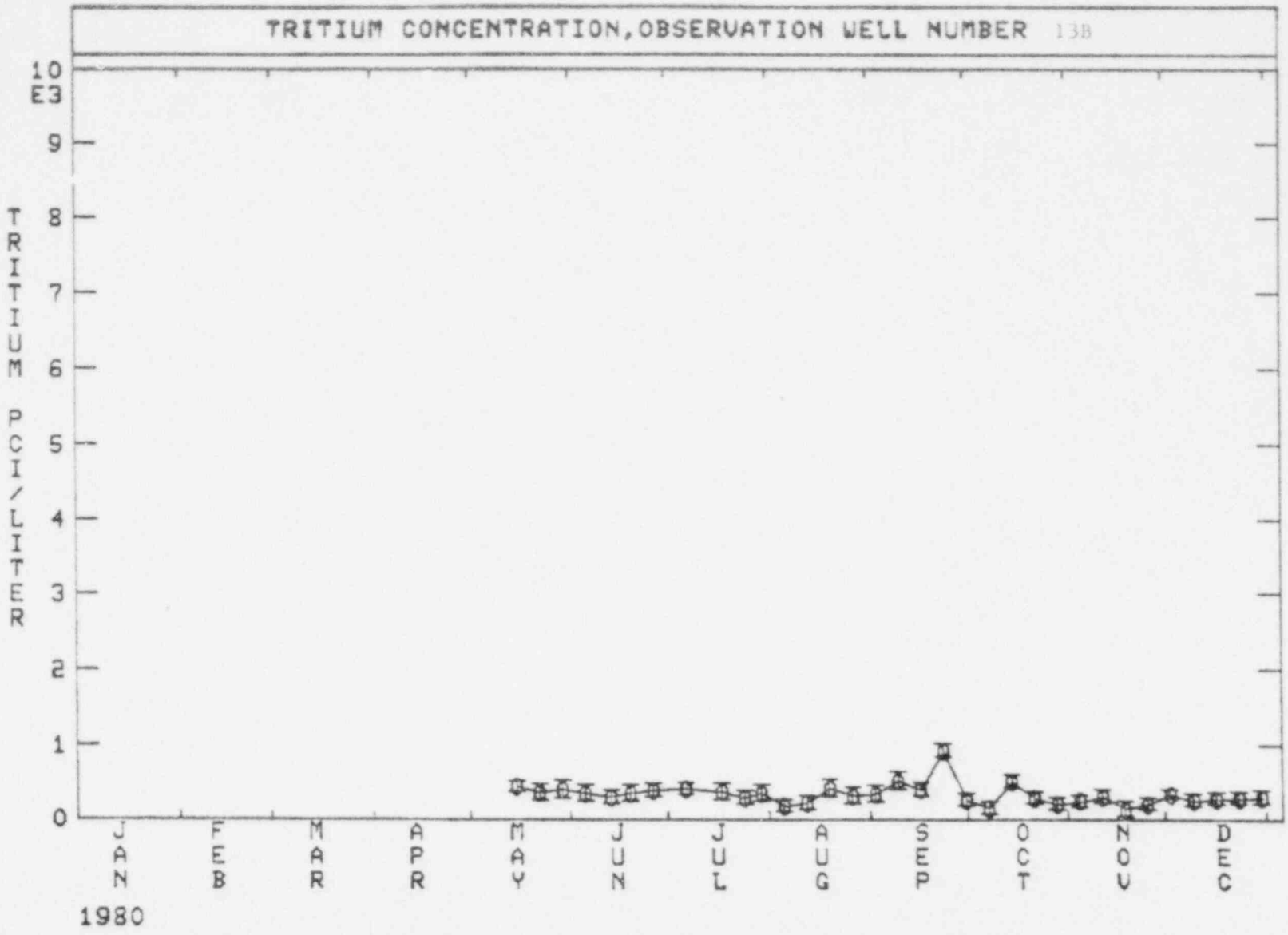
GRAPH I-9


TRITIUM CONCENTRATION, OBSERVATION WELL NUMBER 9
TRITIUM PCI/LITER
10
E3
9
8
7
6
5
4
3
2
1
0
JAN
1980
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC

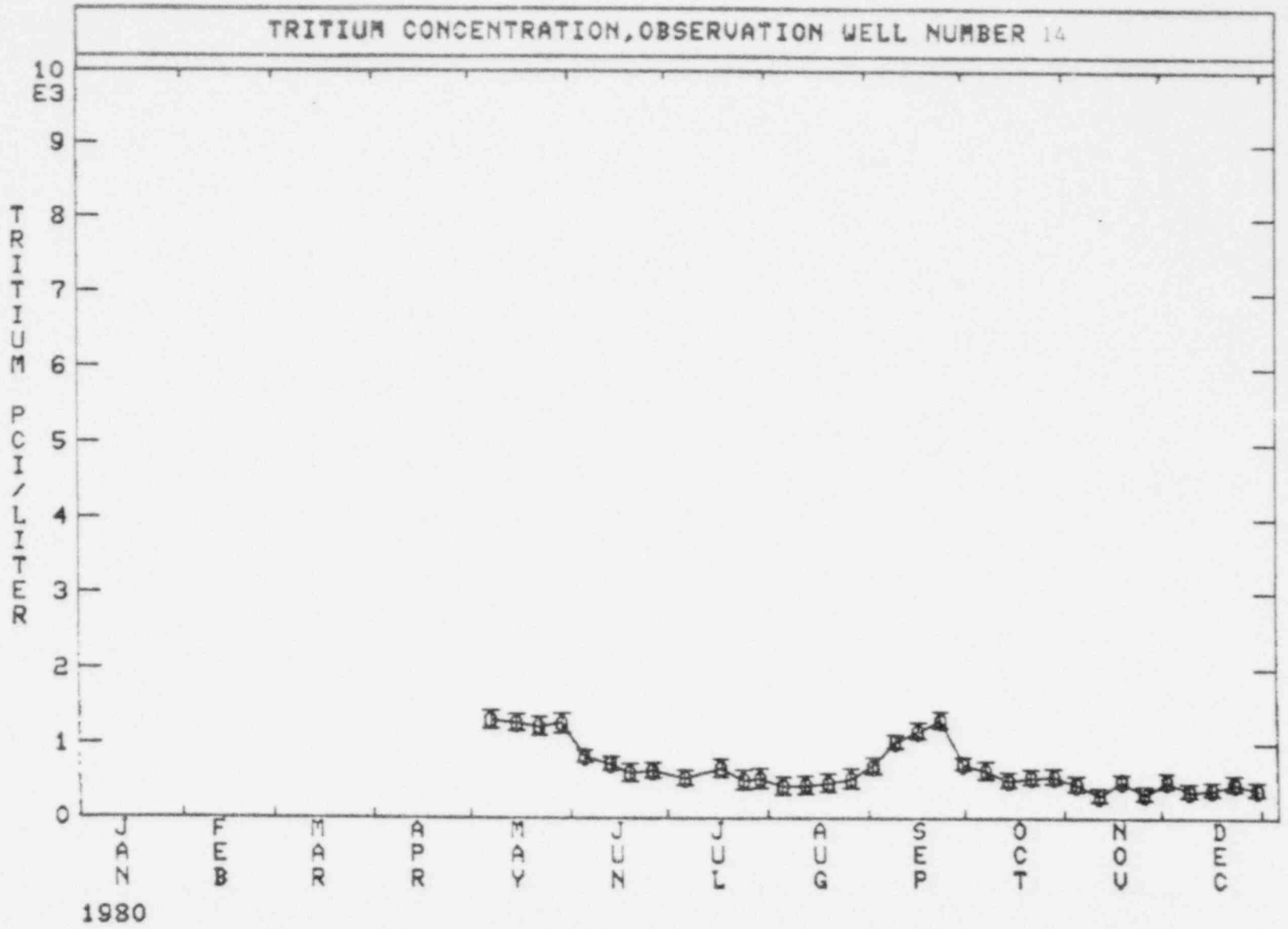
GRAPH I-10

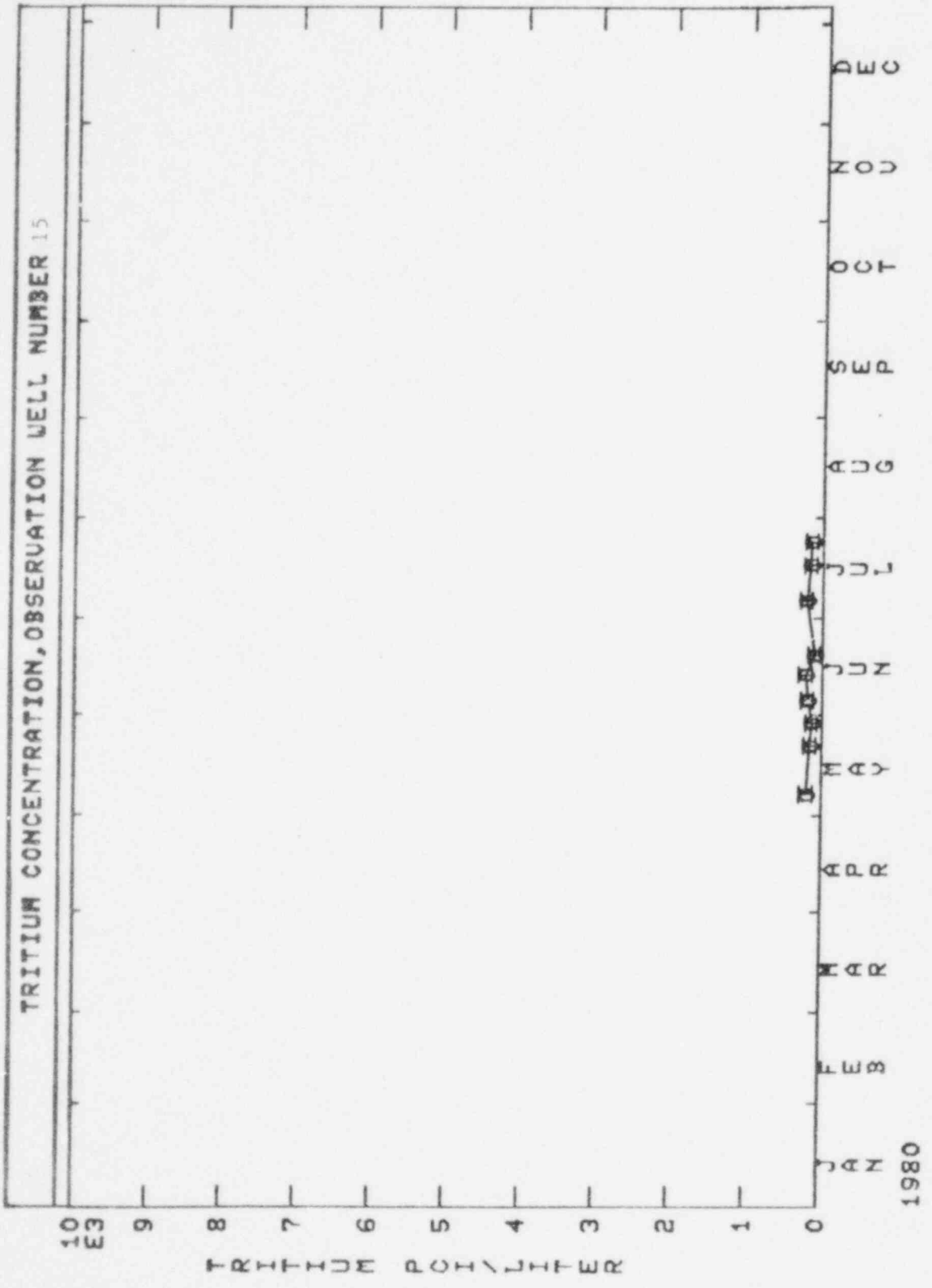

TRITIUM CONCENTRATION, OBSERVATION WELL NUMBER 10
TRITIUM PCI/LITER
10 E3
9
8
7
6
5
4
3
2
1
0
JAN
1980
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC

GRAPH I-11


TRITIUM CONCENTRATION, OBSERVATION WELL NUMBER 13B
TRITIUM PCI/LITER
10 E3
9
8
7
6
5
4
3
2
1
0
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1980

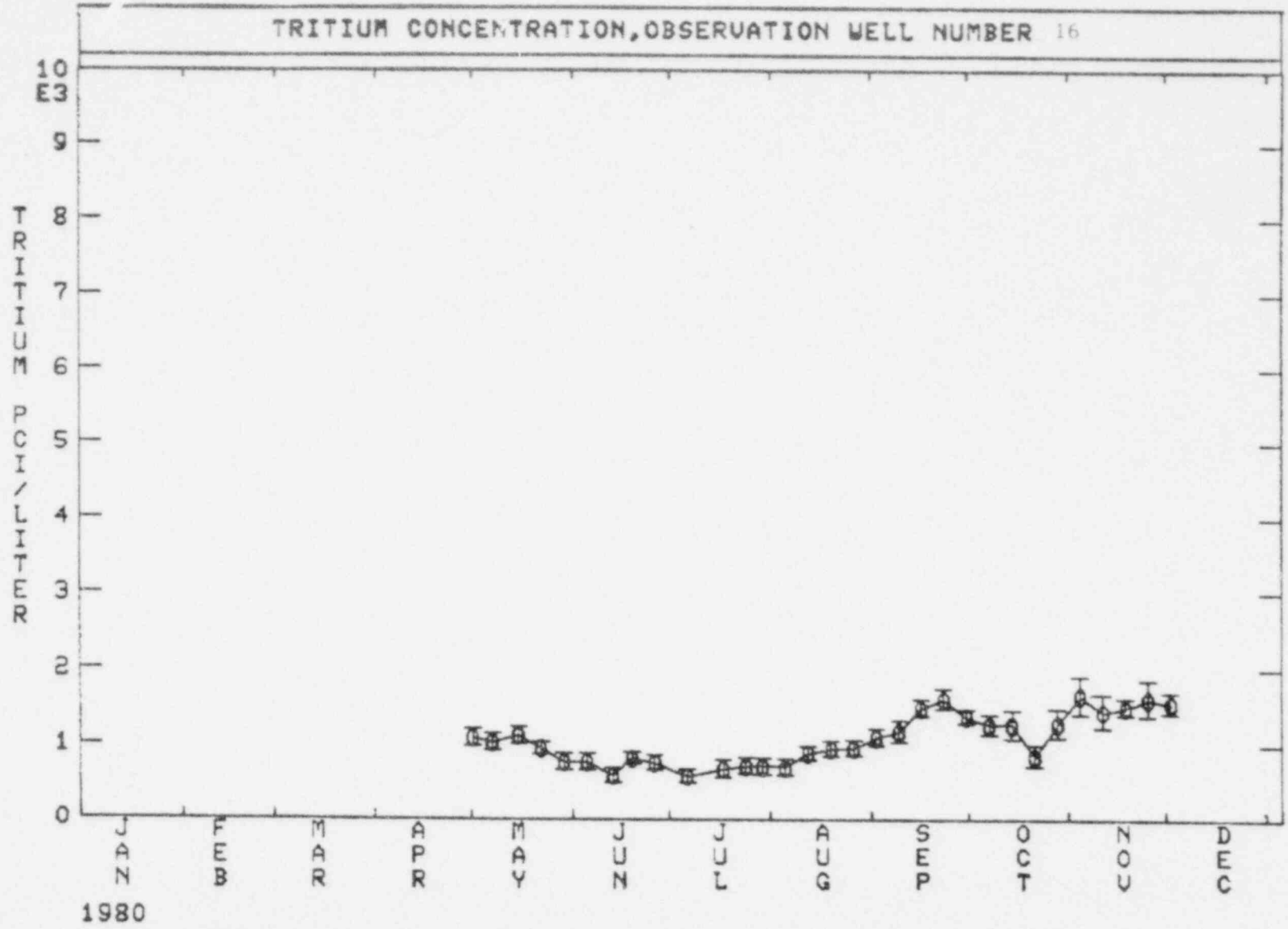
GRAPH I-12


TRITIUM CONCENTRATION, OBSERVATION WELL NUMBER 14
TRITIUM PCI/LITER
10 E3
9
8
7
6
5
4
3
2
1
0
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1980


TRITIUM CONCENTRATION, OBSERVATION WELL NUMBER 15
TRITIUM PCI/LITER
10 E3
9
8
7
6
5
4
3
2
1
0
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1980

GRAPH I-13

GRAPH I-14


TRITIUM CONCENTRATION, OBSERVATION WELL NUMBER 16
TRITIUM PCI/LITER
10 E3
9
8
7
6
5
4
3
2
1
0
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1980

GRAPH I-15

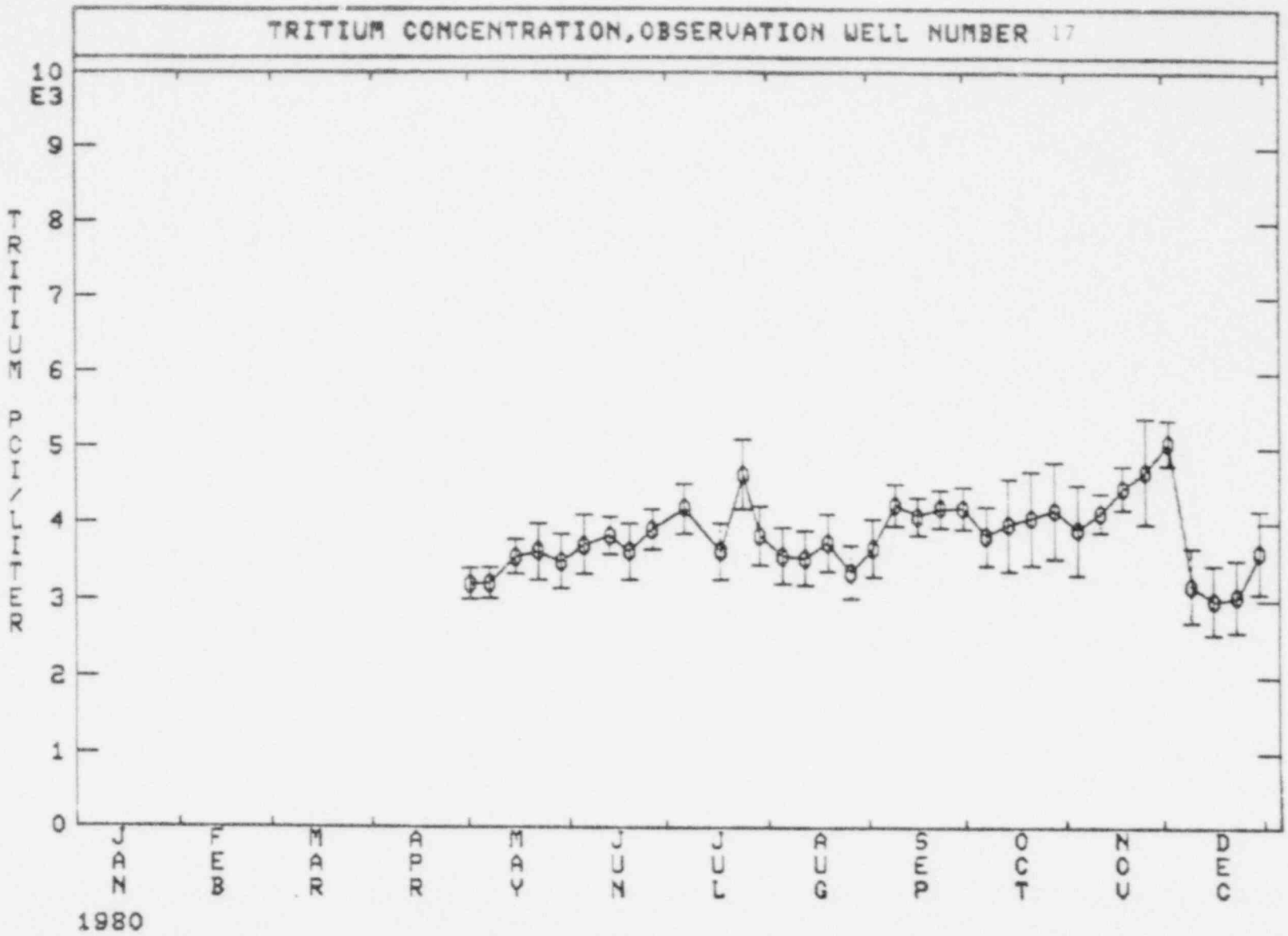

TRITIUM CONCENTRATION, OBSERVATION WELL NUMBER 17
TRITIUM PCI/LITER
10 E3
9
8
7
6
5
4
3
2
1
0
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1980

TABLE I-3

REPORT NO. 1 DATE: February 15, 1981
PAGE 1 OF 1

GPU ENVIRONMENTAL CONTROLS GROUP
CESIUM-137 CONCENTRATION (PCI/L)

DATE OF SAMPLE	M.W. 1		M.W. 2		M.W. 3		M.W. 4		M.W. 5		M.W. 6		M.W. 7		M.W. 8	
	CS-137	+/-	CS-137	+/-	CS-137	+/-	CS-137	+/-	CS-137	+/-	CS-137	+/-	CS-137	+/-	CS-137	+/-
April 12,1988					12.2	7										
May 16,1988			5.19	4.87												
May 30,1988	9.53	4.49														
September 10,1988											14.2	2.8				
September 24,1988			13.4	6.3												
October 1 ,1988			34.9	6.3												
October 15,1988									14.2	2.8						
November 12,1988			9.62	4.42												
December 3 ,1988			5.9	2.36												
December 10,1988			38.2	4.2												
December 17,1988			88.1	8.8												
December 24,1988			24.1	5.9												

TABLE I-4

REPORT NO. 1 DATE: February 19, 1981

PAGE 1 OF 1

GPU ENVIRONMENTAL CONTROLS GROUP

CESIUM-134 CONCENTRATION (PCI/L)

DATE OF SAMPLE	M.W. 1 CS-134	+/-%	M.W. 2 CS-134	+/-%	M.W. 3 CS-134	+/-%	M.W. 4 CS-134	+/-%	M.W. 5 CS-134	+/-%	M.W. 6 CS-134	+/-%	M.W. 7 CS-134	+/-%	M.W. 8 CS-134	+/-%
October 1 ,1980			12.8	5.5												
December 10,1980			12.9	5.2												
December 17,1980			35	4.9												
December 24,1980			18.5	3.9												

TABLE I-5

Date	Well Number	Cs-137 (pCi/ℓ)
August 27, 1980	13B	11.3±5.6
September 3, 1980	14	6.68±2.87
October 15, 1980	17	12.6±5.4
October 22, 1980	9	14.3±5.4
October 22, 1980	14	9.02±5.16
October 29, 1980	17	13.7±5.8
November 12, 1980	16	8.98±4.96

TABLE I-6

Co-58 DETECTED IN GROUNDWATER

Well Number		Value (pCi/ℓ)
2	April 9, 1980	7.67±4.22
2	April 14, 1980	8.82±5.13

OBSERVATION WELL SOIL SAMPLES

DATA SHEET

TABLE I-1A, I-1B

SUBJECT Observation Well Soil Sample Results DATE _____ SHEET _____

LOCATION _____

ENGINEER _____

OW-Core-9 4/22/80

Core Depth Feet	Core Description	H_3 pCi/l
0-1	brown to black fill	290+120
1-2	medium to coarse sand, fine silt & clay	130+100
2-3	some gravel, very fine sand & silt	300+ 90
3-4	medium to coarse sand, some gravel & fine sand	280+ 80
4-5	same as 3-4	370+ 80
5-6	fine materials	220+ 80
6-7	same as 5-6 but more coarse than above	340+ 90
7-9	composition as in 6-7	490+100
9-11	"	<100
11-13	"	<140
13-15	"	230+ 80
15-17	"	150+ 90
17-19	"	200+ 70
19-21	at 19' water table	830+ 80
21-22	some gravel, dense medium to coarse sand	820+ 80
22-24	24'-bedrock very dense	650+100
24-26	limestone, quartz, cobbles, red color very dense	1440+140
26.5-27.1	medium dense rock, red sandstone	3480+220
26-28	fine sandstone-siltstone bedrock 27.1'	3340+220

OW-Core-16 4/28/80

Core Depth Feet	Core Description	H_3 pCi/l
0-1	sand, gravel	2070+130
1-2	clay, sand, gravel	1930+150
2-3	"	1560+130
3-4	clay, sand, gravel bedrock	910+100
4-5	same as 3-4 level	2270+150
5-7	same as 4-5 level	4210+260
7-9	clay, gravel, sandstone	2550+160
9-11	same as 7-9 level	2120+140
11-13	dense clay, gravel and sand	480+ 90
13-15	same as 11-13 level	330+ 80
15-17	gravel, sand	430+ 90
17-19	gravel, sand	370+ 80
19-21	dark gravel, clay	830+100
21-23	gravel, clay	600+140
23-25	gravel, clay, sand	790+100
25-27	sand, gravel, clay lamestone	1180+100
27-28	bedrock, fine sand gravel	880+ 90

3.1a

DATA SHEET

TABLE I-1C, I-1D

SUBJECT H_3 Levels (pCi/l) in Observation Wells DATE _____ SHEET _____

LOCATION OW-10 (4/24/80)

ENGINEER OW-SS1 (4/29/80)

Located between BWST and Service Bldg.

Core Depth Feet	Core Description	H_3 pCi/l		Core Depth Feet	Core Description	H_3 pCi/l
0-1	sand and gravel	390± 90		0-1	sand, gravel, and stone	540± 80
1-2	fill, chips & sand	560± 90		1-2	" " "	1030±100
2-3	sand and chips	240± 80		2-3	sand and gravel	1300±110
3-4	sand, clay & chips	240± 70		3-4	" " "	580± 90
4-5	" " " "	350± 80		4-5	" " "	1180± 90*
5-7	sand and gravel	160± 70		5-7	" " "	950±120
7-9	" " "	260± 70		7-9	" " "	1350±120
9-11	" " "	200± 80		9-10.5	" " "	1220± 90
11-13	sand, clay & gravel	330± 80		10.5-12	" " "	1180±100
13-15A	sand, shale and quartz	<120				
13-15B	"	160± 80				
15-17	sand, shale, gravel quartz & clay	320± 80			*Cs-137 Detected	
17-19	"	100± 80			Value .101±.041 pCi/gm	
19-21	shale, sand, clay & gravel	140± 70				
21-23	sand and gravel	110± 80			+-Sample reanalyzed-	
23-25	sand and gravel	1700±140			Cs-137 <.05 pCi/gm	
25-27	sand, gravel and bedrock	1630±150				

3.1b

DATA SHEET

TABLE I-1E

SUBJECT H_3 Levels (pCi/l) in Observation Wells DATE 4/25/80 SHEET

LOCATION OW-11

ENGINEER

Core Depth Feet	Core Description	H_3 pCi/l		Core Depth Feet	Core Description	H_3 pCi/l
0-1	sand & gravel	2010±140				
1-2	gravel	1450±120*				
2-3	sand, gravel, bedrock & quartz	1211±110				
3-4	sand, gravel & bedrock	1950±150				
4-5	gravel & sand	1020± 90				
5-5.8	gravel & clay	1460±110				
	*Cs-137 - .0654±.0280 pCi/gm					

DATA SHEET

TABLE I-1F

SUBJECT H_3 Levels (pCi/l) in Observation Wells

DATE 4/23,4/24/80 SHEET

LOCATION OW-12 (was 5 Ft. West of OW-17)

ENGINEER

Core Depth Feet	Core Description	H_3 pCi/l		Core Depth Feet	Core Description	H_3 pCi/l
0-1	small stones & sand	610± 90				
1-2	no sample	*				
2-3	small stones & sandy soil	*				
3-4	small stones	*				
4-5	gravel, sand & small stones	*				
5-7.5	gravel & small stones	*				
7.5-10.5	no sample	*				
10.5-11.5	small stones & sandy gravel	58C±100				
11.5-12.5	small stones & sandy gravel	340± 80				
13-14.1	fine to coarse sand & gravel	1280±140				
14.1-15	fine to coarse sand & gravel, some silt/clay	1010±110				
15-16	cobbles & sand	980±100				
18-20 A	clay, cobbles & sand	4230±260				
18-20 B	"	4140±240				
20-21.6 A	"	4530±280				
20-21.6 B	"	5900±360				
21.6-21.8	"	9550±580				
21.8-22.5A	"	7390±444				
21.8-22.5B	"	10100±600				
23.5-25.5	sand, stone & gravel	6080±360				
25.5-27	sand, rock & sandstone	5700±340				
27.5-27.6	"	3620±220				
	*-no water could be					
	extracted from					
	the sample for					
	tritium analysis.					

DATA SHEET

TABLE I-1G

SUBJECT H3 Levels (pCi/ℓ) in Observation Wells DATE 5/7/80 SHEET

LOCATION OW-13B

ENGINEER

Core Depth Feet	Core Description	H_3 pCi/l		Core Depth Feet	Core Description	H_3 pCi/l
0-1	Sand and Gravel	630 ± 90				
1-2	Sand, Gravel and Cobbel	780 ± 90				
2-3	Sand and Gravel	1240±100				
3-4	" " "	1030±100				
4-5	" " "	560±110				
5-7	" " "	1150±110				
7-9	Sand, Gravel and Clay	200 ± 80				
9-11	Sand and Gravel	250 ± 80				
11-13	" " "	490 ± 80				
13-15	Sand, Gravel and Clay	420 ± 90				
15-17	Sand and Gravel	420 ± 90				
17-19	" " "	640±110				
19-21	" " "	1020±100				
21-12	" " "	440 ± 80				
23-24.1	Sand, Gravel and Bedrock	530 ± 80				
24.1-25	Sand and Bedrock	590 ± 80				

3.1e

DATA SHEET

TABLE I-1H

SUBJECT H_3 Levels in Observation Wells DATE 4/30, 5/1 SHEET

LOCATION OW-14

ENGINEER

Core Depth Feet	Core Description	H_3 pCi/l		Core Depth Feet	Core Description	H_3 pCi/l
0-1	Sand, Cobbles and Gravel	1820±110				
1-2	Sand, Cobbles, Gravel and Clay	1240±100				
2-3	Clay, Sand and Gravel	780±100				
3-4	Sand and Gravel	910 ± 90				
4-5	Sand, Gravel and Quartz	1050±100				
5'-7'	"	550 ± 90				
7'-9'	Sand and Gravel	690±100				
9'-11'	Sandstone, Sand, Gravel and Quartz	650 ± 90				
11'-13'	Sand and Gravel	670 ± 80				
13'-15'	Sand, Gravel and Clay	590 ± 80				
15'-17'	Sand, Gravel and Clay	1610±160*				
17'-19'	Bedrock, Sand, Silt and Gravel	430±160				
19'-21'	Gravel and Sand	800 ± 80				
21'-23'	Quartz, Sand and Cobbles	700 ± 80				
23.5-25.5	Sand and Gravel	550 ± 80				
25.5-27.5	Sand and Gravel	2210±140				
27.5-29.5	Sand and Gravel	2270±150				
29.5-30.7	"	1450±120				

*Cs-134 - 142±0.5 pCi/gm

3.1f

DATA SHEET

TABLE I-11

SUBJECT H_3 Levels (pCi/l) in Observation Wells DATE 5/6/80 SHEET

LOCATION OW-15

ENGINEER

Core Depth Feet	Core Description	H_3 pCi/l		Core Depth Feet	Core Description	H_3 pCi/l
0-1	loam/silt fine sandy, clay-silt	350±100*				
1-2	same as 0-1' level	<130				
2-4	clay, silt	160± 80				
4-5	clay, silt	520± 90				
5-7	silt, sand & clay	<130				
7-9	trace clay, sand, gravel, mica & quartz	170± 80				
9-11	clay/sand	330± 90				
	*Cs-137 -.388±.070 pCi/g					

3.1g

DATA SHEET

TABLE I-1J

SUBJECT H_3 Levels (pCi/ℓ) in Observation DATE 4/29, 4/30 SHEET

LOCATION OW-17

ENGINEER

Core Depth Feet	Core Description	H_3 pCi/l		Core Depth Feet	Core Description	H_3 pCi/l
0-1	Gravel	1080±100				
1-2	Gravel	250± 70				
2-3	Fine Sand/Gravel	620± 80				
3-4	Sand/Gravel	420± 80				
4-5	" "	370±100				
5-7	" "	300± 80				
7-9	No Sample	-				
10-12	Sand/Gravel	350±100				
12-14	Loose Sand and Gravel	370± 80				
14-17	Sand/Gravel	510± 70				
17-20	No Sample	-				
20-22	Clay, Sand, Gravel and Cobbles	1630±150				
23-25	Sand, Gravel and Limestone	4180±260				
25-27	Sand, Gravel and Some Cobbles	4190±260				
27-28	Fine and Medium Sand, Some Gravel	3340±200				

Quality Assurance Program

During the period of April 11, 1980 through April 15, 1980 daily groundwater samples were obtained from the eight monitoring wells on Three Mile Island. A daily sample was also taken at a shallow pond located at the south end of the Island. On April 12, 1980 ten soil samples from the five and ten foot levels of boring holes located around the BWST were obtained. All of the groundwater, pond water and soil samples were then sent to four different laboratories for radiological analyses (gamma and tritium).

The four labs that analyzed the samples were Teledyne Isotopes (Westwood, NJ), Radiation Management Corporation (RMC-Philadelphia, PA), Oak Ridge (Oak Ridge, TN) and Tennessee Valley Authority (TVA-Muscle Shoals, AL). The reported results are listed on the following tables.

The four laboratories also participated in a special Environmental Protection Agency (EPA) tritium cross-check program and returned their findings to the EPA. The results are listed in this section.

TABLE I-7

EPA TRITIUM CROSS-CHECK RESULTS

Date:

Sample: Tritium

Know-Value = 1500 pCi/ℓ

Expected Laboratory Precision (1S, 1 Determination) = 336 pCi

Lab	Result	Experimental Sigma	RNG ANLY ($\bar{R}$ + Sr)	Average	Normalized Deviation (Grand-Avg)	(Known)
RMC	1560					
	1500					
	1530	30	.11	1530	.3	.2
TVA	1680					
	1490					
	1670	107	.33	1613	.8	.6
TI	1500					
	1430					
	1480	36	.12	1470	.0	-2
OR	1200					
	1000	141	.53	1100	-1.5	-1.7

T = Teledyne
RMC = RMC
OR = Oak Ridge
TVA = TVA

TABLE I-8
H_3 Analysis
pCi/liter

Date/lab	1 MW1	2 MW2	3 MW3	4 MW4	5 MW5	6 MW6	7 MW7	8 MW8	9 Pond	10	11	12	13
4/11 T[1]	210±80	1010±110	700± 80	320±80	120±70	320±80	240±80	1060±100	190±70				
RMC[2]	<300.0	770±200	560±190	<300.0	<300.0	<300.0	<300.0	690±200	<250				
OR[3]	870 200	1300 300	1000 300	860 200	980 200	1400 200	1100 200	1400 200					
TVA[4]	178±57	922±79	388±78	252± 59	160±57	301± 60	436± 60	885± 74	172±55				
5													
4/12 T[6]	100	920± 80	720±100	350±80	260±70	400±80	270±80	1020±100	<100				
RMC[7]	<250	810±180	600±170	<250	<250	<250	300±160	710±200	<300				
OR[8]	400±200	1900±500	1700±400	610±200	520±200	720±200	1800±400	1600±400					
TVA[9]	135±56	774± 74	644±70	292±70	169±74	356± 61	393± 63	793± 75	123±54				
10													
4/13 T[11]	150±70	980±110	690± 90	270±80	330±100	530±80	380±80	790±100	100±80				
RMC[12]	<300	580±200	440±190	<300	<250	290±160	330±160	810±170	<250				
OR[13]	440±200	1700±400	1800±300	340±320	500±200	590±200	1600±400	1700±400					
TVA[14]	252±59	860± 77	449± 63	264± 59	188±75	295±61	350±62	860±78	85±73				
15													
4/14 T[16]	170±70	1010±100	590± 70	320±80	230±70	430±80	480±80	860±100	90±80				
RMC[17]	<250	840±170	640±160	<250	<250	<250	250±160	620±160	<290				
OR[18]	1400±200	1500±400	1200±300	950±200	880±200	1100±200	1700±300	1200±300					
TVA[19]	179±75	988±97	559±68	348±78	129±58	264±60	292±77	682±72	179±75				
20													
4/15 T[21]	290±70	610± 80	1040±100	290±70	210±70	370±80	300±60	570± 90	110±80				
RMC[22]	<290	550±190	520±190	<290	<250	340±160	300±160	700±170	<250				
OR[23]	750±200	1500±300	1400±300	810±200	1100±200	1100±200	1000±300	1400±400					
TVA[24]	178±57	837±92	455±65	442±81	188±75	292±77	292±77	827±92	104±73				
25													
26													
27													
28													
29													
30													
31													

TABLE I-9

Task 11C TMI Environmental Samples, Results in pCi/ml

Sample	Code	Date	^{3}H	^{58}Co	^{60}Co	^{137}Cs
Ground water	MW-1	4/15	0.75±0.2	<0.002	<0.002	<0.002
Ground water	MW-2	4/15	1.5 ±0.3	<0.002	<0.003	<0.003
Ground water	MW-3	4/15	1.4 ±0.3	<0.002	<0.003	<0.003
Ground water	MW-4	4/15	0.81±0.2	<0.001	<0.002	<0.001
Ground water	MW-5	4/15	1.1 ±0.2	<0.002	<0.003	<0.002
Ground water	MW-6	4/15	1.1 ±0.2	<0.001	<0.002	<0.001
Ground water	MW-7	4/15	1.0 ±0.3	<0.003	<0.003	<0.003
Ground water	MW-8	4/15	1.4 ±0.4	<0.003	<0.003	<0.003
Pond water		4/15	0.64±0.2	<0.001	<0.003	<0.003
Ground water	MW-1	4/14	1.4 ±0.2	<0.003	<0.004	<0.004
Ground water	MW-2	4/14	1.5 ±0.4	<0.003	<0.003	<0.003
Ground water	MW-3	4/14	1.2 ±0.3	<0.003	<0.003	<0.003
Ground water	MW-4	4/14	0.95±0.2	<0.003	<0.003	<0.003
Ground water	MW-5	4/14	0.88±0.2	<0.003	<0.003	<0.003
Ground water	MW-6	4/14	1.1 ±0.2	<0.003	<0.003	<0.003
Ground water	MW-7	4/14	1.7 ±0.3	<0.003	<0.003	<0.003
Ground water	MW-8	4/14	1.2 ±0.3	<0.002	<0.003	<0.003
Pond water		4/14	0.58±0.2	<0.002	<0.002	<0.002
Ground water	MW-1	4/13	0.44±0.2	<0.004	<0.003	<0.003
Ground water	MW-2	4/13	1.7 ±0.4	<0.003	<0.003	<0.003
Ground water	MW-3	4/13	1.8 ±0.3	<0.003	<0.003	<0.003
Ground water	MW-4	4/13	0.34±0.32	<0.003	<0.003	<0.003
Ground water	MW-5	4/13	0.50±0.2	<0.004	<0.003	<0.003
Ground water	MW-6	4/13	0.59±0.2	<0.003	<0.003	<0.003
Ground water	MW-7	4/13	1.6 ±0.4	<0.003	<0.002	<0.003
Ground water	MW-8	4/13	1.7 ±0.4	<0.003	<0.002	<0.003
Pond water		4/13	0.55±0.2	<0.003	<0.002	<0.003
Ground water	MW-1	4/12	0.4 ±0.2	<0.003	<0.002	<0.003
Ground water	MW-2	4/12	1.9 ±0.5	<0.003	<0.002	<0.003
Ground water	MW-3	4/12	1.7 ±0.4	<0.003	<0.002	<0.003
Ground water	MW-4	4/12	0.61±0.2	<0.003	<0.002	<0.003
Ground water	MW-5	4/12	0.52±0.2	<0.003	<0.002	<0.003
Ground water	MW-6	4/12	0.72±0.2	<0.003	<0.002	<0.003
Ground water	MW-7	4/12	1.8 ±0.4	<0.003	<0.002	<0.003
Ground water	MW-8	4/12	1.6 ±0.4	<0.003	<0.002	<0.003
Pond water		4/12	0.71±0.2	<0.003	<0.002	<0.003
Ground water	MW-1	4/11	0.87±0.2	<0.003	<0.002	<0.003
Ground water	MW-2	4/11	1.3 ±0.3	<0.003	<0.002	<0.003
Ground water	MW-3	4/11	1.0 ±0.3	<0.003	<0.002	<0.003
Ground water	MW-4	4/11	0.86±0.2	<0.003	<0.002	<0.003
Ground water	MW-5	4/11	0.98±0.2	<0.003	<0.002	<0.003
Ground water	MW-6	4/11	1.4 ±0.2	<0.003	<0.002	<0.003
Ground water	MW-7	4/11	1.1 ±0.2	<0.003	<0.002	<0.003
Ground water	MW-8	4/11	1.4 ±0.2	<0.003	<0.002	<0.003
Pond water		4/11	1.2 ±0.2	<0.003	<0.002	<0.002
EMSL-LV-A			1.9 ±0.3			
EMSL-LV-B			1.6 ±0.3			
Bkgd.			0.52±0.23			

TABLE I-10

TENNESSEE VALLEY AUTHORITY
Radioanalytical Laboratory

TMI - Water Samples - Gamma Analysis Results (pCi/L)

		Bi-214	Pb-212	Pb-214	K-40	Co-58
MW1	4/11/80	82 ± 5		74 ± 5		
MW2	4/11/80	69 ± 4	3 ± 2	57 ± 4	95 ± 18	
MW3	4/11/80	54 ± 3	11 ± 2	54 ± 4		
MW4	4/11/80	23 ± 3	6 ± 2	21 ± 3	121 ± 18	
MW5	4/11/80	42 ± 3	11 ± 2	39 ± 3		
MW6	4/11/80	36 ± 3		33 ± 4	78 ± 18	
MW7	4/11/80	44 ± 3	10 ± 3	34 ± 3		
MW8	4/11/80	33 ± 4	4 ± 2	33 ± 4		
Pond	4/11/80	22 ± 3	9 ± 3	10 ± 3		
MW1	4/12/80	42 ± 3	13 ± 3	35 ± 3		
MW2	4/12/80	36 ± 3		15 ± 4	72 ± 25	
MW3	4/12/80	23 ± 3		25 ± 3		
MW4	4/12/80	55 ± 4	7 ± 3	39 ± 3		
MW5	4/12/80	40 ± 4		35 ± 4		
MW6	4/12/80	38 ± 4		32 ± 3		
MW7	4/12/80	48 ± 4		40 ± 4	72 ± 18	
MW8	4/12/80	25 ± 3		28 ± 3		
Pond	4/12/80	14 ± 3	15 ± 3			
MW1	4/13/80	39 ± 4		32 ± 4		
*MW2	4/13/80	22 ± 1	11 ± 1	12 ± 2	59 ± 6	1.2 ± 0.8
MW3	4/13/80	16 ± 3		17 ± 3		
MW4	4/13/80	12 ± 2		14 ± 3		
MW5	4/13/80	21 ± 3	12 ± 3	24 ± 4		
MW6	4/13/80	13 ± 3		17 ± 3	151 ± 19	
MW7	4/13/80	20 ± 3		16 ± 3		
MW8	4/13/80	25 ± 3	6 ± 2	20 ± 3		
Pond	4/13/80	16 ± 3		15 ± 3		
MW1	4/14/80	35 ± 3	8 ± 3	29 ± 3		
MW2	4/14/80	23 ± 3			55 ± 11	
MW3	4/14/80	25 ± 3		19 ± 3		
MW4	4/14/80	16 ± 3		15 ± 3		
MW5	4/14/80	17 ± 3	5 ± 2	15 ± 3		
MW6	4/14/80	15 ± 3		10 ± 3	172 ± 21	
MW7	4/14/80	13 ± 3	9 ± 2	13 ± 3		
MW8	4/14/80	23 ± 3	7 ± 2	19 ± 3	76 ± 18	
Pond	4/14/80	7 ± 3			99 ± 16	

TABLE I-10 (cont'd)

TENNESSEE VALLEY AUTHORITY
Radioanalytical Laboratory

TMI - Water Samples - Gamma Analysis Results (pCi/L)

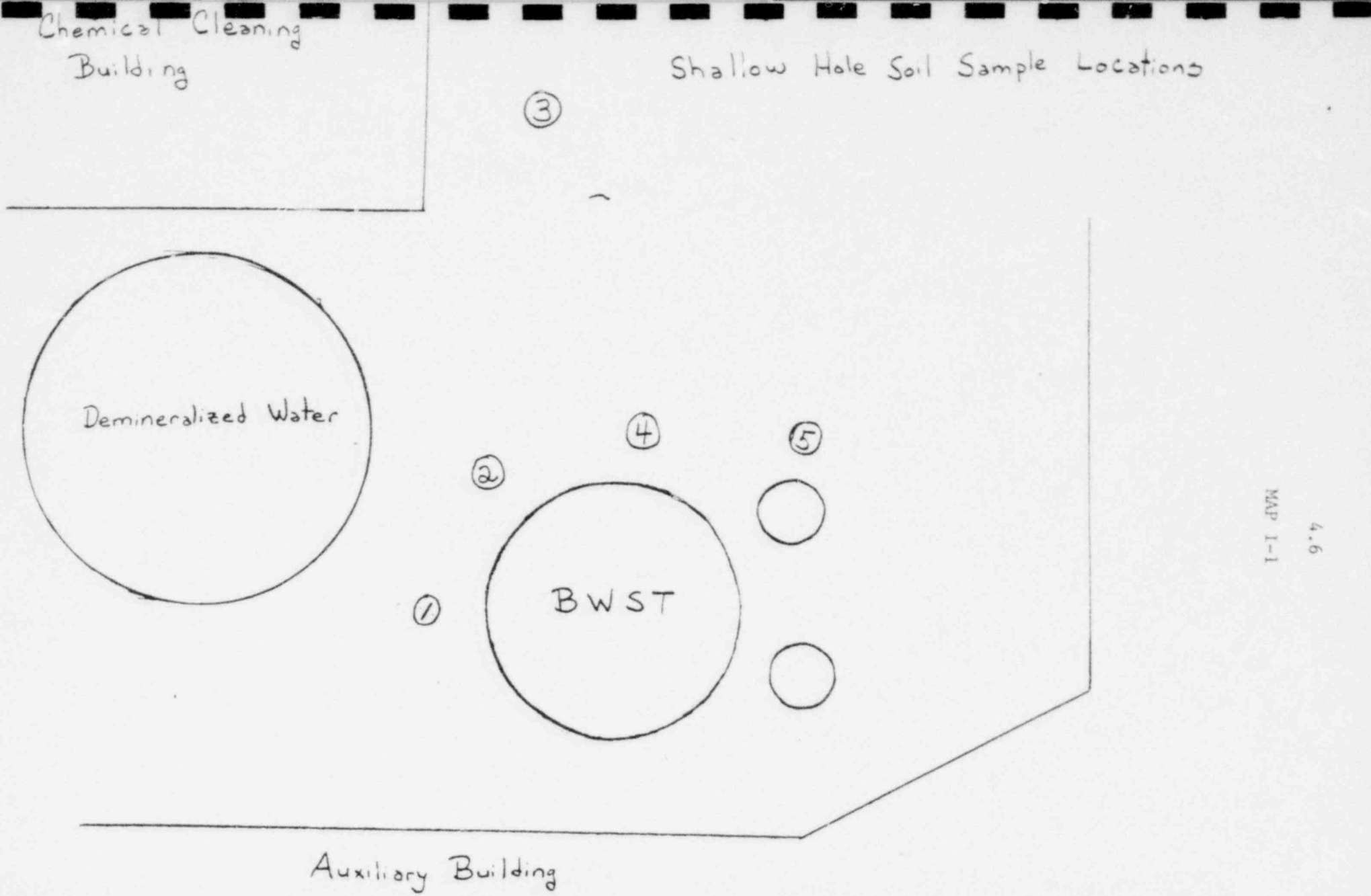
		Bi-214	PB-212	PB-214	K-40	Co-58
MW1	4/15/80	27 ± 3	7 ± 3	22 ± 3		
*MW2	4/15/80	24 ± 2	8 ± 2	18 ± 2	49 ± 8	1.1 ± 1.2
MW3	4/15/80	32 ± 3	10 ± 3	22 ± 3	40 ± 13	
MW4	4/15/80	25 ± 3	8 ± 3	15 ± 3		
MW5	4/15/80	15 ± 4		11 ± 4	102 ± 16	
MW6	4/15/80	10 ± 3			140 ± 23	
MW7	4/15/80	18 ± 3	8 ± 2	16 ± 3		
MW8	4/15/80	16 ± 3		11 ± 2	109 ± 17	
Pond	4/15/80	17 ± 3	9 ± 2	13 ± 3		

Error Term = 1 standard deviation; LLD values may be found in Procedure QC-100 of our laboratory manual.

3.5L of sample was placed in a 3.5L Marinelli beaker and counted for eight hours. Nuclide identification and quantification was performed by ND4420 software. Samples were not filtered prior to analysis. Either a 14 percent, 16 percent, or 27 percent Ge(Li) detector was used for the analysis.

*These samples were counted for 24-36 hours on a 27 percent Ge(Li) detector.

No other radionuclideswere detected in the sample.


Chemical Cleaning Building
Shallow Hole Soil Sample Locations
③
Demineralized Water
④
⑤
②
①
BWST
Auxiliary Building
N

MAP I-1

TABLE I-11

REPORT OF ANALYSIS FROM TELEDYNE ON SOIL SAMPLES
TAKEN NEAR BWST ON APRIL 12, 1980

I. All gamma scans were normal.

II. Tritium Results:

Location of Sample	Depth (Feet)	H_3 (pCi/l)
BWST 1	5	250± 80
	10	100± 90
BWST 2	5	330± 80
	10	160± 90
BWST 3	5	250±110
	8	220± 70
BWST 4	5	160± 80
	10	210±110
BWST 5	5	220± 80
	10	290± 90

TABLE I-12

Reference 1
Task 11C TMI Environmental Samples, Results in pCi/g

Sample Code	Level	Date	^{3}H	^{137}Cs	^{58}Co	^{60}Co
Soil sample #1	~ 5 ft	4/12	<3	<0.01	<0.01	<0.02
Soil sample #2	5 ft	4/12	<3	<0.01	<0.01	<0.02
Soil sample #3	5 ft	4/12	<3	<0.01	<0.01	<0.02
Soil sample #4	~ 5 ft	4/12	<3	<0.01	<0.01	<0.01
Soil sample #5	5 ft	4/12	<3	<0.01	<0.01	<0.01
Soil sample #1	~10 ft	4/12	1+3	<0.01	<0.01	<0.02
Soil sample #2	10 ft	4/12	1+3	<0.01	<0.01	<0.02
Soil sample #3	8 ft	4/12	<3	<0.01	<0.01	<0.02
Soil Sample #4	10 ft	4/12	<3	<0.01	<0.01	<0.02
Soil sample #5	10 ft	4/12	<3	<0.01	<0.01	<0.02

Chemical Analyses of Groundwater

During the spring of 1980, a series of chenical analyses were performed on the groundwater samples from the monitoring wells, and the pond at the south end of Three Mile Island. The results of the tests performed by Princeton Testing Laboratory (Princeton, NJ) and Gilbert/Commonwealth (Reading, PA) are listed on the following pages.

TABLE I-13

Reference 2

TENNESSEE VALLEY AUTHORITY
Radioanalytical Laboratory

TMI - Soil Samples - Gamma Analysis Results (pCi/g-dry)

	BWST #1 @10 ft	BWST #1 @5 ft	BWST #3 @8 ft	BWST #4 @5 ft	BWST #5 @10 ft	BWST #1 @5 ft	BWST #2 @10 ft	BWST #3 @5 ft	BWST #4 @10 ft	BWST #5 @5 ft
Ac-228	0.74 ± .03	0.61 ± .04	0.80 ± .03	0.64 ± .03	0.72 ± .04	0.79 ± .03	0.77 ± .03	0.66 ± .03	0.74 ± .03	0.80 ± .04
Bi-212	0.50 ± .05	0.54 ± .05	0.50 ± .04	0.43 ± .05	0.46 ± .05	0.42 ± .04	0.40 ± .05	0.44 ± .04	0.57 ± .04	0.58 ± .05
Bi-214	0.55 ± .02	0.55 ± .02	0.63 ± .02	0.55 ± .02	0.59 ± .02	0.65 ± .02	0.66 ± .02	0.54 ± .02	0.60 ± .02	0.65 ± .02
K-40	9.63 ± .20	9.89 ± .22	11.66 ± .17	9.23 ± .20	10.45 ± .22	10.05 ± .16	10.73 ± .22	10.15 ± .21	10.75 ± .16	10.92 ± .22
Pb-212	0.68 ± .01	0.58 ± .01	0.82 ± .01	0.64 ± .01	0.79 ± .01	0.78 ± .01	0.74 ± .01	0.68 ± .01	0.76 ± .01	0.80 ± .01
Pb-214	0.57 ± .02	0.54 ± .02	0.64 ± .01	0.57 ± .02	0.59 ± .02	0.68 ± .01	0.66 ± .02	0.59 ± .02	0.66 ± .01	0.65 ± .02
Ra-226	0.55 ± .02	0.55 ± .02	0.63 ± .02	0.55 ± .02	0.59 ± .02	0.65 ± .02	0.66 ± .02	0.54 ± .02	0.60 ± .02	0.65 ± .02
Tl-208	0.24 ± .01	0.22 ± .01	0.27 ± .01	0.22 ± .01	0.24 ± .01	0.24 ± .01	0.24 ± .01	0.22 ± .01	0.24 ± .01	0.27 ± .01
Cs-137	0.03 ± .01	0.01 ± .01	ND	0.02 ± .01	ND	ND	ND	0.01 ± .01	0.02 ± .01	ND

Error Term = 1 standard deviation; LLD values may be found in Procedure QC-100 of our laboratory manual.

600 gram of sample was placed in a 0.5 L Marinelli beaker and counted for eight hours. Nuclide identification and quantification was performed by ND4420 software. Samples were dried and hand ground prior to analysis. Either 14 percent, 16 percent, or 27 percent Ge(Li) detector was for used for the analysis.

ND - not detected.

TABLE I-14

ACID EXTRACTABLES, PESTICIDES AND PCB's

Components	MW-1	MW-2	MW-4	MW-5	MW-6	MW-7	MW-8	Por
	Concentration, ug/l							
2-Chlorophenol	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 I
4-Nitrophenol	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 I
Phenol	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 I
2,4-Dimethylphenol	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 I
2,4-Dichlorophenol	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 11 I
2,4,6-Trichlorophenol	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 I
4-Chloro-3-methylphenol	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 I
2,4-Dinitorphenol	< 15 ND	< 15 ND	< 15 ND	< 15 ND	< 15 ND	< 15 ND	< 15 ND	< 15 I
2-Methyl-4,6-dinitrophenol	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 I
Pentachlorophenol	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 I
4-Nitrophenol	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 I
Aldrin	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 I
a-BHC	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 I
b-BHC	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 I
d-BHC	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 I
g-BHC	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 I
Chlordane	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 I
4,4'DDD	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 I
4,4'DDE	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 I
4,4'DDT	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 I
Dieldrin	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 I
Endosulfan I	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 I
Endosulfan II	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 I
Endosulfan Sulfate	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 I
Endrin	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 I
Endrin Aldehyde	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 I
Heptachlor	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 I
Heptachlor epoxide	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 I
Toxaphene	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 I
PCB 1016	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 I
PCB 1221	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 I
PCB 1232	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 I
PCB 1242	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 I
PCB 1248	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 I
PCB 1254	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 I
PCB 1260	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 I

TABLE T-15

VOLATILE ORGANICS

Components	MW-1*	MW-2*	MW-4*	MW-5	MW-6	MW-7	MW-8	Pond
	Concentration, ug/l							
hylene Chloride	<5 ND	< 5 ND	<5 ND	< 5 ND	<5 ND	< 5 ND	< 5 ND	< 5 ND
-Dichloroethene	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND
-Dichloroethane	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND
ns-1,2-Dichloroethene	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND
hloroform	<5 ND	< 5 ND	<5 ND	< 5 ND	<5 ND	< 5 ND	< 5 ND	< 5 ND
-Dichloroethane	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND
,1,1-Trichloroethane	< 2 ND	< 2 ND	< ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND
bon Tetrachloride	<5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND
omodichloromethane	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND
-Dichloropropane	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND
ns-1,3-Dichloropropene	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND
richloroethene	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND
romochloromethane	<5 ND	< 5 ND	<5 ND	< 5 ND	<5 ND	< 5 ND	< 5 ND	< 5 ND
is-1,3-dichloropropene	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND
,2-Trichloroethane	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND
enzene	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND
hloroethylvinyl ether	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND
omoform	<7 ND	< 7 ND	<7 ND	< 7 ND	<7 ND	< 7 ND	< 7 ND	< 7 ND
rachloroethene	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND
,2,2,-Tetrachloroethane	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND
oluene	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND
orobenzene	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND
thylbenzene	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND

Note * - Tetrahydrofuran detected.

TABLE I-16

BASE/NEUTRAL EXTRACTABLES

Components	MW-1	MW-2	MW-4	MW-5	MW-6	MW-7	MW-8	Pond
	Concentration, ug/l							
1,3-Dichlorobenzene	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 NI
1,4-Dichlorobenzene	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 NI
Hexachloroethane	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 NI
Bis(2-chloroethyl) ether	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 NI
1,2-Dichlorobenzene	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 NI
Bis(2-chloroisopropyl) ether *	ND	ND	ND	ND	ND	ND	ND	NI
N-Nitrosodipropylamine *	ND	ND	ND	ND	ND	ND	ND	NI
Isophorone	< 15 ND	< 15 ND	<15 ND	<15 ND	< 15 ND	<15 ND	<15 ND	< 15 NI
Nitrobenzene	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 NI
Hexachlorobutadiene	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 NI
1,2,4-Trichlorobenzene	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 NI
Bis(2-Chloroethoxy) Methane	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 NI
Hexachlorocyclopentadiene	< 10 ND	< 10 ND	<10 ND	<10 ND	< 10 ND	<10 ND	<10 ND	< 10 NI
Dimethylphthalate	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 NI
2,6-Dinitrotoluene	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 NI
4-Chlorophenyl phenyl ether	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 NI
2,4-Dinitrotoluene	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 NI
1,2-Diphenylhydrazine	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 NI
Diethyl Phthalate	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 NI
N-Nitrosodiphenylamine *	ND	ND	ND	ND	ND	ND	ND	NI
Hexachlorobenzene	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 NI
4-Bromophenyl phenyl ether	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 NI
Benzidine	< 10 ND	< 10 ND	<10 ND	<10 ND	< 10 ND	<10 ND	<10 ND	< 10 NI
Butyl Benzyl Phthalate	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 NI
Bis(2-ethylhexyl) phthalate	< 10 ND	< 10 ND	<10 ND	<10 ND	< 10 ND	<10 ND	<10 ND	< 10 NI
Dioctyl phthalate	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 NI

Note * - Component not detected . Detection limits have not been conclusively defined.

BASE/NEUTRAL EXTRACTABLES

Components	MW-1	MW-2	MW-4	MW-5	MW-6	MW-7	MW-8	Pond
	Concentration, ug/l							
,3-Dichlorobenzene	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND
-Dichlorobenzene	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND
exachloroethane	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND
(2-chloroethyl) ether	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND
,2-Dichlorobenzene	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND
(2-chloroisopropyl) ether *	ND	ND	ND	ND	ND	ND	ND	ND
Nitrosodipropylamine *	ND	ND	ND	ND	ND	ND	ND	ND
phorone	< 15 ND	< 15 ND	< 15 ND	< 15 ND	< 15 ND	< 15 ND	< 15 ND	< 15 ND
robenzene	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND
exachlorobutadiene	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND
,4-Trichlorobenzene	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND
is(2-Chloroethoxy) Methane	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND
achlorocyclopentadiene	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND
imethylphthalate	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND
-Dinitrotoluene	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND
-Chlorophenyl phenyl ether	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND
-Dinitrotoluene	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND	< 2 ND
,2-Diphenylhydrazine	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND
thyl Phthalate	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND
itrosodiphenylamine *	ND	ND	ND	ND	ND	ND	ND	ND
exachlorobenzene	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND
romophenyl phenyl ether	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND	< 1 ND
enzidine	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND
yl Benzyl Phthalate	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND
is(2-ethylhexyl) phthalate	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND	< 10 ND
tyl phthalate	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND	< 5 ND

Note * - Component not detected . Detection limits have not been conclusively defined.

TABLE I-17

Component	MW-3
	ug/l
2-Chlorophenol	< 1 ND
2-Nitrophenol	< 2 ND
Phenol	< 1 ND
2,4-Dimethylphenol	< 1 ND
2,4-Dichlorophenol	< 1 ND
2,4,6-Trichlorophenol	< 1 ND
4-Chloro-3-methylphenol	< 1 ND
2,4-Dinitrophenol	< 15 ND
2-Methyl-4,6-dinitrophenol	< 2 ND
Pentachlorophenol	< 1 ND
4-Nitrophenol	< 10 ND

TABLE I-18

VOLATILE ORGANICS

Components	MW-3 *
	Concentration, ug/l
Methylene Chloride	< 5 ND
1,1-Dichloroethene	< 2 ND
1,1,-Dichloroethane	< 2 ND
Trans-1,2-Dichloroethene	< 2 ND
Chloroform	< 5 ND
1,2-Dichloroethane	< 2 ND
1,1,1-Trichloroethane	< 2 ND
Carbon Tetrachloride	< 5 ND
Bromodichloromethane	< 2 ND
1,2-Dichloropropane	< 2 ND
Trans-1,3-Dichloropropene	< 2 ND
Trichloroethene	< 2 ND
Dibromochloromethane	< 5 ND
cis-1,3-Dichloropropene	< 2 ND
1,1,2-Trichloroethane	< 2 ND
Benzene	< 2 ND
2-Chloroethylvinyl ether	< 2 ND
Bromoform	< 7 ND
Tetrachloroethene	< 2 ND
1,1,2,2-Tetrachloroethane	< 2 ND
Toluene	< 2 ND
Chlorobenzene	< 2 ND
Ethylbenzene	< 2 ND

Note * - Tetrahydrofuran detected

TABLE I-19

PESTICIDES AND PCB's

Components	MW-3
	Concentration, ug/l
Aldrin	< 1 ND
a-BHC	< 1 ND
b-BHC	< 1 ND
d-BHC	< 1 ND
g-BHC	< 1 ND
Chlrodane	< 10 ND
4,4'DDD	< 1 ND
4,4'DDE	< 1 ND
4,4'DDT	< 1 ND
Dieldrin	< 1 ND
Endosulfan I	< 1 ND
Endosulfan II	< 1 ND
Endosulfan Sulfate	< 1 ND
Endrin	< 1 ND
Endrin Aldehyde	< 1 ND
Heptachlor	< 1 ND
Heptachlor epoxide	< 1 ND
Toxaphene	< 10 ND
PCB 1016	< 10 ND
PCB 1221	< 10 ND
PCB 1232	< 10 ND
PCB 1242	< 10 ND
PCB 1248	< 10 ND
PCB 1254	< 10 ND
PCB 1260	< 10 ND

TABLE I-20

BASE/NEUTRAL EXTRACTABLES

Components	MW-3 Concentration, ug/l
1,3-Dichlorobenzene	< 1 ND
1,4-Dichlorobenzene	< 1 ND
Hexachloroethane	< 1 ND
Bix(2-Chloroethyl) ether	< 5 ND
1,2-Dichlorobenzene	< 1 ND
N-Nitrosodipropylamine	< 5 ND
Isophorone	< 15 ND
Nitrobenzene	< 2 ND
Hexachlorobutadiene	< 1 ND
1,2,4-Trichlorobenzene	< 1 ND
Bis(2-Chloroethoxy) Methane	< 5 ND
Hexachlorocyclopentadiene	< 10 ND
Dimethylphthalate	< 1 ND
2,6-Dinitrotoluene	< 2 ND
4-Chlorophenyl phenyl ether	< 1 ND
2,4-Dinitrotoluene	< 2 ND
1,2-Diphenylhydrazine	< 1 ND
Diethyl Phthalate	< 15 ND
N-Nitrosodiphenylamine	ND
Hexachlorobenzene	< 1 ND
4-Bromophenyl phenyl ether	< 1 ND
Benzidine	< 10 ND
Butyl Benzyl Phthalate	< 10 ND
Bis(2-ethylhexyl) phthalate	< 10 ND
Doctyl phthalate	< 10 ND

TABLE I-21

TOTAL ORGANIC CARBON AND TOTAL CARBON ANALYSES

	MW-3	MW-6
	mg/l	
Total Carbon	280	101
Total Organic Carbon	43	7

TABLE I-22

SEMI-QUANTITATIVE SPECTROGRAPHIC ANALYSIS

mg/liter	MW-3
1390-139	Ca, Na
139-14	Mg, Si, Al
14 - 1.4	B, Fe
1.4 - .14	P, Mn, Mo, V, Ag, Ti
.14 - .014	Ba, Pb, Cr, Ni, Cu
.014 - .0014	Ga,
< .0014	Be

Not detected at the levels reported below

< 1.4	Hg
< .14	As, Te, Tl, Li, Cd, Zn, Sr, Co
< .014	Sb, Sn, In, Bi, Nb, Zr
< .0014	Ge

Total Solids = 1390 mg/liter

TABLE I-23

SEMI-QUANTITATIVE SPECTROGRAPHIC ANALYSIS

mg/liter	MW-6
1070 - 107	Ca
107 - 11	Mg,Si,Al,Na
11 - 1.1	Fe
1.1 - .11	Ba,Mn,Zn,Ti,Sr
.11 - .011	B,Pb,Ni,Mo,V,Cu,Ag,Co,Zr
.011 - .0011	Cr,Sn,Ga
< .0011	---

Not detected at the levels reported below:

< 1.1	Hg
< .11	As,Te,P,Tl,Li,Cd
< .011	Sb,In,Bi,Nb
< .0011	Be,Ge

Total Solids = 1070 mg/liter

Gilbert/Commonwealth Groundwater Results[4]

TABLE I-24

Code	Well Number	Date Sampled
316875	3	March 27, 1980
316880	3	March 28, 1980
316991	1	April 3, 1980
316992	3	April 3, 1980
316993	5	April 3, 1980
316994	8	April 3, 1980

TABLE I-25

Code	Well Number	
316875	3	
	TESTS	VALUE
	BOD-5 Day	3.9 mg/ℓ
	Total Coliforms	2 per 100 ml
316880	3	
	Iron, Total	7.20mg/ℓ
	pH	9.6
	Total Organic Carbon	9.6 mg/ℓ

TABLE I-25
(cont'd)

GAI Lab. No.		316991	316992	316993	316994
Alkalinity, M.O.	mg/l $CaCO_3$	167	808	185	345
Alkalinity, P.	mg/l $CaCO_3$	-	188	-	-
Aluminum	mg/l Al	0.88	8.82	0.15	3.09
Antimony	mg/l Sb	<0.13	<0.13	<0.13	<0.13
BOD-5 Day	mg/l	2.6	6.4	0.6	3.5
Boron	mg/l Bo	0.10	0.10	0.10	0.10
COD	mg/l	40.24	129.21	2.39	35.86
Chloride	mg/l Cl^-	23	12	16	9
Chromium, Total	mg/l Cr	<0.03	<0.03	<0.03	<0.03
Conductivity	µmho/cm	436	964	452	545
Copper	mg/l Cu	<0.02	0.04	<0.02	<0.02
Cobalt	mg/l Co	<0.13	0.19	<0.13	<0 13
Dissolved Oxygen	mg/l	5.9	7.7	7.1	4.4
Hardness, Total	mg/l $CaCO_3$	278	54	334	402
Iron, Total	mg/l Fe	0.94	6.03	0.08	4.38
Manganese	mg/l Mn	1.44	0.42	0.12	6.71
Nickel	mg/l Ni	0.05	0.06	0.03	0.05
Nitrogen, Kjeldahl	mg/l N	3.73	3.27	0.46	2.15
pH		6.47	9.91	7.47	7.05
Phosphorus, Total	mg/l P	0.04	4.16	0.04	0.01
Residue, Total	mg/l @ 105°C	420	13400	459	534
Residue, Diss.	mg/l @ 105°C	391	1120	457	479
Residue, Susp.	mg/l	20	164	6	46
Silica, Soluble	mg/l SiO_2	13.6	3.5	10.2	11.0
Sulfate	mg/l SO_4^-	0.35	0.15	0.14	0.10
TOC	mg/l	20.8	26.8	5.8	21.6
Zinc	mg/l Zn	3.65	0.73	0.08	1.92
Titanium	mg/l Ti	<0.40	0.78	<0.40	<0.40
Lead	mg/l Pb	<0.1	<0.1	<0.1	<0.1
Solvent Extract.	mg/l	0.2	16.0	<0.2	<0.2
Total Coliforms	per 100 ml	1600	23	240	≤2400

Sample Source		MW 1	MW 3	MW 5	MW 8	River Gate 19
Date Sampled		4-9-80	4-9-80	4-9-80	4-9-80	4-9-80
GAI Lab. No.		317038	317039	317040	317041	317042
Total Coliforms	per 100 ml	≥ 2400	170	49	≥ 2400	920
Fecal Coliforms	per 100 ml	< 2	<2	< 2	< 2	350

TABLE I-26

ANALYSIS OF PRECIPITATE OF MW-3 (%)

LOI - 60.94

SiO_2 - 20.21

Al_2O_3 - 8.92

Fe_2O_3 - 4.14

REFERENCES

1. Letter from Dr. J. Carter, Oak Ridge Laboratory, Oak Ridge, Tenn. to Dr. G. G. Baker, TMI Environmental Controls, Middletown, PA September, 1980.

2. Letter from Mr. L. G. Kanipe, TVA, Muscle Shoals, AL, to Mr. W. E. Riethle, Manager, Environmental Controls TMI, Middletown, PA May 6, 1980.

3. Letter From Dr. G. Dennison, Princeton Testing Laboratory, Princeton, NJ, to Dr. G. G. Baker, TMI Environmental Controls, Middletwon, PA June 11, 1980.

4. Letter from Mr. T. M. Isert, GAI, Reading, PA, to Mr. J. C. DeVine, TMI Recovery Engineering, Middletown, PA April 29, 1980.