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February 28, 2007

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-001

Subject: Annual Radioactive Effluent Release Report for 2006
Arkansas Nuclear One - Units 1 and 2
Docket Nos. 50-313, 50-368, and 72.13 (ISFSI)
License Nos. DPR-51 and NPF-6

Dear Sir or Madam:

Arkansas Nuclear One, Units 1 & 2 (ANO-1 and ANO-2) Technical Specifications (TSs) 5.6.3 and 6.6.3, respectively, require the submittal of an Annual Radioactive Effluent Release Report. 10CFR72.44(d)(3) also requires the annual submittal of a summary of effluents from the independent spent fuel storage facility. The enclosed compact disc contains the information to fulfill these reporting requirements for the 2006 calendar year at ANO.

Liquid and gaseous release data show that the dose from both ANO-1 and ANO-2 was considerably below the Offsite Dose Calculation Manual (ODCM) limits, while no effluents were attributed to the spent fuel stored in the independent spent fuel storage installation. This data reveals that the radioactive effluents had an overall minimal dose contribution to the surrounding environment. Pursuant to ANO-1 TS 5.5.1 and ANO-2 TS 6.5.1, the ODCM is submitted as an attachment to the Annual Radioactive Effluent Release Report. A copy of the Process Control Program is also attached. Should you have any questions regarding this report, please contact Richard Scheide at (479) 858-4618.

There are no new commitments contained in this submittal.

Sincerely,

Dale E. James
Manager, Licensing

DEJ/rs
Attachments

IE48
A009
IE17

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Attachment 1
to
0CAN020704

Annual Radioactive Effluent Release Report for 2006

ARKANSAS NUCLEAR ONE

UNIT 1 AND UNIT 2

OPERATING LICENSE NOS. DPR-51, NPF-6, and 72.13 (ISFSI)

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

JANUARY 1 THROUGH DECEMBER 31, 2006

TABLE OF CONTENTS

1. INTRODUCTION ---------- 3

2. REGULATORY LIMITS ---------- 3

3. SUMMARY OF LIQUID EFFLUENT DATA ---------- 6

4. SUMMARY OF GASEOUS EFFLUENT DATA ---------- 15

5. SUMMARY OF RADIATION DOSES ---------- 24

6. SUMMARY OF DOSE TO MEMBERS OF THE PUBLIC ---------- 26

7. HISTORICAL EFFLUENT DATA ---------- 27

8. SOLID WASTE SUMMARY ---------- 39

9. UNPLANNED RELEASES ---------- 46

10. RADIATION INSTRUMENTATION ---------- 46

11. CHANGES TO THE PROCESS CONTROL PROGRAM ---------- 46

12. CHANGES TO THE OFFSITE DOSE CALCULATION MANUAL ---------- 46

13. LLD LEVELS ---------- 46

14. RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ---------- 47

15. SUMMARY OF HOURLY METEOROLOGICAL DATA ---------- 47

16. DESCRIPTION OF MAJOR CHANGES TO RADIOACTIVE WASTE SYSTEMS ---------- 47

17. INDEPENDENT SPENT FUEL STORAGE INSTALLATION (ISFSI) EFFLUENT RELEASES ---------- 47

1. INTRODUCTION

Arkansas Nuclear One (ANO) is a two unit site consisting of a Babcock & Wilcox (Unit 1) and a Combustion Engineering (Unit 2) nuclear steam supply system. Both liquid and gaseous effluents are released in accordance with the Offsite Dose Calculation Manual (ODCM). This report is a summary of the effluent data in accordance with Unit 1 TS 5.6.3 and Unit 2 TS 6.6.3. This report provides the following information:

A. Routine radioactive effluent release reports covering the operation of the units and the independent spent fuel storage installation (ISFSI) during the reporting period.

B. Description of unplanned releases to unrestricted areas.

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

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

E. Summary of radiation doses due to radiological effluents during the previous calendar year.

F. Radiation dose to members of the public due to activities inside the site boundary.

G. Description of licensee initiated major changes to the radioactive waste systems during the previous calendar year.

H. Items to be reported in the annual Radioactive Effluent Release Report per other miscellaneous ODCM requirements.

This report covers the period from January 1 through December 31, 2006.

2. REGULATORY LIMITS

The ODCM contains 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 Unit 1 and Unit 2 is considerably below the ODCM 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 ODCM:

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 to any organ

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

As required by Regulatory Guide 1.21, Rev. 1, *Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants,* a summary of data for liquid releases is provided in the annual Radioactive Effluent Release Report. This summary covers releases from January 1 through December 31, 2006. The summary of liquid effluents for both Unit 1 and Unit 2 is as follows:

	Unit 1	Unit 2
Number of releases:	150	106
Total time for all releases (minutes):	535179	472745
Maximum time for a release (minutes):	11159	11164
Average time for a release (minutes):	3569	4460
Minimum time for a release (minutes):	10	70

The Unit 1 liquid releases consisted of:

150 Planned Releases

0 Unplanned Releases

The Unit 2 liquid releases consisted of:

106 Planned Releases

0 Unplanned Releases

ANNUAL SUMMATION FOR ALL RELEASES BY QUARTER
(ALL LIQUID EFFLUENTS)
January 1 through June 30, 2006

Unit 1

Type of Effluent	Units	Quarter 1	Quarter 2	Est. Total Error %
A. Fission and Activation Products				
1. Total Release (Not Including Tritium, Gases, Alpha)	Curies	1.039E-02	3.025E-03	25
2. Average Diluted Concentration During Period	μCi/ml	3.388E-11	8.283E-12	
3. Percent of Applicable Limit	%	1.129E-02	2.761E-03	
B. Tritium				
1. Total Release	Curies	1.655E+01	3.919E+01	25
2. Average Diluted Concentration During Period	μCi/ml	5.397E-08	1.073E-07	
3. Percent of Applicable Limit	%	1.799E-03	3.576E-03	
C. Dissolved and Entrained Gases				
1. Total Release	Curies	1.099E-03	0.000E+00	25
2. Average Diluted Concentration During Period	μCi/ml	3.586E-12	0.000E+00	
3. Percent of Applicable Limit	%	1.793E-06	0.000E+00	
D. Gross Alpha Radioactivity				
1. Total Release	Curies	0.000E+00	0.000E+00	25
E. Waste Vol Released (Pre-Dilution)	Liters	1.541E+07	1.657E+07	25
F. Volume of Dilution Water Used	Liters	3.065E+11	3.652E+11	25

ANNUAL SUMMATION FOR ALL RELEASES BY QUARTER
(ALL LIQUID EFFLUENTS)
July 1 through December 31, 2006

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	2.398E-03	4.855E-03	25
2. Average Diluted Concentration During Period	μCi/ml	6.117E-12	1.455E-11	
3. Percent of Applicable Limit	%	2.039E-03	4.849E-03	
B. Tritium				
1. Total Release	Curies	4.859E+01	2.041E+02	25
2. Average Diluted Concentration During Period	μCi/ml	1.240E-07	6.114E-07	
3. Percent of Applicable Limit	%	4.132E-03	2.038E-02	
C. Dissolved and Entrained Gases				
1. Total Release	Curies	1.966E-05	2.361E-02	25
2. Average Diluted Concentration During Period	μCi/ml	5.016E-14	7.074E-11	
3. Percent of Applicable Limit	%	2.508E-08	3.537E-05	
D. Gross Alpha Radioactivity				
1. Total Release	Curies	0.000E+00	7.640E-04	25
E. Waste Vol Released (Pre-Dilution)	Liters	1.334E+07	1.398E+07	25
F. Volume of Dilution Water Used	Liters	3.919E+11	3.337E+11	25

UNIT 1

REPORT CATEGORY : ANNUAL LIQUID CONTINUOUS AND BATCH RELEASES
: TOTALS FOR EACH NUCLIDE RELEASED
TYPE OF ACTIVITY : ALL RADIONUCLIDES
REPORTING PERIOD : QUARTER # 1 AND QUARTER # 2 YEAR 2006

		CONTINUOUS RELEASES		BATCH RELEASES	
NUCLIDE	UNIT	QUARTER 1	QUARTER 2	QUARTER 1	QUARTER 2
NB-95	CURIES	0.00E+00	0.00E+00	7.56E-06	0.00E+00
MN-54	CURIES	0.00E+00	0.00E+00	1.16E-05	0.00E+00
XE-133	CURIES	0.00E+00	0.00E+00	1.10E-03	0.00E+00
CS-134	CURIES	0.00E+00	0.00E+00	3.91E-05	1.32E-06
AG-110M	CURIES	0.00E+00	0.00E+00	5.29E-05	1.12E-05
CS-137	CURIES	5.04E-04	0.00E+00	1.39E-04	6.33E-05
CO-60	CURIES	0.00E+00	0.00E+00	2.16E-04	1.07E-04
CO-58	CURIES	0.00E+00	0.00E+00	1.82E-03	1.52E-04
FE-55	CURIES	3.94E-03	0.00E+00	7.90E-04	7.65E-04
SB-125	CURIES	0.00E+00	0.00E+00	2.87E-03	1.93E-03
H-3	CURIES	9.21E-02	2.62E-01	1.64E+01	3.89E+01
Total for Period	CURIES	9.65E-02	2.62E-01	1.65E+01	3.89E+01

UNIT 1

REPORT CATEGORY : ANNUAL LIQUID CONTINUOUS AND BATCH RELEASES
: TOTALS FOR EACH NUCLIDE RELEASED
TYPE OF ACTIVITY : ALL RADIONUCLIDES
REPORTING PERIOD : QUARTER # 3 AND QUARTER # 4 YEAR 2006

		CONTINUOUS RELEASES		BATCH RELEASES	
NUCLIDE	UNIT	QUARTER 3	QUARTER 4	QUARTER 3	QUARTER 4
AG-110M	CURIES	0.00E+00	0.00E+00	1.02E-05	0.00E+00
FE-55	CURIES	0.00E+00	0.00E+00	1.28E-04	0.00E+00
XE-135	CURIES	0.00E+00	0.00E+00	0.00E+00	1.01E-05
MN-54	CURIES	0.00E+00	0.00E+00	0.00E+00	3.14E-05
CS-134	CURIES	0.00E+00	0.00E+00	4.73E-06	1.10E-04
ZR-95	CURIES	0.00E+00	0.00E+00	6.09E-05	1.24E-04
CR-51	CURIES	0.00E+00	0.00E+00	0.00E+00	1.26E-04
NB-95	CURIES	0.00E+00	0.00E+00	1.23E-04	2.17E-04
SB-125	CURIES	0.00E+00	0.00E+00	8.47E-04	2.69E-04
CO-60	CURIES	0.00E+00	0.00E+00	1.96E-04	4.10E-04
G-ALPHA	CURIES	0.00E+00	5.71E-04	0.00E+00	1.93E-04
CS-137	CURIES	0.00E+00	0.00E+00	4.57E-05	9.76E-04
CO-58	CURIES	0.00E+00	0.00E+00	9.84E-04	2.59E-03
XE-133	CURIES	0.00E+00	0.00E+00	1.97E-05	5.48E-03
KR-85	CURIES	0.00E+00	0.00E+00	0.00E+00	1.81E-02
H-3	CURIES	2.17E-01	1.49E-01	4.84E+01	2.04E+02
Total for Period	CURIES	2.17E-01	1.50E-01	4.84E+01	2.04E+02

ANNUAL SUMMATION FOR ALL RELEASES BY QUARTER
(ALL LIQUID EFFLUENTS)
January 1 through June 30, 2006

Unit 2

Type of Effluent	Units	Quarter 1	Quarter 2	Est. Total Error %
A. Fission and Activation Products				
1. Total Release (Not Including Tritium, Gases, Alpha)	Curies	5.662E-03	1.232E-02	25
2. Average Diluted Concentration During Period	μCi/ml	1.847E-11	3.373E-11	
3. Percent of Applicable Limit	%	6.156E-03	1.124E-02	
B. Tritium				
1. Total Release	Curies	1.022E+02	3.106E+02	25
2. Average Diluted Concentration During Period	μCi/ml	3.334E-07	8.503E-07	
3. Percent of Applicable Limit	%	1.111E-02	2.834E-02	
C. Dissolved and Entrained Gases				
1. Total Release	Curies	5.189E-04	1.168E-02	25
2. Average Diluted Concentration During Period	μCi/ml	1.692E-12	3.197E-11	
3. Percent of Applicable Limit	%	8.461E-07	1.599E-05	
D. Gross Alpha Radioactivity				
1. Total Release	Curies	0.000E+00	0.000E+00	25
E. Waste Vol Released (Pre-Dilution)	Liters	2.378E+07	2.145E+07	25
F. Volume of Dilution Water Used	Liters	3.065E+11	3.652E+11	25

ANNUAL SUMMATION FOR ALL RELEASES BY QUARTER
(ALL LIQUID EFFLUENTS)
July 1 through December 31, 2006

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	2.467E-02	2.229E-02	25
2. Average Diluted Concentration During Period	μCi/ml	6.293E-11	6.677E-11	
3. Percent of Applicable Limit	%	2.098E-02	2.226E-02	
B. Tritium				
1. Total Release	Curies	3.959E+02	5.183E+01	25
2. Average Diluted Concentration During Period	μCi/ml	1.010E-06	1.553E-07	
3. Percent of Applicable Limit	%	3.366E-02	5.177E-03	
C. Dissolved and Entrained Gases				
1. Total Release	Curies	5.028E-01	3.752E-02	25
2. Average Diluted Concentration During Period	μCi/ml	1.283E-09	1.124E-10	
3. Percent of Applicable Limit	%	6.413E-04	5.620E-05	
D. Gross Alpha Radioactivity				
1. Total Release	Curies	0.000E+00	4.286E-04	25
E. Waste Vol Released (Pre-Dilution)	Liters	2.659E+07	8.724E+06	25
F. Volume of Dilution Water Used	Liters	3.919E+11	3.337E+11	25

UNIT 2

REPORT CATEGORY : ANNUAL LIQUID CONTINUOUS AND BATCH RELEASES
: TOTALS FOR EACH NUCLIDE RELEASED
TYPE OF ACTIVITY : ALL RADIONUCLIDES
REPORTING PERIOD : QUARTER # 1 AND QUARTER # 2 YEAR 2006

		CONTINUOUS RELEASES		BATCH RELEASES	
NUCLIDE	UNIT	QUARTER 1	QUARTER 2	QUARTER 1	QUARTER 2
NB-97	CURIES	0.00E+00	0.00E+00	0.00E+00	1.56E-05
CS-134	CURIES	0.00E+00	0.00E+00	1.59E-05	1.58E-05
NB-95	CURIES	0.00E+00	0.00E+00	0.00E+00	2.22E-05
MN-54	CURIES	0.00E+00	0.00E+00	3.39E-05	6.53E-05
SB-125	CURIES	0.00E+00	0.00E+00	5.80E-04	1.47E-04
CO-58	CURIES	0.00E+00	0.00E+00	9.61E-05	1.62E-04
CS-137	CURIES	0.00E+00	0.00E+00	6.10E-05	2.35E-04
AG-110M	CURIES	0.00E+00	0.00E+00	1.29E-04	2.49E-04
CO-60	CURIES	0.00E+00	0.00E+00	7.67E-05	2.65E-04
BE-7	CURIES	0.00E+00	0.00E+00	0.00E+00	3.74E-04
XE-133	CURIES	0.00E+00	0.00E+00	5.19E-04	3.19E-03
KR-85	CURIES	0.00E+00	0.00E+00	0.00E+00	8.48E-03
FE-55	CURIES	0.00E+00	0.00E+00	4.67E-03	1.08E-02
H-3	CURIES	2.19E-01	2.23E-01	1.02E+02	3.11E+02
Total for Period	CURIES	2.19E-01	2.23E-01	1.02E+02	3.11E+02

UNIT 2

REPORT CATEGORY : ANNUAL LIQUID CONTINUOUS AND BATCH RELEASES
: TOTALS FOR EACH NUCLIDE RELEASED
TYPE OF ACTIVITY : ALL RADIONUCLIDES
REPORTING PERIOD : QUARTER # 3 AND QUARTER # 4 YEAR 2006

		CONTINUOUS RELEASES		BATCH RELEASES	
NUCLIDE	UNIT	QUARTER 3	QUARTER 4	QUARTER 3	QUARTER 4
LA-140	CURIES	0.00E+00	0.00E+00	9.50E-06	0.00E+00
TC-99M	CURIES	0.00E+00	0.00E+00	1.08E-05	0.00E+00
I-132	CURIES	0.00E+00	0.00E+00	1.34E-05	0.00E+00
I-133	CURIES	0.00E+00	0.00E+00	3.63E-05	0.00E+00
XE-135	CURIES	0.00E+00	0.00E+00	1.43E-04	0.00E+00
AG-110M	CURIES	0.00E+00	0.00E+00	2.55E-04	0.00E+00
I-131	CURIES	0.00E+00	0.00E+00	1.08E-03	0.00E+00
XE-133M	CURIES	0.00E+00	0.00E+00	3.17E-03	0.00E+00
KR-85	CURIES	0.00E+00	0.00E+00	2.74E-02	0.00E+00
NB-97	CURIES	0.00E+00	0.00E+00	2.12E-05	5.12E-06
CS-137	CURIES	0.00E+00	0.00E+00	4.15E-04	8.26E-05
SB-124	CURIES	0.00E+00	0.00E+00	0.00E+00	1.04E-04
FE-59	CURIES	0.00E+00	0.00E+00	1.06E-04	1.07E-04
MN-54	CURIES	0.00E+00	0.00E+00	2.81E-04	1.31E-04
ZR-95	CURIES	0.00E+00	0.00E+00	1.51E-04	2.72E-04
CO-60	CURIES	0.00E+00	0.00E+00	8.53E-04	3.60E-04
NB-95	CURIES	0.00E+00	0.00E+00	1.75E-04	4.20E-04
G-ALPHA	CURIES	0.00E+00	3.67E-04	0.00E+00	4.29E-04
XE-131M	CURIES	0.00E+00	0.00E+00	6.62E-03	1.08E-03
CR-51	CURIES	0.00E+00	0.00E+00	6.05E-04	1.28E-03
SB-125	CURIES	0.00E+00	0.00E+00	1.97E-03	1.36E-03
CO-58	CURIES	0.00E+00	0.00E+00	1.12E-03	2.47E-03
FE-55	CURIES	1.95E-05	2.54E-04	1.76E-02	1.57E-02
XE-133	CURIES	0.00E+00	0.00E+00	4.65E-01	3.64E-02
H-3	CURIES	1.19E-01	2.83E-02	3.96E+02	5.18E+01
Total for Period	CURIES	1.19E-01	2.89E-02	3.96E+02	5.19E+01

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 annual Radioactive Effluent Release Report. This summary covers releases from January 1 to December 31, 2006. The summary of gaseous effluents for both Unit 1 and Unit 2 is as follows:

	Unit 1	Unit 2
Number of releases:	188	164
Total time for all releases (minutes):	1526827	1236137
Maximum time for a release (minutes):	10675	10802
Average time for a release (minutes):	8121	7537
Minimum time for a release (minutes):	15	4

The Unit 1 gaseous releases consisted of:

188 Planned vent & tank releases

0 Unplanned releases

The Unit 2 gaseous releases consisted of:

164 Planned vent & tank releases

0 Unplanned releases

ANNUAL SUMMATION FOR ALL RELEASES BY QUARTER
(ALL AIRBORNE EFFLUENTS)
January 1 through June 30, 2006

Unit 1

Type of Effluent	Units	Quarter 1	Quarter 2	Est. Total Error %
A. Fission and Activation Products				
1. Total Release	Curies	0.000E+00	0.000E+00	25
2. Average Release Rate for Period	μCi/Sec	0.000E+00	0.000E+00	
3. Percent of Applicable Limit	%	0.000E+00	0.000E+00	
B. Radioiodines				
1. Total Iodine-131	Curies	0.000E+00	0.000E+00	25
2. Average Release Rate for Period	μCi/Sec	0.000E+00	0.000E+00	
3. Percent of Applicable Limit	%	0.000E+00	0.000E+00	
C. Particulates				
1. Particulates (Half-Lives > 8 Days)	Curies	0.000E+00	0.000E+00	25
2. Average Release Rate for Period	μCi/Sec	0.000E+00	0.000E+00	
3. Percent of Applicable Limit	%	0.000E+00	0.000E+00	
4. Gross Alpha Radioactivity	Curies	0.000E+00	0.000E+00	
D. Tritium				
1. Total Release	Curies	7.198E+00	7.613E+00	25
2. Average Release Rate for Period	μCi/Sec	9.257E-01	9.683E-01	
3. Percent of Applicable Limit	%	1.296E-03	1.356E-03	

ANNUAL SUMMATION FOR ALL RELEASES BY QUARTER
(ALL AIRBORNE EFFLUENTS)
July 1 through December 31, 2006

Unit 1

Type of Effluent	Units	Quarter 3	Quarter 4	Est. Total Error %
A. Fission and Activation Products				
1. Total Release	Curies	0.000E+00	0.000E+00	25
2. Average Release Rate for Period	μCi/Sec	0.000E+00	0.000E+00	
3. Percent of Applicable Limit	%	0.000E+00	0.000E+00	
B. Radioiodines				
1. Total Iodine-131	Curies	0.000E+00	0.000E+00	25
2. Average Release Rate for Period	μCi/Sec	0.000E+00	0.000E+00	
3. Percent of Applicable Limit	%	0.000E+00	0.000E+00	
C. Particulates				
1. Particulates (Half-Lives > 8 Days)	Curies	0.000E+00	0.000E+00	25
2. Average Release Rate for Period	μCi/Sec	0.000E+00	0.000E+00	
3. Percent of Applicable Limit	%	0.000E+00	0.000E+00	
4. Gross Alpha Radioactivity	Curies	0.000E+00	0.000E+00	
D. Tritium				
1. Total Release	Curies	8.100E+00	5.691E+00	25
2. Average Release Rate for Period	μCi/Sec	1.019E+00	7.160E-01	
3. Percent of Applicable Limit	%	1.427E-03	1.002E-03	

UNIT 1

REPORT CATEGORY : ANNUAL AIRBORNE GROUND LEVEL CONTINUOUS AND BATCH RELEASES
: TOTALS FOR EACH NUCLIDE RELEASED
TYPE OF ACTIVITY : FISSION GASES, IODINES, AND PARTICULATES
REPORTING PERIOD : QUARTER # 1 AND QUARTER # 2 YEAR 2006

NUCLIDE	UNIT	CONTINUOUS RELEASES QUARTER 1	CONTINUOUS RELEASES QUARTER 2	BATCH RELEASES QUARTER 1	BATCH RELEASES QUARTER 2
Fission Gases					
NONE	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total for Period	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines					
NONE	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total for Period	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
NONE	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total for Period	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Other					
H-3	CURIES	0.00E+00	0.00E+00	7.20E+00	7.61E+00
Total for Period	CURIES	0.00E+00	0.00E+00	7.20E+00	7.61E+00

UNIT 1

REPORT CATEGORY : ANNUAL 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 2006

NUCLIDE	UNIT	CONTINUOUS RELEASES QUARTER 3	CONTINUOUS RELEASES QUARTER 4	BATCH RELEASES QUARTER 3	BATCH RELEASES QUARTER 4
Fission Gases					
NONE	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total for Period	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines					
NONE	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total for Period	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
NONE	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total for Period	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Other					
H-3	CURIES	0.00E+00	0.00E+00	8.10E+00	5.69E+00
Total for Period	CURIES	0.00E+00	0.00E+00	8.10E+00	5.69E+00

ANNUAL SUMMATION FOR ALL RELEASES BY QUARTER
(ALL AIRBORNE EFFLUENTS)
January 1 through June 30, 2006

Unit 2

Type of Effluent	Units	Quarter 1	Quarter 2	Est. Total Error %
A. Fission and Activation Products				
1. Total Release	Curies	0.00E+00	0.000E+00	25
2. Average Release Rate for Period	μCi/Sec	0.00E+00	0.000E+00	
3. Percent of Applicable Limit	%	0.00E+00	0.000E+00	
B. Radioiodines				
1. Total Iodine-131	Curies	0.00E+00	0.00E+00	25
2. Average Release Rate for Period	μCi/Sec	0.00E+00	0.00E+00	
3. Percent of Applicable Limit	%	0.00E+00	0.00E+00	
C. Particulates				
1. Particulates (Half-Lives > 8 Days)	Curies	0.000E+00	0.00E+00	25
2. Average Release Rate for Period	μCi/Sec	0.000E+00	0.00E+00	
3. Percent of Applicable Limit	%	0.000E+00	0.00E+00	
4. Gross Alpha Radioactivity	Curies	1.075E-05	0.000E+00	
D. Tritium				
1. Total Release	Curies	1.310E+01	1.566E+01	25
2. Average Release Rate for Period	μCi/Sec	1.685E+00	1.992E+00	
3. Percent of Applicable Limit	%	2.359E-03	2.788E-03	

ANNUAL SUMMATION FOR ALL RELEASES BY QUARTER
(ALL AIRBORNE EFFLUENTS)
July 1 through December 31, 2006

Unit 2

Type of Effluent	Units	Quarter 3	Quarter 4	Est. Total Error %
A. Fission and Activation Products				
1. Total Release	Curies	7.225E+01	1.369E+01	25
2. Average Release Rate for Period	μCi/Sec	9.089E+00	1.723E+00	
3. Percent of Applicable Limit	%	1.272E-01	2.412E-02	
B. Radioiodines				
1. Total Iodine-131	Curies	2.290E-05	1.950E-05	25
2. Average Release Rate for Period	μCi/Sec	2.881E-06	2.453E-06	
3. Percent of Applicable Limit	%	8.067E-06	6.869E-06	
C. Particulates				
1. Particulates (Half-Lives > 8 Days)	Curies	1.100E-07	7.840E-05	25
2. Average Release Rate for Period	μCi/Sec	1.384E-08	9.863E-06	
3. Percent of Applicable Limit	%	3.874E-08	2.762E-05	
4. Gross Alpha Radioactivity	Curies	0.000E+00	0.000E+00	
D. Tritium				
1. Total Release	Curies	1.001E+01	6.748E+00	25
2. Average Release Rate for Period	μCi/Sec	1.259E+00	8.489E-01	
3. Percent of Applicable Limit	%	1.762E-03	1.188E-03	

UNIT 2

REPORT CATEGORY : ANNUAL AIRBORNE GROUND LEVEL CONTINUOUS AND BATCH RELEASES
: TOTALS FOR EACH NUCLIDE RELEASED
TYPE OF ACTIVITY : FISSION GASES, IODINES, AND PARTICULATES
REPORTING PERIOD : QUARTER # 1 AND QUARTER # 2 YEAR 2006

NUCLIDE	UNIT	CONTINUOUS RELEASES QUARTER 1	CONTINUOUS RELEASES QUARTER 2	BATCH RELEASES QUARTER 1	BATCH RELEASES QUARTER 2
Fission Gases					
NONE	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total for Period	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines					
NONE	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total for Period	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
NONE	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total for Period	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Other					
G-ALPHA	CURIES	0.00E+00	0.00E+00	1.08E-05	0.00E+00
H-3	CURIES	0.00E+00	0.00E+00	1.31E+01	1.57E+01
Total for Period	CURIES	0.00E+00	0.00E+00	1.31E+01	1.57E+01

UNIT 2

REPORT CATEGORY : ANNUAL 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 2006

NUCLIDE	UNIT	CONTINUOUS RELEASES QUARTER 3	CONTINUOUS RELEASES QUARTER 4	BATCH RELEASES QUARTER 3	BATCH RELEASES QUARTER 4
Fission Gases					
XE-133M	CURIES	0.00E+00	0.00E+00	2.36E-03	0.00E+00
XE-135	CURIES	0.00E+00	0.00E+00	1.35E-02	0.00E+00
XE-133	CURIES	0.00E+00	0.00E+00	7.22E+01	1.37E+01
Total for Period	CURIES	0.00E+00	0.00E+00	7.22E+01	1.37E+01
Iodines					
I-131	CURIES	0.00E+00	0.00E+00	2.29E-05	1.95E-05
Total for Period	CURIES	0.00E+00	0.00E+00	2.29E-05	1.95E-05
Particulates					
CS-137	CURIES	0.00E+00	0.00E+00	1.10E-07	0.00E+00
MN-54	CURIES	0.00E+00	0.00E+00	0.00E+00	2.11E-06
CO-60	CURIES	0.00E+00	0.00E+00	0.00E+00	2.95E-06
ZR-95	CURIES	0.00E+00	0.00E+00	0.00E+00	5.83E-06
NB-95	CURIES	0.00E+00	0.00E+00	0.00E+00	8.15E-06
CO-58	CURIES	0.00E+00	0.00E+00	0.00E+00	2.62E-05
CR-51	CURIES	0.00E+00	0.00E+00	0.00E+00	3.31E-05
Total for Period	CURIES	0.00E+00	0.00E+00	1.10E-07	7.84E-05
Other					
H-3	CURIES	0.00E+00	0.00E+00	1.00E+01	6.75E+00
Total for Period	CURIES	0.00E+00	0.00E+00	1.00E+01	6.75E+00

5. SUMMARY OF RADIATION DOSES

The following is a summary of the annual radiation doses due to radiological effluents during 2006 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	0.0004	0.03	0.0001	0.01	0.0001	0.01	0.0008	0.05	0.0013	0.04
Bone	0.0004	0.01	0.0000	0.00	0.0000	0.00	0.0005	0.01	0.0009	0.01
Liver	0.0006	0.01	0.0001	0.00	0.0001	0.00	0.0010	0.02	0.0018	0.02
Thyroid	0.0000	0.00	0.0001	0.00	0.0000	0.00	0.0003	0.01	0.0004	0.00
Kidney	0.0002	0.00	0.0001	0.00	0.0001	0.00	0.0005	0.01	0.0009	0.01
Lung	0.0001	0.00	0.0001	0.00	0.0001	0.00	0.0004	0.01	0.0006	0.01
GI-LLI	0.0001	0.00	0.0001	0.00	0.0001	0.00	0.0004	0.01	0.0006	0.01

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	0.0044	0.06	0.0047	0.06	0.0050	0.07	0.0035	0.05	0.0176	0.12
Bone	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00
Liver	0.0044	0.06	0.0047	0.06	0.0050	0.07	0.0035	0.05	0.0176	0.12
Thyroid	0.0044	0.06	0.0047	0.06	0.0050	0.07	0.0035	0.05	0.0176	0.12
Kidney	0.0044	0.06	0.0047	0.06	0.0050	0.07	0.0035	0.05	0.0176	0.12
Lung	0.0044	0.06	0.0047	0.06	0.0050	0.07	0.0035	0.05	0.0176	0.12
GI-LLI	0.0044	0.06	0.0047	0.06	0.0050	0.07	0.0035	0.05	0.0176	0.12

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	0.0000	0.00	0.0000	0.00
Beta	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00

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	0.0002	0.01	0.0006	0.04	0.0007	0.05	0.0001	0.01	0.0016	0.05
Bone	0.0001	0.00	0.0002	0.00	0.0002	0.00	0.0001	0.00	0.0006	0.01
Liver	0.0002	0.00	0.0006	0.01	0.0008	0.02	0.0002	0.00	0.0019	0.02
Thyroid	0.0002	0.00	0.0004	0.01	0.0002	0.02	0.0001	0.00	0.0016	0.02
Kidney	0.0002	0.00	0.0005	0.01	0.0006	0.01	0.0001	0.00	0.0014	0.01
Lung	0.0002	0.00	0.0005	0.01	0.0006	0.01	0.0001	0.00	0.0013	0.01
GI-LLI	0.0002	0.00	0.0005	0.01	0.0006	0.01	0.0002	0.00	0.0015	0.01

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	0.0081	0.11	0.0096	0.13	0.0062	0.08	0.0042	0.06	0.0281	0.19
Bone	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0001	0.00	0.0001	0.00
Liver	0.0081	0.11	0.0096	0.13	0.0062	0.08	0.0042	0.06	0.0281	0.19
Thyroid	0.0081	0.11	0.0096	0.13	0.0111	0.15	0.0084	0.11	0.0372	0.25
Kidney	0.0081	0.11	0.0096	0.13	0.0062	0.08	0.0042	0.06	0.0281	0.19
Lung	0.0081	0.11	0.0096	0.13	0.0062	0.08	0.0042	0.06	0.0281	0.19
GI-LLI	0.0081	0.11	0.0096	0.13	0.0062	0.08	0.0042	0.06	0.0281	0.19

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	0.0023	0.05	0.0004	0.01	0.0027	0.03
Beta	0.0000	0.00	0.0000	0.00	0.0067	0.07	0.0013	0.01	0.0080	0.04

6. SUMMARY OF DOSE TO MEMBERS OF THE PUBLIC

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

UNIT 1

	BONE	LIVER	TBODY	THYROID	KIDNEY	GI-LLI	LUNG	SKIN
Gaseous Effluent								
Iodine/Tritium Particulate	0.00E+00	2.93E-03	2.93E-03	2.93E-3	2.93E-03	2.93E-03	2.93E-03	
Noble Gas			0.00E+00					0.00E+0
Liquid Effluent								
Fish	9.49E-04	1.77E-03	1.33E-03	4.27E-04	8.75E-04	5.86E-04	5.90E-04	
Sediment			2.54E-06					2.98E-05
Unit 1 Total	9.49E-04	4.70E-03	4.26E-03	3.36E-03	3.81E-03	3.52E-03	3.52E-03	2.98E-05

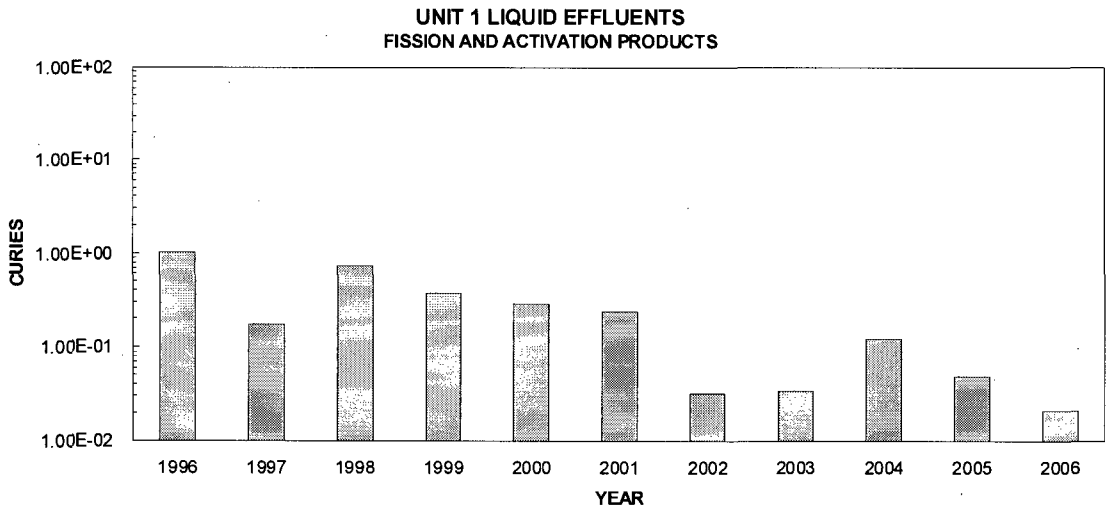
UNIT 2

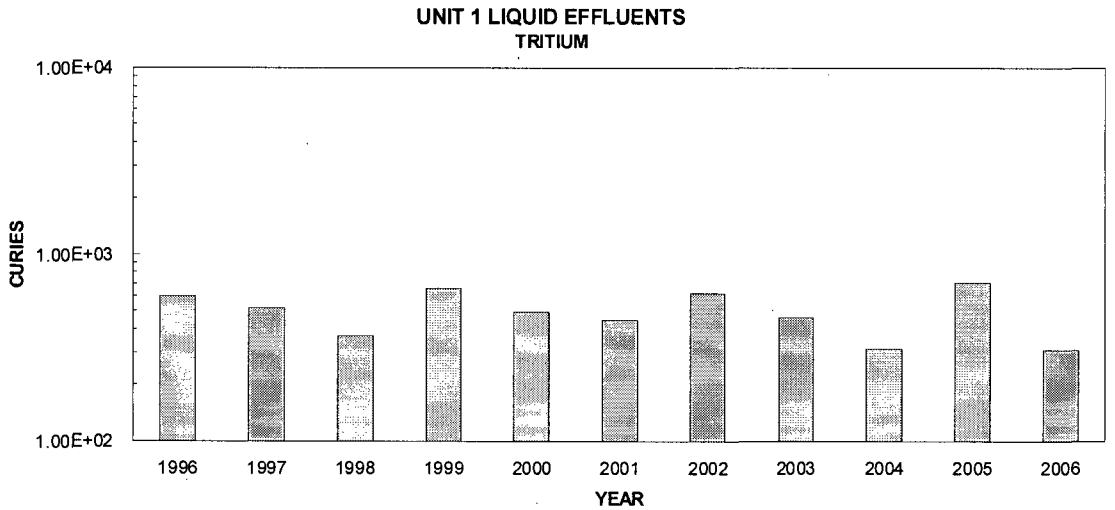
Gaseous Effluent								
Iodine/Tritium Particulate	1.38E-05	4.77E-03	4.77E-03	6.32E-03	4.77E-03	4.77E-03	4.77E-03	
Noble Gas			6.87E-04					1.62E-03
Liquid Effluent								
Fish	5.71E-04	1.86E-03	1.57E-03	1.61E-03	1.36E-03	1.31E-03	1.46E-03	
Sediment			2.86E-05					3.35E-05
Unit 2 Total	5.85E-04	6.63E-03	7.06E-03	7.93E-03	6.13E-03	6.08E-03	6.23E-03	1.66E-03

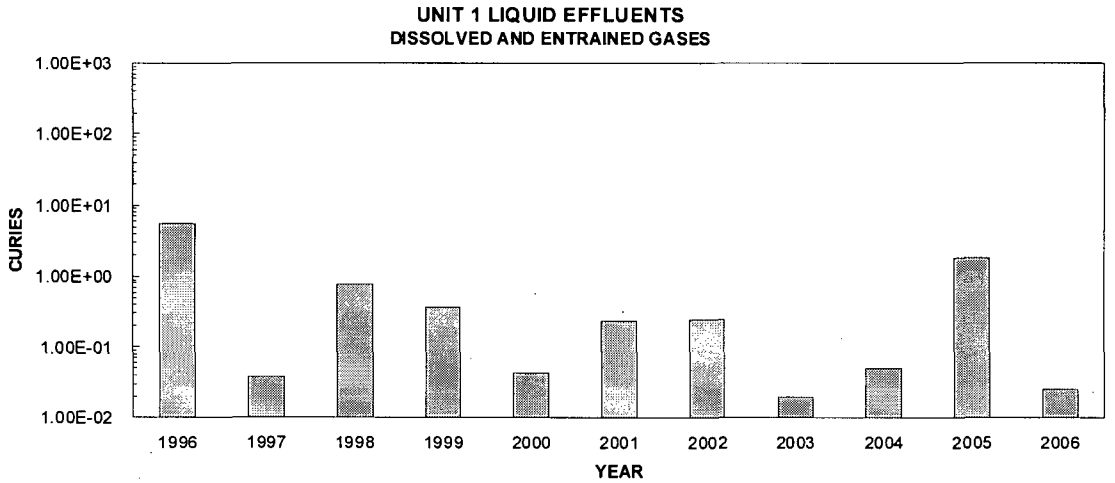
Site Total	1.53E-03	1.13E-02	1.13E-02	1.13E-02	9.94E-03	9.60E-03	9.75E-03	1.69E-03
Limit (40CFR190)	25	25	75	25	25	25	25	25
% Limit	6.12E-03	4.52E-02	1.51E-02	4.52E-02	3.98E-02	3.84E-02	3.90E-02	6.74E-03

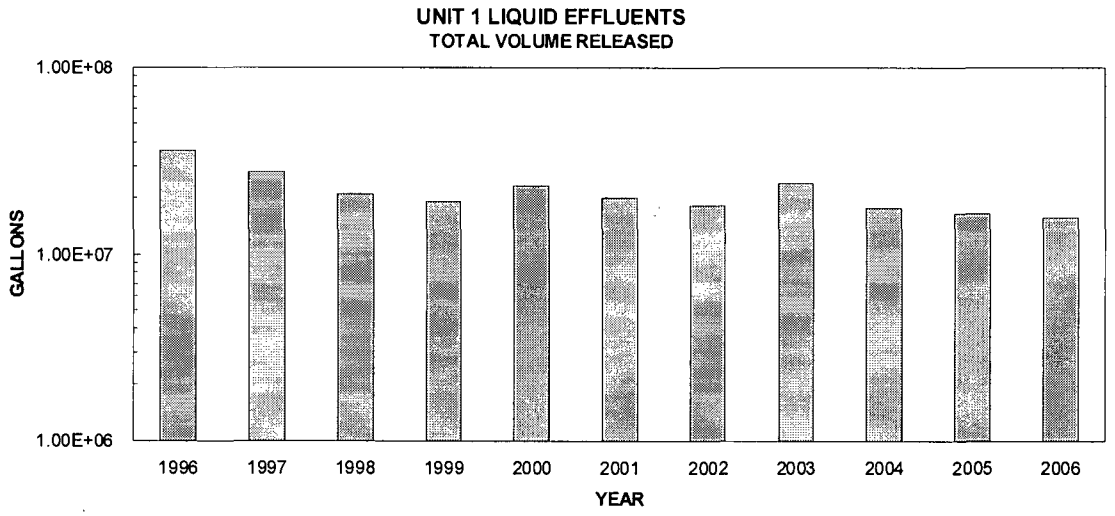
7. HISTORICAL EFFLUENT DATA

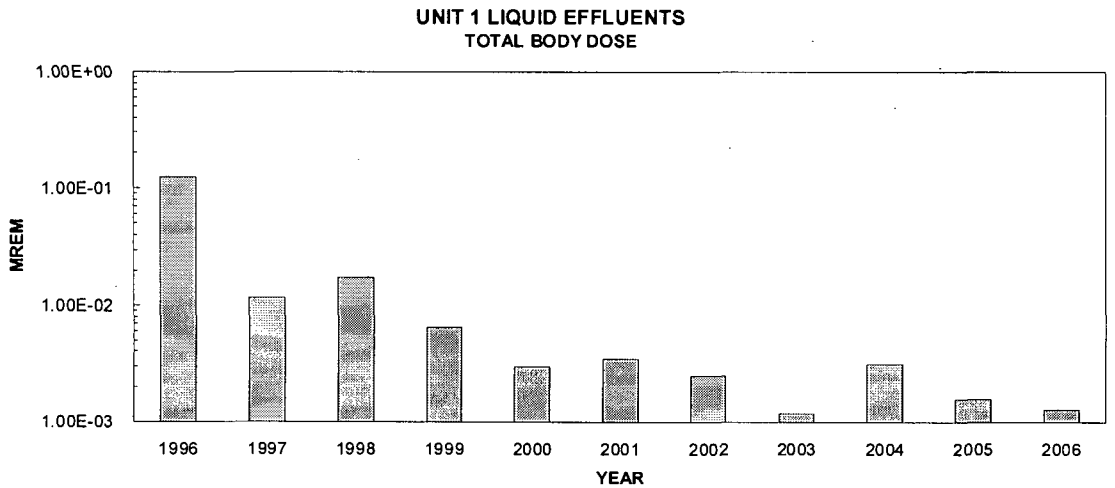
The following graphs show the historical release data for both units on a yearly basis. These graphs compare data from 1996 through 2006.

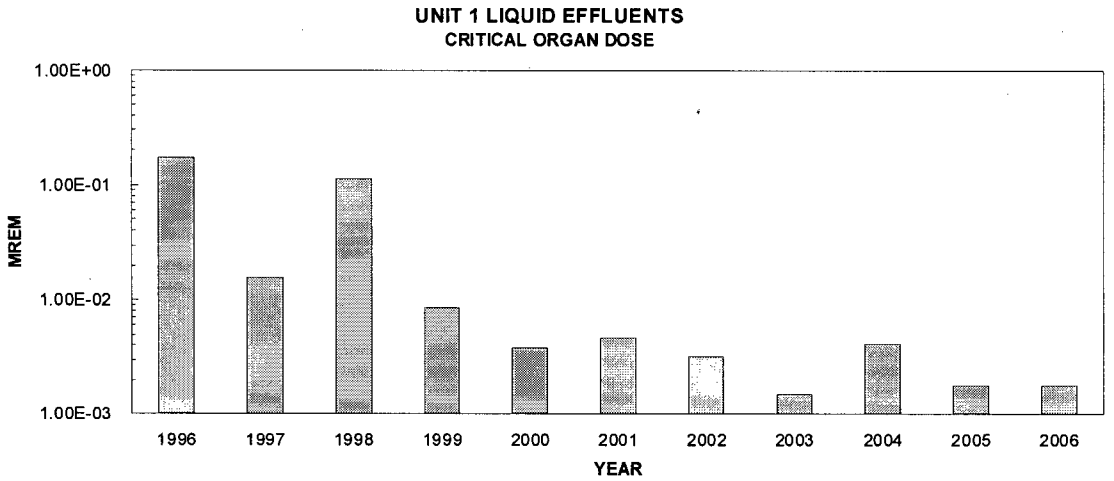


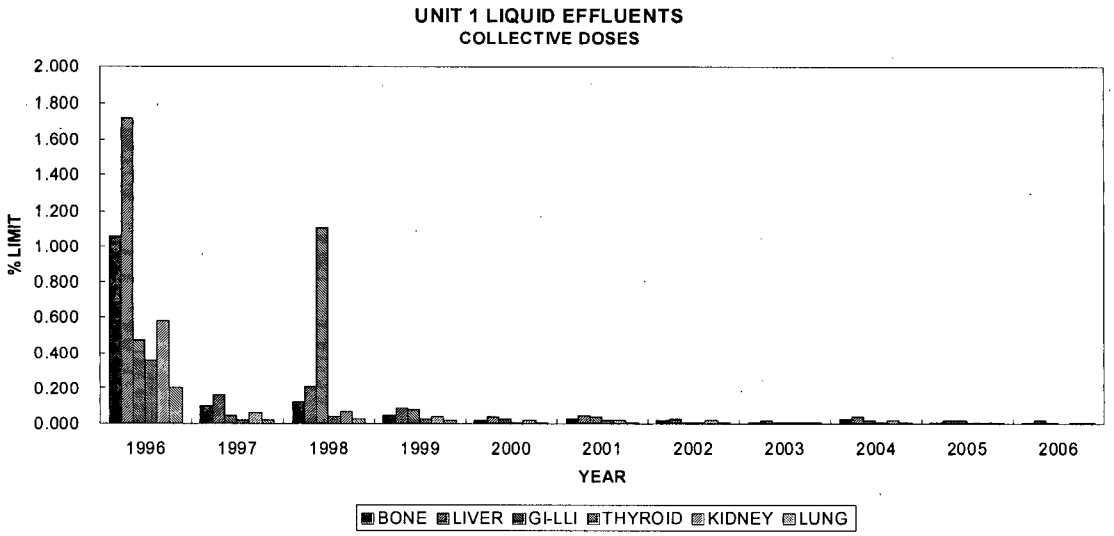


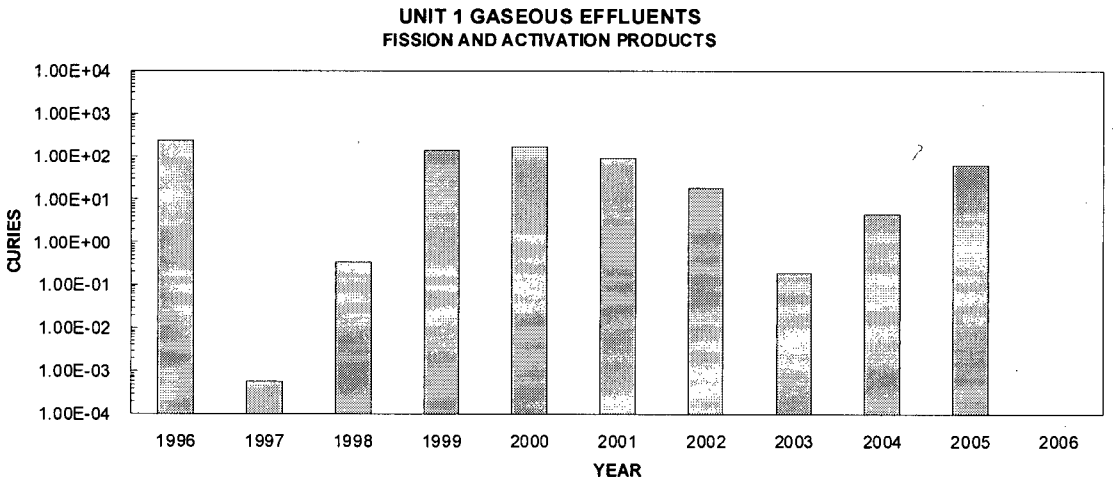

UNIT 1 LIQUID EFFLUENTS
DISSOLVED AND ENTRAINED GASES
CURIES
1.00E+03
1.00E+02
1.00E+01
1.00E+00
1.00E-01
1.00E-02
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
YEAR

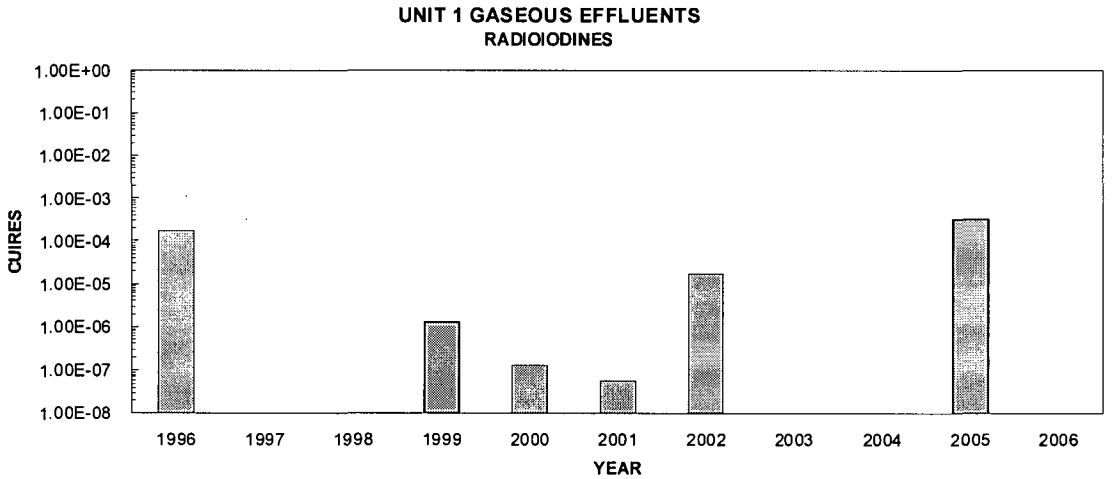

UNIT 1 LIQUID EFFLUENTS
TOTAL VOLUME RELEASED
GALLONS
1.00E+08
1.00E+07
1.00E+06
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
YEAR

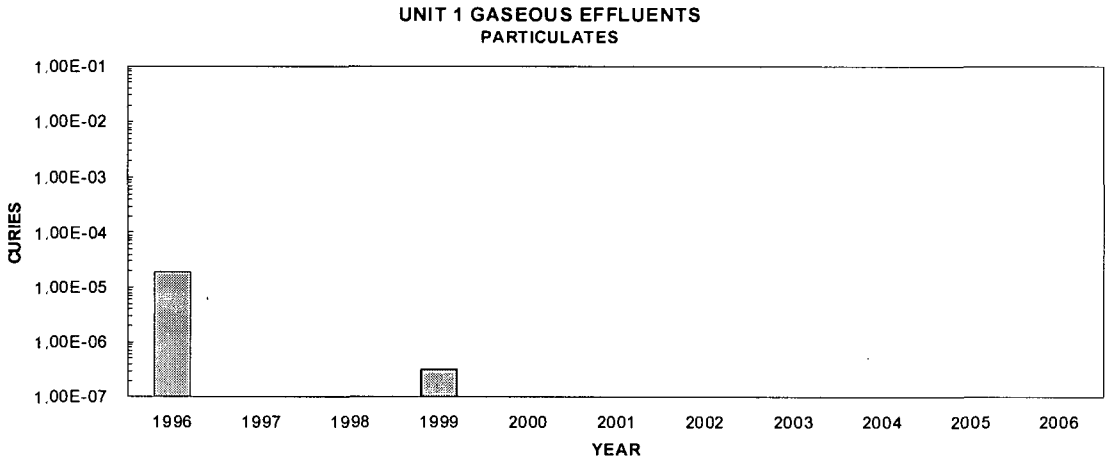

UNIT 1 LIQUID EFFLUENTS
TOTAL BODY DOSE
MREM
1.00E+00
1.00E-01
1.00E-02
1.00E-03
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
YEAR

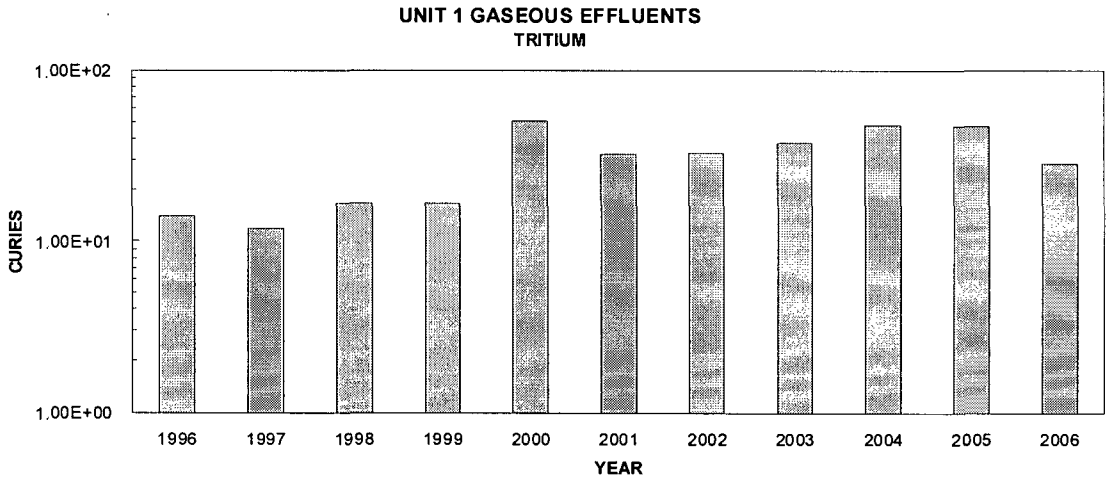

UNIT 1 LIQUID EFFLUENTS
CRITICAL ORGAN DOSE
MREM
1.00E+00
1.00E-01
1.00E-02
1.00E-03
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
YEAR

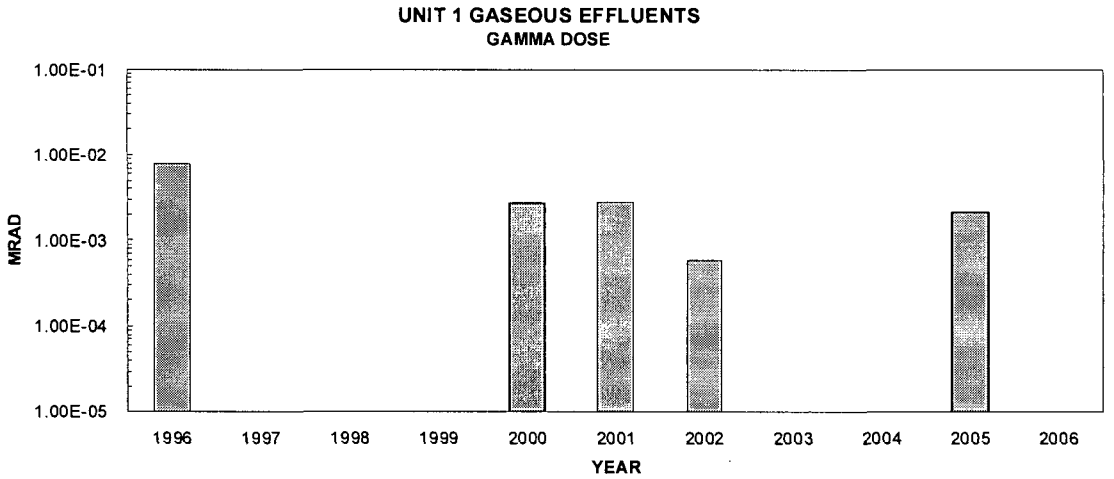

UNIT 1 LIQUID EFFLUENTS
COLLECTIVE DOSES
% LIMIT
2.000
1.800
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
YEAR
BONE
LIVER
GI-LLI
THYROID
KIDNEY
LUNG

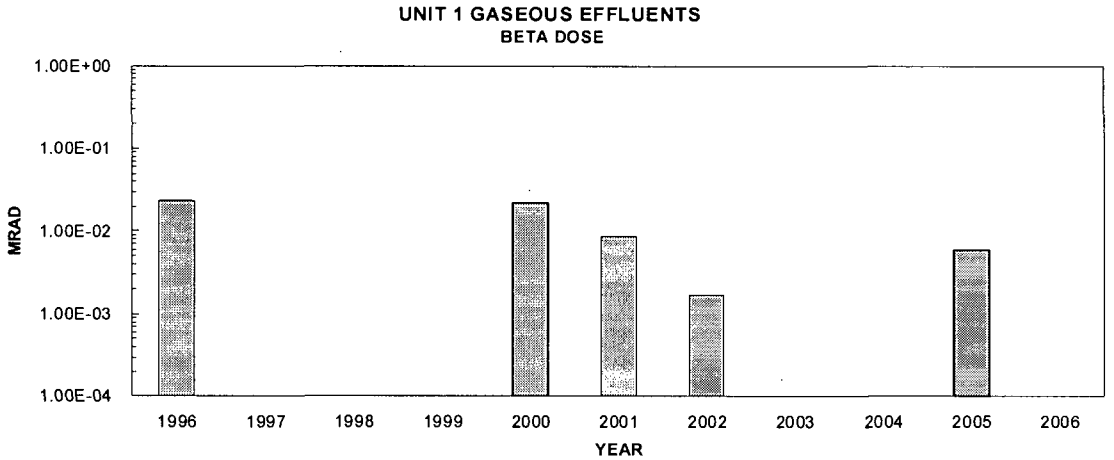

UNIT 1 GASEOUS EFFLUENTS
FISSION AND ACTIVATION PRODUCTS
CURIES
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
1.00E-01
1.00E-02
1.00E-03
1.00E-04
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
YEAR

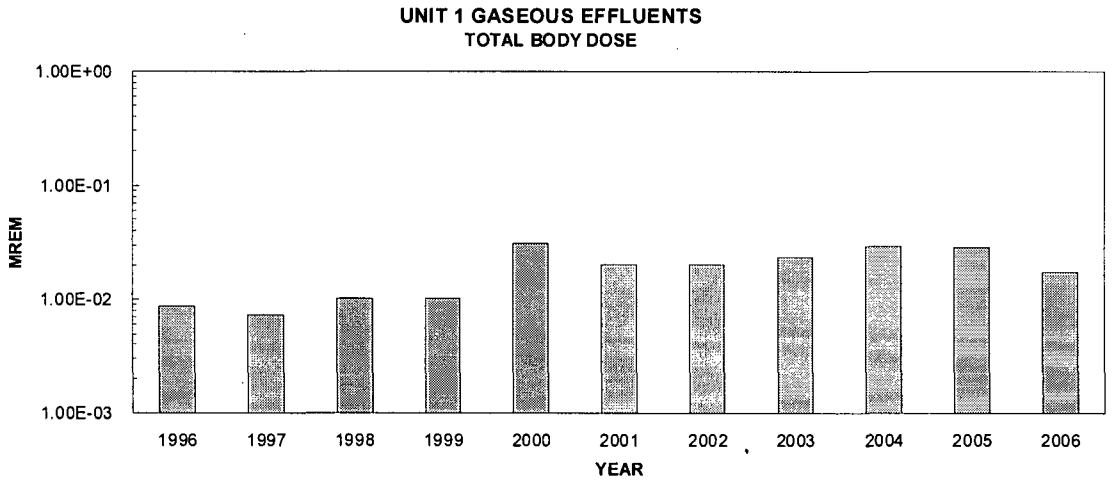

UNIT 1 GASEOUS EFFLUENTS
RADIOIODINES
CURIES
1.00E+00
1.00E-01
1.00E-02
1.00E-03
1.00E-04
1.00E-05
1.00E-06
1.00E-07
1.00E-08
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
YEAR

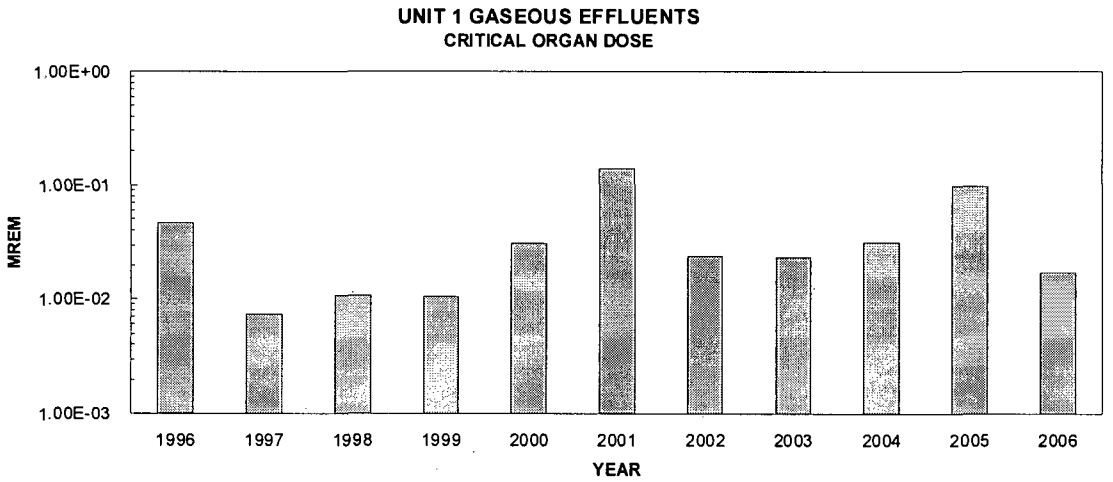

UNIT 1 GASEOUS EFFLUENTS
PARTICULATES
CURIES
1.00E-01
1.00E-02
1.00E-03
1.00E-04
1.00E-05
1.00E-06
1.00E-07
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
YEAR

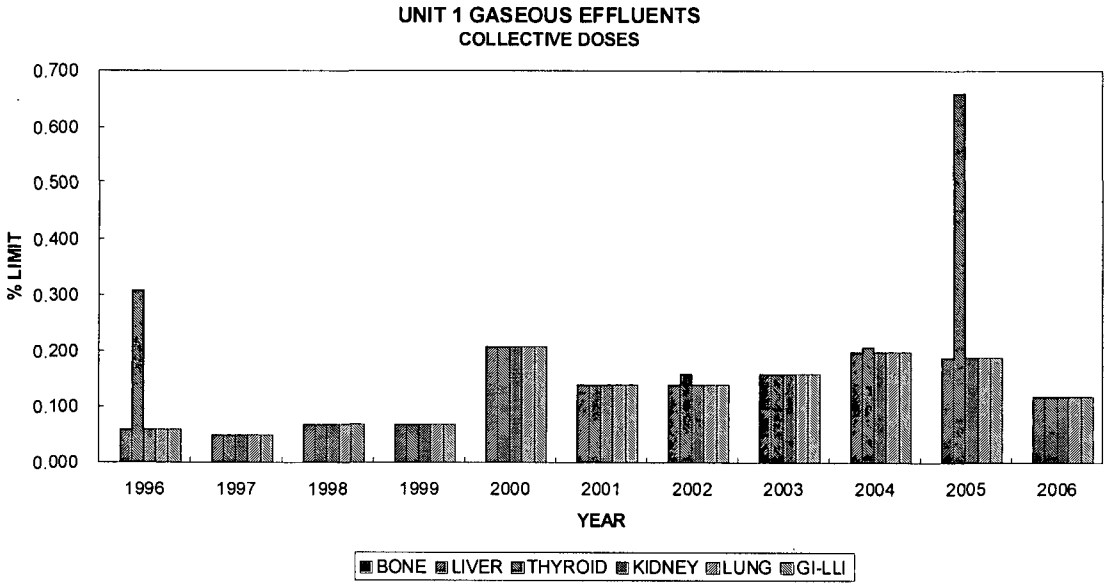

UNIT 1 GASEOUS EFFLUENTS
TRITIUM
CURIES
1.00E+02
1.00E+01
1.00E+00
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
YEAR

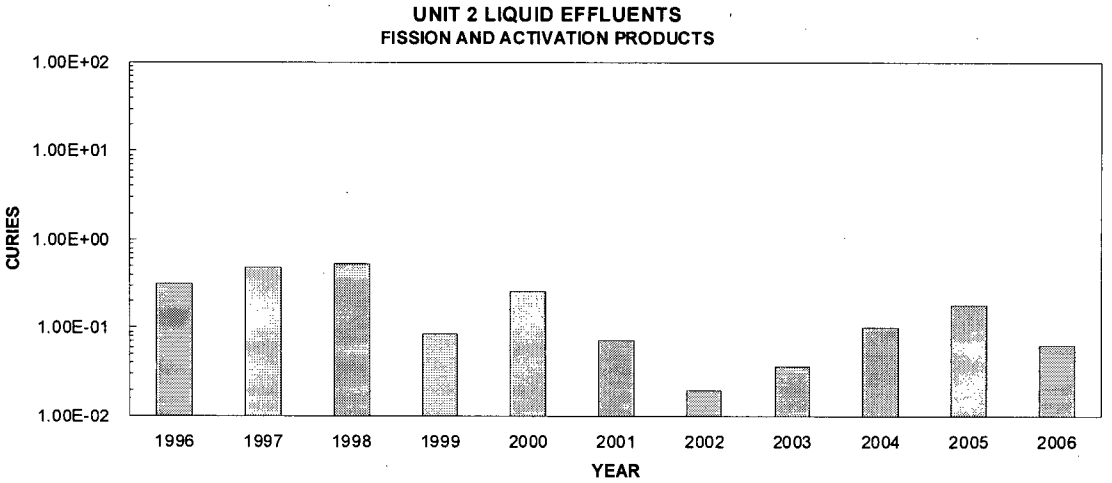

UNIT 1 GASEOUS EFFLUENTS
GAMMA DOSE
MRAD
1.00E-01
1.00E-02
1.00E-03
1.00E-04
1.00E-05
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
YEAR

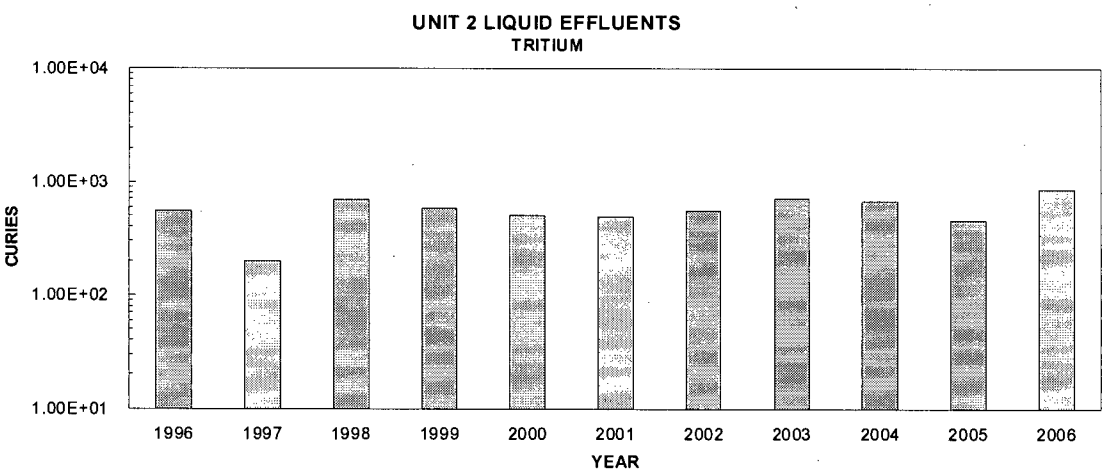

UNIT 1 GASEOUS EFFLUENTS
BETA DOSE
MRAD
1.00E+00
1.00E-01
1.00E-02
1.00E-03
1.00E-04
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
YEAR

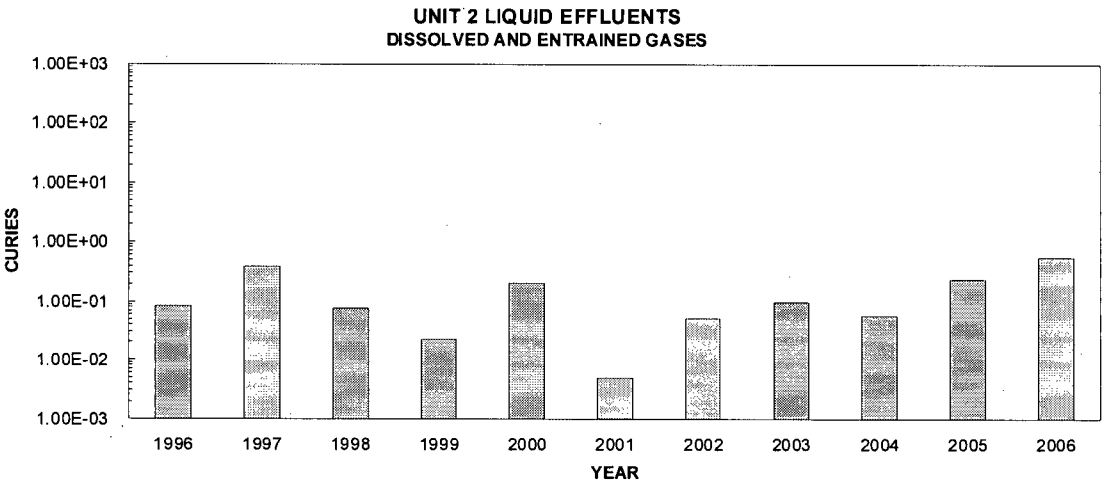

UNIT 1 GASEOUS EFFLUENTS
TOTAL BODY DOSE
MREM
1.00E+00
1.00E-01
1.00E-02
1.00E-03
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
YEAR

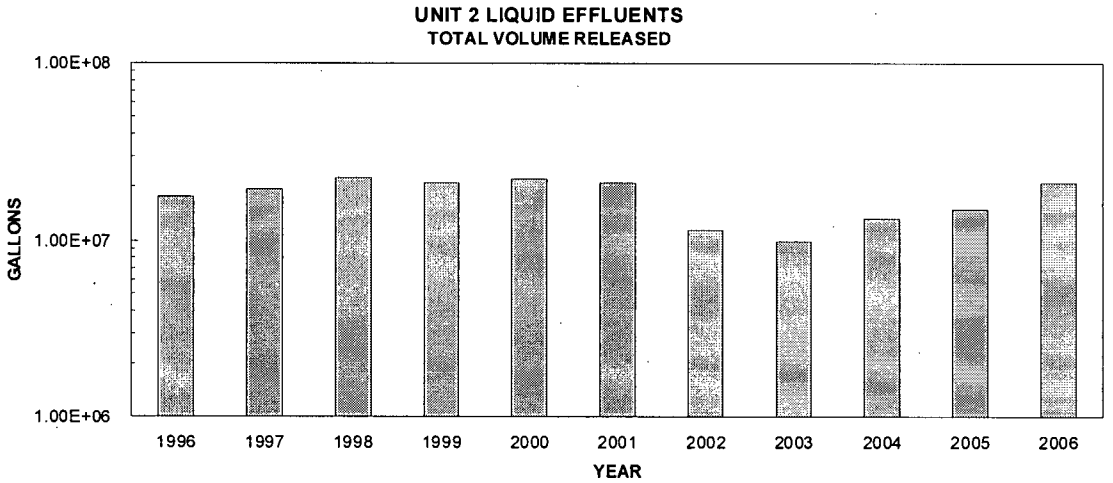

UNIT 1 GASEOUS EFFLUENTS
CRITICAL ORGAN DOSE
1.00E+00
1.00E-01
1.00E-02
1.00E-03
MREM
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
YEAR

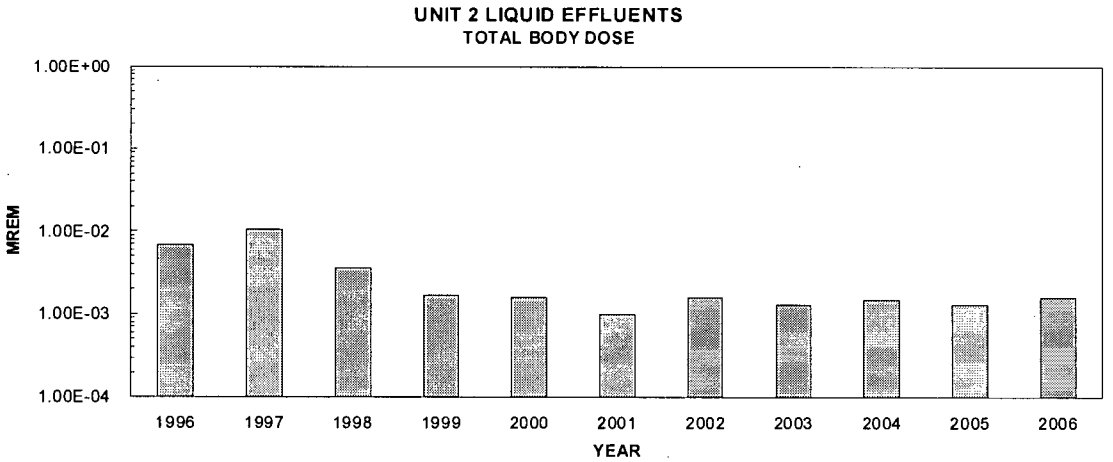

UNIT 1 GASEOUS EFFLUENTS
COLLECTIVE DOSES
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
% LIMIT
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
YEAR
BONE
LIVER
THYROID
KIDNEY
LUNG
GI-LLI

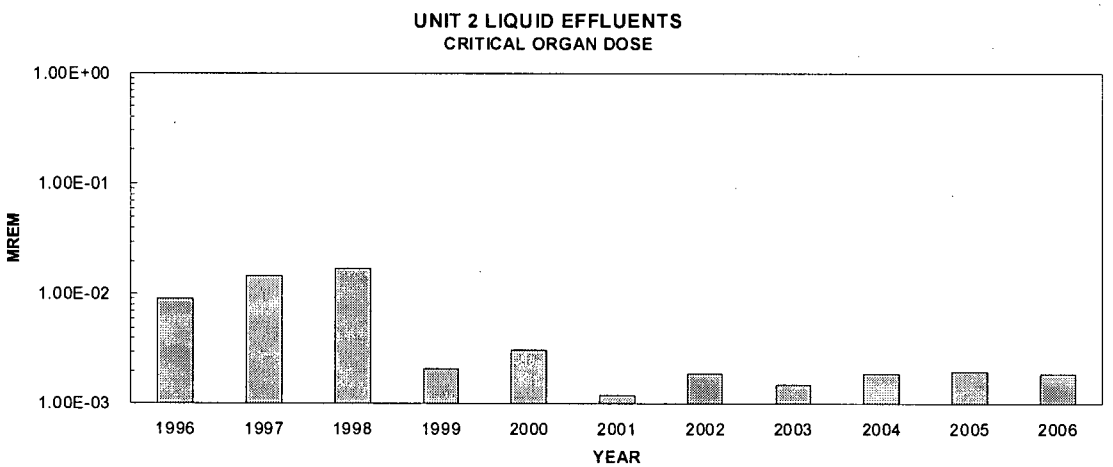

UNIT 2 LIQUID EFFLUENTS
FISSION AND ACTIVATION PRODUCTS
CURIES
1.00E+02
1.00E+01
1.00E+00
1.00E-01
1.00E-02
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
YEAR

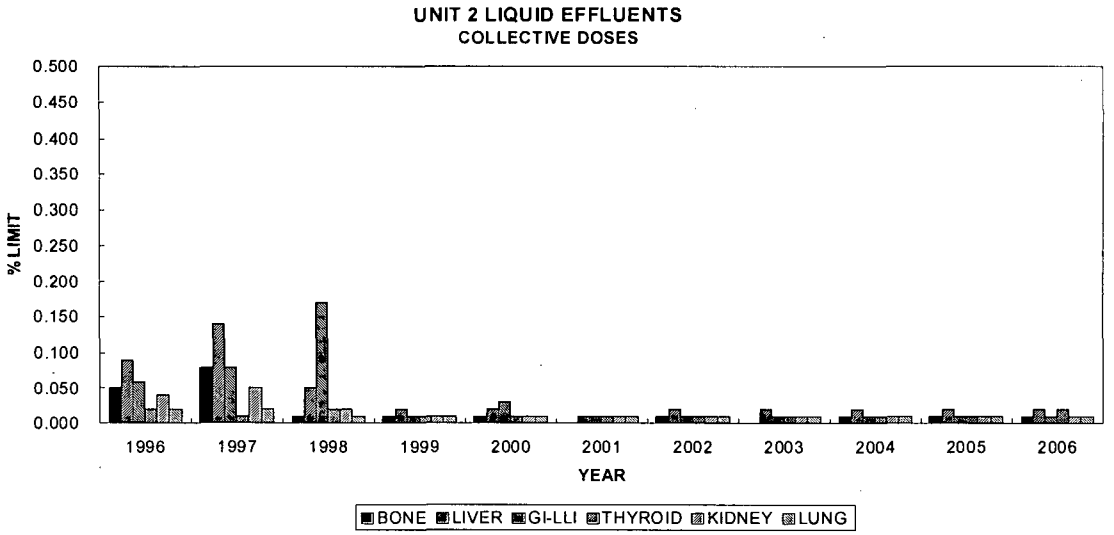

UNIT 2 LIQUID EFFLUENTS
TRITIUM
CURIES
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
YEAR

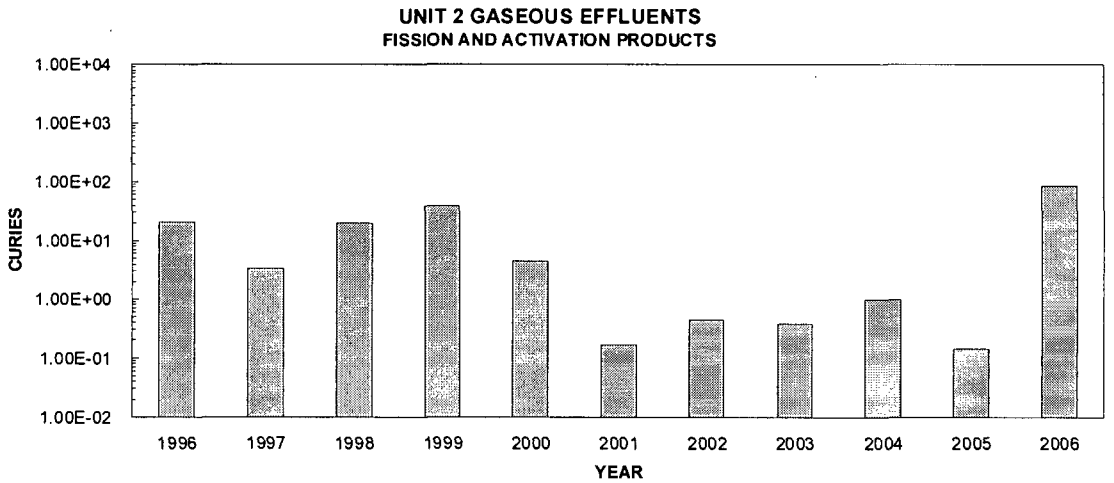

UNIT 2 LIQUID EFFLUENTS
DISSOLVED AND ENTRAINED GASES
CURIES
1.00E+03
1.00E+02
1.00E+01
1.00E+00
1.00E-01
1.00E-02
1.00E-03
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
YEAR

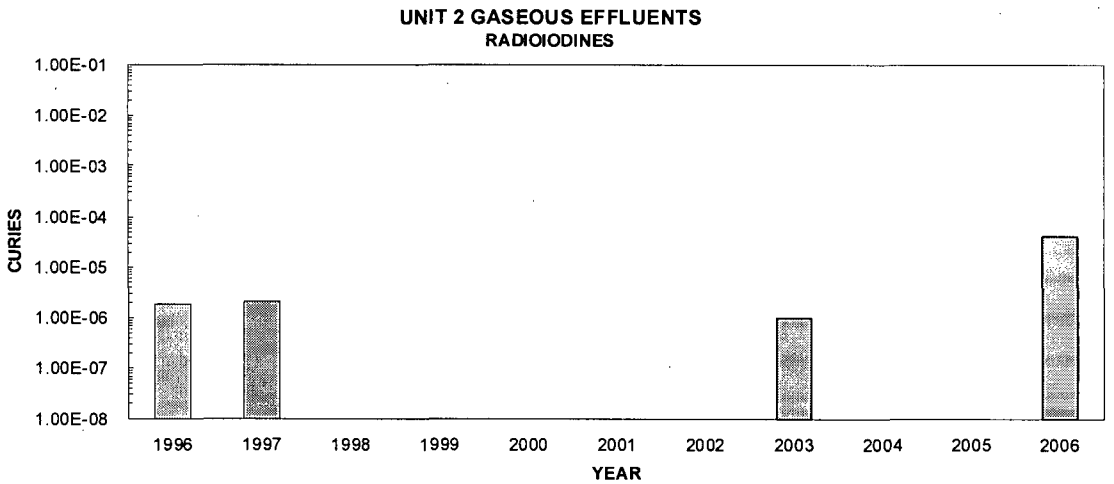

UNIT 2 LIQUID EFFLUENTS
TOTAL VOLUME RELEASED
GALLONS
1.00E+08
1.00E+07
1.00E+06
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
YEAR

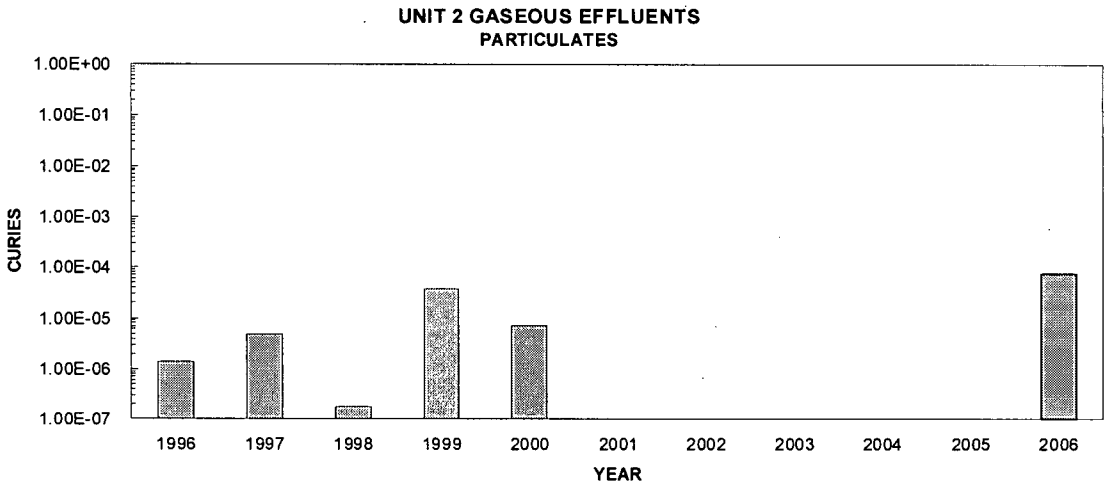

UNIT 2 LIQUID EFFLUENTS
TOTAL BODY DOSE
MREM
1.00E+00
1.00E-01
1.00E-02
1.00E-03
1.00E-04
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
YEAR

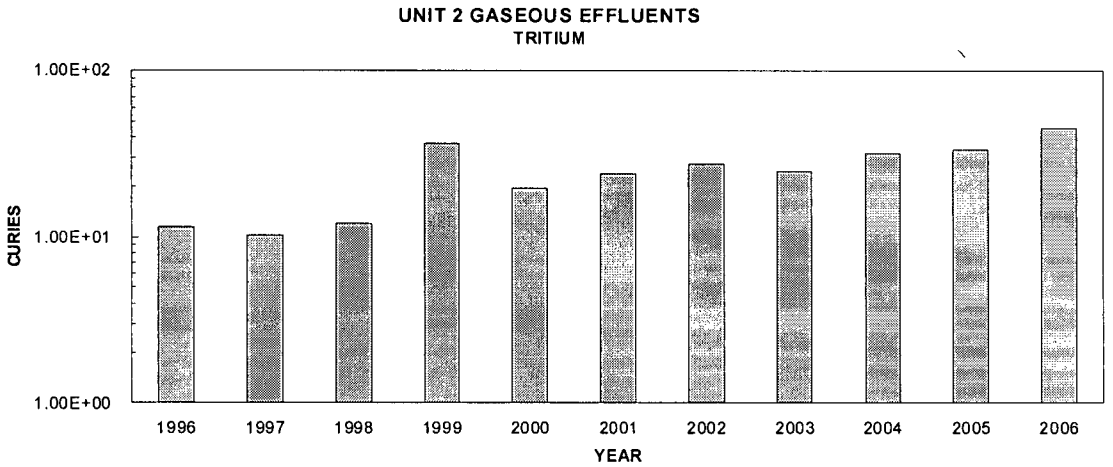

UNIT 2 LIQUID EFFLUENTS
CRITICAL ORGAN DOSE
MREM
1.00E+00
1.00E-01
1.00E-02
1.00E-03
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
YEAR

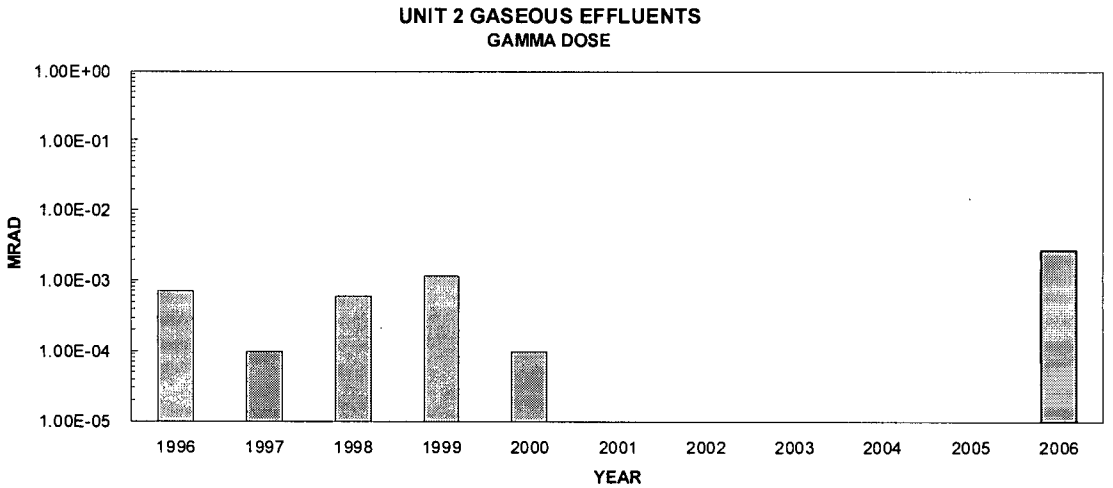

UNIT 2 LIQUID EFFLUENTS
COLLECTIVE DOSES
% LIMIT
0.500
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
YEAR
BONE
LIVER
GI-LLI
THYROID
KIDNEY
LUNG

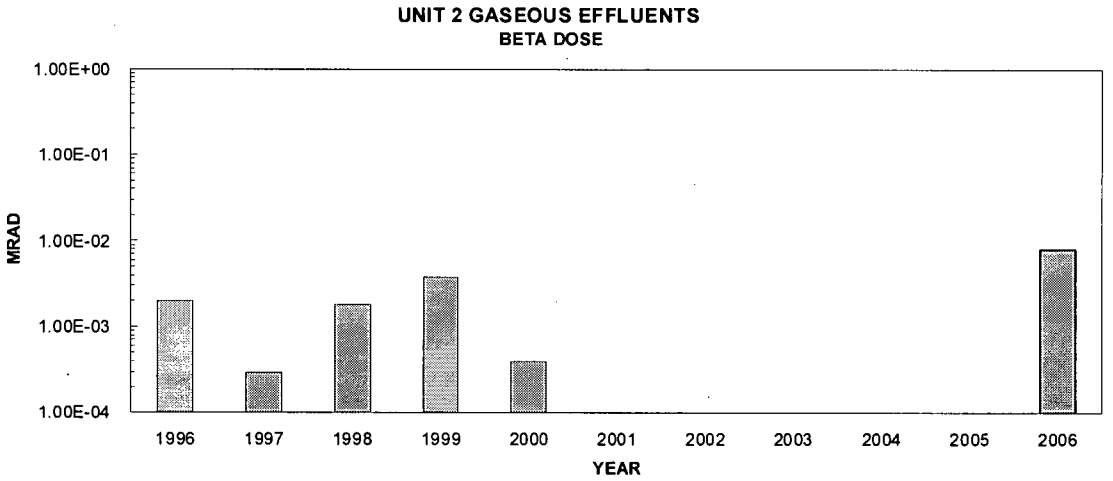

UNIT 2 GASEOUS EFFLUENTS
FISSION AND ACTIVATION PRODUCTS
CURIES
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
1.00E-01
1.00E-02
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
YEAR

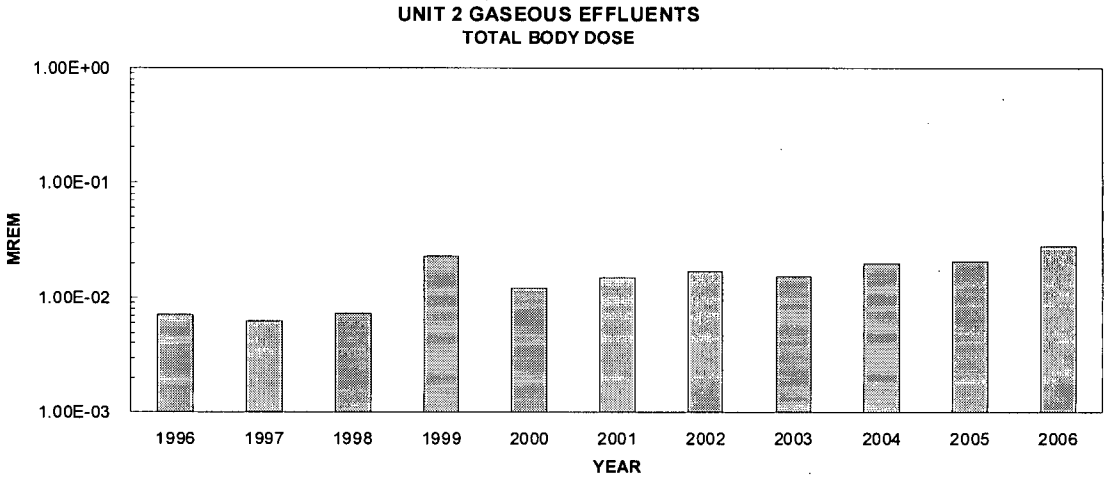

UNIT 2 GASEOUS EFFLUENTS
RADIOIODINES
CURIES
1.00E-01
1.00E-02
1.00E-03
1.00E-04
1.00E-05
1.00E-06
1.00E-07
1.00E-08
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
YEAR

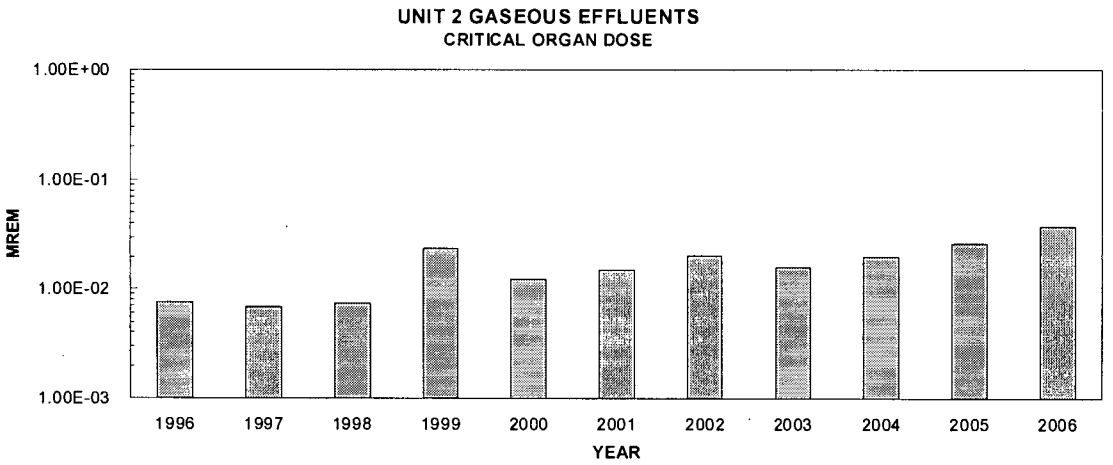

UNIT 2 GASEOUS EFFLUENTS
PARTICULATES
CURIES
1.00E+00
1.00E-01
1.00E-02
1.00E-03
1.00E-04
1.00E-05
1.00E-06
1.00E-07
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
YEAR

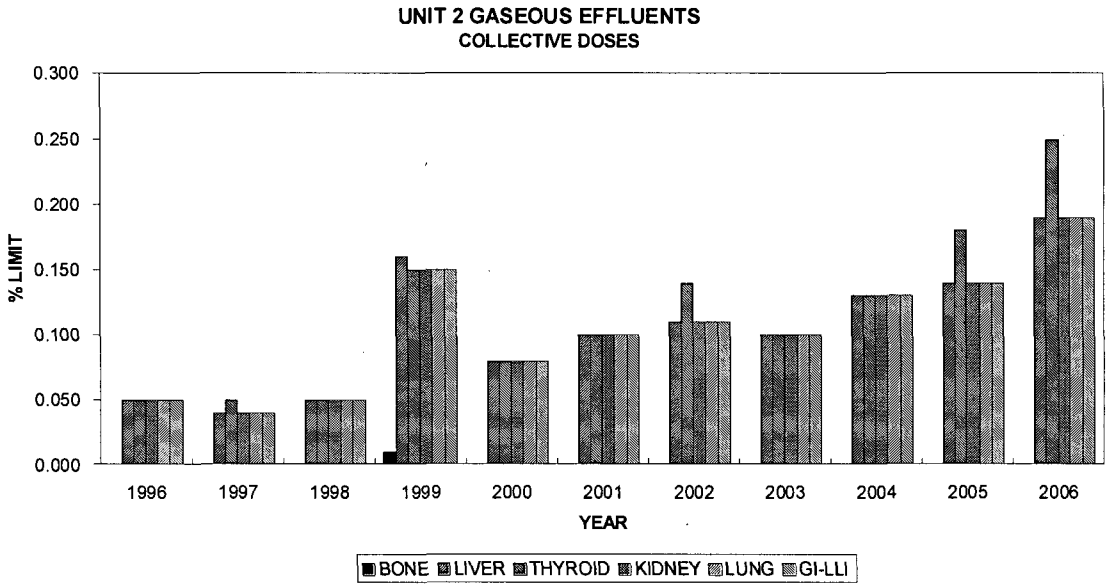

UNIT 2 GASEOUS EFFLUENTS
TRITIUM
CURIES
1.00E+02
1.00E+01
1.00E+00
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
YEAR


UNIT 2 GASEOUS EFFLUENTS
GAMMA DOSE
MRAD
1.00E+00
1.00E-01
1.00E-02
1.00E-03
1.00E-04
1.00E-05
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
YEAR


UNIT 2 GASEOUS EFFLUENTS
BETA DOSE
MRAD
1.00E+00
1.00E-01
1.00E-02
1.00E-03
1.00E-04
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
YEAR


UNIT 2 GASEOUS EFFLUENTS
TOTAL BODY DOSE
MREM
1.00E+00
1.00E-01
1.00E-02
1.00E-03
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
YEAR


UNIT 2 GASEOUS EFFLUENTS
CRITICAL ORGAN DOSE
MREM
1.00E+00
1.00E-01
1.00E-02
1.00E-03
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
YEAR


UNIT 2 GASEOUS EFFLUENTS
COLLECTIVE DOSES
0.300
0.250
0.200
0.150
0.100
0.050
0.000
% LIMIT
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
YEAR
BONE
LIVER
THYROID
KIDNEY
LUNG
GI-LLI

8. SOLID WASTE SUMMARY

As required by Regulatory Guide 1.21, Rev. 1, a summary of data for solid wastes shipped offsite is provided in the annual Radioactive Effluent Release Report.

This summary covers shipments from January 1 through December 31, 2006. The summary for solid waste shipments is as follows:

REGULATORY GUIDE 1.21 REPORT
EFFLUENT AND WASTE DISPOSAL ANNUAL SUMMARY REPORT
SOLID WASTE AND IRRADIATED FUEL SHIPMENTS
JANUARY 1, 2006 THROUGH JUNE 30, 2006

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, evaporator bottoms, etc.	m^3	5.26E+01	
	Ci	4.22E+02	±2.5E+01
b. Dry compressible waste, contaminated equip, etc.	m^3	7.40E+02	
	Ci	1.02E+00	±2.5E+01
c. Irradiated components, control rods, etc.	m^3	0.00E+00	
	Ci	0.00E+00	±2.5E+01
d. Other (describe):	m^3	0.00E+00	
	Ci	0.00E+00	±2.5E+01

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

a. Spent resins, filter sludges, evaporator bottoms, etc.

	%	Curies
H-3	0.029	1.24E-01
C-14	0.739	3.12E+00
Mn-54	2.667	1.13E+01
Fe-55	13.460	5.68E+01
Co-57	0.363	1.53E+00
Co-58	25.194	1.06E+02
Co-60	3.951	1.67E+01
Ni-59	0.277	1.17E+00
Ni-63	46.730	1.97E+02
Zn-65	0.000	1.50E-03
Sr-89	0.000	1.92E-03
Sr-90	0.055	2.33E-01
Tc-99	0.002	9.85E-03
Sb-125	0.374	1.58E+00
I-125	0.002	6.87E-03
Cs-134	2.400	1.01E+01
Cs-137	3.728	1.57E+01
Ce-144	0.022	9.49E-02
Am-241	0.003	1.36E-02
Cm-243	0.001	2.78E-03
Cm-244	0.001	2.77E-03

b. Dry compressible waste, contaminated equipment, etc.

	%	Curies
H-3	0.212	2.16E-03
C-14	0.261	2.66E-03
Cr-51	1.386	1.41E-02
Mn-54	2.144	2.19E-02
Fe-55	30.985	3.16E-01
Fe-59	0.015	1.55E-04
Co-57	0.469	4.78E-03
Co-58	42.480	4.33E-01
Co-60	5.522	5.63E-02
Ni-63	4.765	4.86E-02
Sr-90	0.005	5.23E-05
Zr-95	2.764	2.82E-02
Nb-95	3.960	4.04E-02
Sb-125	0.267	2.72E-03
I-125	0.009	9.58E-05
Cs-134	0.173	1.77E-03
Cs-137	4.558	4.65E-02
Ce-144	0.022	2.19E-04
Am-241	0.001	5.36E-06

c. Irradiated components, control rods, etc.

	%	Curies
None		

d. Other (describe):

	%	Curies
None		

3. Solid Waste Disposition

Number of Shipments	Mode of Transportation	Destination
13	Hittman Transport	Bear Creek Operations
2	Hittman Transport	Gallaher Road Operations
2	RACE Logistics, LLC	RACE, LLC
5	Hittman Transport	Studsvik Processing Facility

B. Irradiated Fuel Shipments (Disposition)

Number of Shipments	Mode of Transportation	Destination
None		

REGULATORY GUIDE 1.21 REPORT
EFFLUENT AND WASTE DISPOSAL ANNUAL SUMMARY REPORT
SOLID WASTE AND IRRADIATED FUEL SHIPMENTS
JULY 1, 2006 THROUGH DECEMBER 31, 2006

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, evaporator bottoms, etc.	m^3	1.50E+01	
	Ci	9.15E+01	±2.5E+01
b. Dry compressible waste, contaminated equip, etc.	m^3	1.03E+03	
	Ci	1.05E+00	±2.5E+01
c. Irradiated components, control rods, etc.	m^3	0.00E+00	
	Ci	0.00E+00	±2.5E+01
d. Other (describe): Sources for disposal.	m^3	9.81E-01	
	Ci	2.50E-01	±2.5E+01

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

a. Spent resins, filter sludges, evaporator bottoms, etc.

	%	Curies
H-3	0.068	6.27E-02
C-14	0.992	9.08E-01
Mn-54	1.048	9.59E-01
Fe-55	15.198	1.39E+01
Co-57	0.476	4.36E-01
Co-58	23.954	2.19E+01
Co-60	4.125	3.78E+00
Ni-59	0.274	2.50E-01
Ni-63	45.273	4.14E+01
Sr-90	0.087	7.98E-02
Tc-99	0.006	5.05E-03
Sb-125	0.597	5.47E-01
Cs-134	3.281	3.00E+00
Cs-137	4.586	4.20E+00
Ce-144	0.031	2.85E-02
Am-241	0.004	4.08E-03

b. Dry compressible waste, contaminated equipment, etc.

	%	Curies
H-3	1.211	1.27E-02
C-14	1.512	1.58E-02
Cr-51	0.077	8.03E-04
Mn-54	0.725	7.58E-03
Fe-55	12.997	1.36E-01
Fe-59	0.109	1.14E-03
Co-57	0.314	3.28E-03
Co-58	25.866	2.71E-01
Co-60	9.594	1.00E-01
Ni-63	20.736	2.17E-01
Sr-89	0.000	3.20E-06
Sr-90	0.029	3.04E-04
Zr-95	1.318	1.38E-02
Nb-95	2.596	2.71E-02
Sn-113	0.005	5.14E-05
Sb-125	1.522	1.59E-02
I-125	0.062	6.49E-04
Cs-134	0.989	1.03E-02
Cs-137	20.202	2.11E-01
Ce-141	0.007	7.25E-05
Ce-144	0.126	1.32E-03
Am-241	0.003	3.09E-05
Cm-242	0.000	3.18E-07

c. Irradiated components, control rods, etc.

	%	Curies

None

d. Other: Sources for disposal.

	%	Curies
C-14	0.000	1.48E-07
Na-22	0.000	4.07E-10
Cl-36	0.003	8.00E-06
Mn-54	0.000	1.19E-12
Co-57	0.001	1.44E-06
Co-58	0.000	1.65E-32
Co-60	49.632	1.24E-01
Sr-85	0.000	6.13E-09
Sr-90	0.065	1.63E-04
Y-88	0.002	3.96E-06
Tc-99	0.000	3.71E-07
Cd-109	0.011	2.81E-05
Sn-113	0.000	8.03E-07
I-131	0.000	3.59E-50
Cs-134	0.000	2.37E-09
Cs-137	49.813	1.24E-01
Ba-133	0.002	4.51E-06
Ce-139	0.000	7.06E-07
Ce-144	0.000	1.61E-13
Hg-203	0.000	9.88E-07
Tl-204	0.008	1.96E-05
Ra-226	0.013	3.25E-05
Th-230	0.000	3.95E-09
U-238	0.424	1.06E-03
Pu-239	0.001	1.96E-06
Am-241	0.024	6.09E-05

3. Solid Waste Disposition

Number of Shipments	Mode of Transportation	Destination
13	Hittman Transport	Bear Creek Operations
1	Union Pacific Railroad	Duratek Services Inc.
3	Hittman Transport	Gallaher Road Operations
1	Hittman Transport	RACE, LLC
2	RACE Logistics, LLC	RACE, LLC
1	Hittman Transport	Studsvik Processing Facility

B. Irradiated Fuel Shipments (Disposition)

Number of Shipments	Mode of Transportation	Destination
None		

9. UNPLANNED RELEASES

An unplanned release is defined as any release of radioactive material to the environment that does not meet the following criteria:

A. Sample analysis prior to release, and
B. Release calculations performed prior to release.

During 2006, there were no unplanned releases to an unrestricted area.

10. RADIATION INSTRUMENTATION

As required by ODCM Appendices 1 and 2, any radioactive effluent instrumentation inoperable for more than 30 days shall be reported in the annual Radioactive Effluent Release Report.

During 2006, there were no instances of radioactive effluent instrumentation inoperable for longer than 30 days.

11. CHANGES TO THE PROCESS CONTROL PROGRAM

As required by ODCM Appendices 1 and 2, a description of changes made to the Process Control Program (EN-RW-105) shall be included in the annual Radioactive Effluent Release Report for the period in which the change was made effective.

The following changes were made to the Process Control Program in 2006.

- Editorial clarification for definition of Batch
- Re-formatted in accordance to EN-AD-101
- Cancelled ENS-RW-105 and ENN-RW-105 and implemented Revision 0 as a fleet wide procedure. (EN-RW-105)

An additional clarification change was made in Section 1.0 to explain the purpose of the Process Control Program. A copy of the Process Control Program is contained in Attachment 3.

12. CHANGES TO THE OFFSITE DOSE CALCULATION MANUAL

In accordance with Unit 1 and Unit 2 TS, changes to the ODCM shall be included in the annual Radioactive Effluent Release Report for the period in which the change(s) was made effective.

There were no changes made to the ODCM during 2006.

13. LLD LEVELS

In accordance with ODCM Appendices 1 and 2, lower limits of detection (LLDs) higher than required shall be documented in the annual Radioactive Effluent Release Report.

During 2006, there were no LLDs higher than required.

14. RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

In accordance with ODCM Appendices 1 and 2 Limitations L2.6.1.A and L2.6.2.A, unavailability of milk or fresh, leafy vegetable samples, or an increase in an environmental sample location's calculated dose commitment must be identified in the annual Radioactive Effluent Release Report.

A. Changes in Sample Locations

During 2006, there were no changes to milk or fresh leafy vegetable sample locations or instances where milk or fresh leafy vegetable samples were unavailable.

B. Increase in Calculated Dose Commitment

There were no environmental sampling locations identified during 2006 that would yield a calculated dose commitment greater than the values currently being calculated.

15. SUMMARY OF HOURLY METEOROLOGICAL DATA

In accordance with ODCM Appendices 1 and 2 Limitations L3.2.1.D.1, in lieu of including a summary of the meteorological data in this report, the 2006 data is retained at ANO. This data is available for NRC review.

16. DESCRIPTION OF MAJOR CHANGES TO RADIOACTIVE WASTE SYSTEMS

There were no major changes made to the Unit 1 liquid and gaseous or Unit 2 liquid and gaseous radwaste systems during 2006.

17. INDEPENDENT SPENT FUEL STORAGE INSTALLATION (ISFSI) EFFLUENT RELEASES

No effluent releases occurred from the ISFSI during 2006.

Attachment 2
to
0CAN020704

Offsite Dose Calculation Manual

Offsite Dose Calculation Manual

Arkansas Nuclear One

Revision 014-03-0

Record of Revision

Rev. No.	Pages Affected	Approved (Implemented) Date
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TABLE OF CONTENTS

PAGE

1.0 INTRODUCTION 5

2.0 LIQUID EFFLUENTS 6

2.1 Radioactive Liquid Effluent Monitor Setpoint 6

2.2 Liquid Dose Calculation 8

2.2.1 Dose Calculations for Aquatic Foods 8

2.2.2 Dose Calculations for Potable Water 10

2.3 Liquid Projected Dose Calculation 12

3.0 GASEOUS EFFLUENTS 12

3.1 Gaseous Monitor Setpoints 12

3.1.1 Batch Release Setpoint Calculations 13

3.1.2 Eberline SPING (Final Effluent) Monitor Setpoint Calculations 14

3.2 Airborne Release Dose Rate Effects 16

3.2.1 Noble Gas Release Rate 16

3.2.2 I-131, Tritium and Particulate Release Dose Rate Effects 19

3.3 Dose Due to Noble Gases 19

3.3.1 Beta and Gamma Air Doses from Noble Gas Releases 20

3.4 Dose Due to I-131, Tritium and Particulates in Gaseous Effluents 20

3.4.1 Total Dose from Atmospherically Released Radionuclide 22

3.5 Gaseous Effluent Projected Dose Calculation 33

3.6 Dose to the Public Inside the Site Boundary 34

3.6.1 Liquid Releases 34

3.6.2 Airborne Release 35

TABLE OF CONTENTS (Continued)

PAGE

4.0 ENVIRONMENTAL SAMPLING STATIONS - RADIOLOGICAL..... 36

FIGURES

Figure 4-1 Radiological Sample Stations..... 38
Figure 4-2 Maximum Area Boundary for Radioactive Release Calculation (Exclusion Area..... 40

TABLES

Table 4-1 Environmental Sampling Stations - Radiological..... 42

APPENDICES

Appendix 1 Radiological Effluent Controls - Unit 1..... 50

1.0 DEFINITIONS..... 51

2.0 RELEASE CONTROLS..... 54

2.1 Radioactive Liquid Effluent Monitoring Instrumentation..... 56

2.2 Radioactive Gaseous Effluent Monitoring Instrumentation..... 62

2.3 Radioactive Liquid Effluents..... 73

2.3.1 Concentration..... 73

2.3.2 Dose..... 79

2.3.3 Waste Treatment..... 80

2.4 Radioactive Gaseous Effluents..... 81

2.4.1 Dose Rate..... 81

2.4.2 Dose - Noble Gases..... 85

2.4.3 Dose - Iodine-131, Tritium, And Radionuclides in Particulate Form..... 86

2.4.4 Gaseous Radwaste Treatment..... 87

2.5 Radioactive Effluents..... 88

2.5.1 Total Dose..... 88

TABLE OF CONTENTS (Continued)

PAGE

2.6 Radiological Environmental Monitoring..... 90

2.6.1 Radiological Environmental Monitoring Program Description..... 90

2.6.2 Land Use Census..... 100

2.6.3 Interlaboratory Comparison Program..... 102

3.0 ADMINISTRATIVE CONTROLS..... 103

3.1 Programs..... 103

3.2 Radioactive Effluent Release Report..... 104

3.3 Annual Radiological Environmental Operating Report..... 106

3.4 Special Reports..... 107

4.0 UNIT 1 MAIN STEAM LINE RADIATION MONITORS..... 108

Appendix 2 Radiological Effluent Controls - Unit 2..... 111

1.0 DEFINITIONS 112

2.0 RELEASE CONTROLS..... 115

2.1 Radioactive Liquid Effluent Monitoring Instrumentation..... 117

2.2 Radioactive Gaseous Effluent Monitoring Instrumentation..... 123

2.3 Radioactive Liquid Effluents..... 137

2.3.1 Concentration..... 137

2.3.2 Dose..... 142

2.3.3 Waste Treatment..... 143

2.4 Radioactive Gaseous Effluents..... 144

2.4.1 Dose Rate..... 144

2.4.2 Dose - Noble Gases..... 148

2.4.3 Dose - Iodine-131, Tritium, And Radionuclides in Particulate Form..... 150

2.4.4 Gaseous Radwaste Treatment..... 152

TABLE OF CONTENTS (Continued)

PAGE

2.5 Radioactive Effluents..... 154

2.5.1 Total Dose..... 154

2.6 Radiological Environmental Monitoring..... 156

2.6.1 Monitoring Program..... 156

2.6.2 Land Use Census..... 166

2.6.3 Interlaboratory Comparison Program..... 168

3.0 ADMINISTRATIVE CONTROLS..... 169

3.1 Programs..... 169

3.2 Radioactive Effluent Release Report..... 170

3.3 Annual Radiological Environmental Operating Report..... 172

3.4 Special Reports..... 173

1.0 INTRODUCTION

The Offsite Dose Calculation Manual (ODCM) provides guidance for making release rate and dose calculations for radioactive liquid and gaseous effluents from Arkansas Nuclear One - Units 1 and 2. The methodology is drawn from NUREG-0133, Rev. 0. Parameters contained within this manual were taken from NUREG-0133 and Regulatory Guide 1.109 except as noted for site specific values. These numbers and the calculational method may be changed as provided for in the Technical Specifications.

The following references are utilized in conjunction with the limitations included in this manual concerning the indicated subjects:

Subject	ANO-1	ANO-2
Process Control Program (PCP)	NMM RW-105	NMM RW-105
Radioactive Effluent Controls Program	TS 5.5.4	TS 6.5.4
Annual Radiological Environmental Monitoring Report	TS 5.6.2	TS 6.6.2
Radioactive Effluent Release Report	TS 5.6.3	TS 6.6.3
Offsite Dose Calculation Manual	TS 5.5.1	TS 6.5.1

2.0 LIQUID EFFLUENTS

2.1 Radioactive Liquid Effluent Monitor Setpoint

The Radioactive Liquid Effluent Instrumentation Limitation requires that the radioactive liquid effluents be monitored with the alarm/trip setpoints adjusted to ensure that the limits of the radioactive liquid effluent concentration limitations are not exceeded. These concentrations are for the site. The alarm/trip setpoint on the liquid effluent monitor is dependent upon the dilution water flowrate, radwaste tank flowrate, isotopic composition of the radioactive liquid to be discharged, a gross gamma count of the liquid to be discharged, background count rate of the monitor, and the efficiency of the monitor. Due to the fact that these are variables, an adjustable setpoint is used. The setpoint must be calculated and the monitor setpoint set prior to the release of each batch of radioactive liquid effluents. The following methodology is used for the setpoint determination for the following monitors.

ANO-1: RE-4642 Liquid Radwaste Monitor

ANO-2: 2RE-2330 Liquid Radwaste Monitor
2RE-4423 Liquid Radwaste Monitor

1) A sample from each tank (batch) to be discharged is obtained and counted for gross gamma (Cs-137 equivalent) and a gamma isotopic analysis is performed.

2) A dilution factor (DF) for the tank is calculated based upon the results of the gamma isotopic analysis and the Maximum Permissible Concentration (MPC) of each detected radionuclide.

   DF is calculated as follows:

$$DF = \Sigma_i \ (C_i/MPC_i) + C_{TNG}/MPC_{TNG}$$

   where:

   DF = dilution factor;

   C_i = concentration of isotope "i", (µCi/ml);

   MPC_i = maximum permissible concentration of isotope "i", (from 10 CFR 20, Appendix B, Table II, column 2 in µCi/ml);

   C_{TNG} = total concentration of noble gases (µCi/ml); and

   MPC_{TNG} = 2×10^{-4} (µCi/ml) per Appendix 1, Limitation L2.3.1.A and Appendix 2, Limitation L2.3.1.A.

3) The dilution water flowrate is normally the number of ANO-1 circulating water pumps in operation at the time of release. Each circulating water pump has an approximate flowrate of 191,500 gpm (this flowrate may be reduced due to throttling of circ water pump flow and/or circ water bay configuration). However, under specific conditions and under strict controls, lower dilution water flowrates utilizing service water and cooling tower blowdown flowrates may be used.

4) The theoretical release rate, F_m, of the tank (batch) to be released is expressed in terms of the dilution water flowrate, such that for each volume of dilution water released, a given volume of liquid radwaste may be combined. This may be expressed as follows:

$$F_m = DV/DF$$

where:

F_m = theoretical release rate (gpm);

DV = Dilution volume (gpm). When ANO-1 circulating water pumps are running, DV is the number of ANO-1 circulating water pumps in operation multiplied by the approximate flowrate of an ANO-1 circulating water pump (normally 191,500 gpm) or an indicated flow rate. The minimum total flow rate shall be greater than or equal to 100,000 gpm. Otherwise DV is dilution volume provided by service water and cooling tower blowdown flowrate; and

DF = dilution factor as calculated in Step 2 above.

> NOTE
>
> In the above equation, the theoretical release rate (F_M) approaches zero as the dilution factor increases. The actual flowrate (F_A) will normally be equal to the theoretical release rate for high activity releases. For low activity releases, the theoretical release rate becomes large and may exceed the capacity of the pump discharging the tank. In these cases, the actual release rate may be set to the maximum flowrate of the discharge pump.

5) The monitor setpoint is calculated by incorporating the monitor reading prior to starting the release (i.e., background countrate), and a factor which is the amount of increase in the release concentration that would be needed to exceed the radioactive liquid concentration limitation. The monitor setpoint is expressed as follows:

$$M_L = A*(K*F_M/F_A) + B$$

where:

M_L = monitor setpoint (CPM);

A = allocation fraction for the specific unit. (Typically, these values are set at 0.45, but may be adjusted up or down as needed. However, the total site allocation can not exceed 1.0.)

K = monitor countrate (CPM) expected based on the gross activity of the release. (This value is obtained from a graph of activity (µCi/ml) versus output countrate for the monitor (CPM));

F_M/F_A = number of times the activity would have to increase to exceed the radioactive liquid effluent-concentration limitation; and

B = background countrate (CPM) prior to the release.

To permit the computer to calculate the setpoint, an equation for the expected countrate (K) is expressed as follows:

$$K = \text{Slope} * 10^{S_A} + \text{Offset}$$

where:

$$\text{Slope} = \frac{\text{Log of the detector response in CPM}}{\text{Log of activity concentration in } \mu\text{Ci/ml}}$$

S_A = Gross gamma (Cs-137 equivalent) activity for the tank (µCi/ml); and

Offset = detector response (CPM) for the minimum detectable sample activity calculated from the calibration data.

> NOTE
> I&C personnel use varying concentrations of Cs-137 to determine the response curve; therefore, a Cs-137 equivalent activity must be used to accurately predict the countrate.

Combining terms, the equation for determining the monitor setpoint may be expressed as follows:

$$M_L = A * [(\text{Slope} * 10^{S_A} + \text{Offset}) * F_M/F_A] + B$$

2.2 Liquid Dose Calculation

The "dose" or "dose commitment" to an individual in the unrestricted area shall be less than or equal to the limits specified in Radioactive Liquid Effluents-Dose Appendix 1 and Appendix 2 Limitations. The dose limits are on a per reactor basis. This value is calculated using the Adult as the maximum exposed individual via the aquatic foods (Sport Freshwater Fish) and the potable water pathways.

2.2.1 Dose Calculations for Aquatic Foods

The concentrations of radionuclides in aquatic foods are assumed to be directly related to the concentrations in water. The equilibrium ratios between the two concentrations are called "bioaccumulation factors".

Two different pathways are calculated for aquatic foods: sport and commercial freshwater fish.

The internal dose "d" from the consumption of aquatic foods in pathway "p" to organ "j" of individuals of age group "a" from all nuclides "i" is computed as follows: (See Chapter 4 of NUREG-0133 and Regulatory Guide 1.109-12, equation A-3).

$$d_p(r,\theta,a,j) = \Sigma_i \{1100*e^{-\lambda_i t_p}*B_i\}*M*U_a*F^{-1}*Q_i*D_{aij}$$

The total dose from both aquatic food pathways is then:

$$D(r,\theta,a,j) = \sum_p d_p(r,\theta,a,j)$$

where:

r = user-selected distance from the release point to the receptor location, in kilometers. It may be different from the controlling distance specified for the potable water pathway (0.4 km);

θ = user-selected sector (one of sixteen 22.5° sectors surrounding the reactor site, designated N, NNE, NE, ... etc). This sector may be different from the controlling sector specified for the potable water pathway (S);

a = user-selected age group: infant, child, teen, adult. It is the same controlling age group used in the potable water pathway (adult);

j = user-selected organ: bone, liver, total body, thyroid, kidney, lung, GI-LLI. It is the same controlling organ used in the potable water pathway (liver);

{ } = represents the concentration factor stored in the database;

> NOTE
> Only one concentration factor is needed to represent the two pathways since sport and commercial use the same bioaccumulation factor for a given pathway.

1100 = factor to convert from (Ci/yr)/(ft³/sec) to pCi/liter;

λ_i = decay constant of nuclide "i" in hr^{-1};

t_p = environmental transit time, release to receptor;

> NOTE
> This value should be set to 0 hours (i.e., no decay correction) for the above equation in order to be consistent with the equation presented in Chapter 4 of NUREG-0133. For maximum individual dose calculations, this value is set to 24 hours, which is the minimum transit time recommended by Regulatory Guide 1.109, Appendix A, 2.b.

B_i = bioaccumulation factor for nuclide "i", in ρCi/kg per ρCi/liter. Cesium has a site specific number based on carnivorous and bottom feeder sport fish of 400 ρCi/kg per ρCi/liter (0CAN048408, dated April 13, 1984); Niobium has a site specific number based upon freshwater fish of 300 ρCi/kg per ρCi/liter.

M = dimensionless mixing ratio (reciprocal of the dilution factor) at the point of exposure;

U_a = annual usage factor that specifies the intake rate for an individual of age group "a", in kilograms/year. The program selects this usage factor in accordance with the controlling age group "a" as specified previously by the user;

F = average flow rate in ft^3/sec. This value is based on total dilution volume for the quarter divided by time into the quarter;

Q_i = number of curies of nuclide "i" released; and

D_{aij} = ingestion dose factor for age group "a", nuclide "i", and organ "j", in mrem per ρCi ingested. The program selects the ingestion dose factor according to the user-specified controlling age group "a" and controlling organ "j".

2.2.2 Dose Calculations for Potable Water

The dose "D" from ingestion of water to organ "j" of individuals of age group "a" due to all nuclides "i" is calculated as follows (See Chapter 4 of NUREG-0133 and NRC Reg. Guide 1.109-12, equation A-2):

NOTE

The potable water pathway is used only during the time that the Russellville Water System is using the Arkansas River as a water source. The Russellville Water Works will notify ANO when they are using the Arkansas River as a water source.

$$D(r,\theta,a,j) = \Sigma_i \left[\{1100 * e^{-\lambda_i t_p}\} * M * U_a * F^{-1} * Q_i * D_{aij} \right]$$

where:

r = user-selected distance (0.4 km) from the release point to the receptor location, in kilometers. It may be different from the controlling distance selected for the aquatic food pathway;

θ = user-selected sector; (one of the sixteen 22.5° sectors surrounding the reactor site, designated N, NNE, NE, ... etc.). It may be different from the controlling sector for the aquatic food pathway;

a = user-selected age group (infant, child, teen, adult). The same controlling age group is used for all liquid pathways (adult);

j = user-selected organ (bone, liver, total body, thyroid, kidney, lung, GI-LLI). The same controlling organ is used for all liquid pathways (liver).

{} = the expression in brackets represents the concentration factor stored in the database;

1100 = factor to convert from (Ci/yr)/(ft³/sec) to ρCi/liter;

M = dimensionless mixing ratio (reciprocal of the dilution factor) at the point of exposure;

λ_i = decay constant of nuclide "i" in hr^{-1}; and

t_p = environmental transit time, release to receptor.

NOTE

This value is set to 0 hours (i.e., no decay correction) for the above equation to be consistent with the equation presented in Chapter 4 of NUREG-0133.

U_a = annual usage factor that specifies the intake rate for an individual of age group "a", in liters/year. The program selects this usage factor according to the user-specified controlling age group "a";

F = average flow rate in ft^3/sec; this value is based on total dilution volume for one quarter divided by time into the quarter;

Q_i = number of curies of nuclide "i" in the release; and

D_{aij} = ingestion dose factor, for age group "a", nuclide "i", and organ "j", in mrem per ρCi ingested. The program selects the ingestion dose factor according to the user-specified controlling age group "a" and controlling organ "j".

2.3 Liquid Projected Dose Calculation

The quarterly projected dose is based upon the methodology of Section 2.2 and is expressed as follows:

$$D_{QP} = 92*(D_{QC} + D_{RP})/T$$

where:

D_{QP} = quarterly projected dose (mrem);

92 = number of days per quarter;

D_{QC} = cumulative dose for the quarter (mrem);

D_{RP} = dose for current release (mrem); and

T = current days into quarter;

3.0 GASEOUS EFFLUENTS

3.1 Gaseous Monitor Setpoints

NOTE

Sections 3.1.1 and 3.1.2 below detail two methods of calculating setpoints at ANO. These methods cover two different sets of monitors of which only one will be in-service at any one time.

3.1.1 Batch Release Setpoint Calculations

3.1.1.a This section applies to the following gaseous radiation monitors (These releases are also monitored by the SPING monitors in Section 3.1.2):

ANO-1	
RE-4830*	Waste gas holdup system monitor
RX-9820	Unit 1 Containment Purge SPING
ANO-2	
2RE-8233	Containment purge
2RX-9820	Unit 2 Containment Purge SPING
2RE-2429*	Waste gas holdup system monitor

* These monitors provide automatic isolation for the waste gas holdup systems.

The setpoints to be used during a batch type of release (i.e., reactor building [containment] purge, release from the waste gas holdup system or any other non-routine release) will be calculated for each release before it occurs.

3.1.1.b The basic methodology for determining a monitor setpoint is based upon the expected concentration at the monitor (C_M). This is in turn based upon the fraction of an MPC assigned to this release point. Batch releases are maintained below the assigned MPC fraction by controlling the release rate. The calculated value of S may not exceed the equivalent of 1 MPC at site boundary. If value of S for RX(2RX)-9820 is less than SPING channel 5 high alarm setpoint, then high alarm setpoint may be used as a default value. If value of S for RE-4830 and 2RE-2429 is less than 50,000 counts/min, then 50,000 counts/min may be used as a minimum setpoint. If value of S for 2RE-8233 is less than 1,000 counts/min, then 1,000 counts/min may be used as a minimum setpoint.

$$S = 1.2 * (C_M * K) + (2.0 * B)$$

where:

S = monitor setpoint (counts/min);

C_M = Xe-133 equivalent concentration at the monitor (µCi/ml);

K = conversion factor determined from response curve of monitor (counts/min per µCi/ml). This value is 1.0 when calculating S for RX(2RX)-9820.

2.0 = factor to accommodate random count rate fluctuations;

B = background count rate at the monitor (counts/min).

1.2 = Safety Factor to correct for instrument uncertainties.

3.1.2 Eberline SPING (Final Effluent) Monitor Setpoint Calculations

3.1.2.a This section applies to the following gaseous radiation monitors:

ANO-1

RX-9820	Containment Purge
RX-9835	Hydrogen Purge/Emerg. Pen. Room Vent.
RX-9830	Fuel Handling Area
RX-9825	Radwaste Area

ANO-2

2RX-9820	Containment Purge
2RX-9840	PASS Bldg.
2RX-9845	Aux. Bldg. Ventilation
2RX-9835	Hydrogen Purge/Emerg. Pen. Room Vent.
2RX-9830	Fuel Handling Area
2RX-9825	Radwaste Area
2RX-9850	Low-Level Radwaste Storage Building

The determination of setpoints for the above monitors is based on an assigned fraction of the MPC of noble gas activity at the site boundary, (Xe-133 equivalent) released from the above release points. The total of these fractions is always less than 1.00. The assigned fractions are based on the vent flow rates, atmospheric dilution rate, and the ventilation system(s) in operation.

> NOTE
> The fact that an effluent monitor is in alarm does not necessarily mean that radioactive gases are being released at such a rate that the MPC limit is being exceeded. The alarm would indicate that radioactive gases are being released at a rate that is exceeding the fractional allocation of an MPC allotted to that particular release point. Consideration must be given to the release rate of radioactive gases via all of the release pathways.

The initial fractions of an MPC allocated to the release points are given below. The allocations may be changed as needed, to allow for operational transients, but may not exceed a site total of 1.00.

Monitor Number	Monitor Name	Fractional Allocation
RX-9820	Containment Purge	0.1000
RX-9835	Hydr. Purge/Emerg. Pen. Rm. Vent.	0.0001
RX-9830	Fuel Handling Area	0.1500
RX-9825	Radwaste Area	0.2000

Monitor Number	Monitor Name	Fractional Allocation
2RX-9820	Containment Purge	0.1000
2RX-9840	PASS Bldg.	0.0100
2RX-9845	Aux. Bldg. Ventilation	0.0100
2RX-9835	Hydr. Purge/Emerg. Pen. Rm. Vent.	0.0001
2RX-9830	Fuel Handling Area	0.1500
2RX-9825	Radwaste Area	0.2000
2RX-9850	Radwaste Storage Bldg.	0.0100

NOTE

The setpoints to be used during a batch release (i.e., reactor building [containment] purge, release from the waste gas holdup system) will be calculated for each release before it occurs.

3.1.2.b SPING monitor setpoints may be calculated as follows:

$$\text{Setpoint } (\mu Ci/cc) = A * \left[\frac{\text{Xe-133 eq } (\mu Ci/cc)}{F*1.3215E-9*TMPC} \right]$$

where:

A = allocation fraction (the fraction of an MPC at the site boundary (of noble gas Xe-133 eq activity) assigned to the particular release point);

Xe-133 eq = Xenon-133 equivalent concentration;

F = discharge flow of the particular release point in CFM;

$$1.3215E-9 = 2.8317E-2(cm/cf) * \left[\frac{2.8E-6(sec/m^3)}{60(sec/min)} \right]$$

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 ρCi/m³ of nuclide "i" at the user-specified controlling distance in sector θ (1.05 km);

(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(θ) = annual average gaseous dispersion factor (corrected for radioactive decay) in the sector at angle "θ" at the receptor location in sec/m³. This value is 2.8E-6 sec/m³ for short term releases.

The annual dose to the total body and skin due to noble gas can be calculated according to Sections 3.1.2.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:

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

where:

$D^T(\theta)$ = total body dose rate due to immersion in a semi-infinite cloud of gas at the controlling distance in sector "θ", in mrem/yr. The program computes one total body dose rate value for each sector in which the user has specified a controlling distance and reports only the maximum value;

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

RBPF = Reactor Building (Containment) Purge Factor - This factor is used to calculate the length of time (fractional duty cycle) that the purge fans will be in operation. It is calculated by comparing the highest dose rate (DOSER) to its applicable release limit, taking into account the allocation factor for the release point (RBPF = Allocation* Limit/DOSER). This factor is calculated only for Unit One and Two Reactor Building (Containment) Purges. For all other releases, this factor is set to 1.0;

S_F = dimensionless attenuation factor accounting for the dose reduction due to shielding by residential structures. The NRC recommended value is 0.7 (for maximum individual);

$x_i(\theta)$ = average ground-level concentration of nuclide "i" at the receptor location in the sector at angle "θ" from the release point, as defined in Section 3.2.1.a; and

DFB_i = total body dose factor for a semi-infinite cloud of radionuclide "i", which includes the attenuation of 5 g/cm² of tissue, in mrem-m³/ρCi-yr

3.2.1.c Annual Skin Dose Rate

The annual dose rate to the skin of the maximally exposed individual due to noble gases is calculated as follows. (See Regulatory Guide 1.109-20 equation B-9)

$$D^S(\theta) = RBPF \left[1.11 * S_F * \Sigma_i (x_i(\theta) * DF_i^\gamma) + \Sigma_i (x_i(\theta) * DFS_i) \right]$$

where:

$D^S(\theta)$ = skin dose due to immersion in a semi-infinite cloud of gas at the user-specified controlling distance in sector "θ", in mrem;

> NOTE
> The program computes a skin dose value for each sector in which the user has specified a controlling distance, but prints out only the maximum value.

RBPF = Reactor Building (Containment) Purge Factor as defined in Section 3.2.1.b.

1.11 = average ratio of tissue to air energy absorption coefficient;

S_F = dimensionless attenuation factor accounting for the dose reduction due to shielding by residential structures. The value is 0.7 (for maximum individual);

$x_i(\theta)$ = is the average ground-level concentration of nuclide "i" at the receptor location in the sector at angle "θ" from the release point, as defined in Section 3.2.1;

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

DF_i^γ = gamma air dose factor for a semi-infinite cloud of radionuclide "i", in mrad-m³/ρCi-yr; and

DFS_i = beta skin dose factor for a semi-infinite cloud of radionuclide "i", which includes the attenuation by the outer "dead" layer of skin, in mrem-m³/ρCi-yr.

3.2.2 I-131, Tritium and Particulate Release Dose Rate Effects

The annual dose rate to the maximally exposed individual for I-131, tritium and radionuclides in particulate form with half-lives greater than eight days is calculated as follows:

$$DR^{TOT} = RBPF * \left[DR^{I} + DR^{G} + DR^{M} \right]$$

where:

RBPF = Reactor Building (Containment) Purge Factor as defined in Section 3.2.1.b;

DR^{I} = dose rate to the controlling age group (infant) associated with the inhalation of radioiodines and particulates, as calculated in Section 3.4.1.b;

DR^{G} = dose rate from direct exposure to activity deposited on the ground plane, as calculated in Section 3.4.1.a; and

DR^{M} = dose rate to the controlling age group (infant) and the controlling organ for ingestion of food (milk), as calculated in Section 3.4.1.d.

Calculation of the annual dose rate considers the infant as the most restrictive age group. The organs that are considered as contributing to the dose rate are: skin, bone, liver, total body, thyroid, kidney, lung, and GI-LLI. The food pathway for the infant is considered to be from milk only. All three pathways will contribute to the total body dose, while the skin will be affected by only the ground plane pathway. The other organs are affected only by the inhalation and food pathways.

3.3 Dose Due to Noble Gases

The air dose in unrestricted areas due to noble gases released in gaseous effluents shall be less than or equal to 5 mrad for gamma radiation and 10 mrad for beta radiation for any calendar quarter for each unit. The objective of less than or equal to 10 mrad of gamma radiation and 20 mrad of beta radiation for a calendar year per unit (2.5 mrad and 5 mrad respectively per quarter) should be used for planning releases.

NOTE

The following equations have been simplified from equations in NUREG-0133, Rev. 0, in that there are no free-standing stacks at ANO. The equations were further simplified in that there are no long term (i.e., continuous) releases. The individual stack vents are sampled weekly and are assigned a release period of 168 hours per sample (i.e., considered as short term (batch) releases). Individual samples are to be taken for each waste gas tank release and reactor building (containment) purge.

3.3.1 Beta and Gamma Air Doses from Noble Gas Releases

Using the average ground level concentration of radionuclide "i" at the receptor location calculated in Section 3.2.1.a, the associated annual gamma or beta air dose may be calculated by the following equation. (See Regulatory Guide 1.109-20 equation B-5.)

$$D^{\gamma}(\theta) \ \underline{or} \ D^{\beta}(\theta) = \Sigma_i \left[x_i(\theta) * (DF_i^{\gamma} \ \underline{or} \ DF_I^{\beta}) \right]$$

where:

$D^{\gamma}(\theta)$ or $D^{\beta}(\theta)$ = the gamma or beta air dose for the controlling distance in sector "θ". (Only the maximum value is reported), and

DF_i^{γ} or DF_i^{β} = gamma or beta air dose factors for a uniform semi-infinite cloud of nuclide "i", in mrad-m³/ρCi-yr.

3.4 Dose Due to I-131, Tritium, and Particulates in Gaseous Effluents

The calculational methodology for determining the dose to an individual from I-131, tritium, and radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released to unrestricted areas as specified in the Appendix 1 and Appendix 2 Limitations is in this section.

The child is the controlling age group unless stated otherwise.

The inhalation and ground plane pathways are considered to exist at all locations. The grass-cow-milk, grass-cow-meat, and vegetation pathways are used where applicable.

It is assumed that iodines are in the elemental form.

A dispersion parameter of 2.8E-6 sec/m³ (per ANO-2 SAR, Section 2.3.4.4) is used for "w" in the inhalation pathway since the majority of gaseous activity released from the site is within the 8 to 24 hours time frame (i.e., reactor building [containment] purges and waste gas decay tanks).

The equation is:

$$D^{TOT} = D^{G} + D^{I} + D^{V} + D^{L} + D^{M} + D^{F}$$

where:

D^{TOT} = total dose;

D^{G} = dose contribution from ground plane deposition as calculated in Section 3.4.1.a;

D^{I} = dose contribution from inhalation of radioiodines, tritium, and particulates (>8 days) as calculated in Section 3.4.1.b;

D^{V} = dose contributions from consumption of vegetation (defined as produce) for humans and stored feed for cattle. See Section 3.4.1.c for calculations;

D^{L} = dose contributions from consumption of fresh leafy vegetables (defined as garden products) for humans and pasture grass for cattle. See Section 3.4.1.c for calculations;

D^{M} = dose contribution from consumption of cow's milk; and

> NOTE
> Consumption by the cow of both stored feeds and pasture grasses is taken into account when calculating this dose contribution. Concentration factors for both food sources are calculated.

D^{F} = dose contribution from consumption of meat.

> NOTE
> Consumption by the cow of both stored feeds and pasture grasses is taken into account when calculating this dose contribution. Concentration factors for both types of animal are calculated.

3.4.1 Total Dose from Atmospherically Released Radionuclide

After the calculation of the concentration factors from the applicable parts of Section 3.4.1, the maximum individual dose as calculated for controlling age group "a" and controlling organ "j", in sector θ at the controlling distance "r" is given from:

$D^G(r,\theta,j,a)$ (Section 3.4.1.a) for ground plane deposition

$D^I(r,\theta,j,a)$ (Section 3.4.1.b) for inhalation

$$D^V(r,\theta,j,a) = \sum_i DFI_{ija} U_a^V C_i^V(r,\theta)$$ for produce

$$D^L(r,\theta,j,a) = \sum_i DFI_{ija} U_a^L C_i^L(r,\theta)$$ for leafy vegetables

$$D^M(r,\theta,j,a) = \sum_i DFI_{ija} U_a^m C_i^m(r,\theta)$$ for cow's milk

$$D^F(r,\theta,j,a) = \sum_i DFI_{ija} U_a^F C_i^F(r,\theta)$$ for meat

where:

a = controlling age group (infant, child, teen, or adult);

j = controlling organ (bone, liver, total body, thyroid, kidney, lung, or GI-LLI);

r = user-selected distance from the release point to the receptor location in a particular sector, in kilometers. (The controlling distance is the same for all airborne pathways, 1.05 km.);

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

DFI_{ija} = dose conversion factor for ingestion of nuclide "i", organ "j", and age group "a", in mrem/ρCi;

NOTE

Values used in these tables are taken from Tables E-11 through E-14 of Regulatory Guide 1.109. DFI_{ija} is selected according to the controlling organ and age group as specified in the database.

U_a^V, U_a^L, U_a^M, U_a^F = ingestion rates for produce, leafy vegetables, cow's milk, and meat, respectively, for individuals in age group "a". Values used are taken from Table E-5 of Regulatory Guide 1.109.);

C_i^V, D_i^L, C_i^M, D_i^F = concentration of nuclide "i" for produce, leafy vegetables, cow's milk, and meat, respectively, in ρCi/kg or ρCi/liter.

The program calculates that maximum individual dose for each sector surrounding the plant in which the user has specified a controlling distance for each of the following pathways: A) ground plane deposition; B) inhalation and the ingestion of; C) produce; D) leafy vegetables; E) cow's milk; and F) meat. Only the receptor point receiving the maximum dose value is printed.

3.4.1.a Dose from Ground Plane Deposition

The dose D^G from direct exposure to activity deposited on the ground plane is calculated as follows (see Regulatory Guide 1.109-24, equations C-1 and C-2):

$$D^G(r,\theta,j,a) = \{S_F * 1.0 \times 10^{12} * \Sigma_i \left[\lambda_i^{-1} * (1 - e^{-\lambda_i t_b}) \right]\} * DOQ(r,\theta) * Q_i * DFG_{ij}$$

where:

r = user-selected distance from the release point to the receptor location in a particular sector, in kilometers. The controlling distance is the same for all airborne pathways (1.05 km);

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

a = user-selected age group (infant, child, teen, adult) which is the same controlling age group used for all airborne pathways (child);

j = user-selected organ (bone, liver, total body, thyroid, kidney, lung, GI-LLI) which is the same controlling organ used for all airborne pathways;

{ } = represents the concentration factor stored in the database;

S_F = dimensionless attenuation factor accounting for the dose reduction due to shielding by residential structures. The value is 0.7 (for maximum individual);

1.0×10^{12} = number of ρCi per Ci;

λ_i = decay constant of nuclide "i" in hr^{-1};

t_b = length of time over which the accumulation is evaluated (nominally 15 years which is the approximate midpoint of facility operating life or 1.31×10^5 hours);

$DOQ(r,\theta)$ = average relative deposition of the effluent at the receptor location "r" in sector "θ", considering depletion of the plume during transport, in m^{-2};

Q_i = release of nuclide "i" in curies, and

DFG_{ij} = open field ground plane dose conversion factor for organ "j" (total body or skin) from radionuclide "i", in mrem-m²/ρCi-hr. The dose factor is selected according to the user-specified controlling age group "a" and controlling organ "j".

3.4.1.b Dose from Inhalation of Radionuclides in Air

The dose D^I to organ "j" of age group "a" associated via inhalation of radioiodines and particulates is (see Reg. Guide 1.109-25, Equations C-3 and C-4):

$$D^I(r,\theta,j,a) = 3.17 \times 10^4 * R_a * \Sigma_i \left[Q_i * D2DPX/Q(r,\theta) * DFA_{ija} \right]$$

where:

r = user-selected distance from the release point to the receptor location in a particular sector, in kilometers. The controlling distance is the same for all airborne pathways (1.05 km);

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

j = user-selected organ (bone, liver, total body, thyroid, kidney, lung, GI-LLI) and is the same controlling organ as that used for all airborne pathways;

a = user-selected age group (infant, child, teen, adult) and is the same controlling age group as that used for all airborne pathways;

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

R_a = annual air intake for individuals in age group "a" (in m^3/year). The air intake factor is selected in accordance with the user-specified controlling age group;

Q_i = release of nuclide "i" in curies;

$D2DPX/Q(r,\theta)$ = annual average atmospheric dispersion factor of the radionuclide at the receptor location "r" in sector "θ" (in sec/m^3) as calculated; and

> NOTE
> This includes depletion (for radioiodines and particulates) and radioactive decay of the plume.

DFA_{ija} = inhalation dose factor for radionuclide "i", organ "j", and age group "a". The inhalation dose factor is selected in accordance with the user-specified controlling age group "a" and controlling organ "j".

3.4.1.c Dose from Nuclide Concentrations in Vegetation

> NOTE
> To reduce the computational overhead of the computer, the calculations for dose resulting from nuclide concentrations in forage, produce and leafy vegetables is performed in three steps.

First, the concentration factors (CF) are computed and stored in the database. The concentration factor includes all the parameters that are considered constant for each nuclide and agricultural activity, such as the radioactive decay constant, removal rate constant, exposure time, etc.

Second, the deposition rate from the plume is multiplied by the concentration factor and the nuclide activity to produce the nuclide concentration as follows:

$$C_i^V(r,\theta) = CF_i * DOQ(r,\theta) * Q_i$$

where:

$C_i^V(r,\theta)$ = concentration of nuclide "i" at the receptor location (r,θ);

CF_i = concentration factor of nuclide "i";

$DOQ(r,\theta)$ = relative deposition of nuclide "i". For the short term dispersion option, DOQ is replaced by (F x DOQ), where F is the short term dispersion correction factor;

Q_i = quantity of nuclide "i" released in curies.

For carbon-14 and tritium, the nuclide concentration is calculated from the concentration factor times the decayed and depleted X/Q for radioiodines and particulates (D2DPX/Q), times the quantity of nuclide "i" released in curies. For the short term dispersion option, D2DPX/Q is replaced by F x D2DPX/Q, where F is the short term dispersion correction factor.

$C_T^V(r,\theta) = CF_T * D2DPX/Q(r,\theta) * Q_T$ for tritium, and

$CF^V_{14}(r,\theta) = CF_{14} * D2DPX/Q(r,\theta) * Q_{14}$ for carbon-14

Third, the nuclide concentrations for a particular pathway (produce, leafy vegetables, cow's milk, and meat) are summed and multiplied by: 1) the ingestion rate for a particular age group and 2) the dose conversion factor:

$$D(r,\theta,j,a) = \Sigma_i \left[(DFI_{ija} * U_a * C_i^V(r,\theta) \right]$$

where:

r = user-selected distance from the release point to the receptor location in a particular sector, in kilometers (1.05 km);

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

j = user-selected organ (bone, liver, total body, thyroid, kidney, lung, GI-LLI), and is the same controlling organ as that used for all airborne pathways;

a = user-selected age group (infant, child, teen, adult), and is the same controlling age group as that used for all airborne pathways;

DFI_{ija} = dose conversion factor for ingestion of nuclide "i", organ "j", and age group "a", in mrem/ρCi, according to the controlling organ and age group;

U_a = annual ingestion rate of food in a particular pathway (kilograms/year or liters/year) for individuals in age group "a", according to the controlling age group; and

$C_i^v(r,\theta)$ = concentration of nuclide "i" at the receptor location (r,θ).

3.4.1.c.1 Calculating Vegetation Concentration Factors

NUREG-0133 calculations for radioiodines and particulate radionuclides (except tritium and carbon-14), the concentration factor of nuclide "i" in and on vegetation is estimated as follows:

$$CF_i^v = CONST*\left(\frac{r}{Y_v*\lambda_i}\right)*e^{-\lambda_i t_h}*f$$

where:

CF_i^v = concentration factor of radionuclide "i" in vegetation (forage, produce, or leafy vegetables), in m^2-hr/kg;

CONST = 1.14×10^8 number of ρCi per Ci (10^{12}) divided by the number of hours per year (8760);

r = is the fraction of deposited activity retained on crops, leafy vegetables, or pasture grass, from airborne radioiodine and particulate deposition:

r = 1.00 for radioiodines

r = 0.20 for particulates

Y_v = agricultural productivity (yield or vegetation area density), in kg (wet weight)/m²:

- Y_s = 2.0 kg/m² for stored animal feed for grass-animal-man pathways
- Y_p = 0.7 kg/m² for pasture grass for grass-animal-man pathways
- Y_l = 2.0 kg/m² for leafy vegetation (fresh) for crop/vegetation-man pathways
- Y_g = 2.0 kg/m² for garden produce (stored vegetables) for crop/vegetation-man pathways

λ_i = is the decay constant of nuclide "i" in hr^{-1};

t_h = is a holdup time that represents the time interval between harvest and consumption of the food, in hours:

- t_h = 0 hours for pasture grass consumed by animals
- t_h = 2160 hours for stored feed consumed by animals
- t_h = 24 hours for leafy vegetables consumed by humans
- t_h = 1440 hours for produce consumed by humans

f = is the fraction of leafy vegetables or produce grown in garden of interest:

- f = 0.76 for the fraction of produce ingested, grown in garden of interest. (This is f_g in equation C-13 of Regulatory Guide 1.109)

f = 1.00 for the fraction of leafy vegetables grown in garden of interest. (This is f_1 in equation C-13 of Regulatory Guide 1.109)

f = 1.00 for all other pathways

3.4.1.c.2 Concentration Factor for Carbon-14

For carbon-14, the concentration factor in and on vegetation is estimated as follows (see Regulatory Guide 1.109-26, equation C-8):

$$CF^V_{14} = 2.2 \times 10^7 * \rho$$

where:

CF^V_{14} = concentration factor of carbon-14 in and on vegetation, in m²-hr/kg; and

ρ = is defined as the ratio of total annual release time (for C-14 atmospheric releases) to the total annual time during which photosynthesis occurs (taken to be 4400 hours), under the condition that the value of "ρ" should never exceed unity. For continuous C-14 releases, "ρ" is taken to be unity.

(Thus, the value of 2.2×10^7 is stored for CF^V_{14} in lieu of a site specific value for "ρ".)

3.4.1.c.3 Concentration Factor for Tritium

The concentration factor for tritium in vegetation is calculated from the tritium concentration in air surrounding the vegetation (see Regulatory Guide 1.109-27, equation C-9):

$$CF^V_T = \frac{1.2 \times 10^7}{H}$$

where:

CF^V_T = concentration factor for tritium in vegetation (in m²-hr/kg); and

H = absolute humidity at the location of the vegetation, in g/m³. (The regulatory default value for "H" is 8.0 grams/m³.)

(Thus, the value 1.5×10^6 is stored for CF^V_T in lieu of a site specific value for "H".)

3.4.1.c.4 Nuclide Concentrations in Produce and Leafy Vegetables

The concentrations in and on produce and leafy vegetables of all radioiodine and particulate nulcides "i" (except carbon-14 and tritium) are calculated as follows:

$C_i^V(r,\theta) = CF_i^V * DOQ(r,\theta) * Q_i$ for produce; and

$C_i^L(r,\theta) = CF_i^L * DOQ(r,\theta) * Q_i$ for leafy vegetables

where:

CF_i^V = concentration factor of nuclide "i" in produce;

CF_i^L = concentration factor of nuclide "i" in leafy vegetables;

(Note that the difference between CF_i^V and CF_i^L are the values for t_h and f_1.)

$DOQ(r,\theta)$ = relative deposition of the radionuclide "i" at the receptor (r,θ); and

Q_i = release of nuclide "i" (in curies).

The C-14 and H-3 nuclide concentrations are calculated from the concentration factors times the decayed and depleted radioiodine relative deposition D2DPX/Q times the fraction grown in the garden of interest (f_g = 0.76, f_1 = 1.0):

$C_T^V(r,\theta) = CF_T^V * D2DPX/Q(r,\theta) * Q_T * f_g$

$C_T^L(r,\theta) = CF_T^L * D2DPX/Q(r,\theta) * Q_T * f_1$ for tritium

$C^V{}_{14}(r,\theta) = CF^V{}_{14} * D2DPX/Q(r,\theta) * Q_{14} * f_g$

$C^L{}_{14}(r,\theta) = CF^L{}_{14} * D2DPX/Q(r,\theta) * Q_{14} * f_1$ for carbon-14

3.4.1.d Nuclide Concentration in Cow's Milk

The radionuclide concentration in cow's milk is dependent upon the quantity and contamination level of feed consumed by the animal. The concentration is estimated (see Regulatory Guide 1.109-27, equations C-10 and C-11) as follows:

$$C_i^m(r,\theta) = \{F_m * Q_F * e^{-\lambda_i t_f} * [f_p * f_s * CF_i^v + (1 - f_p) * CF_i^{v1} + f_p * (1 - f_s) * CF_i^{v1}]\} * D(r,\theta) * Q_i$$

where:

$C_i^m(r,\theta)$ = is the concentration of nuclide "i" in cow's milk at the receptor location (r,θ), in ρCi/liter;

{ } = the expression in brackets represents the concentration factor. (Note that the concentration factor for cow's milk involves two different vegetation concentration factors (see below).);

F_m = average fraction of the cow's daily intake of radionuclide "i" (which appears in each liter of milk), in days/liter;

Q_F = amount of feed consumed by the cow per day, in kg/day (wet weight);

λ_i = decay constant of nuclide "i" in hr^{-1};

t_f = average transport time of the activity from the feed into the milk and to the receptor (a value of 2 days is assumed);

f_p = fraction of the year that cows graze on pasture;

f_s = fraction of daily feed that is pasture grass when the cow grazes on pasture;

CF_i^v = vegetation concentration factor of nuclide "i" on pasture grass with the holdup time t_h = 0 days, in ρCi/kg. (Refer to the explanation of the vegetation concentration factor calculation);

CF_i^{v1} = vegetation concentration factor of nuclide "i" in stored feeds with the holdup time t_h = 90 days, in ρCi/kg. (Refer to the explanation of the vegetation concentration factor calculations);

$D(r,\theta)$ = relative deposition $DOQ(r,\theta)$ of the radionuclides, except carbon-14 and tritium. For carbon-14 and tritium, the decayed and depleted dispersion factor $D2DPX/Q(r,\theta)$ for radioiodines and particulates (in sec/m³) is used; and

Q_i = is the release of nuclide "i" in curies.

3.4.1.e Nuclide Concentration in Meat

The radionuclide concentration in meat is dependent upon the quantity and contamination level of feed consumed by the animal. The concentration is estimated (see Regulatory Guide 1.109-27, equations C-11 and C-12) as follows:

$$C_i^f(r,\theta) = \{F_f * Q_F * e^{-\lambda_i t_s} * [f_p * f_s * CF_i^v + (1 - f_p) * CF_i^{v1} + f_p * (1 - f_s) * CF_i^{v1}]\} * D(r,\theta) * Q_i$$

where:

NOTE
All parameters used in this pathway are for beef cattle.

$C_i^f(r,\theta)$ = concentration of nuclide "i" in animal flesh at the receptor location (r,θ) in ρCi/liter;

{ } = the expression in brackets represents the concentration factor (Note that the concentration factor for meat involves two different vegetation concentration factors);

F_f = average fraction of the animal's daily intake of radionuclide "i" which appears in each kilogram of flesh (in days/kg);

Q_f = amount of feed consumed by the animal per day in kg/day (wet weight);

λ_i = decay constant of nuclide "i" in hr^{-1};

t_s = average time from slaughter of the animal to consumption by humans (20 days);

f_p = fraction of the year that animals graze on pasture;

f_s = fraction of daily feed that is pasture grass when the animal grazes on pasture;

CF_i^v = vegetation concentration factor of nuclide "i" on pasture grass with the holdup time t_h = 0 days in pCi/kg. (Refer to the explanation of the vegetation concentration factor calculation);

CF_i^{v1} = vegetation concentration factor of nuclide "i" in stored feeds with the holdup time t_h = 90 days, in pCi/kg. (Refer to the explanation of the vegetation concentration factor calculation);

$D(r,\theta)$ = relative deposition $DOQ(r,\theta)$ of the radionuclides, except carbon-14 and tritium. For carbon-14 and tritium, the decayed and depleted dispersion factor $D2DPX/Q(r,\theta)$ for radioiodines and particulates (in sec/m³) is used;

Q_i = is the release of nuclide "i" (in curies).

3.5 Gaseous Effluent Projected Dose Calculation

3.5.1 The quarterly projected dose is based upon the methodology of Sections 3.3 and 3.4, and is expressed as follows:

$$D_{QP} = \left[\frac{D_{QC} + D_{RP}}{T} \right] * 92$$

where:

D_{QP} = Quarterly projected dose (mrem);

D_{QC} = cumulative dose for the quarter (mrem);

D_{RP} = dose for current release (mrem);

T = current days into quarter; and

92 = number of days per quarter.

3.6 Dose to the Public Inside the Site Boundary

3.6.1 Liquid Releases

Dose to the public inside the site boundary due to liquid releases will be due to ingestion of fish caught from the discharge canal and exposure to sediment along the discharge canal bank while fishing.

3.6.1.a Dose Due to Ingestion of Fish

Dose due to ingestion of fish is calculated using the methodology given in Section 2.2, Liquid Dose Calculation.

3.6.1.b Dose Due to Exposure to Shoreline Sediments

Dose from external exposure to shoreline sediments is calculated from equation A-7 of Regulatory Guide 1.109, Rev. 1, 10/77.

$$R_{apj} = 110{,}000 \frac{U_{ap} * M_p * W}{F} * \Sigma_i \left[Q_i * T_i * D_{aipj} * [\exp(-\lambda_i t_p)] * [1-\exp(-\lambda_i t_b)] \right]$$

where:

R_{apj} = is the total annual dose to organ "j" of individuals of age group "a" from all of the nuclides "i" in pathway in mrem/yr;

U_{ap} = is the usage factor that specifies exposure time for the maximum individual of age group "a" in hours from Table E-5 of Regulatory Guide 1.109. 67 hours for shoreline recreation for a teen was chosen. Adult is the controlling age group for ingestion but the maximum usage factor (teen) was used rather than the adult factor to ensure a conservative dose estimate;

M_p = is the mixing ratio (reciprocal of dilution factor);

W = is the shoreline width factor from Table A-2 of Regulatory Guide 1.109. The discharge canal value of 0.1 was chosen;

F = is the flow rate of the liquid effluent in ft^3/sec. This was determined by:

$$F(ft^3/sec) = \text{waste volume (gal/yr)} * \left[\frac{.134\ ft^3}{1\ gal}\right] * \left[\frac{1\ yr}{8760\ hr}\right] * \left[\frac{1\ hr}{3600\ sec}\right]$$

Q_i = is the release of nuclide "i" in Ci/yr;

T_i = is the radioactive half-life of nuclide "i", in days, from Radioactive Decay Data Tables, Technical Information Center, U. S. Dept. of Energy, 1981;

D_{aipj} = is the dose factor specific to age group "a", nuclide "i", and organ "j" from Table E-6 of Regulatory Guide 1.109;

λ_i = is the radioactive decay constant of nuclide "i" in hr^{-1};

t_p = is the average transit time for nuclides to reach the point of exposure. A value of 0 hours was chosen due to the proximity of the discharge canal to the plant; and

t_b = is the period of time for which sediment is exposed to the contaminated water in hours. The mid-point of plant operating life, 15 years was chosen per Regulatory Guide 1.109.

3.6.2 Airborne Release

3.6.2.a Dose Due to Noble Gases

Dose to fisherman at the discharge canal can be calculated by the ratio of dispersion factor for the discharge canal (1.6E-4 sec/m³ from Table 2-45 SAR, Unit 1, 100 meters downwind in a southerly direction) and the usage factor of 67 hours of shoreline recreation to the values used in Section 3.3 of this manual.

$$\text{Dose at discharge canal} = D^T(\theta) * \left[\frac{1.6E\text{-}4}{2.8E\text{-}6}\right] * \left[\frac{67\ hr}{8670\ hr}\right]$$

where $D^T(\theta)$ is the noble gas dose calculated by Section 3.3.

3.6.2.b Dose Due to Iodine, Tritium and Particulates from Gaseous Effluents

Section 3.4 calculates total dose for iodine, tritium and particulates as the sum of:

$$D^{TOT} = D^G + D^I + D^V + D^L + D^M + D^F$$

where:

D^G = ground plane deposition;

D^I = inhalation;

D^v = consumption of vegetation;

D^L = consumption of fresh leafy vegetables;

D^m = consumption of milk; and

D^F = consumption of meat and poultry;

The only contributions relevant to fishing activities at the discharge canal are ground plane deposition and inhalation. As D^G and D^I are not independently available, a conservative estimate can be obtained by using the same correction factor developed for noble gas dose to the total dose calculated in Section 3.4 for iodine, tritium and particulates. Depletion of the plume as it travels downwind can be ignored since the fraction remaining in the plume at 100 meters (discharge canal) and 1046 meters (site boundary) are both greater than 90% according to Figure 3 of Regulatory Guide 1.111.

The only activity inside the plant site by members of the public that might contribute a significant dose is fishing along the banks of the discharge canal. Travel along public roads would involve short exposure time and tours of the facility are conducted according to radiological control procedures enforced at the plant to control exposure. Fishing is the only uncontrolled activity.

4.0 ENVIRONMENTAL SAMPLING STATIONS - RADIOLOGICAL

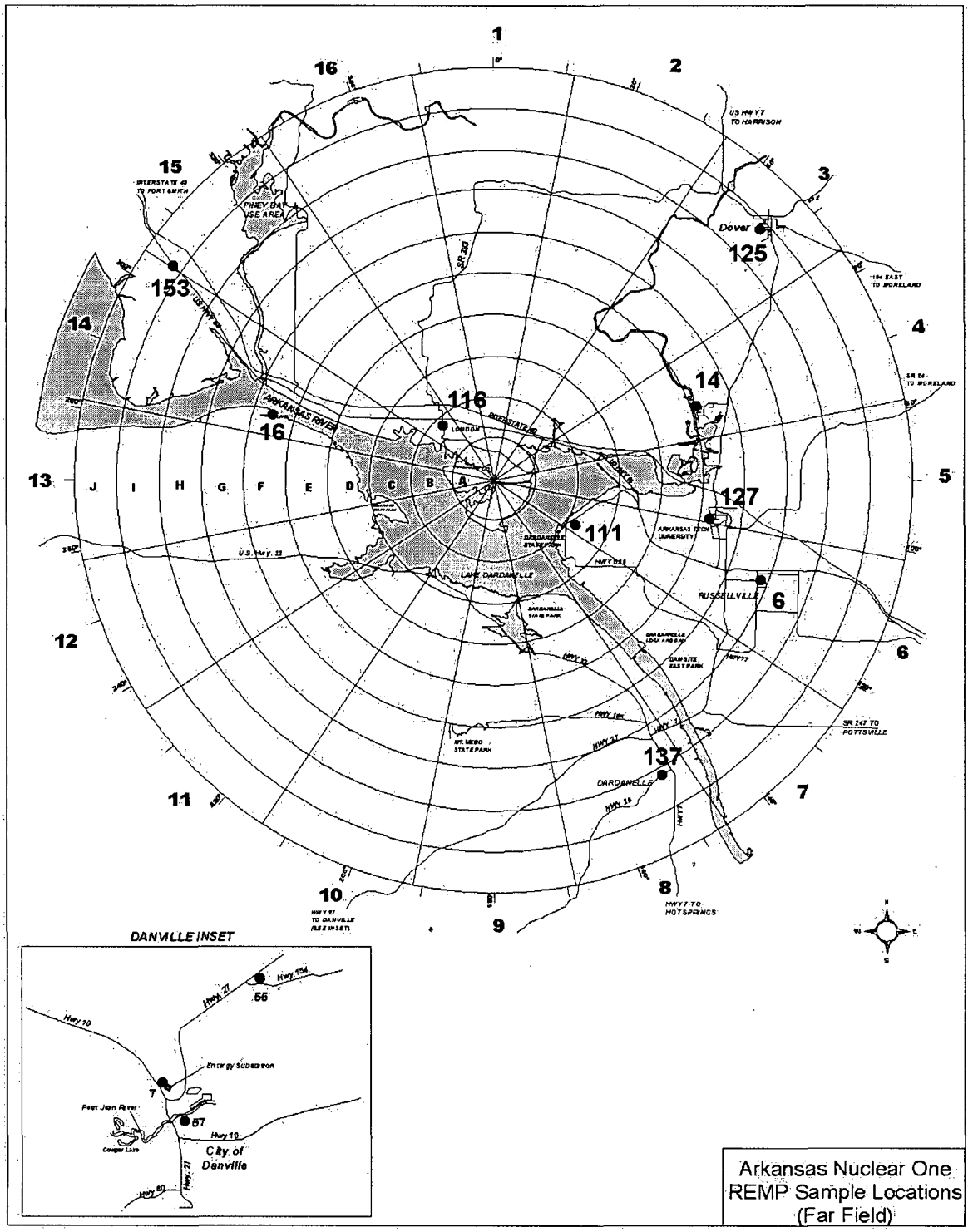
Environmental samples will be collected as specified in the Appendix 1 and Appendix 2 Limitations. The approximate locations of selected sample sites are shown on Figure 4-1 for illustrative purposes.

Table 4-1 lists the approximate distances and directions of the sample stations from the plant.

FIGURES

FIGURE 4-1

RADIOLOGICAL SAMPLE STATIONS



Arkansas Nuclear One
REMP Sample Locations
(Far Field)

FIGURE 4-1

RADIOLOGICAL SAMPLE STATIONS

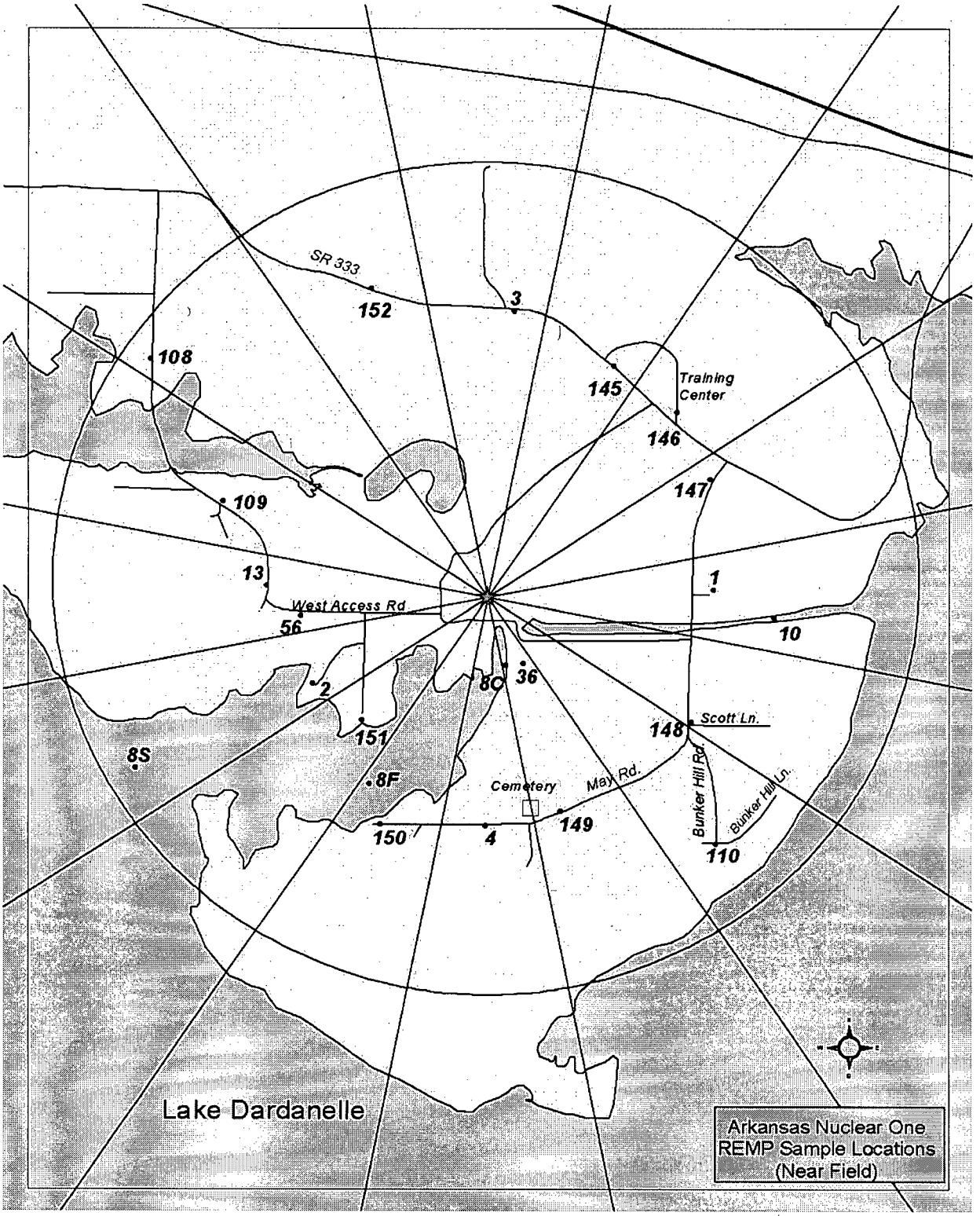
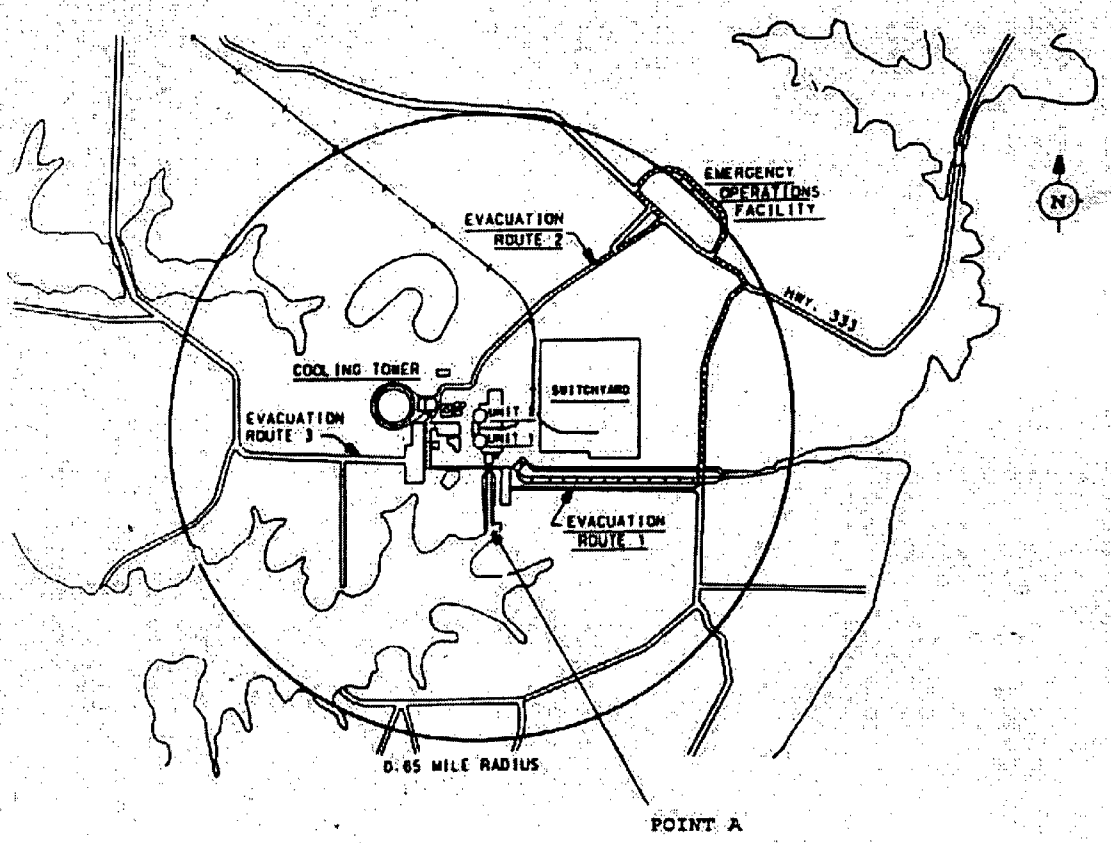


FIGURE 4-2

MAXIMUM AREA BOUNDARY FOR RADIOACTIVE RELEASE CALCULATION
(EXCLUSION AREAS)

GASES - 1046 METER RADIUS
LIQUIDS - END OF DISCHARGE CANAL (POINT A)



TABLES

TABLE 4-1
Environmental Sampling Stations - Radiological

Sample Station Number: 1
Approximate Direction and Distance from Plant: 88° - 0.5 miles
Sample Types: 1) Airborne radioiodines
2) Airborne particulates
3) Direct radiation
Sample Station Location:

The TLD is on a pole near the meteorology tower approximately 0.6 miles east of ANO.

Sample Station Number: 2
Approximate Direction and Distance from Plant: 243° - 0.5 miles
Sample Types: 1) Airborne radioiodines
2) Airborne particulates
3) Direct radiation
Sample Station Location:

IF traveling from ANO,
THEN go approximately 0.2 miles west toward Gate 4. Turn left (at the east end of the sewage treatment plant) and go approximately 0.1 miles. Turn right and go approximately 0.1 miles. The sample station is on the right.

Sample Station Number: 3
Approximate Direction and Distance from Plant: 5° - 0.7 miles
Sample Types: 1) Direct radiation
Sample Station Location:

IF traveling west on Highway 333,
THEN go approximately 0.35 miles from Gate 2 at ANO. TLD is located on utility pole on south side of Highway 333 S.

IF traveling east on Highway 333,
THEN go approximately 0.9 miles from junction of Highway 333 and Flatwood Road. TLD is located on utility pole on south side of Highway 333 S.

Sample Station Number: 4
Approximate Direction and Distance from Plant: 181° - 0.5 miles
Sample Types: 1) Direct radiation
Sample Station Location:

Go approximately 0.25 miles south from bridge over intake canal. Turn right onto May Road. Proceed approximately 0.1 miles west of May Cemetery entrance. The TLD is located on a utility pole on the south side of May Road.

TABLE 4-1
Environmental Sampling Stations - Radiological

Sample Station Number: 6
Approximate Direction and Distance from Plant: 111° - 6.8 miles
Sample Types: 1) Airborne radioiodines
2) Airborne particulates
3) Direct radiation
Sample Station Location:

Go to the Entergy local office which is located off Highway 7T in Russellville, AR (305 South Knoxville Avenue). The sample station is against the east wall of the back lot.

Sample Station Number: 7
Approximate Direction and Distance from Plant: 210° - 19.0 miles
Sample Types: 1) Airborne radioiodines
2) Airborne particulates
3) Direct radiation
Sample Station Location:

Turn west at junction of Highway 7 and Highway 27 in Dardanelle, AR. Proceed to junction of Highway 27 and Highway 10 in Danville, AR. Turn right onto Highway 10 and proceed a short distance to the Entergy supply yard, which is on the right adjacent to an Entergy substation. The sample station is in the southwest corner of the supply yard.

Sample Station Number: 8
Approximate Direction and Distance from Plant:
Sample Types: 1) Surface water (composite) 166° - 0.2 miles
2) Shoreline sediment 243° - 0.9 miles
3) Fish 212° - 0.5 miles
Sample Station Location:

Plant discharge canal

Sample Station Number: 10
Approximate Direction and Distance from Plant: 95° - 0.5 miles (intake canal)
Sample Types: 1) Surface water (grab)
Sample Station Location:

Surface water (grab) is collected at plant intake canal.

Sample Station Number: 13
Approximate Direction and Distance from Plant: 273° - 0.5 miles
Sample Types: 1) Broad leaf vegetation
Sample Station Location:

IF traveling west from ANO toward Gate 4,
THEN go approximately 0.4 miles from ANO. Turn right onto Flatwood Road. Go a short distance. The sample may be collected from either side of Flatwood Road.

TABLE 4-1
Environmental Sampling Stations - Radiological

Sample Station Number: 14
Approximate Direction and Distance from Plant: 70° - 5.1
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: 287° - 5.5 miles
Sample Types: 1) Shoreline sediment
2) Fish
Sample Station Location:

Panther Bay, located on the south side of the Ar River across from the mouth of Piney Creek.

Sample Station Number: 36
Approximate Direction and Distance from Plant: 153° - 0.02 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: 55
Approximate Direction and Distance from Plant: 208° - 16.5 miles
Sample Types: 1) Broadleaf Vegetation
Sample Station Location:

From Dardanelle, travel south on Highway 27. Go approximately 15.5 miles to the intersection of Highways 27 and 154. The sample station is located at this intersection.

Sample Station Number: 56
Approximate Direction and Distance from Plant: 264° - 0.4 miles
Sample Types: 1) Airborne radioiodines
2) Airborne particulates
3) Direct Radiation
Sample Station Location:

If traveling west from ANO, the sample station is located at the west end of the sewage treatment plant near the facility blower building.

TABLE 4-1
Environmental Sampling Stations - Radiological

Sample Station Number: 57
Approximate Direction and Distance from Plant: 208° - 19.5 miles
Sample Types: 1) Drinking water
Sample Station Location:

Go to Danville and turn left on Fifth Street. Go approximately three blocks. The Danville public water supply treatment facility is located on the left.

Sample Station Number: 108
Approximate Direction and Distance from Plant: 306° - 0.9 miles
Sample Types: 1) Direct radiation
Sample Station Location:

IF traveling from Highway 333,
THEN turn south onto Flatwood Road and go approximately 0.4 miles. The TLD is on a utility pole on the right.

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

Sample Station Number: 109
Approximate Direction and Distance from Plant: 291° - 0.6 miles
Sample Types: 1) Direct radiation
Sample Station Location:

IF traveling west from ANO toward Gate 4,
THEN go approximately 0.4 miles and turn right onto Flatwood Road. Go approximately 0.2 miles. The TLD is on a utility pole on the right across from the junction of Flatwood Road and Round Mountain Road.

Sample Station Number: 110
Approximate Direction and Distance from Plant: 138° - 0.8 miles
Sample Types: 1) Direct radiation
Sample Station Location:

From bridge over intake canal, go south approximately 0.25 miles. Turn left and go approximately 0.25 miles. Turn right on Bunker Hill Lane. The TLD is on the first utility pole on the left.

Sample Station Number: 111
Approximate Direction and Distance from Plant: 120° - 2.0 miles
Sample Types: 1) Direct radiation
Sample Station Location:

From junction of Highway 64 and Highway 326 (Marina Road), go approximately 2.1 miles on Marina Road. The TLD is on a utility pole on the left just prior to curve.

TABLE 4-1
Environmental Sampling Stations - Radiological

Sample Station Number: 116
Approximate Direction and Distance from Plant: 318° - 1.8 miles
Sample Types: 1) Direct radiation
Sample Station Location:

Go one block south of the west junction of Highway 333 and Highway 64 in London, AR. The TLD is on a utility pole north of the railroad tracks.

Sample Station Number: 125
Approximate Direction and Distance from Plant: 46° - 8.7 miles
Sample Types: 1) Direct radiation
Sample Station Location:

While traveling north on Highway 7, turn left onto Water Street in Dover, AR. Go one block and turn left onto South Elizabeth Street. Go one block and turn right onto College Street. The TLD is on a utility pole at the southeast corner of the red brick school building, which is located on top of hill.

Sample Station Number: 127
Approximate Direction and Distance from Plant: 100° - 5.2 miles
Sample Types: 1) Direct radiation
Sample Station Location:

The TLD is located on Arkansas Tech Campus on N. Glenwood Street. If traveling south on State Highway 7 from Interstate 40, turn right on N. Glenwood. Follow N. Glenwood for approximately 0.6 miles. The TLD is located on a utility pole (with a No Parking sign on it) across from the northeast corner of Paine Hall.

Sample Station Number: 137
Approximate Direction and Distance from Plant: 151° - 8.2 miles
Sample Types: 1) Direct radiation
Sample Station Location:

At junction of Highway 7 and Highway 28 in Dardanelle, AR, go approximately 0.2 miles on Highway 28. The TLD is on a speed limit sign on the right in front of the Morris R. Moore Arkansas National Guard Armory.

Sample Station Number: 145
Approximate Direction and Distance from Plant: 28° - 0.6 miles
Sample Types: 1) Direct radiation
Sample Station Location:

The TLD is located near the west entrance to the RERTC on a utility pole on the north side of State Highway 333.

TABLE 4-1
Environmental Sampling Stations - Radiological

Sample Station Number: 146
Approximate Direction and Distance from Plant: 45° - 0.6 miles
Sample Types: 1) Direct radiation
Sample Station Location:

The TLD is located on the south end of the east parking lot at the RERTC. The TLD is located on a utility pole.

Sample Station Number: 147
Approximate Direction and Distance from Plant: 61° - 0.6 miles
Sample Types: 1) Direct radiation
Sample Station Location:

The TLD is located on the west side of Bunker Hill Road, approximately 100 yards from the intersection with State Highway 333.

Sample Station Number: 148
Approximate Direction and Distance from Plant: 122° - 0.6 miles
Sample Types: 1) Direct radiation
Sample Station Location:

If traveling east from ANO, turn right on Bunker Hill Road. Travel south for approximately 0.25 miles to the intersection with Scott Lane. The TLD is located on the county road sign post.

Sample Station Number: 149
Approximate Direction and Distance from Plant: 156° - 0.5 miles
Sample Types: 1) Direct radiation
Sample Station Location:

If traveling south on Bunker Hill Road, turn right on May Road. Travel approximately 0.4 miles. The TLD is located on a "Notice" sign on the north side of May Road.

Sample Station Number: 150
Approximate Direction and Distance from Plant: 205° - 0.6 miles
Sample Types: 1) Direct radiation
Sample Station Location:

If traveling south on Bunker Hill Road, turn right on May Road. Travel approximately 0.8 miles. The TLD is located just past the McCurley Place turn off on the north side of May Road on a utility pole.

Sample Station Number: 151
Approximate Direction and Distance from Plant: 225° - 0.4 miles
Sample Types: 1) Direct radiation
Sample Station Location:

If traveling west from ANO, turn south on plant road along the est side of the sewage treatment plant. The TLD is located at the end of this road, near the lake on a metal post.

TABLE 4-1
Environmental Sampling Stations - Radiological

Sample Station Number: 152 Approximate Direction and Distance from Plant: 340° - 0.8 miles Sample Types: 1) Direct radiation Sample Station Location: If traveling.west on State Highway 333 from the RERTC, travel approximately 0.7 miles. The TLD is located on the north side of State Highway 333 on a London City limit sign post.
Sample Station Number: 153 Approximate Direction and Distance from Plant: 304° - 9.2 miles Sample Types: 1) Direct radiation Sample Station Location: Travel State Highway 64 West to Knoxville Elementary School. The TLD is located near the school entrance gate on a utility pole..

APPENDICES

Legend

BL#.#.# = Limitation Bases Number
BS#.#.# = Surveillance Limitation Bases Number
L#.#.# = Limitation Number
S#.#.# = Surveillance Limitation Number

APPENDIX 1

Radioactive Effluent Controls
UNIT 1

1.0 DEFINITIONS

OPERABLE - OPERABILITY

1.1 A system, subsystem, train, component or device shall be operable or have operability when it is capable of performing its specified function(s). Implicit in this definition shall be the assumption that all necessary attendant instrumentation, controls, normal and emergency electrical power sources, cooling or seal water, lubrication or other auxiliary equipment that are required for the system, subsystem, train, component or device to perform its function(s) are also capable of performing their related support function(s).

CHANNEL TEST

1.2 A channel test is the injection of an internal or external test signal into the channel to verify its proper response, including alarm and/or trip initiating action, where applicable.

INSTRUMENT CHANNEL CHECK

1.3 An instrument channel check is a verification of acceptable instrument performance by observation of its behavior and/or state; this verification includes comparison of output and/or state of independent channels measuring the same variable.

INSTRUMENT CHANNEL CALIBRATION

1.4 An instrument channel calibration is a test, and adjustment (if necessary), to establish that the channel output responds with acceptable range and accuracy to known values of the parameter which the channel measures or an accurate simulation of these values. Calibration shall encompass the entire channel, including equipment actuation, alarm or trip and shall be deemed to include the channel test.

SOURCE CHECK

1.5 A source check shall be the qualitative assessment of channel response when the channel sensor is exposed to a radioactive source.

LIQUID RADWASTE TREATMENT SYSTEM

1.6 A liquid radwaste treatment system is a system designed and used for holdup, filtration, and/or demineralization of radioactive liquid effluents prior to their release to the environment.

GASEOUS RADWASTE TREATMENT SYSTEM

1.7 A gaseous radwaste treatment system is any system designed and installed to reduce radioactive gaseous effluents by collecting gases from radioactive systems and providing for decay or holdup for the purpose of reducing the total radioactivity prior to release to the environment.

DEFINITIONS

VENTILATION EXHAUST TREATMENT SYSTEM

1.8 A ventilation exhaust treatment system is any system designed and installed to reduce gaseous radioiodine or radioactive material in particulate form in effluents by passing ventilation or vent exhaust gases through charcoal adsorbers and/or HEPA filters for the purpose of removing iodines or particulates from the gaseous exhaust stream prior to the release to the environment (such a system is not considered to have any effect on noble gas effluents). Engineered Safety Feature (ESF) atmospheric cleanup systems are not considered to be ventilation exhaust treatment systems.

PURGE - PURGING

1.9 Purge or purging is the controlled process of discharging air or gas from a confinement to reduce the airborne radioactivity concentration in such a manner that replacement air or gas is required to purify the confinement.

MEMBER(S) OF THE PUBLIC

1.10 Member(s) of the public shall include all persons who are not occupationally associated with the plant. This category does not include employees of the utility, its contractors or vendors. Also excluded from the category are persons who enter the site to service equipment or to make deliveries. This category does include persons who use portions of the site for recreational, occupational or other purposes not associated with the plant.

EXCLUSION AREA

1.11 The exclusion area is that area surrounding ANO within a minimum radius of 0.65 miles of the reactor buildings and controlled to the extent necessary by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials.

UNRESTRICTED AREA

1.12 An unrestricted area shall be any area beyond the exclusion area boundary.

FREQUENCY NOTATION

1.13 The frequency notation specified for the performance of Surveillance Limitations shall correspond to the following intervals:

P		Completed prior to each release
S	Shift	At least once per 12 hours
D	Daily	At least once per 24 hours
W	Weekly	At least once per 7 days
M	Monthly	At least once per 31 days
Q	Quarterly	At least once per 92 days
SA	Semiannual	At least once per 184 days
R	Refueling	At least once per 18 months
N/A		Not Applicable

BATCH RELEASE

1.14 A "Batch" release is the discharge of liquid wastes of a discrete volume. Prior to sampling for analysis, each batch shall be isolated and then thoroughly mixed to assure representative sampling.

CONTINUOUS RELEASE

1.15 A "Continuous" release is the discharge of liquid waste of a non-discrete volume, e.g. from a volume of a system that has an input flow during the continuous release.

2.0 RELEASE CONTROLS

LIMITATION

L2.0.1 The Limitation and Action requirements shall be applicable during the conditions specified for each limitation.

L2.0.2 Adherence to the requirements of the Limitation and/or associated Action within the specified time interval shall constitute compliance with the Limitation. In the event the Limitation is restored prior to the expiration of the specified time interval, completion of the action statement is not required.

BASES

BL2.0.1 This limitation establishes the general requirements applicable to Limitations. Limitations are the lowest functional capability or performance levels of equipment required for safe operation of the facility. When a Limitation is not met, the licensee shall follow any remedial Action permitted by the Limitation until the condition can be met. This limitation establishes the applicability statement within each individual limitation as the requirement for when (i.e., in which specified conditions) conformance to the Limitation is required for safe operation of the facility. The Action requirements establish those remedial measures that must be taken within specified time limits when the requirements of a Limitation are not met. The Action requirements specify the remedial measures that permit continued operation of the facility which is not further restricted by the time limits of the Action requirements. In this case, conformance to the Action requirements provides an acceptable level of safety for unlimited continued operations as long as the Action requirements continue to be met. The specified time limits of the Action requirements are applicable from the point in time it is identified that a Limitation is not met. The time limits of the Action requirements are also applicable when a system or component is removed from service for surveillance testing or investigation of operational problems. Individual limitations may include a specified time limit for completion of a Surveillance Limitation when equipment is removed from service. In this case, the allowable outage time limits of the Action requirements are applicable when this limit expires if the surveillance has not been completed.

BL2.0.2 This limitation establishes the general requirements applicable to Limitations. Limitations are the lowest functional capability or performance levels of equipment required for safe operation of the facility. When a limitation is not met, the licensee shall follow any remedial Action permitted by the Limitation until the condition can be met. This limitation establishes that noncompliance with a limitation exists when the requirements of the Limitation are not met and the associated Action requirements have not been implemented within the specified time interval. The purpose of this limitation is to clarify that (1) implementation of the Action requirements constitutes compliance with a limitation and (2) completion of the remedial measures of the Action requirements is not required when compliance with a Limitation is restored within the time interval specified in the associated Action requirements.

SURVEILLANCE LIMITATION

S2.0.1 Surveillance Limitations shall be applicable during the conditions specified for individual Limitations unless otherwise stated in an individual Surveillance Limitation.

S2.0.2 Each Surveillance Limitation shall be performed within the specified surveillance interval with a maximum allowable extension not to exceed 25% of the specified surveillance interval.

BASES

BS2.0.1 This surveillance limitation establishes the general requirements applicable to Surveillance Limitations. Surveillance Limitations are requirements relating to test, calibration, or inspection to ensure that the necessary quality of systems and components is maintained and that the limitations will be met. This surveillance limitation establishes the requirement that surveillances must be performed during the conditions for which the requirements of the Limitation apply unless otherwise stated in an individual Surveillance Limitation. The purpose of this surveillance limitation is to ensure that the surveillances are performed to verify the operational status of systems and components and that parameters are within specified limits to ensure safe operation of the facility when the plant is an a specified condition for which the associated Limitations are applicable. Surveillance Limitations do not have to be performed when the facility is in a condition for which the requirements of the associated Limitation do not apply unless otherwise specified.

BS2.0.2 This surveillance limitation establishes the general requirements applicable to Surveillance Limitations. Surveillance Limitations are requirements relating to test, calibration, or inspection to ensure that the necessary quality of systems and components is maintained and that the limitations will be met. This surveillance limitation establishes the limit for which the specified time interval for Surveillance Limitations may be extended. It permits an allowable extension of the normal surveillance interval to facilitate surveillance scheduling and consideration of plant operating conditions that may not be suitable for conducting the surveillance (e.g., transient conditions or other ongoing surveillance or maintenance activities). It also provides flexibility to accommodate the length of a fuel cycle for surveillances that are performed at a refueling frequency and are specified with an 18-month surveillance interval. It is not intended that this provision be used repeatedly as a convenience to extend surveillance intervals beyond that specified for surveillances. This surveillance limitation is based upon engineering judgement and the recognition that the most probable result of any particular surveillance being performed is the verification of conformance with the Surveillance Limitations. This provision is sufficient to ensure that the reliability ensured through surveillance activities is not significantly degraded beyond that obtained from the specified surveillance intervals.

2.1 RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

LIMITATION

L2.1.1 The radioactive liquid effluent monitoring instrumentation shown in Table 2.1-1 shall be operable with their alarm/trip setpoints set to ensure that the limits of Appendix 1, Limitation L2.3.1.A are not exceeded.

APPLICABILITY: During releases via this pathway.

OBJECTIVE: To provide instrumentation for radioactive liquid releases.

ACTIONS:

1. With alarm/trip setpoints less conservative than required by the above limitation, immediately suspend the release of radioactive liquid effluents monitored by the affected channel, until the setpoint is changed to an acceptably conservative value.

2. With less than the minimum number of channels operable, take the action shown in Table 2.1-1. Return the instruments to operable status within 30 days or, in lieu of any other report, explain in the next Radioactive Effluent Release Report why the inoperability was not corrected.

Table 2.1-1

Radioactive Liquid Effluent Monitoring Instrumentation

	Instrument	Minimum Operable Channels	Applicability	Action
1.	Liquid radwaste effluent monitor (automatic termination)	1	During releases via this pathway (DRVTP)	1
2.	Liquid radwaste effluent flow monitor	1	DRVTP	2

Table 2.1-1 (Continued)

Table Notation

ACTION 1

With the number of channels operable less than required, effluent releases may be resumed provided that prior to initiating a release :

a. At least two independent samples of the tank's contents are analyzed in accordance with Appendix 1, Limitation S2.3.1.A.1 & S2.3.1.A.2;

b. At least two technically qualified members of the facility staff independently verify that the computer input data is correct and;

c. At least 2 members of the facility staff independently verify the discharge valve lineup.

Otherwise, suspend release of radioactive effluents via this pathway.

ACTION 2

With the number of channels operable less than required, effluent releases via this pathway may continue provided the flow rate is estimated at least once per 4 hours during actual releases. Pump curves may be used to estimate flow.

RELEASE CONTROLS

RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

SURVEILLANCE LIMITATION

S2.1.1 Each radioactive liquid effluent monitoring instrumentation channel shall be demonstrated operable by performance of the channel check, source check, channel calibration, and channel test at the frequencies shown in Table 2.1-2.

APPLICABILITY: Applies to the instrumentation in the liquid radwaste system that is used to limit the amount of radioactivity released to the environs.

OBJECTIVE: To provide surveillance limitations for the instruments required in Appendix 1, Limitation L2.1.1.

Table 2.1-2

Radioactive Liquid Effluent Monitoring Instrumentation Surveillance Limitation

Instrument	Channel Check	Source Check	Channel Calibration	Channel Test
Liquid radwaste effluent line				
Radiation monitor (automatic termination)	D*	P**	R	Q
Flow monitor	D*	N/A	R	N/A

Notation

*During releases via this pathway

**A check source is not required if the background activity is greater than the activity of the check source.

P Prior to release
D Daily
Q Quarterly
R Every 18 months
N/A Not Applicable

BL2.1.1 The radioactive liquid effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in liquid effluents during actual or potential releases. The alarm/trip setpoints for these instruments shall be calculated in accordance with the methods in this manual to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20.

BS2.1.1 To ensure that the instrumentation for the liquid radwaste system is operable.

The channel test demonstrates that automatic isolation of this pathway and control room alarm annunciation occur if the instrument indicates measured levels above the trip setpoint. The channel test also demonstrates that alarm annunciation occurs if any of the following conditions exist:

A. Power to the detector is lost.
B. The instrument indicates a downscale failure.
C. Instrument controls are not set in the operate mode.

The initial channel calibration is performed using one or more of the reference standards certified by the National Institute of Standards and Technology or using standards that have been obtained from suppliers that participate in measurement assurance activities with NIST. These standards permit calibrating the system over its intended range of energy and measurement range. For subsequent channel calibration, sources that have been related to the initial calibration are used.

2.2 RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

LIMITATION

L2.2.1 The radioactive gaseous effluent monitoring instrumentation shown in Table 2.2-1 shall be operable with their alarm/trip setpoints set to ensure that the limits of Appendix 1, Limitation L2.4.1.A are not exceeded.

APPLICABILITY: As shown in Table 2.2-1.

OBJECTIVE: To provide instrumentation for radioactive gaseous releases.

ACTIONS:

1. With a channel alarm/trip setpoint less conservative than required, declare the channel inoperable.

2. With less than the minimum number of channels operable, take the action shown in Table 2.2-1. Return the instruments to operable status within 30 days or, in lieu of any other report, explain in the next Radioactive Effluent Release Report why the inoperability was not corrected.

Table 2.2-1

Radioactive Gas Effluent Monitoring Instrumentation

Instrument	Minimum Channels Operable	Applicability	Parameter	Action
1. Waste Gas Holdup System				
Noble gas activity monitor (provides alarm and automatic termination of release)	1	During releases via this pathway (DRVTP)	Radioactivity	1
Effluent flow monitor	1	DRVTP	System flow	2
2. Auxiliary Building Ventilation System				
a) Noble gas activity monitor	1	DRVTP	Radioactivity	3
b) Iodine sampler	1	DRVTP	Verify presence of cartridge	4
c) Particulate sampler	1	DRVTP	Verify presence of filter	4
d) Effluent flow monitor	1	DRVTP	System flow	2
e) Sampler flow monitor	1	DRVTP	Sample flow	2

Table 2.2-1 (Continued)

Radioactive Gaseous Effluent Monitoring Instrumentation

Instrument	Minimum Channels Operable	Applicability	Parameter	Action
3. Spent Fuel Pool Area Ventilation System				
a) Noble gas activity monitor	1	DRVTP	Radioactivity	3
b) Iodine sampler	1	DRVTP	Verify presence of cartridge	4
c) Particulate sampler	1	DRVTP	Verify presence of filter	4
d) Effluent flow monitor	1	DRVTP	System flow	2
e) Sampler flow monitor	1	DRVTP	Sample flow	2
4. Reactor Building Purge and Ventilation System				
a) Noble gas activity monitor	1	DRVTP	Radioactivity	3, 5
b) Iodine sampler	1	DRVTP	Verify presence of cartridge	4
c) Particulate sampler	1	DRVTP	Verify presence of filter	4
d) Effluent flow monitor	1	DRVTP	System flow	2
e) Sampler flow monitor	1	DRVTP	Sample flow	2

Table 2.2-1 (Continued)

Radioactive Gaseous Effluent Monitoring Instrumentation

Instrument	Minimum Channels Operable	Applicability	Parameter	Action
5. Emergency Penetration Room Ventilation System				
a) Noble gas activity monitor	1	DRVTP	Radioactivity	3
b) Iodine sampler	1	DRVTP	Verify presence of cartridge	4
c) Particulate sampler	1	DRVTP	Verify presence of filter	4
d) Effluent flow monitor	1	DRVTP	System flow	2
e) Sampler flow monitor	1	DRVTP	Sample flow	2

Table 2.2-1 (Continued)

Table Notation

ACTION 1 With the number of channels operable less than required, the contents of the tank may be released to the environment provided that prior to initiating the release:

a. At least two independent samples of the tank's contents are analyzed, and

b. At least two technically qualified members of the facility staff independently verify the computer input data, and

c. At least 2 members of the facility staff independently verify the correct discharge valve lineup.

Otherwise, suspend release of radioactive effluents via this pathway.

ACTION 2 With the number of channels operable less than required, effluent releases via this pathway may continue provided the flow rate is estimated at least once per 4 hours.

ACTION 3 With the number of channels operable less than required, effluent releases via this pathway may continue provided grab samples are taken at least once per 12 hours and these samples are analyzed for gross activity within 24 hours. During the performance of required source checks of radioactive gaseous effluent monitoring instrumentation for plant ventilation systems, these requirements need not be implemented if the instrument is restored to an operable condition within four hours.

ACTION 4 With the number of channels operable less than required, effluent releases via the affected pathway may continue provided samples are continuously collected with auxiliary sampling equipment as required in Table 2.4-1. A time period of up to four hours is allowed to continue releases via the affected pathway without auxiliary sampling equipment in operation. If at the conclusion of the four-hour period normal instrumentation is not restored or auxiliary sampling equipment is not in operation, then releases via the pathway shall be immediately suspended. The allowable four-hour time period is applicable if the instrumentation is discovered to be inoperable for any reason and whenever it is necessary to render the instrumentation inoperable in order to perform the weekly surveillance (i.e., filter changeout) required by ODCM Appendix 1 Table 2.4-1.

ACTION 5 When purging the reactor building, immediately suspend purging if less than the required number of monitoring channels are operable. Purging may be resumed provided that prior to initiating the purge:

a. At least two independent samples of the reactor building atmosphere are analyzed, and

b. At least two technically qualified members of the facility staff independently verify the computer input data.

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

SURVEILLANCE LIMITATION

S2.2.1 Each radioactive gaseous effluent monitoring instrumentation channel shall be demonstrated operable by performance of the channel check, source check, channel calibration, and channel test at the frequencies shown in Table 2.2-2.

APPLICABILITY: Applies to the instrumentation in the gaseous radwaste system that is used to limit the amount of activity released to the environs.

OBJECTIVE: To provide surveillance limitations for the instruments listed in Appendix 1, Limitation L2.2.1.

Table 2.2-2

Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Limitations

Instrument	Channel Check	Source** Check	Channel Calibration	Channel Functional Test
1. Waste Gas Holdup System				
a. Noble Gas Activity Monitor (provides automatic termination of release)	D*	P	R	Q
b. Effluent Flow Monitor	D*	N/A	R	N/A
2. Auxiliary Building Ventilation System				
a. Noble Gas Activity Monitor	D*	M	R	Q
b. Effluent Flow Monitor	D*	N/A	R	N/A
c. Sampler Flow Monitor	D*	N/A	R	N/A
d. Iodine Sampler Cartridge	W*(1)	N/A	N/A	N/A
e. Particulate Sampler Filter	W*(1)	N/A	N/A	N/A

Table 2.2-2 (Continued)

Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Limitations

Instrument	Channel Check	Source** Check	Channel Calibration	Channel Functional Test
3. Spent Fuel Pool Area Ventilation System				
a. Noble Gas Activity Monitor	D*	M	R	Q
b. Effluent Flow Monitor	D*	N/A	R	N/A
c. Sampler Flow Monitor	D*	N/A	R	N/A
d. Iodine Sampler Filter	W*(1)	N/A	N/A	N/A
e. Particulate Sampler Filter	W*(1)	N/A	N/A	N/A
4. Reactor Building Purge System				
a. Noble Gas Activity Monitor	D*	M	R	P
b. Effluent Flow Monitor	D*	N/A	R	N/A
c. Sampler Flow Monitor	D*	N/A	R	N/A
d. Iodine Sampler Filter	W*(1)	N/A	N/A	N/A
e. Particulate Sampler Filter	W*(1)	N/A	N/A	N/A

Table 2.2-2 (Continued)

Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Limitations

Instrument	Channel Check	Source** Check	Channel Calibration	Channel Functional Test
5. Emergency Penetration Room Ventilation System				
a. Noble Gas Activity Monitor	D*	M	R	Q
b. Effluent Flow Monitor	D*	N/A	R	N/A
c. Sampler Flow Monitor	D*	N/A	R	N/A
d. Iodine Sampler Filter	W*(1)	N/A	N/A	N/A
e. Particulate Sampler Filter	W*(1)	N/A	N/A	N/A

Table 2.2-2 (Continued)

Table Notation

*During releases via this pathway.

**A check source is not required if the background activity is greater than the activity of the check source.

P	Prior to release
D	Daily
W	Weekly
M	Monthly
Q	Quarterly
R	Once per 18 Months
N/A	Not applicable

(1) Verify presence of cartridge or filter only.

BL2.2.1 The radioactive gaseous effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in gaseous effluents during actual or potential releases. The alarm/trip setpoints for these instruments shall be calculated in accordance with methods in this manual to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20.105.

BS2.2.1 To ensure that the instrumentation for the gaseous radwaste system is operable.

The channel test demonstrates that control room alarm annunciation occurs if any of the following conditions exist:

1. The instrument indicates measured levels above the alarm/trip setpoint.
2. Power to the detector is lost.
3. The instrument indicates a downscale failure.
4. Instrument controls are not set in the operate mode.

For the waste gas holdup system noble gas activity monitor, the channel test also demonstrates that automatic isolation of the release pathway occurs if the instrument indicates above the trip setpoint.

The initial channel calibration is performed using one or more of the reference standards certified by the National Institute of Standards and Technology or using standards that have been obtained from suppliers that participate in measurement assurance activities with NIST. These standards permit calibrating the system over its intended range of energy and measurement range. For subsequent channel calibration, sources that have been related to the initial calibration are used.

2.3 RADIOACTIVE LIQUID EFFLUENTS

2.3.1 Concentration

LIMITATION

L2.3.1.A The concentration of radioactive material released to the discharge canal shall be limited to the concentration specified in 10 CFR Part 20, 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 2×10^{-4} µCi/ml.

APPLICABILITY: At all times

OBJECTIVE: To ensure that the limits of 10 CFR 20 are met.

ACTION:

1. With the concentration of radioactive material released exceeding the above limits, immediately initiate action to restore concentration to within limits and provide notification to the Commission within 24 hours. In lieu of any other report, prepare and submit a Special Report within 30 days pursuant to Appendix 1, Section 3.4 Limitations.

RELEASE CONTROLS

RADIOACTIVE LIQUID EFFLUENTS

SURVEILLANCE LIMITATION

S2.3.1.A.1 Radioactive liquid wastes shall be sampled and analyzed according to the sampling and analyses program of Table 2.3-1.

S2.3.1.A.2 The results of the radioactivity analyses shall be used in accordance with this manual to assure that the concentrations at point of release are maintained within the limits of Appendix 1, Limitation L2.3.1.A.

APPLICABILITY: At all times

OBJECTIVE: To ensure that the limits of Appendix 1, Limitation L2.3.1.A are met.

Table 2.3-1

RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSES PROGRAM

Liquid Release Type	Sampling Frequency	Minimum Analyses Frequency	Type of Activity Analyses	Lower Limit of Detection (LLD) (µCi/ml) (a)
A. Batch Waste Release (d)	P Each Batch	P Each Batch	γ isotopic (g)	5×10^{-7} (b)
			I-131	1×10^{-6}
	P One Batch/M	M	Dissolved and Entrained Gases (Gamma Emitters)	1×10^{-5}
	P Each Batch	M Composite (c)	H-3	1×10^{-5}
			Gross Alpha	1×10^{-7}
	P Each Batch	Q Composite (c)	Sr-89, Sr-90	5×10^{-8}
			Fe-55	1×10^{-6}
B. Continuous Waste Release (e)	Continuous (f)(h)	D (f)	γ isotopic (g)	5×10^{-7} (b)
			I-131	1×10^{-6}
	M Grab Sample	M	Dissolved and Entrained Gases (Gamma Emitters)	1×10^{-5}
	Continuous (f)(h)	M Composite (c)	H-3	1×10^{-5}
			Gross Alpha	1×10^{-7}
	Continuous (f)(h)	Q Composite (c)	Sr-89, Sr-90	5×10^{-8}
			Fe-55	1×10^{-6}

Table 2.3-1 (Continued)

TABLE NOTATION

a. The Lower Limit of Detection (LLD) is the smallest concentration of radioactive material in a sample that will be detected with 95% probability with 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system (which may include radio-chemical separation):

$$LLD = \frac{4.66\ S_b}{E * V * 2.22 * Y * \exp(-\lambda\Delta t)}$$

where

LLD is the lower limit of detection as defined above (as pCi per unit mass or volume)

S_b is the standard deviation of the background counting rate or of the counting rate of a blank sample (in counts per minute).

E is the counting efficiency (as counts per transformation)

V is the sample size (in units of mass or volume)

2.22 is the number of transformations per minute per picocurie

Y is the fractional radiochemical yield (when applicable)

λ is the radioactive decay constant for the particular radionuclide

Δt is the elapsed time between sample collection (or end of the sample collection period) and time of counting

Typical values of E, V, Y and Δt should be used in the calculation.

It should be recognized that the LLD is an a Priori (before the fact) limit representing the capability of measurement system and not an a Posteriori (after the fact) limit for a particular measurement.

TABLE 2.3-1 (Continued)

TABLE NOTATION

b. For certain mixtures of gamma emitters, it may not be possible to measure radionuclides in concentrations near their sensitivity limits when other nuclides are present in the sample in much greater concentrations. Under these circumstances, it will be more appropriate to calculate the concentration of such radionuclides using observed ratios with those radionuclides which are measurable.

c. A composite sample is one in which the quantity of liquid sampled is proportional to the quantity of liquid waste discharged and in which the method of sampling employed results in a specimen which is representative of the liquids released.

d. A batch release is the discharge of liquid wastes of a discrete volume. Prior to sampling, each batch shall be isolated and mixed to ensure representative sampling.

e. A continuous release is the discharge of liquid waste of a non-discrete volume, e.g. from a volume of a system that has an input flow during the continuous release.

f. If continuous samples cannot be obtained, then grab samples shall be collected and analyzed at least 1/24 hrs when the specific activity of the secondary coolant is ≤0.01 μCi/ml IDE (I-131) or at least 1/12 hrs when the specific activity of the secondary coolant is >0.01 μCi/ml IDE (I-131). Grab sample frequency may be increased due to plant conditions.

g. The principal gamma emitters for which the LLD limitation will apply are exclusively the following radionuclides: Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, Ce-141, and Ce-144. This list does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall also be identified and reported. Nuclides which are below the LLD for the analyses should not be reported as being present at the LLD level. When unusual circumstances result in LLD's higher than required, the reasons shall be documented in the Radioactive Effluent Release Report.

h. To be representative of the quantities and concentrations of radioactive materials in liquid effluents, samples shall be collected continuously in proportion to the rate of flow of the effluent stream. Prior to analysis, all samples taken for the composite shall be thoroughly mixed in order for the composite sample to be reperesentative of the effluent release.

P Prior to Release
D Daily
M Monthly
Q Quarterly

BASES

BL2.3.1.A This limitation is provided to ensure that the concentration of radioactive materials released in liquid waste effluents from the site to unrestricted areas will be less than the concentration levels specified in 10 CFR Part 20, Appendix B, Table II. This limit provides additional assurance that the levels of radioactive materials in bodies of water outside the site will not result in exposures greater than the Section II.A design objectives of Appendix I, 10 CFR Part 50, to a member of the public. The concentration limit for noble gases is based upon the assumption that Xe-133 is the controlling radioisotope and its MPC in air (submersion) was converted to an equivalent concentration in water using the methods described in International Commission on Radiological Protection (ICRP) Publication 2.

BS2.3.1.A This limitation is provided to ensure that the concentration of radioactive materials released in liquid waste effluents from the site to unrestricted areas will be less than the concentration levels specified in 10 CFR Part 20, Appendix B, Table II. This limit provides additional assurance that the levels of radioactive materials in bodies of water outside the site will not result in exposures greater than the Section II.A design objectives of Appendix I, 10 CFR Part 50, to an individual. The concentration limit for noble gases is based upon the assumption that Xe-133 is the controlling radioisotope and its MPC in air (submersion) was converted to an equivalent concentration in water using the methods described in International Commission of Radiological Protection (ICRP) Publication 2.

RELEASE CONTROLS

RADIOACTIVE LIQUID EFFLUENTS

2.3.2 Dose

LIMITATION

L2.3.2.A The dose commitment to a member of the public from radioactive material in liquid effluents released from ANO-1 to the discharge canal shall be:

1. During any calendar quarter less than or equal to 1.5 mrem to the total body and less than or equal to 5 mrem to any organ, and

2. During any calendar year less than or equal to 3 mrem to the total body and less than or equal to 10 mrem to any organ

APPLICABILITY: At all times

OBJECTIVE: To ensure that the dose limits of 10 CFR 50, Appendix I, Section IV.A, are met.

ACTION:

1. With the calculated dose from the release of radioactive materials in liquid effluents exceeding any of the above limits, in lieu of any other report, prepare and submit a Special Report to the Commission within 30 days, pursuant to Appendix 1, Section 3.4 Limitations.

BASES

BL2.3.2.A Limitation L2.3.2 provides assurance that releases of liquid effluents will result in concentrations far below the limits of 10 CFR 20. The limitation provides the required operating flexibility and at the same time assures that the release of radioactive material in liquid effluents will be kept "as low as reasonably achievable".

RELEASE CONTROLS

RADIOACTIVE LIQUID EFFLUENTS

2.3.3 Waste Treatment

LIMITATION

L2.3.3.A The appropriate parts of the liquid radwaste treatment system shall be used to reduce the radioactive materials in liquid waste prior to their discharge when it is projected that the cumulative dose during a calendar quarter due to liquid effluent releases would exceed 0.18 mrem to the total body or 0.625 mrem to any organ. The provisions of this limitation do not apply to the laundry tanks due to their incompatibility with the radwaste system.

APPLICABILITY: At all times

OBJECTIVE: To assure that the amount of radioactive material in liquid effluents will be "as low as reasonably achievable."

ACTION:

1. With radioactive liquid waste being discharged without treatment and in excess of the above limits, in lieu of any other report, prepare and submit a Special Report to the Commission within 30 days per Appendix 1, Section 3.4 Limitations.

BASES

BL2.3.3.A The requirements that the appropriate portions of this system be used when specified provides assurance that the releases of radioactive materials in liquid effluents will be kept "as low as is reasonably achievable." The specified limits governing the use of appropriate portions of the liquid radwaste treatment system were specified as a suitable fraction of the guide set forth in Section II.A of Appendix I, 10 CFR Part 50, for liquid effluents. The values of 0.18 mrem and 0.625 mrem are approximately 25% of the yearly design objectives on a quarterly basis. The yearly design objectives are given in 10 CFR 50, Appendix I, Section II.

2.4 RADIOACTIVE GASEOUS EFFLUENTS

2.4.1 Dose Rate

LIMITATION

L2.4.1.A The dose rate in unrestricted areas (see Figure 4-2) due to radioactive materials released in gaseous effluents from the site shall be:

1. For noble gases: Less than or equal to 500 mrem/yr to the total body and less than or equal to 3000 mrem/yr to the skin.

2. For iodine-131, for tritium and for all radionuclides in particulate form with half lives greater than 8 days: Less than or equal to 1500 mrem/yr to any organ.

During periods of reactor building purging the dose rate may be averaged over a one hour interval.

APPLICABILITY: At all times

OBJECTIVE: To ensure that the dose rate in unrestricted areas from gaseous effluents will be within the limits of 10 CFR 20.

ACTION:

1. With the dose rate(s) exceeding the above limits, without delay restore the release rate to within the above limit(s).

SURVEILLANCE LIMITATIONS

S2.4.1.A.1 The dose rate, due to noble gases in gaseous effluents shall be determined in accordance with this manual to be within the limits of Appendix 1, Limitation L2.4.1.A.

S2.4.1.A.2 The dose rate in unrestricted areas, due to iodine-131, tritium, and all radionuclides in particulate form with half-lives greater than 8 days released in gaseous effluents, shall be determined in accordance with this manual to be within the required limits by using the results of the sampling and analyses program, specified in Table 2.4-1.

APPLICABILITY: At all times

OBJECTIVE: To ensure that the dose rate, at any time, in unrestricted areas from gaseous effluents will be within the dose limits of 10 CFR 20.

TABLE 2.4-1

RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSES PROGRAM

Gaseous Release Type	Sampling Frequency	Minimum Analyses Frequency	Type of Activity Analyses	Lower Limit of Detection (LLD) (µCi/ml) (a)
A. Waste Gas Storage Tank	P Each Tank Grab Sample	P Each Tank	Principal Gamma Emitters (b)	1×10^{-4} (g)
B. Reactor Bldg. Purge	P Each Purge Grab Sample	P Each Purge	Principal Gamma Emitters (b) H-3	1×10^{-4} (g) 1×10^{-6}
C. Unit Vents	M (c) (d) Grab Sample	M	Principal Gamma Emitters (b) H-3	1×10^{-4} (g) 1×10^{-6}
(Auxiliary Bldg.)	Continuous (e)	W (f) Charcoal Sample	I-131	1×10^{-12}
(Spent Fuel Pool Area Ventilation)	Continuous (e)	W (f) Particulate Sample	Principal Gamma Emitters (b) (I-131, Others)	1×10^{-11}
(Rx Bldg. Ventilation)	Continuous (e)	M Particulate Sample	Gross Alpha	1×10^{-11}
(Emergency Penetration Room Ventilation)	Continuous (e)	Q Composite Particulate Sample	Sr-89, Sr-90	1×10^{-11}
	Continuous (e)	Noble Gas Monitor	Noble Gases Gross Beta or Gamma	1×10^{-6} (Xe-133 equiv.)

TABLE 2.4-1 (Continued)

TABLE NOTATION

a. See definition in Table 2.3-1, Table Notation.

b. The principal gamma emitters for which the LLD limitation will apply are exclusively the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, and Xe-138 for gaseous emissions and Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, Ce-141 and Ce-144 for particulate emissions. This list does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall also be identified and reported. Nuclides which are below the LLD for the analyses should not be reported as being present at the LLD level for that nuclide. When unusual circumstances result in LLD's higher than required, the reasons shall be documented in the Radioactive Effluent Release Report.

c. Tritium grab samples shall be taken from the Reactor Building ventilation exhaust at least once per 24 hours when the refueling canal is flooded.

d. Tritium grab samples shall be taken at least once per 7 days from the ventilation exhaust from the spent fuel area, whenever spent fuel is in the spent fuel pool.

e. The ratio of the sample flow rate to the sampled stream flow rate shall be known for the time period covered by each dose or dose rate calculation made in accordance with Appendix 1, Limitation L2.4.1.A, L2.4.2.A, and L2.4.3.A.

f. Samples shall be changed at least once per 7 days and analyses shall be completed within 48 hours after changing (or after removal from the sampler).

g. For certain radionuclides with low gamma yield or low energies, or for certain radionuclides mixtures, it may not be possible to measure radionuclides in concentrations near the LLD. Under these circumstances, the LLD may be increased inversely proportional to the magnitude of the gamma yield (i.e., $(1 \times 10^{-4}/I)$, where I is the photon abundance expressed as a decimal fraction), but in no case shall the LLD, as calculated in this manner for a specific radionuclide, be greater than 10% of the MPC value specified in 10 CFR 20, Appendix B, Table II, Column 1.

P Prior to Release
W Weekly
M Monthly
Q Quarterly

BASES

BL2.4.1.A This limitation is provided to ensure that, at any time, the dose rate due to gaseous effluents from all units on the site will be within the limits of 10 CFR 20 for unrestricted areas.

This limitation applies to the release of gaseous effluents from all reactors at the site.

BS2.4.1.A.1/2 This limitation provides for sampling and analyses to ensure that Appendix 1, Limitation L2.4.1.A is met.

RADIOACTIVE GASEOUS EFFLUENTS

2.4.2 Dose - Noble Gases

LIMITATIONS

L2.4.2.A The dose due to noble gases released in gaseous effluents from ANO-1 to unrestricted areas (see Figure 4-2) shall be:

1. During any calendar quarter, less than or equal to 5 mrads for gamma radiation and less than or equal to 10 mrads for beta radiation, and

2. During any calendar year, less than or equal to 10 mrads for gamma radiation and less than or equal to 20 mrads for beta radiation.

APPLICABILITY: At all times

OBJECTIVE: To ensure that the design objective doses of 10 CFR 50, Appendix I, Section IV.A, are not exceeded.

ACTION:

1. With the calculated dose from radioactive noble gases in gaseous effluents exceeding any of the above limits, in lieu of any other report, prepare and submit a Special Report to the Commission within 30 days, pursuant to Appendix 1, Section 3.4 Limitations.

BASES

BL2.4.2.A Limitation L2.4.2.A implements the design guides specified in 10 CFR 50, Appendix I, Section II, and the limiting condition for operation as set forth in Section IV.A of Appendix I.

The limitations provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A, Appendix I, to assure that the releases of radioactive material in gaseous effluents will be kept "as low as is reasonably achievable."

These limits provide reasonable assurance that radioactive material discharged in gaseous effluents will not result in the exposure of an individual in an unrestricted area, to annual average concentrations exceeding the limits specified in Appendix B, Table II of 10 CFR Part 20 [10 CFR Part 20.106(b)]. For individuals who may at times be within the exclusion area boundary, the occupancy of the individual will be sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the exclusion area boundary.

RADIOACTIVE GASEOUS EFFLUENTS

2.4.3 Dose - Iodine-131, Tritium, and Radionuclides in Particulate Form

LIMITATIONS

L2.4.3.A The dose to a member of the public from iodine-131, from tritium, and from all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released from ANO-1 to unrestricted areas (see Figure 4-2) shall be:

1. During any calendar quarter, less than or equal to 7.5 mrems to any organ, and

2. During any calendar year, less than or equal to 15 mrems to any organ.

APPLICABILITY: At all times

OBJECTIVE: To ensure that the dose limits of 10 CFR 50, Appendix I, Section IV.A, are met.

ACTION:

1. With the calculated dose from the release of iodine-131, tritium and radionuclides in particulate form with half-lives greater than 8 days, in gaseous effluents exceeding any of the above limits, in lieu of any other report, prepare and submit a Special Report to the Commission within 30 days, pursuant to Appendix 1, Section 3.4 Limitations.

BASES

BL2.4.3.A Limitation L2.4.3.A implements the design guides set forth in 10 CFR 50, Appendix I, Section II.C, and the limiting conditions for operation as set forth in Appendix I, Section IV.A.

This limitation provides the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive materials in gaseous effluents will be kept "as low as reasonably achievable".

RADIOACTIVE GASEOUS EFFLUENTS

2.4.4 Gaseous Radwaste Treatment

LIMITATIONS

L2.4.4.A Ventilation exhaust treatment systems shall be used to reduce radioactive materials in gaseous waste prior to discharge when the projected doses due to gaseous effluent releases from ANO-1 to unrestricted areas (see Figure 4-2) would exceed 0.625 mrad for gamma radiation and 1.25 mrad for beta radiation over a calendar quarter; or when the projected doses due to iodine-131, tritium, and radionuclides in particulate form with half-lives greater than 8 days would exceed 1.0 mrem to any organ over a calendar quarter.

L2.4.4.B When degasifying the reactor coolant system, the gaseous radwaste treatment system shall be utilized to process the degassing effluent to reduce the concentration of radioactive materials prior to discharge when the projected doses due to gaseous effluent releases from ANO-1 to unrestricted areas (see Figure 4-2) would exceed 0.625 mrad for gamma radiation and 1.25 mrad for beta radiation over a calendar quarter.

APPLICABILITY: At all times

OBJECTIVE: To assure that the amount of radioactive material in gaseous effluents is "as low as reasonably achievable."

ACTION:

1. With gaseous waste being discharged without treatment and in excess of the above limits, in lieu of any other report, prepare and submit to the Commission within 30 days a Special Report, per Appendix 1, Section 3.4 Limitations.

BASES

BL2.4.4.A/B The requirement that the appropriate portions of these systems be used when specified provides reasonable assurance that the releases of radioactive materials in gaseous effluents will be kept "as low as reasonably achievable." The specified limits governing the use of appropriate portions of the systems were specified as a suitable fraction of the guide set forth in Sections II.B and II.C of Appendix I, 10 CFR Part 50, for gaseous effluents. The values 0.625 mrad, 1.25 mrad, and 1.0 mrem are approximately 25% of the yearly design objectives on a quarterly basis. The yearly design objectives are given in Appendix 1, Limitations L2.4.2.A and L2.4.3.A.

2.5 RADIOACTIVE EFFLUENTS

2.5.1 Total Dose

LIMITATIONS

L2.5.1.A The calculated doses from the release of radioactive materials in liquid or gaseous effluents shall not exceed twice the limits of Appendix 1, Limitation L2.3.2.A, L2.4.2.A, or L2.4.3.A.

APPLICABILITY: At all times

OBJECTIVE: To ensure that the limits of 40 CFR 190 are not exceeded.

ACTION:

1. With the calculated doses exceeding the above limits, prepare and submit a Special Report pursuant to 10 CFR Part 20.405C.

2. If the limits of 40 CFR 190 have been exceeded, obtain a variance from the Commission to permit further releases in excess of 40 CFR 190 limits. A variance is granted until staff action on the request is completed.

SURVEILLANCE LIMITATION

S2.5.1.A Cumulative dose contributions and dose projections for liquid effluents and for gaseous effluents shall be determined in accordance with this manual at least once per 31 days.

APPLICABILITY: At all times

OBJECTIVE: To ensure that the requirements of 10 CFR 50, Appendix I, Section III.A are met.

BASES

BL2.5.1.A This limitation is provided to meet the dose limits of 40 CFR 190 that have now been incorporated into 10 CFR Part 20. The limitation requires the preparation and submittal of a Special Report whenever the calculated doses from plant radioactive effluents exceed twice the design objective doses of Appendix I. For sites containing up to 4 reactors, it is highly unlikely that the resultant dose to a member of the public will exceed the dose limits of 40 CFR 190 if the individual reactors remain within the reporting requirement level. The Special Report will describe a course of action that should result in limiting the annual dose to a member of the public to within the 40 CFR 190 limits. For the purposes of the Special Report, it may be assumed that the dose commitment to the member of the public from other uranium fuel cycle sources is negligible, with the exception that dose contributions from other nuclear fuel cycle facilities within a radius of 8 km must be considered. If the dose to any member of the public is estimated to exceed the requirements of 40 CFR 190, the Special Report with a request for a variance (provided the release conditions resulting in violation of 40 CFR 190 have not already been corrected), in accordance with the provisions of 40 CFR 190.11 and 10 CFR 20.405c, is considered to be a timely request and fulfills the requirements of 40 CFR 190 until NRC staff action is completed. The variance only relates to the limits of 40 CFR 190, and does not apply in any way to the other requirements for dose limits in 10 CFR 20, as addressed in Appendix 1, Section 2.3 & 2.4 Limitations. An individual is not considered to be a member of the public during any period in which he/she is engaged in carrying out any operation that is part of the nuclear fuel cycle.

BS2.5.1.A These calculations provide the dose values to be compared to the limits of Appendix 1, Limitations L2.3.2.A, L2.3.3.A, L2.4.2.A, L2.4.3.A, L2.4.4.A, and L2.5.1.A.

2.6 RADIOLOGICAL ENVIRONMENTAL MONITORING

2.6.1 Radiological Environmental Monitoring Program Description

LIMITATION

L2.6.1.A The radiological environmental monitoring samples shall be collected pursuant to Table 2.6-1 and shall be analyzed pursuant to the requirements of Tables 2.6-1 and 2.6-2. The sample locations shall be listed in Table 4-1.

APPLICABILITY: Applies at all times.

OBJECTIVE: To provide information on the radiological effects of station operation on the environment.

ACTION:

1. With the radiological environmental monitoring program not being conducted as specified in Table 2.6-1, prepare and submit to the Commission in the Annual Radiological Environmental Operating Report a description of the reasons for not conducting the program as required and the plans for preventing a recurrence.

2. With the level of radioactivity as the result of plant effluents in an environmental sampling medium at one or more of the locations specified in Table 2.6-1 exceeding the limits of Table 2.6-3 when averaged over any calendar quarter, prepare and submit to the Commission, within 30 days from the end of the affected quarter, a Special Report which includes an evaluation of any release conditions, environmental factors or other aspects which caused the limits of Table 2.6-3 to be exceeded, and defines the actions taken to reduce radioactive effluents so that the potential annual dose to a member of the public is less than the calendar year limits of Appendix 1, Limitations L2.3.2.A and L2.4.2.A. When more than one of the radionuclides in Table 2.6-3 are detected in the sampling medium, this Special Report shall be submitted if:

$$\frac{\text{Concentration (1)}}{\text{reporting level (1)}} + \frac{\text{Concentration (2)}}{\text{reporting level (2)}} + \ldots \geq 1.0$$

SURVEILLANCE LIMITATIONS (Continued)

When radionuclides other than those in Table 2.6-3 are detected and are the result of plant effluents, this Special Report shall be submitted if the potential annual dose to a member of the public is equal to or greater than the calendar year limits of Appendix 1, Limitations L2.3.2.A and L2.4.2.A. This Special Report is not required if the measured level of radioactivity was not the result of plant effluents, however, in such an event, the condition shall be reported and described in the Annual Radiological Environmental Operating Report.

3. With milk or fresh leafy vegetable samples unavailable from any of the sample locations required by Table 2.6-1, identify locations for obtaining replacement samples and add them to the radiological environmental monitoring program within 30 days. The specific locations from which samples were unavailable may then be deleted from the monitoring program. Identify the causes of the unavailability of samples and identify the new location(s) for obtaining replacement samples in the next Radioactive Effluent Release Report and also include in the report a revised Table 4-1 reflecting the new location(s).

TABLE 2.6-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Number of Sample Location[a]	Sample and Collection Frequency[a]	Type and Frequency of Analyses
1. AIRBORNE			
a. Radioiodine and Particulates	4 Locations 2 Samples close to Site Boundary, in (or near) different sectors with the highest calculated annual average groundlevel D/Q. 1 Sample from the vicinity of a community having the highest calculated annual average groundlevel D/Q. 1 Sample from a control location 15-30 km. (10-20 miles) distance[c].	Continuous operation of sampler with sample collection as required by dust loading but at least once per 14 days.	Radioiodine canister. Analyze at least once per 14 days for I-131. Particulate sampler: Analyze for gross beta radioactivity following filter change[b]

TABLE 2.6-1 (Continued)

Exposure Pathway and/or Sample	Number of Sample Location[a]	Sample and Collection Frequency[a]	Type and Frequency of Analyses
2. DIRECT RADIATION[d]	24 Locations - 16 inner ring stations with two or more dosimeters in each meteororological sector in the general area of the Site Boundary - 8 stations with two or more dosimeters in special interest areas such as population centers, nearby residences, schools, and in 1 - 2 areas to serve as control locations.	Once per 92 days	Gamma dose. Once per 92 days.

TABLE 2.6-1 (Continued)

Exposure Pathway and/or Sample	Number of Sample Location[a]	Sample and Collection Frequency[a]	Type and Frequency of Analyses
3. WATERBORNE			
a. Surface Water	1 Indicator location (influenced by plant discharge) 1 Control location (uninfluenced by plant discharge)	Once per 92 days.	Gamma isotopic[e] and Tritium analyses once 92 days.
b. Drinking Water	1 Indicator location (influenced by plant discharge) 1 Control location (uninfluenced by plant discharge)	Once per 92 days.	I-131, gross beta, gamma isotopic[e] and tritium analyses once per 92 days.
c. Sediment from Shoreline	1 Indicator location (influenced by plant discharge) 1 Control location (uninfluenced by plant discharge)	Once per 365 days	Gamma isotopic[e] analysis once per 365 days.

TABLE 2.6-1 (Continued)

Exposure Pathway and/or Sample	Number of Sample Location[a]	Sample and Collection Frequency[a]	Type and Frequency of Analyses
4. INGESTION			
a. Milk	1 Indicator sample location within 8 km. distant if commercially available. 1 Control sample location at a distant of >8 km. when an indicator exists.	Once per 92 days.	Gamma isotopic[e] and I-131 analyses once per 92 days.
b. Fish	1 Sample of commercially and/or recreationally important species in vicinity of plant discharge. 1 Sample of same species in area not influenced by plant discharge.	Once per 365 days.	Gamma isotopic[e] on edible portions once per 365 days.
c. Food Products	1 Sample of broadleaf (edible or non-edible) near the Site Boundary from one of the highest anticipated annual average groundlevel D/Q sectors, if milk sampling is not performed. 1 Sample location of broadleaf vegetation (edible or non-edible) from a control location 15 - 30 km. distant, if milk sampling is not performed.	Three per 365 days.	Gamma isotopic[e] and I-131 analyses three times per 365 days.

TABLE 2.6-1 (Continued)

TABLE NOTATION

a The ODCM shall include, in a table and figures, specific parameters of distance and direction from the centerline of one reactor, and additional description where pertinent, for each sample location in Table 2.6-1. Refer to NUREG-0133, "Preparation of Radiological Technical Specifications for Nuclear Power Plants," October 1978, and to Radiological Assessment Branch Technical Position, Revision 1, November 1979. Deviations are permitted from the required sampling schedule if specimens are unobtainable due to hazardous conditions, seasonal unavailability, malfunction of automatic sampling equipment and other legitimate reasons. If specimens are unobtainable due to sampling equipment malfunctions, every effort shall be made to complete corrective action before the end of the next sampling period. All deviations from the sampling schedule shall be documented in the Annual Radiological Environmental Operating Report.

It is recognized that, at times, it may not be possible or practical to continue to obtain samples of the media of choice at the most desirable location or time. In these instances, suitable alternative media and locations may be chosen for the particular pathway in question and appropriate substitutions made within 30 days in the radiological environmental monitoring program. In the next Annual Radioactive Effluent Release Report, identify the cause of the unavailability of samples for that pathway and identify the new location(s) for obtaining replacement samples, and also include in the report a revised figure(s) and table(s) for the ODCM reflecting the new location(s).

b Particulate sample filters should be analyzed for gross beta 24 hours or more after sampling to allow for radon and thoron daughter decay. If gross beta activity in air or water is greater than ten times the yearly mean of control samples for any medium, gamma isotopic analysis should be performed on the individual samples.

c The purpose of this sample is to obtain background information.

d One or more instruments, such as a pressurized ion chamber, for measuring and recording dose rate continuously may be used in place of, or in addition to, integrating dosimeters. For the purpose of this table, a thermoluminescent dosimeter may be considered to be one phosphor and two or more phosphors in a packet considered as two or more dosimeters. Film badges should not be used for measuring direct radiation.

e Gamma isotopic analysis means the identification and quantification of gamma-emitting radionuclides that may be attributable to the effluents from the facility.

Table 2.6-2

MAXIMUM VALUES OF THE LOWER LIMITS OF DETECTION (LLD[a])

Analyses	Water (pCi/l)	Airborne Particulate or Gas (pCi/m³)	Fish (pCi/kg,wet)	Milk (pCi/l)	Food Products (pCi/kg,wet)	Sediment (pCi/kg,dry)
Gross Beta	4[b]	1×10^{-2}[c]				
H-3	2000[d]					
Mn-54	15		130			
Fe-59	30		260			
Co-58, 60	15		130			
Zn-65	30		260			
Zr-95	30					
Nb-95	15					
I-131	1[e]	7×10^{-2}[f]		1	60	
Cs-134	15	5×10^{-2}[g]	130	15	60	150
Cs-137	18	6×10^{-2}[g]	150	18	80	180
Ba-140	60			60		
La-140	15			15		

(a) See definition of LLD in table notation of Table 2.3-1.
(b) LLD for drinking water.
(c) Applicable to airborne particulate only.
(d) LLD for drinking water. If no drinking water pathway exists, a value of 3000 may be used.
(e) LLD for drinking water. If no drinking water pathway exists, a gamma isotopic LLD value of 15 pCi/l may be used.
(f) Applicable to airborne gas only.
(g) Applicable to airborne particulate only during gamma isotopic analysis.

TABLE 2.6-3

REPORTING LEVELS FOR RADIOACTIVITY CONCENTRATIONS IN ENVIRONMENTAL SAMPLES

Analyses	Water (pCi/l)	Airborne Particulate or Gases (pCi/m³)	Fish (pCi/kg,wet)	Milk (pCi/l)	Food Products (pCi/kg,wet)
H-3	2×10^4 (a)				
Mn-54	1×10^3		3×10^4		
Fe-59	4×10^2		1×10^4		
Co-58	1×10^3		3×10^4		
Co-60	3×10^2		1×10^4		
Zn-65	3×10^2		2×10^4		
Zr-Nb-95	4×10^2 (b)				
I-131	2	0.9		3	1×10^2
Cs-134	30	10	1×10^3	60	1×10^3
Cs-137	50	20	2×10^3	70	2×10^3
Ba-La-140	2×10^2 (b)			3×10^2 (b)	

(a) For drinking water samples.
(b) Total for parent and daughter.

RADIOLOGICAL ENVIRONMENTAL MONITORING

Radiological Environmental Monitoring Program Description

SURVEILLANCE LIMITATIONS

S2.6.1.A The results of analyses performed on the radiological environmental monitoring samples shall be summarized in the Annual Radiological Environmental Operating Report.

APPLICABILITY: Applies at all times.

OBJECTIVE: To provide information on the radiological effects of station operation on the environment.

BASES

BL2.6.1.A & BS2.6.1.A The radiological monitoring program required by this limitation provides measurements of radiation and of radioactive materials in those exposure pathways and for those radionuclides which lead to the highest potential radiation exposures of individuals resulting from the station operation. This monitoring program thereby supplements the radiological effluents monitoring program by verifying that the measurable concentrations of radioactive materials and levels of radiation are not higher than expected on the basis of the effluent measurements and modeling of the environmental exposure pathways. The initially specified monitoring program will be effective for at least the first three years of commercial operation. Following this period, program changes may be initiated based on operational experience.

The detection capabilities required by Table 2.6-2 are state of the art for routine environmental measurements in industrial laboratories.

2.6.2 Land Use Census

LIMITATION

L2.6.2.A A land use census shall be conducted and shall identify the location of the nearest milk animal, the nearest residence, and the nearest garden* of greater than 500 square feet producing fresh leafy vegetables in each of the 16 meteorological sectors within a distance of five miles from the ANO-1 reactor building.

APPLICABILITY: Applies at all times

OBJECTIVES: This limitation will identify changes in use of the unrestricted areas.

ACTION:

1. With a land use census identifying a location(s) which yields a calculated dose commitment due to I-131, tritium, and radionuclides in particulate form greater than the values currently being calculated in Appendix 1, Limitation S2.5.1.A and Appendix 2, Limitation S2.4.3.A submit location description in the Radioactive Effluent Release Report per Appendix 1, Section 3.2 Limitations.

2. With a land use census identifying a location(s) which yields a calculated dose commitment (via the same exposure pathway) greater than at a location from which samples are currently being obtained in accordance with Appendix 1, Limitation L2.6.1.A, identify the new location in the Radioactive Effluent Release Report per Appendix 1, Section 3.2 Limitations. The new location shall be added to the radiological environmental monitoring program within 30 days, if possible. The sampling location having the lowest calculated dose commitment (via the same exposure pathway) may be deleted from this monitoring program after October 31 of the year in which this land use census was conducted.

*Broad leaf vegetation sampling may be performed at the site boundary in the direction sector with the highest D/Q in lieu of the garden census.

RELEASE CONTROLS

RADIOLOGICAL ENVIRONMENTAL MONITORING

Land Use Census

SURVEILLANCE LIMITATION

S2.6.2.A The land use census shall be conducted at least once per 24 months between the dates of June 1 and October 1, by door-to-door survey, aerial survey, or by consulting local agricultural authorities. The results of the land use census shall be included in the Annual Radiological Environmental Operating Report.

APPLICABILITY: Applies at all times

OBJECTIVES: This limitation will identify changes in use of the unrestricted areas.

BASES

BL2.6.2.A & BS2.6.2.A This limitation is provided to ensure that changes in the use of unrestricted areas are identified and that modifications to the monitoring program are made if required by the results of this census. This census satisfies the requirements of Section IV.B.3 of Appendix I to 10 CFR Part 50. Restricting the census to gardens of greater than 500 square feet provides assurance that significant exposure pathway via leafy vegetables will be identified and monitored since a garden of this size is the minimum required to produce the quantity (26 kg/year) of leafy vegetables assumed in Regulatory Guide 1.109 for consumption by a child. To determine this minimum garden size, the following assumptions were used, 1) that 20% of the garden was used for growing broad leaf vegetation (i.e., similar to lettuce and cabbage), and 2) a vegetation yield of 2 kg/square meter.

2.6.3 Interlaboratory Comparison Program

LIMITATION

L2.6.3.A Analyses shall be performed on radioactive materials supplied as part of Interlaboratory Comparison Program which has been approved by NRC.

APPLICABILITY: Applies to the off-site radiochemistry laboratory.

OBJECTIVE: To provide independent checks on the accuracy of the measurements of radioactive material in environmental samples.

ACTION:

1. With analyses not being performed as required above, report the corrective actions taken to prevent a recurrence to the Commission in the Annual Radiological Environmental Operating Report.

SURVEILLANCE LIMITATION

S2.6.3.A The results of analyses performed as part of the above required Interlaboratory Comparison Program shall be included in the Annual Radiological Environmental Operating Report pursuant to Appendix 1, Section 3.3 Limitations.

APPLICABILITY: Applies to the off-site radiochemistry laboratory.

OBJECTIVE: To provide independent checks on the accuracy of the measurements of radioactive material in environmental samples.

BASES

BL2.6.3.A & BS2.6.3.A The requirement for participation in an Interlaboratory Comparison Program is provided to ensure that independent checks on the precision and accuracy of the measurements of radioactive material in environmental sample matrices are performed as part of a quality assurance program for environmental monitoring in order to demonstrate that the results are reasonably valid.

3.0 ADMINISTRATIVE CONTROLS

3.1 PROGRAMS

LIMITATION

L3.1.1 The following program shall be established, implemented, and maintained:

A. Radioactive Effluent Controls Program

(Refer to Unit 1 Technical Specification 5.5.4)

B. Radiological Environmental Monitoring Program

A program shall be provided to monitor the radiation and radionuclides in the environs of the plant. The program shall provide (1) representative , measurements of radioactivity in the highest potential exposure pathways, and (2) verification of the accuracy of the effluent monitoring program and modeling of environmental exposure pathways. The program shall (1) be contained in this manual, (2) conform to the guidance of Appendix I to 10 CFR Part 50, and (3) include the following:

1. Monitoring, sampling, analysis, and reporting of radiation and radionuclides in the environment in accordance with the methodology and parameters in this manual,

2. A Land Use Census to ensure that changes in the use of areas at and beyond the site boundary are identified and that modifications to the monitoring program are made if required by the results of this census,

3. Participation in an Interlaboratory Comparison Program to ensure that independent checks on the precision and accuracy of the measurements of radioactive materials in environmental sample matrices are performed as part of the quality assurance program for environmental monitoring.

3.2 RADIOACTIVE EFFLUENT RELEASE REPORT**

LIMITATIONS

L3.2.1 The Radioactive Effluent Release Report shall be in accordance with Unit 1 Technical Specification 5.6.3 requirements.

A. The Radioactive Effluent Release Report shall include a summary of the quantities of radioactive liquid and gaseous effluents and solid waste release from the unit. The data will be summarized following the format of Regulatory Guide 1.21, Rev. 1.

B. The Radioactive Effluent Release Report shall include the following information for all unplanned releases to unrestricted areas of radioactive material in gaseous and liquid effluents:

1. A description of the event and equipment involved.

2. Cause(s) for the unplanned release.

3. Actions taken to prevent recurrence.

4. Consequences of the unplanned release.

C. The Radioactive Effluent Release Report shall contain a description of any changes to the ODCM and PCP made during the period of the report. (Refer to Unit 1 Technical Specification 5.5.1.c for potential reporting requirements.)

D. The Radioactive Effluent Release Report shall contain:

1. A summary of the hourly meteorological data collected over the previous calendar year. In lieu of including this summary in the report, the data may be retained by the Licensee for NRC review and noted as such in the report.

2. A summary of radiation doses due to radiological effluents during the previous calendar year calculated in accordance with the methodology specified in this manual.

3. The radiation dose to members of the public due to their activities inside the site boundary. This calculated dose shall include only those dose contributions directly attributed to operation of the unit and shall be compared to the limits specified in 40 CFR 190.

**A single submittal may be made for ANO. The submittal shall combine sections common to both units. The submittal shall specify the releases of radioactive material from each unit.

3.2 RADIOACTIVE EFFLUENT RELEASE REPORT**

LIMITATIONS (Continued)

E. The Radioactive Effluent Release Report shall include a description of licensee initiated major changes to the radioactive waste systems (liquid, gaseous and solid) during the previous calendar year.***

***This information may be included in the periodic SAR update in lieu of inclusion in this report.

3.3 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT*

LIMITATIONS

L3.3.1 The Annual Radiological Environmental Operating Report shall be in accordance with Unit 1 Technical Specification 5.6.2 requirements. The Annual Radiological Environmental Operating Report covering the operation of the unit during the previous calendar year shall be submitted by May 15 of each year.

A. The Annual Radiological Environmental Operating Report shall include summaries, interpretations, and analyses of trends of the results of the radiological environmental monitoring program for the reporting period. If harmful effects or evidence of irreversible damage are detected by the monitoring, the report shall provide an analysis of the problem and a planned course of action to alleviate the problem.

B. The Annual Radiological Environmental Operating Report shall include summarized and tabulated results of all radiological environmental samples and of all environmental radiation measurements required by this manual taken during the reporting period. In the event that some results are not available for inclusion with the report, the report shall be submitted noting and explaining the reasons for the missing results. If the missing data becomes available, it shall be submitted as soon as possible in a supplementary report.

C. The Annual Radiological Environmental Operating Report shall also include the following: a summary description of the radiological environmental monitoring program, a map of all sampling locations keyed to a table giving distances and directions from the reactor buildings; the results of the Land Use Census required by Appendix 1, Section 2.6.2 limitations, and the results of the Interlaboratory Comparison Program participation required by Appendix 1, Section 2.6.3 limitations.

*A single submittal may be made for ANO. The submittal should combine sections common to both units.

3.4 SPECIAL REPORTS

LIMITATIONS

L3.4.1 Special reports shall be submitted to the Administrator of the appropriate Regional Office within the time period specified for each report. These reports shall be submitted covering the activities identified below pursuant to the requirements of the applicable reference limitation.

A. Radioactive Effluents; Appendix 1, Section 2.3, 2.4, 2.5 Limitations and NMM RW-105.

This report shall include the following:

1. Description of occurrence.
2. Identify the cause(s) for exceeding the limit(s)
3. Explain corrective action(s) taken to mitigate occurrence.
4. Define action(s) taken to prevent recurrence.
5. Summary of consequence(s) of occurrence.
6. Describe levels exceeding 40 CFR 190 in accordance with 10 CFR 20.405(c), as applicable.

B. Radiological Environmental Monitoring Sample Analysis; Appendix 1, Section 2.6.1 Limitations.

C. An unplanned offsite release during any one hour period of 1) more than 1 curie of radioactive material in liquid effluents, 2) more than 150 curies of noble gas in gaseous effluents, or 3) more than 0.05 curies of radioiodine in gaseous effluents. The report of an unplanned offsite release of radioactive material shall be submitted within 30 days of the occurrence and shall include the following information:

1. A description of the event and equipment involved.
2. Cause(s) for the unplanned release.
3. Actions taken to prevent recurrence
4. Consequences of the unplanned release.

4.0 UNIT 1 MAIN STEAM LINE RADIATION MONITORING INSTRUMENTATION

LIMITATION

L4.1 The Main Steam Line Radiation Monitoring Instrumentation shall be operable with a minimum measurement range from 10^{-1} to 10^{4} mR/hr, whenever the reactor is above the cold shutdown condition.

APPLICABILITY: Unit 1 Main Steam Line Radiation Monitors

OBJECTIVE: To delineate the condition of the Unit 1 main steam line radiation monitors to assure reactor safety.

ACTION:

1. With the less than minimum number of channels operable, take action shown in Table 4.1-1, Note 1.

SURVEILLANCE LIMITATION

S4.1 The Main Steam Line Radiation Monitors shall be demonstrated operable by performance of the channel check, channel test, and channel calibration at the frequency shown in Table 4.1-2.

APPLICABILITY: Applies to the Main Steam Line Radiation Monitors.

OBJECTIVE: To provide surveillance limitations for the instruments listed Appendix 1, Limitation L4.1.

Table 4.1-1

Instrumentation Limiting Conditions for Operation

Functional Unit	No. of Channels	No. of Channels for system trip	Min. operable channels	Min. degree of redundancy	Operator action if conditions of column 3 or 4 cannot be met
1. Main Steam Line	1/steam line	N/A	1/steam line	0	Note 1

Notes: 1. With the number of OPERABLE Channels less than required by the Minimum Channels OPERABLE requirements, Initiate the preplanned alternate method of monitoring the appropriate parameter(s), within 72 hours, and restore the inoperable Channel(s) to OPERABLE status within 7 days of the event.

Table 4.1-2

Instrument Surveillance Requirements

	Channel Description	Check	Test	Calibrate
1.	Main Steam Line Radiation Monitors	S	M	R

S - Each Shift

M - Monthly

R - Once every 18 months

APPENDIX 2

RADIOACTIVE EFFLUENT CONTROLS UNIT 2

1.0 DEFINITIONS

OPERABLE - OPERABILITY

1.1 A system, subsystem, train, component or device shall be operable or have operability when it is capable of performing its specified function(s). Implicit in this definition shall be the assumption that all necessary attendant instrumentation, controls, normal and emergency electrical power sources, cooling or seal water, lubrication or other auxiliary equipment that are required for the system, subsystem, train, component or device to perform its function(s) are also capable of performing their related support function(s).

CHANNEL CALIBRATION

1.2 A channel calibration shall be the adjustment, as necessary, of the channel output such that it responds with the necessary range and accuracy to known values of the parameter which the channel monitors. The channel calibration shall encompass the entire channel including the sensor and alarm and/or trip functions, and shall include the channel functional test. The channel calibration may be performed by any series of sequential, overlapping or total channel steps such that the entire channel is calibrated.

CHANNEL CHECK

1.3 A channel check shall be the qualitative assessment of channel behavior during operation by observation. This determination shall include, where possible, comparison of the channel indication and/or status with other indications and/or status derived from independent instrument channels measuring the same parameter.

CHANNEL FUNCTIONAL TEST

1.4 A channel functional test shall be:

a. Analog channels - The injection of a simulated signal into the channel as close to the sensor as practicable to verify operability including alarm and/or trip functions.

b. Bistable channels - The injection of a simulated signal into the sensor to verify operability including alarm and/or trip functions.

c. Digital computer channels - The exercising of the digital computer hardware using diagnostic programs and the injection of simulated process data into the channel to verify operability.

SOURCE CHECK

1.5 A source check shall be the qualitative assessment of channel response when the channel sensor is exposed to the radioactive source.

DEFINITIONS

LIQUID RADWASTE TREATMENT SYSTEM

1.6 A liquid radwaste treatment system is a system designed and installed to reduce radioactive liquid effluents from the unit. This is accomplished by providing for holdup, filtration, and/or demineralization of radioactive liquid effluents prior to their release to the environment.

GASEOUS RADWASTE TREATMENT SYSTEM

1.7 A gaseous radwaste treatment system is any system designed and installed to reduce radioactive gaseous effluents from the plant by collecting offgases from radioactive systems and providing for decay or holdup for the purpose of reducing the total radioactivity prior to release to the environment.

VENTILATION EXHAUST TREATMENT SYSTEM

1.8 A ventilation exhaust treatment system is any system designed and installed to reduce gaseous radioiodine or radioactive material in particulate form in effluents by passing ventilation or vent exhaust gases through charcoal adsorbers and/or HEPA filters for the purpose of removing iodines or particulates from the gaseous exhaust stream prior to the release to the environment. Such a system is not considered to have any effect on noble gas effluents. Atmospheric cleanup systems that are Engineered Safety Feature (ESF) actuated are not considered to be ventilation exhaust treatment systems.

MEMBER(S) OF THE PUBLIC

1.9 Member(s) of the public shall include all persons who are not occupationally associated with the plant. This category does not include employees of the utility, its contractors or vendors. Also excluded from this category are persons who enter the site to service equipment or to make deliveries. This category does include persons who use portions of the site for recreational, occupational or other purposes not associated with the plant.

PURGE - PURGING

1.10 Purge or purging is the controlled process of discharging air or gas from a confinement to reduce airborne radioactive concentrations in such a manner that replacement air or gas is required to purify the confinement.

EXCLUSION AREA

1.11 The exclusion area is that area surrounding ANO within a minimum radius of 0.65 miles of the reactor buildings and controlled to the extent necessary by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials.

DEFINITIONS

UNRESTRICTED AREA

1.12 An unrestricted area shall be any area at or beyond the exclusion area boundary.

FREQUENCY NOTATION

1.13 The frequency notation specified for the performance of Surveillance Limitations shall correspond to the following intervals:

P		Completed prior to each release
S	Shift	At least once per 12 hours
D	Daily	At least once per 24 hours
W	Weekly	At least once per 7 days
M	Monthly	At least once per 31 days
Q	Quarterly	At least once per 92 days
SA	Semiannual	At least once per 184 days
R	Refueling	At least once per 18 months
N/A		Not Applicable

BATCH RELEASE

1.14 A "Batch" release is the discharge of liquid wastes of a discrete volume. Prior to sampling for analysis, each batch shall be isolated and then thoroughly mixed to assure representative sampling.

CONTINUOUS RELEASE

1.15 A "Continuous" release is the discharge of liquid waste of a non-discrete volume, e.g. from a volume of a system that has an input flow during the continuous release.

2.0 RELEASE CONTROLS

LIMITATION

L2.0.1 The Limitation and Action requirements shall be applicable during the conditions specified for each limitation.

L2.0.2 Adherence to the requirements of the Limitation and/or associated Action within the specified time interval shall constitute compliance with the Limitation. In the event the Limitation is restored prior to the expiration of the specified time interval, completion of the action statement is not required.

BASES

BL2.0.1 This limitation establishes the general requirements applicable to Limitations. Limitations are the lowest functional capability or performance levels of equipment required for safe operation of the facility. When a Limitation is not met, the licensee shall follow any remedial Action permitted by the Limitation until the condition can be met. This limitation establishes the applicability statement within each individual limitation as the requirement for when (i.e., in which specified conditions) conformance to the Limitation is required for safe operation of the facility. The Action requirements establish those remedial measures that must be taken within specified time limits when the requirements of a Limitation are not met. The Action requirements specify the remedial measures that permit continued operation of the facility which is not further restricted by the time limits of the Action requirements. In this case, conformance to the Action requirements provides an acceptable level of safety for unlimited continued operations as long as the Action requirements continue to be met. The specified time limits of the Action requirements are applicable from the point in time it is identified that a Limitation is not met. The time limits of the Action requirements are also applicable when a system or component is removed from service for surveillance testing or investigation of operational problems. Individual limitations may include a specified time limit for completion of a Surveillance Limitation when equipment is removed from service. In this case, the allowable outage time limits of the Action requirements are applicable when this limit expires if the surveillance has not been completed.

BL2.0.2 This limitation establishes the general requirements applicable to Limitations. Limitations are the lowest functional capability or performance levels of equipment required for safe operation of the facility. When a limitation is not met, the licensee shall follow any remedial Action permitted by the Limitation until the condition can be met. This limitation establishes that noncompliance with a limitation exists when the requirements of the Limitation are not met and the associated Action requirements have not been implemented within the specified time interval. The purpose of this limitation is to clarify that (1) implementation of the Action requirements constitutes compliance with a limitation and (2) completion of the remedial measures of the Action requirements is not required when compliance with a Limitation is restored within the time interval specified in the associated Action requirements.

SURVEILLANCE LIMITATION

S2.0.1 Surveillance Limitations shall be applicable during the conditions specified for individual Limitations unless otherwise stated in an individual Surveillance Limitation.

S2.0.2 Each Surveillance Limitation shall be performed within the specified surveillance interval with a maximum allowable extension not to exceed 25% of the specified surveillance interval.

BASES

BS2.0.1 This surveillance limitation establishes the general requirements applicable to Surveillance Limitations. Surveillance Limitations are requirements relating to test, calibration, or inspection to ensure that the necessary quality of systems and components is maintained and that the limitations will be met. This surveillance limitation establishes the requirement that surveillances must be performed during the conditions for which the requirements of the Limitation apply unless otherwise stated in an individual Surveillance Limitation. The purpose of this surveillance limitation is to ensure that the surveillances are performed to verify the operational status of systems and components and that parameters are within specified limits to ensure safe operation of the facility when the plant is an a specified condition for which the associated Limitations are applicable. Surveillance Limitations do not have to be performed when the facility is in a condition for which the requirements of the associated Limitation do not apply unless otherwise specified.

BS2.0.2 This surveillance limitation establishes the general requirements applicable to Surveillance Limitations. Surveillance Limitations are requirements relating to test, calibration, or inspection to ensure that the necessary quality of systems and components is maintained and that the limitations will be met. This surveillance limitation establishes the limit for which the specified time interval for Surveillance Limitations may be extended. It permits an allowable extension of the normal surveillance interval to facilitate surveillance scheduling and consideration of plant operating conditions that may not be suitable for conducting the surveillance (e.g., transient conditions or other ongoing surveillance or maintenance activities). It also provides flexibility to accommodate the length of a fuel cycle for surveillances that are performed at a refueling frequency and are specified with an 18-month surveillance interval. It is not intended that this provision be used repeatedly as a convenience to extend surveillance intervals beyond that specified for surveillances. This surveillance limitation is based upon engineering judgement and the recognition that the most probable result of any particular surveillance being performed is the verification of conformance with the Surveillance Limitations. This provision is sufficient to ensure that the reliability ensured through surveillance activities is not significantly degraded beyond that obtained from the specified surveillance intervals.

RELEASE CONTROLS

2.1 RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

LIMITATION

L2.1.1 The radioactive liquid effluent monitoring instrumentation channels shown in Table 2.1-1 shall be operable with their alarm/trip setpoints set to ensure that the limits of Appendix 2, Limitation L2.3.1.A are not exceeded.

APPLICABILITY: During releases via this pathway.

ACTION:

1. With a radioactive liquid effluent monitoring instrumentation channel alarm/trip setpoint less conservative than required by the above limitation, immediately suspend the release of radioactive liquid effluents monitored by the affected channel, until the set point is changed to an acceptable conservative value.

2. With less than the minimum number of monitoring instrumentation channels operable, take the action shown in Table 2.1-1.

3. Return the instruments to operable status within 30 days or, in lieu of any other report, explain in the next Radioactive Effluent Release Report why the inoperability was not corrected.

TABLE 2.1-1

RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

INSTRUMENT	MINIMUM CHANNELS OPERABLE	APPLICABILITY	ACTION
1. Gross Radioactivity Monitor(s) (provides alarm and automatic termination of release)			
a. Liquid Radwaste Effluent Line	1	During Releases Via This Pathway (DRVTP)	1
2. Flow Monitor(s)			
a. Liquid Radwaste Effluent Line	1	DRVTP	2

TABLE 2.1-1 (Continued)

TABLE NOTATION

ACTION 1 With the number of channels operable less than required by the Minimum Channels operable requirement, effluent releases may be resumed provided that prior to initiating a release:

a. At least two independent samples are analyzed; and

b. At least two technically qualified members of the Facility Staff independently verify the release rate computer input data; and

c. At least two technically qualified members of the Facility Staff independently verify the discharge valve lineup.

Otherwise, suspend release of radioactive effluents via this pathway.

ACTION 2 With the number of channels operable less than required by the Minimum Channels operable requirement, effluent releases via this pathway may continue provided the flow rate is estimated at least once per 4 hours during actual releases. Pump curves may be used to estimate flow.

RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

SURVEILLANCE LIMITATIONS

S2.1.1 Each radioactive liquid effluent monitoring instrumentation channel shall be demonstrated operable by performance of the channel check, source check,channel calibration, and channel functional test at the frequencies shown in Table 2.1-2.

TABLE 2.1-2

RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE LIMITATIONS

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST
1. Gross Radioactivity Monitor(s) (provides alarm and automatic isolation)				
a. Liquid Radwaste Effluents Line	D*	p**	R	Q
2. Flow Monitor(s)				
a. Liquid Radwaste Effluent Line	D*	N/A	R	N/A

* During releases via this pathway

** A source check is not required if the background activity is greater than the activity of the check source.

P Prior to release
D Daily
Q Quarterly
R Every 18 months
N/A Not Applicable

RELEASE CONTROLS

RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

BASES

BL2.1.1 & BS2.1.1 The radioactive liquid effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in liquid effluents during actual or potential releases of liquid effluents. The alarm/trip setpoints for these instruments shall be calculated in accordance with the procedures in this manual to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20.

For the radioactive liquid effluent instrumentation surveillance requirements, the channel test demonstrates that automatic isolation of this pathway and control room alarm annunciation occur if the instrument indicates measured levels above the trip setpoint. The channel test demonstrates that alarm annunciation occurs if any of the following conditions exist:

A. Power to the detector is lost.

B. The instrument indicates a downscale failure (local alarm only on 2RE-4423).

The initial channel calibration is performed using one or more of the reference standards certified by the National Institute of Standards and Technology or using standards that have been obtained from suppliers that participate in measurement assurance activities with NIST. These standards permit calibrating the system over its intended range of energy and measurement range. For subsequent channel calibration, sources that have been related to the initial calibration are used.

RELEASE CONTROLS

2.2 RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

LIMITATION

L2.2.1 The radioactive gaseous effluent monitoring instrumentation channels shown in Table 2.2-1 shall be operable with their alarm/trip setpoints set to ensure that the limits of Appendix 2, Limitation L2.4.1.A are not exceeded.

APPLICABILITY: During releases via this pathway.

ACTION:

1. With the following gaseous effluent monitoring instrumentation channels alarm/trip setpoint less conservative than required by the above limitation, immediately suspend the release of radioactive gaseous effluents monitored by the affected channel.

   a. Waste Gas Holdup System Noble Gas Activity Monitor (during periods of gaseous releases.)

   b. Containment Purge and Ventilation System Noble Gas Activity Monitor (during periods of containment building purge.)

2. With less than the minimum number of monitoring instrumentation channels operable, take the action shown in Table 2.2-1.

3. Return the instruments to operable status within 30 days or, in lieu of any other report, explain in the next Radioactive Effluent Release Report why the inoperability was not corrected.

TABLE 2.2-1

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

	INSTRUMENT	MINIMUM CHANNELS OPERABLE	APPLICABILITY	PARAMETER	ACTION
1.	Waste Gas Holdup System				
	a. Noble Gas Activity Monitor (provides alarm and automatic termination of release)	1	During Releases Via This Pathway (DRVTP)	Radioactivity	1
	b. Effluent System Flow Monitor	1	DRVTP	System Flow	2
2.	Containment Purge and Ventilation System				
	a. Noble Gas Activity Monitor	1	DRVTP	Radioactivity	3, 5
	b. Iodine Sampler Cartridge	1	DRVTP	Verify Presence of Cartridge	4
	c. Particulate Sampler Filter	1	DRVTP	Verify Presence of Filter	4
	d. Effluent System Flow Monitor	1	DRVTP	System Flow	2
	e. Sampler Flow Monitor	1	DRVTP	Sampler Flow	2

TABLE 2.2-1 (Continued)

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

INSTRUMENT	MINIMUM CHANNELS OPERABLE	APPLICABILIITY	PARAMETER	ACTION
3. Spent Fuel Area Ventilation System				
a. Noble Gas Activity Monitor	1	DRVTP	Radioactivity	3
b. Iodine Sampler Cartridge	1	DRVTP	Verify Presence of Cartridge	4
c. Particulate Sampler Filter	1	DRVTP	Verify Presence of Filter	4
d. Effluent System Flow Monitor	1	DRVTP	System Flow	2
e. Sampler Flow Monitor	1	DRVTP	Sampler Flow	2
4. Auxiliary Building Area Ventilation System				
a. Noble Gas Activity Monitor	1	DRVTP	Radioactivity	3
b. Iodine Sampler Cartridge	1	DRVTP	Verify Presence of Cartridge	4
c. Particulate Sampler Filter	1	DRVTP	Verify Presence of Filter	4
d. Effluent System Flow Monitor	1	DRVTP	System Flow	2
e. Sampler Flow Monitor	1	DRVTP	Sampler Flow	2

TABLE 2.2-1 (Continued)

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

INSTRUMENT	MINIMUM CHANNELS OPERABLE	APPLICABILITY	PARAMETER	ACTION
5. Auxiliary Building Extension Ventilation System				
a. Noble Gas Activity Monitor	1	DRVTP	Radioactivity	3
b. Iodine Sample Cartridge	1	DRVTP	Verify Presence of Cartridge	4
c. Particulate Sampler Filter	1	DRVTP	Verify Presence of Filter	4
d. Effluent System Flow Monitor	1	DRVTP	System Flow	2
e. Sampler Flow Monitor	1	DRVTP	Sampler Flow	2
6. Radwaste Storage Building HVAC Exhaust System				
a. Noble Gas Activity Monitor	1	DRVTP	Radioactivity	6
b. Iodine Sample Cartridge	1	DRVTP	Verify Presence of Cartridge	7
c. Particulate Sampler Filter	1	DRVTP	Verify Presence of Filter	7
d. Effluent System Flow Monitor	1	DRVTP	System Flow	8
e. Sampler Flow Monitor	1	DRVTP	Sampler Flow	8

TABLE 2.2-1 (Continued)

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

INSTRUMENT	MINIMUM CHANNELS OPERABLE	APPLICABILITY	PARAMETER	ACTION
7. Emergency Penetration Room Ventilation System				
a. Noble Gas Activity Monitor	1	DRVTP	Radioactivity	3
b. Iodine Sample Cartridge	1	DRVTP	Verify Presence of Cartridge	4
c. Particulate Sampler Filter	1	DRVTP	Verify Presence of Filter	4
d. Effluent System Flow Monitor	1	DRVTP	System Flow	2
e. Sampler Flow Monitor	1	DRVTP	Sampler Flow	2

TABLE 2.2-1 (Continued)

TABLE NOTATION

ACTION 1 With the number of channels operable less than required by the Minimum Channels operable requirement, the contents of the tank may be released to the environment provided that prior to initiating the release:

a. At least two independent samples of the tank's contents are analyzed; and

b. At least two technically qualified members of the Facility Staff independently verify the computer input data; and

c. At least two technically qualified members of the Facility Staff independently verify the discharge valve lineup.

Otherwise, suspend release of radioactive effluents via this pathway.

ACTION 2 With the number of channels operable less than required by the Minimum Channels operable requirement, effluent releases via this pathway may continue provided the flow rate is estimated at least once per 4 hours.

ACTION 3 With the number of channels operable less than required by the Minimum Channels operable requirement, effluent releases via this pathway may continue provided grab samples are taken at least once per 12 hours and these samples are analyzed for gross activity within 24 hours. During the performance of required source checks of radioactive gaseous effluent monitoring instrumentation for plant ventilation systems, these requirements need not be implemented if the instrument is restored to an operable condition within four hours.

ACTION 4 With the number of channels operable less than required by the Minimum Channels operable requirement, effluent releases via this pathway may continue provided samples are collected with auxiliary sampling equipment. Iodine sample cartridges and particulate sample filters shall be changed at least once per 7 days and analyses shall be completed within 48 hours after changing in accordance with Table 2.4-1. A time period of up to four hours is allowed to continue releases via the affected pathway without auxiliary sampling equipment in operation. If at the conclusion of the four-hour period normal instrumentation is not restored or auxiliary sampling equipment is not in operation, then releases via the pathway shall be immediately suspended. The allowable four-hour time period is applicable if the instrumentation is discovered to be inoperable for any reason and whenever it is necessary to render the instrumentation inoperable in order to perform the weekly surveillance (i.e., filter changeout) required by ODCM Appendix 2 Table 2.4-1.

TABLE 2.2-1 (Continued)

TABLE NOTATION

ACTION 5 With the number of channels operable less than required by the Minimum Channels operable requirement, suspend all operations involving movement of fuel assemblies or CEAs within the pressure vessel.

ACTION 6 With the number of channels operable less than required by the Minimum Channels operable requirement, effluent releases via this pathway may continue provided grab samples are taken at least once per 12 hours and these samples are analyzed for gross activity within 24 hours. Otherwise, suspend all compaction activities within the Radwaste Storage Building.

ACTION 7 With the number of channels operable less than required by the Minimum Channels operable requirement, effluent releases via this pathway may continue provided samples are collected with auxiliary sampling equipment. Iodine sample cartridges and particulate sample filters shall be changed at least once per 7 days and analyses shall be completed within 48 hours after changing in accordance with Table 2.4-1. Otherwise, suspend all compaction activities within the Radwaste Storage Building.

ACTION 8 With the number of channels operable less than required by the Minimum Channels operable requirement, effluent releases via this pathway may continue provided the flow rate is estimated at least once per 4 hours. Otherwise, suspend all compaction activities within the Radwaste Storage Building.

RELEASE CONTROLS

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

SURVEILLANCE LIMITATION

S2.2.1 Each radioactive gaseous effluent monitoring instrumentation channel shall be demonstrated operable by performance of the channel check, source check, channel calibration, and channel functional test at the frequencies shown in Table 2.2-2.

TABLE 2.2-2

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE LIMITATIONS

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST
1. Waste Gas Holdup System				
a. Gas Activity Monitor (provides alarm and automatic termination of release)	D*	p**	R	Q
b. System Effluent Flow Monitor	D*	N/A	R	N/A
2. Containment Purge and Ventilation System				
a. Gas Activity Monitor	D*	p**	R	M (1), P
b. Iodine Sampler Cartridge	W*(2)	N/A	N/A	N/A
c. Particulate Sampler Filter	W*(2)	N/A	N/A	N/A
d. System Effluent Flow Monitor	D*	N/A	R	N/A
e. Sampler Flow Monitor	D*	N/A	R	N/A

TABLE 2.2-2 (Continued)

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE LIMITATIONS

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST
3. Spent Fuel Area Ventilation System				
a. Gas Activity Monitor	D*	M**	R	Q
b. Iodine Sampler Cartridge	W*(2)	N/A	N/A	N/A
c. Particulate Sampler Filter	W*(2)	N/A	N/A	N/A
d. System Effluent Flow Monitor	D*	N/A	R	N/A
e. Sampler Flow Monitor	D*	N/A	R	N/A
4. Auxiliary Building Area Ventilation System				
a. Gas Activity Monitor	D*	M**	R	Q
b. Iodine Sampler Cartridge	W*(2)	N/A	N/A	N/A
c. Particulate Sampler Filter	W*(2)	N/A	N/A	N/A
d. System Effluent Flow Monitor	D*	N/A	R	N/A
e. Sampler Flow Monitor	D*	N/A	R	N/A

TABLE 2.2-2 (Continued)

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE LIMITATIONS

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST
5. Auxiliary Building Extension Ventilation System				
a. Gas Activity Monitor	D*	M**	R	Q
b. Iodine Sampler Cartridge	W*(2)	N/A	N/A	N/A
c. Particulate Sampler Filter	W*(2)	N/A	N/A	N/A
d. System Effluent Flow Monitor	D*	N/A	R	N/A
e. Sampler Flow Monitor	D*	N/A	R	N/A
6. Radwaste Storage Building HVAC Exhaust System				
a. Gas Activity Monitor	D*	M**	R	Q
b. Iodine Sampler Cartridge	W*(2)	N/A	N/A	N/A
c. Particulate Sampler Filter	W*(2)	N/A	N/A	N/A
d. System Effluent Flow Monitor	D*	N/A	R	N/A
e. Sampler Flow Monitor	D*	N/A	R	N/A

TABLE 2.2-2 (Continued)

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE LIMITATIONS

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST
7. Emergency Penetration Room Ventilation System				
a. Gas Activity Monitor	D*	M**	R	Q
b. Iodine Sampler Cartridge	W*(2)	N/A	N/A	N/A
c. Particulate Sampler Filter	W*(2)	N/A	N/A	N/A
d. System Effluent Flow Monitor	D*	N/A	R	N/A
e. Sampler Flow Monitor	D*	N/A	R	N/A

TABLE 2.2-2 (Continued)

TABLE NOTATION

*During releases via this pathway.

**A source check is not required if the background activity is greater than the activity of the check source.

(1) During Containment Building ventilation operations.

(2) Verify presence of cartridge or filter only.

P Prior to release
D Daily
W Weekly
M Monthly
Q Quarterly
R Every 18 months
N/A Not Applicable

RELEASE CONTROLS

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

BASES

BL2.2.1 & BS2.2.1 The radioactive gaseous effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in gaseous effluents during actual or potential releases of gaseous effluents. The alarm/trip setpoints for these instruments shall be calculated in accordance with the procedures in this manual to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20.

For the radioactive gaseous effluent instrumentation surveillance requirements, the channel functional test demonstrates that control room alarm annunciation occurs if any of the following conditions exist:

A. The instrument indicates measured levels above the alarm/trip setpoint.

B. Power to the detector is lost.

C. The instrument indicates a downscale failure.

For the containment purge and the waste gas holdup system noble gas activity monitors, the channel functional test also demonstrates the automatic isolation of the release pathway occurs if the instrument indicates above the trip setpoint.

The initial channel calibration is performed using one or more of the reference standards certified by the National Institute of Standards and Technology or using standards that have been obtained from suppliers that participate in measurement assurance activities with NIST. These standards permit calibrating the system over its intended range of energy and measurement range. For subsequent channel calibration, sources that have been related to the initial calibration are used.

RELEASE CONTROLS

2.3 RADIOACTIVE LIQUID EFFLUENTS

2.3.1 Concentration

LIMITATION

L2.3.1.A The concentration of radioactive material released from the site in liquid effluents to the discharge canal shall be limited to the concentrations specified in 10 CFR Part 20, Appendix B, Table II, Column 2 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration released shall be limited to 2×10^{-4} µCi/ml.

APPLICABILITY: At all times.

ACTION:

1. With the concentration of radioactive material released exceeding the above limits, immediately initiate actions to restore concentrations to within the above limits. Provide notification to the Commission within 24 hours and in lieu of any other report, submit a Special Report pursuant to Appendix 2, Limitation L3.4.1.A within 30 days.

SURVEILLANCE LIMITATIONS

S2.3.1.A.1 Radioactive liquid wastes shall be sampled and analyzed according to the sampling and analyses program of Table 2.3-1.

S2.3.1.A.2 The results of the radioactivity analyses shall be used in accordance with the methods in this manual to assure that the concentrations at the point of release are maintained within the limits of Appendix 2, Limitation L2.3.1.A.

TABLE 2.3-1

RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSES PROGRAM

Liquid Release Type	Sampling Frequency	Minimum Analyses Frequency	Type of Activity Analyses	Lower Limit of Detection (LLD) (uCi/ml) (a)
A. Batch Waste Release (d)	P Each Batch	P Each Batch	γ isotopic (g)	5×10^{-7} (b)
			I-131	1×10^{-6}
	P One Batch/M	M	Dissolved and Entrained Gases (Gamma Emitters)	1×10^{-5}
	P Each Batch	M Composite (c)	H-3	1×10^{-5}
			Gross Alpha	1×10^{-7}
	P Each Batch	Q Composite (c)	Sr-89, Sr-90	5×10^{-8}
			Fe-55	1×10^{-6}
B. Continuous Waste Release (e)	Continuous (f)	D (f)	γ isotopic (g)	5×10^{-7} (b)
			I-131	1×10^{-6}
	M Grab Sample	M	Dissolved and Entrained Gases (Gamma Emitters)	1×10^{-5}
	Continuous (f)(h)	M Composite (c)	H-3	1×10^{-5}
			Gross Alpha	1×10^{-7}
	Continuous (f)(h)	Q Composite (c)	Sr-89, Sr-90	5×10^{-8}
			Fe-55	1×10^{-6}

Table 2.3-1 (Continued)

TABLE NOTATION

a. The LLD is the smallest concentration of radioactive material in a sample that will be detected with 95% probability with 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{4.66\ s_b}{E * V * 2.22 * Y * \exp(-\lambda\Delta t))}$$

Where:

LLD is the lower limit of detection as defined above (as picocurie per unit mass or volume).

s_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute).

E is the counting efficiency (as counts per transformation)

V is the sample size (in units of mass or volume).

2.22 is the number of transformations per minute per picocurie.

Y is the fractional radiochemical yield (when applicable).

λ is the radioactive decay constant for the particular radionuclide, and

Δt is the elapsed time between midpoint of sample collection and time of counting (for plant effluents, not environmental samples).

Typical values of E, V, Y, and Δt shall be used in the calculation.

It should be recognized that the LLD is an a priori (before the fact) limit representing the capability of a measurement system and not an a posteriori (after the fact) limit for a particular measurement.

Table 2.3-1 (Continued)

TABLE NOTATION (Continued)

b. For certain mixtures of gamma emitters, it may not be possible to measure radionuclides in concentrations near their sensitivity limits when other nuclides are present in the sample in much greater concentrations. Under these circumstances, it will be more appropriate to calculate the concentration of such radionuclides using observed ratios with those radionuclides which are measurable.

c. A composite sample is one in which the quantity of liquid sampled is proportional to the quantity of liquid waste discharged and in which the method of sampling employed results in a specimen which is representative of the liquids released.

d. A batch release is the discharge of liquid wastes of a discrete volume. Prior to sampling, each batch shall be isolated and mixed to assure representative sampling.

e. A continuous release is the discharge of liquid waste of a non-discrete volume, e.g. from a volume of a system that has an input flow during the continuous release.

f. If continuous samples cannot be obtained, then grab samples shall be collected and analyzed at least 1/24 hrs when the specific activity of the secondary coolant is ≤0.01 μCi/ml IDE (I-131) or at least 1/12 hrs when the specific activity of the secondary coolant is >0.01 μCi/ml IDE (I-131). Grab sample frequency may be increased due to plant conditions.

g. The principal gamma emitters for which the LLD limitation will apply are exclusively the following radionuclides: Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, Ce-141, and Ce-144. This list does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall also be identified and reported. Nuclides which are below the LLD for the analyses should not be reported as being present at the LLD level. When unusual circumstances result in LLD's higher than required, the reasons shall be documented in the Radioactive Effluent Release Report.

h. To be representative of the quantities and concentrations of radioactive materials in liquid effluents, samples shall be collected continuously in proportion to the rate of flow of the effluent stream. Prior to analysis, all samples taken for the composite shall be thoroughly mixed in order for the composite sample to be reperesentative of the effluent release.

P Prior to release
D Daily
M Monthly
Q Quarterly

RELEASE CONTROLS

RADIOACTIVE LIQUID EFFLUENTS

Concentration

BASES

BL2.3.1.A & BS2.3.1.A This limitation is provided to ensure that the concentration of radioactive materials released in liquid waste effluents in unrestricted areas will be less than the concentration levels specified in 10 CFR Part 20, Appendix B, Table II, Column 2. This limit provides additional assurance that the levels of radioactive materials in bodies of water in unrestricted areas will result in exposures within (1) the Section II.A design objectives of Appendix I, 10 CFR Part 50, to a member of the public, and (2) the limits of 10 CFR Part 20.106(e) to the population. The concentration limit for dissolved or entrained noble gases is based upon the assumption that Xe-133 is the controlling radioisotope and its MPC in air (submersion) was converted to an equivalent concentration in water using the methods described in International Commission on Radiological Protection (ICRP) Publication 2.

RELEASE CONTROLS

RADIOACTIVE LIQUID EFFLUENTS

2.3.2 Dose

LIMITATION

L2.3.2.A The dose commitment to a member of the public from radioactive materials in liquid effluents released from ANO-2 to the discharge canal shall be limited:

1. During any calendar quarter to less than or equal to 1.5 mrem to the total body and to less than or equal to 5 mrem to any organ, and

2. During any calendar year to less than or equal to 3 mrem to the total body and to less than or equal to 10 mrem to any organ.

APPLICABILITY: At all times.

ACTION:

1. With the calculated dose from the release of radioactive materials in liquid effluents exceeding any of the above limits, in lieu of any other report submit a Special Report pursuant to Appendix 2, Limitation L3.4.1.A within 30 days.

SURVEILLANCE LIMITATIONS

S2.3.2.A Cumulative dose contributions from liquid effluents shall be determined in accordance with this manual at least once per 31 days.

BASES

BL2.3.2.A & BS2.3.2.A This limitation provides assurance that releases of liquid effluents will result in concentrations below the limits of 10 CFR 20. The limitation provides the required operating flexibility and at the same time assures that the release of radioactive material in liquid effluents will be kept "as low as is reasonably achievable." The equations specified in this manual for calculating the doses due to the actual release rates of radioactive materials in liquid effluents are consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I", Revision 1, October 1977, and Regulatory Guide 1.113, "Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I", April 1977.

RELEASE CONTROLS

RADIOACTIVE LIQUID EFFLUENTS

2.3.3 Liquid Radwaste Treatment

LIMITATION

L2.3.3.A The liquid radwaste treatment system shall be used to reduce the radioactive materials in liquid wastes prior to their discharge when the projected doses due to the liquid effluent, from ANO-2 to the discharge canal, would exceed 0.18 mrem to the total body or 0.625 mrem to any organ in any calendar quarter.

APPLICABILITY: At all times.

ACTION:

1. With radioactive liquid waste being discharged without treatment and in excess of the above limits, in lieu of any other report, submit a Special Report pursuant to Appendix 2, Limitation L3.4.1.A within 30 days.

SURVEILLANCE LIMITATIONS

S2.3.3.A Doses due to liquid releases shall be projected at least once per 31 days in accordance with this manual.

BASES

BL2.3.3.A & BS2.3.3.A The requirement that the appropriate portions of this system be used, when specified, provides assurance that the releases of radioactive materials in liquid effluents will be kept "as low as is reasonably achievable." The specified limits governing the use of appropriate portions of the liquid radwaste treatment system were specified as a suitable fraction of the dose design objectives set forth in Section II.A of Appendix I, 10 CFR Part 50, for liquid effluents.

The values of 0.18 mrem and 0.625 mrem are approximately 25% of the yearly design objectives on a quarterly basis. The yearly design objectives are given in 10 CFR 50, Appendix I, Section II.

RELEASE CONTROLS

2.4 RADIOACTIVE GASEOUS EFFLUENTS

2.4.1 Dose Rate

LIMITATION

L2.4.1.A The dose rate due to radioactive materials released in gaseous effluents from the site to unrestricted areas (see Figure 4-2) shall be limited to the following:

1. For noble gases: Less than or equal to the 500 mrem/yr to the total body and less than or equal to 3000 mrem/yr to the skin.

2. For iodine-131, for tritium and for all radionuclides in particular form with half lives greater than 8 days: Less than or equal to 1500 mrem/yr to any organ.

During periods of containment purging the dose rate may be averaged over a one hour interval.

APPLICABILITY: At all times.

ACTION:

1. With the dose rate(s) exceeding the above limits, without delay restore the release rate to comply with the above limit(s).

SURVEILLANCE LIMITATIONS

S2.4.1.A.1 The dose rate due to noble gases in gaseous effluents shall be determined to be within the above limits in accordance with the methods and procedures of this manual.

S2.4.1.A.2 The dose rate due to iodine-131, tritium, and all radionuclides in particulate form with half-lifes greater than 8 days in gaseous effluents shall be determined to be within the above limits in accordance with the methods and procedures of this manual by obtaining representative samples and performing analyses in accordance with the sampling and analysis program specified in Table 2.4-1.

TABLE 2.4-1

RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSES PROGRAM

Gaseous Release Type	Sampling Frequency	Minimum Analyses Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD) (uCi/ml) (a)
A. Waste Gas Storage Tank	P Each Tank Grab Sample	P Each Tank	Principal Gamma Emitters(b)	1×10^{-4} (g)
B. Containment Purge	P Each Purge Grab Sample	P Each Purge	Principal Gamma Emitters(b) H-3	1×10^{-4} (g) 1×10^{-6}
C. Unit Vents (Auxiliary Bldg. Ext.)	M (c) (d) Grab Sample	M	Principal Gamma Emitters(b) H-3	1×10^{-4} (g) 1×10^{-6}
(Spent Fuel Pool Area Ventilation)	Continuous(e)	W(f) Charcoal Sample	I-131	1×10^{-12}
(Containment Bldg. Ventilation) (Radwaste Area Ventilation)	Continuous(e)	W(f) Particulate Sample	Principal Gamma Emitters(b) (I-131, Others)	1×10^{-11}
(Low-Level Radwaste Storage Building HVAC Exhaust Ventilation)	Continuous(e)	M Particulate Sample	Gross alpha	1×10^{-11}
(Emergency Penetration Room Ventilation)	Continuous(e)	Q Composite Particulate Sample	Sr-89, Sr-90	1×10^{-11}
	Continuous(e)	Noble Gas Monitor	Noble Gases Gross Beta or Gamma	1×10^{-6} (Xe-133 equiv.)

TABLE 2.4-1 (Continued)

TABLE NOTATION

a. The Lower Limit of Detection (LLD) is defined in Table Notation (a.) of Table 2.3-1 of Appendix 2, Limitation L2.3.1.A.

b. The principal gamma emitters for which the LLD limitation will apply are exclusively the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, and Xe-138 for gaseous emissions and Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, Ce-141 and Ce-144 for particulate emissions. This list does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall also be identified and reported. Nuclides which are below the LLD for the analyses should not be reported as being present at the LLD level for that nuclide. When unusual circumstances result in LLD's higher than required, the reasons shall be documented in the Radioactive Effluent Release Report.

c. Tritium grab samples shall be taken from the Containment Building ventilation exhaust at least once per 24 hours when the refueling canal is flooded.

d. Tritium grab samples shall be taken at least once per 7 days from the ventilation exhaust from the spent fuel area, whenever spent fuel is in the spent fuel pool.

e. The ratio of the sample flow rate to the sampled stream flow rate shall be known for the time period covered by each dose or dose rate calculation made in accordance with Appendix 2, Limitations L2.4.1.A, L2.4.2.A, and L2.4.3.A.

f. Samples shall be changed at least once per 7 days and analyses shall be completed within 48 hours after changing (or after removal from the sampler).

g. For certain radionuclides with low gamma yield or low energies, or for certain radionuclide mixtures, it may not be possible to measure radionuclides in concentrations near the LLD. Under these circumstances, the LLD may be increased inversely proportional to the magnitude of the gamma yield (i.e., $1 \times 10^{-4}/I$, where I is the photon abundance expressed as a decimal fraction), but in no case shall the LLD, as calculated in this manner for a specific radionuclide, be greater than 10% of the MPC value specified in 10 CFR 20, Appendix B, Table II, Column I.

P Prior to release
W Weekly
M Monthly
Q Quarterly

RELEASE CONTROLS

RADIOACTIVE GASEOUS EFFLUENTS

Dose Rate

BASES

BL2.4.1.A & BS2.4.1.A This limitation is provided to ensure that the dose at any time in unrestricted areas from gaseous effluents from all units on the site will be within the limits of 10 CFR Part 20.105(b). This limitation applies to the release of gaseous effluents from all reactors at the site.

RELEASE CONTROLS

RADIOACTIVE GASEOUS EFFLUENTS

2.4.2 Dose - Noble Gases

LIMITATION

L2.4.2.A The dose due to noble gases released in gaseous effluents from ANO-2 to unrestricted areas (See Figure 4-2) shall be:

1. During any calendar quarter, less than or equal to 5 mrads for gamma radiation and less than or equal to 10 mrads for beta radiation, and

2. During any calendar year, less than or equal to 10 mrads for gamma radiation and less than or equal to 20 mrads for beta radiation.

APPLICABILITY: At all times.

ACTION:

1. With the calculated dose from radioactive noble gases in gaseous effluents exceeding any of the above limits, in lieu of any other report, submit a Special Report pursuant to Appendix 2, Limitation L3.4.1.A within 30 days.

SURVEILLANCE LIMITATIONS

S2.4.2.A Cumulative dose contributions for noble gases for the current calendar quarter and current calendar year shall be determined in accordance with this manual at least once per 31 days.

RELEASE CONTROLS

RADIOACTIVE GASEOUS EFFLUENTS

Dose - Noble Gases

BASES

BL2.4.2.A & BS2.4.2.A This limitation is provided to implement the requirements of Sections II.B, III.A, and IV.A of Appendix I, 10 CFR Part 50. The limitation implements the guides set forth in Section II.B of Appendix I. The action statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive material in gaseous effluents will be kept "as low as is reasonably achievable." The Surveillance Limitations implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data such that the actual exposure of a member of the public through appropriate pathways is unlikely to be substantially underestimated. The dose calculations established in this manual for calculating the doses due to the actual release rates of radioactive noble gases in gaseous effluents are consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977, and Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water Cooled Reactors," Revision 1, July 1977. The equations in this manual provided for determining the air doses at and beyond the site boundary are based upon the historical average atmospheric conditions.

RELEASE CONTROLS

RADIOACTIVE GASEOUS EFFLUENTS

2.4.3 Dose - Iodine-131, Tritium, And Radionuclides In Particulate Form

LIMITATION

L2.4.3.A The dose to a member of the public from iodine-131, from tritium, and from all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released from ANO-2 to unrestricted areas (see Figure 4-2) shall be:

1. During any calendar quarter, less than or equal to 7.5 mrems to any organ, and

2. During any calendar year, less than or equal to 15 mrems to any organ.

APPLICABILITY: At all times.

ACTION:

1. With the calculated dose from the release of iodine-131, tritium, and radionuclides in particulate form with half-lives greater than 8 days, in gaseous effluents exceeding any of the above limits, in lieu of any other report, submit a Special Report pursuant to Appendix 2, Limitation L3.4.1.A within 30 days.

SURVEILLANCE LIMITATIONS

S2.4.3.A Cumulative dose contributions for the current calendar quarter and current calendar year for iodine-131, tritium, and radionuclides in particulate form with half-lives greater than 8 days shall be determined in accordance with this manual at least once per 31 days.

RELEASE CONTROLS

RADIOACTIVE GASEOUS EFFLUENTS

Dose - Iodine-131, Tritium, And Radionuclides In Particulate Form

BASES

BL2.4.3.A & BS2.4.3.A This limitation is provided to implement the requirements of Sections II.C, III.A, and IV.A of Appendix I, 10 CFR Part 50. The limiting conditions for operation are the guides set forth in Section II.C of Appendix I. The action statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive materials in gaseous effluents will be kept "as low as is reasonably achievable". The calculational methods in this manual specified in the Surveillance Limitations implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data, such that the actual exposure of a member of the public through appropriate pathways is unlikely to be substantially underestimated. The calculational methods in this manual for calculating the doses due to the actual release rates of the subject materials are consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977, and Regulatory Guide 1.111., "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors," Revision 1, July 1977 These equations also provide for determining the actual doses based upon the historical average atmospheric conditions. The release rate limitations for iodine-131, tritium, and radionuclides in particulate form with half-lives greater than 8 days are dependent on the existing radionuclide pathways to man in the areas at or beyond the site boundary. The pathways that were examined in the development of these calculations were: 1) individual inhalation of airborne radionuclides, 2) deposition of radionuclides onto green leafy vegetation with subsequent consumption by man, 3) deposition onto grassy areas where milk animals and meat producing animals graze with consumption of the milk and meat by man, and 4) deposition on the ground with subsequent exposure of man.

RELEASE CONTROLS

RADIOACTIVE GASEOUS EFFLUENTS

2.4.4 Gaseous Radwaste Treatment

LIMITATION

L2.4.4.A The ventilation exhaust treatment systems shall be used to reduce radioactive materials in gaseous waste prior to their discharge when the projected gaseous effluent doses from ANO-2 to unrestricted areas (see Figure 4-2) would exceed 0.625 mrad for gamma radiation and 1.25 mrad for beta radiation in any calendar quarter; or when the projected doses due to iodine-131, tritium, and radionuclides in particulate form with half-lives greater than 8 days would exceed 1.0 mrem to any organ over a calendar quarter.

L2.4.4.B When degasifying the reactor coolant system, the gaseous radwaste treatment system shall be used to reduce radioactive material in gaseous waste prior to their discharge when the projected gaseous effluent doses for ANO-2 to unrestricted areas (see Figure 4-2) would exceed 0.625 mrad for gamma radiation and 1.25 mrad for beta radiation in any calendar quarter.

APPLICABILITY: At all times.

ACTION:

1. With gaseous waste being discharged without treatment and in excess of the L2.4.4.A limits, in lieu of any other report, submit a Special Report pursuant to Appendix 2, Limitation L3.4.1.A within 30 days.

2. With gaseous waste being discharged without treatment and in excess of the L2.4.4.B limits, in lieu of any other report, submit a Special Report pursuant to Appendix 2, Limitation L3.4.1.A within 30 days.

SURVEILLANCE LIMITATIONS

S2.4.4.A/B Doses due to gaseous releases from the site shall be projected at least once per 31 days in accordance with this manual.

RELEASE CONTROLS

RADIOACTIVE GASEOUS EFFLUENTS

Gaseous Radwaste Treatment

BASES

BL2.4.4.A/B & BS2.4.4.A/B The requirement that the appropriate portions of these systems be used, when specified, provides reasonable assurance that the releases of radioactive materials in gaseous effluents will be kept "as low as is reasonably achievable". This limitation implements the requirements of 10 CFR Part 50.36a, General Design Criterion 60 of Appendix A to 10 CFR Part 50, and the design objectives given in Section II.D of Appendix I to 10 CFR Part 50. The specified limits governing the use of appropriate portions of the systems were specified as a suitable fraction of the dose design objectives set forth in Sections II.B and II.C of Appendix I, 10 CFR Part 50, for gaseous effluents. This limitation applies to gaseous radwaste from ANO-2.

RELEASE CONTROLS

2.5 RADIOACTIVE EFFLUENTS

2.5.1 Total Dose

LIMITATION

L2.5.1.A The calculated doses from the release of radioactive materials in liquid or gaseous effluents shall not exceed twice the limits of Appendix 2, Limitations L2.3.2.A.1, L2.3.2.A.2, L2.4.2.A.1, L2.4.A.2, L2.4.3.A.1, or L2.4.3.A.2.

APPLICABILITY : At all times.

ACTION:

1. With the calculated doses exceeding the above limits, prepare and submit a Special Report pursuant to 10 CFR Part 20.405c.

2. If the limits of 40 CFR 190 have been exceeded, obtain a variance from the Commission to permit further releases in excess of 40 CFR 190 limits. A variance is granted until staff action on the request is complete.

SURVEILLANCE LIMITATIONS

S2.5.1.A Cumulative dose contributions from liquid and gaseous effluents shall be determined in accordance with Appendix 2, Limitations S2.3.2.A, S2.4.2.A, and S2.4.3.A, and in accordance with this manual.

RELEASE CONTROLS

RADIOACTIVE EFFLUENTS

Total Dose

BASES

BL2.5.1.A & BS2.5.1.A This limitation is provided to meet the dose limits of 40 CFR Part 190 that have now been incorporated into 10 CFR Part 20 by 46 FR 18525. The limitation requires the preparation and submittal of a Special Report whenever the calculated doses from plant radioactive effluents exceed twice the design objective doses of Appendix I. For sites containing up to four reactors, it is highly unlikely that the resultant dose to a member of the public will exceed the dose limits of 40 CFR Part 190 if the individual reactors remain within the reporting requirement level. The Special Report will describe a course of action that should result in limiting the annual dose to a member of the public to within the 40 CFR Part 190 limits. For the purposes of the Special Report, it may be assumed that the dose commitment to the member of the public from other uranium fuel cycle sources is negligible, with the exception that dose contributions from other nuclear fuel cycle facilities at the same site or within a radius of 8 km must be considered. If the dose to any member of the public is estimated to exceed the requirements of 40 CFR Part 190, the Special Report with a request for a variance (provided the release conditions resulting in violation of 40 CFR Part 190 have not already been corrected), in accordance with the provision of 40 CFR Part 190.11 and 10 CFR Part 20.405c, is considered to be a timely request and fulfills the requirements of 40 CFR Part 190 until NRC staff action is completed. The variance only relates to the limits of 40 CFR Part 190, and does not apply in any way to the other requirements for dose limits in 10 CFR Part 20, as addressed in Appendix 2, Section 2.3 and 2.4 Limitations. An individual is not considered a member of the public during any period in which he/she is engaged in carrying out any operation that is part of the nuclear fuel cycle.

RELEASE CONTROLS

2.6 RADIOLOGICAL ENVIRONMENTAL MONITORING

2.6.1 Monitoring Program

LIMITATION

L2.6.1.A The radiological environmental monitoring samples shall be collected pursuant to Table 2.6-1 and shall be analyzed pursuant to the requirements of Table 2.6-1 and 2.6-2. The sample locations shall be shown in Table 4-1 in this manual.

APPLICABILITY: At all times.

ACTION:

1. With the radiological environmental monitoring program not being conducted as specified in Table 2.6-1, prepare and submit to the Commission in the Annual Radiological Environmental Operating Report a description of the reasons for not conducting the program as required and the plans for preventing a recurrence.

2. With the level of radioactivity as the result of plant effluents in an environmental sampling medium at one or more of the locations specified in Table 2.6-1 exceeding the limits of Table 2.6-3 when averaged over any calendar quarter, prepare and submit to the Commission, within 30 days from the end of the affected quarter, a Special Report which includes an evaluation of any release conditions, environmental factors or other aspects which caused the limits of Table 2.6-3 to be exceeded, and defines the actions taken to reduce radioactive effluents so that the potential annual dose to a member of the public is less than the calendar year limits of Appendix 2, Limitations L2.3.2.A, L2.4.2.A, and L2.4.3.A. When more than one of the radionuclides in Table 2.6-3 are detected in the sampling medium, this Special Report shall be submitted if:

$$\frac{\text{Concentration (1)}}{\text{reporting level (1)}} + \frac{\text{Concentration (2)}}{\text{reporting level (2)}} + \ldots\ldots \geq 1.0$$

When radionuclides other than those in Table 2.6-3 are detected and are the result of plant effluents, this Special Report shall be submitted if the potential annual dose to a member of the public is equal to or greater than the calendar year limits of Appendix 2, Limitations L2.3.2.A, L2.4.2.A, and L2.4.3.A. This Special Report is not required if the measured level of radioactivity was not the result of plant effluents, however, in such an event, the condition shall be reported and described in the Annual Radiological Environmental Operating Report.

RELEASE CONTROLS

RADIOLOGICAL ENVIRONMENTAL MONITORING

Monitoring Program

LIMITATION (Continued)

3. With milk or fresh leafy vegetable samples unavailable from any of the sample locations required by Table 2.6-1, identify locations for obtaining replacement samples and add them to the radiological environmental monitoring program within 30 days. The specific locations from which samples were unavailable may then be deleted from the monitoring program. Identify the causes of the unavailability of samples and identify the new location(s) for obtaining replacement samples in the next Radioactive Effluent Release Report and also include in the report a revised Table 4-1 reflecting the new location(s).

TABLE 2.6-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Number of Sample Location[a]	Sample and Collection Frequency[a]	Type and Frequency of Analyses
1. AIRBORNE			
a. Radioiodine and Particulates	4 Locations 2 Samples close to Site Boundary, in (or near) different sectors with the highest calculated annual average groundlevel D/Q. 1 Sample from the vicinity of a community having the highest calculated annual average groundlevel D/Q. 1 Sample from a control location 15-30 km. (10-20 miles) distance[c].	Continuous operation of sampler with sample collection as required by dust loading but at least once per 14 days.	Radioiodine canister. Analyze at least once per 14 days for I-131. Particulate sampler: Analyze for gross beta radioactivity following filter change[b]

TABLE 2.6-1 (Continued)

Exposure Pathway and/or Sample	Number of Sample Location[a]	Sample and Collection Frequency[a]	Type and Frequency of Analyses
2. DIRECT RADIATION[d]	24 Locations - 16 inner ring stations with two or more dosimeters in each meteororological sector in the general area of the Site Boundary - 8 stations with two or more dosimeters in special interest areas such as population centers, nearby residences, schools, and in 1 - 2 areas to serve as control locations.	Once per 92 days	Gamma dose. Once per 92 days.

TABLE 2.6-1 (Continued)

Exposure Pathway and/or Sample	Number of Sample Location[a]	Sample and Collection Frequency[a]	Type and Frequency of Analyses
3. WATERBORNE			
a. Surface Water	1 Indicator location (influenced by plant discharge) 1 Control location (uninfluenced by plant discharge)	Once per 92 days.	Gamma isotopic[e] and Tritium analyses once 92 days.
b. Drinking Water	1 Indicator location (influenced by plant discharge) 1 Control location (uninfluenced by plant discharge)	Once per 92 days.	I-131, gross beta, gamma isotopic[e] and tritium analyses once per 92 days.
c. Sediment from Shoreline	1 Indicator location (influenced by plant discharge) 1 Control location (uninfluenced by plant discharge)	Once per 365 days.	Gamma isotopic[e] analysis once per 365 days.

TABLE 2.6-1 (Continued)

Exposure Pathway and/or Sample	Number of Sample Location[a]	Sample and Collection Frequency[a]	Type and Frequency of Analyses
4. INGESTION			
a. Milk	1 Indicator sample location within 8 km. distant if commercially available. 1 Control sample location at a distant of >8 km. when an indicator exists.	Once per 92 days.	Gamma isotopic[e] and I-131 analyses once per 92 days.
b. Fish	1 Sample of commercially and/or recreationally important species in vicinity of plant discharge. 1 Sample of same species in area not influenced by plant discharge.	Once per 365 days.	Gamma isotopic[e] on edible portions once per 365 days.
c. Food Products	1 Sample of broadleaf (edible or non-edible) near the Site Boundary from one of the highest anticipated annual average groundlevel D/Q sectors, if milk sampling is not performed. 1 Sample location of broadleaf vegetation (edible or non-edible) from a control location 15 - 30 km. distant, if milk sampling is not performed.	Three per 365 days.	Gamma isotopic[e] and I-131 analyses three times per 365 days.

TABLE 2.6-1 (Continued)

TABLE NOTATION

a The ODCM shall include, in a table and figures, specific parameters of distance and direction from the centerline of one reactor, and additional description where pertinent, for each sample location in Table 2.6-1. Refer to NUREG-0133, "Preparation of Radiological Technical Specifications for Nuclear Power Plants," October 1978, and to Radiological Assessment Branch Technical Position, Revision 1, November 1979. Deviations are permitted from the required sampling schedule if specimens are unobtainable due to hazardous conditions, seasonal unavailability, malfunction of automatic sampling equipment and other legitimate reasons. If specimens are unobtainable due to sampling equipment malfunctions, every effort shall be made to complete corrective action before the end of the next sampling period. All deviations from the sampling schedule shall be documented in the Annual Radiological Environmental Operating Report.

It is recognized that, at times, it may not be possible or practical to continue to obtain samples of the media of choice at the most desirable location or time. In these instances, suitable alternative media and locations may be chosen for the particular pathway in question and appropriate substitutions made within 30 days in the radiological environmental monitoring program. In the next Annual Radioactive Effluent Release Report, identify the cause of the unavailability of samples for that pathway and identify the new location(s) for obtaining replacement samples, and also include in the report a revised figure(s) and table(s) for the ODCM reflecting the new location(s).

b Particulate sample filters should be analyzed for gross beta 24 hours or more after sampling to allow for radon and thoron daughter decay. If gross beta activity in air or water is greater than ten times the yearly mean of control samples for any medium, gamma isotopic analysis should be performed on the individual samples.

c The purpose of this sample is to obtain background information.

d One or more instruments, such as a pressurized ion chamber, for measuring and recording dose rate continuously may be used in place of, or in addition to, integrating dosimeters. For the purpose of this table, a thermoluminescent dosimeter may be considered to be one phosphor and two or more phosphors in a packet considered as two or more dosimeters. Film badges should not be used for measuring direct radiation.

e Gamma isotopic analysis means the identification and quantification of gamma-emitting radionuclides that may be attributable to the effluents from the facility.

TABLE 2.6-2

MAXIMUM VALUES FOR THE LOWER LIMITS OF DETECTION (LLD[a])

Analyses	Water (pCi/l)	Airborne Particulate or Gas (pCi/m³)	Fish (pCi/kg,wet)	Milk (pCi/l)	Food Products (pCi/kg,wet)	Sediment (pCi/kg,dry)
Gross Beta	4[b]	1×10^{-2}[c]				
H-3	2000[d]					
Mn-54	15		130			
Fe-59	30		260			
Co-58, 60	15		130			
Zn-65	30		260			
Zr-95	30					
Nb-95	15					
I-131	1[e]	7×10^{-2}[f]		1	60	
Cs-134	15	5×10^{-2}[g]	130	15	60	150
Cs-137	18	6×10^{-2}[g]	150	18	80	180
Ba-140	60			60		
La-140	15			15		

(a) See definition of LLD in table notation of Table 2.3-1.
(b) LLD for drinking water.
(c) Applicable to airborne particulate only.
(d) LLD for drinking water. If no drinking water pathway exists, a value of 3000 may be used.
(e) LLD for drinking water. If no drinking water pathway exists, gamma isotopic LLD value of 15 pCi/l may be used.
(f) Applicable to airborne gas only.
(g) Applicable to airborne particulate only during gamma isotopic analysis.

TABLE 2.6-3

REPORTING LEVELS FOR RADIOACTIVITY CONCENTRATIONS IN ENVIRONMENTAL SAMPLES

Analyses	Water (pCi/1)	Airborne Particulate or gases (pCi/m³)	Fish (pCi/kg, wet)	Milk (pCi/1)	Food Products (pCi/kg, wet)
H-3	2×10^4 (a)				
Mn-54	1×10^3		3×10^4		
Fe-59	4×10^2		1×10^4		
Co-58	1×10^3		3×10^4		
Co-60	3×10^3		1×10^4		
Zn-65	3×10^2		2×10^4		
Zr-Nb-95	4×10^2 (b)				
I-131	2	0.9		3	1×10^2
Cs-134	30	10	1×10^3	60	1×10^3
Cs-137	50	20	2×10^3	70	2×10^3
Ba-La-140	2×10^2 (b)			3×10^2 (b)	

(a) For drinking water samples.
(b) Total for parent and daughter.

RELEASE CONTROLS

RADIOLOGICAL ENVIRONMENTAL MONITORING

Monitoring Program

SURVEILLANCE LIMITATIONS

S2.6.1.A The results of analyses performed on the radiological environmental monitoring samples shall be summarized in the Annual Radiological Environmental Operating Report.

BASES

BL2.6.1.A & BS2.6.1.A The radiological monitoring program required by this limitation provides measurements of radiation and of radioactive materials in those exposure pathways and for those radionuclides which lead to the highest potential radiation exposures of individuals resulting from the station operation. This monitoring program thereby supplements the radiological effluents monitoring program by verifying that the measurable concentrations of radioactive materials and levels of radiation are not higher than expected on the basis of the effluent measurements and modeling of the environmental exposure pathways. The initially specified monitoring program will be effective for at least the first three years of commercial operation. Following this period, program changes may be initiated based on operational experience.

The detection capabilities required by Table 2.6-2 are state of the art for routine environmental measurements in industrial laboratories.

RELEASE CONTROLS

RADIOLOGICAL ENVIRONMENTAL MONITORING

2.6.2 Land Use Census

LIMITATION

L2.6.2.A A land use census shall be conducted and shall identify the location of the nearest milk animal, the nearest residence, and the nearest garden* of greater than 500 square feet producing fresh leafy vegetables in each of the 16 meteorological sectors within a distance of five miles.

APPLICABILITY: At all times.

ACTION:

1. With a land use census identifying a location(s) which yields a calculated dose commitment due to I-131, tritium, and radionuclides in particulate form greater than the values currently being calculated in Appendix 2, Limitation S2.4.3.A, submit location description in the Radioactive Effluent Release Report per Appendix 2, Section 3.2 Limitations.

2. With a land use census identifying a location(s) which yields a calculated dose commitment (via the sample exposure pathway) greater than at a location from which samples are currently being obtained in accordance with the Appendix 2, Limitation L2.6.1.A, identify the new location in the Radioactive Effluent Release Report per Appendix 2, Section 3.2 Limitations. The new location shall be added to the radiological environmental monitoring program within 30 days, if possible. The sampling location having the lowest calculated dose commitment (via the same exposure pathway) may be deleted from this monitoring program after October 31 of the year in which this land use census was conducted.

SURVEILLANCE LIMITATIONS

S2.6.2.A The land use census shall be conducted at least once per 24 months between the dates of June 1 and October 1 by door-to-door survey, aerial survey, or by consulting local agricultural authorities. The results of the land use census shall be included in the Annual Radiological Environmental Operating Report.

*Broad Leaf vegetation sampling may be performed at the site boundary in the direction sector with the highest D/Q in lieu of the garden census.

RELEASE CONTROLS

RADIOLOGICAL ENVIRONMENTAL MONITORING

Land Use Census

BASES

BL2.6.2.A & BS2.6.2.A This limitation is provided to ensure that changes in the use of unrestricted areas are identified and that modifications to the monitoring program are made if required by the results of this census. This census satisfies the requirements of Section IV.B.3 of Appendix I to 10 CFR Part 50. Restricting the census to gardens of greater than 500 square feet provides assurance that significant exposure pathway via leafy vegetables will be identified and monitored since a garden of this size is the minimum required to produce the quantity (26 kg/year) of leafy vegetables assumed in Regulatory Guide 1.109 for consumption by a child. To determine this minimum garden size, the following assumptions were used: 1) that 20% of the garden was used for growing broad leaf vegetation (i.e., similar to lettuce and cabbage), and (2) a vegetation yield of 2 kg/square meter.

RELEASE CONTROLS

RADIOLOGICAL ENVIRONMENTAL MONITORING

2.6.3 Interlaboratory Comparison Program

LIMITATION

L2.6.3.A Analyses shall be performed on radioactive materials supplied as part of the Interlaboratory Comparison Program which has been approved by NRC.

APPLICABILITY: At all times.

ACTION:

1. With analyses not being performed as required above, report the corrective actions taken to prevent a recurrence to the Commission in the Annual Radiological Environmental Operating Report.

SURVEILLANCE LIMITATIONS

S2.6.3.A The results of analyses performed as part of the above required Interlaboratory Comparison Program shall be included in the Annual Radiological Environmental Operating Report.

BASES

BL2.6.3.A & BS2.6.3.A The requirement for participation in an Interlaboratory Comparison Program is provided to ensure that independent checks on the precision and accuracy of the measurements of radioactive material in environmental sample matrices are performed as part of a quality assurance program for environmental monitoring in order to demonstrate that the results are reasonably valid.

3.0 ADMINISTRATIVE CONTROLS

3.1 PROGRAMS

LIMITATION

L3.1.1 The following program shall be established, implemented, and maintained:

A. Radioactive Effluent Controls Program

(Refer to Unit 2 Technical Specification 6.5.4)

B. Radiological Environmental Monitoring Program

A program shall be provided to monitor the radiation and radionuclides in the environs of the plant. The program shall provide (1) representative , measurements of radioactivity in the highest potential exposure pathways, and (2) verification of the accuracy of the effluent monitoring program and modeling of environmental exposure pathways. The program shall (1) be contained in this manual, (2) conform to the guidance of Appendix I to 10 CFR Part 50, and (3) include the following:

1. Monitoring, sampling, analysis, and reporting of radiation and radionuclides in the environment in accordance with the methodology and parameters in this manual,

2. A Land Use Census to ensure that changes in the use of areas at and beyond the site boundary are identified and that modifications to the monitoring program are made if required by the results of this census,

3. Participation in an Interlaboratory Comparison Program to ensure that independent checks on the precision and accuracy of the measurements of radioactive materials in environmental sample matrices are performed as part of the quality assurance program for environmental monitoring.

ADMINISTRATIVE CONTROLS

3.2 RADIOACTIVE EFFLUENT RELEASE REPORT*

LIMITATION

L3.2.1 The Radioactive Effluent Release Report shall be in accordance with Unit 2 Technical Specification 6.6.3.

A. The Radioactive Effluent Release Report shall include a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the unit. The data will be summarized following the format of Regulatory Guide 1.21, Revision 1.

B. Any changes in the ODCM and PCP shall be included in the Radioactive Effluent Release Report for the period in which the change(s) was made effective. (Refer to Unit 2 Technical Specification 6.5.1.c for potential reporting requirements.)

C. The Radioactive Effluent Release Report shall include the following information for all unplanned releases to unrestricted areas of radioactive materials in gaseous and liquid effluents:

1. Description of the occurrence.

2. Identify the cause(s) for exceeding the limit(s).

3. Explain corrective actions taken to mitigate occurrence.

4. Define action(s) taken to prevent recurrence.

5. Summary of consequence(s) of occurrence.

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*A single submittal may be made for ANO. The submittal shall combine sections common to both units. The submittal shall specify the releases of radioactive material from each unit.

ADMINISTRATIVE CONTROLS

RADIOACTIVE EFFLUENT RELEASE REPORT*

LIMITATION (Continued)

D. The Radioactive Effluent Release Report shall contain:

1. A summary of the hourly meteorological data collected over the previous calendar year. In lieu of including this summary in the report, the data may be retained by the licensee for NRC review and noted as such in the report.

2. A summary of radiation doses due to radiological effluent during the previous calendar year calculated in accordance with the methodology specified in this manual.

3. The radiation dose to members of the public due to their activities inside the site boundary. This calculated dose shall include only those dose contributions directly attributed to operation of the unit and shall be compared to the limits specified in 40 CFR 190.

E. The Radioactive Effluent Release Report shall contain a description of licensee initiated major changes to the radioactive waste systems (liquid, gaseous and solid) during the previous calendar year.*

*This information may be included in the periodic SAR update in lieu of inclusion in this report.

ADMINISTRATIVE CONTROLS

3.3 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT*

LIMITATION

L3.3.1 The Annual Radiological Environmental Operating Report shall be in accordance with Unit 2 Technical Specification 6.6.2. The Annual Radiological Environmental Operating Report covering the operation of the unit during the previous calendar year shall be submitted by May 15 of year.

A. The Annual Radiological Environmental Operating Report shall include summaries, interpretations, and an analysis of trends of the results of the radiological environmental monitoring program for the reporting period. If harmful effects or evidence of irreversible damage are detected by the monitoring, the report shall provide an analysis of the problem and a planned course of action to alleviate the problem.

B. The Annual Radiological Environmental Operating Report shall include summarized and tabulated results of all radiological environmental samples and of all environmental radiation measurements required by this manual taken during the reporting period. In the event that some results are not available for inclusion with the report, the report shall be submitted noting and explaining the reasons for the missing results. If the missing data becomes available, it shall be submitted as soon as possible in a supplementary report.

C. The Annual Radiological Environmental Operating Report shall also include the following: a summary description of the radiological environmental monitoring program, a map of all sampling locations keyed to a table giving distances and directions from the reactor buildings; the results of the Land Use Census required by Appendix 2, Section 2.6.2 Limitations; and the results of the Interlaboratory Comparison Program participation required by Appendix 2, Section 2.6.3 Limitations.

*A single submittal may be made for ANO. The submittal should combine sections common to both units.

ADMINISTRATIVE CONTROLS

3.4 SPECIAL REPORTS

LIMITATION

L3.4.1 Special reports shall be submitted to the Administrator of the Regional Office within the time period specified for each report. These reports shall be submitted covering the activities identified below pursuant to the requirements of the applicable reference limitation.

A. Radioactive Effluents; Appendix 2, Limitations L2.3.1.A, L2.3.2.A, L2.3.3.A, L2.4.2.A, L2.4.3.A, L2.4.4.A, L2.4.4.B, and L2.5.1.A.

This report shall include the following:

1. Description of occurrence.

2. Identify the cause(s) for exceeding the limit(s)

3. Explain corrective action(s) taken to mitigate occurrence.

4. Define action(s) taken to prevent recurrence.

5. Summary of consequence(s) of occurrence.

6. Describe levels exceeding 40 CFR 190 in accordance with 10 CFR 20.405(c).

B. Radiological Environmental Monitoring Sample Analysis; Appendix 2, Limitation L2.6.1.A.

C. Unplanned Offsite Release during one hour period of 1) more than 1 curie of radioactive material in liquid effluents, 2) more than 150 curies of noble gas in gaseous effluents, or 3) more than 0.05 curies of radioiodine in gaseous effluents. This report shall be submitted within 30 days of the occurrence of the event and shall include the following information:

1. Description of the occurrence.

2. Identify the cause(s) of exceeding the limit(s).

3. Explain corrective action(s) taken to mitigate occurrence.

4. Define action(s) taken to prevent recurrence.

5. Summary of the consequence(s) of occurrence.

Attachment 3
to
0CAN020704

EN-RW-105, "Process Control Program"

Title: **Process Control Program**

Procedure Owner:	**Mark L. Carver / Radwaste Corporate Staff**	
	(Print Name / Title)	
Approved:	Mark L. Carver	**3/27/06**
	(Procedure Owner Signature)	(Date)

Effective Date	**EN Common**	☒	**3/28/06**	**Effective Date Exception**	**ANO**		**PNPS**	**5/15/06**
	ENN	☐			**ECH**	**N/A**	**RBS**	
	ENS	☐			**GGNS**		**VY**	**N/A**
					IPEC	**N/A**	**W3**	
					JAF		**WPO**	**N/A**

Basis Statement

Formatting of EN-RW-105 was completed to match EN-AD-101

Editorial clarification for definition of Batch

Additional clarification within Section 1.0

Approval of this Revision 0 will provide the procedure as a fleet wide procedure with cancellation of the EN-S and EN-N regional procedures

Procedures Affected By This Revision

See basis statement

Process Applicability Exclusion (ENN-LI-100) / Programmatic Exclusion (ENS-LI-101)

All Sites: ☐ Specific Sites: ANO ☐ GGNS ☐ IPEC ☐ JAF ☐ PNPS ☐ RBS ☐ VY ☐ W3 ☐

TABLE OF CONTENTS

Section	Title	Page
1.0	PURPOSE	3
2.0	REFERENCES	3
3.0	DEFINITIONS	3
4.0	RESPONSIBILITIES	6
5.0	DETAILS	7
6.0	INTERFACES	10
7.0	RECORDS	10
8.0	OBLIGATION AND REGULATORY COMMITMENT CROSS-REFERENCES	11
9.0	ATTACHMENTS	11

1.0 PURPOSE

The Process Control Program (PCP) requires formulas, sampling, analyses, test and determinations to be made to ensure that the processing and packing of solid radioactive wastes based on demonstrated processing of actual or simulated wet solid wastes will be accomplished in such a way as to assure compliance with 10 CFR Parts 20, 61 and 71, State Regulations, burial ground requirements, and other requirements governing the disposal of solid radioactive waste. The scope of a PCP is to assure that radioactive waste will be handled, shipped, and disposed of in a safe manner in accordance with approved site or vendor procedures, whichever is applicable. **[GGNS UFSAR, Chapter 16B.1 / TRM – 7.6.3.8 paragraph 1]**

EN-RW-105 implements the requirements of 10CFR Part 50.36a and General Design Criteria 60 of Appendix A to 10CFR Part 50. The process parameters included in the Process Control Program may include but are not limited to waste type, waste pH, waste/liquid/solidification agent/catalyst ratios, waste oil content, waste principal chemical constituents, and mixing and curing times.

2.0 REFERENCES

[1] EN-QV-104, "Entergy Quality Assurance Program Manual Control"

[2] Title 49, Code of Federal Regulations

[3] Title 10, Code of Federal Regulations

[4] Low-Level Waste Licensing Branch Technical Position on Radioactive Waste Classification, 11 May 1983

[5] Disposal Site Criteria and License

[6] Waste Processor Acceptance Criteria

[7] LI-101, "10CFR50.59 Review Program"

3.0 DEFINITIONS

[1] Batch – A quantity of waste to be processed having essentially consistent physical and chemical characteristics as determined through past experience or system operation knowledge by the Radwaste Shipping Specialist. A batch could be a waste tank, several waste tanks grouped together or a designated time period such as between outages as with the DAW waste stream.

[2] Certificate of Compliance - Document issued by the USNRC regulating use of a NRC licensed cask or issued by DHEC regulating a High Integrity Container.

[3] Chelating Agents - EDTA, DTPA, hydroxy-carboxylic acids, citric acid, carbolic acid and glucinic acid.

[4] Compaction - The process of volume reducing solid waste by applying external pressure.

[5] Confirmatory Analysis - The practice of verifying that gross radioactivity measurements using MCA are reasonably consistent with independent laboratory sample data.

[6] Dewatered Waste - Wet waste that has been processed by means other than solidification, encapsulation, or absorption to meet the free standing liquid requirements of 10CFR Part 61.56 (a)(3) and (b)(2).

[7] De-watering - The removal of water or liquid from a waste form, usually by gravity or pumping.

[8] Dilution Factor - The RADMAN computer code factor to account for the non-radioactive binder added to the waste stream in the final product when waste is solidified.

[9] Dry Waste - Radioactive waste which exist primarily in a non-liquid form and includes such items as dry materials, metals, resins, filter media and sludges.

[10] Encapsulation - Encapsulation is a means of providing stability for certain types of waste by surrounding the waste by an appropriate encapsulation media.

[11] Gamma-Spectral-Analysis - Also known as IG, MCA, Ge/Li and gamma spectroscopy.

[12] Gross Radioactivity Measurements - More commonly known as dose to curie conversion for packaged waste characterization and classification.

[13] Homogeneous - Of the same kind or nature; essentially alike. Most Volumetric waste streams are considered homogeneous for purposes of waste classification.

[14] Incineration – The process of burning a combustible material to reduce its volume and yield an ash residue.

[15] Liquid Waste - Radioactive waste that exist primarily in a liquid form and is contained in other than installed plant systems, to include such items as oil, EHC fluid, and other liquids.

[16] Low-Level Radioactive Waste (LLW) - Those wastes containing source, special nuclear, or by-product material that are acceptable for disposal in a land disposal facility. For the purposes of this definition, low-level radioactive waste has the same meaning as in the Low-Level Waste Policy Act, that is, radioactive waste not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or by-product material as defined in section 11e.(2) of the Atomic Energy Act (uranium or thorium tailings and waste).

[17] Measurement of Specific Radionuclides - More commonly known as direct sample or container sample using MCA data for packaged waste characterization and classification.

[18] Processing - Changing, modifying, and/or packaging wet radioactive waste into a form that is acceptable to a disposal facility.

[19] Quality Assurance/Quality Control - As used in this document, "quality assurance" comprises all those planned and systematic actions necessary to provide adequate confidence that a structure, system, or component will perform satisfactorily in service. Quality assurance includes quality control, which comprises those quality assurance actions related to the physical characteristics of a material structure, component, or system to predetermined requirements.

[20] Reportable Quantity Radionuclides (RQ) - Any radionuclide listed in column (1) of Table 2 of 49CFR Part 172.101 which is present in quantities as listed in column (3) of Table 2 of 49CFR Part 172.101.

[21] Sampling Plan - A program to ensure that representative samples from the feed waste and the final waste form are obtained and tested for conformance with parameters stated in the PCP and waste form acceptance criteria.

[22] Scaling Factor - A dimensionless number which relates the concentration of an easy to measure radionuclide (gamma emitter) to one which is difficult to measure (beta and/or alpha emitters).

[23] Significant Quantity - For purposes of waste classification all the following radionuclide values SHALL be considered significant and must be reported on the disposal manifest.

- Any value (real or LLD) for radionuclides listed in Appendix G to 10CFR20 (H-3, C-14, I-129, Tc-99).
- Greater than or equal to 1 percent of the concentration limits as listed in 10CFR Part 61.55 Table 1 .
- Greater than or equal to 1 percent of the Class A concentration limits listed in 10CFR Part 61.55 Table 2.

- Greater than or equal to 1 percent of the total activity.
- Greater than or equal to 1 percent of the Reportable Quantity limits listed on 49CFR Part 172.101 Table 2.

[24] Solidification - The conversion of wet waste into a free-standing monolith by the addition of an agent so that the waste meets the stability and free-standing liquid requirements of the disposal site.

[25] Special Radionuclides - The RADMAN computer code term for radionuclides listed in Appendix G to 10CFR20 (i.e., H-3, C-14, I-129 & Tc-99)

[26] Stability – Structural stability per 10CFR61.2. This can be provided by the waste form, or by placing the waste in a disposal container or structure that provides stability after disposal. Stability requires that the waste form maintain its structural integrity under the expected disposal conditions.

[27] Volume Reduction – any process that reduces the volume of waste. This includes but is not limited to, compaction and incineration.

[28] Waste Container - A vessel of any shape, size, and composition used to contain the final processed waste.

[29] Waste Form - Waste in a waste container acceptable for disposal at a licensed disposal facility.

[30] Waste Stream - A Plant specific and constant source of waste with a distinct radionuclide content and distribution.

[31] Waste Type – A single packaging configuration and waste form tied to a specific waste stream.

4.0 RESPONSIBILITIES

4.1 The Vice President Operations Support (VPOS) is responsible for the implementation of this procedure.

4.2 Each site Senior Nuclear Executive (SNE) is responsible for ensuring that necessary site staff implements this procedure.

4.3 The Low Level RadWaste (LLRW) Focus Group is responsible for evaluating and recommending changes and revisions to this procedure.

5.0 DETAILS

An isotopic analysis shall be performed on every batch for each waste stream so that the waste can be classified in accordance with 10CFR61. The isotopic and curie content of each shipping container shall be determined in accordance with 49CFR packaging requirements. The total activity in the container may be determined by either isotopic analysis or by dose-rate-to-curie conversion.

5.1 PRECAUTIONS AND LIMITATIONS

None

5.2 Dry Waste Management

NOTE

If the provisions of the Process Control Program are not satisfied, suspend shipment of the defectively processed or defectively packaged solid waste from the site. Shipment may be accomplished when the waste is processed / packaged in accordance with the Process Control Program.

[1] Dry waste may be packaged and processed either on-site or at a licensed off-site waste processing facility. The licensed off-site waste processing facility will take title to the waste and certify that it has been properly incinerated, solidified or vitrified prior to disposal.

[2] Dry waste will meet applicable regulatory requirements, vendor waste acceptance criteria and disposal site acceptance criteria.

[3] Dry waste processing may include, but is not limited to compaction, incineration, bulk processing, dewatering, or any other acceptance technologies available.

5.3 Liquid Waste Management

NOTE

The solidification of liquid wastes will be verified with surveillance activities of an approved Process Control Program.

[1] Liquid waste may be packaged and processed either on-site or at a licensed off-site waste processing facility. The licensed off-site waste processing facility will take title to the waste and certify that it has been properly incinerated, solidified or vitrified prior to disposal.

[2] Liquid waste will meet applicable regulatory requirements, vendor waste acceptance criteria and disposal site acceptance criteria.

[3] Liquid waste processing may include, but is not limited to incineration, solidification, or any other acceptance technologies available.

5.4 Quality Assurance

[1] Reviews of solid waste activities performed under the guidance of the Process Control Program are completed through audits and selected monitoring activities.

[2] Certain elements of the Entergy Quality Assurance Program Manual are applied to the Process Control Program.

5.5 Administrative Controls

[1] Information on solid radioactive waste shipped off-site is reported annually to the Nuclear Regulatory Commission in the Annual Radioactive Effluent Release Report as specified by the Offsite Dose Calculation Manual (ODCM)or Technical Specification. **[ANO1 Technical Specifications - 5.6.3] [ANO2 Technical Specifications – 6.9.3] [WF3 Technical Specifications – 6.9.18] [GGNS ODCM – 5.6.3.c]**

[2] All changes to the PCP shall be documented. All records of reviews performed shall be retained as required by the Quality Assurance Program. The documentation of the changes shall **[GGNS UFSAR, Chapter 16B.1 / TRM – 7.6.3.8 paragraph 2]**:

(a) Contain sufficient information to support the change with appropriate analyses or evaluations justifying the change.

(b) Include a determination that the change will maintain the overall conformance of the solidified waste product to existing requirements of Federal, State or other applicable regulations.

[3] All changes in the Process Control Program and supporting documentation are included in each site's next Annual Radiological Effluent Release Report to the Nuclear Regulatory Commission with the following exception at Grand Gulf Nuclear Station and James A. FitzPatrick Nuclear Station. James A. FitzPatrick and. Grand Gulf Specific Requirement – PCP changes are not submitted to the NRC. **[ANO ODCM - L3.2.1.B]**

[4] The changes to RW-105 shall become effective upon review and acceptance by the site's General Plant Manager except as listed below:

(a) For Grand Gulf Nuclear Station, the changes to RW-105 shall be accomplished as specified in Grand Gulf Nuclear Station Technical Requirements Manual (TRM) Section 7.6.3.8. The changes shall become effective upon review and acceptance by the On-site Safety

Review Committee (OSRC) and the approval of the GGNS Plant General Manager. **[GGNS UFSAR, Chapter 16B.1 / TRM – 7.6.3.8 paragraph 2]**

(b) For River Bend Nuclear Station, the procedure approval along with changes to RW-105 shall be accomplished per the River Bend Nuclear Station Technical Requirements, Section 5.5.14.1. The changes shall become effective upon review and acceptance by approval from the River Bend Nuclear Station Plant Manager or Radiation Protection Manager. **[RBS Technical Requirements – 5.5.14.1, 5.5.14.2 & 5.8.2]**

(c) For Waterford 3, the procedure approval along with changes to RW-105 shall be accomplished per Waterford 3 Technical Specifications 6.13.2. The changes shall become effective upon review and acceptance by the Waterford 3 General Plant Manager. **[WF3 Technical Specifications – 6.13.2.b]**

(d) Each site will maintain applicable state and federal regulations (web based access is acceptable), vendor waste acceptance criteria and disposal site waste acceptance criteria.

5.6 Vendor Requirements

[1] Vendors performing radwaste services under 10CFR61 and 10CFR71 requirements will be on the Entergy Qualified Supplier's List (QSL).

[2] Vendors performing radwaste services on-site are to comply with the following:

(a) Dewatering and solidification services shall have a NRC approved Topical Report or other form of certification documenting NRC approval of the processes and associated equipment/containers.

(b) All vendor procedures utilized for performing on-site radwaste services will be reviewed per the requirements of LI-101, technically by the applicable site's Radiation Protection organization and only be accepted per the approvals specified in Section 5.5[4].

(c) All changes to vendor procedures for ongoing on-site radwaste services will be reviewed technically by the site's Radiation Protection organization and screened per the requirements of LI-101, "10CFR50.59 Review Program". Significant procedural changes will require the approvals specified in Section 5.5[4]. During screening, the level of significance for procedural changes on equipment and process parameters may warrant the full 10CFR50.59 documentation and approval process.

6.0 INTERFACES

[1] EN-LI-101, "10CFR50.59 Review Program"

[2] EN-RW-104, "Scaling Factors"

[3] EN-QV-104, "Entergy Quality Assurance Program Manual Control"

7.0 RECORDS

[1] Documentation of pertinent data required to classify waste and verify solidification will be maintained on each batch of processed waste as required by approved procedures.

[2] Documentation will also be maintained to ensure that containers, shipping casks, and methods of packaging wastes meet applicable Federal regulations and disposal site criteria. The records of reviews performed and documents associated with these reviews will be maintained as QA records.

8.0 OBLIGATION AND REGULATORY COMMITMENT CROSS-REFERENCES

Document	Document Section	NMM Procedure Section	Site Applicability
ANO ODCM	L3.2.1.B	5.5 [3]	ANO
ANO1 Technical Specifications	5.6.3	5.5 [1]	ANO
ANO2 Technical Specifications	6.9.3	5.5 [1]	ANO
RBS Technical Requirements	5.5.14	*	RBS
RBS Technical Requirements	5.5.14.1	5.5 [4] (b)	RBS
RBS Technical Requirements	5.5.14.2	5.5 [4] (b)	RBS
RBS Technical Requirements	5.8.2	5.5 [4] (b)	RBS
WF3 Technical Specifications	1.22	*	WF3
WF3 Technical Specifications	6.9.18	5.5 [1]	WF3
WF3 Technical Specifications	6.13.2.b	5.5 [4] (c)	WF3
11759 – NRC IN 79-19	All	*	WF3
GGNS UFSAR, Chapter 16B.1 / TRM	7.6.3.8 paragraph 1	1.0	GGNS
GGNS ODCM	5.6.3.c	5.5 [1]	GGNS
GGNS FSAR	11.4.5.S2	5.6[2](a)	GGNS
GGNS FSAR	11.4.2.3AS7	5.6[2](a)	GGNS
IPN-99-079	All	*	IPEC
Appendix B Technical Specifications	Section 4.5, RECS ODCM Part 1	*	IPEC
NRC Letter 1.98.091	All	*	VY
NRC Letter 1.88.078	All	*	VY

* Covered by directive as a whole or by various paragraphs of the directive.

9.0 ATTACHMENTS

None