

 **Nuclear**

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March 1, 1990
C311-90-2013

US Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Dear Sir:

Three Mile Nuclear Station Unit 1 (TMI-1)
Operating License No. DPR-50
Docket No. 50-289
Second Half - 1989 Semi Annual Effluent and Release Report

Enclosed is the TMI-1 Semi Annual Effluent and Release Report for the period July 1, 1989 through December 31, 1989. This report includes an Executive Summary of the Effluent Release Report, the Disposal and Effluent Release Data, and an assessment of the radiation doses due to liquid and gaseous effluents released from the Unit during the reporting period.

TMI Technical Specification Sections 6.9.4.2.1 and 6.9.4.2.2 require reporting of effluent data and solid waste shipment data in accordance with Reg. Guide 1.21 for the semi-annual report period. These tables are attached including summaries of solid waste shipments and liquid and gaseous effluents for the reporting period.

TMI Technical Specification Section 6.9.4.2.3 requires a summary of unplanned releases from the site to unrestricted areas. During this report period, there were no unplanned releases.

TMI Technical Specification Section 6.9.4.2.4 also requires that changes to the Process Control Program (PCP) and Offsite Dose Calculation Manual (ODCM) be reported. There were no changes to either of these programs. This section also requires "a listing of new locations for dose calculations and/or monitoring identified by the land use census pursuant to Specification 3.23.2." There were no new locations during this semi-annual period.

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TMI Technical Specification Section 6.9.4.2.5 requires reporting of instrumentation not returned to OPERABLE status within 30 days per Section 3.21.1.b and 3.21.2.b. All instrumentation under this Tech. Spec. section was returned to OPERABLE service within 30 days.

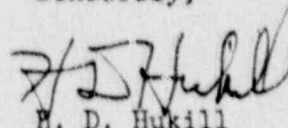
TMI Technical Specification Section 6.9.4.3.1 requires an annual summary of hourly meteorological data collected over the previous year. This data is contained in the attached Joint Frequency Tables.

In accordance with Technical Specification Section 6.9.4.3.2, this report includes an annual summation table and a semi-annual table showing the assessment of the radiation doses due to liquid and gaseous effluents released from the Unit during 1989.

Technical Specification Section 6.9.4.3.3 also requires in part that annually this same report shall include "an assessment of the radiation doses from radioactive liquid and gaseous effluents to MEMBERS OF THE PUBLIC due to their activities inside the site boundary (Figures 5-3 and 5-4) during the report period." Since the public does not have unrestricted access to TMI-1, no assessment of this dose is applicable.

TMI Technical Specification Section 6.9.4.3.4 requires an annual assessment of radiation dose to the most likely exposed real individual from reactor releases and other nearby uranium fuel cycle sources (TMI Unit 2) to show compliance with 40 CFR 190 "Environmental Radiation Protection Standards for Nuclear Power Operations." The annual dose to the maximum exposed individual from effluents for comparison to 40 CFR 190, would be no greater than 0.53 mrem to the thyroid. This sums doses from Unit 1 and Unit 2 and includes the maximum dose regardless of age group for different pathways. It is further estimated based on the maximum average fenceline dose rate for the year of 25.5 mrem above background per standard month, a person residing at the fenceline for the duration specified in RG 1.109 for shoreline exposure, would receive no more than 2.3 mrem direct dose, for a maximum potential total dose of 2.8 mrem for both units.

Sincerely,



M. D. Hukill

Vice President & Director, TMI-1

HDH/DVH/spb:2013

cc: T. Martin
R. Hernan
F. Young

Enclosures

EXECUTIVE SUMMARY
Three Mile Island Nuclear Station Unit 1
Effluent and Offsite Dose Report
for the Period of July 1, 1989 to December 31, 1989

This report summarizes the radioactive liquid and gaseous releases (effluents) from Three Mile Island Unit 1 and the calculated maximum hypothetical radiation exposure to the public resulting from these releases. This report covers the period of operation from July 1 to December 31, 1989.

Radiological releases from the plant are monitored by installed plant monitors sampling the plant stacks for gaseous releases and liquid monitors for discharges to the Susquehanna River. These monitors and sample analyses provide a means for accurate determination of the type and quantities of radioactive materials being released to the environment.

Calculations of the maximum hypothetical dose to an individual and the total population around Three Mile Island due to radioactive releases from the plant are made utilizing environmental conditions that existed at the time of the release. Susquehanna River flow data are used to calculate the maximum hypothetical doses to an individual and the population downstream of TMI due to liquid releases. Actual or "real-time" meteorological data from an onsite tower is used to determine the doses resulting from gaseous releases from the plant. The use of real-time meteorological information permits the determination of both the direction in which the release traveled and the dispersion of radioactive material in the environment.

Utilizing gaseous effluent data and real-time meteorology the maximum hypothetical dose to any individual and to the total population within 50 miles of the plant is calculated. Similarly, Susquehanna River flow and liquid effluent data are used to calculate a maximum hypothetical dose to an individual and a population dose from liquid effluents for any shoreline exposure down to the Chesapeake Bay. Exposure to the public from consumption of water and fish withdrawn from the Susquehanna River downstream of the plant is also calculated.

Dose calculations for liquid and gaseous effluents are performed using a mathematical model which is based on the methods defined by the U. S. Nuclear Regulatory Commission.

The maximum hypothetical doses are conservative overestimates of the actual offsite doses which are likely to occur. For example, the dose does not take into consideration the removal of radioactive material from the river water by precipitation of insoluble salts, absorption onto river sediment, biological removal, or removal during processing by water companies prior to distribution and consumption.

Liquid discharges made during the reporting period July 1 to December 31, 1989 consisted of 216 curies of tritium, 0.24 curies of noble gases (predominantly Xe-133), and 0.012 curies of other beta and gamma emitters, predominantly Co-58. The quantities of effluents are similar to average semi-annual releases from previous Unit 1 operations.

During the reporting period July 1 to December 31, 1989, the maximum hypothetical calculated whole body dose to an individual due to liquid effluents from Three Mile Island Unit 1 was 0.021 mrem. The maximum hypothetical calculated dose to any organ of an individual was 0.028 mrem to the liver.

Airborne discharges made during this same time period consisted of 3.0 curies of tritium, 1676 curies of noble gases, and 0.016 curies of iodines and particulates. These releases are similar to semi-annual releases from previous Unit 1 operation, since the 1985 restart.

The maximum hypothetical calculated dose to any individual from noble gases was 0.054 mrem to the skin and 0.025 mrem to the whole body. Airborne iodine and particulates are calculated to produce 0.29 mrem to the thyroid of the maximum hypothetical individual.

The total maximum hypothetical whole body dose of 0.047 mrem, received by any individual from effluents from TMI-1 for the reporting period is 1000 times lower than the doses the average individual in the area of TMI-1 receives from natural background during the same time period. Natural background averages about 50 mrem whole body semi-annually in the TMI-1 area. In addition, average equivalent dose to the total body from natural radon for the same period is about 100 mrem. The calculated total whole body population dose from all plant releases is 3.3 person-rem. This is 33,000 times lower than the dose attributed to natural background radiation for the reporting period. The doses which could be received by the maximum hypothetical individual are each less than 4% of the annual limits established by the Nuclear Regulatory Commission in Appendix I of 10 CFR 50.

EFFLUENT & WASTE DISPOSAL SEMIANNUAL REPORT
SUPPLEMENTAL INFORMATION
FACILITY: TMI UNIT 1 **LICENSE: DPR 50-289**

1. **REGULATORY LIMITS - - - REFER TO TMI UNIT 1 TECHNICAL SPECIFICATIONS**
 - A. FISSION AND ACTIVATION GASES:
 - B. IODINES:
 - C. PARTICULATES, HALF-LIVES > 8 DAYS:
 - D. LIQUID EFFLUENTS:

2. **MAXIMUM PERMISSIBLE CONCENTRATIONS - - - 10 CFR 20, APPENDIX B TABLE II**
PROVIDE THE MPCs USED IN DETERMINING ALLOWABLE RELEASE
RATES OR CONCENTRATIONS.
 - A. FISSION AND ACTIVATION GASES:
 - B. IODINES:
 - C. PARTICULATES, HALF-LIVES > 8 DAYS:
 - D. LIQUID EFFLUENTS:

3. **AVERAGE ENERGY**
PROVIDE THE AVERAGE ENERGY (E-BAR) OF THE RADIONUCLIDE
MIXTURE IN RELEASES OF FISSION AND ACTIVATION GASES, IF APPLICABLE

E-BAR BETA= 2.19E-01; E-BAR GAMMA= 2.34E-01; E-BAR BETA AND GAMMA= 4.53E-01

4. **MEASUREMENTS AND APPROXIMATIONS OF TOTAL RADIOACTIVITY**
PROVIDE THE METHODS USED TO MEASURE OR APPROXIMATE THE TOTAL RADIOACTIVITY
IN EFFLUENTS AND THE METHODS USED TO DETERMINE RADIONUCLIDE COMPOSITION:
 - A. FISSION AND ACTIVATION GASES: HpGe SPECTROMETRY, LIQUID SCINTILLATION
 - B. IODINES: HpGe SPECTROMETRY
 - C. PARTICULATES HpGe SPECTROMETRY, GAS FLOW PROPORTIONAL,
 - BETA SPECTROMETRY
 - D. LIQUID EFFLUENTS: HpGe SPECTROMETRY, LIQUID SCINTILLATION

5. **BATCH RELEASES**
PROVIDE THE FOLLOWING INFORMATION RELATING TO BATCH RELEASES OF
RADIOACTIVITY MATERIALS IN LIQUID AND GASEOUS EFFLUENTS.
 - A. **LIQUID**

	QUARTER 3	QUARTER 4
1. NUMBER OF BATCH RELEASES:	50	61
2. TOTAL TIME PERIOD FOR BATCH RELEASES: (MIN.)	16902.	20395.
3. MAXIMUM TIME PERIOD FOR A BATCH RELEASE: (MIN.)	705.	915.
4. AVERAGE TIME PERIOD FOR BATCH RELEASES: (MIN.)	338.	334.
5. MINIMUM TIME PERIOD FOR A BATCH RELEASE: (MIN.)	95.	218.
6. AVERAGE STREAM FLOW DURING PERIODS OF RELEASE OF EFFLUENT INTO A FLOWING STREAM: (CFM)	1.26E+06	1.31E+06

 - B. **GASEOUS**

1. NUMBER OF BATCH RELEASES:	24	24
2. TOTAL TIME PERIOD FOR BATCH RELEASES: (MIN.)	17154.	34077.
3. MAXIMUM TIME PERIOD FOR A BATCH RELEASE: (MIN.)	980.	10100.
4. AVERAGE TIME PERIOD FOR BATCH RELEASES: (MIN.)	715.	1420.
5. MINIMUM TIME PERIOD FOR A BATCH RELEASE: (MIN.)	1.	1.

6. **ABNORMAL RELEASES**
 - A. **LIQUID**
 1. NUMBER OF RELEASES:
 2. TOTAL ACTIVITY RELEASED: (CURIES)

 - B. **GASEOUS**
 1. NUMBER OF RELEASES:
 2. TOTAL ACTIVITY RELEASED: (CURIES)

TABLE 1A
EFFLUENT AND WASTE DISPOSAL SEMI-ANNUAL REPORT (1989)
GASEOUS EFFLUENTS-SUMMATION OF ALL RELEASES

UNIT	QUARTER 3	QUARTER 4	EST TOTAL ERROR, %
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A. FISSION AND ACTIVATION GASES

1. TOTAL RELEASE	CI	3.11E+02	1.35E+03	2.50E+01
2. AVG. RELEASE RATE FOR PERIOD	UCI/S	3.92E+01	1.70E+02	
3. PERCENT OF TECH. SPECIFICATION LIMIT	%	*	*	

B. IODINES

1. TOTAL IODINE I131	CI	2.83E-03	2.50E-03	2.50E+01
2. AVG. RELEASE RATE FOR PERIOD	UCI/S	3.56E-04	3.15E-04	
3. PERCENT OF TECH. SPECIFICATION LIMIT	%	*	*	

C. PARTICULATES

1. PART. WITH HALF- LIVES > 8 DAYS	CI	<1.00E-04	2.18E-06	2.50E+01
2. AVG. RELEASE RATE FOR PERIOD	UCI/S	NA	2.74E-07	
3. PERCENT OF TECH. SPECIFICATION LIMIT	%	NA	*	
4. GROSS ALPHA RADIOACTIVITY	CI	<1.00E-11	<1.00E-11	

D. TRITIUM

1. TOTAL RELEASE	CI	1.05E+00	2.00E+00	2.50E+01
2. AVG. RELEASE RATE FOR PERIOD	UCI/S	1.32E-01	2.51E-01	
3. PERCENT OF TECH. SPECIFICATION LIMIT	%	*	*	

NOTE: ALL LESS THAN VALUES (<) ARE IN uCi/cc.

*% TECH. SPEC. LIMITS: LISTED ON DOSE SUMMARY TABLE.

TABLE 1C
EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT (1989)
GASEOUS EFFLUENTS-GROUND-LEVEL RELEASES

CONTINUOUS MODE				BATCH MODE	
NUCLIDES RELEASED	UNIT	QUARTER 3	QUARTER 4	QUARTER 3	QUARTER 4
1. FISSION GASES					
KR 85	CI	2.16E-02	8.01E-03	<8.00E-06	9.90E+00
KR 85M	CI	9.08E-01	7.08E-01	<5.00E-08	4.87E-01
KR 87	CI	6.07E-01	6.44E-01	<8.00E-08	5.04E-06
KR 88	CI	1.12E+00	1.11E+00	<1.00E-07	3.06E-01
XE 133	CI	9.07E+01	1.72E+02	2.08E+02	1.13E+03
XE 135	CI	5.43E+00	5.37E+00	3.88E-01	1.48E+01
XE 135M	CI	8.23E-01	1.09E+00	<5.00E-07	7.73E-06
XE 138	CI	2.73E-01	4.41E-01	<3.00E-07	4.39E-06
XE 133M	CI	3.92E-01	4.06E-01	1.37E+00	9.71E+00
XE 131M	CI	<3.00E-07	<3.00E-07	8.34E-01	4.65E+00
AR 41	CI	<3.00E-07	<3.00E-07	<3.00E-07	7.69E-01
TOTAL FOR PERIOD	CI	1.00E+02	1.82E+02	2.11E+02	1.17E+03
2. IODINES					
I 131	CI	2.83E-03	2.48E-03	<1.00E-08	2.17E-05
I 132	CI	<1.00E-10	<1.00E-10	<1.00E-08	1.25E-06
I 133	CI	5.09E-03	4.46E-03	<1.00E-08	1.46E-05
I 135	CI	5.73E-04	<1.00E-10	<1.00E-10	<1.00E-10
TOTAL FOR PERIOD	CI	8.49E-03	6.94E-03	0.00E+00	3.75E-05
3. PARTICULATES					
SR 89	CI	<1.00E-11	<1.00E-11	<1.00E-08	<1.00E-08
SR 90	CI	<1.00E-11	<1.00E-11	<1.00E-08	<1.00E-08
CS 134	CI	<1.00E-11	<1.00E-11	<1.00E-08	1.01E-06
CS 137	CI	<1.00E-11	<1.00E-11	<1.00E-08	1.17E-06

NOTE: ALL LESS THAN VALUES (<) ARE IN uCi/cc.

TABLE 2A
EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT (1989)
LIQUID EFFLUENTS-SUMMATION OF ALL RELEASES

UNIT	QUARTER 3	QUARTER 4	EST TOTAL ERROR, %
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A. FISSION AND ACTIVATION PRODUCTS

1. TOTAL RELEASE (EX. TRIT., GASES, ALPHA)	CI	2.44E-03	1.00E-02	2.50E+01
2. AVG. DILUTED CONC. DURING PRD.	UCI/ML	2.23E-10	8.45E-10	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	

B. TRITIUM

1. TOTAL RELEASE	CI	1.17E+02	9.84E+01	2.50E+01
2. AVG. DILUTED CONC. DURING PRD.	UCI/ML	1.07E-05	8.31E-06	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	

C. DISSOLVED AND ENTRAINED GASES

1. TOTAL RELEASE	CI	1.87E-02	1.98E-01	2.50E+01
2. AVG. DILUTED CONC. DURING PRD.	UCI/ML	1.71E-09	1.67E-08	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	

D. GROSS ALPHA RADIOACTIVITY

1. TOTAL RELEASE	CI	<1.00E-07	<1.00E-07	2.50E+01
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E. VOL. OF WASTE RELEASED (NO DIL.)	LITERS	1.07E+07	1.12E+07	1.00E+01
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F. VOL. OF DILUTION WATER DURING PERIOD	LITERS	1.09E+10	1.18E+10	1.00E+01
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NOTE: ALL LESS THAN VALUES (<) ARE IN uCi/cc.

*% TECH. SPEC. LIMITS: LISTED ON DOSE SUMMARY TABLE.

TABLE 2B
EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT (1989)
LIQUID EFFLUENTS

CONTINUOUS MODE

BATCH MODE

NUCLIDES RELEASED	UNIT	QUARTER 3	QUARTER 4	QUARTER 3	QUARTER 4
SR 89	CI	<5.00E-08	<5.00E-08	<5.00E-08	6.10E-05
SR 90	CI	<5.00E-08	<5.00E-08	<5.00E-08	<5.00E-08
CS 134	CI	<5.00E-07	<5.00E-07	1.83E-04	2.25E-04
CS 137	CI	9.20E-07	<5.00E-07	3.38E-04	5.99E-04
I 131	CI	<1.00E-06	2.03E-04	1.38E-05	1.02E-03
CO 58	CI	<5.00E-07	<5.00E-07	1.57E-03	7.65E-03
CO 60	CI	<5.00E-07	<5.00E-07	2.36E-05	2.10E-05
ZN 65	CI	<5.00E-07	<5.00E-07	<5.00E-07	<5.00E-07
MN 54	CI	<5.00E-07	<5.00E-07	<5.00E-07	<5.00E-07
CR 51	CI	<5.00E-07	<5.00E-07	<5.00E-07	<5.00E-07
ZR 95	CI	<5.00E-07	<5.00E-07	<5.00E-07	<5.00E-07
NB 95	CI	<5.00E-07	<5.00E-07	<5.00E-07	<5.00E-07
MO 99	CI	<5.00E-07	<5.00E-07	<5.00E-07	1.23E-04
FE 55	CI	<1.00E-06	<1.00E-06	2.63E-04	<1.00E-06
AG 110M	CI	<5.00E-07	<5.00E-07	4.50E-05	4.30E-05
I 133	CI	<5.00E-07	<5.00E-07	<5.00E-07	5.22E-05
CS 136	CI	<5.00E-07	<5.00E-07	<5.00E-07	8.01E-06
SB 125	CI	<5.00E-07	<5.00E-07	7.33E-06	<5.00E-07
TOTAL FOR PERIOD	CI	9.20E-07	2.03E-04	2.44E-03	9.80E-03
KR 85M	CI	<1.00E-04	<1.00E-04	<1.00E-04	1.25E-05
XE 131M	CI	<1.00E-04	<1.00E-04	<1.00E-04	1.86E-04
XE 133M	CI	<1.00E-04	<1.00E-04	1.29E-04	1.65E-03
XE 133	CI	7.02E-04	<1.00E-04	1.75E-02	1.95E-01
XE 135	CI	<1.00E-04	<1.00E-04	3.10E-04	1.14E-03

NOTE: ALL LESS THAN VALUES (<) ARE IN uCi/cc.

TABLE 3A
EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT
SOLID WASTE AND IRRADIATED FUEL SHIPMENTS

A. Solid waste shipped off-site for burial or disposal (not irradiated fuel)

1. Type of waste	UNIT	6 month period	EST. TOTAL ERROR %
a. Spent resins, filter sludges, evaporator bottoms, etc.	m ³ C1	48.97 m ³ 6.659 C1	5%
b. Dry compressible waste, contaminated equipment, etc.	m ³ C1	107.35 m ³ .2457 C1	5%
c. Irradiated components, control rods, etc.	m ³ C1	n/a	n/a
d. Other (describe)	m ³ C1	n/a	n/a

2. Estimate of major nuclide composition (by type of waste)		
a. Co58	34.06 %	
H3	26.19 %	
Cs137	15.47 %	
Cs134	8.86 %	
b. Cs137	50.08 %	
Ni63	12.69 %	
Co58	11.19 %	
Co60	10.49 %	
Cs134	5.39 %	
c.	%	
	%	
	%	
	%	
	%	
	%	
d.	%	
	%	
	%	
	%	

3. Solid Waste Disposition		
Number of Shipments	Mode of Transportation	Destination
SEE ATTACHED		

B. Irradiated Fuel Shipments (Disposition)

Number of Shipments	Mode of Transportation	Destination
N/A		

TMI-1 EFFLUENT & WASTE DISPOSAL SEMI-ANNUAL REPORT

06/01/89 Through 12/31/89

Table A.3.a

<u>No. of Shipments</u>	<u>Mode of Transportation</u>	<u>Destination</u>
4	Tractor-Flatbed	Hanford-Richland, WA
1	Tractor-Closed Van	Hanford-Richland, WA

Table A.3.b

<u>No. Of Shipments</u>	<u>Mode of Transportation</u>	<u>Destination</u>
*3	Tractor-Flatbed	Scientific Ecology Group-Oak Ridge, TN
3	Tractor-Flatbed	Hanford-Richland, WA
1	Tractor-Closed Van	Hanford-Richland, WA

WASTE SHIPPED AS FOLLOWS:

TABLE A.1.a:

Seven (7) - 170 Ft.³ Steel Liners/Dewatered Resin
 One (1) - 183.2 Ft.³ Steel Liner/Dewatered Resin
 Two (2) - 178 Ft.³ Steel Liners/Solidified with Cement

TABLE A.1.b:

Seven (7) - 44 Ft.³ Steel Boxes
 *Three (3) - 1040 Ft.³ Cargo Containers/DAW for Volume Reduction
 Two (2) - 73.4 Ft.³ Steel Boxes
 One (1) - 98 Ft.³ Steel Box
 *One (1) - 92 Ft.³ Steel Box/DAW for volume reduction.
 Two (2) - 7.5 Ft.³ Steel Drums
 One (1) - 11.3 Ft.³ Steel Drum

*Material Sent to Waste Processor for Volume Reduction

INTERPRETATION OF DOSE SUMMARY TABLE

The Dose Summary Table presents the maximum hypothetical doses to an individual and the general population resulting from the release of gaseous and liquid effluents from TMI-1 during the second half reporting period of 1989.

A. Liquid (Individual)

The first two lines present the maximum hypothetical dose to an individual. Presented are the whole body and critical organ doses. Calculations are performed on the four age groups and eight organs recommended in Regulatory Guide 1.109. The pathways considered for TMI are drinking water, irrigated cow milk, irrigated goat milk, irrigated beef, consumption of fish, and standing on the shoreline influenced by TMI effluents. The latter two pathways are considered to be the primary recreational activities associated with the Susquehanna River in the vicinity of TMI. The irrigation pathways apply to the sewage sludge. The "receptor" would be that individual who consumes water from the Susquehanna River and fish residing in the plant discharge, while occupying an area of shoreline influenced by the plant discharge and consuming the milk and beef fed irrigated vegetation.

After calculating the doses to all age groups for all eight organs resulting from the three pathways described above, the Dose Summary Table presents the maximum whole body dose and affected age group along with the organ and associated age group that received the largest dose.

For the second half of 1989 the calculated maximum whole body dose received by anyone would have been 0.021 mrem to an adult. Similarly, the maximum organ dose would have been 0.028 mrem to the liver of a teen.

B. Gaseous (Individual)

There are seven major pathways considered in the dose calculations for gaseous effluents. These are: (1) plume, (2) inhalation, consumption of (3) cow milk, (4) goat milk, (5) vegetables, (6) meat, and (7) standing on contaminated ground.

Lines 3 and 4 present the maximum plume exposure at or beyond the site boundary. The notation of "air dose" is interpreted to mean that these doses are not to an individual, but are considered to be the maximum dose that would have occurred at or beyond the site boundary. The Dose Summary Table presents the distance in meters to the location in the affected sector (compass point) where the theoretical maximum plume exposure occurred. It should be noted that real-time meteorology was used in all dose calculations for gaseous effluents. Lines 5 and 6 present the dose which could actually be received by an individual from the noble gas effluents for the second half of 1989. The calculated maximum whole body dose received by anyone from noble gases would have been 0.025 mrem. Similarly, the maximum dose to the skin would have been 0.054 mrem.

The iodines and particulates section described in line 7 represents the maximum exposed organ due to iodine and particulates. This does not include any whole body plume exposure which would be separated out by lines 5 and 6. The doses presented in this section again reflect the maximum exposed organ for the appropriate age group.

The second half 1989 iodines and particulates would have resulted in a maximum dose of 0.29 mrem to the thyroid of an infant residing 560 meters from the site in the W sector. No other organ of any age group would have received a greater dose.

C. Liquid and Gaseous (Population)

Lines 8 - 11 present the person-rem doses resulting from the liquid and gaseous effluents. These doses are summed over all pathways and the affected populations. Liquid person-rem is based upon the population encompassed within the region from the TMI outfall extending down to the Chesapeake Bay. The person-rem for gaseous effluents are based upon the 1980 population and consider the population out to a distance of 50 miles around TMI. Population doses are summed over all distances and sectors to give an aggregate dose.

Based upon the calculations performed for the second half of 1989, liquid effluents resulted in a whole body population dose of 3.1 person-rem. The maximum critical organ population dose to the thyroid was 3.4 person-rem. Gaseous effluents resulted in a whole body population dose of 0.24 person-rem. Maximum critical organ population dose to the thyroid was 1.9 person-rem.

TABLE 1

UNIT 1
Second Half 1989 Dose Report

SUMMARY OF MAXIMUM INDIVIDUAL DOSES FOR UNIT 1 FROM
July 1, 1989 through December 31, 1989

Effluent	Applicable Organ	Estimated Dose (mrem)	Age Group	Location Dist Dir (m) (toward)		% of Applicable Limit		Technical Specification Limits (mrem)	
						Quarterly	Annual	Quarterly	Annual
(1) Liquid	Total Body	0.021	Adult	Receptor 1	Receptor 1	1.4	0.71	1.5	3.0
(2) Liquid	Liver	0.028	Teen			0.56	0.28	5.0	10.0
(3) Noble Gas	Air Dose (gamma-mrad)	0.34	---	160	WNW	6.8	3.4	5.0	10.0
(4) Noble Gas	Air Dose (beta-mrad)	0.36	---	160	WNW	3.6	1.8	10.0	20.0
(5) Noble Gas	Total Body	0.025	A11	560	W	---	---	---	---
(6) Noble Gas	Skin	0.054	A11	560	W	---	---	---	---
(7) Iodine & Particulates	Thyroid	0.29	Infant	560	W	3.9	1.9	7.5	15.0

SUMMARY OF MAXIMUM POPULATION DOSES FOR UNIT 1 FROM
July 1, 1989 through December 31, 1989

Effluent	Applicable Organ	Estimated Population Dose (person-rem)
(8) Liquid	Total Body	3.1
(9) Liquid	Thyroid	3.4
(10) Gaseous	Total Body	0.24
(11) Gaseous	Thyroid	1.9

TABLE 2

UNIT 1
Annual 1989 Dose Report

SUMMARY OF MAXIMUM INDIVIDUAL DOSES FOR UNIT 1 FROM
January 1, 1989 through December 31, 1989

Effluent	Applicable Organ	Estimated Dose (mrem)	Age Group	Location Dist (m)	Dir (toward)	% of Applicable Limit		Technical Specification Limits (mrem)	
						Quarterly	Annual	Quarterly	Annual
(1) Liquid	Total Body	0.031	Adult	Receptor 1		---	1.0	1.5	3.0
(2) Liquid	Liver	0.041	Teen	Receptor 1		---	0.4	5.0	10.0
(3) Noble Gas	Air Dose (gamma-mrad)	0.42	---	160	WNW	---	4.2	5.0	10.0
(4) Noble Gas	Air Dose (beta-mrad)	0.44	---	160	WNW	---	2.2	10.0	20.0
(5) Noble Gas	Total Body	0.032	All	560	W	---	---	---	---
(6) Noble Gas	Skin	0.072	All	750	ENE	---	---	---	---
(7) Iodine & Particulates	Thyroid	0.45	Infant	560	W	---	3.0	7.5	15.0

SUMMARY OF MAXIMUM POPULATION DOSES FOR UNIT 1 FROM
January 1, 1989 through December 31, 1989

Effluent	Applicable Organ	Estimated Population Dose (person-rem)
(8) Liquid	Total Body	4.0
(9) Liquid	Thyroid	4.4
(10) Gaseous	Total Body	0.32
(11) Gaseous	Thyroid	2.9

Annual summations will not equal the sum of each periodic report due to receptor location changes and interpolation results.

JOINT FREQUENCY TABLES

HOURS AT EACH WIND SPEED AND DIRECTION
 PERIOD OF RECORD = 89010101-89123124
 STABILITY CLASS: A DT/DZ
 ELEVATION: SPEED:SP100A DIRECTION:D1100A LAPSE:DT150A

WIND DIRECTION	WIND SPEED(MPH)						
	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	3	41	21	0	2	0	67
NNE	4	8	0	0	0	0	12
NE	4	4	3	0	0	0	11
ENE	0	1	0	0	0	0	1
E	4	6	4	0	0	0	14
ESE	0	7	11	0	0	0	18
SE	2	8	7	0	0	0	17
SSE	1	1	0	0	0	0	2
S	1	0	2	0	0	0	3
SSW	4	15	17	3	0	0	39
SW	5	32	15	5	0	0	57
WSW	6	14	3	0	0	0	23
W	12	20	16	1	0	0	49
WNW	20	24	24	3	0	0	71
NW	23	72	61	20	2	0	178
NNW	24	75	46	15	7	1	168
TOTAL	113	328	230	47	11	1	730

PERIODS OF CALM(HOURS): 1
 VARIABLE DIRECTION 233
 HOURS OF MISSING DATA: 166

PERIOD OF RECORD = 89010101-89123124
 STABILITY CLASS: C DT/DZ
 ELEVATION: SPEED:SP100A DIRECTION:D1100A LAPSE:DT150A

WIND DIRECTION	WIND SPEED(MPH)						
	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	4	2	0	9	0	0	15
NNE	0	3	1	0	0	0	4
NE	1	5	1	0	0	0	7
ENE	1	2	2	0	0	0	5
E	1	3	2	0	0	0	6
ESE	0	2	6	0	0	0	8
SE	0	1	3	0	0	0	4
SSE	0	2	0	0	0	0	2
S	2	0	4	0	0	0	6
SSW	0	12	10	4	0	0	26
SW	3	5	4	3	0	0	15
WSW	2	2	3	0	0	0	7
W	3	2	1	4	0	0	10
WNW	3	2	7	11	1	0	24
NW	4	8	10	13	1	2	38
NNW	5	2	2	11	1	1	25
TOTAL	29	53	56	55	6	3	202

PERIODS OF CALM(HOURS): 1
 VARIABLE DIRECTION 41
 HOURS OF MISSING DATA: 166

PERIOD OF RECORD = 89010101-89123124
 STABILITY CLASS: D DT/DZ
 ELEVATION: SPEED:SP100A DIRECTION:D1100A LAPSE:DT150A

WIND DIRECTION	WIND SPEED(MPH)						
	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	33	71	27	8	0	0	139
NNE	32	51	5	1	0	0	89
NE	27	95	7	0	0	0	129
ENE	42	86	16	0	0	0	144
E	28	97	71	4	0	0	200
ESE	20	64	88	1	0	0	173
SE	25	60	26	5	0	0	116
SSE	18	35	17	2	0	1	73
S	12	69	42	3	0	0	126
SSW	11	63	63	9	1	0	147
SW	31	56	28	9	2	0	126
WSW	18	29	18	5	0	0	70
W	28	35	70	61	9	0	203
WNW	25	37	62	94	22	7	247
NW	28	54	98	95	47	7	329
NNW	37	61	50	36	12	0	196
TOTAL	415	963	688	333	93	15	2507

PERIODS OF CALM(HOURS): 1
 VARIABLE DIRECTION 626
 HOURS OF MISSING DATA: 166

PERIOD OF RECORD = 89010101-89123124
 STABILITY CLASS: B DT/DZ
 ELEVATION: SPEED:SP100A DIRECTION:D1100A LAPSE:DT150A

WIND DIRECTION	WIND SPEED(MPH)						
	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	10	2	4	4	0	20
NNE	0	3	0	0	0	0	3
NE	2	2	0	0	0	0	4
ENE	2	7	1	0	0	0	10
E	0	8	4	0	0	0	12
ESE	2	8	8	0	0	0	18
SE	2	2	3	1	0	0	8
SSE	2	0	3	1	0	0	6
S	1	5	5	0	0	0	11
SSW	2	10	12	5	1	0	30
SW	5	13	7	4	0	0	29
WSW	5	5	3	0	0	0	13
W	5	8	4	7	0	1	25
WNW	2	10	15	9	2	0	38
NW	2	13	13	20	4	0	52
NNW	5	16	10	12	7	0	50
TOTAL	37	118	92	63	18	1	329

PERIODS OF CALM(HOURS): 1
 VARIABLE DIRECTION 73
 HOURS OF MISSING DATA: 166

JOINT FREQUENCY TABLES

PERIOD OF RECORD = 89010101-89123124
STABILITY CLASS: E DT/DZ
ELEVATION: SPEED:SP100A DIRECTION:D1100A LAPSE:DT150A

WIND DIRECTION	WIND SPEED(MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	60	114	21	3	0	0	198
NNE	47	95	12	1	0	0	155
NE	65	82	9	0	0	0	156
ENE	61	94	14	8	0	0	177
E	59	99	36	11	0	0	205
ESE	42	51	46	1	0	0	140
SE	53	34	9	2	0	0	98
SSE	34	37	13	6	0	0	90
S	40	78	34	3	0	0	155
SSW	48	136	68	14	2	0	268
SW	62	127	48	3	1	0	241
WSW	74	114	23	3	0	0	214
W	68	130	81	15	6	0	300
WNW	66	89	118	40	5	2	320
NW	62	66	91	69	8	1	297
NNW	78	90	41	16	4	0	229
TOTAL	919	1436	664	195	26	3	3243

PERIODS OF CALM(HOURS): 1
VARIABLE DIRECTION: 1157
HOURS OF MISSING DATA: 166

PERIOD OF RECORD = 89010101-89123124
STABILITY CLASS: G DT/DZ
ELEVATION: SPEED:SP100A DIRECTION:D1100A LAPSE:DT150A

WIND DIRECTION	WIND SPEED(MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	25	13	0	0	0	0	38
NNE	8	3	0	0	0	0	11
NE	13	2	0	0	0	0	15
ENE	25	7	0	0	0	0	32
E	20	3	0	0	0	0	23
ESE	25	9	0	0	0	0	34
SE	25	2	0	0	0	0	27
SSE	24	3	0	0	0	0	27
S	27	4	0	0	0	0	31
SSW	22	19	0	0	0	0	41
SW	25	13	0	0	0	0	38
WSW	19	18	1	0	0	0	38
W	27	18	2	1	0	0	48
WNW	20	14	1	0	0	0	35
NW	27	10	4	0	0	0	41
NNW	18	15	2	0	0	0	35
TOTAL	350	153	10	1	0	0	514

PERIODS OF CALM(HOURS): 1
VARIABLE DIRECTION: 297
HOURS OF MISSING DATA: 166

PERIOD OF RECORD = 89010101-89123124
STABILITY CLASS: F DT/DZ
ELEVATION: SPEED:SP100A DIRECTION:D1100A LAPSE:DT150A

WIND DIRECTION	WIND SPEED(MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	25	45	3	0	0	0	73
NNE	25	10	0	0	0	0	35
NE	22	8	0	0	0	0	30
ENE	30	18	0	0	0	0	48
E	47	26	1	0	0	0	74
ESE	44	15	3	0	0	0	62
SE	28	7	1	0	0	0	36
SSE	31	2	0	0	0	0	33
S	31	7	1	0	0	0	39
SSW	36	41	0	1	1	0	79
SW	41	36	2	2	0	0	81
WSW	52	31	2	0	0	0	85
W	53	42	4	1	0	0	100
WNW	50	28	4	0	0	0	82
NW	52	30	11	0	0	1	94
NNW	56	47	15	0	0	0	118
TOTAL	623	393	47	4	1	1	1069

PERIODS OF CALM(HOURS): 1
VARIABLE DIRECTION: 592
HOURS OF MISSING DATA: 166

PERIOD OF RECORD = 89010101-89123124
STABILITY CLASS: ALL DT/DZ
ELEVATION: SPEED:SP100A DIRECTION:D1100A LAPSE:DT150A

WIND DIRECTION	WIND SPEED(MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	150	296	74	24	6	0	550
NNE	116	173	18	2	0	0	309
NE	134	198	20	0	0	0	352
ENE	161	215	33	8	0	0	417
E	159	242	118	15	0	0	534
ESE	133	156	162	2	0	0	453
SE	135	114	49	8	0	0	306
SSE	110	80	33	9	0	1	233
S	114	163	88	6	0	0	371
SSW	123	296	170	36	5	0	630
SW	172	282	104	26	3	0	587
WSW	176	211	55	8	0	0	450
W	196	255	178	90	15	1	735
WNW	186	204	231	157	30	9	817
NW	198	253	288	217	62	11	1029
NNW	223	306	166	90	34	2	821
TOTAL	2486	3444	1787	698	155	24	8594

PERIODS OF CALM(HOURS): 1
VARIABLE DIRECTION: 3019
HOURS OF MISSING DATA: 166