

1996

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

R. E. GINNA NUCLEAR PLANT

ROCHESTER GAS AND ELECTRIC

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1.0

INTRODUCTION

This Annual Radioactive Effluent Release Report is for Rochester Gas and Electric Corporation R.E. Ginna plant and is submitted in accordance with the requirements of Technical Specification Section 5.6.3. The report covers the period from January 1, 1996 through December 31, 1996.

This report includes a summary of the quantities of radioactive gaseous and liquid effluents and solid waste released from the plant presented in the format outlined in Appendix B of Regulatory Guide 1.21, Revision 1, June 1974.

All gaseous and liquid effluents discharged during this reporting period were in compliance with the limits of the R.E. Ginna Technical Specifications as defined in the Offsite Dose Calculation Manual (ODCM).

2.0 SUPPLEMENTAL INFORMATION

2.1 Regulatory Limits

The ODCM limits applicable to release of radioactive material in liquid and gaseous effluents are:

2.1.1 Fission and Activation Gases

The instantaneous dose rate, as calculated in the ODCM, due to noble gases released in gaseous effluents from the site shall be limited to a release rate which would yield ≤ 500 mrem/yr to the total body and ≤ 3000 mrem/yr to the skin if allowed to continue for a full year.

The air dose, as calculated in the ODCM, due to noble gases released in gaseous effluents from the site shall be limited to the following:

- (i) During any calendar quarter to ≤ 5 mrad for gamma radiation and to ≤ 10 mrad for beta radiation.
- (ii) During any calendar year to ≤ 10 mrad for gamma radiation and to ≤ 20 mrad for beta radiation.

2.1.2 Radioiodine, Tritium and Particulates

The instantaneous dose rate, as calculated in the ODCM, due to radioactive materials released in gaseous effluents from the site as radioiodines, radioactive materials in particulate form, and radionuclides other than noble gases with half-lives greater than 8 days shall be limited to a release rate which would yield ≤ 1500 mrem/yr to any organ if allowed to continue for a full year.

The dose to an individual, as calculated in the ODCM, from radioiodine, radioactive materials in particulate form and radionuclides other than noble gases with half-lives greater than eight days released with gaseous effluents from the site shall be limited to the following:

- (I) During any calendar quarter to ≤ 7.5 mrem to any organ.
- (ii) During any calendar year to ≤ 15 mrem to any organ.

2.1.3 Liquid Effluents

The release of radioactive liquid effluents shall be such that the concentration in the circulating water discharge does not exceed the limits specified in accordance with Appendix B, Table II, Column 2 and notes thereto of 10CFR20. For dissolved or entrained noble gases the total activity due to dissolved or entrained noble gases shall not exceed 2 E-4 uCi/ml .

The dose or dose commitment to an individual as calculated in the ODCM from radioactive materials in liquid effluents released to unrestricted areas shall be limited:

- (I) During any calendar quarter to ≤ 1.5 mrem to the total body and to ≤ 5 mrem to any organ, and
- (ii) During any calendar year to ≤ 3 mrem to the total body and to ≤ 10 mrem to any organ.

2.2 Maximum Permissible Concentrations (MPC)

2.2.1 For gaseous effluents, maximum permissible concentrations are not directly used in release rate calculations since the applicable limits are stated in terms of dose rate at the unrestricted area boundary.

2.2.2 For liquid effluents, ten times the effluent concentration values specified in 10CFR20, Appendix B, Table II, column 2, are used to calculate release rates and permissible concentrations at the unrestricted area boundary as permitted by Technical Specification 5.5.4.b. A value of 2E-04 uCi/ml is used as the MPC for dissolved and entrained noble gases in liquid effluents.

2.3

Release Rate Limits

The release rate limits for fission and activation gases from the R.E. Ginna plant are not based on the average energy of the radionuclide mixture in gaseous effluents; therefore, this value is not applicable. However, the average 1996 beta/gamma energy of the radionuclide mixture was 0.221 Mev.

2.4

Measurements and Approximations of Total Radioactivity

Gamma spectroscopy was the primary analysis method used to determine the radionuclide composition and concentration of gaseous and liquid effluents. Composite samples were analyzed for Sr-89, Sr-90 and Fe-55 by a contract laboratory. Tritium and alpha analysis were done using liquid scintillation and gas flow proportional counting respectively.

The total radioactivity in effluent releases was determined from the measured concentration of each radionuclide present and the total volume of effluents released.

2.5

Batch Releases

2.5.1

Liquid

1. Number of batch releases:	1.75 E+02
2. Total time period for batch releases:	3.51 E+04 min
3. Maximum time period for a batch release:	6.12 E+02 min
4. Average time period for batch releases:	2.00 E+02 min
5. Minimum time period for a batch release:	2.1 E+01 min
6. Average stream flow (LPM) during periods of release effluent into a flowing stream:	1.18 E+02

2.5.2

Gaseous

1. Number of batch releases:	2.6 E+01
2. Total time period for batch releases:	7.23 E+03 min
3. Maximum time period for a batch release:	5.56 E+02 min
4. Average time period for batch releases:	2.77 E+02 min
5. Minimum time period for a batch release:	7.8 E+01 min



2.6

Abnormal Releases

There were no abnormal releases of liquid or gaseous effluents during the reporting period.

3.0

SUMMARY OF GASEOUS RADIOACTIVE EFFLUENTS

The quantities of radioactive material released in gaseous effluents are summarized in tables 1A and 1B. Plant vent and Containment Vent releases are modeled as mixed mode and Air Ejector is modeled as ground level release.

4.0

SUMMARY OF LIQUID RADIOACTIVE EFFLUENTS

The quantities of radioactive material released in liquid effluents are summarized in tables 2A and 2B.

5.0

SOLID WASTES

The quantities of radioactive material released in shipments of solid waste transported from the site during the reporting period are summarized in table 3. Principal nuclides were determined by gamma spectroscopy and non-gamma emitters were calculated from scaling factors determined by an independent laboratory from representative samples of that waste type. The majority of Dry Active Waste is processed utilizing an off-site processor who reduces the volume and then sends the waste for burial.

6.0

LOWER LIMIT OF DETECTION NOT MET

There were no liquid or gaseous releases for which the LLD for specified gamma emitting nuclides was not met.

7.0

RADIOLOGICAL IMPACT

An assessment of doses to the maximally exposed individual from gaseous and liquid effluents was performed for locations representing the maximum dose. In all cases, doses were well below Technical Specification limits as defined in the ODCM. Doses were assessed based upon actual meteorological conditions considering the noble gas exposure, inhalation, ground plane and ingestion pathways. The ingestion pathways considered were the fruit, vegetable, fish, drinking water, goat's milk, cow's milk and meat pathway. The results of this assessment are presented in Tables 4A and 4B.



A review of 1995 data revealed that when the data was entered into the computer program only the final week of data for each month was used to calculate effluent releases during the month for continuous releases. This meant that the dose to the general population was undercalculated for gaseous releases during the outage period and other months. The data for 1995 was reentered and the calculation rerun. The new calculation results are included with this report. All results still indicate that the maximally exposed adult received less than $2\text{E-}5$ Rem total body dose and the maximally exposed child received $<5\text{E-}5$ Rem to the thyroid. These calculated doses are $< 1\%$ of the allowed maximum of 10CFR50, Appendix I exposures.

8.0 METEOROLOGICAL DATA

The annual summary of hourly meteorological data collected during 1996 is not included with this report, but can be made available at the RG&E Ginna Plant.

9.0 LAND USE CHANGES

There were no changes in critical receptor location for dose calculations during the reporting period. There were no large changes in land use within 5 miles of the plant. Additional new homes were built.

10.0 CHANGES TO THE OFFSITE DOSE CALCULATION MANUAL (ODCM)

The ODCM was totally rewritten for the implementation of Amendment 61 to R.E. Ginna Technical Specifications. The change became effective 2/24/96. Changes were made to the ODCM to clarify wording on the Modes when specific effluent monitors are required to be operable and to add ACTION statements based on MODE changes. For the steam generator replacement project, wording was added to describe actions after holes are cut through the containment dome. Typos were corrected and non-required environmental sample points were removed from applicable tables.

11.0 CHANGES TO THE PROCESS CONTROL PROGRAM (PCP)

The change to the PCP for the implementation of Amendment 61 to the R.E. Ginna Technical Specifications was the removal of the reference to R.E. Ginna Technical Specifications. No other changes were required.

12.0 MAJOR CHANGES TO RADWASTE TREATMENT SYSTEMS

There were no major changes to the Radwaste Treatment Systems during the reporting period.

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Table 1A

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT

**GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES
JANUARY - JUNE 1996**

	Unit	Quarter 1st	Quarter 2nd	Est. Total Error, %
A. Fission & activation gases				
1. Total release	Ci	1.38E+01	3.67E+01	5.90E+00
2. Average release rate for period	uCi/sec	1.75E+00	4.67E+00	
3. Percent of technical specification limit	%	2.78E-04	7.42E-04	
B. Iodines				
1. Total iodine-131	Ci	2.51E-05	1.11E-04	6.60E+00
2. Average release rate for period	uCi/sec	3.19E-06	1.41E-05	
3. Percent of technical specification limit	%	7.01E-03	3.09E-02	
C. Particulates				
1. Particulates with half-lives > 8days	Ci	1.46E-06	5.27E-04	4.00E+01
2. Average release rate for period	uCi/sec	1.86E-07	6.71E-05	
3. Percent of technical specification limit	%	1.40E-05	5.04E-03	
4. Gross alpha radioactivity	Ci			
D. Tritium				
1. Total release	Ci	8.59E+00	2.06E+01	3.20E+00
2. Average release rate for period	uCi/sec	1.09E+00	2.62E+00	
3. Percent of technical specification limit	%	1.28E-04	3.09E-04	

Note: Isotope for which no value is given were not identified in applicable releases.

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Table 1A

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT

**GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES
JULY - DECEMBER 1996**

	Unit	Quarter 3rd	Quarter 4th	Est. Total Error, %
A. Fission & activation gases				
1. Total release	Ci	2.76E+01	7.50E+00	7.90E+00
2. Average release rate for period	uCi/sec	3.47E+00	9.44E-01	
3. Percent of technical specification limit	%	5.51E-04	1.50E-04	
B. Iodines				
1. Total iodine-131	Ci	1.77E-05	1.09E-05	2.10E+01
2. Average release rate for period	uCi/sec	2.23E-06	1.37E-06	
3. Percent of technical specification limit	%	4.89E-03	3.00E-03	
C. Particulates				
1. Particulates with half-lives > 8days	Ci	1.29E-06	5.77E-12	4.00E+01
2. Average release rate for period	uCi/sec	1.63E-07	7.26E-13	
3. Percent of technical specification limit	%	1.22E-05	5.46E-11	
4. Gross alpha radioactivity	Ci			
D. Tritium				
1. Total release	Ci	6.59E+00	5.26E+00	3.20E+00
2. Average release rate for period	uCi/sec	8.29E-01	6.62E-01	
3. Percent of technical specification limit	%	9.76E-05	7.79E-05	

Note: Isotope for which no value is given were not identified in applicable releases.

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Table 1B
EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
GASEOUS EFFLUENTS - ELEVATED RELEASE

		Continuous Mode		Batch Mode	
Nuclides released	Unit	Quarter	Quarter	Quarter	Quarter
		1st	2nd	1st	2nd
1. Fission gases					
argon-41	Ci	8.67E-01	5.16E-03	2.37E-02	1.92E-02
krypton-85	Ci			8.08E-02	1.19E+00
krypton-85m	Ci	9.15E-02	3.55E-04		3.36E-05
krypton-87	Ci	1.19E-01	4.32E-04		
krypton-88	Ci	1.63E-01	5.84E-04		
xenon-131m	Ci			4.68E-03	1.13E-01
xenon-133	Ci	6.27E+00	4.70E+00	7.51E-01	3.00E+01
xenon-133m	Ci	3.19E-02	1.31E-04	8.66E-04	2.07E-02
xenon-135	Ci	3.18E+00	6.05E-01	2.02E-02	3.88E-02
xenon-135m	Ci	1.47E+00	4.19E-03		1.03E-02
xenon-138	Ci	7.11E-01	1.44E-03		
others (specify)	Ci				
	Ci				
	Ci				
	Ci				
Total for period	Ci	1.29E+01	5.32E+00	8.81E-01	3.14E+01

2. Iodines

iodine-131	Ci	2.32E-05	1.08E-04	1.88E-06	2.20E-06
iodine-133	Ci	9.01E-05	4.65E-06	1.18E-06	5.35E-07
iodine-135	Ci				
Total for period	Ci	1.13E-04	1.13E-04	3.06E-06	2.73E-06

3. Particulates

strontium-89	Ci				
strontium-90	Ci				
cesium-134	Ci				
cesium-137	Ci	1.46E-06	5.60E-05		
Nb-95	Ci				
cobalt-58	Ci		2.70E-04		
cobalt-60	Ci		2.01E-04		
Total for period	Ci	1.46E-06	5.27E-04		
unidentified	Ci				

Note: Isotope for which no value is given were not identified in applicable releases.

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Table 1B
EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
GASEOUS EFFLUENTS - ELEVATED RELEASE

		Continuous Mode		Batch Mode	
Nuclides released	Unit	Quarter	Quarter	Quarter	Quarter
		3rd	4th	3rd	4th
1. Fission gases					
argon-41	Ci	3.19E-05		2.75E-01	5.00E-02
krypton-85	Ci			2.56E-01	6.05E-02
krypton-85m	Ci			4.18E-03	1.32E-04
krypton-87	Ci			1.11E-03	
krypton-88	Ci			2.75E-03	
xenon-131m	Ci			1.57E-03	
xenon-133	Ci	2.15E+01	3.95E+00	3.46E+00	2.83E-01
xenon-133m	Ci			1.19E-02	1.36E-03
xenon-135	Ci	1.97E+00	3.15E+00	1.33E-01	5.64E-03
xenon-135m	Ci			2.46E-03	
xenon-138	Ci	3.94E-06			
others (specify)	Ci				
	Ci				
	Ci				
	Ci				
Total for period	Ci	2.34E+01	7.10E+00	4.15E+00	4.01E-01
2. Iodines					
iodine-131	Ci	1.54E-05	1.08E-05	2.35E-06	1.17E-08
iodine-133	Ci	1.51E-01	1.08E-05	2.45E-07	
iodine-135	Ci				
Total for period	Ci	1.51E-01	2.16E-05	2.60E-06	1.17E-08
3. Particulates					
strontium-89	Ci		5.77E-12		
strontium-90	Ci				
cesium-134	Ci				
cesium-137	Ci	1.29E-06			
Nb-95	Ci				
cobalt-58	Ci				
cobalt-60	Ci				
Total for period	Ci	1.29E-06	5.77E-12		
unidentified	Ci				

Note: Isotope for which no value is given were not identified in applicable releases.

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Table 2A
EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT

**LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES
JANUARY - JUNE 1996**

	Unit	Quarter 1st	Quarter 2nd	Est.Total Error, %
A. Fission and activation products				
1. Total release (not including tritium, gases, alpha)	Ci	8.16E-02	3.18E-02	6.60E+00
2. Average diluted concentration during period	uCi/ml	5.93E-10	5.02E-10	
3. Percent of applicable limit	%	6.20E-02	1.56E-02	
B. Tritium				
1. Total release	Ci	4.35E+01	3.59E+01	3.20E+00
2. Average diluted concentration during period	uCi/ml	3.16E-07	5.66E-07	
3. Percent of applicable limit	%	1.05E-02	1.89E-02	
C. Dissolved and entrained gases				
1. Total release	Ci	9.51E-03	2.02E-03	3.50E+01
2. Average diluted concentration during period	uCi/ml	6.91E-11	3.20E-11	
3. Percent of applicable limit	%	3.45E-05	1.60E-05	
D. Gross alpha radioactivity				
1. Total release	Ci	N/A	N/A	
E. Vol. of waste released (prior to dilution)				
	Liters	4.64E+07	1.30E+07	5.00E+00
F. Vol. of dilution water used during period				
	Liters	1.38E+11	6.33E+10	5.00E+00

Note: Isotope for which no value is given were not identified in applicable releases.

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Table 2A
EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT

LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES
JULY - DECEMBER 1996

	Unit	Quarter 3rd	Quarter 4th	Est.Total Error, %
A. Fission and activation products				
1. Total release (not including tritium, gases, alpha)	Ci	3.87E-03	6.08E-04	8.50E+00
2. Average diluted concentration during period	uCi/ml	2.40E-11	4.18E-12	
3. Percent of applicable limit	%	1.18E-04	1.22E-05	
B. Tritium				
1. Total release	Ci	2.24E+01	1.72E+01	3.20E+00
2. Average diluted concentration during period	uCi/ml	1.39E-07	1.19E-07	
3. Percent of applicable limit	%	4.64E-03	3.95E-03	
C. Dissolved and entrained gases				
1. Total release	Ci			
2. Average diluted concentration during period	uCi/ml			
3. Percent of applicable limit	%			
D. Gross alpha radioactivity				
1. Total release	Ci	N/A	N/A	
E. Vol. of waste released (prior to dilution)				
	Liters	4.20E+07	5.64E+07	5.00E+00
F. Vol. of dilution water used during period				
	Liters	1.61E+11	1.45E+11	5.00E+00

Note: Isotope for which no value is given were not identified in applicable releases.



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**Table 2B
EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
LIQUID EFFLUENTS**

Nuclides Released	Unit	Continuous Mode		Batch Mode	
		Quarter	Quarter	Quarter	Quarter
		1st	2nd	1st	2nd
chromium-51	Ci				4.11E-04
manganese-54	Ci		3.77E-05		
iron-55	Ci			1.72E-05	
iron-59	Ci	5.22E-05		5.07E-04	
cobalt-58	Ci		9.14E-04	6.61E-06	9.75E-05
cobalt-60	Ci		2.36E-05	9.75E-06	6.21E-05
zinc-65	Ci				
strontium-89	Ci			1.64E-06	
strontium-90	Ci				
zirconium/niobium-95	Ci				1.26E-05
molybdenum-99	Ci		3.90E-05		
silver-110m	Ci				4.33E-05
antimony-122	Ci				2.86E-04
antimony-124	Ci		5.62E-05	7.48E-05	7.43E-03
antimony-125	Ci			1.74E-03	1.50E-02
iodine-131	Ci	6.19E-03	1.86E-03	5.78E-03	3.29E-05
iodine-133	Ci	1.95E-02	2.56E-03	1.98E-02	
iodine-135	Ci	4.53E-03	1.24E-03	1.82E-02	
cesium-134	Ci	3.78E-04	3.64E-04	2.15E-03	3.81E-04
cesium-136	Ci	5.01E-05	4.23E-05	1.76E-04	
cesium-137	Ci	7.37E-05	3.49E-04	2.30E-03	3.36E-04
barium/lanthanum-140	Ci		2.27E-05		
cerium-141	Ci				
Te-123m	Ci				1.72E-04
Ru-103	Ci				
Total for period (above)	Ci	3.08E-02	7.51E-03	5.08E-02	2.43E-02
unidentified	Ci				
xenon-133	Ci	1.19E-03	5.99E-04	1.34E-03	1.03E-03
xenon-135	Ci	3.41E-03	3.95E-04	3.58E-03	

Note: Isotope for which no value is given were not identified in applicable releases.



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Table 2B
EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
LIQUID EFFLUENTS

Nuclides Released	Unit	Continuous Mode		Batch Mode	
		Quarter 3rd	Quarter 4th	Quarter 3rd	Quarter 4th
chromium-51	Ci				
manganese-54	Ci				
iron-55	Ci				
iron-59	Ci				
cobalt-58	Ci			8.09E-06	
cobalt-60	Ci			3.92E-05	7.21E-05
zinc-65	Ci				
strontium-89	Ci				
strontium-90	Ci				
zirconium/niobium-95	Ci				2.49E-06
molybdenum-99	Ci			1.03E-05	
silver-110m	Ci				1.82E-05
antimony-122	Ci				
antimony-124	Ci				3.66E-05
antimony-125	Ci			4.36E-05	2.53E-04
iodine-131	Ci				
iodine-133	Ci				
iodine-135	Ci				
cesium-134	Ci				
cesium-136	Ci				
cesium-137	Ci	3.72E-03	2.07E-04	5.05E-05	1.87E-05
barium/lanthanum-140	Ci				
cerium-141	Ci				
Ru-106	Ci				
Ru-103	Ci				
Total for period (above)		3.72E-03	2.07E-04	1.52E-04	4.01E-04
unidentified					
xenon-133	Ci				
xenon-135	Ci				

Note: Isotope for which no value is given were not identified in applicable releases.

Table 3

**EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
SOLID WASTE AND IRRADIATED FUEL SHIPMENTS**

January 1, 1996 - December 31, 1996

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL - (Not irradiated fuel)

1. Type of waste	Unit	12 month period	Est. total Error %
a. Spent resins, filter sludges, evaporator bottoms, etc.	m ³ Ci	1.24 E+01 6.3 E+01	2 E+00 2 E+00
b. Dry compressible waste, contaminated equip, etc.	m ³ Ci	1.16 E+01 2.57 E-01	2 E+00 2 E+00
c. Irradiated components, control rods, etc.	m ³ Ci	2.8 E-03 2.32 E+01	5 E+00 2 E+00
d. Other: _____	m ³ Ci		

2. Estimate of major nuclide composition (by type of waste)								
a. Ni-63	%	4.54 E+01	b. Fe-55	%	3.32 E+01	c. Fe-59	%	9.02 E+01
Co-60	%	3.29 E+01	Co-58	%	1.27 E+01	Co-60	%	4.9 E+00
Fe-55	%	9.0 E+00	Co-60	%	1.04 E+01	Mn-54	%	4.7 E+00
Cs-137	%	5.7 E+00	Cs-137	%	8.0 E+00			
Sb-125	%	3.2 E+00	Ni-63	%	6.5 E+00			
Cs-134	%	9 E-01	Sb-124	%	5.2 E+00			
Ce-144	%	7 E-01	Cr-51	%	5.1 E+00			
Mn-54	%	6 E-01	Nb-95	%	4.6 E+00			
Pu-241	%	1 E-01	Ce-144	%	3.2 E+00			
			Sb-125	%	2.9 E+00			
			Zr-95	%	2.8 E+00			
			Cs-134	%	1.9 E+00			
			Mn-54	%	1.4 E+00			
			Pu-241	%	8 E-01			

3. Solid Waste Disposition		
Number of Shipments	Mode of Transportation	Destination
3	Highway Vehicle	Oak Ridge, TN
3	Highway Vehicle	Memphis, TN
3	Highway Vehicle	Barnwell, SC

B. IRRADIATED FUEL SHIPMENTS (Disposition)

Number of Shipments	Mode of Transportation	Destination
None		



Table 4A
Radiation Doses to Maximally Exposed Individual Receptor
From Gaseous Releases in Rem
First Quarter 1996

	ADULT			TEEN			CHILD			INFANT		
	T.BODY	THYRD	SKIN	T.BODY	THYRD	SKIN	T.BODY	THYRD	SKIN	T.BODY	THYRD	SKIN
N	1.6E-07	1.6E-07	8.7E-07	1.6E-07	1.6E-07	8.7E-07	1.6E-07	1.6E-07	8.7E-07	1.4E-07	1.4E-07	8.7E-07
NNE	1.6E-07	1.6E-07	5.9E-07	1.6E-07	1.6E-07	5.9E-07	1.6E-07	1.6E-07	5.9E-07	1.4E-07	1.5E-07	5.9E-07
NE	1.1E-07	1.1E-07	5.6E-07	1.1E-07	1.1E-07	5.6E-07	1.0E-07	1.1E-07	5.6E-07	9.1E-08	9.4E-08	5.6E-07
ENE	1.4E-07	1.4E-07	7.3E-07	1.4E-07	1.4E-07	7.3E-07	1.3E-07	1.4E-07	7.3E-07	1.2E-07	1.2E-07	7.3E-07
E	2.2E-06	2.2E-06	5.4E-06	2.2E-06	2.2E-06	5.4E-06	2.1E-06	2.2E-06	5.4E-06	2.1E-06	2.1E-06	5.4E-06
ESE	1.5E-06	1.5E-06	3.6E-06	1.5E-06	1.6E-06	3.6E-06	1.5E-06	1.5E-06	3.6E-06	1.5E-06	1.5E-06	3.6E-06
SE	3.0E-06	3.1E-06	7.9E-06	3.0E-06	3.1E-06	7.9E-06	3.0E-06	3.0E-06	7.9E-06	2.9E-06	2.9E-06	7.9E-06
SSE	2.6E-06	2.6E-06	6.7E-06	2.6E-06	2.6E-06	6.7E-07	2.6E-06	2.6E-06	6.7E-06	2.5E-06	2.5E-06	6.7E-06
S	2.8E-06	2.8E-06	6.9E-06	2.8E-06	2.8E-06	6.9E-06	2.8E-06	2.8E-06	6.9E-06	2.7E-06	2.7E-06	6.9E-06
SSW	3.5E-06	3.5E-06	8.1E-06	3.5E-06	3.5E-06	8.1E-06	3.5E-06	3.5E-06	8.1E-06	3.4E-06	3.5E-06	8.1E-06
SW	7.6E-06	7.6E-06	1.7E-05	7.6E-06	7.7E-06	1.7E-05	7.6E-06	7.6E-06	1.7E-05	7.4E-06	7.5E-06	1.7E-05
WSW	2.6E-06	2.6E-06	5.7E-06	2.6E-06	2.6E-06	5.7E-06	2.6E-06	2.6E-06	5.7E-06	2.5E-06	2.6E-06	5.7E-06
W	2.3E-06	2.3E-06	4.5E-06	2.3E-06	2.3E-06	4.5E-06	2.3E-06	2.3E-06	4.5E-06	2.3E-06	2.3E-06	4.5E-06
WNW	1.1E-06	1.1E-06	2.0E-06	1.1E-06	1.1E-06	2.0E-06	1.1E-06	1.1E-06	2.0E-06	1.1E-06	1.1E-06	2.0E-06
NW	4.9E-08	5.0E-08	2.7E-07	4.9E-08	5.1E-08	2.7E-07	4.7E-08	4.9E-08	2.7E-07	4.2E-08	4.3E-08	2.7E-07
NNW	1.1E-07	1.1E-07	6.0E-07	1.1E-07	1.1E-07	6.0E-07	1.0E-07	1.1E-07	6.0E-07	9.0E-08	9.3E-08	6.0E-07
MAX.	7.6E-06	7.6E-06	1.7E-05	7.6E-06	7.7E-06	1.7E-05	7.6E-06	7.6E-06	1.7E-05	7.4E-06	7.5E-06	1.7E-05



Table 4A
Radiation Doses to Maximally Exposed Individual Receptor
From Gaseous Releases in Rem
Second Quarter 1996

	ADULT			TEEN			CHILD			INFANT		
	T.BODY	THYRD	SKIN	T.BODY	THYRD	SKIN	T.BODY	THYRD	SKIN	T.BODY	THYRD	SKIN
N	3.8E-07	3.8E-07	5.4E-07	3.8E-07	3.9E-07	5.4E-07	3.6E-07	3.6E-07	5.4E-07	2.9E-07	2.9E-07	5.4E-07
NNE	5.5E-07	5.6E-07	8.3E-07	5.6E-07	5.6E-07	8.3E-07	5.3E-07	5.3E-07	8.3E-07	4.3E-07	4.3E-07	8.3E-07
NE	4.9E-07	5.0E-07	7.3E-07	4.9E-07	5.0E-07	7.3E-07	4.7E-07	4.7E-07	7.3E-07	3.8E-07	3.8E-07	7.3E-07
ENE	3.4E-07	3.4E-07	4.8E-07	3.4E-07	3.5E-07	4.8E-07	3.2E-07	3.3E-07	4.8E-07	2.5E-07	2.6E-07	4.8E-07
E	1.4E-05	1.4E-05	1.8E-05	1.4E-05	1.5E-05	1.8E-05	1.5E-05	1.6E-05	1.8E-05	9.8E-06	1.0E-05	1.8E-05
ESE	1.4E-05	1.4E-05	1.8E-05	1.4E-05	1.5E-05	1.8E-05	1.5E-05	1.6E-05	1.8E-05	1.0E-05	1.1E-05	1.8E-05
SE	8.8E-06	8.8E-06	1.2E-05	9.0E-06	9.0E-06	1.2E-05	9.4E-06	9.6E-06	1.2E-05	6.7E-06	7.0E-06	1.2E-05
SSE	3.3E-06	3.3E-06	4.4E-06	3.4E-06	3.4E-06	4.4E-06	3.6E-06	3.7E-06	4.4E-06	2.3E-06	2.4E-06	4.4E-06
S	7.3E-06	7.4E-06	9.9E-06	7.6E-06	7.7E-06	9.9E-06	8.2E-06	8.4E-06	9.9E-06	5.4E-06	5.4E-06	9.9E-06
SSW	8.2E-06	8.3E-06	1.0E-05	8.6E-06	8.7E-06	1.0E-05	9.6E-06	9.8E-06	1.0E-05	5.7E-06	5.8E-06	1.0E-05
SW	1.7E-05	1.7E-05	2.2E-05	1.8E-05	1.8E-05	2.2E-05	1.9E-05	2.0E-05	2.2E-05	1.3E-05	1.4E-05	2.2E-05
WSW	1.4E-05	1.4E-05	1.7E-05	1.5E-05	1.5E-05	1.7E-05	1.6E-05	1.7E-05	1.7E-05	1.1E-05	1.1E-05	1.7E-05
W	9.6E-06	9.6E-06	1.3E-05	9.9E-06	9.9E-06	1.3E-05	1.1E-05	1.1E-05	1.3E-05	7.6E-06	7.7E-06	1.3E-05
WNW	4.7E-06	4.8E-06	5.5E-06	5.0E-06	5.0E-06	5.5E-06	5.8E-06	5.8E-06	5.5E-06	2.6E-06	2.6E-06	5.5E-06
NW	1.6E-07	1.6E-07	2.4E-07	1.6E-07	1.6E-07	2.4E-07	1.5E-07	1.6E-07	2.4E-07	1.2E-07	1.3E-07	2.4E-07
NNW	2.6E-07	2.6E-07	3.7E-07	2.6E-07	2.6E-07	3.7E-07	2.5E-07	2.5E-07	3.7E-07	2.0E-07	2.0E-07	3.7E-07
MAX.	1.7E-05	1.7E-05	2.2E-05	1.8E-05	1.8E-05	2.2E-05	1.9E-05	2.0E-05	2.2E-05	1.3E-05	1.4E-05	2.2E-05



Table 4A
Radiation Doses to Maximally Exposed Individual Receptor
From Gaseous Releases in Rem
Third Quarter 1996

	ADULT			TEEN			CHILD			INFANT		
	T.BODY	THYRD	SKIN	T.BODY	THYRD	SKIN	T.BODY	THYRD	SKIN	T.BODY	THYRD	SKIN
N	1.3E-07	2.1E-07	1.6E-07	1.3E-07	2.8E-07	1.6E-07	1.2E-07	3.7E-07	1.6E-07	9.5E-07	3.4E-07	1.6E-07
NNE	1.20E-07	2.1E-07	1.6E-07	1.3E-07	2.8E-07	1.6E-07	1.2E-07	3.6E-07	1.6E-07	9.4E-07	3.3E-07	1.6E-07
NE	1.3E-07	2.1E-07	1.6E-07	1.3E-07	2.9E-07	1.6E-07	1.2E-07	3.7E-07	1.6E-07	9.7E-07	3.4E-07	1.6E-07
ENE	6.7E-08	1.1E-06	8.6E-08	6.8E-08	1.5E-06	8.6E-08	6.5E-08	2.0E-06	8.6E-08	5.2E-08	1.8E-06	8.6E-08
E	1.3E-06	3.7E-05	1.1E-06	1.4E-06	4.2E-05	1.1E-06	1.8E-06	7.1E-05	1.1E-06	1.1E-06	6.5E-05	1.1E-06
ESE	2.4E-06	8.6E-05	2.2E-06	2.6E-06	9.5E-05	2.2E-06	3.1E-06	1.7E-04	2.2E-06	1.9E-06	1.5E-04	2.2E-06
SE	9.4E-07	2.2E-05	7.9E-07	1.0E-06	2.5E-05	7.9E-07	1.2E-06	4.2E-05	7.9E-07	7.7E-07	4.2E-05	7.9E-07
SSE	3.3E-07	7.0E-06	2.1E-07	3.5E-07	8.2E-06	2.1E-07	4.5E-07	1.4E-05	2.1E-07	3.2E-07	1.6E-05	2.1E-07
S	5.9E-07	1.0E-05	3.3E-07	6.4E-07	1.2E-05	3.3E-07	8.0E-07	2.0E-05	3.3E-07	4.0E-07	1.7E-05	3.3E-07
SSW	3.7E-07	3.6E-06	1.2E-07	4.1E-07	4.7E-06	1.2E-07	5.5E-07	9.1E-06	1.2E-07	3.8E-07	1.5E-05	1.2E-07
SW	5.8E-07	3.3E-06	2.1E-07	6.4E-07	4.2E-06	2.1E-07	8.6E-07	8.0E-06	2.1E-07	6.3E-07	1.3E-05	2.1E-07
WSW	5.6E-07	2.5E-06	2.0E-07	6.3E-07	3.3E-06	2.0E-07	8.6E-07	5.9E-06	2.0E-07	6.1E-07	9.3E-06	2.0E-07
W	3.8E-07	1.2E-06	1.0E-07	4.3E-07	1.5E-06	1.0E-07	6.1E-07	2.2E-06	1.0E-07	3.5E-07	2.3E-06	1.0E-07
WNW	2.4E-08	6.4E-07	1.7E-08	2.6E-08	6.3E-07	1.7E-08	3.2E-08	1.0E-06	1.7E-08	1.1E-08	2.6E-07	1.7E-08
NW	3.6E-08	5.9E-07	4.5E-08	3.7E-08	7.9E-07	4.5E-08	3.5E-08	1.0E-06	4.5E-08	2.8E-08	9.5E-07	4.5E-08
NNW	6.3E-08	1.1E-06	8.3E-08	6.4E-08	1.5E-06	8.3E-08	6.1E-08	2.0E-06	8.3E-08	4.9E-08	1.8E-06	8.3E-08
MAX.	2.4E-06	8.6E-05	2.2E-06	2.6E-06	9.5E-05	2.2E-06	3.1E-06	1.7E-04	2.2E-06	1.9E-06	1.5E-04	2.2E-06



Table 4A
Radiation Doses to Maximally Exposed Individual Receptor
From Gaseous Releases in Rem
Fourth Quarter 1996

	ADULT			TEEN			CHILD			INFANT		
	T.BODY	THYRD	SKIN	T.BODY	THYRD	SKIN	T.BODY	THYRD	SKIN	T.BODY	THYRD	SKIN
N	4.2E-08	4.2E-08	4.5E-08	4.2E-08	4.2E-08	4.5E-08	3.9E-08	4.0E-08	4.5E-08	3.0E-08	3.0E-08	4.5E-08
NNE	4.2E-08	4.2E-08	4.5E-08	4.2E-08	4.3E-08	4.5E-08	3.9E-08	3.9E-08	4.5E-08	2.9E-08	3.0E-08	4.5E-08
NE	3.6E-08	3.6E-08	3.5E-08	3.6E-08	3.7E-08	3.5E-08	3.3E-08	3.4E-08	3.5E-08	2.5E-08	2.5E-08	3.5E-08
ENE	3.7E-08	3.8E-08	3.7E-08	3.7E-08	3.8E-08	3.7E-08	3.5E-08	3.6E-08	3.7E-08	2.6E-08	2.7E-08	3.7E-08
E	1.5E-07	1.5E-07	1.3E-07	1.6E-07	1.6E-07	1.3E-07	1.9E-07	2.0E-07	1.3E-07	1.2E-07	1.2E-07	1.3E-07
ESE	2.8E-07	3.0E-07	2.8E-07	2.9E-07	3.2E-07	2.8E-07	3.3E-07	3.7E-07	2.8E-07	2.0E-07	2.6E-07	2.8E-07
SE	2.3E-07	2.4E-07	2.5E-07	2.4E-07	2.5E-07	2.5E-07	2.6E-07	2.8E-07	2.5E-07	1.6E-07	1.9E-07	2.5E-07
SSE	7.9E-08	8.6E-08	7.9E-08	8.3E-08	9.0E-08	7.9E-08	9.2E-08	1.1E-07	7.9E-08	5.6E-08	7.5E-08	7.9E-08
S	4.3E-07	4.7E-07	4.1E-07	4.5E-07	4.9E-07	4.1E-07	5.3E-07	5.9E-07	4.1E-07	2.7E-07	3.4E-07	4.1E-07
SSW	3.0E-07	3.2E-07	3.0E-07	3.2E-07	3.5E-07	3.0E-07	3.7E-07	4.1E-07	3.0E-07	2.0E-07	2.5E-07	3.0E-07
SW	3.4E-07	3.7E-07	3.3E-07	3.6E-07	4.0E-07	3.3E-07	4.2E-07	4.8E-07	3.3E-07	2.6E-07	3.5E-07	3.3E-07
WSW	2.2E-07	2.4E-07	2.1E-07	2.3E-07	2.5E-07	2.1E-07	2.7E-07	3.0E-07	2.1E-07	1.6E-07	2.1E-07	2.1E-07
W	1.3E-07	1.3E-07	1.0E-07	1.4E-07	1.4E-07	1.0E-07	1.7E-07	1.8E-07	1.0E-07	1.0E-07	1.2E-07	1.0E-07
WNW	5.8E-09	6.2E-09	5.4E-09	6.1E-09	6.5E-09	5.4E-09	7.2E-09	7.8E-09	5.4E-09	2.9E-09	3.0E-09	5.4E-09
NW	1.3E-08	1.3E-08	1.2E-08	1.3E-08	1.3E-08	1.2E-08	1.2E-08	1.2E-08	1.2E-08	8.6E-09	8.9E-09	1.2E-08
NNW	3.0E-08	3.0E-08	2.9E-08	3.0E-08	3.1E-08	2.9E-08	2.8E-08	2.9E-08	2.9E-08	2.1E-08	2.1E-08	2.9E-08
MAX.	4.3E-07	4.7E-07	4.1E-07	4.5E-07	4.9E-07	4.1E-07	5.3E-07	5.9E-07	4.1E-07	2.7E-07	3.5E-07	4.1E-07



Table 4B

Radiation Doses to Maximally Exposed Individual Receptor

Radiation Dose To Maximally Exposed Individual

From Liquid Release in Rem

1996

	Adult	Teen	Child	Infant
First Quarter				
T. Body	3.50E-07	3.52E-07	3.14E-07	1.91E-07
Bone	2.55E-08	2.55E-08	2.54E-08	2.55E-08
Thyroid	3.92E-07	4.04E-07	3.77E-07	2.49E-07
Second Quarter				
T. Body	8.86E-06	9.44E-06	1.11E-05	4.75E-06
Bone	1.28E-07	1.46E-07	2.11E-07	1.17E-07
Thyroid	9.01E-06	9.59E-06	1.13E-05	5.04E-06
Third Quarter				
T. Body	1.87E-06	1.97E-06	2.40E-06	1.21E-06
Bone	9.06E-07	9.55E-07	1.25E-06	9.63E-07
Thyroid	8.01E-05	8.50E-05	1.43E-04	9.88E-05
Fourth Quarter				
T. Body	2.86E-07	3.08E-07	3.83E-07	1.30E-07
Bone	1.52E-08	1.83E-08	2.96E-08	1.40E-08
Thyroid	3.23E-07	3.44E-07	4.45E-07	1.82E-07

