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RMC-TR-77-01

RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

For The

THREE MILE ISLAND NUCLEAR STATION

1976 ANNUAL REPORT

JANUARY 1 THROUGH DECEMBER 31

Prepared for

METROPOLITAN EDISON COMPANY

By

RADIATION MANAGEMENT CORPORATION

MARCH 1977

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SUMMARY

During the period January 1 through December 31, 1976, Radiation Management Corporation (RMC) participated in the operational radiological environmental monitoring program (REMP) conducted by Metropolitan Edison Company at Three Mile Island Nuclear Station (TMINS).

The RMC portion of this program was designed to aid in meeting the obligations of the Environmental Technical Specifications (ETS) for TMINS Unit #1 (TMI-1) (1) and the Preoperational Requirements for TMINS Unit #2 (TMI-2).

A total of 1381 analyses were performed on 959 samples during the period covered by this report. These samples were taken from the aquatic, atmospheric and terrestrial environments and included direct radiation measurements. Additional samples and analyses beyond those required by the environmental technical specifications were performed as noted in the data tables of Appendix B.

Surface water (6 locations, 72 samples) was analyzed for gamma emitting nuclides while quarterly composites (24) were analyzed for H-3. Untreated drinking water (3 locations, 12 samples) was analyzed for H-3, Sr-89, Sr-90 and gamma emitting nuclides. Fish (2 locations, 8 samples) and sediment (3 locations, 6 samples) were also taken from the aquatic environment and analyzed for Sr-89, Sr-90 and gamma emitting nuclides. No aquatic plant samples were available during this period.

The atmospheric environment sampling program included air particulates, air iodine, and precipitation. Air particulates (9 locations, 482 samples) were analyzed for gross beta activity and gamma emitting nuclides. Charcoal cartridges (4 locations, 206 samples) were analyzed for I-131. Precipitation, primarily rain water, (4 locations, 48 samples) was analyzed for gross beta activity, H-3, Sr-89, Sr-90, and gamma emitting nuclides.

Milk (5 locations, 45 samples) was taken from the terrestrial environment and analyzed for I-131, Sr-89, Sr-90. Two goat's milk samples were taken and analyzed for I-131. In accordance with environmental technical specifications, an update on the milking animal census was performed during this period. A distribution of 1082 milking cows at 32 locations was determined, an increase of 38 cows since September 1975. No dairy operations, closer to TMINS than those already being sampled, were found. Green leafy vegetables (4 locations, 4 samples), fruit (2 locations, 4 samples), meat and game (4 locations, 4 samples), and alfalfa (2 locations, 2 samples) were taken and analyzed for gamma emitting nuclides.

In addition, 312 analyses for immersion dose (21 locations, 78 packets) using TLDs were made during this period.

All radionuclide concentrations were similar to those normally found in local unaffected areas, except for those pathways exhibiting elevated activities due to the Chinese Nuclear Test of September 26, 1976, tritium activity in two surface water samples, and gamma activity in one sediment sample.

The Chinese Nuclear Test resulted in elevated concentrations of radionuclides in many environmental pathways. These increases can be distinguished from those of TMINS operation since they effect both indicator and background locations equally. A dose to an infant's thyroid of 60 mrem can be attributed to I-131 in milk as a result of these tests.

The H-3 concentration in surface water at a downstream indicator location (1.5 miles downstream) showed an elevated level relative to the upstream samples twice during the reporting period. No increase in the H-3 levels at the downstream locations where river water is used as a drinking water source was observed. Therefore, no measurable dose can be attributed to the release of H-3 from TMINS.

During October a variety of nuclides were detected in a sediment sample; probably not the result of station operation. Since these nuclides were not detected in surface water or fish, the only significant dose pathway would be from standing on the shoreline. A highly conservative dose estimate yields an insignificant dose to a hypothetical maximum individual of 0.33 mrem/year.

It is therefore concluded that station operation did not produce any significant changes in the observed environmental levels of radioactivity. These temporary changes noted in sediment could have resulted in an insignificant dose to a hypothetical maximum individual of 0.33 mrem.

INTRODUCTION

A complete radiological environmental monitoring program (REMP) for Three Mile Island Nuclear Station (TMINS) has been conducted by Metropolitan Edison Company since June 1969. Radiation Management Corporation has participated in this program since February 21, 1974. Results of the preoperational phase of the REMP up to June 5, 1974, and of the operational phase (June 5, 1974 through December 31, 1975) were reported in previous RMC documents (2,3,4,5). This report continues the operational series with coverage of 1976. It presents in detail the type and number of samples analyzed, the analyses performed and the data generated by RMC during the period January 1 through December 31, 1976. Interpretation of the data and conclusions are also presented.

Three Mile Island is the site of an operational nuclear power unit of the pressurized water reactor (PWR) type. When complete the station will consist of two reactor units. Unit 1, rated at 871 MWe, achieved criticality on June 5, 1974. This marked the beginning of the operational phase of the REMP. Unit 2, rated at 959 MWe, is under construction and scheduled for commercial operation in 1978.

The station is located on Three Mile Island in the Susquehanna River, in Dauphin County, ten miles southeast of Harrisburg, Pennsylvania. The average flow of the river at this point is 34,000 cfs(6). The site consists of an 814 acre tract on Three Mile Island and several smaller adjacent islands. General climatic conditions are characterized by a mild continental-type climate with little severe weather. Agriculture is the largest land usage in the area (48%), with the emphasis on poultry, dairy cattle and field crops(7).

The census of milking cows located within five miles of TMINS(7) was updated in the previous semi-annual report(5) and again during this report period. The distribution and approximate locations of these animals are given in Table B-21 (Appendix B).

More specific information on the demography, meteorology and land use characteristics of local area may be found in the Environmental Report(8) Environmental Statement(9), Final Safety Analysis Report for TMI-2(10), and the Environmental Report Supplement II(11).

PROGRAM

In the operational phase of the REMP, radioanalytical data are collected for comparison to that generated in the preoperational phase. Differences between these two periods are examined statistically to determine whether any station effects exist based on the magnitude and fluctuations of radioactivity levels determined in the preoperational phase.

Objectives

The objectives of the operational radiological environmental program are:

1. To fulfill the obligations of the Radiological Surveillance-Environmental sections of the Environmental Technical Specifications for TMI-1 and the Preoperational Program for TMI-2.

2. To determine whether any statistically significant increase occurs in the concentration of radionuclides 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 radioactive releases are within allowable limits and that TMI-1 operations have no detrimental effects on the health and safety of the public or on the environment.

This report provides information for the Metropolitan Edison Company, General Public Utilities, regulatory agencies and the public record toward these objectives.

Design

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

Sampling locations were 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, which are unrelated to station operation. Indicator station data are also evaluated relative to background characteristics established prior to station operation. Additional samples beyond those required by the Environmental Technical Specifications were collected and analyzed; They are listed as Metropolitan Edison Company management audit samples in the data tables (Appendix B).

The analysis of samples and the analytical data generated during the program are routinely evaluated by the RMC project leader who is the liaison with Metropolitan Edison Company personnel. Further review of REMP design and analytical data is performed by RMC and Metropolitan Edison Company professional staff in light of current regulatory trends and operating experience. The analytical procedures and quality control methods utilized by RMC are detailed in Reference 12.

Table 1 summarizes information on the Three Mile Island Nuclear Station operational REMP as performed by RMC. Appendix A explains the RMC sample coding system which specifies sample type and relative locations at a glance. Table A-1 gives the pertinent information on individual sampling locations, while Maps A-1, -2 and -3 show their geographic locations.

Exceptions

The operational REMP was conducted in accordance with the Environmental Technical Specifications for TMI-1(1) and the Preoperational Program for TMI-2. Deviations from the program as described in Table 3 of these specifications occurred during this period. Because aquatic plants are very scarce in the vicinity of TMINS, none were available for sampling during this report period.

Milk samples were taken during those months when milk cows were on pasture, (March through November). The farm from which background milk samples were obtained (1F2) went out of buisness in March. This farm was replaced in April with location 2G1. Pump outages resulted in the loss of 14 air particulate samples and 2 air iodine samples at various stations. Air sample recovery rate was greater than 97%.

RESULTS AND DISCUSSION

The averages and ranges of analytical results are summarized in Tables 2 and 3. Table 2 is a summary of gross beta, H-3, Sr-89, Sr-90, I-131 and gamma spectrometric results for various samples. Table 3 is a summary of ambient radiation levels as measured by thermoluminescent dosimeters. Results for each type of sample were grouped according to the analysis performed. Means and standard deviations of these results were calculated when applicable. These standard deviations represent sample population variability rather than analytical variability. For this calculation, all results below the MDL were considered to be at the MDL. Comparisons of TLD results were made using T tests for unequal observations and unequal variations as described by Steel & Torrie (13).

The data for individual samples are presented in tabular form in Appendix B, Tables B-1 through B-19. Within the data tables a 95% (± 2 sigma) confidence interval is supplied. These intervals represent the range of values into which 95% of repeated analyses of the sample would fall. All results occurring at or below the relevant minimum detectable level were reported as being "less than" the MDL value.

TABLE 1

SYNOPSIS OF THE OPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM FOR TMINS

JANUARY 1 THROUGH DECEMBER 31, 1976

SAMPLE TYPE	SAMPLING FREQUENCY	SAMPLING LOCATIONS	NUMBER	ANALYSIS TYPE	ANALYSIS FREQUENCY	ANALYSIS NUMBER
Surface Water/ Drinking Water	MC	6	72	H-3	QC	24
				Gamma	MC	72
				Sr-89	QC	12
				Sr-90	QC	12
Fish	SA	2	8	Sr-89	SA	8
				Sr-90	SA	8
				Gamma	SA	8
Sediment	SA	3	6	Sr-89	SA	6
				Sr-90	SA	6
				Gamma	SA	6
Air Particulates	W	9	482	Beta	W	482
				Gamma	MC	24
Air Iodine	W	4	206	I-131	W	206
Precipitation	M	4	48	H-3	QC	16
				Beta	M	48
				Sr-89	SA	8
				Sr-90	SA	8
				Gamma	QC	16
Milk	M	5	45	I-131	M	45
				Sr-89	QC	20
				Sr-90	QC	20
Green Leafy Vegetables	A	4	4	Gamma	A	4
Fruits	A	2	4	Gamma	A	4
Beef and Game	A	4	4	Gamma	A	4
Vegetation	A	2	2	Gamma	A	2
Dosimeters	Q	21	78	Gamma Dose	Q	312

TABLE 2

SUMMARY OF RADIONUCLIDE CONCENTRATIONS IN ENVIRONMENTAL SAMPLES FROM TMINS

JANUARY 1 THROUGH DECEMBER 31, 1976

SAMPLE TYPE	ANALYSIS PERFORMED	NO. OF SAMPLES ANALYZED	NO. ABOVE MDL	MINIMUM	MAXIMUM	AVERAGE ± 2 SIGMA	PRE-OP MEAN	UNITS
Surface Water	H-3 (Upstream)	8	8	106	400±75	215±200	240±180	pCi/l
	H-3 (Downstream)	16	13	<80	886±76	251±449	-	pCi/l
	Sr-89	12	1	0.4±0.3	<1.6	-	-	pCi/l
	Sr-90	12	6	<0.4	0.7±0.2	0.6±0.4	-	pCi/l
	Gamma*	72					-	pCi/l
	K-40		3	<6.0	16±9	-	-	pCi/l
	ZrNb-95		2	<0.4	4.4±0.7	-	-	pCi/l
	Ra-226		7	<0.9	2.1±1.2	-	-	pCi/l
Fish	Sr-89	8	0	<1.7	<27	-	-	pCi/kg (wet)
	Sr-90	8	7	2.0±0.8	108±14	33±81	45±55	pCi/kg (wet)
	Gamma	8						
	K-40		8	2600±260	3200±320	2838±512	3300±1700	pCi/kg (wet)
	ZrNb-95		1	<4.0	7.0±5.7	-	-	pCi/kg (wet)
	Cs-137		2	<5.0	13±6	-	-	pCi/kg (wet)
Sediment	Sr-89	6	3	4.3±3.7	34±6	17±20	-	pCi/kg (dry)
	Sr-90	6	6	14±5	78±9	37±47	390±450	pCi/kg (dry)
	Gamma	6						
	Be-7		4	<100	1200±300	500±910	940±1690	pCi/kg (dry)
	K-40		6	14000±1000	18000±2000	15500±2757	14700±6700	pCi/kg (dry)
	Mn-54		1	<10	20±20	-	-	pCi/kg (dry)
	Co-58		1	<10	50±20	-	-	pCi/kg (dry)
	Zr-95		3	<20	3100±300	612±2449	79±152	pCi/kg (dry)
	Nb-95		3	<20	2400±200	462±1904	176±172	pCi/kg (dry)
	Ru-103		3	90±30	1200±100	460±1282	-	pCi/kg (dry)
	Sb-125		1	<40	100±60	-	-	pCi/kg (dry)
	I-131		1	<10	200±40	-	-	pCi/kg (dry)
	Cs-137		6	230±40	480±50	345±173	430±290	pCi/kg (dry)
	Bala-140		1	<20	800±90	-	-	pCi/kg (dry)
	Ce-141		2	<20	2600±300	-	-	pCi/kg (dry)
	Ra-226		6	1100±100	1200±200	1116±82	1070±280	pCi/kg (dry)
	Th-232		6	400±200	1300±100	850±787	1110±600	pCi/kg (dry)
Air Particulates	Beta	482		<3	748±28	45±185	146±164	10^{-3} pCi/m^3
	Gamma	24						
	Be-7		24	40±4	130±14	74±53	46±27	10^{-3} pCi/m^3
	Mn-54		3	<0.05	0.4±0.4	-	-	10^{-3} pCi/m^3
	Co-58		4	<0.05	0.6±0.4	-	-	10^{-3} pCi/m^3
	Zr-95		7	<0.07	35±4	-	10±8	10^{-3} pCi/m^3
	Nb-95		6	<0.07	28±3	-	21±17	10^{-3} pCi/m^3
	Ru-103		6	<0.08	19±2	-	1.4±0.8	10^{-3} pCi/m^3
	Ru-106		1	<0.5	<3	-	20±18	10^{-3} pCi/m^3
	I-131		2	<0.09	2.0±0.4	-	-	10^{-3} pCi/m^3
	Cs-137		18	<0.1	3.4±1.2	0.7±1.6	4.0±5.3	10^{-3} pCi/m^3
	Bala-140		4	<0.1	11±1	-	-	10^{-3} pCi/m^3
	Ce-141		6	<0.1	32±3	-	-	10^{-3} pCi/m^3
	Ce-144		4	<0.7	13±5	-	50±48	10^{-3} pCi/m^3

TABLE 2 (Cont.)

SUMMARY OF RADIONUCLIDE CONCENTRATIONS IN ENVIRONMENTAL SAMPLES FROM TMINS

JANUARY 1 THROUGH DECEMBER 31, 1976

SAMPLE TYPE	ANALYSIS PERFORMED	NO. OF SAMPLES ANALYZED	NO. ABOVE MDL	MINIMUM	MAXIMUM	AVERAGE ± 2 SIGMA	PRE-OP MEAN	UNITS
Air Iodine	I-131	206	4	<4	108±11	-	-	10^{-3}pCi/m^3
Precipitation	H-3	16	15	<80	360±66	170±186	370±170	pCi/l
	Beta	48	41	<1.9	782±19	59±293	22±27	pCi/l
	Sr-89	8	4	<0.6	7.7±0.8	2.3±4.8	-	pCi/l
	Sr-90	8	5	<0.4	1.1±0.4	0.7±0.5	5.1±9.0	pCi/l
	Gamma	16						
	Be-7		8	4.4±4.0	37±11	17±21	33±56	pCi/l
	Co-58		1	<0.3	3.0±0.9	-	-	pCi/l
	Zr-95		4	<0.4	63±6	-	-	pCi/l
	Nb-95		4	<0.4	100±10	-	-	pCi/l
	Ru-103		4	3.2±0.7	12±2	-	-	pCi/l
	Ce-141		4	1.3±0.6	15±2	-	-	pCi/l
	Ce-144		2	<1.0	52±13	-	-	pCi/l
	Ra-226		3	<0.6	3.2±1.3	-	-	pCi/l
Milk	I-131	45	9	<0.04	46±5	-	-	pCi/l
	Sr-89	20	1	<0.3	2.2±0.9	-	-	pCi/l
	Sr-90	20	14	<0.3	5.6±2.2	1.9±3.2	4.9±7.1	pCi/l
Green Leafy Vegetable	Gamma	4						
	K-40		4	2000±200	3000±300	2400±848	13800±26800	pCi/kg
Fruits	Gamma	4						
	K-40		4	1000±100	2500±250	1825±1400	-	pCi/kg
Beef	Gamma	2						
	K-40		2	3300±330	3500±350	3400±283	1600±200	pCi/kg
Game	Gamma	2						
	K-40		2	3100±310	3100±310	3100±0	-	pCi/kg
	Cs-137		1	<5	15±7	10±14	-	pCi/kg
Vegetation	Gamma	2						
	Be-7		2	780±410	850±390	815±99	1670±2810	pCi/kg (dry)
	K-40		2	26000±2600	42000±420	34000±22600	13780±26835	pCi/kg (dry)

* All gamma emitters not listed were <MDL in all samples.

TABLE 3

SUMMARY OF DIRECT RADIATION MEASUREMENTS AT [illegible]

JANUARY 1 THROUGH DECEMBER 31, 1976

SAMPLE	NO. OF SAMPLES	SAMPLING PERIOD	MINIMUM	MAXIMUM	AVERAGE ± 2 SIGMA	UNITS
CONTROL LOCATIONS						
Quarterly TLD Dose Rate	24	12-29-75 to 3-31-76	5.75±0.24	7.62±0.60	6.47±1.50	mrem/standard month*
		3-31-76 to 6-30-76	4.80±0.30	7.05±0.45	5.79±1.48	mrem/standard month
		6-30-76 to 9-29-76	5.00±0.22	7.03±0.14	5.64±1.42	mrem/standard month
		9-29-76 to 12-29-76	5.38±0.36	8.49±0.25	6.83±2.09	mrem/standard month
INDICATOR LOCATIONS						
Quarterly TLD Dose Rate	54	12-29-75 to 3-31-76	4.72±0.19	6.32±0.13	5.70±2.27	mrem/standard month
		3-31-76 to 6-30-76	3.99±0.37	5.66±0.36	4.98±0.98	mrem/standard month
		6-30-76 to 9-29-76	3.91±0.21	5.70±0.54	4.92±1.18	mrem/standard month
		9-29-76 to 12-29-76	5.46±0.53	6.98±0.63	6.09±0.91	mrem/standard month

* Standard Month = 30.4 days.

Aquatic Environment

Surface Water

Monthly surface water samples were collected at 6 locations on the dates shown in Table B-1. Weekly grab samples from stations 1C3, 9A2 and 9B1 were taken and composited monthly. Samples from stations 8E1, 15F1 and 7G1 were taken on a semi-continuous basis and composited to monthly samples. Each sample was analyzed for gamma emitting nuclides by RMC procedure TGC and quarterly composites from each station were analyzed for H-3 by RMC procedure HXH. Samples from 8E1, 15F1 and 7G1 (drinking water treatment facilities) were also analyzed for Sr-89 and Sr-90. The results therefrom are included in this report.

Results of H-3 analyses are presented in Table B-2 and Figure 1. Concentrations of H-3 were observed to be slightly higher than normal during first and third quarters at one indicator station. No increase was observed at this time at station 7G1 (Columbia) or SE1 (Brunner Island). These concentrations returned to background levels in the following quarter composite at all downstream locations. The dose implications of these H-3 levels are discussed under "Assessment of Impact".

Results of analyses of surface water for Sr-89 and Sr-90 are presented in Table B-3. These analyses were made on untreated water from the Brunner Island water treatment facility (8E1), the Steelton municipal water works (15F1) and the Columbia water treatment plant(7G1). All but one Sr-89 concentration was below the MDL (1.0 pCi/l); Sr-90 concentrations were less than 1.0 pCi/l in all of the samples analyzed.

Gamma spectrometric analysis of surface water samples (Table B-4) showed that the naturally occurring nuclides K-40 and Ra-226 were present at concentrations above their respective MDLs in 3 and 7 samples respectively. The fission products ZrNb-95 were found in 2 samples. These nuclides were detected in an upstream sample in October and a downstream sample in November. The measured concentration (4.4 ± 0.7 pCi/l) downstream was greater than 10 times the control station value (<0.4 pCi/l) and was reported to the USNRC in accordance with TMI-1 ETS. This radionuclide was probably not of TMINS origin but rather the result of fallout from the Chinese atmospheric nuclear detonation of September 26, 1976. As stated earlier, similar levels were detected in the upstream sample during the previous month and at other reactor sites in the Mid-Atlantic region during this period.

Fish

Fish samples were collected at 2 locations each in July and October of this reporting period. Adult fish were taken for samples each weighing about 2 kg. These were separated into classes of bottom feeder versus predator-game species; fillets were analyzed. Gamma spectrometry (TGC) and Sr-89 and Sr-90 analyses (SRD,SRB) were performed on subdivided fish samples. The results of these analyses are given in Table B-5. Sr-89 was not detected in any of the samples. Sr-90 was detected in 7 of the 8 samples with the highest value of 108 pCi/kg detected in the upstream sample (16B1). The gamma spectrometric results show natural K-40 present in all fish samples, as expected. The gamma emitters ZrNb-95 and Cs-137 were detected in 1 and 2 samples, respectively; none of these levels were reportable. No other gamma emitters were detected. Typical MDLs by this method are listed in Table B-20.

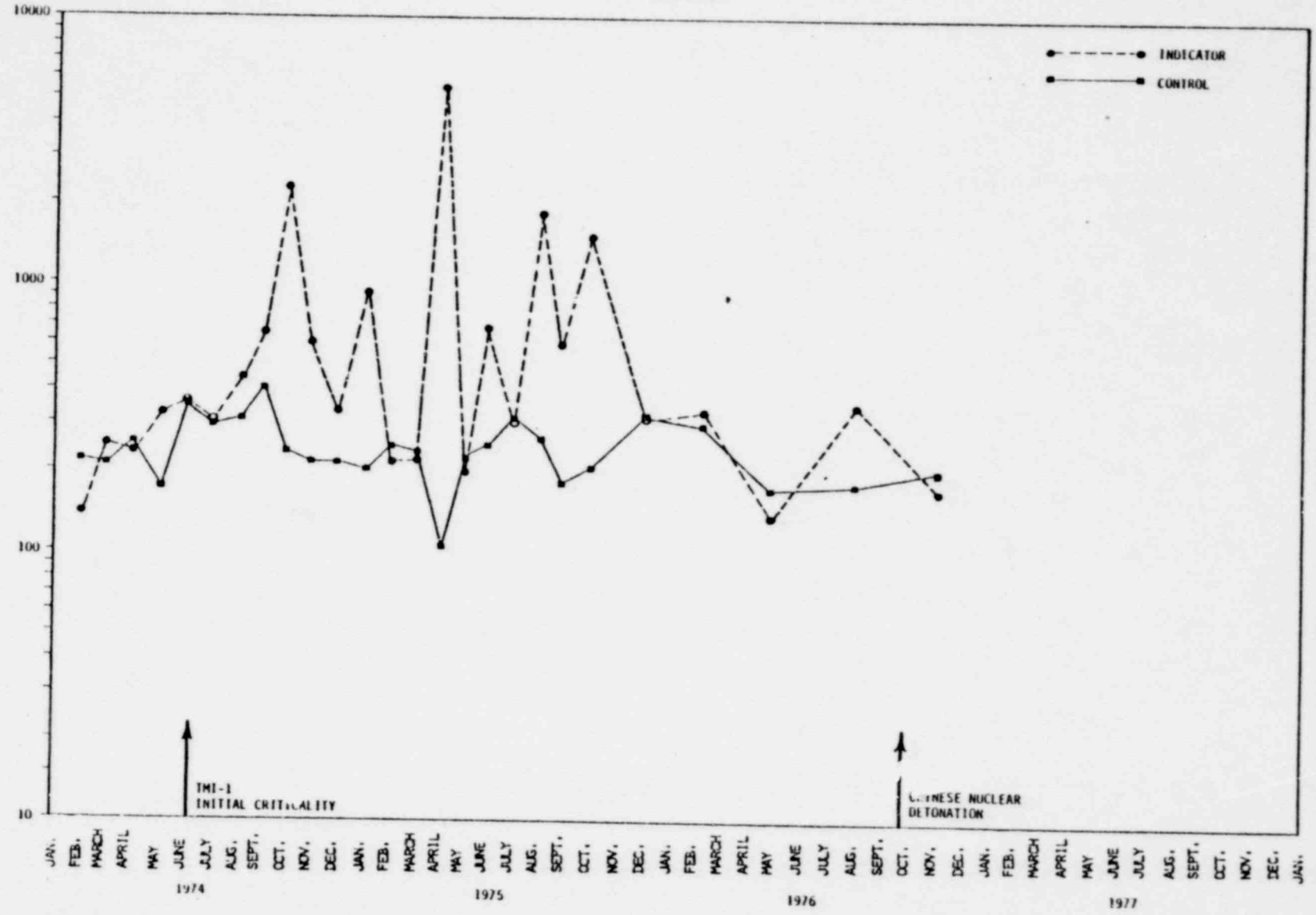
1448 088

FIGURE 1

AVERAGE TRITIUM CONCENTRATIONS IN

SUSQUEHANNA RIVER IN THE VICINITY OF TMINS

1974-1976



Sediment

Three sediment samples were taken in July and again in October. All samples were analyzed for Sr-89 and Sr-90 and gamma emitting nuclides, by RMC analytical procedures SRD, SRB and TGC, respectively.

Strontium in sediment results are given in Table B-6. Sr-89 was detected in 3 samples while Sr-90 was detected in 6 of the six samples. Indicator and control samples showed similar levels of both nuclides.

The results of the gamma analyses are given in Table B-7. The naturally occurring radionuclides (K-40, Ra-226 and Th-232) were found in all 6 sediment samples. The gamma emitters Zr-95, Nb-95, Ru-103, I-131, Ce-141, and BaLa-140 were detected at station 981 in October at concentrations significantly higher than those at the control station. A nonroutine report was submitted on this sample. The elevated levels of these nuclides were probably not the result of TMINS operations. The dose implications of these results are discussed under "Assessment of Impact". Other gamma emitters detected at low levels were Be-7, Mn-54, Co-58, Sb-125, and Cs-137.

Atmospheric Environment

The atmospheric environment around TMINS was examined by analyzing air particulate filters, charcoal cartridges and precipitation samples. Air particulate samples were collected at 9 locations with low volume air samplers using Hollingsworth and Voss HV-70 gauze backed filters. At 4 of these locations, air iodine samples were collected on Cesco "8" charcoal flow through cartridges connected in series following the air particulate filters. Air volumes sampled were measured with temperature compensated dry gas meters and recorded. Both air particulate and iodine samples were collected weekly.

Precipitation was collected by using a 12 inch diameter funnel draining into a 5 gallon polyethylene bottle. The accumulated samples were collected and composited for monthly analysis. The amount of precipitation which fell during the sampling period was measured and recorded.

Air Particulates

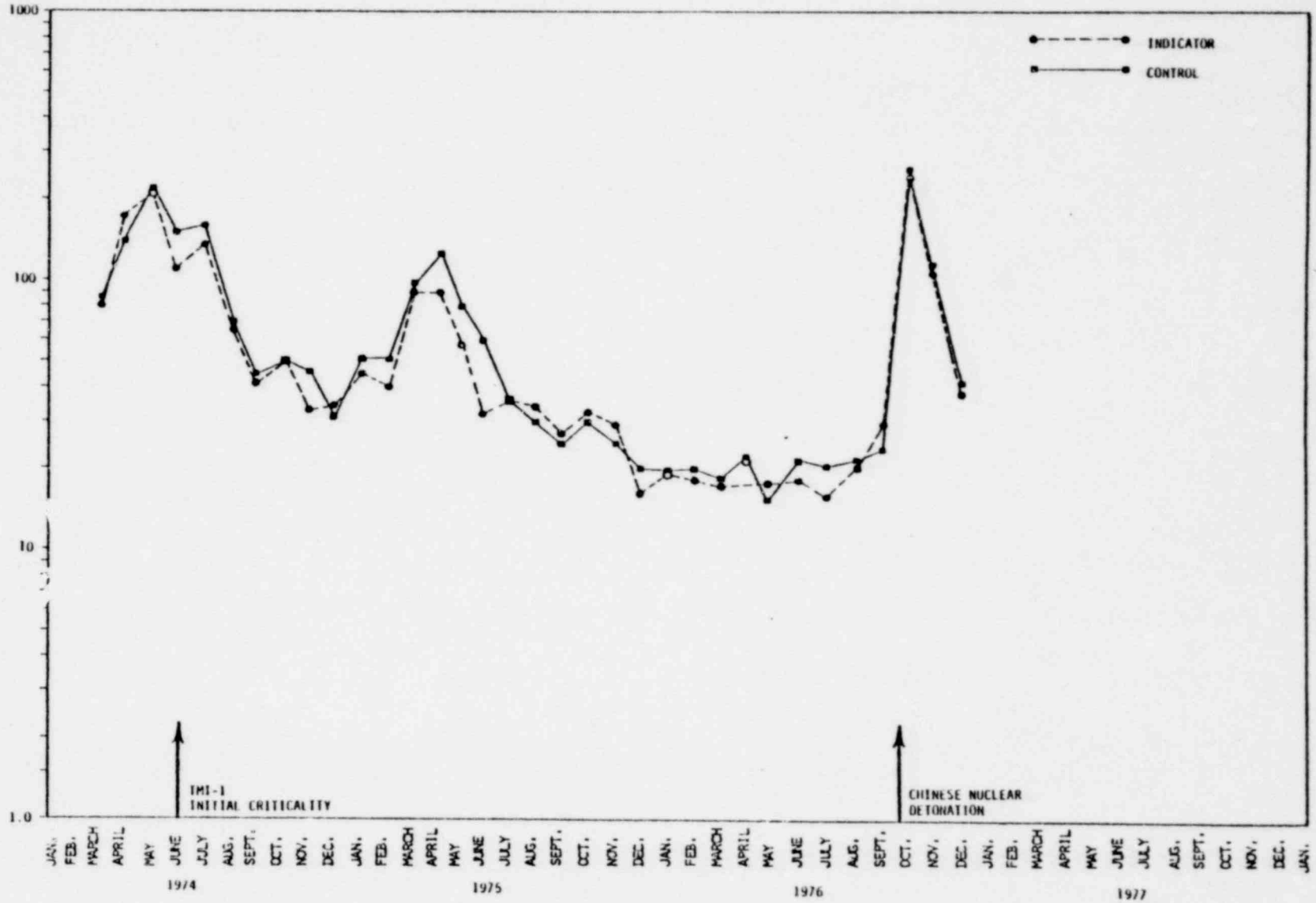
All air particulate samples were analyzed weekly for gross beta activity by RMC procedure TBD and monthly composites of all indicator and of all control samples were examined for gamma emitting nuclides by RMC procedure TGC.

Results of the gross beta analyses are listed in Table B-8. Gross concentrations of beta emitters in air remained relatively constant through September. During the first week in October beta activity at both indicator and background locations increased dramatically. This increase was obviously the result of the Chinese Nuclear Weapons Test of September 26, 1976. The indicator and control monthly averages plotted in Figure 2 demonstrate these trends and show similar behavior at both indicator and control locations. Monthly gross beta activity in all samples averaged 0.022 pCi/m from January through September, while the September through December activity averaged 0.137 pCi/m .

FIGURE 2

AVERAGE GROSS BETA CONCENTRATIONS IN
AIRBORNE PARTICULATES IN THE VICINITY OF TMINS

1974-1976



The gamma spectrometric results on monthly composites of air particulate filters are presented in Table B-9. Prominent nuclides found in samples were naturally occuring Be-7 and the probable fallout nuclides, Ce-144, Ce-141, BaLa-140, Cs-137, Ru-103, Mn-54, Zr-95 and Nb-95. As expected, the concentrations of these nuclides increased at both indicator and control locations following the Chinese Nuclear Test. I-131 was detected in both indicator and control composites immediately following the test. Typical MDLs for gamma spectrometric analysis of air particulate samples are listed in Table B-20.

Air Iodine

Gaseous iodine was collected on charcoal cartridges at 4 locations. The resulting samples were analyzed weekly for I-131 by RMC procedure IXB. Results are listed in Table B-10. All but 4 results were less than the respective MDLs which were of the order of 0.01 pCi/m^3. The four positive values were observed immediately following the Chinese Nuclear Test at all four sampling locations.

Precipitation

Monthly precipitation samples were analyzed for gross beta activity by RMC procedure TBA. The RMC analytical procedures HXH and TGC were utilized for the analysis of H-3 and gamma emitting nuclides, respectively, in quarterly composites of precipitation from each station. Concentrations of Sr-89 and Sr-90 (RMC procedures SRC, SRA) were determined in semi-annual composites from each station. The results of gross beta activity measurements in precipitation samples are presented in Table B-11. As with other atmospheric media, gross beta activity increased dramatically following the Chinese Nuclear Test. The data for the period prior to the test averaged 6.1 pCi/l while averaging 218 pCi/l after the test. The wet deposition of beta activity averaged 0.5 nCi/m^2, prior to the test (Table B-12). No significant differences between indicator and control locations were observed.

The results of analyses of quarterly composites of precipitation for H-3 and gamma emitting nuclides are presented in Table B-13. Tritium concentrations averaged 170 pCi/l. Various gamma emitting nuclides were detected in precipitation. These gamma emitters were those discussed under air particulates and were only detected after the Chinese test. The observed levels of these nuclides were similar at both indicator and control locations. Typical MDLs for gamma spectrometric analyses of precipitation are listed in Table B-20.

Semi-annual composites of precipitation samples from each station were analyzed for Sr-89 and Sr-90 and the results are presented in Table B-14. Of the 8 samples analyzed, 5 contained detectable levels of Sr-90 while Sr-89 was detected on 4 samples. All but one of the detectable levels occurred after the Chinese test. All increases were observed at both indicator and control locations.

Terrestrial Environment

The terrestrial environment around TMINS was examined by analyzing samples of milk from 5 locations on a monthly basis and green leafy vegetables on an annual basis. Two goat milk samples were also collected. Two gallon milk samples were collected and shipped fresh to RMC. Each sample was analyzed for I-131 using RMC procedure IXD. Quarterly composites from each station were analyzed for Sr-89 (SRC) and Sr-90 (SRA). Green leafy vegetables (cabbage), fruits (apples & peaches), and alfalfa samples were taken in July at 6 stations. Each sample was analyzed for gamma emitters by RMC procedure TGC.

The results of I-131 analyses of milk are presented in Table B-15. None of the 35 milk samples analyzed before October showed detectable levels of I-131. The October and November samples had detectable concentrations of I-131 in 5 and 4 samples, respectively, due to Chinese fallout. Nonroutine reports were submitted for three of these results on the basis of ETS reporting levels. Station to station comparisons of milk results are not necessarily valid since many herd specific factors control this pathway. Based on observations at other nuclear facilities near TMINS and on data from government programs, these concentrations are the result of Chinese weapons test fallout. Concentrations of Sr-89 and Sr-90 in quarterly composites of milk samples are listed in Table B-16. Of the 20 samples analyzed, Sr-89 was detected in one while Sr-90 was detected in 14. Results from indicator stations were similar to those from the control station and all results were similar to preoperational levels.

The results of gamma spectrometric analysis of green leafy vegetable, fruit and alfalfa samples (Table B-17) showed detectable levels of natural K-40 in all cases and of Be-7 in both alfalfa samples. No other gamma emitters were detected.

Direct Radiation

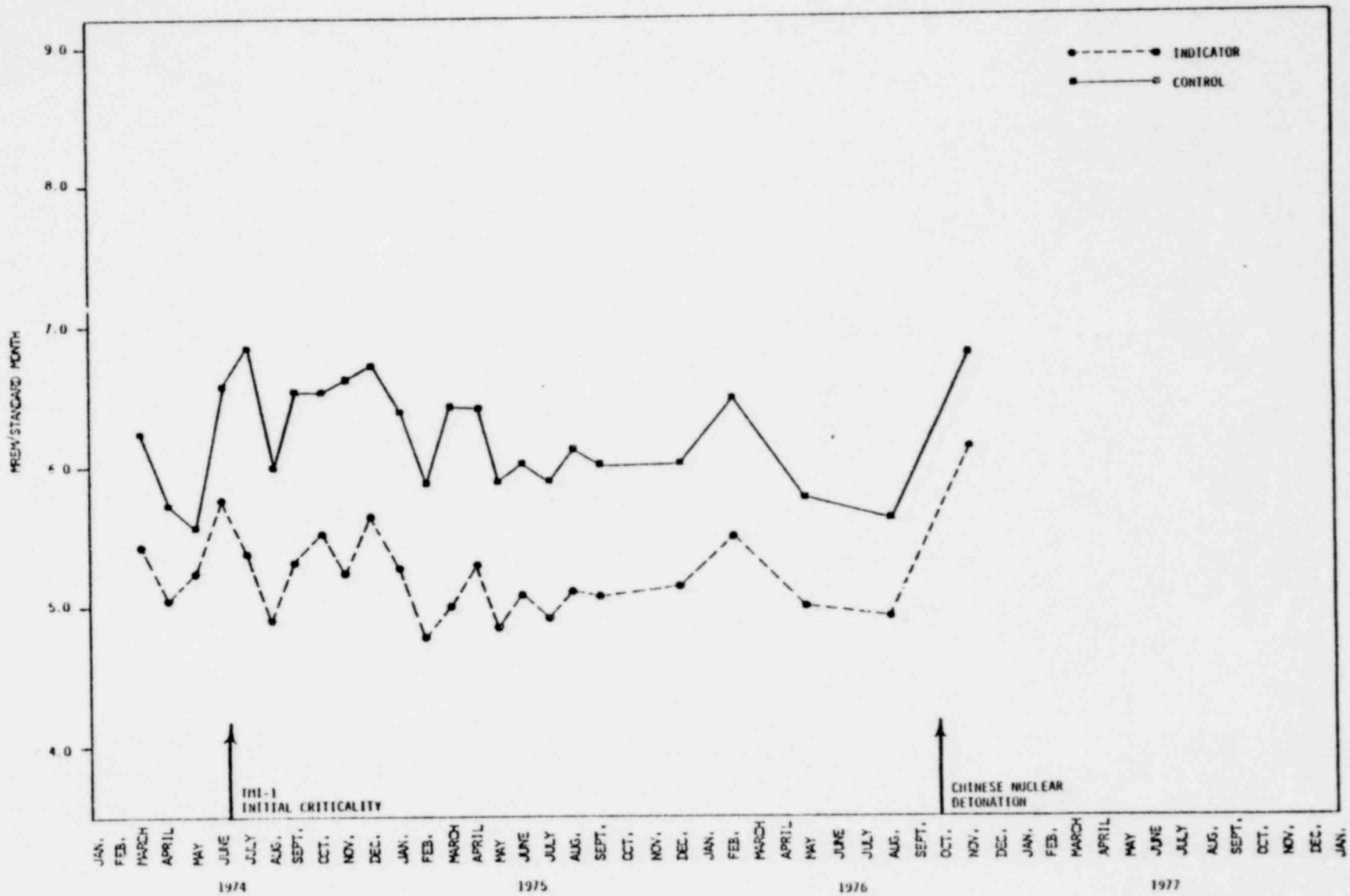
The ambient radiation levels in the area of Three Mile Island Nuclear Station were determined with energy compensated calcium sulfate (Tm) thermoluminescent dosimeters. A total of 78 quarterly TLD packets (4 TLDs each) were placed at 21 locations around TMINS. The results of the TLD measurements are presented in table B-19. All TLD results presented in this report have been normalized to a standard month (30.4 days) to eliminate the differences in exposure periods. The resulting dose rate was similar to preoperational levels averaging, 5.6 mrad/standard month. Statistical analysis shows that the fourth quarter TLD results were significantly higher than the previous 3 quarters ($t_{.05}=2.08$, $t=4.75$, $df=59,17$). This increase was the result of the Chinese bomb test since no statistical difference between control and indicator stations can be shown ($t_{.05}=2.54$, $t=1.65$, $df=5,11$).

The projected annual dose computed from results for this reporting period is 67 mrads, or 67 mrem assuming a quality factor of 1. An annual dose equivalent of 82 mrem was computed for the Harrisburg area and published by the EPA(14). The difference between this calculated value and the measured RMC value is not considered significant because of the differences in technique and the statistical variability of each. The average monthly ambient radiation dose rates for indicator and control stations are plotted in Figure 3. No trends in ambient gamma radiation levels as a result of TMI-1 operations are apparent from this graph.

FIGURE 3

AVERAGE GAMMA DOSE RATES IN THE VICINITY OF TMINS

1974-1976



ASSESSMENT OF IMPACT

The gaseous and liquid effluent streams from TMI-1 were continously sampled and/or monitored for the presence of radioactive materials by Metropolitan Edison Company. The REMP was designed and conducted in a manner to permit identification of the radionuclides actually released from the station.

Of the radioactive materials released from TMI-1 to the environs, only H-3 in surface water and various gamma emitters in sediment showed a potential contribution from TMI-1. Those samples which resulted in non-routine reports are listed in Table 4.

Thus, the only pathways for potential exposure of individuals or of a segment of population to radioactive materials from station operation is from consumption of river water or from shoreline deposits.

Untreated river water is monitored as part of the TMINS REMP at 2 locations (Brunner Island, 8E1, and Columbia, 7G1) in the downstream vicinity which use treated river water continuously for human consumption. At no time during the reporting period did H-3 levels at these stations differ statistically from those at the upstream station. It can then be concluded that these H-3 levels did not result in a significant dose to man.

A variety of fission products were detected in one downstream sediment sample during October at low concentrations, but greater than the control location. The conservative approach would be to assume that all of these radionuclides would be of TMINS origin. Based on the equations used in USNRC regulatory guide 1.109(17) a potential dose of 0.33 mrem was calculated. This calculation is for a hypothetical maximum teenager spending 34 hours (1/2 recommended annual usage) on ground contaminated to the same degree as the sediment and assuming a surface density of 240kg/m . These insignificant doses are the maxima which could be attributed to the radionuclides released to the Susquehanna River by TMI-1.

TABLE 4

1976 ENVIRONMENTAL SAMPLE DATE WHICH RESULTED IN NON-ROUTINE REPOR 'NG

SAMPLE TYPE	STATION NO.	SAMPLING DATES	ANALYSIS	RESULT	UNITS	TYPE OF REPORT
SURFACE WATER	9A2	NOVEMBER	GAMMA			
			ZrNb-95	4.4±0.7	pCi/l	NRR
SEDIMENT	9B1	OCTOBER	GAMMA			
			Zr-95	3.1±0.3	pCi/g(dry)	NRR
			Nb-95	2.4±0.2		
			Ru-103	1.2±0.1		
			I-131	0.2±0.04		
			Ce-141	2.6±0.3		
			BaLa-140	0.8±0.1		
MILK	7B3	OCTOBER	I-131	46±5	pCi/l	NRR

CONCLUSIONS

The preoperational Radiological Environmental Monitoring Program (REMP) conducted by RMC and Metropolitan Edison Company was continued as the operational program after TMI-1 initial criticality on June 5, 1974 and as a preoperational program for TMI-2. The REMP (from January 1 through December 31, 1976) described in this report was conducted according to the Environmental Technical Specifications for TMINS Unit #1 which permitted the objectives of the program to be met. Additional sampling and analyses beyond those required by the Technical Specifications were performed as management audit samples. All results therefrom were reviewed by RMC and Metropolitan Edison to assess all possible environmental pathways.

Although other possible dose pathways to man were considered in the environs of the TMINS site, tritium in surface water and fission products in sediment were the only radionuclides of potential TMINS origin detected above background levels with only sediment potentially contributing to dose. The radiation dose to people from ambient gamma radiation, as measured by thermoluminescent dosimeters, averaged 5.6 mrem/month and showed no evidence of a TMINS contribution during this operational period of TMI-1. The radiation dose to people in the TMINS environs is compared with the exposure from other artificial and natural sources in the following table:

Source of Exposure	Annual Dose in mrem
Medical	72(15)
Ambient Gamma (TLD)	67
Radionuclides in body (primarily K-40)	18(16)
Normal Global fallout	4(16)
Fission Products in Sediment	0.33
I-131 in Milk (Chinese Fallout)	60

The possible contribution of TMINS is insignificant in comparison with just one pathway associated with the Chinese fallout incident. Even though the potential TMI-1 contribution to population exposure is very small (approximately 0.2% of that from other sources), TMINS has a continuing program to improve operating techniques and to maintain equipment directed toward reducing releases of radioactive materials to the environment. It can be concluded that operation of TMI-1 did not significantly alter the radiological characteristics of the TMINS environs. The radionuclides and radiation levels observed were principally due to natural radioactivity and global fallout.

REFERENCES

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(15) S.E. Thompson, C.A. Burton, D.J. Quinn and T. C. Ng, "Concentration Factors of Chemical Elements in Aquatic Organisms." UCRL-50564 (Rev. 1), October 1972.

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APPENDIX A

APPENDIX A Sampling Locations

Sample Identification

RMC identifies samples by a three-part code. The first two letters are the power station identification code, in this case TM. The next one to three letters are for the media sampled.

AI	= Air Iodine	FPL	= Green Leafy Vegetables
AP	= Air Particulates	ID	= Immersion Dose (TLD)
AQF	= Fish	M	= Milk
AQP	= Aquatic Plants	RW	= Precipitation
AQS	= Sediment	SW	= Surface Water
E	= Soil	V	= Fodder Crops
FPF	= Fruit		

The last four symbols are a location code based on direction and distance from the site. Of the last four symbols, the first two represent each of the sixteen angular sectors of 22-1/2 degrees centered about the reactor site. Sector one is divided evenly by the north axis and the other sectors are numbered in a clockwise direction; i.e., 2=NNE, 3=NE, 4=ENE, 5=E, etc. The next digit is a letter which represents the radial distance from the plant:

S = On-site location	E = 4-5 miles off-site
A = 0-1 miles off-site	F = 5-10 miles off-site
B = 1-2 miles off-site	G = 10-20 miles off-site
C = 2-3 miles off-site	H = >20 miles off-site
D = 3-4 miles off-site	

The last number is the station numerical designation within each sector and zone; e.g. 1, 2, ...

The location portions of these codes (i.e. 1S1, 3A1, etc.) are shown in the attached table along with more detailed information and a map coordinate number used to designate the individual samples in the analytical result tables, Appendix B.

TABLE A-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SAMPLING LOCATIONS

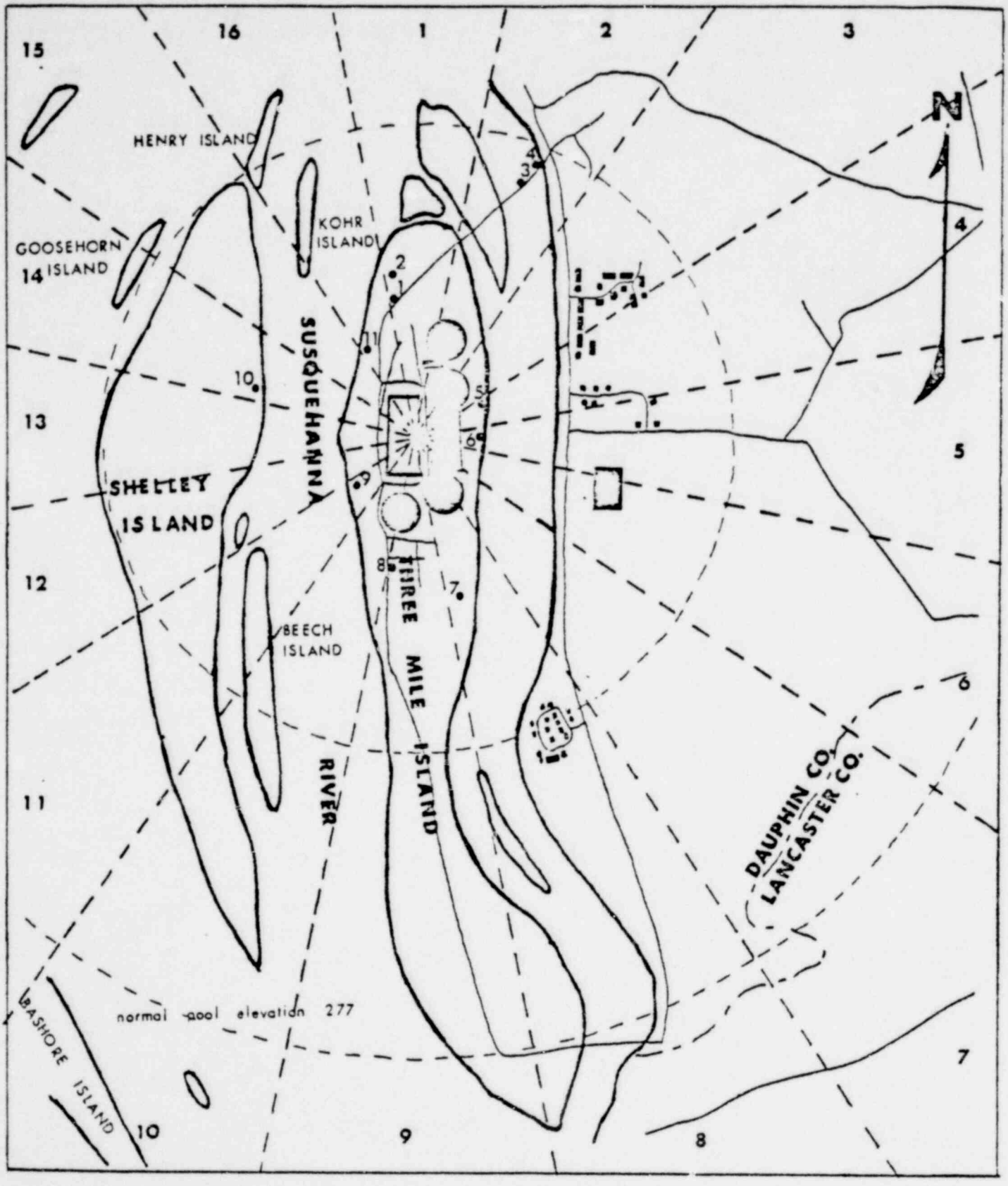
LOCATION CODE	MAP NO.	DESCRIPTION*
1S1	1	0.4 miles N of site
1S2	2	0.4 miles N of site
2S2	3	0.7 miles NNE of site on light pole in middle of North Bridge
2S3	4	0.7 miles NNE of site beside guard house at North Gate
4S2	5	0.3 miles ENE of site on top of dike, East Fence
5S3	6	0.2 miles E of site on top of dike, East Fence
8S1	7	0.5 miles SSE of site at South Weather Station
9S2	8	0.4 miles S of site at South Beach of Three Mile Island
11S1	9	0.1 miles SW of site, west of Mechanical Draft Towers on dike
14S2	10	0.4 miles WNW of site at Shelly's Island picnic area
16S1	11	0.2 miles NNW of site at gate in fence on west side of Three Mile Island
1A2	12	0.7 miles N of site at north tip of Three Mile Island
4A1	13	0.5 miles ENE of site on Laurel Rd., Met. Ed. pole #668-OL
5A1	14	0.4 miles E of site on north side of Observation Center Building
9A2	15	0.5 miles S of site below Discharge Pipe
11A1	16	0.2 miles SW of site off Discharge Pipe
16A1	17	0.4 miles NNW of site on Kohr Island
4B1	18	1.1 miles ENE of site, west of Gringrich Road
5B1	19	1.0 mile E of site on Peck Road
7B3	20	1.6 miles SE of on east side of Conewago Creek
9B1	21	1.5 miles S of site, above York Haven Dam

TABLE A-1 (CONT.)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SAMPLING LOCATIONS

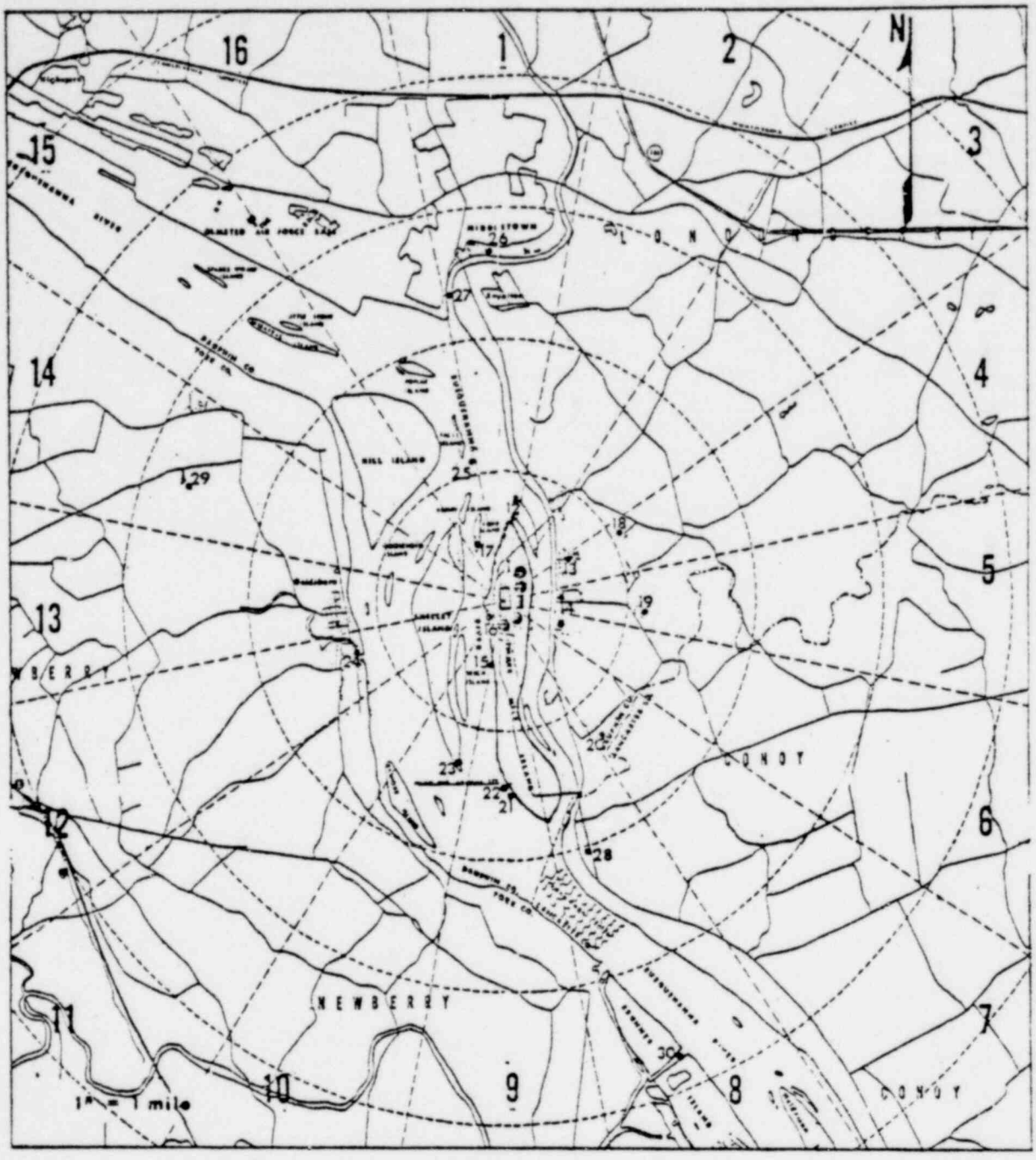
LOCATION CODE	MAP NO.	DESCRIPTION*
9B2	22	1.4 miles S of site, north of York Haven Dam
10B1	23	1.1 miles SSW of site on south beach of Shelly's Island
12B1	24	1.6 miles WSW of site adjacent to Fishing Creek
16B1	25	1.1 miles NNW of site below Fall Island
1C1	26	2.6 miles N of site ar Middletown Substation
1C3	27	2.3 miles N of site at Swatara Creek
8C1	28	2.3 miles SSE of site
14C1	29	2.7 miles WNW of site near intersection of Routes 262 and 392
8E1	30	4.1 miles SSE of site at Brunner Island
1F1	31	6 miles N of site at Hummelstown Substation on Fiddler's Elbow Road
5F1	32	9 miles E of site on East Ridge and Greentree Roads
5F2	33	5.8 miles E of site at Masonic Home
7F1	34	9 miles SE of site at Drager Farm off Engle's Tollgate Road
15F1	35	8.7 miles NW of site at Steelton Municipal Water Works
2G1	36	2 miles NNE of Hershey on Rt. 39 Hummelstown
4G1	37	10 miles ENE of site at Lawn - Met. Ed. Pole #J1813
7G1	38	15 miles SE of site at Columbia Water Treatment Plant
9G1	39	13 miles S of site in Mit. Ed. York Load Dispatch Station
15G1	40	15 miles NW of site at West Fairview Substation
5H1	41	80 miles E of site on RMC roof in Philadelphia
5H2	42	80 miles E of site on RMC roof in Philadelphia

* All distances are measured from a point that is midway between the Reactor Buildings of Units One and Two



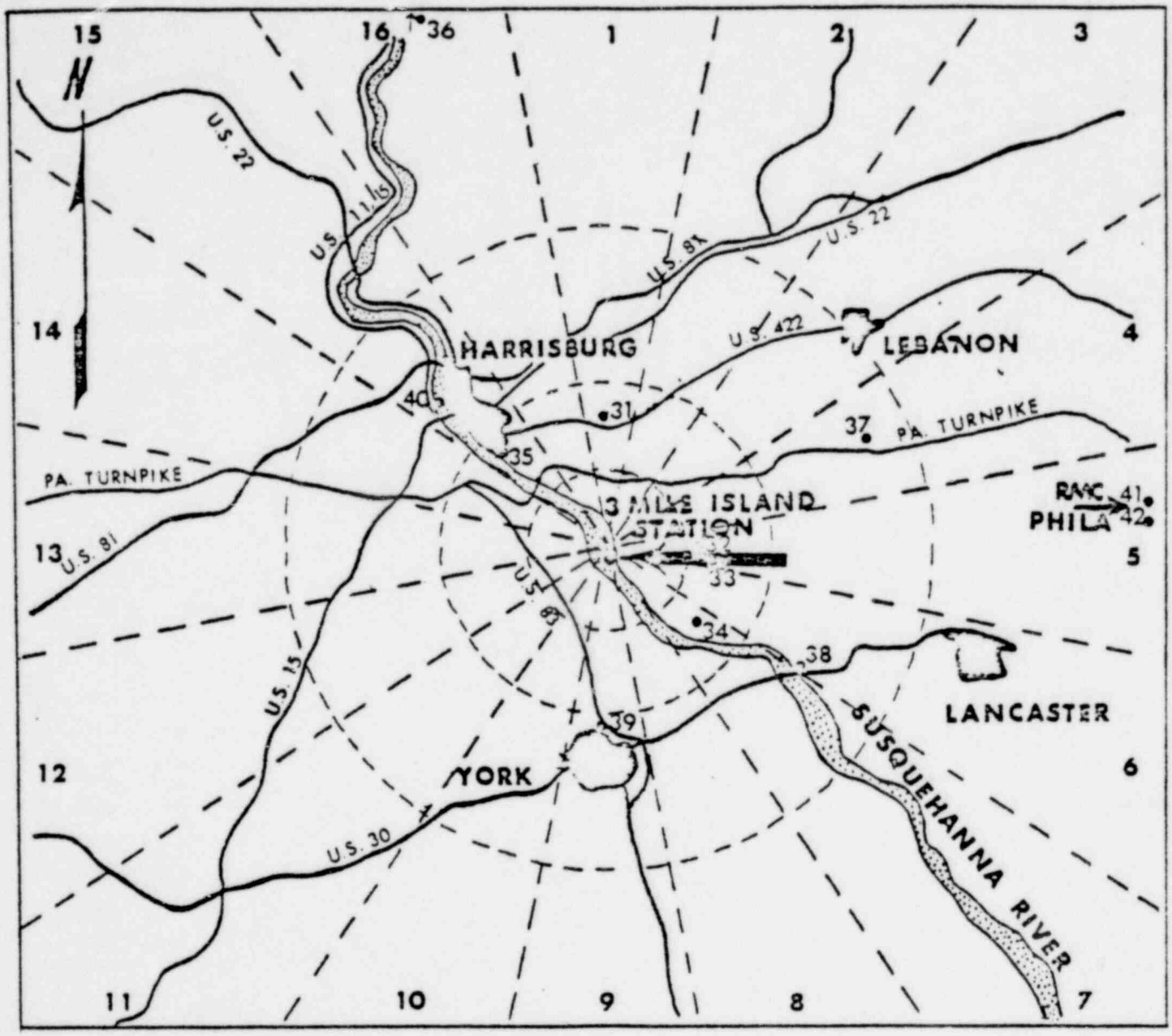
Map A-1

THREE MILE ISLAND NUCLEAR STATION
Location of Operational
Radiological Environmental
Monitoring Stations within
The Site Boundaries



Map A-2

THREE MILE ISLAND NUCLEAR STATION
Location of Operational
Radiological Environmental
Monitoring Stations within
5 Miles of the Site



1" = APPR. 10 MILES

Map A-3

THREE MILE ISLAND NUCLEAR STATION
Location of Operational
Radiological Environmental
Monitoring Stations Greater
Than 5 Miles from the Site

APPENDIX B

APPENDIX B Data Tables

Appendix B is a presentation of the results of the TMINS Radiological Envrironmental Monitoring Program.

APPENDIX B Data Tables (Cont.)

TABLE B-1

SAMPLING PERIODS FOR SURFACE WATER SAMPLES (JANUARY-JUNE), 1976

STATION NO.	JAN	FEB	MAR	APR	MAY	JUN
TM-SW-1C3*	1-07-76 to 1-29-76	2-05-76 to 2-26-76	3-04-76** to 3-25-76	4-01-76 to 4-29-76	5-06-76 to 5-27-76	6-03-76 to 7-01-76
TM-SW-15F1	12-31-75 to 1-29-76	1-30-76 to 2-26-76	2-27-76 to 3-25-76	3-26-76 to 4-29-76	4-30-76 to 5-27-76	5-28-76 to 7-01-76
TM-SW-9A2	1-07-76 to 1-29-76	2-05-76 to 2-26-76	3-04-76 to 3-25-76	4-01-76 to 4-29-76	5-06-76 to 5-27-76	6-03-76 to 7-01-76
TM-SW-9B1	1-07-76 to 1-29-76	2-05-76 to 2-26-76	3-04-76 to 3-25-76	4-01-76 to 4-29-76	5-06-76 to 5-27-76	6-03-76 to 7-01-76
TM-SW-8E1*	12-31-75 to 1-29-76	1-29-76 to 2-28-76	2-28-76 to 3-31-76	3-31-76 to 5-01-76	5-01-76 to 5-30-76	5-30-76 to 6-30-76
TM-SW-7G1	1-07-76 to 1-29-76	1-29-76 to 2-26-76	2-26-76 to 3-25-76	3-25-76 to 4-29-76	4-29-76 to 5-27-76	5-27-76 to 7-01-76

* Management audit samples
** Sample container empty upon receipt at RMC due to leak

TABLE B-1 (CONT.)

SAMPLING PERIODS FOR SURFACE WATER SAMPLES (JULY-DECEMBER), 1976

STATION NO.	JUL	AUG	SEP	OCT	NOV	DEC
TM-SW-1C3*	7-01-76 to 7-29-76	8-05-76 to 8-26-76	9-02-76 to 9-30-76	10-07-76 to 10-27-76	10-28-76 to 11-30-76	12-01-76 to 12-24-76
TM-SW-15F1	7-02-76 to 7-29-76	7-30-76 to 8-26-76	8-27-76 to 9-30-76	10-01-76 to 10-27-76	10-28-76 to 11-30-76	12-01-76 to 12-29-76
TM-SW-9A2	7-01-76 to 7-29-76	8-05-76 to 8-26-76	9-02-76 to 9-30-76	10-07-76 to 10-27-76	11-04-76 to 11-30-76	12-08-76 to 12-29-76
TM-SW-9B1	7-01-76 to 7-29-76	8-05-76 to 8-26-76	9-02-76 to 9-30-76	10-07-76 to 10-27-76	11-04-76 to 11-30-76	12-08-76 to 12-29-76
TM-SW-8E1*	6-30-76 to 7-31-76	7-31-76 to 8-28-76	8-28-76 to 9-29-76	9-29-76 to 10-27-76	10-30-76 to 11-27-76	11-27-76 to 12-29-76
TM-SW-7G1	7-01-76 to 7-29-76	7-29-76 to 8-26-76	8-26-76 to 9-30-76	9-30-76 to 10-27-76	10-27-76 to 11-30-76	11-30-76 to 12-29-76

* Management audit samples

TABLE B-2

CONCENTRATIONS OF TRITIUM IN SURFACE WATER, 1976

Results in Units of pCi/l ± 2 sigma

STATION NO.	JAN-MAR	APR-JUN	JUL-SEP	OCT-DEC	AVERAGE
UPSTREAM LOCATIONS					
TM-SW-1C3*	400±75	226±26	131±61	303±70	265±228
TM-SW-15F1	197±64	122±64	233±61	106±71	164±121
UPSTREAM AVERAGE	298±287	179±161	182±144	204±279	215±200
DOWNSTREAM LOCATIONS					
TM-SW-9A2	461±75	180±65	203±65	97±68	235±314
TM-SW-9B1	608±76	120±64	886±76	366±71	495±656
TM-SW-8E1*	113±73	131±74	96±51	<80**	105±44
TM-SW-7G1	175±73	122±64	237±65	143±74	169±100
DOWNSTREAM AVERAGE	339±469	138±57	355±717	172±265	251±449

* Management audit samples
** Results confirmed by reanalysis.

TABLE B-3

CONCENTRATIONS OF SR-89 AND SR-90 IN UNTREATED DRINKING WATER, 1976

Results in Units of pCi/l

STATION NO.	START DATE	STOP DATE	SR-89	SR-90
TM-SW-15F1	12-31-75	3-25-76	<0.8	<0.6
	3-26-76	7-01-76	<0.5	<0.5
	7-02-76	9-30-76	<1.2	<0.8
	10-01-76	12-29-76	<0.6	0.7±0.2
TM-SW-8E1*	12-31-75	3-31-76	<1.0	0.4±0.4
	3-31-76	6-30-76	<1.6	<1.0
	6-30-76	9-29-76	<1.4	<0.9
	9-29-76	12-29-76	<1.2	0.5±0.5
TM-SW-7G1	1-07-76	3-25-76	<1.0	0.5±0.4
	3-25-76	7-01-76	<1.2	0.6±0.5
	7-01-76	9-30-76	<1.2	0.7±0.5
	9-30-76	12-29-76	0.4±0.3	<0.4

* Management audit sample

TABLE B-4

CONCENTRATIONS OF GAMMA EMITTERS IN SURFACE WATER, 1976

Results in Units of pCi/l ± 2 Sigma

STATION NO.	NUCLIDE* FOUND	JAN	FEB	MAR	APR	MAY	JUN
TM-SW-1C3**	K-40	<6.0	16±9	<6.0	<7.0	<7.0	<8.0
TM-SW-15F1		<MDL	<MDL	<MDL	<MDL	<MDL	<MDL
TM-SW-9A2	K-40	<7.0	<7.0	<8.0	<8.0	<7.0	<7.0
TM-SW-9B1	Ra-226	<0.9	<0.9	<0.9	<1.0	<0.9	<0.9
TM-SW-8E1**		<MDL	<MDL	<MDL	<MDL	<MDL	<MDL
TM-SW-7G1	Ra-226	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9

STATION NO.	NUCLIDE* FOUND	JUL	AUG	SEP	OCT	NOV	DEC
TM-SW-1C3**	K-40	<7.0	<7.0	<7.0	<7.0	<7.0	<7.0
TM-SW-15F1	K-40	<7.0	<7.0	<10	<7.0	12±10	<9.0
	ZrNb-95	<0.5	<0.5	<0.7	1.5±0.7	<0.4	<0.7
	Ra-226	<0.9	<0.9	<1.0	<0.9	1.8±1.[illegible]	<1.0
TM-SW-9A2	K-40	<7.0	<7.0	12±11	<7.0	<7.0	<6.0
	ZrNb-95	<0.4	<0.5	<0.4	<0.5	4.4±0.7	<0.4
TM-SW-9B1	K-40	<7.0	<7.0	<7.0	14±11	<7.0	<7.0
	Ra-226	<0.9	1.7±1.4	<0.9	2.1±1.2	2.1±1.2	<0.9
TM-SW-8E1**		<MDL	<MDL	<MDL	<MDL	<MDL	<MDL
TM-SW-7G1	Ra-226	<0.9	1.7±1.2	1.3±1.2	<0.9	1.5±1.2	<0.9

* All other gamma emitters <MDL, Table B-20
** Management audit samples

TABLE B-5

CONCENTRATIONS OF SR-89 AND SR-90 AND GAMMA EMITTERS IN FISH, 1976

Results in Units of pCi/kg(wet) ± 2 sigma

STATION NO.	SAMPLE TYPE*	SAMPLING MONTH	Sr-89	Sr-90	K-40**	ZrNb-95**	Cs-137**
UPSTREAM SAMPLES							
TM-AQF-16B1	Rock Bass	July	<27	108±14	3100±310	<6	<7
TM-AQF-16B1	Channel Catfish	July	<17	13±7	2600±260	<6	<7
TM-AQF-16B1	Rock Bass	Oct.	<7.2	<4.5	2600±260	<4	13±6
TM-AQF-16B1	Catfish	Oct.	<10	18±4	2700±270	<4	<5
DOWNSTREAM SAMPLES							
TM-AQF-9B2	Rock Bass	July	<25	86±13	3100±310	<5	<6
TM-AQF-9B2	Channel Catfish	July	<22	23±9	2600±260	<5	<6
TM-AQF-9B2	Rock Bass	Oct.	<8	7.7±3.4	2800±280	<4	<5
TM-AQF-9B2	Channel Catfish	Oct.	<1.7	2.0±0.8	3200±320	7.0±5.7	6.8±6.1

* Bottom feeders - catfish, brown bull head; predator/game - small mouth bass, rock bass.
** All other gamma emitters <MDL, Table B-20.

TABLE B-6

CONCENTRATIONS OF SR-89 AND SR-90 IN SEDIMENT, 1976

Results in Units of pCi/kg (dry) ± 2 sigma

STATION NO.	SAMPLING DATE	SR-89	SR-90
TM-AQS-1A2	7-15-76	<18	78±9
	10-21-76	16±6	14±5
TM-AQS-9B1	7-15-76	<21	37±10
	10-21-76	34±6	24±5
TM-AQS-11A2	7-15-76	<10	50±5
	10-21-76	4.3±3.7	21±4

TABLE B-7

CONCENTRATIONS OF GAMMA EMITTERS IN SEDIMENT, 1976

Results in Units of pCi/g (dry) ± 2 sigma

NUCLIDE*	TM-AQS-1A2 7-15-76	TM-AQS-1A2 10-21-76	TM-AQS-9B1 7-15-76	TM-AQS-9B1 10-21-76	TM-AQS-11A1 7-15-76	TM-AQS-11A1 10-21-76
Be-7	1.2±0.3	0.2±0.1	0.7±0.2	0.3±0.2	<MDL	<0.1
K-40	16±2	15±2	18±2	15±2	14±1	15±2
Mn-54	<0.01	<0.01	<0.01	0.02±0.02	<0.01	<0.01
Co-58	<0.01	<0.01	<0.01	0.05±0.02	<0.01	<0.01
Zr-95	<0.02	0.2±0.05	<0.03	3.1±0.3	<0.02	0.3±0.1
Nb-95	<0.02	0.1±0.03	<0.03	2.4±0.2	<0.02	0.2±0.04
Ru-103	<MDL	0.09±0.02	<MDL	1.2±0.1	<MDL	0.09±0.03
Ru-106	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Sb-125	<MDL	<0.04	0.10±0.06	<0.05	<MDL	<0.05
I-131	<0.01	<0.01	<0.01	0.2±0.04	<0.01	<0.02
Cs-137	0.23±0.04	0.29±0.04	0.32±0.04	0.36±0.04	0.48±0.05	0.39±0.06
Ce-141	<MDL	0.08±0.03	<MDL	2.6±0.3	<MDL	<0.02
Ce-144	<0.1	<0.1	<0.1	<0.2	<0.1	<0.09
Bala-140	<0.02	<0.03	<0.03	0.8±0.09	<0.02	<0.03
Ra-226	1.1±0.1	1.1±0.1	1.1±0.1	1.1±0.2	1.1±0.1	1.2±0.1
Th-232	0.5±0.2	1.2±0.1	0.6±0.3	1.1±0.1	0.4±0.2	1.3±0.1

* All other gamma emitters <MDL, Table B-20

TABLE B-8

CONCENTRATIONS OF BETA EMITTERS IN AIR PARTICULATES, 1976

Results in Units of 10^{-3} pCi/m^3 ± 2 sigma

START DATE	STOP DATE	STATION NO. TM-AP-1F1**	TM-AP-5F1	TM-AP-7F1	TM-AP-9G1	TM-AP-15G1
12-31-75	1-07-76	16±5	9±4	22±5	13±4	18±5
1-07-76	1-15-76	27±6	25±5	19±5	15±4	28±6
1-15-76	1-22-76	32±5	26±6	16±5	24±5	30±7
1-22-76	1-29-76	14±5	20±6	9±5	15±5	17±5
1-29-76	2-05-76	16±6	19±6	26±6	22±6	19±5
2-05-76	2-12-76	24±6	22±7	16±5	16±5	18±6
2-12-76	2-19-76	19±6	18±5	22±6	<33	25±5
2-19-76	2-26-76	15±7	17±6	24±7	18±6	22±7
2-26-76	3-04-76	21±6	16±5	15±5	23±5	18±5
3-04-76	3-11-76	19±5	13±4	20±5	15±4	21±5
3-11-76	3-18-76	17±6	19±5	20±6	24±5	6±4
3-17-76	3-25-76	22±6	16±5	21±6	17±8	20±6
3-25-76	4-01-76	23±6	22±5	24±6	*	13±4
4-01-76	4-08-76	13±5	10±4	17±4	*	18±5
4-08-76	4-15-76	23±6	23±5	24±5	*	28±6
4-15-76	4-22-76	±7	41±7	35±6	*	42±7
4-22-76	4-29-76	4	11±4	10±4	*	13±4
4-29-76	5-06-76	2	14±5	12±5	*	15±5
5-06-76	5-13-76	25±6	24±5	23±5	*	26±5
5-13-76	5-20-76	10±4	15±4	12±4	*	21±5
5-20-76	5-27-76	11±4	10±4	11±4	*	9±4
5-27-76	6-03-76	12±4	13±4	10±4	*	13±4
6-03-76	6-10-76	28±6	26±6	21±5	53±23	26±6
6-10-76	6-17-76	21±6	22±7	13±5	27±6	20±5
6-17-76	6-24-76	17±5	13±3	16±5	14±4	16±4
6-24-76	7-01-76	23±5	22±5	22±5	19±5	18±5
7-01-76	7-08-76	14±5	18±5	12±4	13±4	8±4
7-08-76	7-15-76	18±5	21±4	9±4	67±25	23±5

TABLE B-8 (CONT.)

CONCENTRATIONS OF BETA EMITTERS IN AIR PARTICULATES, 1976

Results in Units of 10^{-3} pCi/m^3 ± 2 sigma

START DATE	STOP DATE	STATION NO. TM-AP-1F1**	TM-AP-5F1	TM-AP-7F1	TM-AP-9G1	TM-AP-15G1
7-15-76	7-22-76	27±6	16±4	22±5	18±8	23±5
7-22-76	7-29-76	12±5	19±5	20±5	<28	14±5
7-29-76	8-05-76	17±5	22±5	17±5	24±6	18±5
8-05-76	8-12-76	22±5	20±4	8±3	24±5	20±5
8-12-76	8-19-76	17±5	20±5	20±5	48±7	19±5
8-19-76	8-26-76	22±6	27±6	31±6	29±6	31±6
8-26-76	9-02-76	17±5	22±5	13±5	15±5	24±5
9-02-76	9-09-76	18±5	19±5	16±5	20±5	22±5
9-09-76	9-16-76	22±6	28±6	26±6	32±6	30±7
9-16-76	9-23-76	-	21±5	20±5	20±5	28±6
9-23-76	9-30-76	-	61±8	4±2	22±5	18±4
9-30-76	10-07-76	-	689±24	575±19	465±19	645±22
10-07-76	10-14-76	-	35±1	201±15	748±28	154±10
10-14-76	10-21-76	-	274±16	68±7	25±5	88±8
10-21-76	10-28-76	-	96±9	25±6	60±8	48±7
10-28-76	11-04-76	-	+	149±4	107±8	131±10
11-04-76	11-10-76	-	+	357±18	75±8	74±8
11-10-76	11-17-76	-	+	27±5	82±8	130±10
11-17-76	11-23-76	-	+	125±12	119±10	84±8
11-23-76	11-30-76	-	+	108±10	67±7	130±10
11-30-76	12-08-76	-	+	53±7	62±6	51±7
12-08-76	12-15-76	-	+	<5	18±4	55±7
12-15-76	12-22-76	-	+	68±8	24±5	42±6
12-22-76	12-29-76	-	+	16±5	14±4	34±6

TABLE B-8 (CONT.)

CONCENTRATION OF BETA EMITTERS IN AIR PARTICULATES, 1976

Results in Units of 10^{-3} pCi/m^3 ± 2 sigma

START DATE	STOP DATE	STATION NO. TM-AP-1S2	TM-AP-2S3**	TM-AP-8S1	TM-AP-5A1
12-31-75	1-07-76	19±5	24±7	21±5	6±4
1-07-76	1-15-76	23±5	19±4	23±5	12±4
1-15-76	1-22-76	26±5	28±7	22±6	18±5
1-22-76	1-29-76	13±5	15±6	15±5	<4
1-29-76	2-05-76	16±5	19±6	20±6	18±5
2-05-76	2-12-76	20±5	21±7	14±5	16±5
2-12-76	2-19-76	15±5	22±6	16±5	15±5
2-19-76	2-26-76	20±7	19±8	14±7	14±6
2-26-76	3-04-76	23±6	12±6	22±5	16±5
3-04-76	3-11-76	16±4	12±4	16±4	13±4
3-11-76	3-18-76	8±5	7±4	16±5	10±5
3-17-76	3-25-76	17±5	16±6	13±4	9±5
3-25-76	4-01-76	23±5	27±6	21±5	31±6
4-01-76	4-08-76	15±4	15±7	12±4	29±6
4-08-76	4-15-76	13±4	8±6	18±4	16±4
4-15-76	4-22-76	34±6	34±7	23±5	34±6
4-22-76	4-29-76	14±4	13±5	10±4	8±4
4-29-76	5-06-76	21±5	16±6	17±5	9±4
5-06-76	5-13-76	21±5	18±6	18±5	25±6
5-13-76	5-20-76	12±4	22±6	15±4	12±4
5-20-76	5-27-76	12±4	53±8	5±4	10±4
5-27-76	6-03-76	12±4	14±5	10±4	14±4
6-03-76	6-10-76	23±5	27±5	21±5	25±5
6-10-76	6-17-76	24±5	25±6	22±6	17±5
6-17-76	6-24-76	14±3	15±5	*	11±4
6-24-76	7-01-76	19±5	15±6	10±5	14±4
7-01-76	7-08-76	19±5	7±4	12±4	5±4
7-08-76	7-15-76	14±4	20±5	20±5	22±5

TABLE B-8 (CONT.)

CONCENTRATIONS OF BETA EMITTERS IN AIR PARTICULATES, 1976

Results in Units of 10^{-3} pCi/m^3 ± 2 sigma

START DATE	STOP DATE	STATION NO. TM-AP-1S2	TM-AP-2S3**	TM-AP-8S1	TM-AP-5A1
7-15-76	7-22-76	17±4	25±6	22±5	21±5
7-22-76	7-29-76	17±5	11±6	15±5	5±4
7-29-76	8-05-76	16±5	72±13	17±5	21±6
8-05-76	8-12-76	7±3	26±6	5±3	21±5
8-12-76	8-19-76	17±4	16±5	18±5	4±3
8-19-76	8-26-76	27±6	20±12	24±6	22±6
8-26-76	9-02-76	18±5	25±22	<3	18±5
9-02-76	9-09-76	21±5	17±6	19±5	15±5
9-09-76	9-16-76	22±6	18±7	25±6	25±6
9-16-76	9-23-76	19±5	-	20±5	23±5
9-23-76	9-30-76	15±4	-	<13	18±4
9-30-76	10-07-76	347±17	-	655±23	202±13
10-07-76	10-14-76	349±16	-	149±11	339±16
10-14-76	10-21-76	28±5	-	50±6	115±9
10-21-76	10-27-76	156±12	-	75±9	38±7
10-27-76	11-04-76	105±8	-	128±10	172±11
11-04-76	11-10-76	140±10	-	136±11	81±9
11-10-76	11-17-76	74±8	-	74±8	67±7
11-17-76	11-23-76	108±10	-	84±9	117±10
11-23-76	11-30-76	16±4	-	110±9	87±8
11-30-76	12-08-76	66±7	-	56±7	26±5
12-08-76	12-15-76	56±7	-	57±7	46±6
12-15-76	12-22-76	46±7	-	51±7	41±6
12-22-76	12-29-76	35±6	-	16±5	14±5

TABLE B-8 (CONT.)

CONCENTRATIONS OF BETA EMITTERS IN AIR PARTICULATES, 1976

Results in Units of 10^{-3} pCi/m^3 ± 2 sigma

START DATE	STOP DATE	STATION NO. TM-AP-12B1	TM-AP-1C1**	AVERAGE
12-31-75	1-07-76	23±6	-	17±2
1-07-76	1-15-76	19±5	-	20±10
1-15-76	1-22-76	30±5	-	25±10
1-22-76	1-29-76	15±5	-	14±9
1-29-76	2-05-76	21±5	-	20±6
2-05-76	2-12-76	17±5	-	18±6
2-12-76	2-19-76	23±6	-	21±11
2-19-76	2-26-76	17±7	-	18±7
2-26-76	3-04-76	24±6	-	19±8
3-04-76	3-11-76	18±5	-	16±6
3-11-76	3-18-76	19±6	-	15±12
3-17-76	3-25-76	21±6	-	17±8
3-25-76	4-01-76	22±5	-	23±10
4-01-76	4-08-76	20±5	-	16±11
4-08-76	4-15-76	23±5	-	20±13
4-15-76	4-22-76	80±9	-	40±32
4-22-76	4-29-76	11±4	-	11±4
4-29-76	5-06-76	15±5	-	15±7
5-06-76	5-13-76	27±6	-	23±7
5-13-76	5-20-76	12±4	-	14±8
5-20-76	5-27-76	16±5	-	20±37
5-27-76	6-03-76	12±4	-	12±3
6-03-76	6-10-76	26±5	-	28±18
6-10-76	6-17-76	23±6	-	21±8
6-17-76	6-24-76	16±4	-	15±4
6-24-76	7-01-76	24±5	-	19±9
7-01-76	7-08-76	16±5	-	12±9
7-08-76	7-15-76	22±5	-	18±12

TABLE B-8 (CONT.)

CONCENTRATION OF BETA EMITTERS IN AIR PARTICULATES, 1976

Results in Units of 10^{-3} pCi/m^3 ± 2 sigma

START DATE	STOP DATE	STATION NO. TM-AP-12B1	TM-AP-1C1**	AVERAGE
7-15-76	7-22-76	23±5	-	21±7
7-22-76	7-29-76	19±5	-	16±12
7-29-76	8-05-76	18±5	-	24±34
8-05-76	8-12-76	19±4	-	17±15
8-12-76	8-19-76	25±5	-	20±22
8-19-76	8-26-76	29±6	-	26±8
8-26-76	9-02-76	21±6	-	18±13
9-02-76	9-09-76	22±5	-	19±5
9-09-76	9-16-76	25±6	-	25±8
9-16-76	9-23-76	21±5	216±55	22±6
9-23-76	9-30-76	18±4	17±5	21±33
9-30-76	10-07-76	572±21	729±34	518±340
10-07-76	10-14-76	263±17	494±32	280±432
10-14-76	10-21-76	135±10	56±8	98±162
10-21-76	10-27-76	99±10	56±9	75±84
10-27-76	11-04-76	225±13	*	145±84
11-04-76	11-10-76	157±12	*	144±184
11-10-76	11-17-76	81±8	172±12	87±83
11-17-76	11-23-76	120±11	*	108±35
11-23-76	11-30-76	50±7	95±10	83±74
11-30-76	12-08-76	63±7	54±7	53±24
12-08-76	12-15-76	12±4	44±3	37±41
12-15-76	12-22-76	45±7	15±5	42±32
12-22-76	12-29-76	21±6	<5	19±21

* Sampling equipment inoperative.
** Station 1C1 replaced stations 2S3 and 1F1 on 9-16-76.
+ No sample received.

TABLE B-9

CONCENTRATIONS OF GAMMA EMITTERS IN AIR PARTICULATES, 1976

Results in Units of 10^{-3} pCi/m^3 ± 2 sigma

STATION NO.	NUCLIDE*	12-31-75 to 1-29-76	1-29-76 to 3-04-76	3-04-76 to 4-01-76	4-01-76 to 4-29-76	4-29-76 to 6-03-76	6-03-76 to 7-01-76
TM-AP-BACKGROUND **	Be-7	57±6	62±6	110±11	130±14	110±11	130±13
	Mn-54	0.4±0.4	<0.2	<0.4	<0.5	<0.4	<0.3
	Co-58	<0.3	<0.2	<0.5	<0.7	<0.5	<0.3
	Zr-95	<0.4	<0.4	<0.9	<0.9	<0.7	<0.5
	Ru-106	<2.0	<2.0	<5.0	<5.0	<4.0	<3.0
	Cs-137	0.5±0.4	0.4±0.2	2.7±0.9	3.4±1.2	1.2±0.6	0.9±0.5
	Ce-144	<2.0	<1.0	<3.0	<6.0	<3.0	<2.0
TM-AP-INDICATOR +	Be-7	42±4	40±4	46±5	90±9	63±6	100±10
	Mn-54	<0.07	<0.05	0.10±0.04	<0.09	0.08±0.06	<0.08
	Co-58	0.2±0.1	<0.06	<0.07	<0.1	<0.09	<0.05
	Zr-95	<0.1	0.1±0.1	<0.08	<0.1	<0.08	<0.1
	Ru-106	<0.6	<0.6	<0.5	0.8±0.6	<0.6	<0.7
	Cs-137	0.1±0.1	0.2±0.1	0.2±0.1	0.6±0.2	0.4±0.1	0.5±0.2
	Ce-144	0.8±0.6	2.0±0.8	2.1±0.6	1.4±0.5	2.0±1.0	<0.8

TABLE B-9 (CONT.)

CONCENTRATIONS OF GAMMA EMITTERS IN AIR PARTICULATES, 1976

Results in Units of 10^{-3} pCi/m^3 ± 2 sigma

STATION NO.	NUCLIDE*	7-01-76 to 7-29-76	7-29-76 to 9-02-76	9-02-76 to 9-30-76	9-30-76 to 10-27-76	10-27-76 to 11-30-76	11-30-76 to 12-24-76
TM-AP-BACKGROUND	Be-7	78±8	86±9	70±7	80±8	78±41	65±6
**	Mn-54	<0.2	<0.09	<0.09	<0.2	<0.3	<0.2
	Co-58	<0.1	<0.07	<0.1	0.6±0.4	<0.4	<0.2
	Nb-95	<0.1	<0.07	<0.1	28±3	16±2	3.2±0.4
	Zr-95	<0.3	<0.2	<0.2	35±4	15±2	3.2±0.4
	Ru-103	<0.1	<0.08	<0.09	14±1	19±2	1.4±0.5
	Ru-106	<1.0	<0.8	<0.8	<2.0	<3.0	<2.0
	I-131	<0.1	<0.09	<0.1	2.0±0.4	<0.4	<0.2
	Cs-137	1.0±0.3	0.6±0.2	0.3±0.2	<0.2	<0.4	<0.2
	BaLa-140	<0.3	<0.1	<0.2	11±1	5.0±1.3	<0.4
	Ce-144	<0.9	<0.9	<0.7	5.1±1.4	13±5	<1.0
	Ce-141	<0.2	<0.2	<0.2	32±3	26±3	3.7±0.6
TM-AP-INDICATOR	Be-7	62±6	77±8	58±6	45±4	49±5	48±5
	Mn-54	<0.1	<0.1	<0.1	<0.1	<0.1	0.09
	Co-58	<0.09	<0.1	<0.1	0.3±0.2	<0.1	0.3±0.2
	Nb-95	<0.1	<0.09	<0.1	14±1	9.1±0.9	2.5±0.3
	Zr-95	<0.2	<0.1	<0.2	16±2	8.6±0.9	2.7±0.5
	Ru-103	<0.1	<0.09	<0.1	10±1	9.5±1.0	3.8±0.4
	Ru-106	<0.8	<0.9	<0.9	<2.0	<1.0	<1.0
	I-131	<0.1	<0.1	<0.1	1.6±0.4	<0.1	<0.1
	Cs-137	0.8±0.2	0.5±0.2	0.4±0.2	<0.2	<0.2	<0.1
	BaLa-140	<0.2	<0.2	<0.2	6.2±0.9	2.4±0.2	<0.2
	Ce-144	<1.0	<0.7	<1.0	7.6±3.0	2.0±0.21	<1.0
	Ce-141	<0.2	<0.1	<0.3	19±2	10±1	3.0±0.4

* All other gamma emitters <MDL, Table B-20

** Background stations are 1F1, 5F1, 7F1, 7G1, 15G1

\+ Indicator stations are 1S2, 2S3, 8S1, 5A1, 12B1, 1C1

TABLE B-10

CONCENTRATIONS OF I-131 IN FILTERED AIR, 1976

Results* in Units of 10^{-3} pCi/m^3

START DATE	STOP DATE	STATION NO. TM-AI-1S2	TM-AI-8S1	TM-AI-5A1	TM-AI-15G1
12-31-75	1-07-76	<8	<10	<10	<12
1-07-76	1-15-76	<6	<7	<7	<7
1-15-76	1-22-76	<8	<8	<10	<11
1-22-76	1-29-76	<8	<8	<8	<8
1-29-76	2-05-76	<5	<6	<6	<6
2-05-76	2-12-76	<6	<6	<6	<6
2-12-76	2-19-76	<7	<7	<7	<7
2-19-76	2-26-76	<8	<8	<8	<8
2-26-76	3-04-76	<7	<7	<7	<7
3-04-76	3-11-76	<6	<6	<6	<6
3-11-76	3-18-76	<8	<6	<8	<8
3-18-76	3-25-76	<7	<6	<7	<9
3-25-76	4-01-76	<7	<7	<7	<7
4-01-76	4-08-76	<7	<7	<7	<9
4-08-76	4-15-76	<8	<8	<8	<8
4-15-76	4-22-76	<9	<9	<9	<10
4-22-76	4-29-76	<10	<10	<12	<10
4-29-76	5-06-76	<10	<10	<11	<10
5-06-76	5-13-76	<7	<7	<7	<9
5-13-76	5-20-76	<9	<10	<9	<10
5-20-76	5-27-76	<10	<10	<10	<10
5-27-76	6-03-76	<8	<8	<8	<10
6-03-76	6-10-76	<7	<9	<8	<10
6-10-76	6-17-76	<7	<7	<7	<7
6-17-76	6-24-76	<4	**	<7	<9
6-24-76	7-01-76	<10	<15	<10	<12
7-01-76	7-08-76	<11	<9	<10	<11

TABLE B-10 (CONT.)

CONCENTRATIONS OF I-131 IN FILTERED AIR, 1976

Results* in Units of 10^{-3} pCi/m^3

START DATE	STOP DATE	STATION NO. TM-AI-1S2	TM-AI-8S1	TM-AI-5A1	TM-AI-15G1
7-08-76	7-15-76	<9	<9	<9	<7
7-15-76	7-22-76	<8	<8	<8	<9
7-22-76	7-29-76	<8	<9	<8	<9
7-29-76	8-05-76	<8	<8	<9	<9
8-05-76	8-12-76	<8	<8	<9	<9
8-12-76	8-19-76	<8	<9	<8	<8
8-19-76	8-26-76	<16	<19	<16	<16
8-26-76	9-02-76	<9	<9	<10	<10
9-02-76	9-09-76	<5	<9	<8	<8
9-09-76	9-16-76	<17	<14	<17	<17
9-16-76	9-23-76	<10	<10	<10	<10
9-23-76	9-30-76	<10	<45	<10	<8
9-30-76	10-07-76	99±10	108±11	66±7	76±8
10-07-76	10-14-76	<6	<6	<6	<6
10-14-76	10-21-76	<9	<9	<9	<7
10-21-76	10-27-76	<8	<7	<8	<7
10-27-76	11-04-76	<5	<6	<5	<5
11-04-76	11-10-76	<6	<7	<7	<7
11-10-76	11-17-76	<8	<8	<7	<9
11-17-76	11-23-76	<6	<6	+	<6
11-23-76	11-30-76	<6	<7	<6	<6
11-30-76	12-08-76	<5	<5	<5	<6
12-08-76	12-15-76	<8	<8	<7	<8
12-15-76	12-22-76	<22	<18	<20	<20
12-22-76	12-29-76	<10	<10	<10	<10

* Results corrected for decay.

** Sample equipment inoperative.

\+ Sample lost.

TABLE B-11

CONCENTRATIONS OF BETA EMITTERS IN PRECIPITATION, 1976

Results in Units of pCi/l ± 2 sigma

START DATE	STOP DATE	STATION NO. TM-RW-8S1	TM-RW-5A1	TM-RW-7F1	TM-RW-15G1	AVERAGE
12-31-75	1-29-76	8.0±3.0	4.8±2.8	9.1±3.1	4.0±2.8	6.5±4.9
1-29-76	2-26-76	11±3	3.7±2.8	12±3	7.9±3.2	8.6±7.5
2-26-76	3-25-76	5.8±2.3	13±3	16±3	6.5±2.4	10±10
3-25-76	4-29-76	<1.9	4.0±2.2	3.5±2.1	3.3±2.1	3.2±1.8
4-29-76	5-27-76	3.5±2.4	5.7±2.6	6.6±2.6	<3.0	4.7±3.4
5-27-76	7-01-76	5.8±2.7	<3.0	3.4±2.5	3.8±2.5	4.0±2.5
7-01-76	7-29-76	12±3	9.6±2.9	5.2±2.5	7.9±2.8	8.7±5.7
7-29-76	8-26-76	5.6±2.2	5.3±2.1	<3.0	6.5±2.2	5.1±3.0
8-26-76	9-30-76	<3.0	<3.0	6.2±3.2	<3.0	?±3.2
9-30-76	10-27-76	153±8	158±8	139±8	156±8	152±17
10-27-76	11-30-76	365±13(8C1)	782±19	459±15	358±13	491±399
11-30-76	12-29-76	16±3	15±3	4.9±2.4	4.9±2.4+	10±12
	AVERAGE	49±216	84±448	56±265	47±214	59±293

+ Sampling period 12-01-76 through 12-29-76.

TABLE B-12

BETA EMITTER DEPOSITION, 1976

Results in Units of nCi/m^2 ± 2 sigma

START DATE	STOP DATE	STATION NO. TM-RW-8S1	TM-RW-5A1	TM-RW-7F1	TM-RW-15G1	AVERAGE
12-31-75	1-29-76	1.0±0.4	0.6±0.3	1.1±0.4	0.4±0.3	0.8±0.7
1-29-76	2-26-76	0.5±0.1	0.2±0.1	0.4±0.1	0.3±0.1	0.4±0.3
2-26-76	3-25-76	0.2±0.1	0.4±0.1	0.4±0.1	0.2±0.1	0.3±0.2
3-25-76	4-29-76	<0.1	0.3±0.1	0.2±0.1	0.3±0.2	0.2±0.2
4-29-76	5-27-76	0.2±0.2	0.4±0.2	0.4±0.2	<0.3	0.3±0.2
5-27-76	7-01-76	0.8±0.4	<0.4	0.5±0.3	1.5±1.0	0.8±1.0
7-01-76	7-29-76*	1.2±0.3	0.9±0.3	0.5±0.3	1.2±0.4	1.0±0.7
	AVERAGE	0.6±0.9	0.5±0.5	0.5±0.6	0.6±1.0	0.5±0.7

* Deposition Calculations Discontinued in August.

TABLE B-13

CONCENTRATIONS OF TRITIUM AND GAMMA EMITTERS IN PRECIPITATION, 1976

Results in Units of pCi/l ± 2 sigma

STATION NO.	START DATE	STOP DATE	H-3	Be-7*	Co-58	Zr-95	Nb-95	Ru-103	Ce-141	Ce-144	Ra-226*
TM-RW-8S1	12-31-75	3-25-76	120±60	<MDL	<0.5	<0.4	<0.4	<MDL	<MDL	<3.0	<0.8
	3-25-76	7-01-76	160±65	<MDL	<0.5	<0.4	<0.4	<MDL	<MDL	<3.0	<0.9
	7-01-76	9-30-76	120±56	16±8	<0.5	<0.5	<0.5	<MDL	<MDL	<3.0	3.2±1.3
	9-30-76	12-29-76	97±68	4.4±4.0	<0.8	4.4±1.3	4.0±0.7	3.2±0.7	2.6±0.9	<2.0	<0.6
TM-RW-5A1	12-31-75	3-25-76	130±63	<MDL	<0.5	<0.4	<0.4	<MDL	<MDL	<3.0	<0.9
	3-25-76	7-01-76	<80	<MDL	<0.5	<0.4	<0.4	<MDL	<MDL	<3.0	<0.9
	7-01-76	9-30-76	86±54	19±8	<0.5	<0.5	<0.5	<MDL	<MDL	<3.0	<1.0
	9-30-76	12-29-76	270±27	5.4±3.6	<0.3	1.5±0.7	1.4±0.5	3.3±0.5	1.3±0.6	<1.0	<0.7
TM-RW-7F1	12-31-75	3-25-76	110±63	14±6	<0.5	<0.4	<0.4	<MDL	<MDL	<3.0	<0.9
	3-25-76	7-01-76	360±66	<MDL	<0.5	<0.5	<0.5	<MDL	<MDL	<3.0	<0.9
	7-01-76	9-30-76	156±54	<MDL	<0.5	<0.5	<0.5	<MDL	<MDL	<3.0	3.1±1.3
	9-30-76	12-29-76	300±70	37±11	3.0±0.9	63±6	100±10	12±2	15±2	20±7	<2.0
TM-RW-15G1	12-31-75	3-25-76	100±63	<MDL	<0.5	<0.4	<0.4	<MDL	<MDL	<3.0	<0.9
	3-25-76	7-01-76	190±65	<MDL	<0.5	<0.4	<0.4	<MDL	<MDL	<3.0	<0.9
	7-01-76	9-30-76	108±54	14±9	<0.5	<0.5	<0.5	<MDL	<MDL	<3.0	1.9±1.3
	9-30-76	12-29-76	331±70	24±12	<1.0	44±4	65±6	12±2	12±3	52±13	<2.0

* All other gamma emitters <MDL, Table B-20.

TABLE B-14

CONCENTRATIONS OF SR-89 AND SR-90 IN PRECIPITATION, 1976

Results in Units of pCi/l

STATION NO.	START STOP	START STOP	SR-89	SR-90
TM-RW-5A1	12-31-75 7-01-76	7-01-76 12-29-76	<0.6 2.5±0.6	<0.5 1.0±0.4
TM-RW-8S1	12-31-75 7-01-76	7-01-76 12-24-76	<0.6 2.8±0.6	0.5±0.3 1.1±0.4
TM-RW-7F1	12-31-75 7-01-76	7-01-76 12-29-76	<0.7 2.6±0.6	<0.5 0.8±0.4
TM-RW-15G1	12-31-75 7-01-76	7-01-76 12-29-76	<0.6 7.7±0.8	<0.4 1.0±0.6

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TABLE B-15

CONCENTRATIONS OF I-131 IN MILK, 1976

Results* in Units of pCi/l

STATION NO.	JAN**	FEB**	MAR	APR+	MAY	JUN
TM-M-4B1	-	-	<0.06	<0.05	<0.04	<0.05
TM-M-5B1	-	-	<0.04	<0.06	<0.05	<0.05
TM-M-7B3	-	-	<0.04	<0.04	<0.04	<0.04
TM-M-14C1	-	-	<0.04	<0.06	<0.05	<0.05
TM-M-2G1	-	-	<0.0[illegible]++	<0.05	<0.04	<0.08

TABLE B-15 (CONT.)

CONCENTRATIONS OF I-131 IN MILK, 1976

Results* in Units of pCi/l

STATION NO.	JUL	AUG	SEP	OCT	NOV	DEC**
TM-M-4B1	<0.05	<0.05	<0.06	2.2±0.2	<0.06	-
TM-M-5B1	<0.05	<0.04	<0.05	0.4±0.1	2.4±0.2	-
TM-M-7B3	<0.05	<0.05	<0.05	46±5	4.1±0.4	-
TM-M-14C1	<0.04	<0.05	<0.06	1.9±0.2	0.08±0.05	-
TM-M-2G1	<0.05	<0.04	<0.05	3.2±0.3	0.09±0.05	-

* Results corrected for decay to sampling date.
** No sample in January, February, December; non-grazing season.
+ Samples collected on 5-01-76.
++ 2G1 replace 1F2 in April.

TABLE B-16

CONCENTRATIONS OF SR-89 AND SR-90 IN MILK, 1976

Results in Units of pCi/l ± 2 sigma

STATION NO.	START DATE	STOP* DATE	SR-89	SR-90
TM-M-4B1	3-31-76	3-31-76	<1.4	2.0±0.6
	5-01-76	6-30-76	<4.8	5.6±2.2
	7-31-76	9-29-76	<1.3	4.7±0.6
	10-30-76	11-27-76	<0.6	<0.4
TM-M-5B1	3-31-76	3-31-76	<0.8	0.9±0.4
	5-01-76	6-30-76	<1.2	1.8±0.6
	7-31-76	9-29-76	<1.3	1.0±0.6
	10-30-76	11-27-76	<0.3	<0.3
TM-M-7B3	3-31-76	3-31-76	<1.3	0.7±0.6
	5-01-76	6-30-76	<2.2	3.2±1.0
	7-31-76	9-29-76	<1.0	0.5±0.4
	10-30-76	11-27-76	2.2±0.9	<1.0
TM-M-14C1	3-31-76	3-31-76	<1.3	1.6±0.6
	5-01-76	6-30-76	<2.7	3.3±0.9
	7-31-76	9-29-76	<2.4	1.8±1.1
	10-30-76	11-27-76	<1.3	<0.9
TM-M-2G1	3-31-76	3-31-76	<1.1**	1.8±0.6**
	5-01-76	6-30-76	<4.7	4.9±2.2
	7-31-76	9-29-76	<1.2	<0.8
	10-30-76	11-27-76	<2.0	<1.4

* No sample collected in January, February, December; non-grazing season.
** 2G1 replaced 1F2 in April.

TABLE B-17

CONCENTRATIONS OF GAMMA EMITTERS IN GREEN LEAFY VEGETABLES, FRUITS AND ALFALFA, 1976

Results in Units of pCi/kg (wet) ± 2 sigma

STATION NO.	SAMPLING DATE	SAMPLE TYPE	K-40*	Be-7*
TM-FPL-5B1	7-31-76	Cabbage	2300±230	<MDL
TM-FPL-7B3	7-31-76	Cabbage	3000±300	<MDL
TM-FPL-14C1	7-31-76	Cabbage	2000±200	<MDL
TM-FPL-2G1	7-31-76	Cabbage	2300±230	<MDL
TM-FPF-5F2	7-31-76	Apples	1000±100	<MDL
TM-FPF-5F2	7-31-76	Peaches	2300±230	<MDL
TM-FPF-12G2	7-31-76	Apples	1500±150	<MDL
TM-FPF-12G2	7-31-76	Peaches	2500±250	<MDL
TM-V-5B1	7-31-76	Alfalfa	42000±4200+	850±390
TM-V-2G1	7-31-76	Alfalfa	26000±2600+	780±410+

* All other gamma emitters <MDL, Table B-20
\+ pCi/kg (dry)

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TABLE B-18

CONCENTRATION OF GAMMA EMITTERS IN BEEF AND GAME, 1976

Results in Units of pCi/g (wet) ± 2 sigma

STATION NO.	SAMPLING DATE	SAMPLE TYPE	K-40	Cs-137*
TM-FPB-2D1	11-05-76	Beef	3.3±0.3	<0.005
TM-FPB-5F3	11-05-76	Beef	3.5±0.4	<0.005
TM-GAD-7F2	12-14-76	Deer	3.1±0.3	<0.005
TM-GAD-8D1	12-02-76	Deer	3.1±0.3	0.015±0.007

* All other gamma emitters <MDL, Table B-20.

TABLE B-19

TLD DOSE RATE, 1976

Results in Units of mrem/standard month

STATION NO.	12-29-75 to 3-31-76	3-31-76 to 6-30-76	6-30-76 to 9-29-76	9-29-76 to 12-29-76	AVERAGE
CONTROL LOCATIONS					
TM-ID-1F1	7.09±0.14	5.84±0.26	5.56±0.55	5.38±0.36	5.97±1.54
TM-ID-7F1	7.62±0.60	7.05±0.45	7.03±0.14	8.49±0.25	7.55±1.37
TM-ID-4G1	5.95±0.25	5.86±0.26	5.54±0.40	7.13±0.28	6.12±1.39
TM-ID-9G1	6.43±0.28	5.81±0.27	5.42±0.23	6.53±0.48	6.05±1.05
TM-ID-15G1	6.02±0.47	5.38±0.27	5.30±0.56	7.16±0.33	5.96±1.72
TM-ID-5H1	5.75±0.24	4.80±0.30	5.00±0.22	6.27±0.20	5.46±1.36
INDICATOR LOCATIONS					
TM-ID-1S2	5.48±0.32	4.91±0.40	4.85±0.08	6.08±0.22	5.33±1.15
TM-ID-2S2	4.72±0.19	4.58±0.13	4.53±0.23	5.46±0.53	4.82±0.86
TM-ID-4S2	5.52±0.37	5.59±0.60	5.59±0.87	6.30±0.21	5.75±0.74
TM-ID-5S3	5.18±0.29	4.57±0.41	4.86±0.50	5.62±0.50	5.06±0.90
TM-ID-8S1	5.69±0.64	5.28±0.36	5.13±0.37	6.06±0.63	5.54±0.84
TM-ID-9S2	5.69±0.14	5.23±0.16	5.70±0.54	6.34±0.48	5.74±0.91
TM-ID-11S1	6.30±0.20	5.66±0.36	5.42±0.25	6.98±0.63	6.09±1.40
TM-ID-14S2	*	4.74±0.46**	3.91±0.21	++	4.32±1.17
TM-ID-16S1	6.32±0.13	5.63±0.66	5.36±0.64	6.66±0.46	5.99±1.20
TM-ID-4A1	5.59±0.13	4.68±0.25	4.93±0.42	6.03±0.19	5.31±1.23
TM-ID-5A1	5.42±0.39	4.97±0.30	5.12±0.35	6.17±0.19	5.42±1.07
TM-ID-16A1	+	4.90±0.54**	4.55±0.35	++	4.72±0.49
TM-ID-10B1	+	5.51±0.23**	5.70±0.09	++	5.60±0.27
TM-ID-12B1	4.81±0.14	3.99±0.37	4.03±0.21	5.47±0.41	4.58±1.41
TM-ID-1C1	5.05±0.16	4.50±0.18	4.15±0.21	5.90±0.59	4.90±1.52
AVERAGE	5.81±1.49	5.21±1.34	5.13±1.39	6.34±1.53	5.59±1.71

* TLD's stolen.
** Quarterly sampling period 4-08-76 to 6-30-76.
\+ Results not calculated - no in-transit doses.
++ TLDs not collected due to icy river conditions.

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TABLE B-20

TYPICAL MDLs* FOR GAMMA SPECTROMETRY, 1976

NUCLIDES	SURFACE WATER (pCi/l)	FISH (pCi/kg)	SEDIMENT (pCi/g)	AIR PARTICULATES (10^{-3}pCi/m^3)	PRECIPITATION (pCi/l)	FOOD PRODUCTS (Green Leafy Vegetation, Fruits, Beef) (pCi/kg)
Na-22	0.2	3	0.01	0.07	0.2	1
K-40	7	-	-	7	7	-
Cr-51	3	30	0.1	0.6	3	20
Mn-54	0.5	6	0.01	0.2	0.5	3
Co-58	0.5	5	0.01	0.1	0.5	3
Fe-59	1	10	0.03	0.1	1	6
Co-60	0.6	7	0.01	0	0.6	4
Zn-65	1	20	0.03	0.3	1	7
ZrNb-95	0.5	5	0.02	0.6	0.4	3
Mo-99	4	40	0.08	1	4	20
RuRh-106	2	20	0.1	1	2	10
Ra-110m	0.4	5	0.04	0.9	0.4	2
Te-129m	7	20	0.2	1	7	40
I-131	0.4	4	0.01	0.1	0.4	2
Te-132	0.4	4	0.02	0.07	0.4	2
I-133	0.5	6	0.01	0.1	0.5	3
Cs-134	0.5	5	0.02	0.4	0.5	2
Cs-136	0.7	9	0.02	0.06	0.7	4
Cs-137	0.5	7	-	-	0.5	3
BaLa-140	0.6	7	0.03	0.3	0.6	3
Ce-144	3	30	0.1	1	3	10
Ra-226	0.9	10	-	0.2	0.9	5
Th-232	2	20	-	0.4	2	10

* At time of analysis.

TABLE B-21

DISTRIBUTION OF MILK COWS WITHIN FIVE MILES OF TMINS, 1976

FARM DIRECTION	FARM DISTANCE	NUMBER OF COWS	FARM DIRECTION	FARM DISTANCE	NUMBER OF COWS
N	3.1	80	ESE	3.8	45
N	4.9	1	ESE	4.3	24
NE	2.3	20	ESE	4.5	32
NE	4.4	50	SE	1.4	42
NE	4.1	90	SE	4.0	1
ENE	1.0	39	SE	4.1	84
ENE	2.5	2	SE	4.7	50
ENE	4.2	38	SE	4.8	19
ENE	4.4	90	SSW	4.9	26
ENE	4.5	44	SW	4.7	1
ENE	4.8	57	WSW	4.0	2
E	1.0	69	WNW	2.7	25
E	3.5	26	WNW	2.9	4
ESE	2.3	25	WNW	3.1	4
ESE	3.1	1	WNW	3.6	28
ESE	3.2	28			
ESE	3.6	35			

Total Number of Farms 32
Total Number of Milk Cows 1082