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U. S. Nuclear Regulatory Commission
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Subject: Arkansas Nuclear One - Units 1 and 2
Docket Nos. 50-313 and 50-368
License Nos. DPR-51 and NPF-6
Semiannual Radiological Effluent Release Report
for the Third and Fourth Quarters Of 1994

Gentlemen:

Arkansas Nuclear One, Units 1 and 2 (ANO-1 & 2) Technical Specifications 6.12.2.6 and 6.9.3, respectively, require the submittal of a Semiannual Radioactive Effluent Release Report. The purpose of this letter is to complete this reporting requirement for the third and fourth quarters of 1994 at ANO. This submittal also includes the additional information required by Technical Specifications 6.12.2.6 and 6.9.3 which is to be provided in the first report filed each year. Liquid and gaseous release data show that the dose from both ANO-1 and ANO-2 is generally a factor of 100 below the technical specification limits. This data reveals that the radioactive effluents have an overall minimal dose contribution to the surrounding environment.

Should you have any questions regarding this submittal, please contact me.

Very truly yours,

Dwight C. Mims

Dwight C. Mims
Director, Licensing

DCM/jjd

attachments

JE38

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ARKANSAS NUCLEAR ONE

UNIT 1 AND UNIT 2

OPERATING LICENSE NO. DPR-51 AND NPF-6

SEMIANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

JULY 1 THROUGH DECEMBER 31, 1994

TABLE OF CONTENTS

1. INTRODUCTION

Arkansas Nuclear One (ANO) is a two unit plant consisting of a Babcock & Wilcox (Unit 1) and a Combustion Engineering (Unit 2) design. Both liquid and gaseous effluents are released in accordance with the technical specifications for each unit. This report is a summary of the effluent data in accordance with Unit 1 Technical Specification 6.12.2.6 and Unit Two Technical Specification 6.9.3. This report provides the following information:

A. Routine radioactive effluent release reports covering the operation of the units during the reporting period.

B. Description of unplanned releases to unrestricted areas.

C. Description of changes to Offsite Dose Calculation Manual (ODCM).

D. Description of changes to Process Control Program (PCP).

E. Summary of radiation doses due to radiological effluents during the previous calendar year. This data is included in the first report of each year.

F. Radiation dose to members of the public due to their activities inside the site boundary. This data is included in the first report of each year.

G. Description of licensee initiated major changes to the radioactive waste systems during the previous calendar year. This data is included in the first report of each year.

H. Items to be reported in the Semiannual Report per other miscellaneous Technical Specifications.

This report covers the period from July 1 through December 31, 1994.

2. REGULATORY LIMITS

Unit One and Unit Two Technical Specifications contain the limits to which ANO must adhere. Because of the "as low as reasonably achievable" (ALARA) philosophy at ANO, an attempt is made to reduce the amount of radiation released to the environment. Liquid and gaseous release data show that the dose from both ANO-1 and ANO-2 is generally a factor of 100 below the technical specification limits. This data reveals that the radioactive effluents have an overall minimal dose contribution to the surrounding environment. The following are the limits required by the technical specifications.

A. Gaseous Effluents

1. Dose rate due to radioactive materials released in gaseous effluent to unrestricted areas shall be limited to the following:

   a. Noble gases

      Less than or equal to 500 mrem/year to the total body
      Less than or equal to 3000 mrem/year to the skin

   b. Iodine-131, tritium, and for all radionuclides in particulate form with half lives greater than 8 days

      Less than or equal to 1500 mrem/yr

2. Dose - Noble Gases

   Quarterly

   Less than or equal to 5 mrads gamma
   Less than or equal to 10 mrads beta

   Yearly

   Less than or equal to 10 mrads gamma
   Less than or equal to 20 mrads beta

3. Dose - Iodine-131, Tritium, and Radionuclides in Particulate Form

   Quarterly

   Less than or equal to 7.5 mrems to any organ

   Yearly

   Less than or equal to 15 mrems to any organ

B. Liquid Effluents

1. Concentration

The concentration of radioactive material released to the discharge canal shall be limited to the concentration specified in 10CFR20, Appendix B, Table II, Column 2 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the total concentration released shall be limited to 2E-4 microcuries/ml.

2. Dose

Quarterly

Less than or equal to 1.5 mrem total body
Less than or equal to 5 mrem critical organ

Yearly

Less than or equal to 3 mrem total body
Less than or equal to 10 mrem critical organ

3. SUMMARY OF LIQUID EFFLUENT DATA

The following data is a summary of the number and times of releases for both Unit 1 and Unit 2. These releases occurred between July 1 and December 31, 1994.

	Unit 1	Unit 2
Number of releases:	586	195
Total time for all releases (minutes):	97365	54002
Maximum time for a release (minutes):	466	1050
Average time for a release (minutes):	166	277
Minimum time for a release (minutes):	5	32

As required by Regulatory Guide 1.21, Rev. 1, a summary of data for liquid releases is to be provided in the Semiannual Report. The following five pages provide a summary of liquid effluents for both Unit 1 and Unit 2:

SEMIANNUAL SUMMATION FOR ALL RELEASES BY QUARTER
(ALL LIQUID EFFLUENTS)
July 1 through December 31, 1994

Unit 1

Type of Effluent	Units	Quarter 3	Quarter 4	Est. Total Error %
A. Fission and Activation Products				
1. Total Release (Not Including Tritium, Gases, Alpha)	Curies	8.063E-2	7.675E-2	0
2. Average Diluted Concentration During Period	µCi/ml	2.115E-10	2.347E-10	
3. Percent of Applicable Limit	%	7.049E-2	7.823E-2	
B. Tritium				
1. Total Release	Curies	1.293E+2	1.364E+2	0
2. Average Diluted Concentration During Period	µCi/ml	3.391E-7	4.170E-7	
3. Percent of Applicable Limit	%	1.130E-2	1.390E-2	
C. Dissolved and Entrained Gases				
1. Total Release	Curies	1.693E-1	1.994E+0	0
2. Average Diluted Concentration	µCi/ml	4.440E-10	6.096E-9	
3. Percent of Applicable Limit	%	2.220E-4	3.048E-3	
D. Gross Alpha Radioactivity				
1. Total Release	Curies	2.204E-3	0.000E+0	0
E. Waste Vol Released (Pre-Dilution)	Liters	3.604E+7	3.277E+7	0
F. Volume of Dilution Water Used	Liters	3.812E+11	3.270E+11	0

UNIT 1
REPORT CATEGORY : SEMIANNUAL LIQUID CONTINUOUS AND BATCH RELEASES
: TOTALS FOR EACH NUCLIDE RELEASED
TYPE OF ACTIVITY : ALL RADIONUCLIDES
REPORTING PERIOD : QUARTER # 3 AND QUARTER # 4 YEAR 1994

		CONTINUOUS RELEASES		BATCH RELEASES	
NUCLIDE	UNIT	QUARTER 3	QUARTER 4	QUARTER 3	QUARTER 4
SN-113	CURIES	0.00E+00	0.00E+00	3.26E-06	0.00E+00
ZR-97	CURIES	0.00E+00	0.00E+00	1.72E-05	0.00E+00
NB-97	CURIES	0.00E+00	0.00E+00	1.85E-05	0.00E+00
CE-141	CURIES	0.00E+00	0.00E+00	2.69E-05	0.00E+00
SB-124	CURIES	0.00E+00	0.00E+00	2.74E-05	0.00E+00
G-ALPHA	CURIES	0.00E+00	0.00E+00	2.20E-03	0.00E+00
TC-99M	CURIES	0.00E+00	0.00E+00	1.76E-05	1.10E-05
AR-41	CURIES	0.00E+00	0.00E+00	0.00E+00	1.23E-05
SR-92	CURIES	0.00E+00	0.00E+00	0.00E+00	1.33E-05
SB-122	CURIES	0.00E+00	0.00E+00	0.00E+00	1.74E-05
CS-138	CURIES	0.00E+00	0.00E+00	0.00E+00	3.04E-05
KR-85M	CURIES	0.00E+00	0.00E+00	2.07E-05	3.14E-05
I-133	CURIES	0.00E+00	0.00E+00	3.56E-05	5.44E-05
CR-51	CURIES	0.00E+00	0.00E+00	1.85E-04	1.27E-04
KR-88	CURIES	0.00E+00	0.00E+00	0.00E+00	1.36E-04
ZR-95	CURIES	0.00E+00	0.00E+00	1.29E-04	1.60E-04
MN-54	CURIES	0.00E+00	0.00E+00	6.39E-04	3.43E-04
CO-57	CURIES	0.00E+00	0.00E+00	4.21E-04	4.98E-04
NB-95	CURIES	0.00E+00	0.00E+00	6.42E-04	5.56E-04
AG-110M	CURIES	0.00E+00	0.00E+00	1.69E-03	7.69E-04
SR-89	CURIES	0.00E+00	0.00E+00	0.00E+00	1.14E-03
I-131	CURIES	0.00E+00	0.00E+00	1.11E-03	1.29E-03
NA-24	CURIES	0.00E+00	0.00E+00	3.79E-03	1.41E-03
CS-134	CURIES	0.00E+00	0.00E+00	2.75E-03	1.43E-03
XE-135	CURIES	0.00E+00	0.00E+00	1.60E-04	3.85E-03
CS-137	CURIES	0.00E+00	0.00E+00	8.43E-03	5.31E-03
CO-58	CURIES	0.00E+00	0.00E+00	1.27E-02	8.33E-03
XE-133M	CURIES	0.00E+00	0.00E+00	1.25E-03	1.01E-02
FE-55	CURIES	0.00E+00	0.00E+00	4.08E-03	1.09E-02
SB-125	CURIES	0.00E+00	0.00E+00	2.70E-02	2.21E-02
CO-60	CURIES	0.00E+00	0.00E+00	1.69E-02	2.22E-02

NUCLIDE	UNIT	CONTINUOUS RELEASES QUARTER 3	CONTINUOUS RELEASES QUARTER 4	BATCH RELEASES QUARTER 3	BATCH RELEASES QUARTER 4
XE-131M	CURIES	0.00E+00	0.00E+00	2.42E-03	3.41E-02
KR-85	CURIES	0.00E+00	0.00E+00	1.20E-02	1.07E-01
XE-133	CURIES	0.00E+00	0.00E+00	1.53E-01	1.84E+00
H-3	CURIES	0.00E+00	0.00E+00	1.29E+02	1.36E+02
Total for Period	CURIES	0.00E+00	0.00E+00	1.30E+02	1.38E+02

SEMIANNUAL SUMMATION FOR ALL RELEASES BY QUARTER
(ALL LIQUID EFFLUENTS)
July 1 through December 31, 1994

Unit 2

Type of Effluent	Units	Quarter 3	Quarter 4	Est. Total Error %
A. Fission and Activation Products				
1. Total Release (Not Including Tritium, Gases, Alpha)	Curies	3.871E-2	4.334E-2	0
2. Average Diluted Concentration During Period	µCi/ml	1.015E-10	1.325E-10	
3. Percent of Applicable Limit	%	3.385E-2	4.418E-2	
B. Tritium				
1. Total Release	Curies	9.163E+1	1.609E+2	0
2. Average Diluted Concentration During Period	µCi/ml	2.403E-7	4.920E-7	
3. Percent of Applicable Limit	%	8.011E-3	1.640E-2	
C. Dissolved and Entrained Gases				
1. Total Release	Curies	2.017E-2	1.516E+0	0
2. Average Diluted Concentration	µCi/ml	5.291E-11	4.6376E-9	
3. Percent of Applicable Limit	%	2.645E-5	2.319E-3	
D. Gross Alpha Radioactivity				
1. Total Release	Curies	3.622E-3	4.526E-4	0
E. Waste Vol Released (Pre-Dilution)	Liters	6.949E+6	8.905E+6	0
F. Volume of Dilution Water Used	Liters	3.812E+11	3.270E+11	0

UNIT 2
REPORT CATEGORY : SEMIANNUAL LIQUID CONTINUOUS AND BATCH RELEASES
: TOTALS FOR EACH NUCLIDE RELEASED.
TYPE OF ACTIVITY : ALL RADIONUCLIDES
REPORTING PERIOD : QUARTER # 3 AND QUARTER # 4 YEAR 1994

		CONTINUOUS RELEASES		BATCH RELEASES	
NUCLIDE	UNIT	QUARTER 3	QUARTER 4	QUARTER 3	QUARTER 4
NB-95	CURIES	0.00E+00	0.00E+00	1.98E-05	0.00E+00
ZR-95	CURIES	0.00E+00	0.00E+00	2.28E-05	0.00E+00
NA-24	CURIES	0.00E+00	0.00E+00	2.45E-05	0.00E+00
I-133	CURIES	0.00E+00	0.00E+00	5.64E-05	0.00E+00
Y-91M	CURIES	0.00E+00	0.00E+00	8.37E-05	0.00E+00
CR-51	CURIES	0.00E+00	0.00E+00	6.24E-04	0.00E+00
SN-113M	CURIES	0.00E+00	0.00E+00	0.00E+00	4.95E-06
I-134	CURIES	0.00E+00	0.00E+00	0.00E+00	7.25E-06
CO-57	CURIES	0.00E+00	0.00E+00	5.77E-05	8.30E-05
SB-124	CURIES	0.00E+00	0.00E+00	1.54E-03	1.08E-04
XE-135	CURIES	0.00E+00	0.00E+00	1.10E-04	2.62E-04
AG-110M	CURIES	0.00E+00	0.00E+00	2.41E-04	3.03E-04
G-ALPHA	CURIES	0.00E+00	0.00E+00	3.62E-03	4.53E-04
CS-134	CURIES	0.00E+00	0.00E+00	6.14E-04	1.57E-03
FE-55	CURIES	0.00E+00	0.00E+00	5.24E-03	3.01E-03
MN-54	CURIES	0.00E+00	0.00E+00	1.75E-03	3.29E-03
CO-60	CURIES	0.00E+00	0.00E+00	1.35E-03	3.53E-03
I-131	CURIES	0.00E+00	0.00E+00	1.72E-03	4.55E-03
CS-137	CURIES	0.00E+00	0.00E+00	2.00E-03	5.09E-03
SB-125	CURIES	0.00E+00	0.00E+00	1.12E-02	6.55E-03
XE-133	CURIES	0.00E+00	0.00E+00	0.00E+00	7.97E-03
CO-58	CURIES	0.00E+00	0.00E+00	1.21E-02	1.52E-02
XE-131M	CURIES	0.00E+00	0.00E+00	0.00E+00	1.84E-02
XE-133	CURIES	0.00E+00	0.00E+00	2.01E-02	1.49E+00
H-3	CURIES	0.00E+00	0.00E+00	9.16E+01	1.61E+02
Total for Period	CURIES	0.00E+00	0.00E+00	9.17E+01	1.62E+02

4. SUMMARY OF GASEOUS EFFLUENT DATA

As required by Regulatory Guide 1.21, Rev. 1, a summary of data for gaseous releases is provided in the Semiannual Report. This summary covers releases from July 1 to December 31, 1994. The summary of gaseous effluents for both Unit 1 and Unit 2 is as follows:

	Unit 1	Unit 2
Number of releases:	56	87
Total time for all releases (minutes):	448012	468284
Maximum time for a release (minutes):	10295	10619
Average time for a release (minutes):	8000	5321
Minimum time for a release (minutes):	57	2

The Unit 1 gaseous releases consisted of:

7 emergency feedwater (EFW) pump releases - These releases were a result of surveillances to the steam driven EFW pump.

49 vent releases.

The Unit 2 gaseous releases consisted of:

10 emergency feedwater (EFW) pump releases - These releases were a result of surveillances to the steam driven EFW pump.

77 vent releases.

SEMIANNUAL SUMMATION FOR ALL RELEASES BY QUARTER
(ALL AIRBORNE EFFLUENTS)
July 1 through December 31, 1994

Unit 1

Type of Effluent	Units	Quarter 3	Quarter 4	Est. Total Error %
A. Fission and Activation Products				
1. Total Release	Curies	0.000E+0	1.101E+1	0
2. Average Release Rate for Period	µCi/Sec	0.000E+0	1.385E+0	
3. Percent of Applicable Limit	%	0.000E+0	1.938E-2	
B. Radioiodines				
1. Total Iodine-131	Curies	0.000E+0	E-7	0
2. Average Release Rate for Period	µCi/Sec	0.000E+0	E-7	
3. Percent of Applicable Limit	%	0.000E+0	3.215E-7	
C. Particulates				
1. Particulates (Half-Lives > 8 Days)	Curies	4.118E-9	8.550E-7	0
2. Average Release Rate for Period	µCi/Sec	5.181E-10	1.076E-7	
3. Percent of Applicable Limit	%	1.451E-9	3.012E-7	
4. Gross Alpha Radioactivity	Curies	1.907E-6	1.703E-6	
D. Tritium				
1. Total Release	Curies	1.257E+0	4.588E+0	0
2. Average Release Rate for Period	µCi/Sec	1.581E-1	5.773E-1	
3. Percent of Applicable Limit	%	2.214E-4	8.082E-4	

UNIT 1
REPORT CATEGORY : SEMIANNUAL AIRBORNE GROUND LEVEL
: CONTINUOUS AND BATCH RELEASES
: TOTALS FOR EACH NUCLIDE RELEASED
TYPE OF ACTIVITY : FISSION GASES, IODINES, AND PARTICULATES
REPORTING PERIOD : QUARTER # 3 AND QUARTER # 4 YEAR 1994

		CONTINUOUS RELEASES		BATCH RELEASES	
NUCLIDE	UNIT	QUARTER 3	QUARTER 4	QUARTER 3	QUARTER 4
Fission Gases					
XE-133	CURIES	0.00E+00	0.00E+00	0.00E+00	1.10E+01
Total for Period	CURIES	0.00E+00	0.00E+00	0.00E+00	1.10E+01
Iodines					
I-131	CURIES	0.00E+00	0.00E+00	0.00E+00	9.13E-07
I-133	CURIES	0.00E+00	0.00E+00	0.00E+00	2.53E-06
Total for Period	CURIES	0.00E+00	0.00E+00	0.00E+00	3.44E-06
Particulates					
NB-95	CURIES	0.00E+00	0.00E+00	0.00E+00	5.13E-07
Total for Period	CURIES	0.00E+00	0.00E+00	0.00E+00	5.13E-07
Other					
SR-89	CURIES	0.00E+00	0.00E+00	4.12E-09	3.42E-07
G-ALPHA	CURIES	0.00E+00	0.00E+00	1.91E-06	1.70E-06
H-3	CURIES	0.00E+00	0.00E+00	1.26E+00	4.59E+00
Total for Period	CURIES	0.00E+00	0.00E+00	1.26E+00	4.59E+00

SEMIANNUAL SUMMATION FOR ALL RELEASES BY QUARTER
(ALL AIRBORNE EFFLUENTS)
July 1 through December 31, 1994

Unit 2

Type of Effluent	Units	Quarter 3	Quarter 4	Est. Total Error %
A. Fission and Activation Products				
1. Total Release	Curies	5.316E+1	3.201E+2	0
2. Average Release Rate for Period	µCi/Sec	6.688E+0	4.027E+1	
3. Percent of Applicable Limit	%	9.364E-2	5.638E-1	
B. Radioiodines				
1. Total Iodine-131	Curies	7.059E-8	5.257E-7	0
2. Average Release Rate for Period	µCi/Sec	8.881E-9	6.614E-8	
3. Percent of Applicable Limit	%	2.487E-8	1.852E-7	
C. Particulates				
1. Particulates (Half-Lives > 8 Days)	Curies	1.113E-8	3.807E-7	0
2. Average Release Rate for Period	µCi/Sec	1.400E-9	4.790E-8	
3. Percent of Applicable Limit	%	3.921E-9	1.341E-7	
4. Gross Alpha Radioactivity	Curies	1.711E-10	2.682E-6	
D. Tritium				
1. Total Release	Curies	1.502E+0	3.324E+0	0
2. Average Release Rate for Period	µCi/Sec	1.889E-1	4.181E-1	
3. Percent of Applicable Limit	%	2.645E-4	5.854E-4	

UNIT 2
REPORT CATEGORY : SEMIANNUAL AIRBORNE GROUND LEVEL
: CONTINUOUS AND BATCH RELEASES
: TOTALS FOR EACH NUCLIDE RELEASED
TYPE OF ACTIVITY : FISSION GASES, IODINES, AND PARTICULATES
REPORTING PERIOD : QUARTER # 3 AND QUARTER # 4 YEAR 1994

		CONTINUOUS RELEASES		BATCH RELEASES	
NUCLIDE	UNIT	QUARTER 3	QUARTER 4	QUARTER 3	QUARTER 4
Fission Gases					
XE-135	CURIES	0.00E+00	0.00E+00	9.98E+00	1.20E+01
XE-133	CURIES	0.00E+00	0.00E+00	4.32E+01	3.08E+02
Total for Period	CURIES	0.00E+00	0.00E+00	5.32E+01	3.20E+02
Iodines					
I-133	CURIES	0.00E+00	0.00E+00	3.48E-08	2.36E-07
I-131	CURIES	0.00E+00	0.00E+00	7.06E-08	5.26E-07
I-134	CURIES	0.00E+00	0.00E+00	0.00E+00	3.39E-05
Total for Period	CURIES	0.00E+00	0.00E+00	1.05E-07	3.47E-05
Particulates					
Total for Period	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Other					
SR-89	CURIES	0.00E+00	0.00E+00	1.10E-11	0.00E+00
SR-90	CURIES	0.00E+00	0.00E+00	1.11E-08	3.81E-07
G-ALPHA	CURIES	0.00E+00	0.00E+00	1.71E-10	2.68E-06
H-3	CURIES	0.00E+00	0.00E+00	1.50E+00	3.32E+00
Total for Period	CURIES	0.00E+00	0.00E+00	1.50E+00	3.32E+00

5. SUMMARY OF RADIATION DOSES

The following is a summary of the annual radiation doses due to radiological effluents during 1994 calculated in accordance with the Offsite Dose Calculation Manual.

UNIT 1

Liquid Radwaste Effluents

Dose Limits (mRem): Total Body = 1.5/Qtr 3/Yr, Other Organs = 5/Qtr 10/Yr

Organ	Qtr 1	%	Qtr 2	%	Qtr 3	%	Qtr 4	%	Year	%
TBody	0.0072	0.48	0.0141	0.94	0.0054	0.36	0.0036	0.24	0.0302	1.01
Bone	0.0068	0.14	0.0126	0.25	0.0047	0.09	0.0032	0.06	0.0274	0.27
Liver	0.0099	0.20	0.0200	0.40	0.0076	0.15	0.0050	0.10	0.0424	0.42
Thyroid	0.0001	0.00	0.0013	0.03	0.0047	0.01	0.0008	0.02	0.0029	0.03
Kidney	0.0033	0.07	0.0069	0.14	0.0026	0.05	0.0018	0.04	0.0147	0.15
Lung	0.0012	0.02	0.0025	0.05	0.0010	0.02	0.0007	0.01	0.0055	0.05
GI-LLI	0.0023	0.05	0.0109	0.22	0.0066	0.13	0.0066	0.13	0.0264	0.26

Gaseous Radwaste Effluents

Iodine, H-3, and Particulate (ITP) - Dose Limits (mRem) = 7.5/Qtr 15/Yr

Organ	Qtr 1	%	Qtr 2	%	Qtr 3	%	Qtr 4	%	Year	%
TBody	0.0024	0.03	0.0017	0.02	0.0008	0.01	0.0028	0.04	0.0077	0.05
Bone	0.0001	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0001	0.00
Liver	0.0024	0.03	0.0017	0.02	0.0008	0.01	0.0028	0.04	0.0077	0.05
Thyroid	0.0024	0.03	0.0017	0.02	0.0008	0.01	0.0030	0.04	0.0079	0.05
Kidney	0.0024	0.03	0.0017	0.02	0.0008	0.01	0.0028	0.04	0.0077	0.05
Lung	0.0024	0.03	0.0017	0.02	0.0008	0.01	0.0028	0.04	0.0077	0.05
GI-LLI	0.0024	0.03	0.0017	0.02	0.0008	0.01	0.0028	0.04	0.0077	0.05

Noble Gas Air Dose Limits (mRad) = Gamma 5/Qtr 10/Yr, Beta 10/Qtr 20/Yr

Type	Qtr 1	%	Qtr 2	%	Qtr 3	%	Qtr 4	%	Year	%
Gamma	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0003	0.01	0.0003	0.00
Beta	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0010	0.01	0.0010	0.01

UNIT 2

Liquid Radwaste Effluents

Dose Limits (mRem): Total Body = 1.5/Qtr 3/Yr, Other Organs = 5 /Qtr 10/Yr

Organ	Qtr 1	%	Qtr 2	%	Qtr 3	%	Qtr 4	%	Year	%
TBody	0.0016	0.11	0.0019	0.13	0.0016	0.11	0.0036	0.24	0.0088	0.29
Bone	0.0016	0.03	0.0012	0.02	0.0028	0.06	0.0030	0.06	0.0087	0.09
Liver	0.0020	0.04	0.0026	0.05	0.0031	0.06	0.0051	0.10	0.0127	0.13
Thyroid	0.0048	0.10	0.0011	0.02	0.0028	0.02	0.0022	0.04	0.0089	0.09
Kidney	0.0018	0.04	0.0008	0.02	0.0007	0.01	0.0018	0.04	0.0052	0.05
Lung	0.0004	0.01	0.0003	0.01	0.0010	0.02	0.0008	0.02	0.0024	0.02
GI-LLI	0.0213	0.43	0.0221	0.44	0.0013	0.03	0.0009	0.02	0.0455	0.46

Gaseous Radwaste Effluents

Iodine, H-3, and Particulate - Dose Limits (mRem) = 7.5/Qtr 15/Yr

Organ	Qtr 1	%	Qtr 2	%	Qtr 3	%	Qtr 4	%	Year	%
TBody	0.0023	0.03	0.0012	0.02	0.0009	0.01	0.0021	0.03	0.0065	0.04
Bone	0.0001	0.00	0.0000	0.00	0.0000	0.00	0.0002	0.00	0.0003	0.00
Liver	0.0023	0.03	0.0012	0.02	0.0009	0.01	0.0020	0.03	0.0065	0.04
Thyroid	0.0023	0.03	0.0012	0.02	0.0009	0.01	0.0022	0.03	0.0066	0.04
Kidney	0.0023	0.03	0.0012	0.02	0.0009	0.01	0.0020	0.03	0.0065	0.04
Lung	0.0023	0.03	0.0012	0.02	0.0009	0.01	0.0020	0.03	0.0064	0.04
GI-LLI	0.0023	0.03	0.0012	0.02	0.0009	0.01	0.0020	0.03	0.0065	0.04

Noble Gas Air dose Limits (mRad) = Gamma 5/Qtr 10/Yr, Beta 10/Qtr 20/Yr

Type	Qtr 1	%	Qtr 2	%	Qtr 3	%	Qtr 4	%	Year	%
Gamma	0.0002	0.00	0.0000	0.00	0.0031	0.06	0.0117	0.23	0.0149	0.15
Beta	0.0005	0.01	0.0000	0.00	0.0062	0.06	0.0313	0.31	0.0380	0.19

6. SUMMARY OF DOSE TO MEMBERS OF THE PUBLIC

The following is a summary of the annual radiation dose to members of the public due to activities inside the site boundary.

UNIT 1

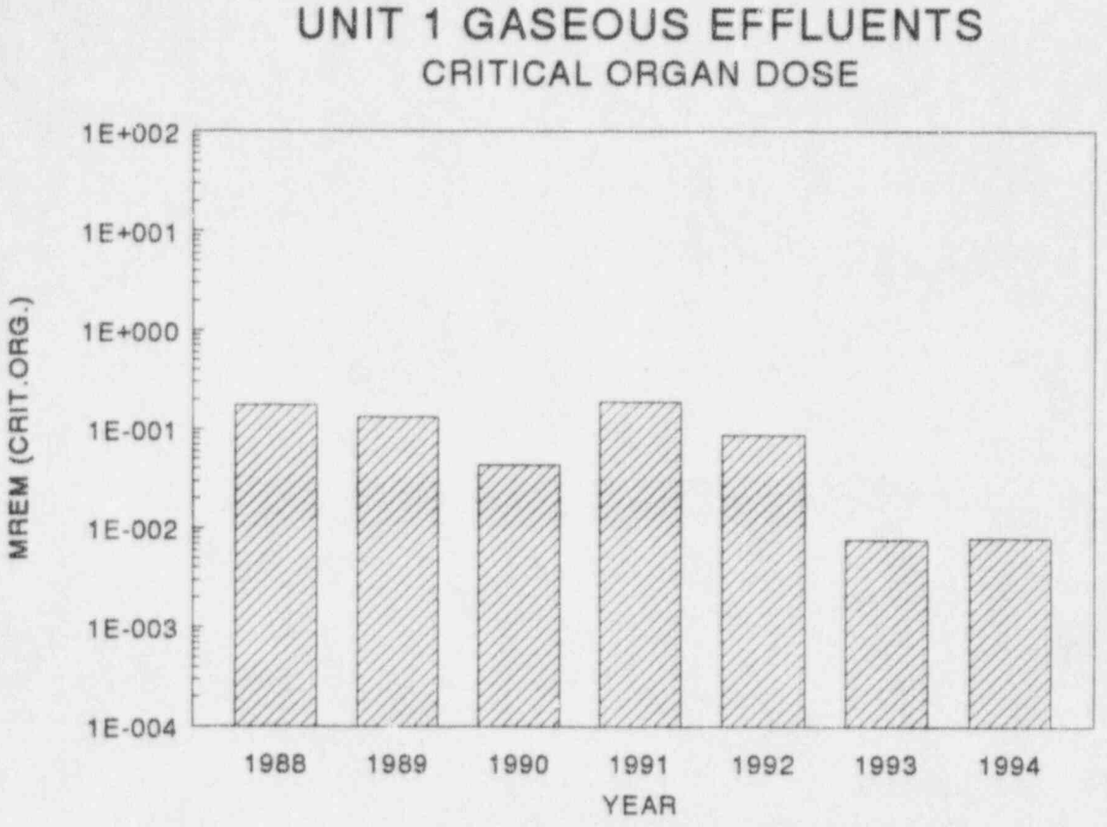
	BONE	LIVER	TBODY	THYROID	KIDNEY	GI-LLI	LUNG	SKIN
Gaseous Effluent								
ITP	4.81E-5	3.38E-3	3.38E-3	3.47E-3	3.38E-3	3.38E-3	3.38E-3	
Noble Gas			8.84E-5					2.09E-4
Liquid Effluent								
Fish	2.74E-2	4.24E-2	3.02E-2	2.85E-3	1.47E-2	5.46E-3	2.64E-2	
Sediment			1.35E-3					1.59E-3
Unit 1 Total	2.75E-2	4.57E-2	3.37E-2	6.32E-3	1.81E-2	8.83E-3	2.98E-2	1.79E-3

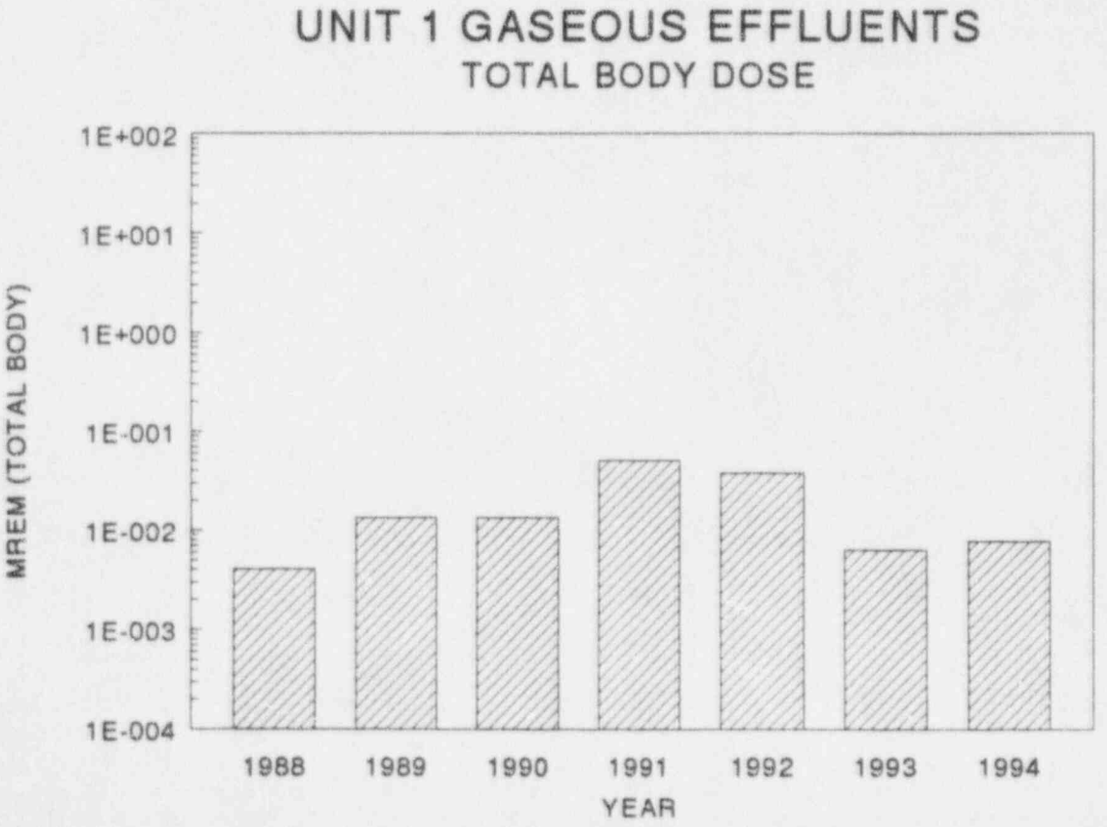
UNIT 2

Gaseous Effluent								
ITP	1.41E-4	2.82E-3	2.85E-3	2.88E-3	2.82E-3	2.82E-3	2.82E-3	
Noble Gas			3.93E-3					9.11E-3
Liquid Effluent								
Fish	8.67E-3	1.27E-2	8.78E-3	8.93E-3	5.22E-3	2.42E-3	4.55E-2	
Sediment			4.19E-4					4.92E-4
Unit 2 Total	8.82E-3	1.55E-2	1.56E-2	1.18E-2	8.04E-3	5.24E-3	4.84E-2	9.60E-3
Site Total	3.63E-2	6.13E-2	4.93E-2	1.81E-2	2.61E-2	1.41E-2	7.82E-2	1.14E-2
Limit (40CFR190)	25	25	75	25	25	25	25	25
% Limit	1.45E-1	2.45E-1	6.57E-2	7.25E-2	1.04E-1	5.63E-2	3.13E-1	4.56E-2

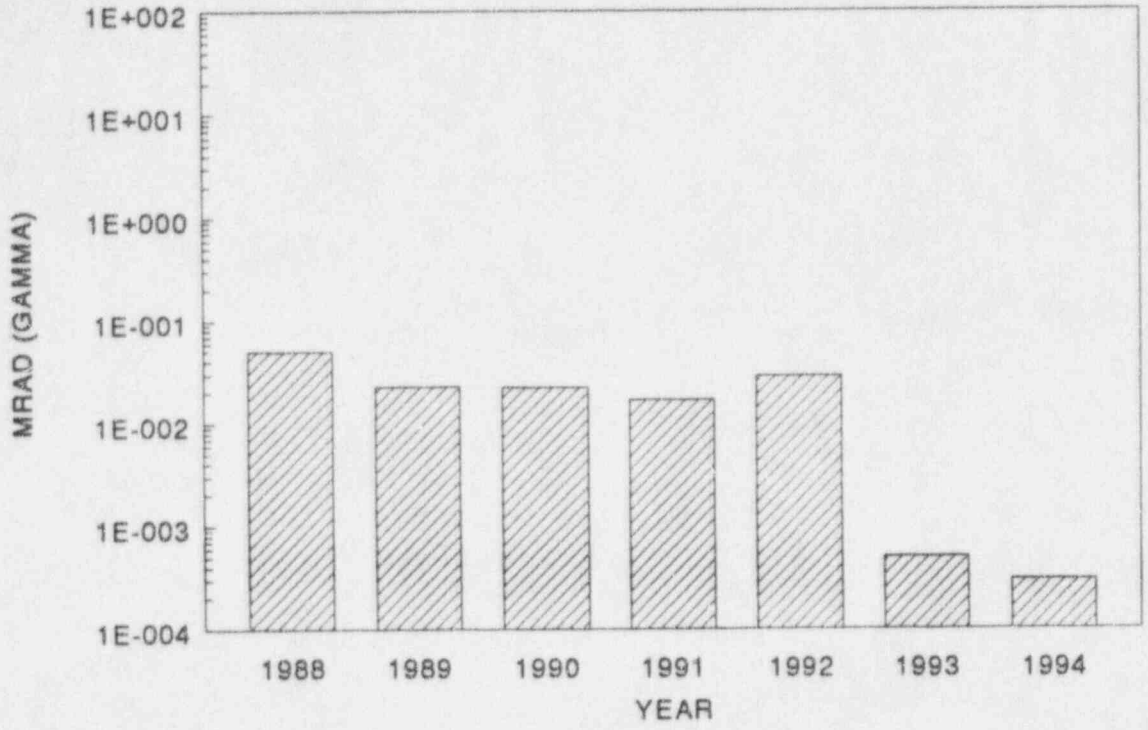
7. HISTORICAL EFFLUENT DATA

The following graphs show the historical release data for both units on a yearly basis. These graphs compare data from 1988 through 1994.

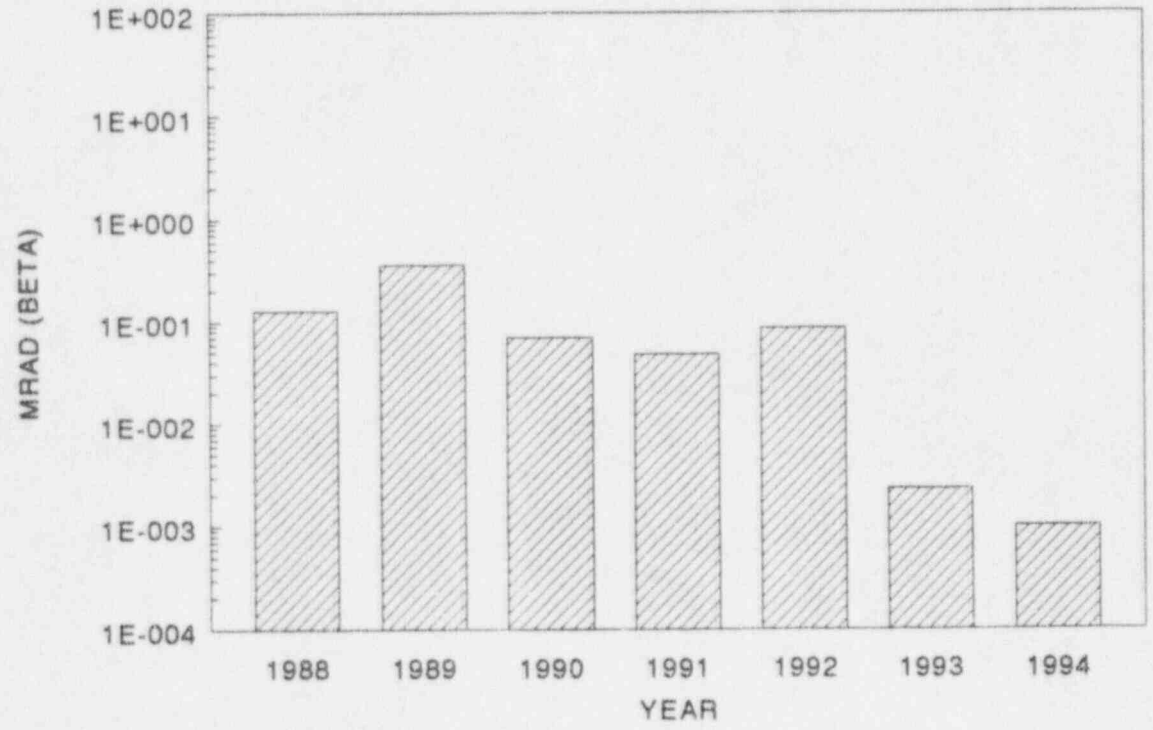


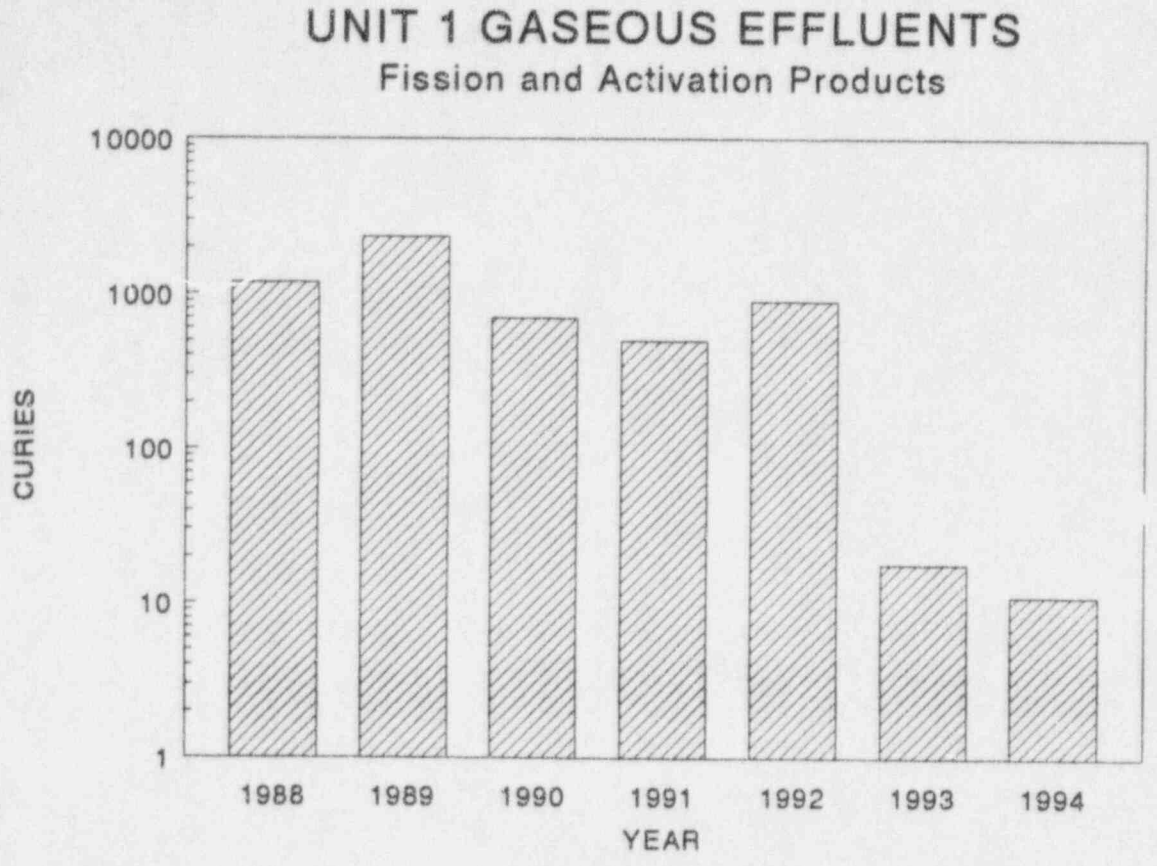


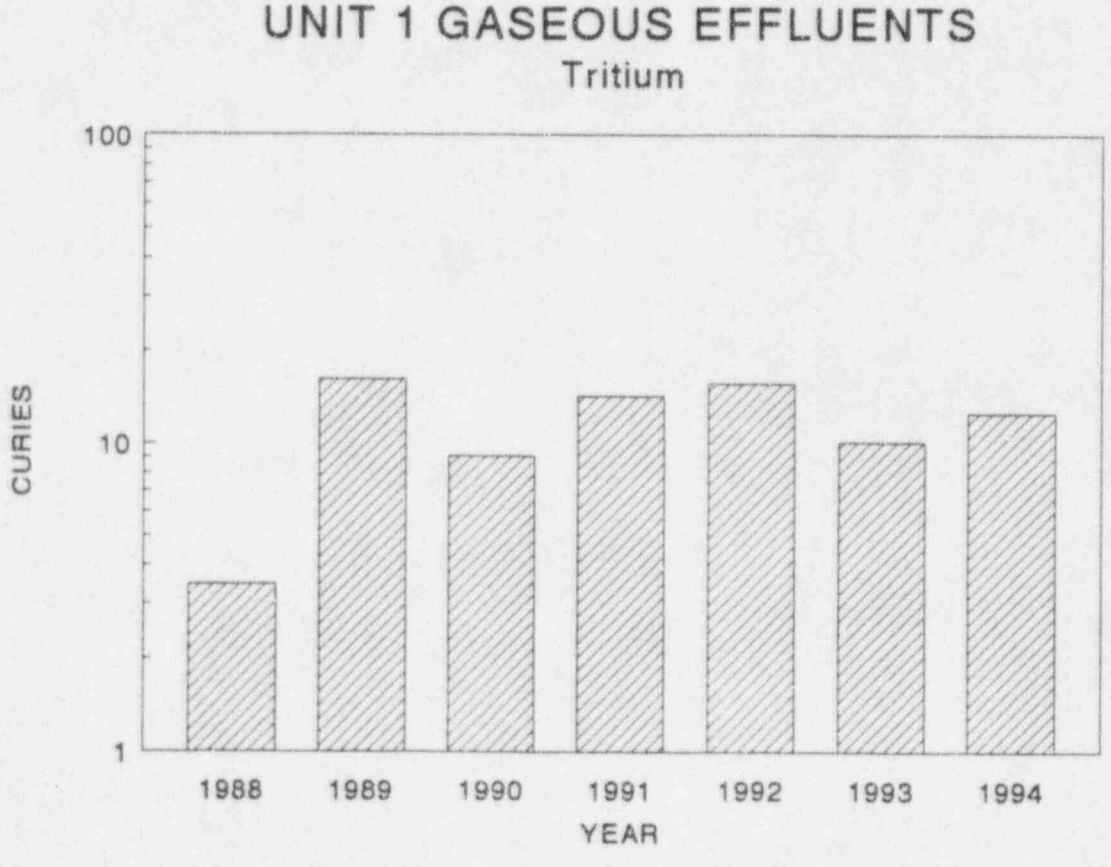
UNIT 1 GASEOUS EFFLUENTS
GAMMA DOSE

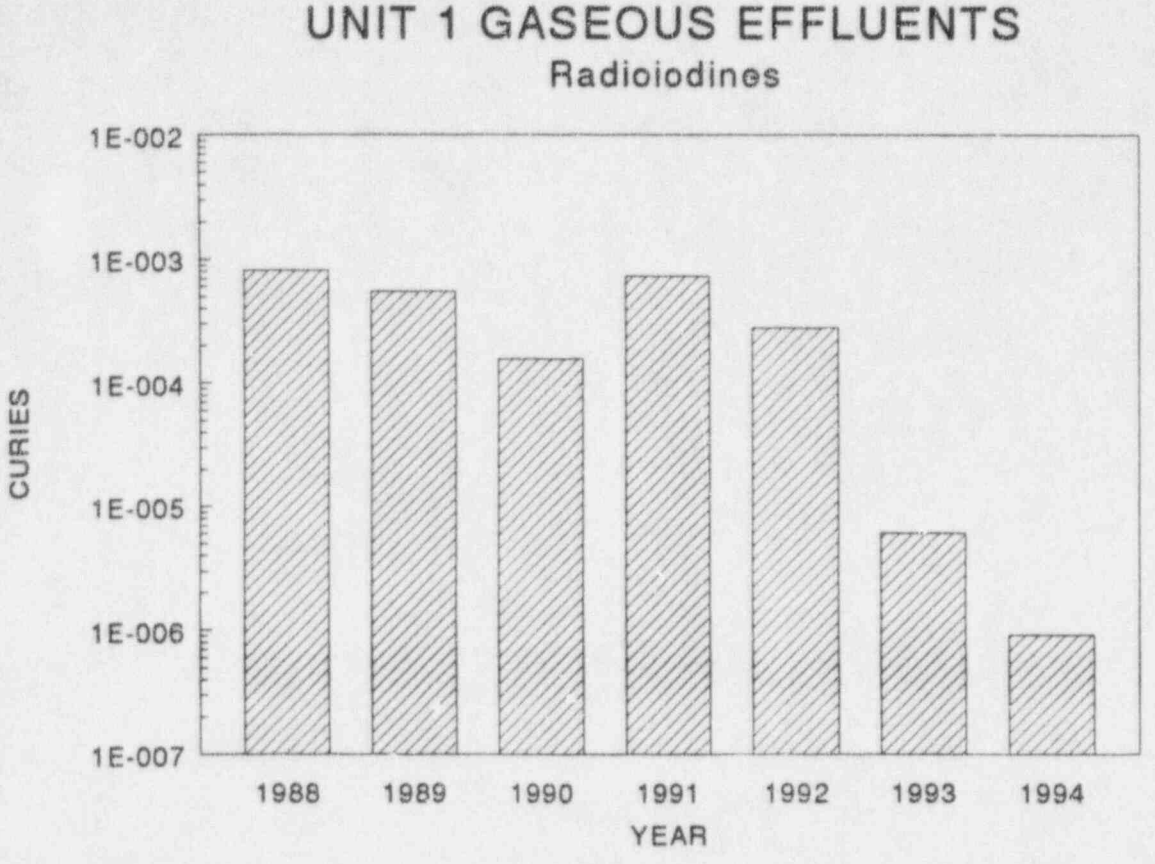


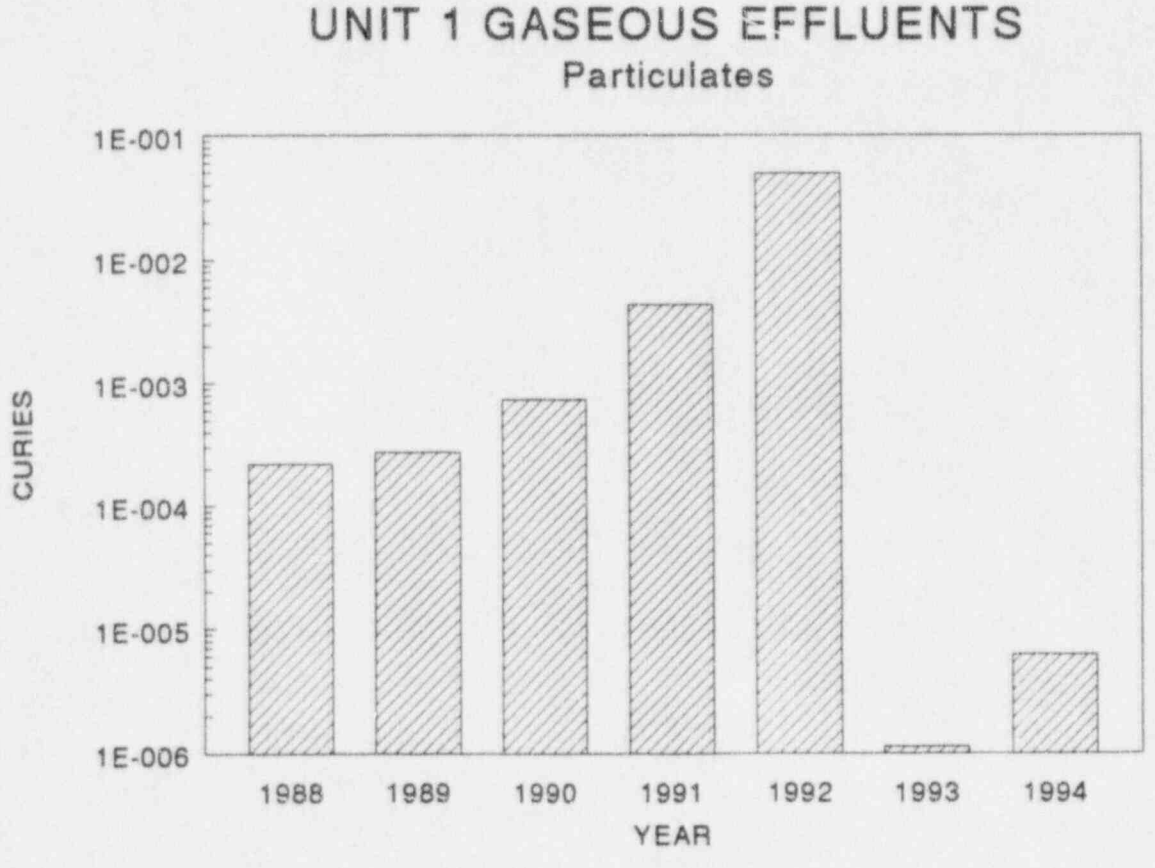
UNIT 1 GASEOUS EFFLUENTS
BETA DOSE



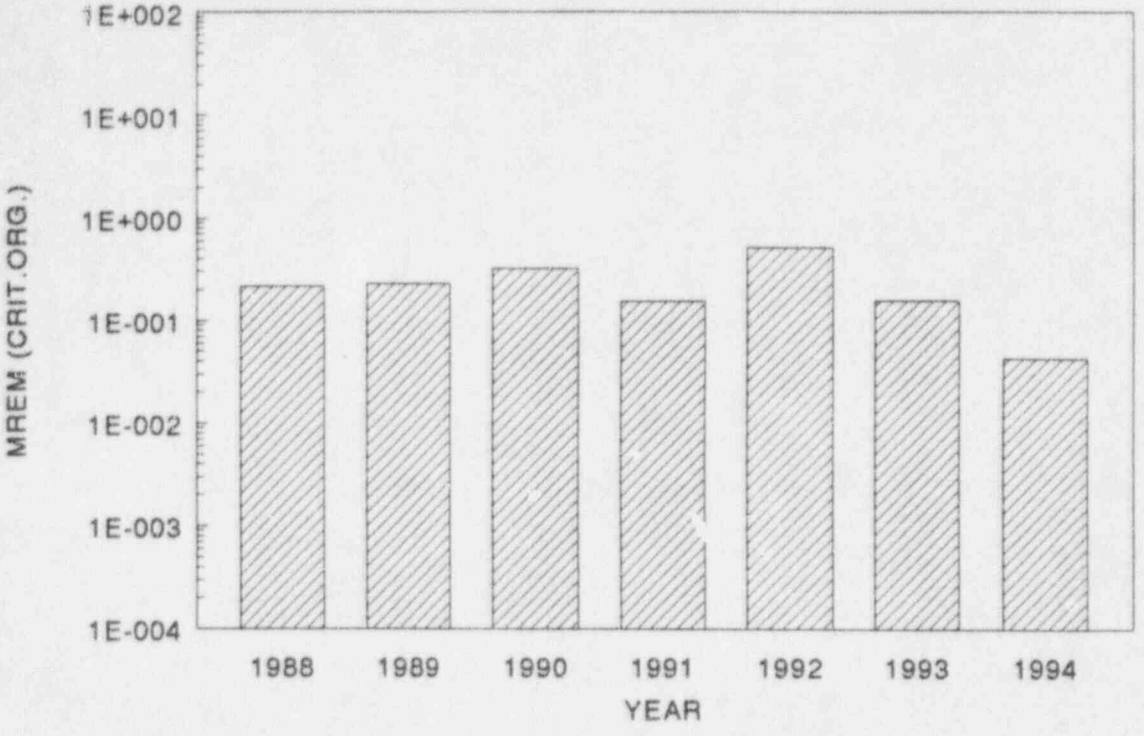

UNIT 1 GASEOUS EFFLUENTS
Fission and Activation Products
10000
1000
100
10
1
CURIES
1988
1989
1990
1991
1992
1993
1994
YEAR


UNIT 1 GASEOUS EFFLUENTS
Tritium
100
10
1
CURIES
1988
1989
1990
1991
1992
1993
1994
YEAR

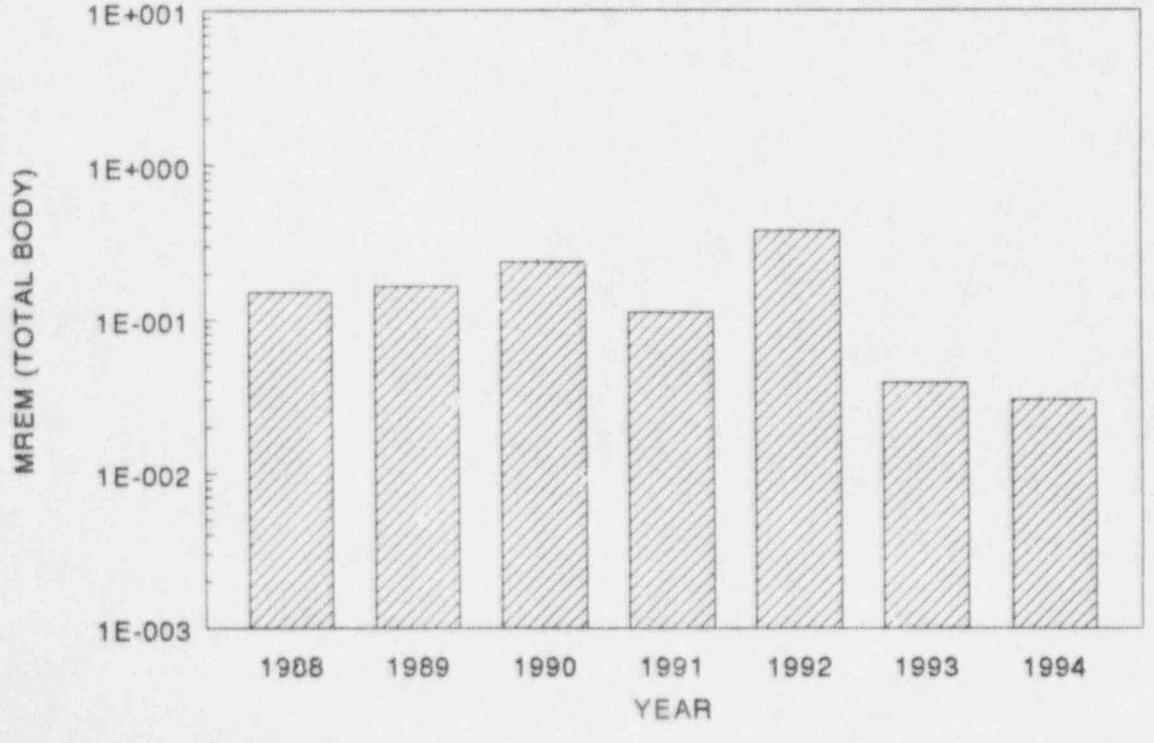

UNIT 1 GASEOUS EFFLUENTS
Radioiodines
1E-002
1E-003
1E-004
1E-005
1E-006
1E-007
CURIES
1988
1989
1990
1991
1992
1993
1994
YEAR

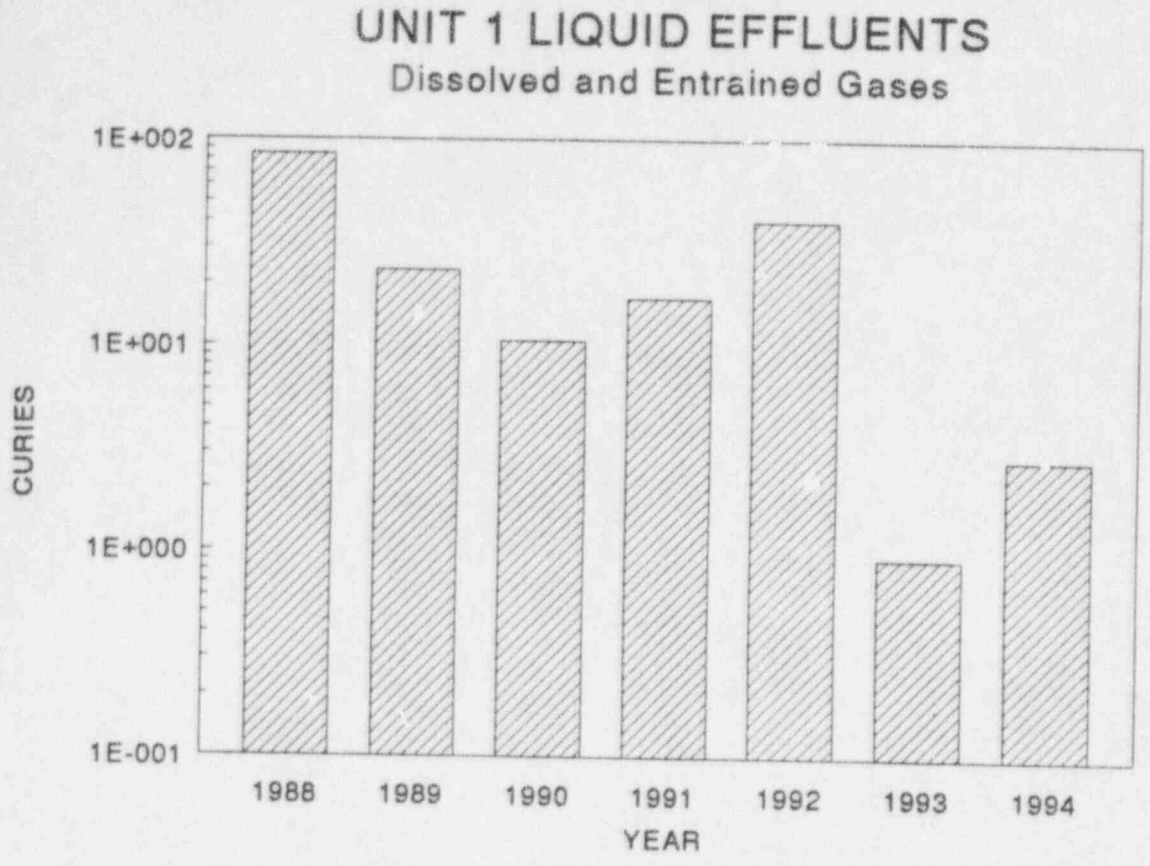

UNIT 1 GASEOUS EFFLUENTS
Particulates
1E-001
1E-002
1E-003
1E-004
1E-005
1E-006
CURIES
1988
1989
1990
1991
1992
1993
1994
YEAR

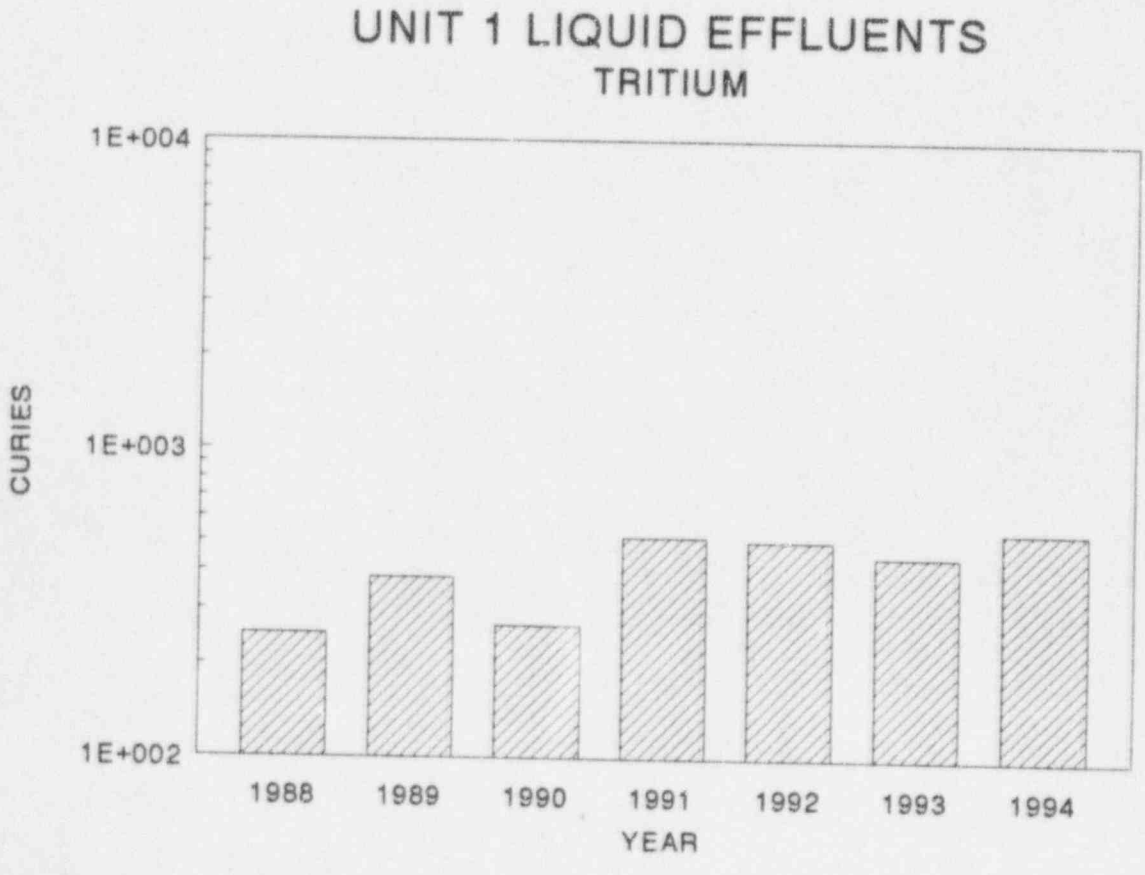
UNIT 1 LIQUID EFFLUENTS
CRITICAL ORGAN DOSE



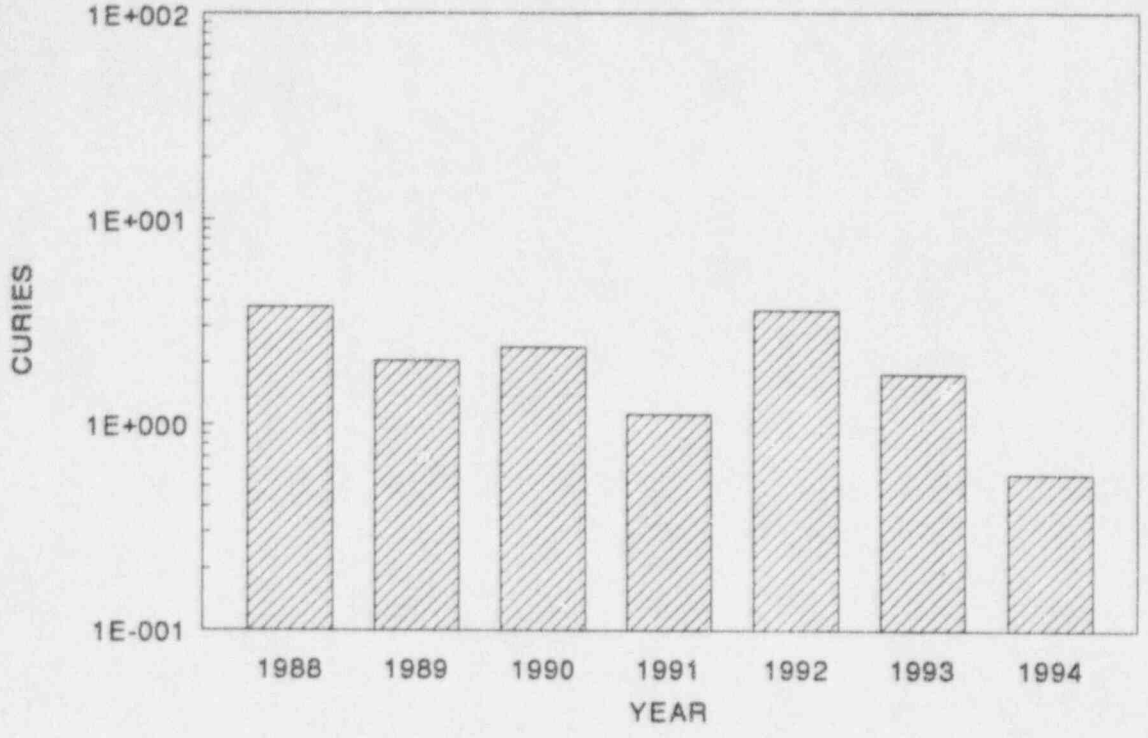
UNIT 1 LIQUID EFFLUENTS
TOTAL BODY DOSE



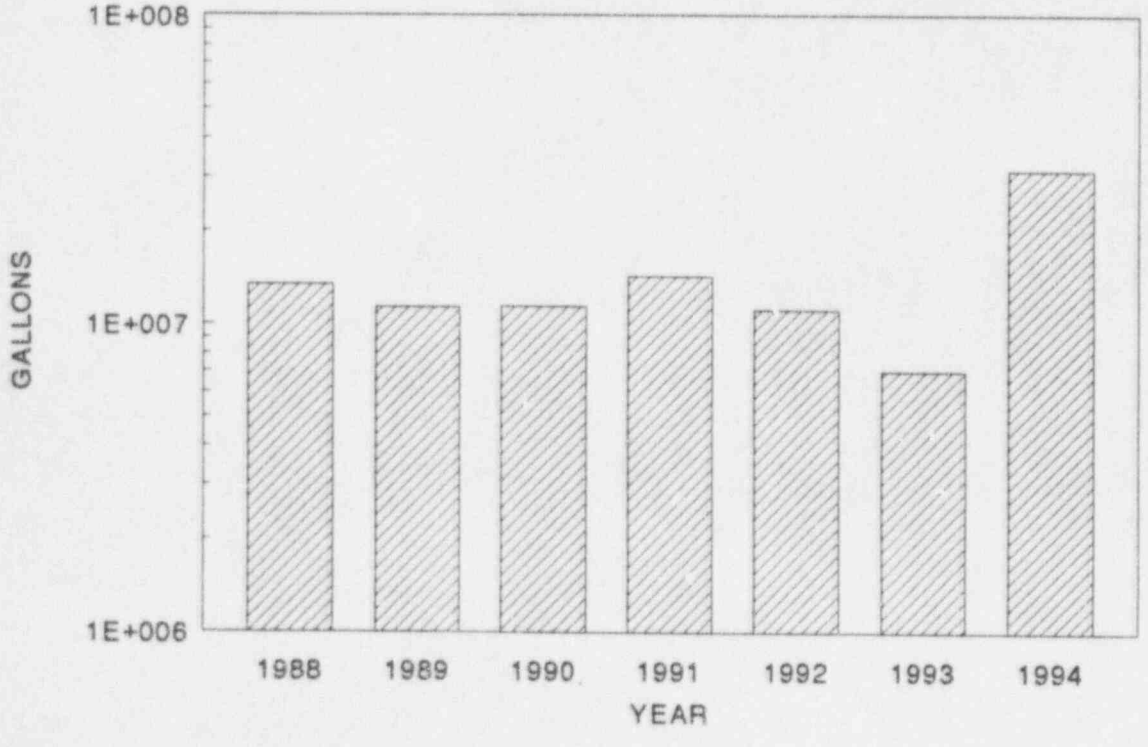

UNIT 1 LIQUID EFFLUENTS
Dissolved and Entrained Gases
1E+002
1E+001
1E+000
1E-001
CURIES
1988
1989
1990
1991
1992
1993
1994
YEAR


UNIT 1 LIQUID EFFLUENTS
TRITIUM
1E+004
1E+003
1E+002
CURIES
1988
1989
1990
1991
1992
1993
1994
YEAR

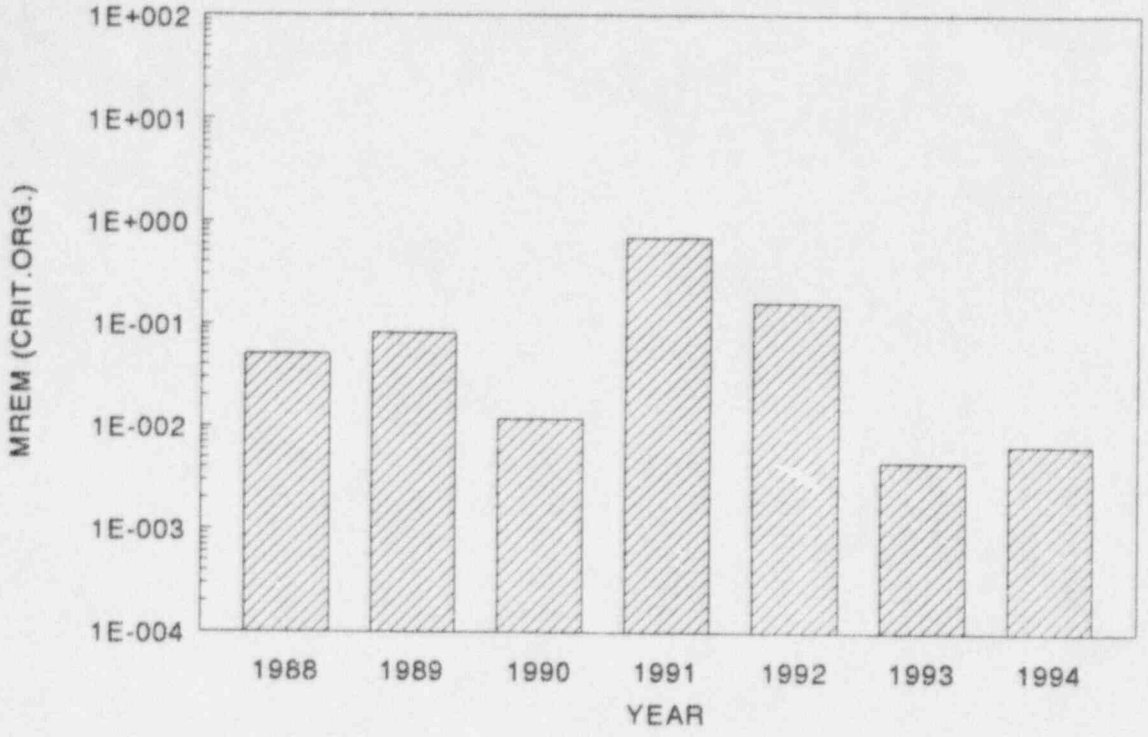
UNIT 1 LIQUID EFFLUENTS
FISSION AND ACTIVATION PRODUCTS



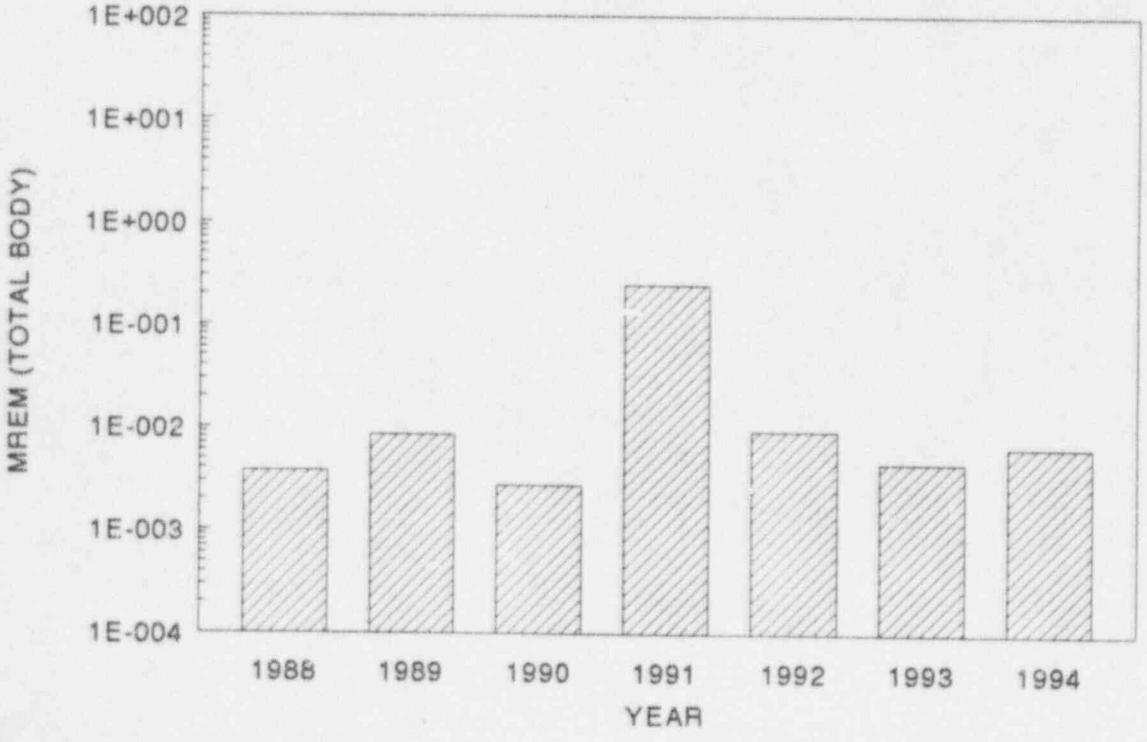
UNIT 1 LIQUID EFFLUENTS
TOTAL VOLUME RELEASED



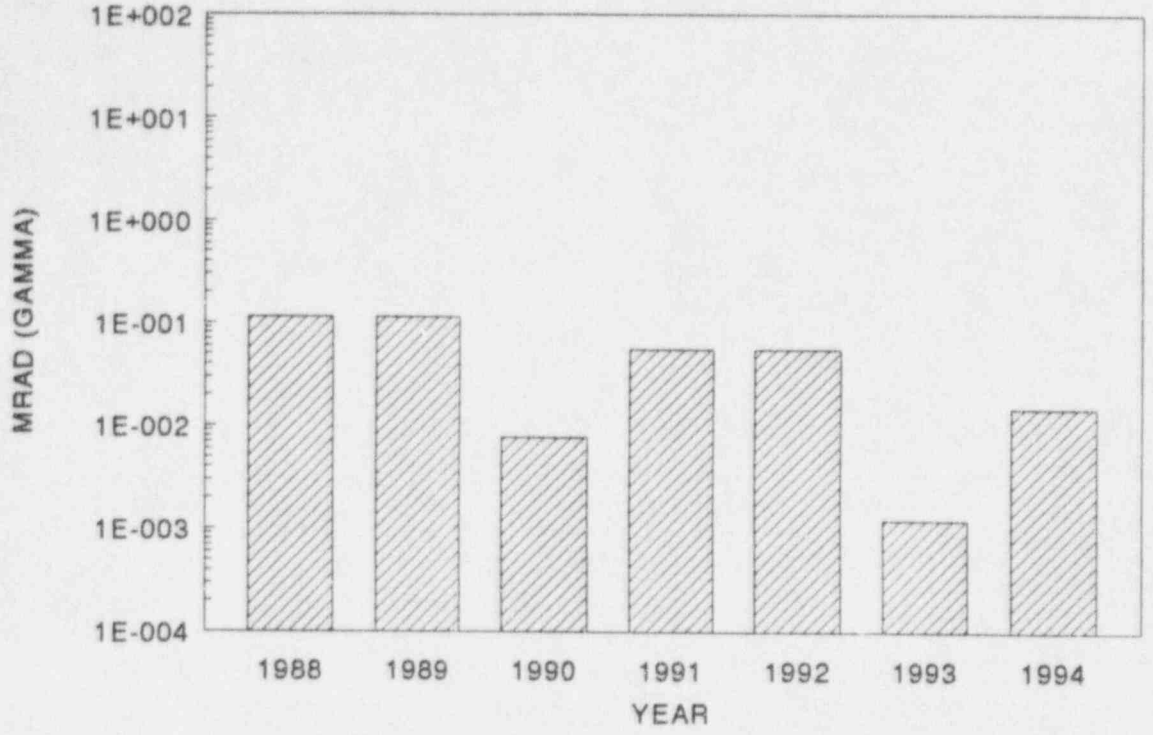
UNIT 2 GASEOUS EFFLUENTS
CRITICAL ORGAN DOSE



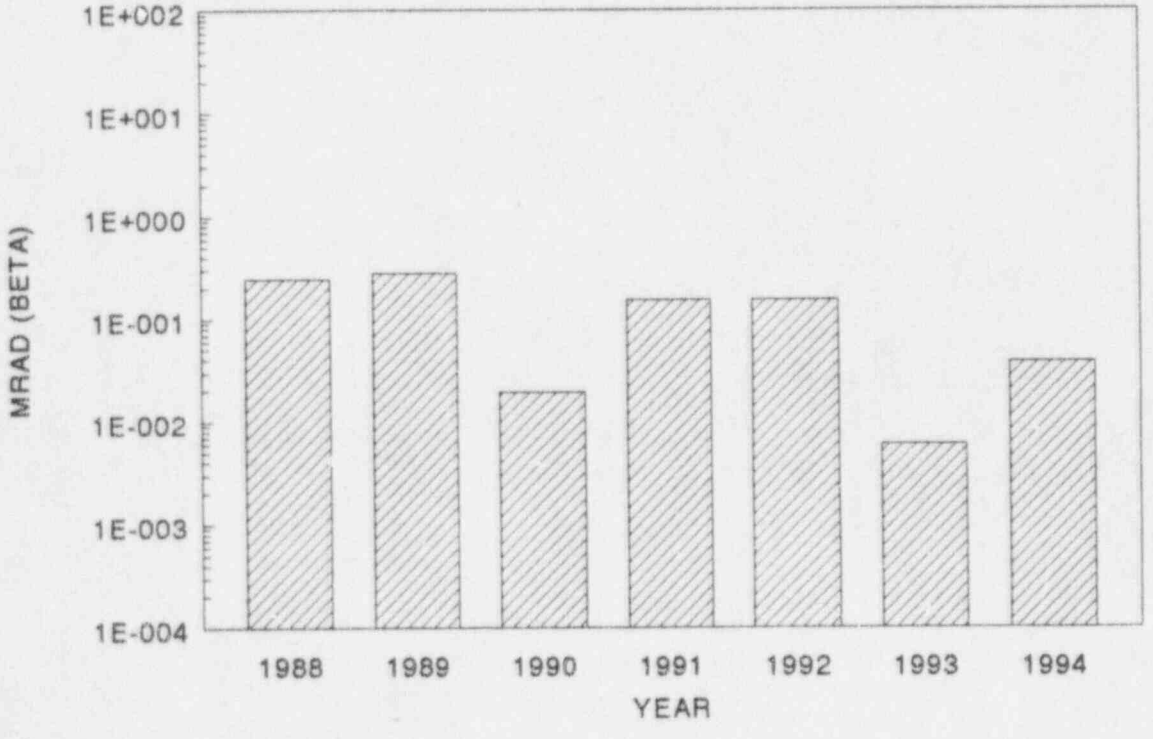
UNIT 2 GASEOUS EFFLUENTS
TOTAL BODY DOSE

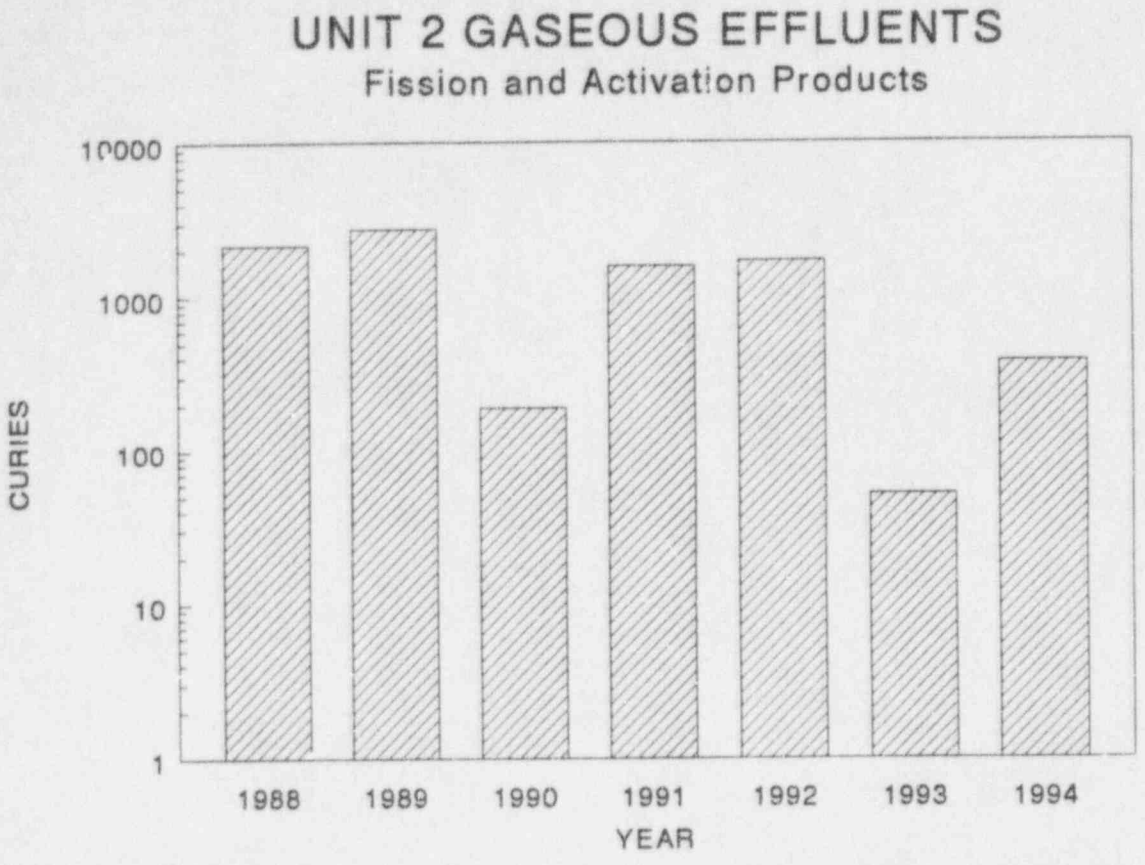


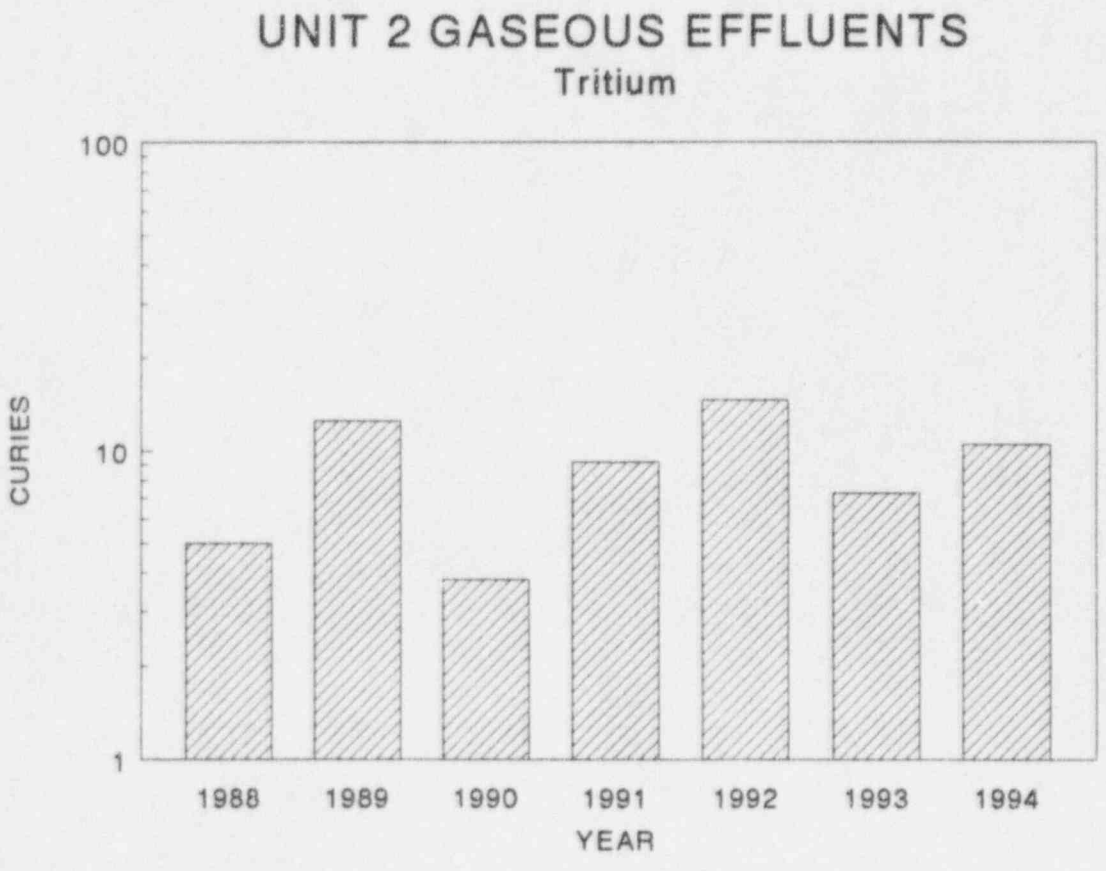
UNIT 2 GASEOUS EFFLUENTS
GAMMA DOSE



UNIT 2 GASEOUS EFFLUENTS
BETA DOSE

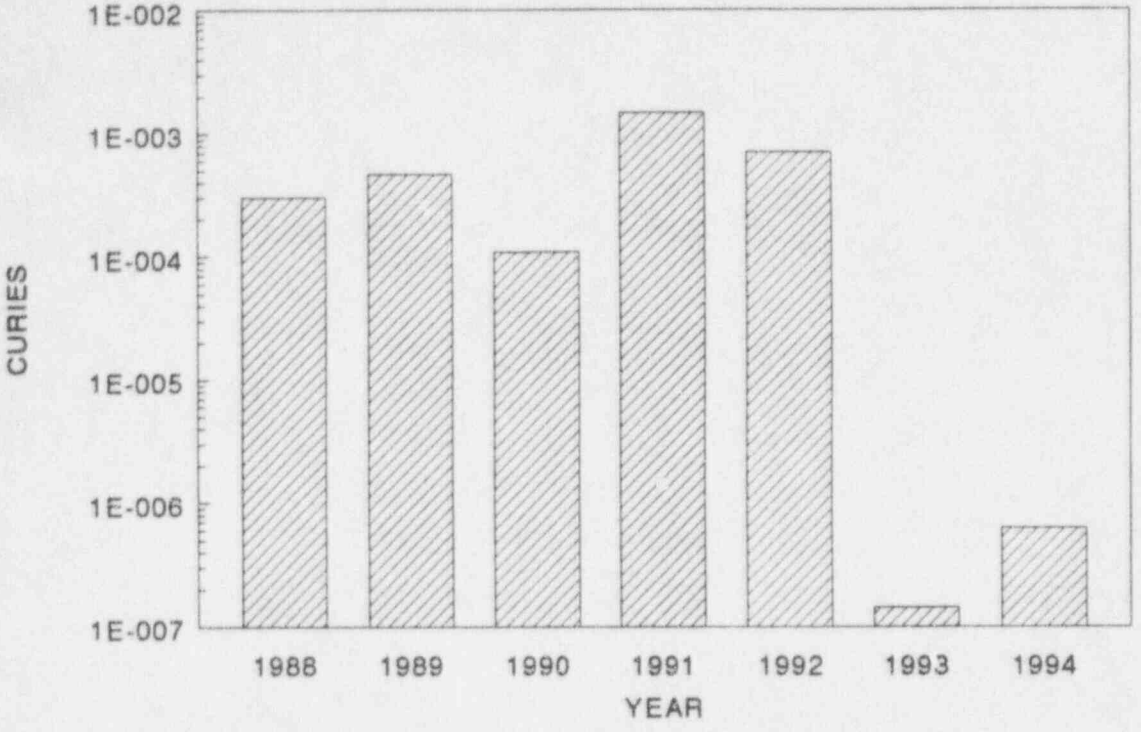



UNIT 2 GASEOUS EFFLUENTS
Fission and Activation Products
10000
1000
100
10
1
CURIES
1988
1989
1990
1991
1992
1993
1994
YEAR


UNIT 2 GASEOUS EFFLUENTS
Tritium
100
10
1
CURIES
1988
1989
1990
1991
1992
1993
1994
YEAR

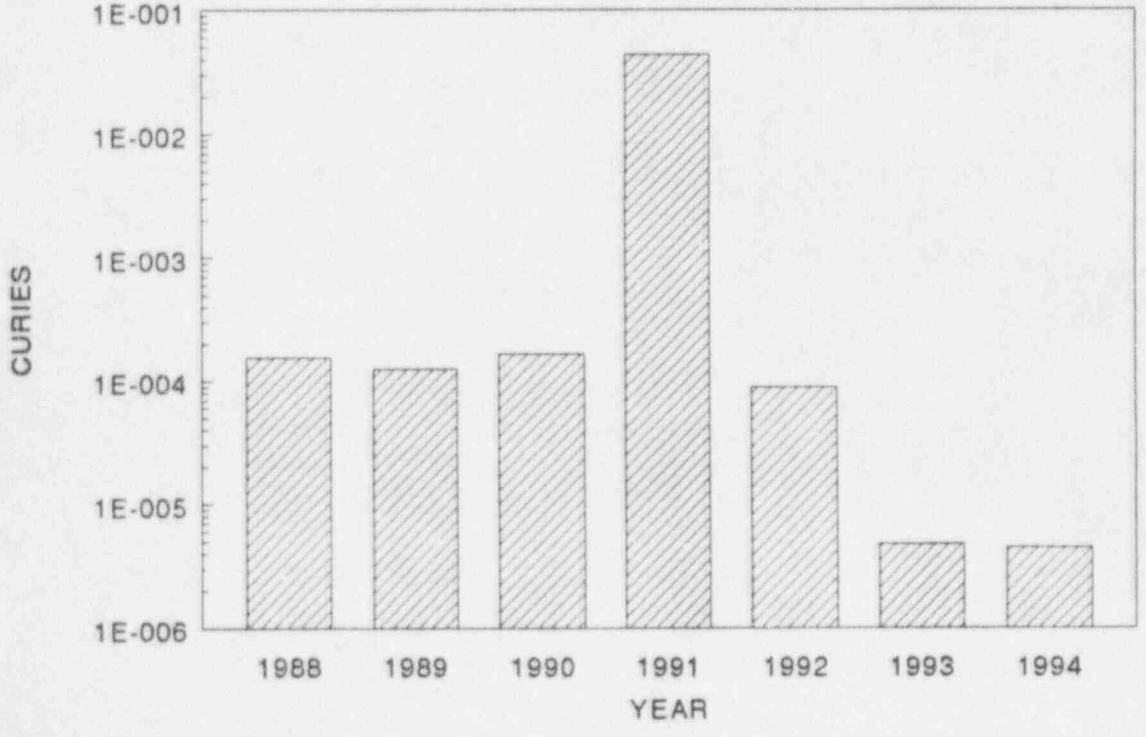
UNIT 2 GASEOUS EFFLUENTS

Radioiodines

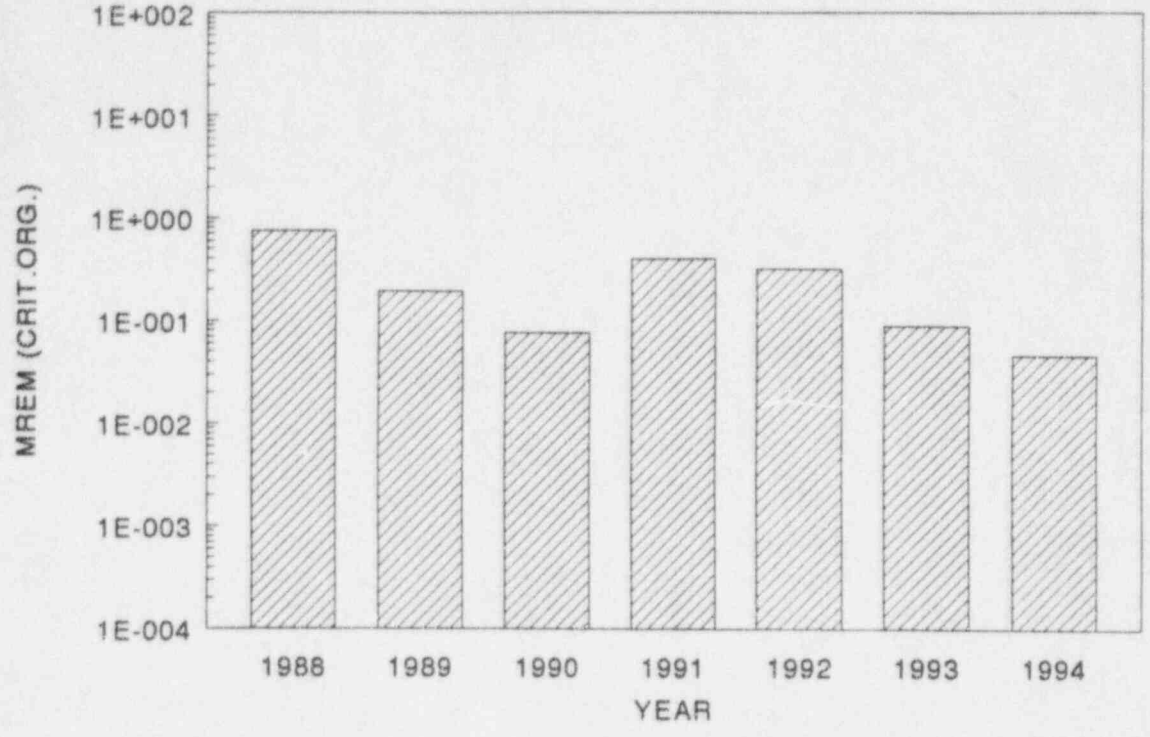


UNIT 2 GASEOUS EFFLUENTS

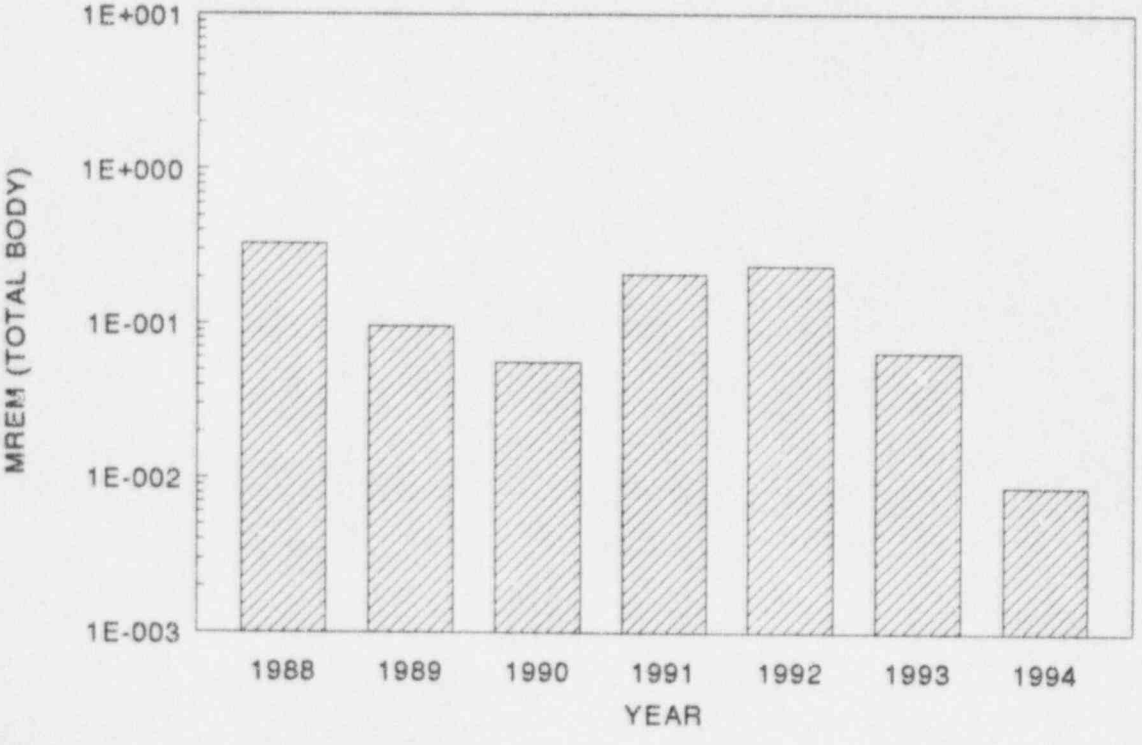
Particulates

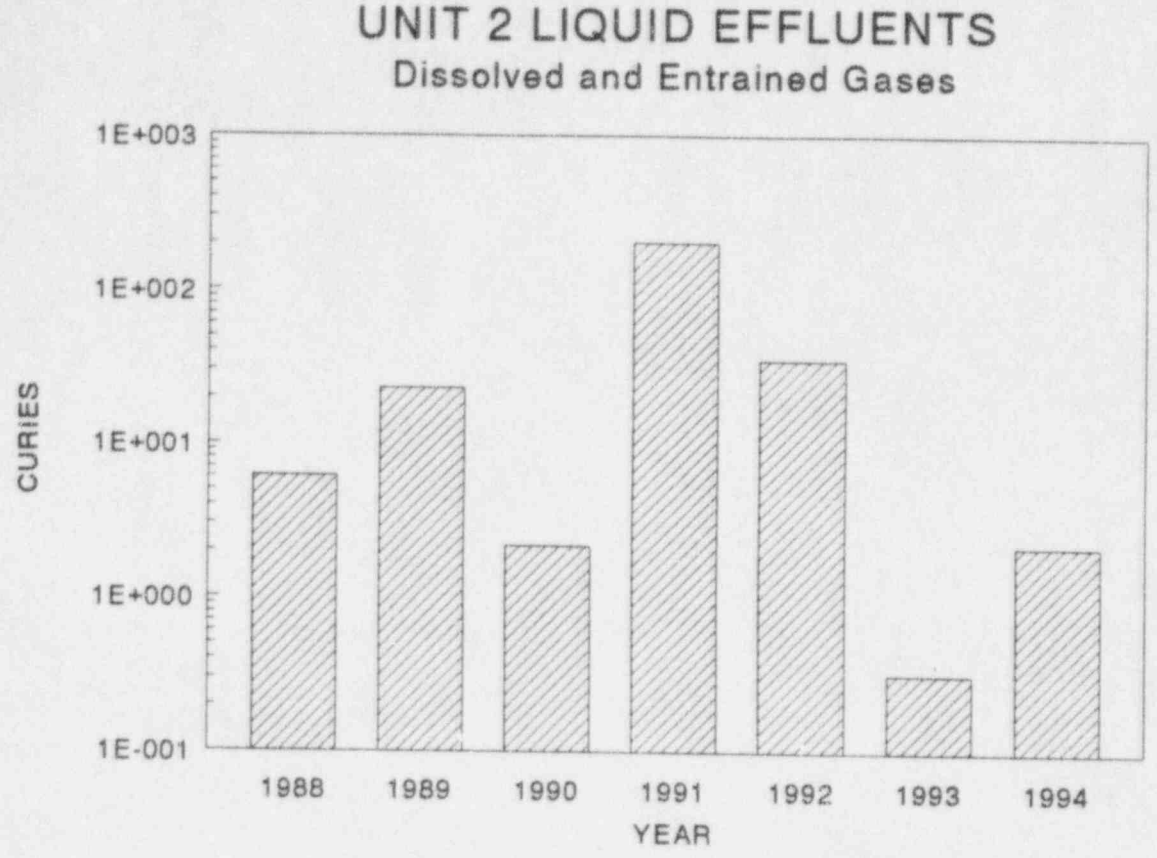


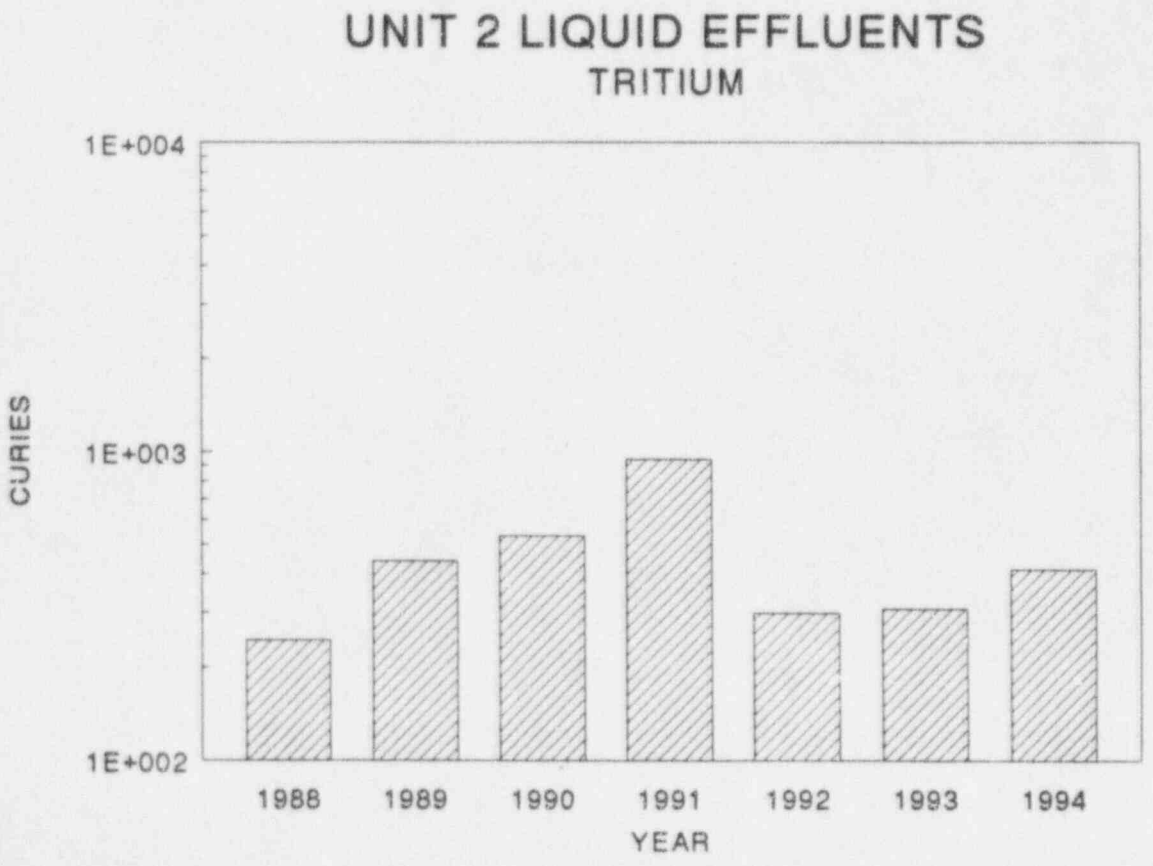
UNIT 2 LIQUID EFFLUENTS
CRITICAL ORGAN DOSE



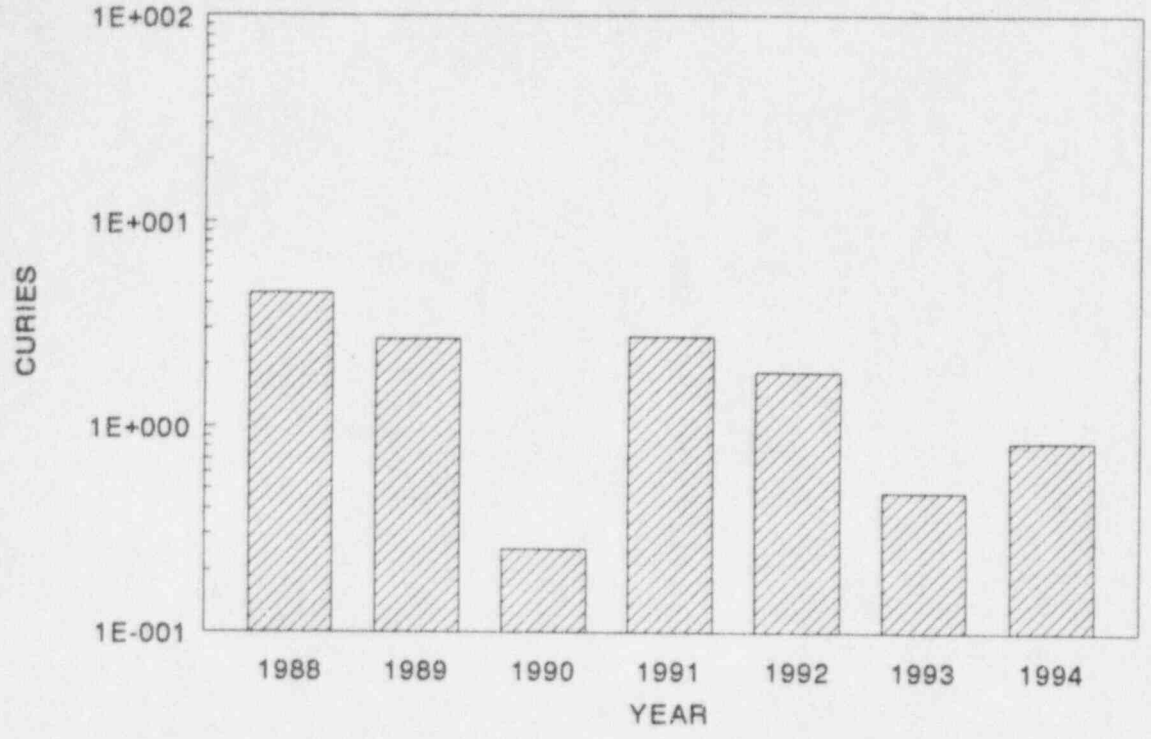
UNIT 2 LIQUID EFFLUENTS
TOTAL BODY DOSE



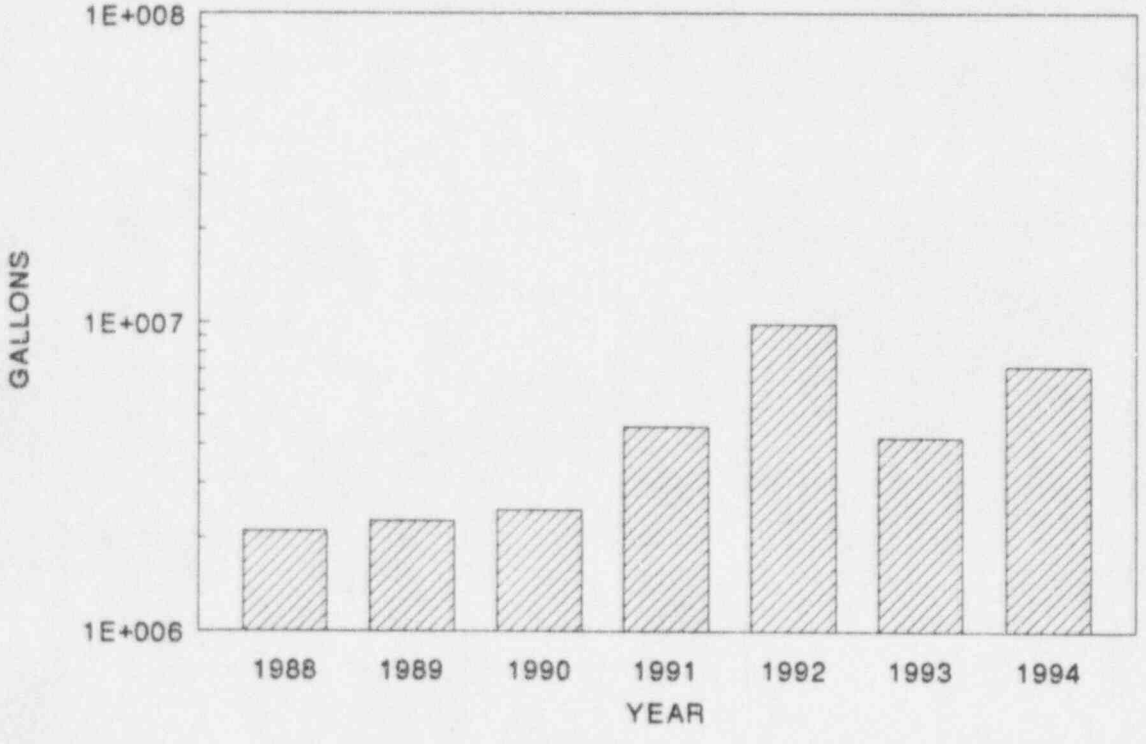

UNIT 2 LIQUID EFFLUENTS
Dissolved and Entrained Gases
1E+003
1E+002
1E+001
1E+000
1E-001
CURIES
1988
1989
1990
1991
1992
1993
1994
YEAR


UNIT 2 LIQUID EFFLUENTS
TRITIUM
1E+004
1E+003
1E+002
CURIES
1988
1989
1990
1991
1992
1993
1994
YEAR

UNIT 2 LIQUID EFFLUENTS
FISSION AND ACTIVATION PRODUCTS



UNIT 2 LIQUID EFFLUENTS
TOTAL VOLUME RELEASED



8. SOLID WASTE SUMMARY

The following is a summary of the solid wastes shipped offsite, both annually and during the last six months of 1994.

REGULATORY GUIDE 1.21 REPORT
WASTE DISPOSAL ANNUAL SUMMARY REPORT
SOLID WASTE AND IRRADIATED FUEL SHIPMENTS
JANUARY THROUGH DECEMBER 1994

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,	m^3	3.38E+01	
evaporator bottoms, etc.	Ci	4.52E+02	3.77E+00
b. Dry compressible waste,	m^3	1.34E+02	
contaminated equip, etc.	Ci	9.41E+00	9.42E-01
c. Irradiated components,	m^3	0.00E+00	
control rods, etc.	Ci	0.00E+00	0.00E+00
d. Other (describe)	m^3	0.00E+00	
	Ci	0.00E+00	0.00E+00

2. Estimate of Major Nuclide Composition (by Type of Waste)

		%	Curies
a.	CS-137	61.6	2.78E+02
	CS-134	33.2	1.50E+02
	NI-63	2.8	1.28E+01
	FE-55	1.0	4.38E+00
	CO-60	0.6	2.50E+00
	CO-58	0.4	1.95E+00
	AG-110m	0.2	1.00E+00
	C-14	0.1	4.07E-01
b.	CS-137	34.7	3.26E+00
	CO-58	28.9	2.72E+00
	CS-134	14.0	1.32E+00
	FE-55	8.6	8.13E-01

NI-63	8.1	7.60E-01
CO-60	2.8	2.62E-01
NB-95	1.0	9.29E-02
MN-54	1.0	9.15E-02
ZR-95	0.6	5.41E-02

c. N/A

d. N/A

3. Solid Waste Disposition

Number of Shipments	Mode of Transportation	Destination
2	Unshielded Van/Truck	Oak Ridge, TN
10	Unshielded Van/Truck	Wampum, PA
1	Cask Shipment (Type B)	Barnwell, SC

B. Irradiated Fuel Shipments (Disposition)

Number of Shipments	Mode of Transportation	Destination
N/A	N/A	N/A

REGULATORY GUIDE 1.21 REPORT
WASTE DISPOSAL ANNUAL SUMMARY REPORT
SOLID WASTE AND IRRADIATED FUEL SHIPMENTS
JULY 1 THROUGH DECEMBER 31, 1994

A. Solid Waste Shipped Offsite for Burial or Disposal (Not Irradiated Fuel)

1. Type of Waste	Unit	6-Month Period	Est. Total Error, %
a. Spent resins, filter sludges,	m^3	0.00E+00	
evaporator bottoms, etc.	Ci	0.00E+00	0.00E+00
b. Dry compressible waste,	m^3	0.00E+00	
contaminated equip, etc.	Ci	0.00E+00	0.00E+00
c. Irradiated components,	m^3	0.00E+00	
control rods, etc.	Ci	0.00E+00	0.00E+00
d. Other (describe)	m^3	0.00E+00	
	Ci	0.00E+00	0.00E+00

2. Estimate of Major Nuclide Composition (by Type of Waste)

a. N/A

b. N/A

c. N/A

d. N/A

3. Solid Waste Disposition

Number of Shipments	Mode of Transportation	Destination
1	Unshielded Van/Truck	Oak Ridge, TN

B. Irradiated Fuel Shipments (Disposition)

Number of Shipments	Mode of Transportation	Destination
N/A	N/A	N/A

9. UNPLANNED RELEASES

No unplanned releases occurred during the third and fourth quarters of 1994.

10. RADIATION INSTRUMENTATION

As required by Unit 1 and Unit 2 Technical Specifications, any radioactive effluent instrumentation inoperable for more than 30 days shall be reported in the next Semiannual Radioactive Effluent Release Report. During the third and fourth quarters of 1994, no instrumentation was inoperable longer than 30 days.

11. CHANGES TO THE PROCESS CONTROL PROGRAM

As required by Unit 1 and Unit 2 Technical Specifications, a description of changes made to the Process Control Program (PCP) during the reporting period shall be included in the next Semiannual Radioactive Effluent Release Report. No changes were made to the PCP during the third and fourth quarters of 1994.

12. CHANGES TO THE OFFSITE DOSE CALCULATION MANUAL

During the third and fourth quarters of 1994, the following changes were made to the Offsite Dose Calculation Manual (ODCM).

A. Editorial change to page 15, Section 3.2.1.a.
B. Editorial change to page 41, sample station number 29.
C. Deleted "Food Products" samples from sample station number 32, page 42.
D. Editorial change to page 42, sample station number 33.
E. Changed the designation "Settling Pond" to "Wastewater Holding Pond" on page 42, sample station number 36.
F. Editorial change on page 42, sample station 37.
G. Added new sample station number 48 on page 44.
H. Changed the alternate food products sample point to a regular food products sample point for sample station number 108, page 44.
I. Editorial change to page 50, sample station number 129.
J. Added sample station number 48 to Figure 4-1, page 37.

Revised pages for the ODCM are included in Attachment 2.

13. LLD LEVELS

In accordance with Unit 1 and Unit 2 Technical Specifications, lower limits of detection (LLDs) higher than required shall be documented in the Semiannual Radioactive Effluent Release Report. During the reporting period, there were no LLDs higher than required.

14. RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

A. There were three environmental sample location changes during the reporting period. The following is a description and reason for each change:

1. Sample Station Number 32 - Food products for this sample point were deleted. This sample was moved to sample station number 48. The garden at sample station number 32 no longer exists.

2. Sample Station Number 48 - This sample station was added to the environmental monitoring program to replace the food products sample deleted from sample station number 32.

3. Sample Station Number 108 - The food products sample for this sample station became a regular sample, as opposed to an alternate sample, in order to increase sampling quantity and food diversity.

B. During the reporting period, there were no sampling locations identified which would yield a calculated dose commitment greater than the values currently being calculated.

15. SUMMARY OF HOURLY METEOROLOGICAL DATA

In accordance with ANO-1 and 2 Technical Specification 6.12.2.6(e) and 6.9.3.4.1, respectively, in lieu of including a summary of the meteorological data in this report, the 1994 data is retained at ANO. This data is available for NRC review.

16. DESCRIPTION OF MAJOR CHANGES TO RADWASTE SYSTEMS

During 1994, no major changes were made to the liquid or gaseous radwaste systems for either unit.

ATTACHMENT 2

OFFSITE DOSE CALCULATION MANUAL

REPLACEMENT PAGES

OFFSITE DOSE CALCULATION MANUAL

FOR ARKANSAS NUCLEAR ONE

REVISION 4

where:

2.8E-6 = the annual average gaseous dispersion factor (corrected for radioactive decay) as defined in Section 2.3 of the ANO-2 SAR; and

TMPC = total MPCs at site boundary.

3.2 Airborne Release Dose Rate Effects

3.2.1 Noble Gas Release Rate

3.2.1.a To calculate the noble gas release dose rate, the average ground-level concentration of radionuclide "i" at the receptor location must first be determined from the following equation. (See Regulatory Guide 1.109-20 equation B-4).

$$x_i(\theta) = 3.17 \times 10^4 * Q_i * D1X/Q(\theta)$$

where:

$x_i(\theta)$ = average ground level concentration in $\rho Ci/m^3$ of nuclide "i" at the user-specified controlling distance in sector θ (1.05km);

(θ) = one of the sixteen 22.5° sectors surrounding the reactor site, designated N, NNE, NE, ... etc. (WNW);

3.17×10^4 = number of ρCi per Ci divided by the number of seconds/year;

Q_i = release rate of nuclide "i" in curies/yr and

$D1X/Q(\theta)$ = annual average gaseous dispersion factor (corrected for radioactive decay) in the sector at angle "θ" at the receptor location in sec/m^3. This value is 2.8E-6 sec/m^3 for short term releases.

The annual dose to the total body and skin due to noble gas can be calculated according to Sections 3.2.1.b and 3.2.1.c.

3.2.1.b Annual Total Body Dose Rate

The annual average total body dose rate to the maximally exposed individual is calculated as follows:

$$D^T(\theta) = RBPF * S_F * \Sigma_i \left[x_i(\theta) * DFB_i \right]$$

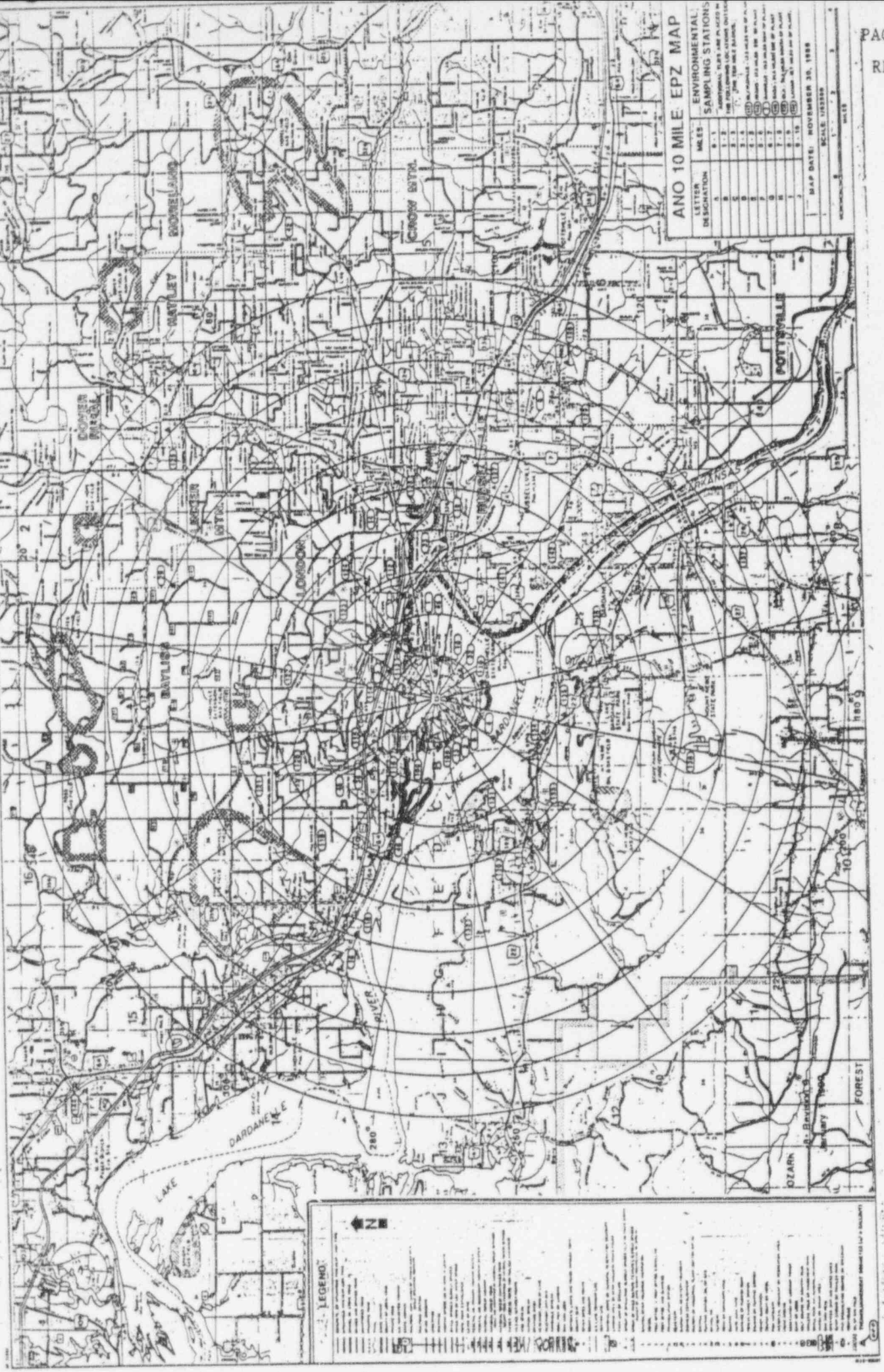

ANO 10 MILE EPZ MAP
ENVIRONMENTAL SAMPLING STATIONS
LETTER DESIGNATION
MILES
MAP DATE: NOVEMBER 30, 1988
SCALE 1/62500
LEGEND
DARDANELLE
LAKE
RIVER
DOVER
ATKINS
POTTSVILLE
DARDANELLE
RUSSELLVILLE
OZARK
FOREST

FIGURE 4-1

TABLE 4-1
Environmental Sampling Stations - Radiological

Sample Station Number: 14
Approximate Direction and Distance from Plant: 70° - 5.3 miles
Sample Types: 1) Drinking water
Sample Station Location:

From junction of Highway 7 and Water Works Road, go approximately 0.8 miles west on Water Works Road. The sample station is on the left at the intake to the Russellville city water system from the Illinois Bayou.

Sample Station Number: 16
Approximate Direction and Distance from Plant: 290° - 5.9 miles
Sample Types: 1) Shoreline sediment
Sample Station Location:

From junction of Highway 64 and Highway 359 (Flat Rock Piney Bay Recreational Area turnoff), go approximately 0.7 miles west on Highway 64. The sample station is at the Piney Creek area on Lake Dardanelle.

Sample Station Number: 19
Approximate Direction and Distance from Plant: 95° - 5.1 miles
Sample Types: 1) Milk
Sample Station Location:

Turn from Highway 7 onto Harrell Drive in Russellville, AR and go approximately 0.1 miles. Turn right and go approximately 0.25 miles. The sample station is on the left at the Arkansas Tech Dairy.

Sample Station Number: 29
Approximate Direction and Distance from Plant: 24° - 6.9 miles
Sample Types: 1) Milk (alternate)
Sample Station Location:

Turn south from Highway 333 onto County Road 141 and go approximately 0.55 miles. Turn left and go approximately 0.6 miles. Turn left and go approximately 0.05 miles. The sample station is on the right at the Harold Steuber Dairy.

TABLE 4-1
Environmental Sampling Stations - Radiological

Sample Station Number: 32
Approximate Direction and Distance from Plant: 132° - 0.9 miles
Sample Types: 1) Ground water
Sample Station Location:

From bridge over intake canal, go south approximately 0.25 miles. Turn left and go approximately 0.25 miles. Turn left on Bunker Hill Lane and go approximately 0.05 miles. The sample station is on the right at Clifton Stewart's residence.

Sample Station Number: 33
Approximate Direction and Distance from Plant: 94° - 3.8 miles
Sample Types: 1) Ground water
Sample Station Location:

From junction of Highway 64 and Highway 326 (Dike Road), go approximately 0.3 miles east on Dike Road. The sample station is on the left at the Ouita Lake Recreation Area on the Illinois Bayou.

Sample Station Number: 36
Approximate Direction and Distance from Plant: 140° - 0.05 miles
Sample Types: 1) Pond water
2) Pond sediment
Sample Station Location:

The sample station is at the Wastewater Holding Pond on the ANO site east of the discharge canal.

Sample Station Number: 37
Approximate Direction and Distance from Plant: 0° - 7.5 miles
Sample Types: 1) Milk
Sample Station Location:

IF traveling north on Highway 333,
THEN go approximately 3.5 miles from junction of Highway 333 and Mill Creek Road on Highway 333. Turn left and go approximately 0.1 miles. The sample station is on the left at the Lawrence Steuber Dairy.

IF traveling from junction of Highway 7 and Highway 333,
THEN go approximately 6.0 miles west on Highway 333. Turn right and go approximately 0.1 mile. The sample station is on the left at the Lawrence Steuber Dairy.

TABLE 4-1
Environmental Sampling Stations - Radiological

Sample Station Number: 45
Approximate Direction and Distance from Plant: 90° - 0.9 miles
Sample Types: 1) Broad leaf vegetation
Sample Station Location:

The sample station is located near mouth of intake canal.

Sample Station Number: 46
Approximate Direction and Distance from Plant: 295° - 4.1 miles
Sample Types: 1) Food products
Sample Station Location:

From west junction of Highway 64 and Highway 333 in London, AR, go west on Highway 64 approximately 2.4 miles. Turn right onto Scottie Lane and go approximately 0.1 miles. The sample location is on the right at Dewey Gregory's residence.

Sample Station Number: 48
Approximate Direction and Distance from Plant: 316° - 2.2 miles
Sample Types: 1) Food Products
Sample Station Location:

R. J. Cochran residence, No. 26 Hwy 64 London West, directly North (across from) London Volunteer Fire Dept.

Sample Station Number: 108
Approximate Direction and Distance from Plant: 301° - 0.9 miles
Sample Types: 1) Direct radiation
2) Food Products
Sample Station Location:

IF traveling from Highway 333,
THEN turn south onto Flatwood Road and go approximately 0.4 miles. The sample station is on the right.

IF traveling north on Flatwood Road,
THEN go approximately 0.4 miles from sample station 109. The sample station is on the left.

TABLE 4-1
Environmental Sampling Stations - Radiological

Sample Station Number: 127
Approximate Direction and Distance from Plant: 102° - 5.6 miles
Sample Types: 1) Direct radiation
Sample Station Location:

The sample station is located on the Arkansas Tech Campus on West O Street on a security light pole in front of Bryan Hall, which is the first building on the left when traveling from North Arkansas on West O Street.

Sample Station Number: 128
Approximate Direction and Distance from Plant: 113° - 8.6 miles
Sample Types: 1) Direct radiation
Sample Station Location:

The sample station is on a utility pole inside the security fence near the Russellville Airport Office. The airport is located off of East 16th Street and is well marked by airport signs.

Sample Station Number: 129
Approximate Direction and Distance from Plant: 118° - 7.3 miles
Sample Types: 1) Direct radiation
Sample Station Location:

The sample station is on a utility pole north of the Russellville High School sign, which is in front of the high school on east side of Highway 7T.

Sample Station Number: 130
Approximate Direction and Distance from Plant: 245° - 4.6 miles
Sample Types: 1) Direct radiation
Sample Station Location:

At junction of Highway 7 and Highway 22 in Dardanelle, AR, take Highway 22 toward Delaware, AR. Go approximately 0.4 miles west of Delaware Recreation Area turnoff. The sample station is on a utility pole on the right in Delaware, AR near Shirley's Beauty Salon.