



March 28, 2001

C0301-10  
10 CFR 50.36a

Docket Nos.: 50-315  
50-316

U. S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Mail Stop O-P1-17  
Washington, D. C. 20555-0001

Donald C. Cook Nuclear Plant Units 1 and 2  
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT  
JANUARY 1, 2000, TO DECEMBER 31, 2000

In accordance with 10 CFR 50.36a(a)(2) and Technical Specification (T/S) 6.9.1.7, Indiana Michigan Power Company is providing the annual radioactive effluent release report for Donald C. Cook Nuclear Plant (CNP) Units 1 and 2. This report covers the period January 1, 2000, through December 31, 2000.

The calculations in this report were performed in accordance with the CNP Offsite Dose Calculation Manual (ODCM). The ODCM was revised twice during the reporting period and a copy of each revision is included as an appendix to this report to fulfill the requirements of T/S 6.14.1.c.

Should you have any questions, please contact Mr. Ronald W. Gaston, Manager of Regulatory Affairs, at (616) 697-5020.

Sincerely,

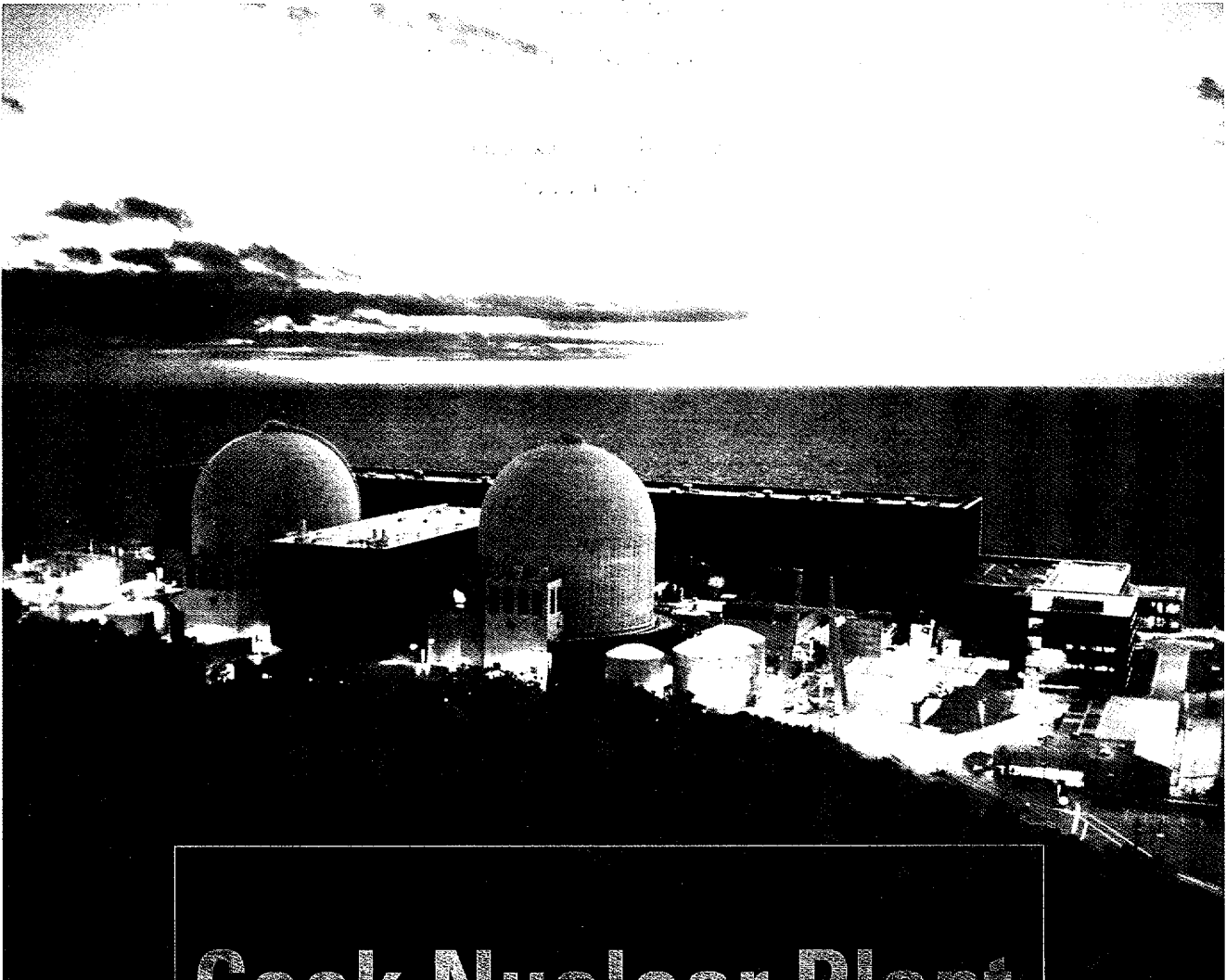
Scot A. Greenlee  
Director of Design Engineering and Regulatory Affairs

/dmb

Enclosure

IE48

c: J. E. Dyer  
MDEQ - DW & RPD, w/o enclosure  
D. Minnaar  
NRC Resident Inspector  
R. Whale, w/o enclosure



# Cook Nuclear Plant Nuclear Generation Group

## Annual Radioactive Effluent Release Report

January 1, 2000 through  
December 31, 2000



*AEP. America's Energy Partner™*

# Annual Radioactive Effluent Release Report

Donald C. Cook Nuclear Plant Units 1 and 2

January 1, 2000 through December 31, 2000

## TABLE OF CONTENTS

	<u>Page</u>
Table of Contents	i
I. Introduction	1
II. Radioactive Releases and Radiological Impact on Man	1
Liquid Releases	2
Gaseous Releases	2
Solid Waste Disposition	2
III. Meteorological	2
IV. Offsite Dose Calculation Manual (ODCM) Changes	2
V. Total Dose	2
VI. Radiation Monitors Inoperable Greater Than 30 Days	3
VII. Conclusion	3

## LIST OF APPENDICES

Appendix	Title
A1.1	Radioactive Release Data: January 1 - December 31, 2000
A1.2	Summary of Maximum Individual Doses: First Quarter, 2000
A1.3	Summary of Maximum Individual Doses: Second Quarter, 2000
A1.4	Summary of Maximum Individual Doses: Third Quarter, 2000
A1.5	Summary of Maximum Individual Doses: Fourth Quarter, 2000
A2.1	Summary of Hourly Meteorological Data: First Quarter, 2000
A2.2	Summary of Hourly Meteorological Data: Second Quarter, 2000
A2.3	Summary of Hourly Meteorological Data: Third Quarter, 2000
A2.4	Summary of Hourly Meteorological Data: Fourth Quarter, 2000
A3.0	Offsite Dose Calculation Manual (ODCM) Revisions

I. INTRODUCTION

This report discusses the radioactive discharges from Unit 1 and Unit 2 of the Donald C. Cook Nuclear Plant during 2000. This is in accordance with the requirements of Cook Nuclear Plant Technical Specification 6.9.1.7.

The table below summarizes the pertinent statistics concerning the Plant's operation during the period from January 1 to December 31, 2000. The data in this table and the descriptive information on plant operation are based upon the respective Unit's Monthly Operating Reports and Control Room Logs for 2000.

Parameter	Unit 1	Unit 2
Gross Electrical Energy Generation (MWH)	457,392	4,950,860
Unit Service Factor (%)	2.8	51.9
Unit Capacity Factor - MDC Net (%)	1.5	51.4

Unit 1 and 2 entered the reporting period in Mode 6 or defueled as a result of an extended shutdown beginning in September of 1997.

Unit 1 entered mode 1 on 12/21/00 and exited this reporting period at 86 % Reactor Thermal Power (RTP).

Unit 2 entered mode 1 on 6/24/00. 100% RTP was attained on 7/5/00. Small power adjustments were made to facilitate main turbine valve testing and steam generator blowdown manipulations. The unit exited the reporting period at 100% RTP.

II. RADIOACTIVE RELEASES AND RADIOLOGICAL IMPACT ON MAN

Since a number of release points are common to both units, the release data from both units are combined to form this two-unit, Annual Radioactive Effluent Release Report. Appendix 1 of this report presents the information in accordance with section 6.9.1.7 of Appendix A to the Facility Operating Licenses, as specified in the Technical Specification, Regulatory Guide 1.21 and 10 CFR Part 50, Appendix I.

The "MIDAS System" by PLG, Inc., is a computer code that calculates doses due to radionuclides that were released from the Donald C. Cook Nuclear Plant.

All liquid and gaseous releases were well within Offsite Dose Calculation Manual limits and Federal Limits.

There were no abnormal liquid or gaseous releases.

Liquid Releases

During 2000 there were 71 liquid batch releases. During the first quarter there were 14 liquid batch releases. During the second quarter there were 15. During the third quarter there were 18. During the fourth quarter there were 24.

Estimated doses (in millirem) to maximally exposed individuals via the liquid release pathways are given in appendices 1.2, 1.3, 1.4, and 1.5 of this report.

### Gaseous Releases

During the first quarter of 2000 there was no gaseous batch releases. During the second quarter there were two batch releases from Waste Gas Decay Tanks (GDT) and eight Containment Pressure Reliefs (CPR). During the third quarter there were no GDT releases, but 79 CPR. During the fourth quarter there were four gaseous batch releases from GDT and 72 CPR. There were a total of 6 GDT and 159 CPR during 2000.

In calculating the dose consequences for continuous and batch gaseous releases during 2000, the meteorological data measured at the time of the release were used.

The estimated doses (in millirem) to maximally exposed individuals via the gaseous release pathways are given in appendices 1.2, 1.3, 1.4, and 1.5 of this report.

### Solid Waste Disposition

There were nine shipments of radioactive waste made during 2000. This included shipments made from the site and the various radioactive waste processors to the ultimate disposal site.

## III. METEOROLOGICAL

Appendices A2.1, A2.2, A2.3, and A2.4 of this report contain the cumulative joint frequency distribution tables of wind speed and wind direction, corresponding to the various atmospheric stability classes for the first, second, third and fourth quarters of 2000. Hourly meteorological data is available for review and/or inspection upon request.

## IV. OFFSITE DOSE CALCULATION MANUAL (ODCM) CHANGES

The Offsite Dose Calculation Manual, 12 PMP 6010 OSD.001, was revised twice during the report period. The reasons for each revision and the Plant Operations Review Committee approvals are documented on the procedure Review and Approval Tracking Form. These revisions did not reduce the accuracy or reliability of dose calculations or setpoint determinations. Appendix 3.0 contains a copy of each revision of the ODCM with changes indicated by marginal bars.

## V. TOTAL DOSE

Section 3.2.5 of the ODCM requires that the dose or dose commitment to a real individual from all uranium fuel cycle sources in Berrien County be limited to no more than 25 millirem to the total body or any organ (except the thyroid, which is limited to no more than 75 millirem) over a period of 12 consecutive months to show conformance with the requirements of 40 CFR Part 190. The maximum cumulative dose to an individual from liquid and gaseous effluents during 2000 was well within the ODCM limits. Measurements using thermoluminescent dosimeters at 11 offsite stations indicate that the dose due to direct radiation is negligible compared to preoperational doses and current background levels. This is fully evaluated in the Annual Environmental Operating Report for 2000.

For individuals that are within the site boundary, the occupancy

time is sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the site boundary.

#### VI. RADIATION MONITORS INOPERABLE GREATER THAN 30 DAYS

This section covers the years 1999 and 2000 because there were instances when radiation monitors were declared inoperable in 1999 and they were not restored to operable status until 2000. Operability was not required while the radiation monitors were inoperable greater than 30 days because the units were shutdown in less than Mode 4 and there were no releases via the unmonitored pathways.

On April 9, 1999, at 1715 hours, the Lower Containment radiation monitors (ERS-1300, ERS-2300, ERS-1400, ERS-2400), the Steam Jet Air Ejector monitors (SRA-1900, SRA-2900), the Gland Seal Condenser monitors (SRA-1800, SRA-2800), and the Unit Vent radiation monitors (VRS-1500, VRS-2500) were all declared inoperable. This was due to the channel functional testing being determined to be in non-compliance with the Technical Specification and the Off-site Dose Calculation Manual. These conditions had existed since the Eberline monitors were installed in 1982 and are applicable to both units. This is documented in LER-99-15. Confidence existed that the monitors would have functioned as designed.

VRS-1500 and VRS-2500 were tested and declared operable on 5/5/99, within the 30-day time frame allowed. ERS-2300 and ERS-2400 were tested and declared operable on 7/9/1999. SRA-2800 was tested and declared operable on 5/16/00 and SRA-2900 was tested and declared operable on 6/6/00. This was prior to there being a release via the applicable pathway. ERS-1300 and ERS-1400 were tested and declared operable on 7/26/99 and 7/25/99, respectively. SRA-1800 and SRA-1900 were tested and declared operable on 12/3/99. This was prior to there being a release via the applicable pathway. This testing confirmed that the monitors would have functioned as designed.

#### VII. CONCLUSION

Based on the information presented in this report, it is concluded that the Donald C. Cook Nuclear Plant Units 1 and 2 performed their intended design function with no demonstrable adverse affect on the health and safety of the general public.



2000 Effluent and Waste Disposal Annual Report

SUPPLEMENTAL INFORMATION

Facility: Donald C. Cook Plant  
Licensee: Indiana Michigan Power Company

1 REGULATORY LIMITS

1.1 Noble Gases

The air dose in unrestricted areas due to noble gases released in gaseous effluents shall be limited to the following:

1.1.1 During any calendar quarter, to  $\leq 5$  mrad for gamma radiation and  $\leq 10$  mrad for beta radiation.

1.1.2 During any calendar year, to  $\leq 10$  mrad for gamma radiation and  $\leq 20$  mrad for beta radiation.

1.2 Iodines - Particulates

The dose to a member of the public from radioiodines, radioactive materials in particulate form, and radionuclides other than noble gases with half-lives greater than eight days in gaseous effluents released to unrestricted areas shall be limited to the following:

1.2.1 During any calendar quarter to  $\leq 7.5$  mrem to any organ.

1.2.2 During any calendar year to  $\leq 15$  mrem to any organ.

1.3 Liquid Effluents

The dose or dose commitment to an individual from radioactive material in liquid effluents released to unrestricted areas shall be limited:

1.3.1 During any calendar quarter to  $\leq 1.5$  mrem to the total body and to  $\leq 5$  mrem to any organ.

1.3.2 During any calendar year to  $\leq 3$  mrem to the total body and to  $\leq 10$  mrem to any organ.

## 2000 Effluent and Waste Disposal Annual Report

### 1.4 Total Dose

The dose or dose commitment to a real individual from all uranium fuel cycle sources is limited to  $\leq 25$  mrem to the total body or any organ (except the thyroid, which is limited to  $\leq 75$  mrem) over a period of 12 consecutive months.

## 2 MAXIMUM PERMISSIBLE CONCENTRATIONS

### 2.1 Gaseous Effluents

The dose rate due to radioactive materials released in gaseous effluents from the site shall be limited to the following:

2.1.1 For noble gases:  $\leq 500$  mrem/yr to the total body and  $\leq 3000$  mrem/yr to the skin.

2.1.2 For all radioiodines and for all radioactive materials in particulate form and radionuclides (other than noble gases) with half-lives greater than eight days:  $\leq 1500$  mrem/yr to any organ.

The above limits are provided to insure 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 in 10 CFR Part 20, Appendix B, Table 2, Column 1.

### 2.2 Liquid Effluents

The concentration of radioactive material released at any time from the site to unrestricted areas shall be limited to the concentrations specified in 10 CFR Part 20, Appendix B, Table 2, Column 2, for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to  $2 \times 10^{-4}$   $\mu\text{Ci/ml}$  total activity.

## 2000 Effluent and Waste Disposal Annual Report

### 3 AVERAGE ENERGY

The average energy ( $\bar{E}$ ) of the radionuclide mixture in releases of fission and activation gases as defined in Regulatory Guide 1.21, Appendix B, Section A.3 is not applicable because the limits used for gaseous releases are based on calculated dose to members of the public.

### 4 MEASUREMENTS and APPROXIMATIONS of TOTAL RADIOACTIVITY

#### 4.1 Fission and Activation Gases

Sampled and analyzed on a 4096 channel analyzer and HpGe detector. Tritium analysis is performed using liquid scintillation counter.

#### 4.2 Iodines

Sampled on iodine adsorbing media and analyzed on a 4096 channel analyzer and HpGe detector.

#### 4.3 Particulates

Sampled on a glass filter and analyzed on a 4096 channel analyzer and HpGe detector. Sr-89 and Sr-90 analyses performed by offsite vendor.

#### 4.4 Liquid Effluents

Sampled and analyzed on a 4096 channel analyzer and HpGe detector. Tritium analysis is performed using liquid scintillation counter. Fe-55, Sr-89 and Sr-90 analyses performed by offsite vendor.

2000 Effluent and Waste Disposal Annual Report

5 BATCH RELEASES

5.1 Liquid

5.1.1 Number of batch releases:

14 releases in the 1<sup>st</sup> quarter, 2000  
15 releases in the 2<sup>nd</sup> quarter, 2000  
18 releases in the 3<sup>rd</sup> quarter, 2000  
24 releases in the 4<sup>th</sup> quarter, 2000

5.1.2 Total time period for batch releases:

11950 minutes

5.1.3 Maximum time for a batch release:

250 minutes

5.1.4 Average time period for batch release:

168 minutes

5.1.5 Minimum time period for a batch release:

17.0 minutes

5.1.6 Average stream flow during periods of release of effluent into a flowing stream:

6.72E+5 gpm circulating water

2000 Effluent and Waste Disposal Annual Report

5.2 Gaseous

5.2.1 Number of batch releases:

0 releases in the 1<sup>st</sup> quarter, 2000  
10 releases in the 2<sup>nd</sup> quarter, 2000  
79 releases in the 3<sup>rd</sup> quarter, 2000  
76 releases in the 4<sup>th</sup> quarter, 2000

5.2.2 Total time period for batch releases:

4251 minutes

5.2.3 Maximum time for a batch release:

119 minutes

5.2.4 Average time period for batch release:

25.8 minutes

5.2.5 Minimum time period for a batch release:

10.0 minutes

2000 Effluent and Waste Disposal Annual Report

6 ABNORMAL RELEASES

6.1 Liquid

6.1.1 Number of Releases:

<u>1<sup>st</sup> Quarter</u>	<u>2<sup>nd</sup> Quarter</u>	<u>3<sup>rd</sup> Quarter</u>	<u>4<sup>th</sup> Quarter</u>
0	0	0	0

6.1.2 Total activity released (Ci):

<u>1<sup>st</sup> Quarter</u>	<u>2<sup>nd</sup> Quarter</u>	<u>3<sup>rd</sup> Quarter</u>	<u>4<sup>th</sup> Quarter</u>
0	0	0	0

6.2 Gaseous

6.2.1 Number of Releases:

<u>1<sup>st</sup> Quarter</u>	<u>2<sup>nd</sup> Quarter</u>	<u>3<sup>rd</sup> Quarter</u>	<u>4<sup>th</sup> Quarter</u>
0	0	0	0

6.2.2 Total activity released (Ci):

<u>1<sup>st</sup> Quarter</u>	<u>2<sup>nd</sup> Quarter</u>	<u>3<sup>rd</sup> Quarter</u>	<u>4<sup>th</sup> Quarter</u>
0	0	0	0

2000 EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT  
 GASEOUS EFFLUENTS-GROUND LEVEL RELEASES  
 CONTINUOUS MODE

Nuclides released	Unit	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
1. FISSION GASES					
H3	Ci	2.83E+01	2.19E+01	1.28E+01	2.00E+01
Total for Period	Ci	2.83E+01	2.19E+01	1.28E+01	2.00E+01
2. IODINES					
Total for Period	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3. PARTICULATES					
CO60	Ci		4.18E-07	1.03E-07	
CS134	Ci		5.29E-08	4.77E-07	
CS137	Ci	5.67E-07	1.99E-06	1.31E-05	
*AG110M	Ci		1.86E-07		
Total for Period	Ci	5.67E-07	2.65E-06	1.36E-05	0.00E+00

\* DENOTES SUPPLEMENTAL ISOTOPES

BATCH MODE

Nuclides released	Unit	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
1. FISSION GASES					
H3	Ci		2.48E-05	1.84E-01	2.57E-01
AR41	Ci			4.59E-01	6.68E-01
KR85	Ci		3.32E-02		2.64E-02
XE133	Ci		2.92E-02	3.79E-01	5.74E-01
XE135	Ci			1.54E-02	2.85E-02
Total for Period	Ci	0.00E+00	6.24E-02	1.04E+00	1.55E+00
2. IODINES					
Total for Period	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3. PARTICULATES					
Total for Period	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00

2000 EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT  
GASEOUS EFFLUENTS-SUMMATION OF ALL RELEASES

	Units	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Est. Total Error, %
-----						
A. FISSION AND ACTIVATION GASES						
-----						
1. Total Release	Ci	0.00E+00	6.24E-02	8.53E-01	1.30E+00	15.0
-----						
2. Average release rate for period	uCi/sec	0.00E+00	7.94E-03	1.07E-01	1.63E-01	
-----						
3. Percent of applicable limit	% Gamma Beta	0.00E+00 0.00E+00	1.73E-04 2.57E-04	4.76E-02 1.04E-02	2.84E-02 6.27E-03	
-----						
B. IODINES						
-----						
1. Total I-131	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A
-----						
2. Average release rate for period	uCi/sec	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
-----						
3. Percent of applicable limit	%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
-----						
C. PARTICULATES						
-----						
1. Particulates with half lives > 8 days	Ci	5.67E-07	2.65E-06	1.36E-05	0.00E+00	14.0
-----						
2. Average release rate for period	uCi/sec	7.21E-08	3.37E-07	1.71E-06	0.00E+00	
-----						
3. Percent of applicable limit	%	1.68E-01	3.29E-01	3.19E-01	1.40E-01	
-----						
4. Gross alpha radioactivity	Ci	<7.15E-07	<6.93E-07	<7.88E-07	<8.37E-07	
-----						
D. Tritium						
-----						
1. Total Release	Ci	2.83E+01	2.19E+01	1.30E+01	2.02E+01	11.0
-----						
2. Average release rate for period	uCi/sec	3.60E+00	2.79E+00	1.64E+00	2.54E+00	
-----						
3. Percent of applicable limit	%	6.00E+01	5.22E+01	3.00E+01	4.28E+01	
-----						



2000 EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT  
LIQUID EFFLUENTS

CONTINUOUS MODE

Nuclides released	Unit	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
H3	Ci	8.40E-02			

BATCH MODE

Nuclides released	Unit	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
H3	Ci	6.52E+01	8.90E+01	4.03E+01	1.31E+02
MN54	Ci	7.08E-04	1.12E-03	5.90E-05	8.89E-05
FE55	Ci	1.14E-02	1.45E-02		
CO60	Ci	3.52E-02	2.35E-02	9.40E-03	1.59E-02
NB95	Ci			5.55E-06	
AG110M	Ci	3.23E-04	6.58E-04	7.78E-04	5.68E-04
CO57	Ci	7.59E-06			
SB125	Ci	1.96E-03	2.11E-03	4.21E-04	2.77E-03
CS134	Ci				1.28E-05
CS137	Ci	7.79E-04		1.43E-05	2.03E-05
*AG108M	Ci		5.24E-05	5.67E-05	5.41E-06
*XE133	Ci			7.06E-05	
*XE135	Ci			2.45E-05	

\* DENOTES SUPPLEMENTAL ISOTOPES

2000 EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT  
LIQUID EFFLUENTS-SUMMATION OF ALL RELEASES  
CONTINUOUS

		Units	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Est. Total Error, %
-----							
A.	FISSION AND ACTIVATION PRODUCTS						
1.	Total Release	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A
2.	Average diluted concentration during period	uCi/ml	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
3.	Percent of applicable limit	%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
-----							
B.	TRITIUM						
1.	Total Release	Ci	8.40E-02	0.00E+00	0.00E+00	0.00E+00	10.4
2.	Average diluted concentration during period	uCi/ml	8.16E-10	0.00E+00	0.00E+00	0.00E+00	
3.	Percent of applicable limit	%	8.16E-05	0.00E+00	0.00E+00	0.00E+00	
-----							
C.	DISSOLVED AND ENTRAINED GASES						
1.	Total Release	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A
2.	Average diluted concentration during period	uCi/ml	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
3.	Percent of applicable limit	%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
-----							
D.	Gross Alpha Radioactivity Total Release	Ci	<2.27E-04	<3.25E-04	<3.29E-03	<4.61E-03	N/A
-----							
E.	Volume of Waste Released	Liters	2.47E+06	3.54E+06	3.59E+07	5.03E+07	2.00
-----							
F.	Volume of Dilution Water used During Period	Liters	1.73E+11	3.77E+11	5.21E+11	4.59E+11	3.48

2000 EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT  
LIQUID EFFLUENTS-SUMMATION OF ALL RELEASES  
BATCH

		Units	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Est. Total Error, %
-----							
A.	FISSION AND ACTIVATION PRODUCTS						
-----							
1.	Total Release	Ci	5.03E-02	4.19E-02	1.07E-02	1.94E-02	12.2
2.	Average diluted concentration during period	uCi/ml	1.44E-08	7.06E-09	1.07E-09	1.74E-09	
3.	Percent of applicable limit	%	3.66E-01	1.38E-01	3.29E-02	4.96E-02	
-----							
B.	TRITIUM						
-----							
1.	Total Release	Ci	6.52E+01	8.90E+01	4.03E+01	1.31E+02	10.1
2.	Average diluted concentration during period	uCi/ml	1.87E-05	1.50E-05	4.02E-06	1.17E-05	
3.	Percent of applicable limit	%	1.87E+00	1.50E+00	4.02E-01	1.17E+00	
-----							
C.	DISSOLVED AND ENTRAINED GASES						
-----							
1.	Total Release	Ci	0.00E+00	0.00E+00	9.51E-05	0.00E+00	N/A
2.	Average diluted concentration during period	uCi/ml	0.00E+00	0.00E+00	9.50E-12	0.00E+00	
3.	Percent of applicable limit	%	0.00E+00	0.00E+00	4.75E-06	0.00E+00	
-----							
D.	Gross Alpha Radioactivity Total Release	Ci	<7.19E-05	<7.59E-05	<5.47E-06	<7.48E-05	N/A
-----							
E.	Volume of Waste Released	Liters	7.58E+05	8.86E+05	1.01E+06	1.31E+06	2.00
-----							
F.	Volume of Dilution Water used During Period	Liters	3.48E+09	5.93E+09	1.00E+10	1.12E+10	3.48

2000 Effluent and Waste Disposal Annual Report  
Solid Waste and Irradiated Fuel Shipments

Solid Waste Shipped Offsite for Burial or Disposal			
1) Type of Waste	Unit	Estimated amount	Estimated Total Error, %
a) Spent resins, filters, sludge, evaporator bottoms, etc.	m <sup>3</sup>	1.49E+01	1.00E+00
	Curies	8.62E+01	3.75E+00
b) Dry compressible waste, contaminated equipment, etc.	m <sup>3</sup>	1.54E+02	1.00E+00
	Curies	2.64E+00	6.48E+00
c) Irradiated components, control rods, etc.	m <sup>3</sup> Curies		
d) Other	m <sup>3</sup> Curies		

2) Estimate of Principle Radionuclide Composition				
a)	Cs-134	1 %	Ni-63	39 %
	Cs-137	4 %	Mn-54	1 %
	Fe-55	18 %	C-14	1 %
	Co-60	32 %	H-3	4 %
b)	Cs-134	7 %	Fe-55	36 %
	Cs-137	1 %	Ni-63	18 %
	Co-60	27%	H-3	10 %

3) Solid Waste Disposition		
No. of Shipments	Mode of Transportation	Destination
4	Truck	Barnwell, SC
5	Truck	Clive, UT

4) Type of Containers used for Shipment: Containers used are strong, tight metal boxes, drums and high integrity containers.

5) Solidification Agent: There were no solidifications performed during this report period.

2000 Effluent and Waste Disposal Annual Report Yearly Release Rates

<b>GASES</b>		
Fission and Activation Gases	Total Release	2.22E+00 Curies
	Average Release Rate	7.02E-02 $\mu$ Ci/sec
	% of Applicable Limits	$\gamma$ 3.81E-02 % $\beta$ 8.46E-03 %
Iodines	Total I-131 Release	0.00 Curies
	Average Release Rate	0.00 $\mu$ Ci/sec
	% of Applicable Limit	0.00 %
Particulates	Total Release	4.07E-05 Curies
	Average Release Rate	1.29E-06 $\mu$ Ci/sec
	% of Applicable Limit	4.78E-01 %
<b>LIQUIDS</b>		
Fission and Activation Products	Total Release	1.22E-01 Curies
	Average Diluted Concentration	4.00E-09 $\mu$ Ci/ml
	% of Applicable Limits	Total Body 5.14E-01 % Organ 1.83E-01 %

1999 Effluent and Waste Disposal Annual Report Yearly Release Rates  
Revised

<b>GASES</b>		
Fission and Activation Gases	Total Release	3.14E-02 Curies
	Average Release Rate	9.96E-04 $\mu$ Ci/sec
	% of Applicable Limits	$\gamma$ 4.03E-06 % $\beta$ 2.29E-04 %
Iodines	Total I-131 Release	0.00 Curies
	Average Release Rate	0.00 $\mu$ Ci/sec
	% of Applicable Limit	0.00 %
Particulates	Total Release	4.16E-07 Curies
	Average Release Rate	1.32E-08 $\mu$ Ci/sec
	% of Applicable Limit	4.79E-01 %
<b>LIQUIDS</b>		
Fission and Activation Products	Total Release	2.04E-01 Curies
	Average Diluted Concentration	2.37E-08 $\mu$ Ci/ml
	% of Applicable Limits	Total Body 1.02E+00 % Organ 4.29E-01 %

| Liquid organ dose % of applicable limit was erroneously reported as 4.29E-02 % in 1999 report.

The following distances were used in the calculation of the maximum individual doses:

<u>Sector</u>	<u>Direction</u>	<u>Boundary (Meters)</u>	<u>Nearest Residence (Meters)</u>
A	N	651	659
B	NNE	617	660
C	NE	789	943
D	ENE	1497	1747
E	E	1274	1716
F	ESE	972	1643
G	SE	629	1136
H	SSE	594	1507
J	S	594	1026
K	SSW	629	942

## Summary of Maximum Individual Doses

1<sup>st</sup> Quarter

Effluent	Applicable Organ	Estimated Dose (mrem)	AGE GROUP	LOCATION DIST DIR (M) (Toward)	% OF APPLICABLE LIMIT	LIMIT (mrem) QTR
Liquid	Total Body	6.90E-03	Adult	Receptor 1	4.60E-01	1.5
Liquid	Liver	9.28E-03	Child	Receptor 1	1.86E-01	5.0
Noble Gas	Air Dose (Gamma-mrad)	0.0		594 (N)	0.0	5.0
Noble Gas	Air Dose (Beta-mrad)	0.0		594 (N)	0.0	10.0
Iodines and Particulates	Liver	1.26E-02	Child	659 (N)	1.68E-01	7.5



LAST LIQUID DOSE ACCUMULATION (MREM)  
 START DATE 0 1 1 1 END DATE 0 33124

BONE LIVER T.BODY THYRD KIDNEY LUNG GI-LLI SKIN

WATER

ADULT	3.9E-05	2.8E-03	2.8E-03	2.7E-03	2.7E-03	2.7E-03	3.4E-03	0.0E+00
TEEN	3.8E-05	2.0E-03	2.0E-03	1.9E-03	1.9E-03	1.9E-03	2.3E-03	0.0E+00
CHILD	1.1E-04	3.8E-03	3.9E-03	3.7E-03	3.7E-03	3.7E-03	4.0E-03	0.0E+00
INFANT	1.1E-04	3.8E-03	3.8E-03	3.6E-03	3.7E-03	3.6E-03	3.8E-03	0.0E+00

SHORE

ADULT	2.1E-04	2.1E-04	2.1E-04	2.1E-04	2.1E-04	2.1E-04	2.1E-04	2.4E-04
TEEN	1.2E-03	1.2E-03	1.2E-03	1.2E-03	1.2E-03	1.2E-03	1.2E-03	1.4E-03
CHILD	2.4E-04	2.4E-04	2.4E-04	2.4E-04	2.4E-04	2.4E-04	2.4E-04	2.9E-04
INFANT	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

FW SPT FISH

ADULT	3.9E-03	5.6E-03	3.9E-03	1.8E-04	2.0E-03	8.0E-04	2.7E-03	0.0E+00
TEEN	4.2E-03	5.8E-03	2.3E-03	1.4E-04	2.0E-03	9.0E-04	1.9E-03	0.0E+00
CHILD	5.2E-03	5.2E-03	1.2E-03	1.2E-04	1.7E-03	7.3E-04	7.2E-04	0.0E+00
INFANT	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

TOTAL

ADULT	4.1E-03	8.6E-03	6.9E-03	3.1E-03	4.9E-03	3.8E-03	6.2E-03	2.4E-04
TEEN	5.4E-03	8.9E-03	5.5E-03	3.2E-03	5.1E-03	4.0E-03	5.4E-03	1.4E-03
CHILD	5.6E-03	9.3E-03	5.3E-03	4.1E-03	5.7E-03	4.7E-03	5.0E-03	2.9E-04
INFANT	1.1E-04	3.8E-03	3.8E-03	3.6E-03	3.7E-03	3.6E-03	3.8E-03	0.0E+00

DATES OF LAST AIR DOSE ACCUMULATION ARE FROM 0 1 1 1 0 TO 0 33124 0  
DOSE ACCUMULATION FOR GAMMA MRAD

FOR RELEASE POINT 1

\*\*DIRECTION FROM N

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM NNE

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM NE

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM ENE

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM E

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM ESE

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM SE

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM SSE

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM S

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM SSW

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM SW

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM WSW

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM W

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM WNW

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM NW

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM NNW

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

DISTANCES USED IN CALCULATIONS

594.0	2416.0	4020.0	5630.0	7240.0
12067.0	24135.0	40225.0	56315.0	80500.0

DATES OF LAST AIR DOSE ACCUMULATION ARE FROM 0 1 1 1 0 TO 0 33124 0  
DOSE ACCUMULATION FOR GAMMA MRAD

FOR RELEASE POINT 2

```
**DIRECTION FROM N
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
**DIRECTION FROM NNE
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
**DIRECTION FROM NE
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
**DIRECTION FROM ENE
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
**DIRECTION FROM E
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
**DIRECTION FROM ESE
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
**DIRECTION FROM SE
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
**DIRECTION FROM SSE
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
**DIRECTION FROM S
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
**DIRECTION FROM SSW
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
**DIRECTION FROM SW
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
**DIRECTION FROM WSW
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
**DIRECTION FROM W
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
**DIRECTION FROM WNW
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
**DIRECTION FROM NW
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
**DIRECTION FROM NNW
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00
```

DISTANCES USED IN CALCULATIONS

594.0 2416.0 4020.0 5630.0 7240.0  
12067.0 24135.0 40225.0 56315.0 80500.0

DATES OF LAST AIR DOSE ACCUMULATION ARE FROM 0 1 1 1 0 TO 0 33124 0  
DOSE ACCUMULATION FOR BETA MRAD

FOR RELEASE POINT 1

\*\*DIRECTION FROM N

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM NNE

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM NE

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM ENE

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM E

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM ESE

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM SE

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM SSE

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM S

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM SSW

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM SW

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM WSW

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM W

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM WNW

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM NW

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM NNW

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

DISTANCES USED IN CALCULATIONS

594.0	2416.0	4020.0	5630.0	7240.0
12067.0	24135.0	40225.0	56315.0	80500.0

DATES OF LAST AIR DOSE ACCUMULATION ARE FROM 0 1 1 1 0 TO 0 33124 0  
DOSE ACCUMULATION FOR BETA MRAD

FOR RELEASE POINT 2

**DIRECTION FROM N				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM NNE				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM NE				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM ENE				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM E				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM ESE				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM SE				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM SSE				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM S				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM SSW				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM SW				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM WSW				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM W				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM WNW				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM NW				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM NNW				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

DISTANCES USED IN CALCULATIONS

594.0 2416.0 4020.0 5630.0 7240.0  
12067.0 24135.0 40225.0 56315.0 80500.0

INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT

FOR DATES 0 1 1 1 THRU 0 33124

T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME PATHWAY, DIST GP= 1, 659. METERS WINDS TOWARD N  
 ADULT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 TEEN 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 CHILD 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

GROUND PATHWAY, DIST GP= 1, 659. METERS WINDS TOWARD N  
 ADULT 7.6E-06 7.6E-06 7.6E-06 7.6E-06 7.6E-06 7.6E-06 7.6E-06 8.9E-06  
 TEEN 7.6E-06 7.6E-06 7.6E-06 7.6E-06 7.6E-06 7.6E-06 7.6E-06 8.9E-06  
 CHILD 7.6E-06 7.6E-06 7.6E-06 7.6E-06 7.6E-06 7.6E-06 7.6E-06 8.9E-06  
 INFNT 7.6E-06 7.6E-06 7.6E-06 7.6E-06 7.6E-06 7.6E-06 7.6E-06 8.9E-06

VEGET PATHWAY, DIST GP= 1, 8045. METERS WINDS TOWARD N  
 ADULT 2.7E-04 2.7E-04 7.1E-08 2.7E-04 2.7E-04 2.7E-04 2.7E-04 0.0E+00  
 TEEN 3.1E-04 3.1E-04 1.1E-07 3.1E-04 3.1E-04 3.1E-04 3.1E-04 0.0E+00  
 CHILD 4.7E-04 4.7E-04 2.7E-07 4.7E-04 4.7E-04 4.7E-04 4.7E-04 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

MEAT PATHWAY, DIST GP= 1, 8045. METERS WINDS TOWARD N  
 ADULT 3.8E-05 3.8E-05 7.1E-09 3.8E-05 3.8E-05 3.8E-05 3.8E-05 0.0E+00  
 TEEN 2.3E-05 2.3E-05 5.8E-09 2.3E-05 2.3E-05 2.3E-05 2.3E-05 0.0E+00  
 CHILD 2.8E-05 2.8E-05 1.1E-08 2.8E-05 2.8E-05 2.8E-05 2.8E-05 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

COW PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD N  
 ADULT 2.3E-04 2.3E-04 2.1E-07 2.3E-04 2.3E-04 2.3E-04 2.3E-04 0.0E+00  
 TEEN 3.1E-04 3.1E-04 3.8E-07 3.1E-04 3.1E-04 3.1E-04 3.1E-04 0.0E+00  
 CHILD 4.8E-04 4.8E-04 9.0E-07 4.8E-04 4.8E-04 4.8E-04 4.8E-04 0.0E+00  
 INFNT 7.3E-04 7.3E-04 1.4E-06 7.3E-04 7.3E-04 7.3E-04 7.3E-04 0.0E+00

GOAT PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD N  
 ADULT 4.8E-04 4.8E-04 6.2E-07 4.8E-04 4.8E-04 4.8E-04 4.8E-04 0.0E+00  
 TEEN 6.2E-04 6.2E-04 1.1E-06 6.2E-04 6.2E-04 6.2E-04 6.2E-04 0.0E+00  
 CHILD 9.8E-04 9.8E-04 2.7E-06 9.8E-04 9.8E-04 9.8E-04 9.8E-04 0.0E+00  
 INFNT 1.5E-03 1.5E-03 4.3E-06 1.5E-03 1.5E-03 1.5E-03 1.5E-03 0.0E+00

INHAL PATHWAY, DIST GP= 1, 659. METERS WINDS TOWARD N  
 ADULT 6.2E-03 6.2E-03 3.9E-08 6.2E-03 6.2E-03 6.2E-03 6.2E-03 0.0E+00  
 TEEN 6.3E-03 6.3E-03 5.5E-08 6.3E-03 6.3E-03 6.3E-03 6.3E-03 0.0E+00  
 CHILD 5.5E-03 5.5E-03 7.4E-08 5.5E-03 5.5E-03 5.5E-03 5.5E-03 0.0E+00  
 INFNT 3.2E-03 3.2E-03 4.5E-08 3.2E-03 3.2E-03 3.2E-03 3.2E-03 0.0E+00

SUBTOTALS (NO PLUME)

ADULT 7.3E-03 7.2E-03 8.5E-06 7.3E-03 7.2E-03 7.2E-03 7.2E-03 8.9E-06  
 TEEN 7.5E-03 7.5E-03 9.2E-06 7.5E-03 7.5E-03 7.5E-03 7.5E-03 8.9E-06  
 CHILD 7.5E-03 7.5E-03 1.2E-05 7.5E-03 7.5E-03 7.5E-03 7.5E-03 8.9E-06  
 INFNT 5.4E-03 5.4E-03 1.3E-05 5.4E-03 5.4E-03 5.4E-03 5.4E-03 8.9E-06

TOTALS

ADULT 7.3E-03 7.2E-03 8.5E-06 7.3E-03 7.2E-03 7.2E-03 7.2E-03 8.9E-06  
 TEEN 7.5E-03 7.5E-03 9.2E-06 7.5E-03 7.5E-03 7.5E-03 7.5E-03 8.9E-06  
 CHILD 7.5E-03 7.5E-03 1.2E-05 7.5E-03 7.5E-03 7.5E-03 7.5E-03 8.9E-06  
 INFNT 5.4E-03 5.4E-03 1.3E-05 5.4E-03 5.4E-03 5.4E-03 5.4E-03 8.9E-06

INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT  
 FOR DATES 0 1 1 1 THRU 0 33124  
 T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME PATHWAY, DIST GP= 1, 660. METERS WINDS TOWARD NNE  
 ADULT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 TEEN 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 CHILD 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

GROUND PATHWAY, DIST GP= 1, 660. METERS WINDS TOWARD NNE  
 ADULT 2.6E-06 2.6E-06 2.6E-06 2.6E-06 2.6E-06 2.6E-06 2.6E-06 2.6E-06 3.0E-06  
 TEEN 2.6E-06 2.6E-06 2.6E-06 2.6E-06 2.6E-06 2.6E-06 2.6E-06 2.6E-06 3.0E-06  
 CHILD 2.6E-06 2.6E-06 2.6E-06 2.6E-06 2.6E-06 2.6E-06 2.6E-06 2.6E-06 3.0E-06  
 INFNT 2.6E-06 2.6E-06 2.6E-06 2.6E-06 2.6E-06 2.6E-06 2.6E-06 2.6E-06 3.0E-06

VEGET PATHWAY, DIST GP= 1, 814. METERS WINDS TOWARD NNE  
 ADULT 3.3E-03 3.3E-03 1.2E-06 3.3E-03 3.3E-03 3.3E-03 3.3E-03 3.3E-03 0.0E+00  
 TEEN 3.8E-03 3.8E-03 1.9E-06 3.8E-03 3.8E-03 3.8E-03 3.8E-03 3.8E-03 0.0E+00  
 CHILD 5.8E-03 5.8E-03 4.4E-06 5.8E-03 5.8E-03 5.8E-03 5.8E-03 5.8E-03 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

MEAT PATHWAY, DIST GP= 1, 7725. METERS WINDS TOWARD NNE  
 ADULT 1.6E-05 1.6E-05 2.6E-09 1.6E-05 1.6E-05 1.6E-05 1.6E-05 1.6E-05 0.0E+00  
 TEEN 9.7E-06 9.7E-06 2.1E-09 9.7E-06 9.7E-06 9.7E-06 9.7E-06 9.7E-06 0.0E+00  
 CHILD 1.2E-05 1.2E-05 3.9E-09 1.2E-05 1.2E-05 1.2E-05 1.2E-05 1.2E-05 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

COW PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD NNE  
 ADULT 9.5E-05 9.5E-05 7.0E-08 9.5E-05 9.5E-05 9.5E-05 9.5E-05 9.5E-05 0.0E+00  
 TEEN 1.2E-04 1.2E-04 1.3E-07 1.2E-04 1.2E-04 1.2E-04 1.2E-04 1.2E-04 0.0E+00  
 CHILD 2.0E-04 2.0E-04 3.1E-07 2.0E-04 2.0E-04 2.0E-04 2.0E-04 2.0E-04 0.0E+00  
 INFNT 3.0E-04 3.0E-04 4.9E-07 3.0E-04 3.0E-04 3.0E-04 3.0E-04 3.0E-04 0.0E+00

GOAT PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD NNE  
 ADULT 1.9E-04 1.9E-04 2.1E-07 1.9E-04 1.9E-04 1.9E-04 1.9E-04 1.9E-04 0.0E+00  
 TEEN 2.5E-04 2.5E-04 3.8E-07 2.5E-04 2.5E-04 2.5E-04 2.5E-04 2.5E-04 0.0E+00  
 CHILD 4.0E-04 4.0E-04 9.2E-07 4.0E-04 4.0E-04 4.0E-04 4.0E-04 4.0E-04 0.0E+00  
 INFNT 6.1E-04 6.1E-04 1.5E-06 6.1E-04 6.1E-04 6.1E-04 6.1E-04 6.1E-04 0.0E+00

INHAL PATHWAY, DIST GP= 1, 660. METERS WINDS TOWARD NNE  
 ADULT 2.5E-03 2.5E-03 1.2E-08 2.5E-03 2.5E-03 2.5E-03 2.5E-03 2.5E-03 0.0E+00  
 TEEN 2.5E-03 2.5E-03 1.7E-08 2.5E-03 2.5E-03 2.5E-03 2.5E-03 2.5E-03 0.0E+00  
 CHILD 2.3E-03 2.3E-03 2.3E-08 2.3E-03 2.3E-03 2.3E-03 2.3E-03 2.3E-03 0.0E+00  
 INFNT 1.3E-03 1.3E-03 1.4E-08 1.3E-03 1.3E-03 1.3E-03 1.3E-03 1.3E-03 0.0E+00

SUBTOTALS (NO PLUME)  
 ADULT 6.1E-03 6.1E-03 4.0E-06 6.1E-03 6.1E-03 6.1E-03 6.1E-03 6.1E-03 3.0E-06  
 TEEN 6.7E-03 6.7E-03 5.0E-06 6.7E-03 6.7E-03 6.7E-03 6.7E-03 6.7E-03 3.0E-06  
 CHILD 8.7E-03 8.7E-03 8.2E-06 8.7E-03 8.7E-03 8.7E-03 8.7E-03 8.7E-03 3.0E-06  
 INFNT 2.2E-03 2.2E-03 4.5E-06 2.2E-03 2.2E-03 2.2E-03 2.2E-03 2.2E-03 3.0E-06

TOTALS  
 ADULT 6.1E-03 6.1E-03 4.0E-06 6.1E-03 6.1E-03 6.1E-03 6.1E-03 6.1E-03 3.0E-06  
 TEEN 6.7E-03 6.7E-03 5.0E-06 6.7E-03 6.7E-03 6.7E-03 6.7E-03 6.7E-03 3.0E-06  
 CHILD 8.7E-03 8.7E-03 8.2E-06 8.7E-03 8.7E-03 8.7E-03 8.7E-03 8.7E-03 3.0E-06  
 INFNT 2.2E-03 2.2E-03 4.5E-06 2.2E-03 2.2E-03 2.2E-03 2.2E-03 2.2E-03 3.0E-06

INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT  
 FOR DATES 0 1 1 1 THRU 0 33124  
 T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME PATHWAY, DIST GP= 1, 943. METERS WINDS TOWARD NE  
 ADULT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 TEEN 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 CHILD 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

GROUND PATHWAY, DIST GP= 1, 943. METERS WINDS TOWARD NE  
 ADULT 1.2E-06 1.2E-06 1.2E-06 1.2E-06 1.2E-06 1.2E-06 1.2E-06 1.4E-06  
 TEEN 1.2E-06 1.2E-06 1.2E-06 1.2E-06 1.2E-06 1.2E-06 1.2E-06 1.4E-06  
 CHILD 1.2E-06 1.2E-06 1.2E-06 1.2E-06 1.2E-06 1.2E-06 1.2E-06 1.4E-06  
 INFNT 1.2E-06 1.2E-06 1.2E-06 1.2E-06 1.2E-06 1.2E-06 1.2E-06 1.4E-06

VEGET PATHWAY, DIST GP= 1, 1052. METERS WINDS TOWARD NE  
 ADULT 2.4E-03 2.4E-03 6.6E-07 2.4E-03 2.4E-03 2.4E-03 2.4E-03 0.0E+00  
 TEEN 2.8E-03 2.8E-03 1.0E-06 2.8E-03 2.8E-03 2.8E-03 2.8E-03 0.0E+00  
 CHILD 4.3E-03 4.3E-03 2.5E-06 4.3E-03 4.3E-03 4.3E-03 4.3E-03 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

MEAT PATHWAY, DIST GP= 1, 7725. METERS WINDS TOWARD NE  
 ADULT 1.8E-05 1.8E-05 2.2E-09 1.8E-05 1.8E-05 1.8E-05 1.8E-05 0.0E+00  
 TEEN 1.1E-05 1.1E-05 1.8E-09 1.1E-05 1.1E-05 1.1E-05 1.1E-05 0.0E+00  
 CHILD 1.3E-05 1.3E-05 3.4E-09 1.3E-05 1.3E-05 1.3E-05 1.3E-05 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

COW PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD NE  
 ADULT 1.1E-04 1.1E-04 6.1E-08 1.1E-04 1.1E-04 1.1E-04 1.1E-04 0.0E+00  
 TEEN 1.4E-04 1.4E-04 1.1E-07 1.4E-04 1.4E-04 1.4E-04 1.4E-04 0.0E+00  
 CHILD 2.2E-04 2.2E-04 2.6E-07 2.2E-04 2.2E-04 2.2E-04 2.2E-04 0.0E+00  
 INFNT 3.4E-04 3.4E-04 4.2E-07 3.4E-04 3.4E-04 3.4E-04 3.4E-04 0.0E+00

GOAT PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD NE  
 ADULT 2.2E-04 2.2E-04 1.8E-07 2.2E-04 2.2E-04 2.2E-04 2.2E-04 0.0E+00  
 TEEN 2.9E-04 2.9E-04 3.3E-07 2.9E-04 2.9E-04 2.9E-04 2.9E-04 0.0E+00  
 CHILD 4.5E-04 4.5E-04 7.9E-07 4.5E-04 4.5E-04 4.5E-04 4.5E-04 0.0E+00  
 INFNT 6.9E-04 6.9E-04 1.3E-06 7.0E-04 6.9E-04 6.9E-04 6.9E-04 0.0E+00

INHAL PATHWAY, DIST GP= 1, 943. METERS WINDS TOWARD NE  
 ADULT 1.6E-03 1.6E-03 6.5E-09 1.6E-03 1.6E-03 1.6E-03 1.6E-03 0.0E+00  
 TEEN 1.6E-03 1.6E-03 9.2E-09 1.6E-03 1.6E-03 1.6E-03 1.6E-03 0.0E+00  
 CHILD 1.4E-03 1.4E-03 1.2E-08 1.4E-03 1.4E-03 1.4E-03 1.4E-03 0.0E+00  
 INFNT 8.2E-04 8.2E-04 7.5E-09 8.2E-04 8.2E-04 8.2E-04 8.2E-04 0.0E+00

SUBTOTALS (NO PLUME)  
 ADULT 4.4E-03 4.4E-03 2.1E-06 4.4E-03 4.4E-03 4.4E-03 4.4E-03 1.4E-06  
 TEEN 4.9E-03 4.9E-03 2.7E-06 4.9E-03 4.9E-03 4.9E-03 4.9E-03 1.4E-06  
 CHILD 6.5E-03 6.5E-03 4.8E-06 6.5E-03 6.5E-03 6.5E-03 6.5E-03 1.4E-06  
 INFNT 1.9E-03 1.9E-03 2.9E-06 1.9E-03 1.9E-03 1.9E-03 1.9E-03 1.4E-06

TOTALS  
 ADULT 4.4E-03 4.4E-03 2.1E-06 4.4E-03 4.4E-03 4.4E-03 4.4E-03 1.4E-06  
 TEEN 4.9E-03 4.9E-03 2.7E-06 4.9E-03 4.9E-03 4.9E-03 4.9E-03 1.4E-06  
 CHILD 6.5E-03 6.5E-03 4.8E-06 6.5E-03 6.5E-03 6.5E-03 6.5E-03 1.4E-06  
 INFNT 1.9E-03 1.9E-03 2.9E-06 1.9E-03 1.9E-03 1.9E-03 1.9E-03 1.4E-06



INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT  
 FOR DATES 0 1 1 1 THRU 0 33124  
 T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME PATHWAY, DIST GP= 1, 1747. METERS WINDS TOWARD ENE  
 ADULT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 TEEN 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 CHILD 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

GROUND PATHWAY, DIST GP= 1, 1747. METERS WINDS TOWARD ENE  
 ADULT 9.6E-07 9.6E-07 9.6E-07 9.6E-07 9.6E-07 9.6E-07 9.6E-07 9.6E-07 1.1E-06  
 TEEN 9.6E-07 9.6E-07 9.6E-07 9.6E-07 9.6E-07 9.6E-07 9.6E-07 9.6E-07 1.1E-06  
 CHILD 9.6E-07 9.6E-07 9.6E-07 9.6E-07 9.6E-07 9.6E-07 9.6E-07 9.6E-07 1.1E-06  
 INFNT 9.6E-07 9.6E-07 9.6E-07 9.6E-07 9.6E-07 9.6E-07 9.6E-07 9.6E-07 1.1E-06

VEGET PATHWAY, DIST GP= 1, 1852. METERS WINDS TOWARD ENE  
 ADULT 6.1E-04 6.1E-04 5.6E-07 6.1E-04 6.1E-04 6.1E-04 6.1E-04 6.1E-04 0.0E+00  
 TEEN 7.0E-04 7.0E-04 8.9E-07 7.0E-04 7.0E-04 7.0E-04 7.0E-04 7.0E-04 0.0E+00  
 CHILD 1.1E-03 1.1E-03 2.1E-06 1.1E-03 1.1E-03 1.1E-03 1.1E-03 1.1E-03 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

MEAT PATHWAY, DIST GP= 1, 3862. METERS WINDS TOWARD ENE  
 ADULT 2.9E-05 2.9E-05 1.7E-08 2.9E-05 2.9E-05 2.9E-05 2.9E-05 2.9E-05 0.0E+00  
 TEEN 1.7E-05 1.7E-05 1.4E-08 1.7E-05 1.7E-05 1.7E-05 1.7E-05 1.7E-05 0.0E+00  
 CHILD 2.1E-05 2.1E-05 2.6E-08 2.1E-05 2.1E-05 2.1E-05 2.1E-05 2.1E-05 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

COW PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD ENE  
 ADULT 6.1E-05 6.1E-05 1.3E-07 6.1E-05 6.1E-05 6.1E-05 6.1E-05 6.1E-05 0.0E+00  
 TEEN 8.0E-05 8.0E-05 2.4E-07 8.0E-05 8.0E-05 8.0E-05 8.0E-05 8.0E-05 0.0E+00  
 CHILD 1.3E-04 1.3E-04 5.8E-07 1.3E-04 1.3E-04 1.3E-04 1.3E-04 1.3E-04 0.0E+00  
 INFNT 1.9E-04 1.9E-04 9.2E-07 1.9E-04 1.9E-04 1.9E-04 1.9E-04 1.9E-04 0.0E+00

GOAT PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD ENE  
 ADULT 1.3E-04 1.2E-04 4.0E-07 1.3E-04 1.3E-04 1.2E-04 1.2E-04 1.2E-04 0.0E+00  
 TEEN 1.6E-04 1.6E-04 7.2E-07 1.6E-04 1.6E-04 1.6E-04 1.6E-04 1.6E-04 0.0E+00  
 CHILD 2.6E-04 2.6E-04 1.7E-06 2.6E-04 2.6E-04 2.6E-04 2.6E-04 2.6E-04 0.0E+00  
 INFNT 3.9E-04 3.9E-04 2.8E-06 3.9E-04 3.9E-04 3.9E-04 3.9E-04 3.9E-04 0.0E+00

INHAL PATHWAY, DIST GP= 1, 1747. METERS WINDS TOWARD ENE  
 ADULT 3.7E-04 3.7E-04 1.8E-09 3.7E-04 3.7E-04 3.7E-04 3.7E-04 3.7E-04 0.0E+00  
 TEEN 3.7E-04 3.7E-04 2.6E-09 3.7E-04 3.7E-04 3.7E-04 3.7E-04 3.7E-04 0.0E+00  
 CHILD 3.3E-04 3.3E-04 3.5E-09 3.3E-04 3.3E-04 3.3E-04 3.3E-04 3.3E-04 0.0E+00  
 INFNT 1.9E-04 1.9E-04 2.1E-09 1.9E-04 1.9E-04 1.9E-04 1.9E-04 1.9E-04 0.0E+00

SUBTOTALS (NO PLUME)  
 ADULT 1.2E-03 1.2E-03 2.1E-06 1.2E-03 1.2E-03 1.2E-03 1.2E-03 1.2E-03 1.1E-06  
 TEEN 1.3E-03 1.3E-03 2.8E-06 1.3E-03 1.3E-03 1.3E-03 1.3E-03 1.3E-03 1.1E-06  
 CHILD 1.8E-03 1.8E-03 5.4E-06 1.8E-03 1.8E-03 1.8E-03 1.8E-03 1.8E-03 1.1E-06  
 INFNT 7.7E-04 7.7E-04 4.7E-06 7.8E-04 7.7E-04 7.7E-04 7.7E-04 7.7E-04 1.1E-06

TOTALS  
 ADULT 1.2E-03 1.2E-03 2.1E-06 1.2E-03 1.2E-03 1.2E-03 1.2E-03 1.2E-03 1.1E-06  
 TEEN 1.3E-03 1.3E-03 2.8E-06 1.3E-03 1.3E-03 1.3E-03 1.3E-03 1.3E-03 1.1E-06  
 CHILD 1.8E-03 1.8E-03 5.4E-06 1.8E-03 1.8E-03 1.8E-03 1.8E-03 1.8E-03 1.1E-06  
 INFNT 7.7E-04 7.7E-04 4.7E-06 7.8E-04 7.7E-04 7.7E-04 7.7E-04 7.7E-04 1.1E-06

INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT  
 FOR DATES 0 1 1 1 THRU 0 33124  
 T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME PATHWAY, DIST GP= 1, 1716. METERS WINDS TOWARD E  
 ADULT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 TEEN 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 CHILD 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

GROUND PATHWAY, DIST GP= 1, 1716. METERS WINDS TOWARD E  
 ADULT 4.6E-07 4.6E-07 4.6E-07 4.6E-07 4.6E-07 4.6E-07 4.6E-07 5.4E-07  
 TEEN 4.6E-07 4.6E-07 4.6E-07 4.6E-07 4.6E-07 4.6E-07 4.6E-07 5.4E-07  
 CHILD 4.6E-07 4.6E-07 4.6E-07 4.6E-07 4.6E-07 4.6E-07 4.6E-07 5.4E-07  
 INFNT 4.6E-07 4.6E-07 4.6E-07 4.6E-07 4.6E-07 4.6E-07 4.6E-07 5.4E-07

VEGET PATHWAY, DIST GP= 1, 1705. METERS WINDS TOWARD E  
 ADULT 6.4E-04 6.4E-04 3.0E-07 6.4E-04 6.4E-04 6.4E-04 6.4E-04 0.0E+00  
 TEEN 7.3E-04 7.3E-04 4.8E-07 7.3E-04 7.3E-04 7.3E-04 7.3E-04 0.0E+00  
 CHILD 1.1E-03 1.1E-03 1.1E-06 1.1E-03 1.1E-03 1.1E-03 1.1E-03 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

MEAT PATHWAY, DIST GP= 1, 6810. METERS WINDS TOWARD E  
 ADULT 1.1E-05 1.1E-05 2.8E-09 1.1E-05 1.1E-05 1.1E-05 1.1E-05 0.0E+00  
 TEEN 6.4E-06 6.4E-06 2.4E-09 6.4E-06 6.4E-06 6.4E-06 6.4E-06 0.0E+00  
 CHILD 7.7E-06 7.7E-06 4.3E-09 7.7E-06 7.7E-06 7.7E-06 7.7E-06 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

COW PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD E  
 ADULT 5.6E-05 5.6E-05 6.2E-08 5.6E-05 5.6E-05 5.6E-05 5.6E-05 0.0E+00  
 TEEN 7.2E-05 7.2E-05 1.1E-07 7.3E-05 7.2E-05 7.2E-05 7.2E-05 0.0E+00  
 CHILD 1.1E-04 1.1E-04 2.7E-07 1.1E-04 1.1E-04 1.1E-04 1.1E-04 0.0E+00  
 INFNT 1.7E-04 1.7E-04 4.3E-07 1.7E-04 1.7E-04 1.7E-04 1.7E-04 0.0E+00

GOAT PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD E  
 ADULT 1.1E-04 1.1E-04 1.9E-07 1.1E-04 1.1E-04 1.1E-04 1.1E-04 0.0E+00  
 TEEN 1.5E-04 1.5E-04 3.4E-07 1.5E-04 1.5E-04 1.5E-04 1.5E-04 0.0E+00  
 CHILD 2.3E-04 2.3E-04 8.2E-07 2.3E-04 2.3E-04 2.3E-04 2.3E-04 0.0E+00  
 INFNT 3.6E-04 3.6E-04 1.3E-06 3.6E-04 3.6E-04 3.6E-04 3.6E-04 0.0E+00

INHAL PATHWAY, DIST GP= 1, 1716. METERS WINDS TOWARD E  
 ADULT 3.5E-04 3.5E-04 1.7E-09 3.5E-04 3.5E-04 3.5E-04 3.5E-04 0.0E+00  
 TEEN 3.5E-04 3.5E-04 2.4E-09 3.5E-04 3.5E-04 3.5E-04 3.5E-04 0.0E+00  
 CHILD 3.1E-04 3.1E-04 3.3E-09 3.1E-04 3.1E-04 3.1E-04 3.1E-04 0.0E+00  
 INFNT 1.8E-04 1.8E-04 2.0E-09 1.8E-04 1.8E-04 1.8E-04 1.8E-04 0.0E+00

SUBTOTALS (NO PLUME)  
 ADULT 1.2E-03 1.2E-03 1.0E-06 1.2E-03 1.2E-03 1.2E-03 1.2E-03 5.4E-07  
 TEEN 1.3E-03 1.3E-03 1.4E-06 1.3E-03 1.3E-03 1.3E-03 1.3E-03 5.4E-07  
 CHILD 1.8E-03 1.8E-03 2.7E-06 1.8E-03 1.8E-03 1.8E-03 1.8E-03 5.4E-07  
 INFNT 7.1E-04 7.1E-04 2.2E-06 7.1E-04 7.1E-04 7.1E-04 7.1E-04 5.4E-07

TOTALS  
 ADULT 1.2E-03 1.2E-03 1.0E-06 1.2E-03 1.2E-03 1.2E-03 1.2E-03 5.4E-07  
 TEEN 1.3E-03 1.3E-03 1.4E-06 1.3E-03 1.3E-03 1.3E-03 1.3E-03 5.4E-07  
 CHILD 1.8E-03 1.8E-03 2.7E-06 1.8E-03 1.8E-03 1.8E-03 1.8E-03 5.4E-07  
 INFNT 7.1E-04 7.1E-04 2.2E-06 7.1E-04 7.1E-04 7.1E-04 7.1E-04 5.4E-07

INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT  
 FOR DATES 0 1 1 1 THRU 0 33124  
 T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME PATHWAY, DIST GP= 1, 1643. METERS WINDS TOWARD ESE  
 ADULT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 TEEN 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 CHILD 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

GROUND PATHWAY, DIST GP= 1, 1643. METERS WINDS TOWARD ESE  
 ADULT 3.6E-07 3.6E-07 3.6E-07 3.6E-07 3.6E-07 3.6E-07 3.6E-07 3.6E-07 4.2E-07  
 TEEN 3.6E-07 3.6E-07 3.6E-07 3.6E-07 3.6E-07 3.6E-07 3.6E-07 3.6E-07 4.2E-07  
 CHILD 3.6E-07 3.6E-07 3.6E-07 3.6E-07 3.6E-07 3.6E-07 3.6E-07 3.6E-07 4.2E-07  
 INFNT 3.6E-07 3.6E-07 3.6E-07 3.6E-07 3.6E-07 3.6E-07 3.6E-07 3.6E-07 4.2E-07

VEGET PATHWAY, DIST GP= 1, 1628. METERS WINDS TOWARD ESE  
 ADULT 6.5E-04 6.5E-04 2.4E-07 6.5E-04 6.5E-04 6.5E-04 6.5E-04 6.5E-04 0.0E+00  
 TEEN 7.4E-04 7.4E-04 3.7E-07 7.4E-04 7.4E-04 7.4E-04 7.4E-04 7.4E-04 0.0E+00  
 CHILD 1.1E-03 1.1E-03 8.8E-07 1.1E-03 1.1E-03 1.1E-03 1.1E-03 1.1E-03 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

MEAT PATHWAY, DIST GP= 1, 2434. METERS WINDS TOWARD ESE  
 ADULT 5.0E-05 5.0E-05 1.2E-08 5.0E-05 5.0E-05 5.0E-05 5.0E-05 5.0E-05 0.0E+00  
 TEEN 3.0E-05 3.0E-05 9.9E-09 3.0E-05 3.0E-05 3.0E-05 3.0E-05 3.0E-05 0.0E+00  
 CHILD 3.6E-05 3.6E-05 1.8E-08 3.6E-05 3.6E-05 3.6E-05 3.6E-05 3.6E-05 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

COW PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD ESE  
 ADULT 5.3E-05 5.3E-05 4.5E-08 5.3E-05 5.3E-05 5.3E-05 5.3E-05 5.3E-05 0.0E+00  
 TEEN 6.9E-05 6.9E-05 8.1E-08 6.9E-05 6.9E-05 6.9E-05 6.9E-05 6.9E-05 0.0E+00  
 CHILD 1.1E-04 1.1E-04 2.0E-07 1.1E-04 1.1E-04 1.1E-04 1.1E-04 1.1E-04 0.0E+00  
 INFNT 1.6E-04 1.6E-04 3.1E-07 1.6E-04 1.6E-04 1.6E-04 1.6E-04 1.6E-04 0.0E+00

GOAT PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD ESE  
 ADULT 1.1E-04 1.1E-04 1.3E-07 1.1E-04 1.1E-04 1.1E-04 1.1E-04 1.1E-04 0.0E+00  
 TEEN 1.4E-04 1.4E-04 2.4E-07 1.4E-04 1.4E-04 1.4E-04 1.4E-04 1.4E-04 0.0E+00  
 CHILD 2.2E-04 2.2E-04 5.9E-07 2.2E-04 2.2E-04 2.2E-04 2.2E-04 2.2E-04 0.0E+00  
 INFNT 3.4E-04 3.4E-04 9.4E-07 3.4E-04 3.4E-04 3.4E-04 3.4E-04 3.4E-04 0.0E+00

INHAL PATHWAY, DIST GP= 1, 1643. METERS WINDS TOWARD ESE  
 ADULT 3.5E-04 3.5E-04 1.9E-09 3.5E-04 3.5E-04 3.5E-04 3.5E-04 3.5E-04 0.0E+00  
 TEEN 3.5E-04 3.5E-04 2.7E-09 3.5E-04 3.5E-04 3.5E-04 3.5E-04 3.5E-04 0.0E+00  
 CHILD 3.1E-04 3.1E-04 3.7E-09 3.1E-04 3.1E-04 3.1E-04 3.1E-04 3.1E-04 0.0E+00  
 INFNT 1.8E-04 1.8E-04 2.2E-09 1.8E-04 1.8E-04 1.8E-04 1.8E-04 1.8E-04 0.0E+00

SUBTOTALS (NO PLUME)  
 ADULT 1.2E-03 1.2E-03 7.9E-07 1.2E-03 1.2E-03 1.2E-03 1.2E-03 1.2E-03 4.2E-07  
 TEEN 1.3E-03 1.3E-03 1.1E-06 1.3E-03 1.3E-03 1.3E-03 1.3E-03 1.3E-03 4.2E-07  
 CHILD 1.8E-03 1.8E-03 2.0E-06 1.8E-03 1.8E-03 1.8E-03 1.8E-03 1.8E-03 4.2E-07  
 INFNT 6.8E-04 6.8E-04 1.6E-06 6.8E-04 6.8E-04 6.8E-04 6.8E-04 6.8E-04 4.2E-07

TOTALS  
 ADULT 1.2E-03 1.2E-03 7.9E-07 1.2E-03 1.2E-03 1.2E-03 1.2E-03 1.2E-03 4.2E-07  
 TEEN 1.3E-03 1.3E-03 1.1E-06 1.3E-03 1.3E-03 1.3E-03 1.3E-03 1.3E-03 4.2E-07  
 CHILD 1.8E-03 1.8E-03 2.0E-06 1.8E-03 1.8E-03 1.8E-03 1.8E-03 1.8E-03 4.2E-07  
 INFNT 6.8E-04 6.8E-04 1.6E-06 6.8E-04 6.8E-04 6.8E-04 6.8E-04 6.8E-04 4.2E-07

INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT

FOR DATES 0 1 1 1 THRU 0 33124

T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME PATHWAY, DIST GP= 1, 1136. METERS WINDS TOWARD SE  
 ADULT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 TEEN 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 CHILD 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

GROUND PATHWAY, DIST GP= 1, 1136. METERS WINDS TOWARD SE  
 ADULT 8.7E-07 8.7E-07 8.7E-07 8.7E-07 8.7E-07 8.7E-07 8.7E-07 1.0E-06  
 TEEN 8.7E-07 8.7E-07 8.7E-07 8.7E-07 8.7E-07 8.7E-07 8.7E-07 1.0E-06  
 CHILD 8.7E-07 8.7E-07 8.7E-07 8.7E-07 8.7E-07 8.7E-07 8.7E-07 1.0E-06  
 INFNT 8.7E-07 8.7E-07 8.7E-07 8.7E-07 8.7E-07 8.7E-07 8.7E-07 1.0E-06

VEGET PATHWAY, DIST GP= 1, 914. METERS WINDS TOWARD SE  
 ADULT 2.0E-03 2.0E-03 8.0E-07 2.0E-03 2.0E-03 2.0E-03 2.0E-03 0.0E+00  
 TEEN 2.2E-03 2.2E-03 1.3E-06 2.2E-03 2.2E-03 2.2E-03 2.2E-03 0.0E+00  
 CHILD 3.5E-03 3.5E-03 3.0E-06 3.5E-03 3.5E-03 3.5E-03 3.5E-03 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

MEAT PATHWAY, DIST GP= 1, 4354. METERS WINDS TOWARD SE  
 ADULT 2.4E-05 2.4E-05 6.1E-09 2.4E-05 2.4E-05 2.4E-05 2.4E-05 0.0E+00  
 TEEN 1.4E-05 1.4E-05 5.1E-09 1.4E-05 1.4E-05 1.4E-05 1.4E-05 0.0E+00  
 CHILD 1.7E-05 1.7E-05 9.4E-09 1.7E-05 1.7E-05 1.7E-05 1.7E-05 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

COW PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD SE  
 ADULT 6.3E-05 6.3E-05 5.9E-08 6.3E-05 6.3E-05 6.3E-05 6.3E-05 0.0E+00  
 TEEN 8.2E-05 8.2E-05 1.1E-07 8.2E-05 8.2E-05 8.2E-05 8.2E-05 0.0E+00  
 CHILD 1.3E-04 1.3E-04 2.6E-07 1.3E-04 1.3E-04 1.3E-04 1.3E-04 0.0E+00  
 INFNT 2.0E-04 2.0E-04 4.1E-07 2.0E-04 2.0E-04 2.0E-04 2.0E-04 0.0E+00

GOAT PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD SE  
 ADULT 1.3E-04 1.3E-04 1.8E-07 1.3E-04 1.3E-04 1.3E-04 1.3E-04 0.0E+00  
 TEEN 1.7E-04 1.7E-04 3.2E-07 1.7E-04 1.7E-04 1.7E-04 1.7E-04 0.0E+00  
 CHILD 2.6E-04 2.6E-04 7.7E-07 2.6E-04 2.6E-04 2.6E-04 2.6E-04 0.0E+00  
 INFNT 4.0E-04 4.0E-04 1.2E-06 4.0E-04 4.0E-04 4.0E-04 4.0E-04 0.0E+00

INHAL PATHWAY, DIST GP= 1, 1136. METERS WINDS TOWARD SE  
 ADULT 7.7E-04 7.7E-04 6.8E-09 7.7E-04 7.7E-04 7.7E-04 7.7E-04 0.0E+00  
 TEEN 7.8E-04 7.8E-04 9.5E-09 7.8E-04 7.8E-04 7.8E-04 7.8E-04 0.0E+00  
 CHILD 6.9E-04 6.9E-04 1.3E-08 6.9E-04 6.9E-04 6.9E-04 6.9E-04 0.0E+00  
 INFNT 3.9E-04 3.9E-04 7.7E-09 3.9E-04 3.9E-04 3.9E-04 3.9E-04 0.0E+00

SUBTOTALS (NO PLUME)  
 ADULT 3.0E-03 3.0E-03 1.9E-06 3.0E-03 3.0E-03 3.0E-03 3.0E-03 1.0E-06  
 TEEN 3.3E-03 3.3E-03 2.6E-06 3.3E-03 3.3E-03 3.3E-03 3.3E-03 1.0E-06  
 CHILD 4.6E-03 4.6E-03 4.9E-06 4.6E-03 4.6E-03 4.6E-03 4.6E-03 1.0E-06  
 INFNT 9.9E-04 9.9E-04 2.5E-06 9.9E-04 9.9E-04 9.9E-04 9.9E-04 1.0E-06

TOTALS  
 ADULT 3.0E-03 3.0E-03 1.9E-06 3.0E-03 3.0E-03 3.0E-03 3.0E-03 1.0E-06  
 TEEN 3.3E-03 3.3E-03 2.6E-06 3.3E-03 3.3E-03 3.3E-03 3.3E-03 1.0E-06  
 CHILD 4.6E-03 4.6E-03 4.9E-06 4.6E-03 4.6E-03 4.6E-03 4.6E-03 1.0E-06  
 INFNT 9.9E-04 9.9E-04 2.5E-06 9.9E-04 9.9E-04 9.9E-04 9.9E-04 1.0E-06

INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT  
 FOR DATES 0 1 1 1 THRU 0 33124  
 T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME PATHWAY, DIST GP= 1, 1507. METERS WINDS TOWARD SSE  
 ADULT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 TEEN 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 CHILD 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

GROUND PATHWAY, DIST GP= 1, 1507. METERS WINDS TOWARD SSE  
 ADULT 8.8E-07 8.8E-07 8.8E-07 8.8E-07 8.8E-07 8.8E-07 8.8E-07 8.8E-07 1.0E-06  
 TEEN 8.8E-07 8.8E-07 8.8E-07 8.8E-07 8.8E-07 8.8E-07 8.8E-07 8.8E-07 1.0E-06  
 CHILD 8.8E-07 8.8E-07 8.8E-07 8.8E-07 8.8E-07 8.8E-07 8.8E-07 8.8E-07 1.0E-06  
 INFNT 8.8E-07 8.8E-07 8.8E-07 8.8E-07 8.8E-07 8.8E-07 8.8E-07 8.8E-07 1.0E-06

VEGET PATHWAY, DIST GP= 1, 1093. METERS WINDS TOWARD SSE  
 ADULT 2.2E-03 2.2E-03 9.8E-07 2.2E-03 2.2E-03 2.2E-03 2.2E-03 2.2E-03 0.0E+00  
 TEEN 2.5E-03 2.5E-03 1.5E-06 2.5E-03 2.5E-03 2.5E-03 2.5E-03 2.5E-03 0.0E+00  
 CHILD 3.9E-03 3.9E-03 3.7E-06 3.9E-03 3.9E-03 3.9E-03 3.9E-03 3.9E-03 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

MEAT PATHWAY, DIST GP= 1, 1093. METERS WINDS TOWARD SSE  
 ADULT 3.2E-04 3.2E-04 9.7E-08 3.2E-04 3.2E-04 3.2E-04 3.2E-04 3.2E-04 0.0E+00  
 TEEN 1.9E-04 1.9E-04 8.0E-08 1.9E-04 1.9E-04 1.9E-04 1.9E-04 1.9E-04 0.0E+00  
 CHILD 2.3E-04 2.3E-04 1.5E-07 2.3E-04 2.3E-04 2.3E-04 2.3E-04 2.3E-04 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

COW PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD SSE  
 ADULT 9.3E-05 9.3E-05 9.6E-08 9.3E-05 9.3E-05 9.3E-05 9.3E-05 9.3E-05 0.0E+00  
 TEEN 1.2E-04 1.2E-04 1.7E-07 1.2E-04 1.2E-04 1.2E-04 1.2E-04 1.2E-04 0.0E+00  
 CHILD 1.9E-04 1.9E-04 4.2E-07 1.9E-04 1.9E-04 1.9E-04 1.9E-04 1.9E-04 0.0E+00  
 INFNT 2.9E-04 2.9E-04 6.6E-07 2.9E-04 2.9E-04 2.9E-04 2.9E-04 2.9E-04 0.0E+00

GOAT PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD SSE  
 ADULT 1.9E-04 1.9E-04 2.9E-07 1.9E-04 1.9E-04 1.9E-04 1.9E-04 1.9E-04 0.0E+00  
 TEEN 2.5E-04 2.5E-04 5.2E-07 2.5E-04 2.5E-04 2.5E-04 2.5E-04 2.5E-04 0.0E+00  
 CHILD 3.9E-04 3.9E-04 1.3E-06 3.9E-04 3.9E-04 3.9E-04 3.9E-04 3.9E-04 0.0E+00  
 INFNT 5.9E-04 5.9E-04 2.0E-06 6.0E-04 5.9E-04 5.9E-04 5.9E-04 5.9E-04 0.0E+00

INHAL PATHWAY, DIST GP= 1, 1507. METERS WINDS TOWARD SSE  
 ADULT 7.2E-04 7.2E-04 3.9E-09 7.2E-04 7.2E-04 7.2E-04 7.2E-04 7.2E-04 0.0E+00  
 TEEN 7.3E-04 7.3E-04 5.5E-09 7.3E-04 7.3E-04 7.3E-04 7.3E-04 7.3E-04 0.0E+00  
 CHILD 6.4E-04 6.4E-04 7.4E-09 6.4E-04 6.4E-04 6.4E-04 6.4E-04 6.4E-04 0.0E+00  
 INFNT 3.7E-04 3.7E-04 4.5E-09 3.7E-04 3.7E-04 3.7E-04 3.7E-04 3.7E-04 0.0E+00

SUBTOTALS (NO PLUME)  
 ADULT 3.5E-03 3.5E-03 2.3E-06 3.5E-03 3.5E-03 3.5E-03 3.5E-03 3.5E-03 1.0E-06  
 TEEN 3.8E-03 3.8E-03 3.2E-06 3.8E-03 3.8E-03 3.8E-03 3.8E-03 3.8E-03 1.0E-06  
 CHILD 5.3E-03 5.3E-03 6.4E-06 5.3E-03 5.3E-03 5.3E-03 5.3E-03 5.3E-03 1.0E-06  
 INFNT 1.3E-03 1.3E-03 3.6E-06 1.3E-03 1.3E-03 1.3E-03 1.3E-03 1.3E-03 1.0E-06

TOTALS  
 ADULT 3.5E-03 3.5E-03 2.3E-06 3.5E-03 3.5E-03 3.5E-03 3.5E-03 3.5E-03 1.0E-06  
 TEEN 3.8E-03 3.8E-03 3.2E-06 3.8E-03 3.8E-03 3.8E-03 3.8E-03 3.8E-03 1.0E-06  
 CHILD 5.3E-03 5.3E-03 6.4E-06 5.3E-03 5.3E-03 5.3E-03 5.3E-03 5.3E-03 1.0E-06  
 INFNT 1.3E-03 1.3E-03 3.6E-06 1.3E-03 1.3E-03 1.3E-03 1.3E-03 1.3E-03 1.0E-06

INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT  
 FOR DATES 0 1 1 1 THRU 0 33124  
 T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME PATHWAY, DIST GP= 1, 1026. METERS WINDS TOWARD S  
 ADULT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 TEEN 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 CHILD 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

GROUND PATHWAY, DIST GP= 1, 1026. METERS WINDS TOWARD S  
 ADULT 1.5E-06 1.5E-06 1.5E-06 1.5E-06 1.5E-06 1.5E-06 1.5E-06 1.8E-06  
 TEEN 1.5E-06 1.5E-06 1.5E-06 1.5E-06 1.5E-06 1.5E-06 1.5E-06 1.8E-06  
 CHILD 1.5E-06 1.5E-06 1.5E-06 1.5E-06 1.5E-06 1.5E-06 1.5E-06 1.8E-06  
 INFNT 1.5E-06 1.5E-06 1.5E-06 1.5E-06 1.5E-06 1.5E-06 1.5E-06 1.8E-06

VEGET PATHWAY, DIST GP= 1, 863. METERS WINDS TOWARD S  
 ADULT 2.3E-03 2.3E-03 1.3E-06 2.3E-03 2.3E-03 2.3E-03 2.3E-03 0.0E+00  
 TEEN 2.7E-03 2.7E-03 2.1E-06 2.7E-03 2.7E-03 2.7E-03 2.7E-03 0.0E+00  
 CHILD 4.1E-03 4.1E-03 4.9E-06 4.1E-03 4.1E-03 4.1E-03 4.1E-03 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

MEAT PATHWAY, DIST GP= 1, 6115. METERS WINDS TOWARD S  
 ADULT 1.5E-05 1.5E-05 4.7E-09 1.5E-05 1.5E-05 1.5E-05 1.5E-05 0.0E+00  
 TEEN 8.8E-06 8.8E-06 3.9E-09 8.8E-06 8.8E-06 8.8E-06 8.8E-06 0.0E+00  
 CHILD 1.1E-05 1.1E-05 7.2E-09 1.1E-05 1.1E-05 1.1E-05 1.1E-05 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

COW PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD S  
 ADULT 6.6E-05 6.6E-05 8.6E-08 6.6E-05 6.6E-05 6.6E-05 6.6E-05 0.0E+00  
 TEEN 8.6E-05 8.6E-05 1.6E-07 8.6E-05 8.6E-05 8.6E-05 8.6E-05 0.0E+00  
 CHILD 1.4E-04 1.4E-04 3.7E-07 1.4E-04 1.4E-04 1.4E-04 1.4E-04 0.0E+00  
 INFNT 2.1E-04 2.1E-04 6.0E-07 2.1E-04 2.1E-04 2.1E-04 2.1E-04 0.0E+00

GOAT PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD S  
 ADULT 1.3E-04 1.3E-04 2.6E-07 1.3E-04 1.3E-04 1.3E-04 1.3E-04 0.0E+00  
 TEEN 1.8E-04 1.8E-04 4.7E-07 1.8E-04 1.8E-04 1.8E-04 1.8E-04 0.0E+00  
 CHILD 2.8E-04 2.8E-04 1.1E-06 2.8E-04 2.8E-04 2.8E-04 2.8E-04 0.0E+00  
 INFNT 4.2E-04 4.2E-04 1.8E-06 4.2E-04 4.2E-04 4.2E-04 4.2E-04 0.0E+00

INHAL PATHWAY, DIST GP= 1, 1026. METERS WINDS TOWARD S  
 ADULT 9.8E-04 9.8E-04 4.3E-09 9.8E-04 9.8E-04 9.8E-04 9.8E-04 0.0E+00  
 TEEN 9.8E-04 9.8E-04 6.1E-09 9.8E-04 9.8E-04 9.8E-04 9.8E-04 0.0E+00  
 CHILD 8.7E-04 8.7E-04 8.2E-09 8.7E-04 8.7E-04 8.7E-04 8.7E-04 0.0E+00  
 INFNT 5.0E-04 5.0E-04 5.0E-09 5.0E-04 5.0E-04 5.0E-04 5.0E-04 0.0E+00

SUBTOTALS (NO PLUME)  
 ADULT 3.5E-03 3.5E-03 3.2E-06 3.5E-03 3.5E-03 3.5E-03 3.5E-03 1.8E-06  
 TEEN 3.9E-03 3.9E-03 4.2E-06 3.9E-03 3.9E-03 3.9E-03 3.9E-03 1.8E-06  
 CHILD 5.4E-03 5.4E-03 7.9E-06 5.4E-03 5.4E-03 5.4E-03 5.4E-03 1.8E-06  
 INFNT 1.1E-03 1.1E-03 3.9E-06 1.1E-03 1.1E-03 1.1E-03 1.1E-03 1.8E-06

TOTALS  
 ADULT 3.5E-03 3.5E-03 3.2E-06 3.5E-03 3.5E-03 3.5E-03 3.5E-03 1.8E-06  
 TEEN 3.9E-03 3.9E-03 4.2E-06 3.9E-03 3.9E-03 3.9E-03 3.9E-03 1.8E-06  
 CHILD 5.4E-03 5.4E-03 7.9E-06 5.4E-03 5.4E-03 5.4E-03 5.4E-03 1.8E-06  
 INFNT 1.1E-03 1.1E-03 3.9E-06 1.1E-03 1.1E-03 1.1E-03 1.1E-03 1.8E-06

INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT  
 FOR DATES 0 1 1 1 THRU 0 33124  
 T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME PATHWAY, DIST GP= 1, 942. METERS WINDS TOWARD SSW  
 ADULT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 TEEN 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 CHILD 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

GROUND PATHWAY, DIST GP= 1, 942. METERS WINDS TOWARD SSW  
 ADULT 9.1E-07 9.1E-07 9.1E-07 9.1E-07 9.1E-07 9.1E-07 9.1E-07 9.1E-07 1.1E-06  
 TEEN 9.1E-07 9.1E-07 9.1E-07 9.1E-07 9.1E-07 9.1E-07 9.1E-07 9.1E-07 1.1E-06  
 CHILD 9.1E-07 9.1E-07 9.1E-07 9.1E-07 9.1E-07 9.1E-07 9.1E-07 9.1E-07 1.1E-06  
 INFNT 9.1E-07 9.1E-07 9.1E-07 9.1E-07 9.1E-07 9.1E-07 9.1E-07 9.1E-07 1.1E-06

VEGET PATHWAY, DIST GP= 1, 770. METERS WINDS TOWARD SSW  
 ADULT 2.6E-03 2.6E-03 8.2E-07 2.6E-03 2.6E-03 2.6E-03 2.6E-03 2.6E-03 0.0E+00  
 TEEN 3.0E-03 3.0E-03 1.3E-06 3.0E-03 3.0E-03 3.0E-03 3.0E-03 3.0E-03 0.0E+00  
 CHILD 4.7E-03 4.7E-03 3.1E-06 4.7E-03 4.7E-03 4.7E-03 4.7E-03 4.7E-03 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

MEAT PATHWAY, DIST GP= 1, 8045. METERS WINDS TOWARD SSW  
 ADULT 1.0E-05 1.0E-05 1.5E-09 1.0E-05 1.0E-05 1.0E-05 1.0E-05 1.0E-05 0.0E+00  
 TEEN 6.2E-06 6.2E-06 1.3E-09 6.2E-06 6.2E-06 6.2E-06 6.2E-06 6.2E-06 0.0E+00  
 CHILD 7.5E-06 7.5E-06 2.3E-09 7.5E-06 7.5E-06 7.5E-06 7.5E-06 7.5E-06 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

COW PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD SSW  
 ADULT 6.9E-05 6.9E-05 4.5E-08 6.9E-05 6.9E-05 6.9E-05 6.9E-05 6.9E-05 0.0E+00  
 TEEN 9.0E-05 9.0E-05 8.1E-08 9.0E-05 9.0E-05 9.0E-05 9.0E-05 9.0E-05 0.0E+00  
 CHILD 1.4E-04 1.4E-04 2.0E-07 1.4E-04 1.4E-04 1.4E-04 1.4E-04 1.4E-04 0.0E+00  
 INFNT 2.2E-04 2.2E-04 3.1E-07 2.2E-04 2.2E-04 2.2E-04 2.2E-04 2.2E-04 0.0E+00

GOAT PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD SSW  
 ADULT 1.4E-04 1.4E-04 1.3E-07 1.4E-04 1.4E-04 1.4E-04 1.4E-04 1.4E-04 0.0E+00  
 TEEN 1.8E-04 1.8E-04 2.4E-07 1.8E-04 1.8E-04 1.8E-04 1.8E-04 1.8E-04 0.0E+00  
 CHILD 2.9E-04 2.9E-04 5.9E-07 2.9E-04 2.9E-04 2.9E-04 2.9E-04 2.9E-04 0.0E+00  
 INFNT 4.4E-04 4.4E-04 9.4E-07 4.4E-04 4.4E-04 4.4E-04 4.4E-04 4.4E-04 0.0E+00

INHAL PATHWAY, DIST GP= 1, 942. METERS WINDS TOWARD SSW  
 ADULT 1.1E-03 1.1E-03 6.2E-09 1.1E-03 1.1E-03 1.1E-03 1.1E-03 1.1E-03 0.0E+00  
 TEEN 1.1E-03 1.1E-03 8.7E-09 1.1E-03 1.1E-03 1.1E-03 1.1E-03 1.1E-03 0.0E+00  
 CHILD 9.6E-04 9.6E-04 1.2E-08 9.6E-04 9.6E-04 9.6E-04 9.6E-04 9.6E-04 0.0E+00  
 INFNT 5.5E-04 5.5E-04 7.1E-09 5.5E-04 5.5E-04 5.5E-04 5.5E-04 5.5E-04 0.0E+00

SUBTOTALS (NO PLUME)  
 ADULT 3.9E-03 3.9E-03 1.9E-06 3.9E-03 3.9E-03 3.9E-03 3.9E-03 3.9E-03 1.1E-06  
 TEEN 4.4E-03 4.4E-03 2.5E-06 4.4E-03 4.4E-03 4.4E-03 4.4E-03 4.4E-03 1.1E-06  
 CHILD 6.1E-03 6.1E-03 4.8E-06 6.1E-03 6.1E-03 6.1E-03 6.1E-03 6.1E-03 1.1E-06  
 INFNT 1.2E-03 1.2E-03 2.2E-06 1.2E-03 1.2E-03 1.2E-03 1.2E-03 1.2E-03 1.1E-06

TOTALS  
 ADULT 3.9E-03 3.9E-03 1.9E-06 3.9E-03 3.9E-03 3.9E-03 3.9E-03 3.9E-03 1.1E-06  
 TEEN 4.4E-03 4.4E-03 2.5E-06 4.4E-03 4.4E-03 4.4E-03 4.4E-03 4.4E-03 1.1E-06  
 CHILD 6.1E-03 6.1E-03 4.8E-06 6.1E-03 6.1E-03 6.1E-03 6.1E-03 6.1E-03 1.1E-06  
 INFNT 1.2E-03 1.2E-03 2.2E-06 1.2E-03 1.2E-03 1.2E-03 1.2E-03 1.2E-03 1.1E-06

## Summary of Maximum Individual Doses

2<sup>nd</sup> Quarter

Effluent	Applicable Organ	Estimated Dose (mrem)	AGE GROUP	LOCATION DIST DIR (M) (Toward)	% OF APPLICABLE LIMIT	LIMIT (mrem) QTR
Liquid	Total Body	3.58E-03	Child	Receptor 1	2.39E-01	1.5
Liquid	GI-Tract	3.92E-03	Adult	Receptor 1	7.84E-02	5.0
Noble Gas	Air Dose (Gamma-mrad)	8.65E-06		651 (N)	1.73E-04	5.0
Noble Gas	Air Dose (Beta-mrad)	2.57E-05		651 (N)	2.57E-04	10.0
Iodines and Particulates	Liver	2.47E-02	Child	659 (N)	3.29E-01	7.5



LAST LIQUID DOSE ACCUMULATION (MREM)  
 START DATE 0 4 1 1 END DATE 0 63024

BONE LIVER T.BODY THYRD KIDNEY LUNG GI-LLI SKIN

WATER

ADULT	1.0E-05	2.4E-03	2.4E-03	2.3E-03	2.3E-03	2.3E-03	2.6E-03	0.0E+00
TEEN	9.8E-06	1.7E-03	1.7E-03	1.7E-03	1.7E-03	1.7E-03	1.8E-03	0.0E+00
CHILD	3.0E-05	3.2E-03	3.2E-03	3.2E-03	3.2E-03	3.2E-03	3.3E-03	0.0E+00
INFANT	2.4E-05	3.2E-03	3.2E-03	3.1E-03	3.1E-03	3.1E-03	3.2E-03	0.0E+00

SHORE

ADULT	8.5E-05	8.5E-05	8.5E-05	8.5E-05	8.5E-05	8.5E-05	8.5E-05	1.0E-04
TEEN	4.8E-04	4.8E-04	4.8E-04	4.8E-04	4.8E-04	4.8E-04	4.8E-04	5.6E-04
CHILD	1.0E-04	1.0E-04	1.0E-04	1.0E-04	1.0E-04	1.0E-04	1.0E-04	1.2E-04
INFANT	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

FW SPT FISH

ADULT	6.9E-05	2.9E-04	2.8E-04	1.6E-04	1.7E-04	1.8E-04	1.2E-03	0.0E+00
TEEN	7.3E-05	2.6E-04	2.5E-04	1.2E-04	1.3E-04	1.5E-04	8.6E-04	0.0E+00
CHILD	9.5E-05	2.2E-04	2.4E-04	1.0E-04	1.1E-04	1.3E-04	3.5E-04	0.0E+00
INFANT	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

TOTAL

ADULT	1.6E-04	2.7E-03	2.7E-03	2.6E-03	2.6E-03	2.6E-03	3.9E-03	1.0E-04
TEEN	5.6E-04	2.4E-03	2.4E-03	2.3E-03	2.3E-03	2.3E-03	3.2E-03	5.6E-04
CHILD	2.2E-04	3.5E-03	3.6E-03	3.4E-03	3.4E-03	3.4E-03	3.8E-03	1.2E-04
INFANT	2.4E-05	3.2E-03	3.2E-03	3.1E-03	3.1E-03	3.1E-03	3.2E-03	0.0E+00

DATES OF LAST AIR DOSE ACCUMULATION ARE FROM 0 4 1 1 0 TO 0 63024 0  
DOSE ACCUMULATION FOR GAMMA MRAD

FOR RELEASE POINT 1

**DIRECTION FROM N				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM NNE				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM NE				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM ENE				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM E				
1.0520E-06	1.3535E-07	6.9639E-08	4.3963E-08	3.1159E-08
1.5715E-08	6.4321E-09	3.3030E-09	2.1590E-09	1.3776E-09
**DIRECTION FROM ESE				
1.7551E-07	2.2581E-08	1.1618E-08	7.3346E-09	5.1985E-09
2.6219E-09	1.0731E-09	5.5105E-10	3.6020E-10	2.2983E-10
**DIRECTION FROM SE				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM SSE				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM S				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM SSW				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM SW				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM WSW				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM W				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM WNW				
2.8878E-08	1.4060E-09	8.4499E-10	6.0335E-10	4.6918E-10
2.8150E-10	1.4074E-10	8.4446E-11	6.0319E-11	4.2197E-11
**DIRECTION FROM NW				
3.1026E-08	1.5106E-09	9.0784E-10	6.4823E-10	5.0408E-10
3.0244E-10	1.5121E-10	9.0727E-11	6.4805E-11	4.5336E-11
**DIRECTION FROM NNW				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

DISTANCES USED IN CALCULATIONS

594.0 2416.0 4020.0 5630.0 7240.0  
12067.0 24135.0 40225.0 56315.0 80500.0

DATES OF LAST AIR DOSE ACCUMULATION ARE FROM 0 4 1 1 0 TO 0 63024 0  
DOSE ACCUMULATION FOR GAMMA MRAD

FOR RELEASE POINT 2

**DIRECTION FROM N				
1.0838E-06	1.2490E-07	5.6633E-08	3.2836E-08	2.2950E-08
1.1467E-08	4.4094E-09	2.1965E-09	1.4096E-09	8.8194E-10
**DIRECTION FROM NNE				
5.4057E-07	6.5156E-08	3.0715E-08	1.8312E-08	1.2730E-08
6.2249E-09	2.3857E-09	1.1836E-09	7.5804E-10	4.7193E-10
**DIRECTION FROM NE				
1.2054E-06	1.6175E-07	7.4800E-08	4.3654E-08	3.0652E-08
1.5446E-08	5.9940E-09	2.9669E-09	1.8956E-09	1.1826E-09
**DIRECTION FROM ENE				
1.6328E-06	1.9671E-07	9.5455E-08	5.7731E-08	4.1091E-08
2.1127E-08	8.4812E-09	4.2389E-09	2.7190E-09	1.7321E-09
**DIRECTION FROM E				
9.9247E-07	1.2349E-07	6.1455E-08	3.7902E-08	2.6927E-08
1.3728E-08	5.5679E-09	2.8244E-09	1.8306E-09	1.1669E-09
**DIRECTION FROM ESE				
1.3254E-06	1.4086E-07	7.0732E-08	4.3945E-08	3.1446E-08
1.6237E-08	6.6195E-09	3.3217E-09	2.1344E-09	1.3760E-09
**DIRECTION FROM SE				
3.9159E-06	4.1382E-07	2.1684E-07	1.3809E-07	9.9861E-08
5.2400E-08	2.1855E-08	1.1035E-08	7.0997E-09	4.6030E-09
**DIRECTION FROM SSE				
5.9895E-06	6.3900E-07	3.3059E-07	2.0876E-07	1.5091E-07
7.9291E-08	3.2954E-08	1.6599E-08	1.0665E-08	6.9080E-09
**DIRECTION FROM S				
1.0009E-05	1.0702E-06	5.5138E-07	3.4756E-07	2.5048E-07
1.3081E-07	5.4112E-08	2.7247E-08	1.7510E-08	1.1320E-08
**DIRECTION FROM SSW				
5.3682E-06	5.5790E-07	2.8858E-07	1.8230E-07	1.3175E-07
6.9162E-08	2.8696E-08	1.4427E-08	9.2564E-09	5.9992E-09
**DIRECTION FROM SW				
1.6964E-06	1.8868E-07	8.6951E-08	5.1111E-08	3.5595E-08
1.7545E-08	6.7022E-09	3.3213E-09	2.1225E-09	1.3241E-09
**DIRECTION FROM WSW				
1.0330E-06	1.1586E-07	5.5800E-08	3.3705E-08	2.3924E-08
1.2235E-08	4.8997E-09	2.4649E-09	1.5895E-09	1.0164E-09
**DIRECTION FROM W				
1.2774E-06	1.4380E-07	6.8556E-08	4.1155E-08	2.9052E-08
1.4686E-08	5.7928E-09	2.8871E-09	1.8486E-09	1.1698E-09
**DIRECTION FROM WNW				
1.2460E-06	1.3837E-07	6.8896E-08	4.2602E-08	3.0262E-08
1.5392E-08	6.2063E-09	3.1213E-09	2.0094E-09	1.2842E-09
**DIRECTION FROM NW				
1.3197E-06	1.4995E-07	7.2707E-08	4.4056E-08	3.1249E-08
1.5916E-08	6.3316E-09	3.1482E-09	2.0096E-09	1.2747E-09
**DIRECTION FROM NNW				
9.2463E-07	9.8646E-08	4.8383E-08	2.9663E-08	2.1084E-08
1.0765E-08	4.3343E-09	2.1827E-09	1.4059E-09	8.9966E-10

DISTANCES USED IN CALCULATIONS

594.0 2416.0 4020.0 5630.0 7240.0  
12067.0 24135.0 40225.0 56315.0 80500.0

DATES OF LAST AIR DOSE ACCUMULATION ARE FROM 0 4 1 1 0 TO 0 63024 0  
DOSE ACCUMULATION FOR BETA MRAD

FOR RELEASE POINT 1

**DIRECTION FROM N				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM NNE				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM NE				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM ENE				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM E				
1.1929E-04	1.5348E-05	7.8967E-06	4.9852E-06	3.5333E-06
1.7820E-06	7.2936E-07	3.7454E-07	2.4482E-07	1.5621E-07
**DIRECTION FROM ESE				
1.9902E-05	2.5605E-06	1.3175E-06	8.3171E-07	5.8948E-07
2.9731E-07	1.2168E-07	6.2486E-08	4.0845E-08	2.6061E-08
**DIRECTION FROM SE				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM SSE				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM S				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM SSW				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM SW				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM WSW				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM W				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM WNW				
3.2747E-06	1.5943E-07	9.5817E-08	6.8416E-08	5.3202E-08
3.1920E-08	1.5960E-08	9.5757E-09	6.8398E-09	4.7849E-09
**DIRECTION FROM NW				
3.5182E-06	1.7129E-07	1.0294E-07	7.3505E-08	5.7159E-08
3.4295E-08	1.7147E-08	1.0288E-08	7.3486E-09	5.1408E-09
**DIRECTION FROM NNW				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

DISTANCES USED IN CALCULATIONS

594.0 2416.0 4020.0 5630.0 7240.0  
12067.0 24135.0 40225.0 56315.0 80500.0

DATES OF LAST AIR DOSE ACCUMULATION ARE FROM 0 4 1 1 0 TO 0 63024 0  
DOSE ACCUMULATION FOR BETA MRAD

FOR RELEASE POINT 2

**DIRECTION FROM N				
3.2224E-06	3.7136E-07	1.6838E-07	9.7629E-08	6.8234E-08
3.4093E-08	1.3110E-08	6.5307E-09	4.1911E-09	2.6222E-09
**DIRECTION FROM NNE				
1.6072E-06	1.9372E-07	9.1321E-08	5.4446E-08	3.7850E-08
1.8508E-08	7.0931E-09	3.5190E-09	2.2538E-09	1.4031E-09
**DIRECTION FROM NE				
3.5840E-06	4.8092E-07	2.2240E-07	1.2979E-07	9.1136E-08
4.5926E-08	1.7821E-08	8.8212E-09	5.6359E-09	3.5162E-09
**DIRECTION FROM ENE				
4.8548E-06	5.8485E-07	2.8381E-07	1.7165E-07	1.2217E-07
6.2814E-08	2.5216E-08	1.2603E-08	8.0843E-09	5.1498E-09
**DIRECTION FROM E				
2.9508E-06	3.6716E-07	1.8272E-07	1.1269E-07	8.0058E-08
4.0815E-08	1.6555E-08	8.3976E-09	5.4426E-09	3.4693E-09
**DIRECTION FROM ESE				
3.9408E-06	4.1881E-07	2.1030E-07	1.3066E-07	9.3496E-08
4.8277E-08	1.9681E-08	9.8761E-09	6.3460E-09	4.0912E-09
**DIRECTION FROM SE				
1.1643E-05	1.2304E-06	6.4470E-07	4.1057E-07	2.9691E-07
1.5580E-07	6.4980E-08	3.2809E-08	2.1109E-08	1.3686E-08
**DIRECTION FROM SSE				
1.7808E-05	1.8999E-06	9.8292E-07	6.2068E-07	4.4869E-07
2.3575E-07	9.7979E-08	4.9352E-08	3.1710E-08	2.0539E-08
**DIRECTION FROM S				
2.9758E-05	3.1818E-06	1.6394E-06	1.0334E-06	7.4474E-07
3.8893E-07	1.6089E-07	8.1011E-08	5.2061E-08	3.3656E-08
**DIRECTION FROM SSW				
1.5961E-05	1.6588E-06	8.5801E-07	5.4202E-07	3.9174E-07
2.0563E-07	8.5319E-08	4.2896E-08	2.7521E-08	1.7837E-08
**DIRECTION FROM SW				
5.0438E-06	5.6098E-07	2.5852E-07	1.5196E-07	1.0583E-07
5.2166E-08	1.9927E-08	9.8749E-09	6.3106E-09	3.9368E-09
**DIRECTION FROM WSW				
3.0715E-06	3.4447E-07	1.6591E-07	1.0021E-07	7.1132E-08
3.6378E-08	1.4568E-08	7.3285E-09	4.7259E-09	3.0219E-09
**DIRECTION FROM W				
3.7980E-06	4.2754E-07	2.0383E-07	1.2236E-07	8.6378E-08
4.3663E-08	1.7223E-08	8.5841E-09	5.4963E-09	3.4780E-09
**DIRECTION FROM WNW				
3.7045E-06	4.1141E-07	2.0484E-07	1.2667E-07	8.9975E-08
4.5764E-08	1.8453E-08	9.2802E-09	5.9744E-09	3.8181E-09
**DIRECTION FROM NW				
3.9238E-06	4.4583E-07	2.1617E-07	1.3099E-07	9.2911E-08
4.7322E-08	1.8825E-08	9.3604E-09	5.9751E-09	3.7900E-09
**DIRECTION FROM NNW				
2.7491E-06	2.9329E-07	1.4385E-07	8.8195E-08	6.2689E-08
3.2006E-08	1.2887E-08	6.4897E-09	4.1801E-09	2.6749E-09

DISTANCES USED IN CALCULATIONS

594.0 2416.0 4020.0 5630.0 7240.0  
12067.0 24135.0 40225.0 56315.0 80500.0

INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT  
 FOR DATES 0 4 1 1 THRU 0 63024  
 T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME	PATHWAY, DIST GP= 1, 659. METERS WINDS TOWARD N							
ADULT	4.9E-06	4.9E-06	4.9E-06	4.9E-06	4.9E-06	4.9E-06	5.2E-06	1.4E-05
TEEN	4.9E-06	4.9E-06	4.9E-06	4.9E-06	4.9E-06	4.9E-06	5.2E-06	1.4E-05
CHILD	4.9E-06	4.9E-06	4.9E-06	4.9E-06	4.9E-06	4.9E-06	5.2E-06	1.4E-05
INFNT	4.9E-06	4.9E-06	4.9E-06	4.9E-06	4.9E-06	4.9E-06	5.2E-06	1.4E-05
GROUND	PATHWAY, DIST GP= 1, 659. METERS WINDS TOWARD N							
ADULT	4.6E-05	4.6E-05	4.6E-05	4.6E-05	4.6E-05	4.6E-05	4.6E-05	5.4E-05
TEEN	4.6E-05	4.6E-05	4.6E-05	4.6E-05	4.6E-05	4.6E-05	4.6E-05	5.4E-05
CHILD	4.6E-05	4.6E-05	4.6E-05	4.6E-05	4.6E-05	4.6E-05	4.6E-05	5.4E-05
INFNT	4.6E-05	4.6E-05	4.6E-05	4.6E-05	4.6E-05	4.6E-05	4.6E-05	5.4E-05
VEGET	PATHWAY, DIST GP= 1, 8045. METERS WINDS TOWARD N							
ADULT	5.5E-04	5.5E-04	3.0E-07	5.5E-04	5.5E-04	5.5E-04	5.5E-04	0.0E+00
TEEN	6.3E-04	6.3E-04	4.8E-07	6.3E-04	6.3E-04	6.3E-04	6.3E-04	0.0E+00
CHILD	9.7E-04	9.7E-04	1.1E-06	9.7E-04	9.7E-04	9.7E-04	9.7E-04	0.0E+00
INFNT	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
MEAT	PATHWAY, DIST GP= 1, 8045. METERS WINDS TOWARD N							
ADULT	7.9E-05	7.9E-05	3.0E-08	7.9E-05	7.9E-05	7.9E-05	7.9E-05	0.0E+00
TEEN	4.7E-05	4.7E-05	2.5E-08	4.7E-05	4.7E-05	4.7E-05	4.7E-05	0.0E+00
CHILD	5.7E-05	5.7E-05	4.6E-08	5.7E-05	5.7E-05	5.7E-05	5.7E-05	0.0E+00
INFNT	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
COW	PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD N							
ADULT	4.6E-04	4.6E-04	8.8E-07	4.6E-04	4.6E-04	4.6E-04	4.6E-04	0.0E+00
TEEN	6.0E-04	6.0E-04	1.6E-06	6.0E-04	6.0E-04	6.0E-04	6.0E-04	0.0E+00
CHILD	9.4E-04	9.4E-04	3.8E-06	9.5E-04	9.4E-04	9.4E-04	9.4E-04	0.0E+00
INFNT	1.4E-03	1.4E-03	6.1E-06	1.4E-03	1.4E-03	1.4E-03	1.4E-03	0.0E+00
GOAT	PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD N							
ADULT	9.4E-04	9.4E-04	2.6E-06	9.4E-04	9.4E-04	9.4E-04	9.4E-04	0.0E+00
TEEN	1.2E-03	1.2E-03	4.8E-06	1.2E-03	1.2E-03	1.2E-03	1.2E-03	0.0E+00
CHILD	1.9E-03	1.9E-03	1.1E-05	1.9E-03	1.9E-03	1.9E-03	1.9E-03	0.0E+00
INFNT	2.9E-03	2.9E-03	1.8E-05	3.0E-03	2.9E-03	2.9E-03	2.9E-03	0.0E+00
INHAL	PATHWAY, DIST GP= 1, 659. METERS WINDS TOWARD N							
ADULT	1.2E-02	1.2E-02	7.3E-07	1.2E-02	1.2E-02	1.2E-02	1.2E-02	0.0E+00
TEEN	1.2E-02	1.2E-02	1.0E-06	1.2E-02	1.2E-02	1.2E-02	1.2E-02	0.0E+00
CHILD	1.0E-02	1.0E-02	1.4E-06	1.0E-02	1.0E-02	1.0E-02	1.0E-02	0.0E+00
INFNT	6.0E-03	6.0E-03	8.4E-07	6.0E-03	6.0E-03	6.0E-03	6.0E-03	0.0E+00
SUBTOTALS (NO PLUME)								
ADULT	1.4E-02	1.4E-02	5.0E-05	1.4E-02	1.4E-02	1.4E-02	1.4E-02	5.4E-05
TEEN	1.4E-02	1.4E-02	5.4E-05	1.4E-02	1.4E-02	1.4E-02	1.4E-02	5.4E-05
CHILD	1.4E-02	1.4E-02	6.4E-05	1.4E-02	1.4E-02	1.4E-02	1.4E-02	5.4E-05
INFNT	1.0E-02	1.0E-02	7.1E-05	1.0E-02	1.0E-02	1.0E-02	1.0E-02	5.4E-05
TOTALS								
ADULT	1.4E-02	1.4E-02	5.5E-05	1.4E-02	1.4E-02	1.4E-02	1.4E-02	6.8E-05
TEEN	1.4E-02	1.4E-02	5.9E-05	1.4E-02	1.4E-02	1.4E-02	1.4E-02	6.8E-05
CHILD	1.4E-02	1.4E-02	6.9E-05	1.4E-02	1.4E-02	1.4E-02	1.4E-02	6.8E-05
INFNT	1.0E-02	1.0E-02	7.6E-05	1.0E-02	1.0E-02	1.0E-02	1.0E-02	6.8E-05

INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT  
 FOR DATES 0 4 1 1 THRU 0 63024  
 T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME PATHWAY, DIST GP= 1, 660. METERS WINDS TOWARD NNE  
 ADULT 2.6E-06 2.6E-06 2.6E-06 2.6E-06 2.6E-06 2.6E-06 2.8E-06 7.4E-06  
 TEEN 2.6E-06 2.6E-06 2.6E-06 2.6E-06 2.6E-06 2.6E-06 2.8E-06 7.4E-06  
 CHILD 2.6E-06 2.6E-06 2.6E-06 2.6E-06 2.6E-06 2.6E-06 2.8E-06 7.4E-06  
 INFNT 2.6E-06 2.6E-06 2.6E-06 2.6E-06 2.6E-06 2.6E-06 2.8E-06 7.4E-06

GROUND PATHWAY, DIST GP= 1, 660. METERS WINDS TOWARD NNE  
 ADULT 2.9E-05 2.9E-05 2.9E-05 2.9E-05 2.9E-05 2.9E-05 2.9E-05 3.4E-05  
 TEEN 2.9E-05 2.9E-05 2.9E-05 2.9E-05 2.9E-05 2.9E-05 2.9E-05 3.4E-05  
 CHILD 2.9E-05 2.9E-05 2.9E-05 2.9E-05 2.9E-05 2.9E-05 2.9E-05 3.4E-05  
 INFNT 2.9E-05 2.9E-05 2.9E-05 2.9E-05 2.9E-05 2.9E-05 2.9E-05 3.4E-05

VEGET PATHWAY, DIST GP= 1, 814. METERS WINDS TOWARD NNE  
 ADULT 6.8E-03 6.8E-03 9.3E-06 6.8E-03 6.8E-03 6.8E-03 6.8E-03 0.0E+00  
 TEEN 7.7E-03 7.7E-03 1.5E-05 7.8E-03 7.7E-03 7.7E-03 7.7E-03 0.0E+00  
 CHILD 1.2E-02 1.2E-02 3.5E-05 1.2E-02 1.2E-02 1.2E-02 1.2E-02 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

MEAT PATHWAY, DIST GP= 1, 7725. METERS WINDS TOWARD NNE  
 ADULT 3.6E-05 3.6E-05 2.1E-08 3.6E-05 3.6E-05 3.6E-05 3.6E-05 0.0E+00  
 TEEN 2.1E-05 2.1E-05 1.7E-08 2.1E-05 2.1E-05 2.1E-05 2.1E-05 0.0E+00  
 CHILD 2.6E-05 2.6E-05 3.1E-08 2.6E-05 2.6E-05 2.6E-05 2.6E-05 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

COW PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD NNE  
 ADULT 2.0E-04 2.0E-04 5.6E-07 2.0E-04 2.0E-04 2.0E-04 2.0E-04 0.0E+00  
 TEEN 2.6E-04 2.6E-04 1.0E-06 2.6E-04 2.6E-04 2.6E-04 2.6E-04 0.0E+00  
 CHILD 4.1E-04 4.1E-04 2.4E-06 4.1E-04 4.1E-04 4.1E-04 4.1E-04 0.0E+00  
 INFNT 6.2E-04 6.2E-04 3.9E-06 6.3E-04 6.2E-04 6.2E-04 6.2E-04 0.0E+00

GOAT PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD NNE  
 ADULT 4.1E-04 4.1E-04 1.7E-06 4.1E-04 4.1E-04 4.1E-04 4.1E-04 0.0E+00  
 TEEN 5.3E-04 5.3E-04 3.0E-06 5.3E-04 5.3E-04 5.3E-04 5.3E-04 0.0E+00  
 CHILD 8.3E-04 8.3E-04 7.3E-06 8.4E-04 8.4E-04 8.3E-04 8.3E-04 0.0E+00  
 INFNT 1.3E-03 1.3E-03 1.2E-05 1.3E-03 1.3E-03 1.3E-03 1.3E-03 0.0E+00

INHAL PATHWAY, DIST GP= 1, 660. METERS WINDS TOWARD NNE  
 ADULT 5.2E-03 5.2E-03 3.9E-07 5.2E-03 5.2E-03 5.2E-03 5.2E-03 0.0E+00  
 TEEN 5.3E-03 5.3E-03 5.5E-07 5.3E-03 5.3E-03 5.3E-03 5.3E-03 0.0E+00  
 CHILD 4.7E-03 4.7E-03 7.4E-07 4.7E-03 4.7E-03 4.7E-03 4.7E-03 0.0E+00  
 INFNT 2.7E-03 2.7E-03 4.5E-07 2.7E-03 2.7E-03 2.7E-03 2.7E-03 0.0E+00

SUBTOTALS (NO PLUME)  
 ADULT 1.3E-02 1.3E-02 4.1E-05 1.3E-02 1.3E-02 1.3E-02 1.3E-02 3.4E-05  
 TEEN 1.4E-02 1.4E-02 4.9E-05 1.4E-02 1.4E-02 1.4E-02 1.4E-02 3.4E-05  
 CHILD 1.8E-02 1.8E-02 7.5E-05 1.8E-02 1.8E-02 1.8E-02 1.8E-02 3.4E-05  
 INFNT 4.6E-03 4.6E-03 4.5E-05 4.6E-03 4.6E-03 4.6E-03 4.6E-03 3.4E-05

TOTALS  
 ADULT 1.3E-02 1.3E-02 4.4E-05 1.3E-02 1.3E-02 1.3E-02 1.3E-02 4.2E-05  
 TEEN 1.4E-02 1.4E-02 5.1E-05 1.4E-02 1.4E-02 1.4E-02 1.4E-02 4.2E-05  
 CHILD 1.8E-02 1.8E-02 7.7E-05 1.8E-02 1.8E-02 1.8E-02 1.8E-02 4.2E-05  
 INFNT 4.6E-03 4.6E-03 4.8E-05 4.6E-03 4.6E-03 4.6E-03 4.6E-03 4.2E-05

INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT

FOR DATES 0 4 1 1 THRU 0 63024

T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME PATHWAY, DIST GP= 1, 943. METERS WINDS TOWARD NE  
 ADULT 4.7E-07 4.7E-07 4.7E-07 4.7E-07 4.7E-07 4.7E-07 5.0E-07 1.3E-06  
 TEEN 4.7E-07 4.7E-07 4.7E-07 4.7E-07 4.7E-07 4.7E-07 5.0E-07 1.3E-06  
 CHILD 4.7E-07 4.7E-07 4.7E-07 4.7E-07 4.7E-07 4.7E-07 5.0E-07 1.3E-06  
 INFNT 4.7E-07 4.7E-07 4.7E-07 4.7E-07 4.7E-07 4.7E-07 5.0E-07 1.3E-06

GROUND PATHWAY, DIST GP= 1, 943. METERS WINDS TOWARD NE  
 ADULT 2.6E-05 2.6E-05 2.6E-05 2.6E-05 2.6E-05 2.6E-05 2.6E-05 3.1E-05  
 TEEN 2.6E-05 2.6E-05 2.6E-05 2.6E-05 2.6E-05 2.6E-05 2.6E-05 3.1E-05  
 CHILD 2.6E-05 2.6E-05 2.6E-05 2.6E-05 2.6E-05 2.6E-05 2.6E-05 3.1E-05  
 INFNT 2.6E-05 2.6E-05 2.6E-05 2.6E-05 2.6E-05 2.6E-05 2.6E-05 3.1E-05

VEGET PATHWAY, DIST GP= 1, 1052. METERS WINDS TOWARD NE  
 ADULT 1.7E-03 1.7E-03 9.9E-06 1.7E-03 1.7E-03 1.7E-03 1.7E-03 0.0E+00  
 TEEN 1.9E-03 1.9E-03 1.6E-05 1.9E-03 1.9E-03 1.9E-03 1.9E-03 0.0E+00  
 CHILD 3.0E-03 3.0E-03 3.7E-05 3.0E-03 3.0E-03 3.0E-03 3.0E-03 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

MEAT PATHWAY, DIST GP= 1, 7725. METERS WINDS TOWARD NE  
 ADULT 1.2E-05 1.2E-05 3.3E-08 1.2E-05 1.2E-05 1.2E-05 1.2E-05 0.0E+00  
 TEEN 6.9E-06 6.9E-06 2.8E-08 6.9E-06 6.9E-06 6.9E-06 6.9E-06 0.0E+00  
 CHILD 8.3E-06 8.3E-06 5.1E-08 8.3E-06 8.3E-06 8.3E-06 8.3E-06 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

COW PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD NE  
 ADULT 7.1E-05 7.0E-05 9.1E-07 7.1E-05 7.1E-05 7.0E-05 7.0E-05 0.0E+00  
 TEEN 9.2E-05 9.2E-05 1.7E-06 9.4E-05 9.2E-05 9.1E-05 9.2E-05 0.0E+00  
 CHILD 1.4E-04 1.4E-04 4.0E-06 1.5E-04 1.5E-04 1.4E-04 1.4E-04 0.0E+00  
 INFNT 2.2E-04 2.2E-04 6.3E-06 2.3E-04 2.2E-04 2.2E-04 2.2E-04 0.0E+00

GOAT PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD NE  
 ADULT 1.5E-04 1.4E-04 2.7E-06 1.5E-04 1.4E-04 1.4E-04 1.4E-04 0.0E+00  
 TEEN 1.9E-04 1.9E-04 5.0E-06 1.9E-04 1.9E-04 1.9E-04 1.9E-04 0.0E+00  
 CHILD 3.0E-04 2.9E-04 1.2E-05 3.0E-04 3.0E-04 2.9E-04 2.9E-04 0.0E+00  
 INFNT 4.5E-04 4.5E-04 1.9E-05 4.7E-04 4.5E-04 4.5E-04 4.5E-04 0.0E+00

INHAL PATHWAY, DIST GP= 1, 943. METERS WINDS TOWARD NE  
 ADULT 1.1E-03 1.1E-03 6.9E-08 1.1E-03 1.1E-03 1.1E-03 1.1E-03 0.0E+00  
 TEEN 1.1E-03 1.1E-03 9.6E-08 1.1E-03 1.1E-03 1.1E-03 1.1E-03 0.0E+00  
 CHILD 9.8E-04 9.8E-04 1.3E-07 9.8E-04 9.8E-04 9.8E-04 9.8E-04 0.0E+00  
 INFNT 5.6E-04 5.6E-04 7.9E-08 5.6E-04 5.6E-04 5.6E-04 5.6E-04 0.0E+00

SUBTOTALS (NO PLUME)  
 ADULT 3.0E-03 3.0E-03 4.0E-05 3.0E-03 3.0E-03 3.0E-03 3.0E-03 3.1E-05  
 TEEN 3.3E-03 3.3E-03 4.9E-05 3.4E-03 3.3E-03 3.3E-03 3.3E-03 3.1E-05  
 CHILD 4.4E-03 4.4E-03 7.9E-05 4.5E-03 4.4E-03 4.4E-03 4.4E-03 3.1E-05  
 INFNT 1.3E-03 1.3E-03 5.2E-05 1.3E-03 1.3E-03 1.3E-03 1.3E-03 3.1E-05

TOTALS  
 ADULT 3.0E-03 3.0E-03 4.0E-05 3.0E-03 3.0E-03 3.0E-03 3.0E-03 3.2E-05  
 TEEN 3.3E-03 3.3E-03 4.9E-05 3.4E-03 3.3E-03 3.3E-03 3.3E-03 3.2E-05  
 CHILD 4.4E-03 4.4E-03 8.0E-05 4.5E-03 4.4E-03 4.4E-03 4.4E-03 3.2E-05  
 INFNT 1.3E-03 1.3E-03 5.2E-05 1.3E-03 1.3E-03 1.3E-03 1.3E-03 3.2E-05



INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT  
 FOR DATES 0 4 1 1 THRU 0 63024  
 T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME PATHWAY, DIST GP= 1, 1747. METERS WINDS TOWARD ENE  
 ADULT 1.1E-07 1.1E-07 1.1E-07 1.1E-07 1.1E-07 1.1E-07 1.2E-07 3.1E-07  
 TEEN 1.1E-07 1.1E-07 1.1E-07 1.1E-07 1.1E-07 1.1E-07 1.2E-07 3.1E-07  
 CHILD 1.1E-07 1.1E-07 1.1E-07 1.1E-07 1.1E-07 1.1E-07 1.2E-07 3.1E-07  
 INFNT 1.1E-07 1.1E-07 1.1E-07 1.1E-07 1.1E-07 1.1E-07 1.2E-07 3.1E-07

GROUND PATHWAY, DIST GP= 1, 1747. METERS WINDS TOWARD ENE  
 ADULT 3.2E-06 3.2E-06 3.2E-06 3.2E-06 3.2E-06 3.2E-06 3.2E-06 3.7E-06  
 TEEN 3.2E-06 3.2E-06 3.2E-06 3.2E-06 3.2E-06 3.2E-06 3.2E-06 3.7E-06  
 CHILD 3.2E-06 3.2E-06 3.2E-06 3.2E-06 3.2E-06 3.2E-06 3.2E-06 3.7E-06  
 INFNT 3.2E-06 3.2E-06 3.2E-06 3.2E-06 3.2E-06 3.2E-06 3.2E-06 3.7E-06

VEGET PATHWAY, DIST GP= 1, 1852. METERS WINDS TOWARD ENE  
 ADULT 7.9E-04 7.9E-04 1.3E-06 7.9E-04 7.9E-04 7.9E-04 7.9E-04 0.0E+00  
 TEEN 9.0E-04 9.0E-04 2.1E-06 9.0E-04 9.0E-04 9.0E-04 9.0E-04 0.0E+00  
 CHILD 1.4E-03 1.4E-03 4.9E-06 1.4E-03 1.4E-03 1.4E-03 1.4E-03 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

MEAT PATHWAY, DIST GP= 1, 3862. METERS WINDS TOWARD ENE  
 ADULT 3.8E-05 3.8E-05 4.0E-08 3.8E-05 3.8E-05 3.8E-05 3.8E-05 0.0E+00  
 TEEN 2.3E-05 2.3E-05 3.3E-08 2.3E-05 2.3E-05 2.3E-05 2.3E-05 0.0E+00  
 CHILD 2.7E-05 2.7E-05 6.2E-08 2.7E-05 2.7E-05 2.7E-05 2.7E-05 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

COW PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD ENE  
 ADULT 8.2E-05 8.1E-05 3.1E-07 8.2E-05 8.2E-05 8.1E-05 8.1E-05 0.0E+00  
 TEEN 1.1E-04 1.1E-04 5.6E-07 1.1E-04 1.1E-04 1.1E-04 1.1E-04 0.0E+00  
 CHILD 1.7E-04 1.7E-04 1.4E-06 1.7E-04 1.7E-04 1.7E-04 1.7E-04 0.0E+00  
 INFNT 2.5E-04 2.5E-04 2.2E-06 2.6E-04 2.5E-04 2.5E-04 2.5E-04 0.0E+00

GOAT PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD ENE  
 ADULT 1.7E-04 1.7E-04 9.3E-07 1.7E-04 1.7E-04 1.7E-04 1.7E-04 0.0E+00  
 TEEN 2.2E-04 2.2E-04 1.7E-06 2.2E-04 2.2E-04 2.2E-04 2.2E-04 0.0E+00  
 CHILD 3.4E-04 3.4E-04 4.1E-06 3.4E-04 3.4E-04 3.4E-04 3.4E-04 0.0E+00  
 INFNT 5.2E-04 5.2E-04 6.5E-06 5.3E-04 5.2E-04 5.2E-04 5.2E-04 0.0E+00

INHAL PATHWAY, DIST GP= 1, 1747. METERS WINDS TOWARD ENE  
 ADULT 4.8E-04 4.8E-04 1.6E-08 4.8E-04 4.8E-04 4.8E-04 4.8E-04 0.0E+00  
 TEEN 4.8E-04 4.8E-04 2.2E-08 4.8E-04 4.8E-04 4.8E-04 4.8E-04 0.0E+00  
 CHILD 4.2E-04 4.2E-04 2.9E-08 4.2E-04 4.2E-04 4.2E-04 4.2E-04 0.0E+00  
 INFNT 2.4E-04 2.4E-04 1.8E-08 2.4E-04 2.4E-04 2.4E-04 2.4E-04 0.0E+00

SUBTOTALS (NO PLUME)  
 ADULT 1.6E-03 1.6E-03 5.8E-06 1.6E-03 1.6E-03 1.6E-03 1.6E-03 3.7E-06  
 TEEN 1.7E-03 1.7E-03 7.6E-06 1.7E-03 1.7E-03 1.7E-03 1.7E-03 3.7E-06  
 CHILD 2.4E-03 2.4E-03 1.4E-05 2.4E-03 2.4E-03 2.4E-03 2.4E-03 3.7E-06  
 INFNT 1.0E-03 1.0E-03 1.2E-05 1.0E-03 1.0E-03 1.0E-03 1.0E-03 3.7E-06

TOTALS  
 ADULT 1.6E-03 1.6E-03 5.9E-06 1.6E-03 1.6E-03 1.6E-03 1.6E-03 4.1E-06  
 TEEN 1.7E-03 1.7E-03 7.7E-06 1.7E-03 1.7E-03 1.7E-03 1.7E-03 4.1E-06  
 CHILD 2.4E-03 2.4E-03 1.4E-05 2.4E-03 2.4E-03 2.4E-03 2.4E-03 4.1E-06  
 INFNT 1.0E-03 1.0E-03 1.2E-05 1.0E-03 1.0E-03 1.0E-03 1.0E-03 4.1E-06

INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT  
 FOR DATES 0 4 1 1 THRU 0 63024  
 T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME PATHWAY, DIST GP= 1, 1716. METERS WINDS TOWARD E  
 ADULT 1.4E-07 1.4E-07 1.4E-07 1.4E-07 1.4E-07 1.4E-07 1.5E-07 4.0E-07  
 TEEN 1.4E-07 1.4E-07 1.4E-07 1.4E-07 1.4E-07 1.4E-07 1.5E-07 4.0E-07  
 CHILD 1.4E-07 1.4E-07 1.4E-07 1.4E-07 1.4E-07 1.4E-07 1.5E-07 4.0E-07  
 INFNT 1.4E-07 1.4E-07 1.4E-07 1.4E-07 1.4E-07 1.4E-07 1.5E-07 4.0E-07

GROUND PATHWAY, DIST GP= 1, 1716. METERS WINDS TOWARD E  
 ADULT 2.9E-06 2.9E-06 2.9E-06 2.9E-06 2.9E-06 2.9E-06 2.9E-06 3.4E-06  
 TEEN 2.9E-06 2.9E-06 2.9E-06 2.9E-06 2.9E-06 2.9E-06 2.9E-06 3.4E-06  
 CHILD 2.9E-06 2.9E-06 2.9E-06 2.9E-06 2.9E-06 2.9E-06 2.9E-06 3.4E-06  
 INFNT 2.9E-06 2.9E-06 2.9E-06 2.9E-06 2.9E-06 2.9E-06 2.9E-06 3.4E-06

VEGET PATHWAY, DIST GP= 1, 1705. METERS WINDS TOWARD E  
 ADULT 1.4E-03 1.4E-03 1.3E-06 1.4E-03 1.4E-03 1.4E-03 1.4E-03 0.0E+00  
 TEEN 1.6E-03 1.6E-03 2.1E-06 1.6E-03 1.6E-03 1.6E-03 1.6E-03 0.0E+00  
 CHILD 2.5E-03 2.5E-03 5.0E-06 2.5E-03 2.5E-03 2.5E-03 2.5E-03 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

MEAT PATHWAY, DIST GP= 1, 6810. METERS WINDS TOWARD E  
 ADULT 2.8E-05 2.8E-05 1.3E-08 2.8E-05 2.8E-05 2.8E-05 2.8E-05 0.0E+00  
 TEEN 1.7E-05 1.7E-05 1.0E-08 1.7E-05 1.7E-05 1.7E-05 1.7E-05 0.0E+00  
 CHILD 2.0E-05 2.0E-05 1.9E-08 2.0E-05 2.0E-05 2.0E-05 2.0E-05 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

COW PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD E  
 ADULT 1.4E-04 1.4E-04 2.8E-07 1.4E-04 1.4E-04 1.4E-04 1.4E-04 0.0E+00  
 TEEN 1.8E-04 1.8E-04 5.0E-07 1.8E-04 1.8E-04 1.8E-04 1.8E-04 0.0E+00  
 CHILD 2.8E-04 2.8E-04 1.2E-06 2.8E-04 2.8E-04 2.8E-04 2.8E-04 0.0E+00  
 INFNT 4.2E-04 4.2E-04 1.9E-06 4.3E-04 4.2E-04 4.2E-04 4.2E-04 0.0E+00

GOAT PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD E  
 ADULT 2.8E-04 2.8E-04 8.3E-07 2.8E-04 2.8E-04 2.8E-04 2.8E-04 0.0E+00  
 TEEN 3.6E-04 3.6E-04 1.5E-06 3.6E-04 3.6E-04 3.6E-04 3.6E-04 0.0E+00  
 CHILD 5.7E-04 5.7E-04 3.6E-06 5.7E-04 5.7E-04 5.7E-04 5.7E-04 0.0E+00  
 INFNT 8.7E-04 8.7E-04 5.8E-06 8.7E-04 8.7E-04 8.7E-04 8.7E-04 0.0E+00

INHAL PATHWAY, DIST GP= 1, 1716. METERS WINDS TOWARD E  
 ADULT 7.9E-04 7.9E-04 2.0E-08 7.9E-04 7.9E-04 7.9E-04 7.9E-04 0.0E+00  
 TEEN 7.9E-04 7.9E-04 2.8E-08 7.9E-04 7.9E-04 7.9E-04 7.9E-04 0.0E+00  
 CHILD 7.0E-04 7.0E-04 3.7E-08 7.0E-04 7.0E-04 7.0E-04 7.0E-04 0.0E+00  
 INFNT 4.0E-04 4.0E-04 2.3E-08 4.0E-04 4.0E-04 4.0E-04 4.0E-04 0.0E+00

SUBTOTALS (NO PLUME)  
 ADULT 2.7E-03 2.7E-03 5.4E-06 2.7E-03 2.7E-03 2.7E-03 2.7E-03 3.4E-06  
 TEEN 3.0E-03 3.0E-03 7.1E-06 3.0E-03 3.0E-03 3.0E-03 3.0E-03 3.4E-06  
 CHILD 4.1E-03 4.1E-03 1.3E-05 4.1E-03 4.1E-03 4.1E-03 4.1E-03 3.4E-06  
 INFNT 1.7E-03 1.7E-03 1.1E-05 1.7E-03 1.7E-03 1.7E-03 1.7E-03 3.4E-06

TOTALS  
 ADULT 2.7E-03 2.7E-03 5.6E-06 2.7E-03 2.7E-03 2.7E-03 2.7E-03 3.8E-06  
 TEEN 3.0E-03 3.0E-03 7.3E-06 3.0E-03 3.0E-03 3.0E-03 3.0E-03 3.8E-06  
 CHILD 4.1E-03 4.1E-03 1.3E-05 4.1E-03 4.1E-03 4.1E-03 4.1E-03 3.8E-06  
 INFNT 1.7E-03 1.7E-03 1.1E-05 1.7E-03 1.7E-03 1.7E-03 1.7E-03 3.8E-06

INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT  
 FOR DATES 0 4 1 1 THRU 0 63024  
 T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME PATHWAY, DIST GP= 1, 1643. METERS WINDS TOWARD ESE  
 ADULT 1.5E-07 1.5E-07 1.5E-07 1.5E-07 1.5E-07 1.5E-07 1.6E-07 6.6E-07  
 TEEN 1.5E-07 1.5E-07 1.5E-07 1.5E-07 1.5E-07 1.5E-07 1.6E-07 6.6E-07  
 CHILD 1.5E-07 1.5E-07 1.5E-07 1.5E-07 1.5E-07 1.5E-07 1.6E-07 6.6E-07  
 INFNT 1.5E-07 1.5E-07 1.5E-07 1.5E-07 1.5E-07 1.5E-07 1.6E-07 6.6E-07

GROUND PATHWAY, DIST GP= 1, 1643. METERS WINDS TOWARD ESE  
 ADULT 1.7E-06 1.7E-06 1.7E-06 1.7E-06 1.7E-06 1.7E-06 1.7E-06 2.0E-06  
 TEEN 1.7E-06 1.7E-06 1.7E-06 1.7E-06 1.7E-06 1.7E-06 1.7E-06 2.0E-06  
 CHILD 1.7E-06 1.7E-06 1.7E-06 1.7E-06 1.7E-06 1.7E-06 1.7E-06 2.0E-06  
 INFNT 1.7E-06 1.7E-06 1.7E-06 1.7E-06 1.7E-06 1.7E-06 1.7E-06 2.0E-06

VEGET PATHWAY, DIST GP= 1, 1628. METERS WINDS TOWARD ESE  
 ADULT 1.2E-03 1.2E-03 7.8E-07 1.2E-03 1.2E-03 1.2E-03 1.2E-03 0.0E+00  
 TEEN 1.4E-03 1.4E-03 1.2E-06 1.4E-03 1.4E-03 1.4E-03 1.4E-03 0.0E+00  
 CHILD 2.2E-03 2.2E-03 2.9E-06 2.2E-03 2.2E-03 2.2E-03 2.2E-03 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

MEAT PATHWAY, DIST GP= 1, 2434. METERS WINDS TOWARD ESE  
 ADULT 9.7E-05 9.7E-05 4.0E-08 9.7E-05 9.7E-05 9.7E-05 9.7E-05 0.0E+00  
 TEEN 5.8E-05 5.8E-05 3.3E-08 5.8E-05 5.8E-05 5.8E-05 5.8E-05 0.0E+00  
 CHILD 7.0E-05 7.0E-05 6.0E-08 7.0E-05 7.0E-05 7.0E-05 7.0E-05 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

COW PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD ESE  
 ADULT 1.1E-04 1.1E-04 1.5E-07 1.1E-04 1.1E-04 1.1E-04 1.1E-04 0.0E+00  
 TEEN 1.4E-04 1.4E-04 2.7E-07 1.4E-04 1.4E-04 1.4E-04 1.4E-04 0.0E+00  
 CHILD 2.2E-04 2.2E-04 6.5E-07 2.2E-04 2.2E-04 2.2E-04 2.2E-04 0.0E+00  
 INFNT 3.3E-04 3.3E-04 1.0E-06 3.4E-04 3.3E-04 3.3E-04 3.3E-04 0.0E+00

GOAT PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD ESE  
 ADULT 2.2E-04 2.2E-04 4.5E-07 2.2E-04 2.2E-04 2.2E-04 2.2E-04 0.0E+00  
 TEEN 2.9E-04 2.8E-04 8.1E-07 2.9E-04 2.9E-04 2.8E-04 2.8E-04 0.0E+00  
 CHILD 4.5E-04 4.5E-04 1.9E-06 4.5E-04 4.5E-04 4.5E-04 4.5E-04 0.0E+00  
 INFNT 6.8E-04 6.8E-04 3.1E-06 6.9E-04 6.9E-04 6.8E-04 6.8E-04 0.0E+00

INHAL PATHWAY, DIST GP= 1, 1643. METERS WINDS TOWARD ESE  
 ADULT 6.7E-04 6.7E-04 2.1E-08 6.7E-04 6.7E-04 6.7E-04 6.7E-04 0.0E+00  
 TEEN 6.8E-04 6.8E-04 2.9E-08 6.8E-04 6.8E-04 6.8E-04 6.8E-04 0.0E+00  
 CHILD 6.0E-04 6.0E-04 3.9E-08 6.0E-04 6.0E-04 6.0E-04 6.0E-04 0.0E+00  
 INFNT 3.4E-04 3.4E-04 2.4E-08 3.4E-04 3.4E-04 3.4E-04 3.4E-04 0.0E+00

SUBTOTALS (NO PLUME)  
 ADULT 2.3E-03 2.3E-03 3.1E-06 2.3E-03 2.3E-03 2.3E-03 2.3E-03 2.0E-06  
 TEEN 2.6E-03 2.6E-03 4.1E-06 2.6E-03 2.6E-03 2.6E-03 2.6E-03 2.0E-06  
 CHILD 3.5E-03 3.5E-03 7.3E-06 3.5E-03 3.5E-03 3.5E-03 3.5E-03 2.0E-06  
 INFNT 1.4E-03 1.4E-03 5.9E-06 1.4E-03 1.4E-03 1.4E-03 1.4E-03 2.0E-06

TOTALS  
 ADULT 2.3E-03 2.3E-03 3.3E-06 2.3E-03 2.3E-03 2.3E-03 2.3E-03 2.7E-06  
 TEEN 2.6E-03 2.6E-03 4.2E-06 2.6E-03 2.6E-03 2.6E-03 2.6E-03 2.7E-06  
 CHILD 3.5E-03 3.5E-03 7.5E-06 3.5E-03 3.5E-03 3.5E-03 3.5E-03 2.7E-06  
 INFNT 1.4E-03 1.4E-03 6.0E-06 1.4E-03 1.4E-03 1.4E-03 1.4E-03 2.7E-06

INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT

FOR DATES 0 4 1 1 THRU 0 63024

T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME PATHWAY, DIST GP= 1, 1136. METERS WINDS TOWARD SE  
ADULT 2.8E-07 2.8E-07 2.8E-07 2.8E-07 2.8E-07 2.8E-07 3.1E-07 1.4E-06  
TEEN 2.8E-07 2.8E-07 2.8E-07 2.8E-07 2.8E-07 2.8E-07 3.1E-07 1.4E-06  
CHILD 2.8E-07 2.8E-07 2.8E-07 2.8E-07 2.8E-07 2.8E-07 3.1E-07 1.4E-06  
INFNT 2.8E-07 2.8E-07 2.8E-07 2.8E-07 2.8E-07 2.8E-07 3.1E-07 1.4E-06

GROUND PATHWAY, DIST GP= 1, 1136. METERS WINDS TOWARD SE  
ADULT 3.1E-06 3.1E-06 3.1E-06 3.1E-06 3.1E-06 3.1E-06 3.1E-06 3.7E-06  
TEEN 3.1E-06 3.1E-06 3.1E-06 3.1E-06 3.1E-06 3.1E-06 3.1E-06 3.7E-06  
CHILD 3.1E-06 3.1E-06 3.1E-06 3.1E-06 3.1E-06 3.1E-06 3.1E-06 3.7E-06  
INFNT 3.1E-06 3.1E-06 3.1E-06 3.1E-06 3.1E-06 3.1E-06 3.1E-06 3.7E-06

VEGET PATHWAY, DIST GP= 1, 914. METERS WINDS TOWARD SE  
ADULT 2.9E-03 2.9E-03 2.0E-06 2.9E-03 2.9E-03 2.9E-03 2.9E-03 0.0E+00  
TEEN 3.3E-03 3.3E-03 3.2E-06 3.3E-03 3.3E-03 3.3E-03 3.3E-03 0.0E+00  
CHILD 5.1E-03 5.1E-03 7.6E-06 5.1E-03 5.1E-03 5.1E-03 5.1E-03 0.0E+00  
INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

MEAT PATHWAY, DIST GP= 1, 4354. METERS WINDS TOWARD SE  
ADULT 4.0E-05 4.0E-05 1.6E-08 4.0E-05 4.0E-05 4.0E-05 4.0E-05 0.0E+00  
TEEN 2.4E-05 2.4E-05 1.3E-08 2.4E-05 2.4E-05 2.4E-05 2.4E-05 0.0E+00  
CHILD 2.9E-05 2.9E-05 2.4E-08 2.9E-05 2.9E-05 2.9E-05 2.9E-05 0.0E+00  
INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

COW PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD SE  
ADULT 1.0E-04 1.0E-04 1.5E-07 1.0E-04 1.0E-04 1.0E-04 1.0E-04 0.0E+00  
TEEN 1.3E-04 1.3E-04 2.7E-07 1.3E-04 1.3E-04 1.3E-04 1.3E-04 0.0E+00  
CHILD 2.1E-04 2.1E-04 6.5E-07 2.1E-04 2.1E-04 2.1E-04 2.1E-04 0.0E+00  
INFNT 3.2E-04 3.2E-04 1.0E-06 3.2E-04 3.2E-04 3.2E-04 3.2E-04 0.0E+00

GOAT PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD SE  
ADULT 2.1E-04 2.1E-04 4.5E-07 2.1E-04 2.1E-04 2.1E-04 2.1E-04 0.0E+00  
TEEN 2.7E-04 2.7E-04 8.1E-07 2.7E-04 2.7E-04 2.7E-04 2.7E-04 0.0E+00  
CHILD 4.3E-04 4.3E-04 1.9E-06 4.3E-04 4.3E-04 4.3E-04 4.3E-04 0.0E+00  
INFNT 6.6E-04 6.6E-04 3.1E-06 6.6E-04 6.6E-04 6.6E-04 6.6E-04 0.0E+00

INHAL PATHWAY, DIST GP= 1, 1136. METERS WINDS TOWARD SE  
ADULT 1.1E-03 1.1E-03 4.0E-08 1.1E-03 1.1E-03 1.1E-03 1.1E-03 0.0E+00  
TEEN 1.1E-03 1.1E-03 5.6E-08 1.1E-03 1.1E-03 1.1E-03 1.1E-03 0.0E+00  
CHILD 1.0E-03 1.0E-03 7.6E-08 1.0E-03 1.0E-03 1.0E-03 1.0E-03 0.0E+00  
INFNT 5.8E-04 5.8E-04 4.6E-08 5.8E-04 5.8E-04 5.8E-04 5.8E-04 0.0E+00

SUBTOTALS (NO PLUME)  
ADULT 4.4E-03 4.4E-03 5.8E-06 4.4E-03 4.4E-03 4.4E-03 4.4E-03 3.7E-06  
TEEN 4.9E-03 4.9E-03 7.5E-06 4.9E-03 4.9E-03 4.9E-03 4.9E-03 3.7E-06  
CHILD 6.8E-03 6.8E-03 1.3E-05 6.8E-03 6.8E-03 6.8E-03 6.8E-03 3.7E-06  
INFNT 1.6E-03 1.6E-03 7.3E-06 1.6E-03 1.6E-03 1.6E-03 1.6E-03 3.7E-06

TOTALS  
ADULT 4.4E-03 4.4E-03 6.1E-06 4.4E-03 4.4E-03 4.4E-03 4.4E-03 5.1E-06  
TEEN 4.9E-03 4.9E-03 7.8E-06 4.9E-03 4.9E-03 4.9E-03 4.9E-03 5.1E-06  
CHILD 6.8E-03 6.8E-03 1.4E-05 6.8E-03 6.8E-03 6.8E-03 6.8E-03 5.1E-06  
INFNT 1.6E-03 1.6E-03 7.6E-06 1.6E-03 1.6E-03 1.6E-03 1.6E-03 5.1E-06

INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT  
 FOR DATES 0 4 1 1 THRU 0 63024  
 T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME	PATHWAY, DIST GP= 1, 1507. METERS WINDS TOWARD SSE							
ADULT	1.2E-07	1.2E-07	1.2E-07	1.2E-07	1.2E-07	1.2E-07	1.3E-07	3.4E-07
TEEN	1.2E-07	1.2E-07	1.2E-07	1.2E-07	1.2E-07	1.2E-07	1.3E-07	3.4E-07
CHILD	1.2E-07	1.2E-07	1.2E-07	1.2E-07	1.2E-07	1.2E-07	1.3E-07	3.4E-07
INFNT	1.2E-07	1.2E-07	1.2E-07	1.2E-07	1.2E-07	1.2E-07	1.3E-07	3.4E-07
GROUND	PATHWAY, DIST GP= 1, 1507. METERS WINDS TOWARD SSE							
ADULT	2.5E-06	2.5E-06	2.5E-06	2.5E-06	2.5E-06	2.5E-06	2.5E-06	2.9E-06
TEEN	2.5E-06	2.5E-06	2.5E-06	2.5E-06	2.5E-06	2.5E-06	2.5E-06	2.9E-06
CHILD	2.5E-06	2.5E-06	2.5E-06	2.5E-06	2.5E-06	2.5E-06	2.5E-06	2.9E-06
INFNT	2.5E-06	2.5E-06	2.5E-06	2.5E-06	2.5E-06	2.5E-06	2.5E-06	2.9E-06
VEGET	PATHWAY, DIST GP= 1, 1093. METERS WINDS TOWARD SSE							
ADULT	2.8E-03	2.8E-03	1.9E-06	2.8E-03	2.8E-03	2.8E-03	2.8E-03	0.0E+00
TEEN	3.2E-03	3.2E-03	3.1E-06	3.2E-03	3.2E-03	3.2E-03	3.2E-03	0.0E+00
CHILD	5.0E-03	5.0E-03	7.2E-06	5.0E-03	5.0E-03	5.0E-03	5.0E-03	0.0E+00
INFNT	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
MEAT	PATHWAY, DIST GP= 1, 1093. METERS WINDS TOWARD SSE							
ADULT	4.0E-04	4.0E-04	1.9E-07	4.0E-04	4.0E-04	4.0E-04	4.0E-04	0.0E+00
TEEN	2.4E-04	2.4E-04	1.6E-07	2.4E-04	2.4E-04	2.4E-04	2.4E-04	0.0E+00
CHILD	2.9E-04	2.9E-04	2.9E-07	2.9E-04	2.9E-04	2.9E-04	2.9E-04	0.0E+00
INFNT	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
COW	PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD SSE							
ADULT	1.3E-04	1.3E-04	1.9E-07	1.3E-04	1.3E-04	1.3E-04	1.3E-04	0.0E+00
TEEN	1.6E-04	1.6E-04	3.4E-07	1.6E-04	1.6E-04	1.6E-04	1.6E-04	0.0E+00
CHILD	2.6E-04	2.6E-04	8.2E-07	2.6E-04	2.6E-04	2.6E-04	2.6E-04	0.0E+00
INFNT	3.9E-04	3.9E-04	1.3E-06	3.9E-04	3.9E-04	3.9E-04	3.9E-04	0.0E+00
GOAT	PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD SSE							
ADULT	2.6E-04	2.6E-04	5.7E-07	2.6E-04	2.6E-04	2.6E-04	2.6E-04	0.0E+00
TEEN	3.3E-04	3.3E-04	1.0E-06	3.4E-04	3.3E-04	3.3E-04	3.3E-04	0.0E+00
CHILD	5.2E-04	5.2E-04	2.5E-06	5.3E-04	5.3E-04	5.2E-04	5.2E-04	0.0E+00
INFNT	8.0E-04	8.0E-04	3.9E-06	8.1E-04	8.0E-04	8.0E-04	8.0E-04	0.0E+00
INHAL	PATHWAY, DIST GP= 1, 1507. METERS WINDS TOWARD SSE							
ADULT	9.3E-04	9.3E-04	1.7E-08	9.3E-04	9.3E-04	9.3E-04	9.3E-04	0.0E+00
TEEN	9.4E-04	9.4E-04	2.4E-08	9.4E-04	9.4E-04	9.4E-04	9.4E-04	0.0E+00
CHILD	8.3E-04	8.3E-04	3.2E-08	8.3E-04	8.3E-04	8.3E-04	8.3E-04	0.0E+00
INFNT	4.8E-04	4.8E-04	1.9E-08	4.8E-04	4.8E-04	4.8E-04	4.8E-04	0.0E+00
SUBTOTALS (NO PLUME)								
ADULT	4.5E-03	4.5E-03	5.4E-06	4.5E-03	4.5E-03	4.5E-03	4.5E-03	2.9E-06
TEEN	4.9E-03	4.9E-03	7.1E-06	4.9E-03	4.9E-03	4.9E-03	4.9E-03	2.9E-06
CHILD	6.9E-03	6.9E-03	1.3E-05	6.9E-03	6.9E-03	6.9E-03	6.9E-03	2.9E-06
INFNT	1.7E-03	1.7E-03	7.8E-06	1.7E-03	1.7E-03	1.7E-03	1.7E-03	2.9E-06
TOTALS								
ADULT	4.5E-03	4.5E-03	5.5E-06	4.5E-03	4.5E-03	4.5E-03	4.5E-03	3.3E-06
TEEN	4.9E-03	4.9E-03	7.2E-06	4.9E-03	4.9E-03	4.9E-03	4.9E-03	3.3E-06
CHILD	6.9E-03	6.9E-03	1.3E-05	6.9E-03	6.9E-03	6.9E-03	6.9E-03	3.3E-06
INFNT	1.7E-03	1.7E-03	7.9E-06	1.7E-03	1.7E-03	1.7E-03	1.7E-03	3.3E-06

INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT  
 FOR DATES 0 4 1 1 THRU 0 63024  
 T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME PATHWAY, DIST GP= 1, 1026. METERS WINDS TOWARD S  
 ADULT 2.7E-07 2.7E-07 2.7E-07 2.7E-07 2.7E-07 2.7E-07 2.8E-07 7.5E-07  
 TEEN 2.7E-07 2.7E-07 2.7E-07 2.7E-07 2.7E-07 2.7E-07 2.8E-07 7.5E-07  
 CHILD 2.7E-07 2.7E-07 2.7E-07 2.7E-07 2.7E-07 2.7E-07 2.8E-07 7.5E-07  
 INFNT 2.7E-07 2.7E-07 2.7E-07 2.7E-07 2.7E-07 2.7E-07 2.8E-07 7.5E-07

GROUND PATHWAY, DIST GP= 1, 1026. METERS WINDS TOWARD S  
 ADULT 9.3E-06 9.3E-06 9.3E-06 9.3E-06 9.3E-06 9.3E-06 9.3E-06 1.1E-05  
 TEEN 9.3E-06 9.3E-06 9.3E-06 9.3E-06 9.3E-06 9.3E-06 9.3E-06 1.1E-05  
 CHILD 9.3E-06 9.3E-06 9.3E-06 9.3E-06 9.3E-06 9.3E-06 9.3E-06 1.1E-05  
 INFNT 9.3E-06 9.3E-06 9.3E-06 9.3E-06 9.3E-06 9.3E-06 9.3E-06 1.1E-05

VEGET PATHWAY, DIST GP= 1, 863. METERS WINDS TOWARD S  
 ADULT 3.6E-03 3.6E-03 5.6E-06 3.6E-03 3.6E-03 3.6E-03 3.6E-03 0.0E+00  
 TEEN 4.1E-03 4.1E-03 8.9E-06 4.2E-03 4.1E-03 4.1E-03 4.1E-03 0.0E+00  
 CHILD 6.4E-03 6.4E-03 2.1E-05 6.4E-03 6.4E-03 6.4E-03 6.4E-03 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

MEAT PATHWAY, DIST GP= 1, 6115. METERS WINDS TOWARD S  
 ADULT 2.7E-05 2.7E-05 2.1E-08 2.7E-05 2.7E-05 2.7E-05 2.7E-05 0.0E+00  
 TEEN 1.6E-05 1.6E-05 1.7E-08 1.6E-05 1.6E-05 1.6E-05 1.6E-05 0.0E+00  
 CHILD 1.9E-05 1.9E-05 3.1E-08 1.9E-05 1.9E-05 1.9E-05 1.9E-05 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

COW PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD S  
 ADULT 1.2E-04 1.2E-04 3.7E-07 1.2E-04 1.2E-04 1.2E-04 1.2E-04 0.0E+00  
 TEEN 1.5E-04 1.5E-04 6.7E-07 1.5E-04 1.5E-04 1.5E-04 1.5E-04 0.0E+00  
 CHILD 2.4E-04 2.4E-04 1.6E-06 2.4E-04 2.4E-04 2.4E-04 2.4E-04 0.0E+00  
 INFNT 3.6E-04 3.6E-04 2.6E-06 3.6E-04 3.6E-04 3.6E-04 3.6E-04 0.0E+00

GOAT PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD S  
 ADULT 2.4E-04 2.4E-04 1.1E-06 2.4E-04 2.4E-04 2.4E-04 2.4E-04 0.0E+00  
 TEEN 3.1E-04 3.1E-04 2.0E-06 3.1E-04 3.1E-04 3.1E-04 3.1E-04 0.0E+00  
 CHILD 4.9E-04 4.8E-04 4.9E-06 4.9E-04 4.9E-04 4.8E-04 4.8E-04 0.0E+00  
 INFNT 7.4E-04 7.4E-04 7.8E-06 7.5E-04 7.4E-04 7.4E-04 7.4E-04 0.0E+00

INHAL PATHWAY, DIST GP= 1, 1026. METERS WINDS TOWARD S  
 ADULT 1.5E-03 1.5E-03 3.9E-08 1.5E-03 1.5E-03 1.5E-03 1.5E-03 0.0E+00  
 TEEN 1.5E-03 1.5E-03 5.4E-08 1.5E-03 1.5E-03 1.5E-03 1.5E-03 0.0E+00  
 CHILD 1.4E-03 1.4E-03 7.3E-08 1.4E-03 1.4E-03 1.4E-03 1.4E-03 0.0E+00  
 INFNT 7.9E-04 7.9E-04 4.4E-08 7.9E-04 7.9E-04 7.9E-04 7.9E-04 0.0E+00

SUBTOTALS (NO PLUME)  
 ADULT 5.5E-03 5.5E-03 1.6E-05 5.6E-03 5.5E-03 5.5E-03 5.5E-03 1.1E-05  
 TEEN 6.2E-03 6.2E-03 2.1E-05 6.2E-03 6.2E-03 6.2E-03 6.2E-03 1.1E-05  
 CHILD 8.5E-03 8.5E-03 3.7E-05 8.6E-03 8.5E-03 8.5E-03 8.5E-03 1.1E-05  
 INFNT 1.9E-03 1.9E-03 2.0E-05 1.9E-03 1.9E-03 1.9E-03 1.9E-03 1.1E-05

TOTALS  
 ADULT 5.5E-03 5.5E-03 1.7E-05 5.6E-03 5.5E-03 5.5E-03 5.5E-03 1.2E-05  
 TEEN 6.2E-03 6.2E-03 2.1E-05 6.2E-03 6.2E-03 6.2E-03 6.2E-03 1.2E-05  
 CHILD 8.5E-03 8.5E-03 3.7E-05 8.6E-03 8.5E-03 8.5E-03 8.5E-03 1.2E-05  
 INFNT 1.9E-03 1.9E-03 2.0E-05 1.9E-03 1.9E-03 1.9E-03 1.9E-03 1.2E-05

INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT  
 FOR DATES 0 4 1 1 THRU 0 63024  
 T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME PATHWAY, DIST GP= 1, 942. METERS WINDS TOWARD SSW  
 ADULT 1.6E-07 1.6E-07 1.6E-07 1.6E-07 1.6E-07 1.6E-07 1.6E-07 4.4E-07  
 TEEN 1.6E-07 1.6E-07 1.6E-07 1.6E-07 1.6E-07 1.6E-07 1.6E-07 4.4E-07  
 CHILD 1.6E-07 1.6E-07 1.6E-07 1.6E-07 1.6E-07 1.6E-07 1.6E-07 4.4E-07  
 INFNT 1.6E-07 1.6E-07 1.6E-07 1.6E-07 1.6E-07 1.6E-07 1.6E-07 4.4E-07

GROUND PATHWAY, DIST GP= 1, 942. METERS WINDS TOWARD SSW  
 ADULT 3.3E-06 3.3E-06 3.3E-06 3.3E-06 3.3E-06 3.3E-06 3.3E-06 3.9E-06  
 TEEN 3.3E-06 3.3E-06 3.3E-06 3.3E-06 3.3E-06 3.3E-06 3.3E-06 3.9E-06  
 CHILD 3.3E-06 3.3E-06 3.3E-06 3.3E-06 3.3E-06 3.3E-06 3.3E-06 3.9E-06  
 INFNT 3.3E-06 3.3E-06 3.3E-06 3.3E-06 3.3E-06 3.3E-06 3.3E-06 3.9E-06

VEGET PATHWAY, DIST GP= 1, 770. METERS WINDS TOWARD SSW  
 ADULT 3.0E-03 3.0E-03 2.1E-06 3.0E-03 3.0E-03 3.0E-03 3.0E-03 0.0E+00  
 TEEN 3.5E-03 3.5E-03 3.3E-06 3.5E-03 3.5E-03 3.5E-03 3.5E-03 0.0E+00  
 CHILD 5.3E-03 5.3E-03 7.9E-06 5.3E-03 5.3E-03 5.3E-03 5.3E-03 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

MEAT PATHWAY, DIST GP= 1, 8045. METERS WINDS TOWARD SSW  
 ADULT 1.3E-05 1.3E-05 3.9E-09 1.3E-05 1.3E-05 1.3E-05 1.3E-05 0.0E+00  
 TEEN 7.7E-06 7.7E-06 3.2E-09 7.7E-06 7.7E-06 7.7E-06 7.7E-06 0.0E+00  
 CHILD 9.3E-06 9.3E-06 6.0E-09 9.3E-06 9.3E-06 9.3E-06 9.3E-06 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

COW PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD SSW  
 ADULT 8.2E-05 8.2E-05 1.1E-07 8.2E-05 8.2E-05 8.2E-05 8.2E-05 0.0E+00  
 TEEN 1.1E-04 1.1E-04 2.1E-07 1.1E-04 1.1E-04 1.1E-04 1.1E-04 0.0E+00  
 CHILD 1.7E-04 1.7E-04 5.0E-07 1.7E-04 1.7E-04 1.7E-04 1.7E-04 0.0E+00  
 INFNT 2.6E-04 2.6E-04 8.0E-07 2.6E-04 2.6E-04 2.6E-04 2.6E-04 0.0E+00

GOAT PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD SSW  
 ADULT 1.7E-04 1.7E-04 3.4E-07 1.7E-04 1.7E-04 1.7E-04 1.7E-04 0.0E+00  
 TEEN 2.2E-04 2.2E-04 6.2E-07 2.2E-04 2.2E-04 2.2E-04 2.2E-04 0.0E+00  
 CHILD 3.4E-04 3.4E-04 1.5E-06 3.5E-04 3.4E-04 3.4E-04 3.4E-04 0.0E+00  
 INFNT 5.3E-04 5.3E-04 2.4E-06 5.3E-04 5.3E-04 5.3E-04 5.3E-04 0.0E+00

INHAL PATHWAY, DIST GP= 1, 942. METERS WINDS TOWARD SSW  
 ADULT 1.2E-03 1.2E-03 2.3E-08 1.2E-03 1.2E-03 1.2E-03 1.2E-03 0.0E+00  
 TEEN 1.2E-03 1.2E-03 3.2E-08 1.2E-03 1.2E-03 1.2E-03 1.2E-03 0.0E+00  
 CHILD 1.1E-03 1.1E-03 4.3E-08 1.1E-03 1.1E-03 1.1E-03 1.1E-03 0.0E+00  
 INFNT 6.3E-04 6.3E-04 2.6E-08 6.3E-04 6.3E-04 6.3E-04 6.3E-04 0.0E+00

SUBTOTALS (NO PLUME)  
 ADULT 4.5E-03 4.5E-03 5.9E-06 4.5E-03 4.5E-03 4.5E-03 4.5E-03 3.9E-06  
 TEEN 5.0E-03 5.0E-03 7.5E-06 5.0E-03 5.0E-03 5.0E-03 5.0E-03 3.9E-06  
 CHILD 7.0E-03 7.0E-03 1.3E-05 7.0E-03 7.0E-03 7.0E-03 7.0E-03 3.9E-06  
 INFNT 1.4E-03 1.4E-03 6.5E-06 1.4E-03 1.4E-03 1.4E-03 1.4E-03 3.9E-06

TOTALS  
 ADULT 4.5E-03 4.5E-03 6.0E-06 4.5E-03 4.5E-03 4.5E-03 4.5E-03 4.3E-06  
 TEEN 5.0E-03 5.0E-03 7.7E-06 5.0E-03 5.0E-03 5.0E-03 5.0E-03 4.3E-06  
 CHILD 7.0E-03 7.0E-03 1.3E-05 7.0E-03 7.0E-03 7.0E-03 7.0E-03 4.3E-06  
 INFNT 1.4E-03 1.4E-03 6.7E-06 1.4E-03 1.4E-03 1.4E-03 1.4E-03 4.3E-06

## Summary of Maximum Individual Doses

3<sup>rd</sup> Quarter

Effluent	Applicable Organ	Estimated Dose (mrem)	AGE GROUP	LOCATION DIST DIR (M) (Toward)	% OF APPLICABLE LIMIT	LIMIT (mrem) QTR
Liquid	Total Body	9.76E-04	Child	Receptor 1	6.51E-02	1.5
Liquid	GI-Tract	1.04E-03	Adult	Receptor 1	2.08E-02	5.0
Noble Gas	Air Dose (Gamma-mrad)	2.38E-03		651 (N)	4.76E-02	5.0
Noble Gas	Air Dose (Beta-mrad)	1.04E-03		651 (N)	1.04E-02	10.0
Iodines and Particulates	Liver	2.39E-02	Child	659 (N)	3.19E-01	7.5



LAST LIQUID DOSE ACCUMULATION (MREM)

START DATE 0 7 1 1      END DATE 0 93024

BONE      LIVER      T.BODY      THYRD      KIDNEY      LUNG      GI-LLI      SKIN

WATER

ADULT	3.1E-07	6.5E-04	6.5E-04	6.5E-04	6.5E-04	6.5E-04	7.1E-04	0.0E+00
TEEN	3.0E-07	4.6E-04	4.6E-04	4.6E-04	4.6E-04	4.6E-04	5.0E-04	0.0E+00
CHILD	8.8E-07	8.8E-04	8.9E-04	8.7E-04	8.7E-04	8.7E-04	9.1E-04	0.0E+00
INFANT	9.4E-07	8.7E-04	8.8E-04	8.6E-04	8.6E-04	8.6E-04	8.8E-04	0.0E+00

SHORE

ADULT	2.1E-05	2.1E-05	2.1E-05	2.1E-05	2.1E-05	2.1E-05	2.1E-05	2.4E-05
TEEN	1.1E-04	1.1E-04	1.1E-04	1.1E-04	1.1E-04	1.1E-04	1.1E-04	1.4E-04
CHILD	2.4E-05	2.4E-05	2.4E-05	2.4E-05	2.4E-05	2.4E-05	2.4E-05	2.8E-05
INFANT	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

FW SPT FISH

ADULT	2.7E-05	9.3E-05	9.3E-05	4.4E-05	5.6E-05	4.8E-05	3.1E-04	0.0E+00
TEEN	2.9E-05	8.4E-05	7.3E-05	3.4E-05	4.7E-05	3.9E-05	2.2E-04	0.0E+00
CHILD	3.6E-05	7.3E-05	6.1E-05	2.8E-05	3.9E-05	3.2E-05	9.1E-05	0.0E+00
INFANT	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

TOTAL

ADULT	4.8E-05	7.6E-04	7.7E-04	7.1E-04	7.2E-04	7.2E-04	1.0E-03	2.4E-05
TEEN	1.4E-04	6.6E-04	6.5E-04	6.1E-04	6.2E-04	6.1E-04	8.3E-04	1.4E-04
CHILD	6.1E-05	9.8E-04	9.8E-04	9.3E-04	9.4E-04	9.3E-04	1.0E-03	2.8E-05
INFANT	9.4E-07	8.7E-04	8.8E-04	8.6E-04	8.6E-04	8.6E-04	8.8E-04	0.0E+00

DATES OF LAST AIR DOSE ACCUMULATION ARE FROM 0 7 1 1 0 TO 0 93024 0  
DOSE ACCUMULATION FOR GAMMA MRAD

FOR RELEASE POINT 1

\*\*DIRECTION FROM N

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM NNE

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM NE

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM ENE

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM E

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM ESE

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM SE

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM SSE

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM S

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM SSW

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM SW

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM WSW

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM W

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM WNW

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM NW

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM NNW

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

DISTANCES USED IN CALCULATIONS

594.0	2416.0	4020.0	5630.0	7240.0
12067.0	24135.0	40225.0	56315.0	80500.0

DATES OF LAST AIR DOSE ACCUMULATION ARE FROM 0 7 1 1 0 TO 0 93024 0  
DOSE ACCUMULATION FOR GAMMA MRAD

FOR RELEASE POINT 2

**DIRECTION FROM N				
1.0160E-03	1.2415E-04	5.6480E-05	3.2684E-05	2.2771E-05
1.1288E-05	4.2842E-06	2.1030E-06	1.3366E-06	8.2880E-07
**DIRECTION FROM NNE				
5.9282E-04	6.9855E-05	3.2987E-05	1.9656E-05	1.3756E-05
6.8281E-06	2.6378E-06	1.3007E-06	8.2778E-07	5.1734E-07
**DIRECTION FROM NE				
8.4028E-04	1.0286E-04	5.0062E-05	3.0420E-05	2.1494E-05
1.0862E-05	4.3275E-06	2.1720E-06	1.3986E-06	8.8587E-07
**DIRECTION FROM ENE				
1.5679E-03	1.8558E-04	9.2488E-05	5.7077E-05	4.0642E-05
2.0804E-05	8.4302E-06	4.2466E-06	2.7367E-06	1.7475E-06
**DIRECTION FROM E				
1.5894E-03	1.8153E-04	9.2633E-05	5.8094E-05	4.1565E-05
2.1413E-05	8.7935E-06	4.4539E-06	2.8786E-06	1.8501E-06
**DIRECTION FROM ESE				
1.7297E-03	2.0047E-04	1.0168E-04	6.3492E-05	4.5401E-05
2.3390E-05	9.5874E-06	4.8538E-06	3.1373E-06	2.0151E-
**DIRECTION FROM SE				
1.9508E-03	2.1050E-04	1.0992E-04	6.9807E-05	5.0484E-05
2.6521E-05	1.1069E-05	5.6007E-06	3.6103E-06	2.3413E-06
**DIRECTION FROM SSE				
2.3793E-03	2.5163E-04	1.3192E-04	8.3966E-05	6.0865E-05
3.2107E-05	1.3435E-05	6.7883E-06	4.3696E-06	2.8389E-06
**DIRECTION FROM S				
2.7430E-03	3.0540E-04	1.5497E-04	9.6753E-05	6.9389E-05
3.5957E-05	1.4752E-05	7.4329E-06	4.7841E-06	3.0787E-06
**DIRECTION FROM SSW				
2.2139E-03	2.3160E-04	1.2064E-04	7.6559E-05	5.5360E-05
2.9067E-05	1.2103E-05	6.1026E-06	3.9235E-06	2.5449E-06
**DIRECTION FROM SW				
8.4513E-04	9.1818E-05	4.5732E-05	2.8254E-05	2.0194E-05
1.0416E-05	4.2353E-06	2.1279E-06	1.3681E-06	8.7932E-07
**DIRECTION FROM WSW				
3.7266E-04	3.9930E-05	2.0084E-05	1.2511E-05	8.9515E-06
4.6203E-06	1.8938E-06	9.6059E-07	6.2130E-07	4.0014E-07
**DIRECTION FROM W				
4.5986E-04	5.4421E-05	2.6338E-05	1.5957E-05	1.1285E-05
5.7197E-06	2.2807E-06	1.1464E-06	7.3899E-07	4.6940E-07
**DIRECTION FROM WNW				
2.5095E-04	2.7094E-05	1.3213E-05	8.0790E-06	5.7323E-06
2.9217E-06	1.1802E-06	6.0175E-07	3.9165E-07	2.5162E-07
**DIRECTION FROM NW				
3.4812E-04	4.2807E-05	2.0280E-05	1.2110E-05	8.5088E-06
4.2677E-06	1.6781E-06	8.4389E-07	5.4456E-07	3.4278E-07
**DIRECTION FROM NNW				
5.2258E-04	5.6077E-05	2.7390E-05	1.6762E-05	1.1949E-05
6.1527E-06	2.5020E-06	1.2717E-06	8.2523E-07	5.3120E-07

DISTANCES USED IN CALCULATIONS

594.0 2416.0 4020.0 5630.0 7240.0  
12067.0 24135.0 40225.0 56315.0 80500.0

DATES OF LAST AIR DOSE ACCUMULATION ARE FROM 0 7 1 1 0 TO 0 93024 0  
DOSE ACCUMULATION FOR BETA MRAD

FOR RELEASE POINT 1

**DIRECTION FROM N				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM NNE				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM NE				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM ENE				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM E				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM ESE				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM SE				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM SSE				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM S				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM SSW				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM SW				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM WSW				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM W				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM WNW				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM NW				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM NNW				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

DISTANCES USED IN CALCULATIONS

594.0 2416.0 4020.0 5630.0 7240.0  
12067.0 24135.0 40225.0 56315.0 80500.0

DATES OF LAST AIR DOSE ACCUMULATION ARE FROM 0 7 1 1 0 TO 0 93024 0  
DOSE ACCUMULATION FOR BETA MRAD

FOR RELEASE POINT 2

**DIRECTION FROM N				
4.4635E-04	5.4570E-05	2.4821E-05	1.4361E-05	1.0005E-05
4.9599E-06	1.8822E-06	9.2390E-07	5.8718E-07	3.6409E-07
**DIRECTION FROM NNE				
2.5956E-04	3.0596E-05	1.4449E-05	8.6097E-06	6.0254E-06
2.9910E-06	1.1555E-06	5.6981E-07	3.6265E-07	2.2664E-07
**DIRECTION FROM NE				
3.6681E-04	4.4938E-05	2.1867E-05	1.3286E-05	9.3870E-06
4.7427E-06	1.8892E-06	9.4826E-07	6.1063E-07	3.8673E-07
**DIRECTION FROM ENE				
6.8604E-04	8.1211E-05	4.0464E-05	2.4967E-05	1.7777E-05
9.0996E-06	3.6869E-06	1.8571E-06	1.1968E-06	7.6417E-07
**DIRECTION FROM E				
6.9606E-04	7.9485E-05	4.0558E-05	2.5435E-05	1.8198E-05
9.3749E-06	3.8497E-06	1.9499E-06	1.2602E-06	8.0995E-07
**DIRECTION FROM ESE				
7.6020E-04	8.8062E-05	4.4673E-05	2.7896E-05	1.9948E-05
1.0278E-05	4.2132E-06	2.1330E-06	1.3787E-06	8.8557E-07
**DIRECTION FROM SE				
8.5507E-04	9.2218E-05	4.8162E-05	3.0591E-05	2.2125E-05
1.1624E-05	4.8523E-06	2.4550E-06	1.5825E-06	1.0263E-06
**DIRECTION FROM SSE				
1.0372E-03	1.0969E-04	5.7507E-05	3.6603E-05	2.6533E-05
1.3996E-05	5.8569E-06	2.9593E-06	1.9049E-06	1.2376E-06
**DIRECTION FROM S				
1.1980E-03	1.3334E-04	6.7668E-05	4.2252E-05	3.0304E-05
1.5704E-05	6.4438E-06	3.2467E-06	2.0896E-06	1.3448E-06
**DIRECTION FROM SSW				
9.7422E-04	1.0188E-04	5.3083E-05	3.3691E-05	2.4364E-05
1.2793E-05	5.3273E-06	2.6863E-06	1.7271E-06	1.1203E-06
**DIRECTION FROM SW				
3.6842E-04	4.0052E-05	1.9943E-05	1.2318E-05	8.8033E-06
4.5397E-06	1.8455E-06	9.2719E-07	5.9615E-07	3.8311E-07
**DIRECTION FROM WSW				
1.6234E-04	1.7392E-05	8.7466E-06	5.4482E-06	3.8981E-06
2.0119E-06	8.2460E-07	4.1831E-07	2.7058E-07	1.7426E-07
**DIRECTION FROM W				
2.0152E-04	2.3884E-05	1.1553E-05	6.9961E-06	4.9470E-06
2.5066E-06	9.9910E-07	5.0219E-07	3.2372E-07	2.0559E-07
**DIRECTION FROM WNW				
1.1026E-04	1.1903E-05	5.8018E-06	3.5461E-06	2.5160E-06
1.2824E-06	5.1783E-07	2.6393E-07	1.7174E-07	1.1032E-07
**DIRECTION FROM NW				
1.5358E-04	1.8884E-05	8.9481E-06	5.3438E-06	3.7548E-06
1.8833E-06	7.4060E-07	3.7245E-07	2.4035E-07	1.5130E-07
**DIRECTION FROM NNW				
2.2855E-04	2.4496E-05	1.1964E-05	7.3219E-06	5.2201E-06
2.6885E-06	1.0935E-06	5.5579E-07	3.6068E-07	2.3220E-07

DISTANCES USED IN CALCULATIONS

594.0 2416.0 4020.0 5630.0 7240.0  
12067.0 24135.0 40225.0 56315.0 80500.0

INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT  
 FOR DATES 0 7 1 1 THRU 0 93024  
 T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME PATHWAY, DIST GP= 1, 659. METERS WINDS TOWARD N  
 ADULT 1.4E-03 1.4E-03 1.4E-03 1.4E-03 1.4E-03 1.4E-03 1.4E-03 2.3E-03  
 TEEN 1.4E-03 1.4E-03 1.4E-03 1.4E-03 1.4E-03 1.4E-03 1.4E-03 2.3E-03  
 CHILD 1.4E-03 1.4E-03 1.4E-03 1.4E-03 1.4E-03 1.4E-03 1.4E-03 2.3E-03  
 INFNT 1.4E-03 1.4E-03 1.4E-03 1.4E-03 1.4E-03 1.4E-03 1.4E-03 2.3E-03

GROUND PATHWAY, DIST GP= 1, 659. METERS WINDS TOWARD N  
 ADULT 2.9E-04 2.9E-04 2.9E-04 2.9E-04 2.9E-04 2.9E-04 2.9E-04 3.4E-04  
 TEEN 2.9E-04 2.9E-04 2.9E-04 2.9E-04 2.9E-04 2.9E-04 2.9E-04 3.4E-04  
 CHILD 2.9E-04 2.9E-04 2.9E-04 2.9E-04 2.9E-04 2.9E-04 2.9E-04 3.4E-04  
 INFNT 2.9E-04 2.9E-04 2.9E-04 2.9E-04 2.9E-04 2.9E-04 2.9E-04 3.4E-04

VEGET PATHWAY, DIST GP= 1, 8045. METERS WINDS TOWARD N  
 ADULT 4.4E-04 4.3E-04 2.7E-06 4.4E-04 4.4E-04 4.3E-04 4.3E-04 0.0E+00  
 TEEN 5.0E-04 5.0E-04 4.3E-06 5.0E-04 5.0E-04 5.0E-04 5.0E-04 0.0E+00  
 CHILD 7.7E-04 7.7E-04 1.0E-05 7.8E-04 7.7E-04 7.7E-04 7.7E-04 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

MEAT PATHWAY, DIST GP= 1, 8045. METERS WINDS TOWARD N  
 ADULT 6.3E-05 6.2E-05 2.7E-07 6.3E-05 6.3E-05 6.2E-05 6.2E-05 0.0E+00  
 TEEN 3.7E-05 3.7E-05 2.2E-07 3.7E-05 3.7E-05 3.7E-05 3.7E-05 0.0E+00  
 CHILD 4.5E-05 4.5E-05 4.1E-07 4.5E-05 4.5E-05 4.5E-05 4.5E-05 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

COW PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD N  
 ADULT 3.7E-04 3.7E-04 7.9E-06 3.8E-04 3.7E-04 3.7E-04 3.7E-04 0.0E+00  
 TEEN 4.9E-04 4.8E-04 1.4E-05 5.0E-04 4.9E-04 4.8E-04 4.8E-04 0.0E+00  
 CHILD 7.6E-04 7.6E-04 3.4E-05 7.9E-04 7.7E-04 7.6E-04 7.6E-04 0.0E+00  
 INFNT 1.2E-03 1.1E-03 5.5E-05 1.2E-03 1.2E-03 1.1E-03 1.2E-03 0.0E+00

GOAT PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD N  
 ADULT 7.7E-04 7.5E-04 2.4E-05 7.8E-04 7.6E-04 7.5E-04 7.5E-04 0.0E+00  
 TEEN 1.0E-03 9.8E-04 4.3E-05 1.0E-03 1.0E-03 9.8E-04 9.8E-04 0.0E+00  
 CHILD 1.6E-03 1.5E-03 1.0E-04 1.6E-03 1.6E-03 1.5E-03 1.5E-03 0.0E+00  
 INFNT 2.4E-03 2.3E-03 1.6E-04 2.5E-03 2.4E-03 2.3E-03 2.4E-03 0.0E+00

INHAL PATHWAY, DIST GP= 1, 659. METERS WINDS TOWARD N  
 ADULT 9.2E-03 9.2E-03 4.0E-06 9.2E-03 9.2E-03 9.2E-03 9.2E-03 0.0E+00  
 TEEN 9.3E-03 9.3E-03 5.6E-06 9.3E-03 9.3E-03 9.3E-03 9.3E-03 0.0E+00  
 CHILD 8.2E-03 8.2E-03 7.6E-06 8.2E-03 8.2E-03 8.2E-03 8.2E-03 0.0E+00  
 INFNT 4.7E-03 4.7E-03 4.6E-06 4.7E-03 4.7E-03 4.7E-03 4.7E-03 0.0E+00

SUBTOTALS (NO PLUME)  
 ADULT 1.1E-02 1.1E-02 3.3E-04 1.1E-02 1.1E-02 1.1E-02 1.1E-02 3.4E-04  
 TEEN 1.2E-02 1.2E-02 3.6E-04 1.2E-02 1.2E-02 1.2E-02 1.2E-02 3.4E-04  
 CHILD 1.2E-02 1.2E-02 4.5E-04 1.2E-02 1.2E-02 1.2E-02 1.2E-02 3.4E-04  
 INFNT 8.5E-03 8.5E-03 5.1E-04 8.8E-03 8.6E-03 8.5E-03 8.5E-03 3.4E-04

TOTALS  
 ADULT 1.3E-02 1.3E-02 1.7E-03 1.3E-02 1.3E-02 1.3E-02 1.3E-02 2.7E-03  
 TEEN 1.3E-02 1.3E-02 1.8E-03 1.3E-02 1.3E-02 1.3E-02 1.3E-02 2.7E-03  
 CHILD 1.3E-02 1.3E-02 1.9E-03 1.3E-02 1.3E-02 1.3E-02 1.3E-02 2.7E-03  
 INFNT 9.9E-03 9.9E-03 1.9E-03 1.0E-02 1.0E-02 9.9E-03 9.9E-03 2.7E-03

INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT  
 FOR DATES 0 7 1 1 THRU 0 93024  
 T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME PATHWAY, DIST GP= 1, 660. METERS WINDS TOWARD NNE  
 ADULT 1.1E-03 1.1E-03 1.1E-03 1.1E-03 1.1E-03 1.1E-03 1.1E-03 1.1E-03 1.8E-03  
 TEEN 1.1E-03 1.1E-03 1.1E-03 1.1E-03 1.1E-03 1.1E-03 1.1E-03 1.1E-03 1.8E-03  
 CHILD 1.1E-03 1.1E-03 1.1E-03 1.1E-03 1.1E-03 1.1E-03 1.1E-03 1.1E-03 1.8E-03  
 INFNT 1.1E-03 1.1E-03 1.1E-03 1.1E-03 1.1E-03 1.1E-03 1.1E-03 1.1E-03 1.8E-03

GROUND PATHWAY, DIST GP= 1, 660. METERS WINDS TOWARD NNE  
 ADULT 1.1E-04 1.1E-04 1.1E-04 1.1E-04 1.1E-04 1.1E-04 1.1E-04 1.1E-04 1.3E-04  
 TEEN 1.1E-04 1.1E-04 1.1E-04 1.1E-04 1.1E-04 1.1E-04 1.1E-04 1.1E-04 1.3E-04  
 CHILD 1.1E-04 1.1E-04 1.1E-04 1.1E-04 1.1E-04 1.1E-04 1.1E-04 1.1E-04 1.3E-04  
 INFNT 1.1E-04 1.1E-04 1.1E-04 1.1E-04 1.1E-04 1.1E-04 1.1E-04 1.1E-04 1.3E-04

VEGET PATHWAY, DIST GP= 1, 814. METERS WINDS TOWARD NNE  
 ADULT 7.6E-03 7.6E-03 4.9E-05 7.6E-03 7.6E-03 7.6E-03 7.6E-03 7.6E-03 0.0E+00  
 TEEN 8.7E-03 8.7E-03 7.7E-05 8.8E-03 8.7E-03 8.7E-03 8.7E-03 8.7E-03 0.0E+00  
 CHILD 1.3E-02 1.3E-02 1.8E-04 1.4E-02 1.3E-02 1.3E-02 1.3E-02 1.3E-02 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

MEAT PATHWAY, DIST GP= 1, 7725. METERS WINDS TOWARD NNE  
 ADULT 4.2E-05 4.1E-05 1.1E-07 4.2E-05 4.2E-05 4.1E-05 4.1E-05 4.1E-05 0.0E+00  
 TEEN 2.5E-05 2.5E-05 8.9E-08 2.5E-05 2.5E-05 2.5E-05 2.5E-05 2.5E-05 0.0E+00  
 CHILD 3.0E-05 3.0E-05 1.6E-07 3.0E-05 3.0E-05 3.0E-05 3.0E-05 3.0E-05 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

COW PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD NNE  
 ADULT 2.3E-04 2.3E-04 2.9E-06 2.3E-04 2.3E-04 2.3E-04 2.3E-04 2.3E-04 0.0E+00  
 TEEN 3.0E-04 3.0E-04 5.3E-06 3.0E-04 3.0E-04 2.9E-04 3.0E-04 3.0E-04 0.0E+00  
 CHILD 4.7E-04 4.7E-04 1.3E-05 4.8E-04 4.7E-04 4.7E-04 4.7E-04 4.7E-04 0.0E+00  
 INFNT 7.1E-04 7.1E-04 2.0E-05 7.3E-04 7.1E-04 7.1E-04 7.1E-04 7.1E-04 0.0E+00

GOAT PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD NNE  
 ADULT 4.7E-04 4.6E-04 8.8E-06 4.7E-04 4.7E-04 4.6E-04 4.6E-04 4.6E-04 0.0E+00  
 TEEN 6.1E-04 6.0E-04 1.6E-05 6.2E-04 6.1E-04 6.0E-04 6.0E-04 6.0E-04 0.0E+00  
 CHILD 9.5E-04 9.5E-04 3.8E-05 9.8E-04 9.6E-04 9.5E-04 9.5E-04 9.5E-04 0.0E+00  
 INFNT 1.5E-03 1.4E-03 6.1E-05 1.5E-03 1.5E-03 1.4E-03 1.5E-03 1.5E-03 0.0E+00

INHAL PATHWAY, DIST GP= 1, 660. METERS WINDS TOWARD NNE  
 ADULT 5.9E-03 5.9E-03 1.9E-06 5.9E-03 5.9E-03 5.9E-03 5.9E-03 5.9E-03 0.0E+00  
 TEEN 5.9E-03 5.9E-03 2.6E-06 5.9E-03 5.9E-03 5.9E-03 5.9E-03 5.9E-03 0.0E+00  
 CHILD 5.2E-03 5.2E-03 3.5E-06 5.2E-03 5.2E-03 5.2E-03 5.2E-03 5.2E-03 0.0E+00  
 INFNT 3.0E-03 3.0E-03 2.1E-06 3.0E-03 3.0E-03 3.0E-03 3.0E-03 3.0E-03 0.0E+00

SUBTOTALS (NO PLUME)  
 ADULT 1.4E-02 1.4E-02 1.7E-04 1.4E-02 1.4E-02 1.4E-02 1.4E-02 1.4E-02 1.3E-04  
 TEEN 1.6E-02 1.6E-02 2.1E-04 1.6E-02 1.6E-02 1.6E-02 1.6E-02 1.6E-02 1.3E-04  
 CHILD 2.0E-02 2.0E-02 3.5E-04 2.0E-02 2.0E-02 2.0E-02 2.0E-02 2.0E-02 1.3E-04  
 INFNT 5.3E-03 5.3E-03 1.9E-04 5.4E-03 5.3E-03 5.3E-03 5.3E-03 5.3E-03 1.3E-04

TOTALS  
 ADULT 1.5E-02 1.5E-02 1.3E-03 1.5E-02 1.5E-02 1.5E-02 1.5E-02 1.5E-02 1.9E-03  
 TEEN 1.7E-02 1.7E-02 1.3E-03 1.7E-02 1.7E-02 1.7E-02 1.7E-02 1.7E-02 1.9E-03  
 CHILD 2.1E-02 2.1E-02 1.4E-03 2.2E-02 2.1E-02 2.1E-02 2.1E-02 2.1E-02 1.9E-03  
 INFNT 6.4E-03 6.4E-03 1.3E-03 6.5E-03 6.4E-03 6.4E-03 6.4E-03 6.4E-03 1.9E-03

INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT

FOR DATES 0 7 1 1 THRU 0 93024

T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME PATHWAY, DIST GP= 1, 943. METERS WINDS TOWARD NE  
 ADULT 2.3E-04 2.3E-04 2.3E-04 2.3E-04 2.3E-04 2.3E-04 2.3E-04 3.8E-04  
 TEEN 2.3E-04 2.3E-04 2.3E-04 2.3E-04 2.3E-04 2.3E-04 2.3E-04 3.8E-04  
 CHILD 2.3E-04 2.3E-04 2.3E-04 2.3E-04 2.3E-04 2.3E-04 2.3E-04 3.8E-04  
 INFNT 2.3E-04 2.3E-04 2.3E-04 2.3E-04 2.3E-04 2.3E-04 2.3E-04 3.8E-04

GROUND PATHWAY, DIST GP= 1, 943. METERS WINDS TOWARD NE  
 ADULT 4.8E-05 4.8E-05 4.8E-05 4.8E-05 4.8E-05 4.8E-05 4.8E-05 5.6E-05  
 TEEN 4.8E-05 4.8E-05 4.8E-05 4.8E-05 4.8E-05 4.8E-05 4.8E-05 5.6E-05  
 CHILD 4.8E-05 4.8E-05 4.8E-05 4.8E-05 4.8E-05 4.8E-05 4.8E-05 5.6E-05  
 INFNT 4.8E-05 4.8E-05 4.8E-05 4.8E-05 4.8E-05 4.8E-05 4.8E-05 5.6E-05

VEGET PATHWAY, DIST GP= 1, 1052. METERS WINDS TOWARD NE  
 ADULT 2.6E-03 2.6E-03 2.6E-05 2.6E-03 2.6E-03 2.6E-03 2.6E-03 0.0E+00  
 TEEN 2.9E-03 2.9E-03 4.1E-05 3.0E-03 2.9E-03 2.9E-03 2.9E-03 0.0E+00  
 CHILD 4.5E-03 4.5E-03 9.6E-05 4.6E-03 4.6E-03 4.5E-03 4.5E-03 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

MEAT PATHWAY, DIST GP= 1, 7725. METERS WINDS TOWARD NE  
 ADULT 2.0E-05 2.0E-05 8.7E-08 2.0E-05 2.0E-05 2.0E-05 2.0E-05 0.0E+00  
 TEEN 1.2E-05 1.2E-05 7.2E-08 1.2E-05 1.2E-05 1.2E-05 1.2E-05 0.0E+00  
 CHILD 1.5E-05 1.5E-05 1.3E-07 1.5E-05 1.5E-05 1.5E-05 1.5E-05 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

COW PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD NE  
 ADULT 1.2E-04 1.1E-04 2.4E-06 1.2E-04 1.1E-04 1.1E-04 1.1E-04 0.0E+00  
 TEEN 1.5E-04 1.5E-04 4.3E-06 1.5E-04 1.5E-04 1.5E-04 1.5E-04 0.0E+00  
 CHILD 2.3E-04 2.3E-04 1.0E-05 2.4E-04 2.4E-04 2.3E-04 2.3E-04 0.0E+00  
 INFNT 3.5E-04 3.5E-04 1.6E-05 3.7E-04 3.6E-04 3.5E-04 3.5E-04 0.0E+00

GOAT PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD NE  
 ADULT 2.4E-04 2.3E-04 7.1E-06 2.4E-04 2.3E-04 2.3E-04 2.3E-04 0.0E+00  
 TEEN 3.1E-04 3.0E-04 1.3E-05 3.2E-04 3.1E-04 3.0E-04 3.0E-04 0.0E+00  
 CHILD 4.8E-04 4.7E-04 3.1E-05 5.0E-04 4.8E-04 4.7E-04 4.8E-04 0.0E+00  
 INFNT 7.3E-04 7.2E-04 4.9E-05 7.8E-04 7.4E-04 7.2E-04 7.3E-04 0.0E+00

INHAL PATHWAY, DIST GP= 1, 943. METERS WINDS TOWARD NE  
 ADULT 1.7E-03 1.7E-03 8.2E-07 1.7E-03 1.7E-03 1.7E-03 1.7E-03 0.0E+00  
 TEEN 1.7E-03 1.7E-03 1.1E-06 1.7E-03 1.7E-03 1.7E-03 1.7E-03 0.0E+00  
 CHILD 1.5E-03 1.5E-03 1.5E-06 1.5E-03 1.5E-03 1.5E-03 1.5E-03 0.0E+00  
 INFNT 8.6E-04 8.6E-04 9.3E-07 8.6E-04 8.6E-04 8.6E-04 8.6E-04 0.0E+00

SUBTOTALS (NO PLUME)

ADULT 4.7E-03 4.7E-03 8.4E-05 4.7E-03 4.7E-03 4.7E-03 4.7E-03 5.6E-05  
 TEEN 5.2E-03 5.1E-03 1.1E-04 5.2E-03 5.2E-03 5.1E-03 5.1E-03 5.6E-05  
 CHILD 6.8E-03 6.8E-03 1.9E-04 6.9E-03 6.8E-03 6.8E-03 6.8E-03 5.6E-05  
 INFNT 2.0E-03 2.0E-03 1.2E-04 2.1E-03 2.0E-03 2.0E-03 2.0E-03 5.6E-05

TOTALS

ADULT 4.9E-03 4.9E-03 3.2E-04 4.9E-03 4.9E-03 4.9E-03 4.9E-03 4.4E-04  
 TEEN 5.4E-03 5.4E-03 3.4E-04 5.4E-03 5.4E-03 5.4E-03 5.4E-03 4.4E-04  
 CHILD 7.0E-03 7.0E-03 4.2E-04 7.2E-03 7.1E-03 7.0E-03 7.0E-03 4.4E-04  
 INFNT 2.2E-03 2.2E-03 3.5E-04 2.3E-03 2.2E-03 2.2E-03 2.2E-03 4.4E-04



INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT  
 FOR DATES 0 7 1 1 THRU 0 93024  
 T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME PATHWAY, DIST GP= 1, 1747. METERS WINDS TOWARD ENE  
 ADULT 3.2E-05 3.2E-05 3.2E-05 3.2E-05 3.2E-05 3.2E-05 3.2E-05 5.3E-05  
 TEEN 3.2E-05 3.2E-05 3.2E-05 3.2E-05 3.2E-05 3.2E-05 3.2E-05 5.3E-05  
 CHILD 3.2E-05 3.2E-05 3.2E-05 3.2E-05 3.2E-05 3.2E-05 3.2E-05 5.3E-05  
 INFNT 3.2E-05 3.2E-05 3.2E-05 3.2E-05 3.2E-05 3.2E-05 3.2E-05 5.3E-05

GROUND PATHWAY, DIST GP= 1, 1747. METERS WINDS TOWARD ENE  
 ADULT 6.9E-06 6.9E-06 6.9E-06 6.9E-06 6.9E-06 6.9E-06 6.9E-06 8.0E-06  
 TEEN 6.9E-06 6.9E-06 6.9E-06 6.9E-06 6.9E-06 6.9E-06 6.9E-06 8.0E-06  
 CHILD 6.9E-06 6.9E-06 6.9E-06 6.9E-06 6.9E-06 6.9E-06 6.9E-06 8.0E-06  
 INFNT 6.9E-06 6.9E-06 6.9E-06 6.9E-06 6.9E-06 6.9E-06 6.9E-06 8.0E-06

VEGET PATHWAY, DIST GP= 1, 1852. METERS WINDS TOWARD ENE  
 ADULT 4.3E-04 4.3E-04 4.0E-06 4.3E-04 4.3E-04 4.3E-04 4.3E-04 0.0E+00  
 TEEN 4.9E-04 4.9E-04 6.3E-06 5.0E-04 4.9E-04 4.9E-04 4.9E-04 0.0E+00  
 CHILD 7.6E-04 7.6E-04 1.5E-05 7.7E-04 7.6E-04 7.6E-04 7.6E-04 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

MEAT PATHWAY, DIST GP= 1, 3862. METERS WINDS TOWARD ENE  
 ADULT 2.2E-05 2.2E-05 1.2E-07 2.2E-05 2.2E-05 2.2E-05 2.2E-05 0.0E+00  
 TEEN 1.3E-05 1.3E-05 1.0E-07 1.3E-05 1.3E-05 1.3E-05 1.3E-05 0.0E+00  
 CHILD 1.6E-05 1.6E-05 1.9E-07 1.6E-05 1.6E-05 1.6E-05 1.6E-05 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

COW PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD ENE  
 ADULT 4.8E-05 4.7E-05 9.4E-07 4.8E-05 4.7E-05 4.7E-05 4.7E-05 0.0E+00  
 TEEN 6.2E-05 6.1E-05 1.7E-06 6.4E-05 6.2E-05 6.1E-05 6.2E-05 0.0E+00  
 CHILD 9.7E-05 9.7E-05 4.1E-06 1.0E-04 9.8E-05 9.7E-05 9.7E-05 0.0E+00  
 INFNT 1.5E-04 1.5E-04 6.5E-06 1.5E-04 1.5E-04 1.5E-04 1.5E-04 0.0E+00

GOAT PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD ENE  
 ADULT 9.8E-05 9.6E-05 2.8E-06 1.0E-04 9.7E-05 9.6E-05 9.6E-05 0.0E+00  
 TEEN 1.3E-04 1.3E-04 5.1E-06 1.3E-04 1.3E-04 1.2E-04 1.3E-04 0.0E+00  
 CHILD 2.0E-04 2.0E-04 1.2E-05 2.1E-04 2.0E-04 2.0E-04 2.0E-04 0.0E+00  
 INFNT 3.0E-04 3.0E-04 2.0E-05 3.2E-04 3.1E-04 3.0E-04 3.0E-04 0.0E+00

INHAL PATHWAY, DIST GP= 1, 1747. METERS WINDS TOWARD ENE  
 ADULT 2.6E-04 2.6E-04 6.7E-08 2.6E-04 2.6E-04 2.6E-04 2.6E-04 0.0E+00  
 TEEN 2.6E-04 2.6E-04 9.4E-08 2.6E-04 2.6E-04 2.6E-04 2.6E-04 0.0E+00  
 CHILD 2.3E-04 2.3E-04 1.3E-07 2.3E-04 2.3E-04 2.3E-04 2.3E-04 0.0E+00  
 INFNT 1.3E-04 1.3E-04 7.6E-08 1.3E-04 1.3E-04 1.3E-04 1.3E-04 0.0E+00

SUBTOTALS (NO PLUME)  
 ADULT 8.6E-04 8.6E-04 1.5E-05 8.7E-04 8.6E-04 8.6E-04 8.6E-04 8.0E-06  
 TEEN 9.6E-04 9.6E-04 2.0E-05 9.7E-04 9.6E-04 9.6E-04 9.6E-04 8.0E-06  
 CHILD 1.3E-03 1.3E-03 3.8E-05 1.3E-03 1.3E-03 1.3E-03 1.3E-03 8.0E-06  
 INFNT 5.9E-04 5.9E-04 3.3E-05 6.2E-04 5.9E-04 5.9E-04 5.9E-04 8.0E-06

TOTALS  
 ADULT 9.0E-04 8.9E-04 4.7E-05 9.0E-04 8.9E-04 8.9E-04 8.9E-04 6.1E-05  
 TEEN 9.9E-04 9.9E-04 5.2E-05 1.0E-03 9.9E-04 9.9E-04 9.9E-04 6.1E-05  
 CHILD 1.3E-03 1.3E-03 7.0E-05 1.4E-03 1.3E-03 1.3E-03 1.3E-03 6.1E-05  
 INFNT 6.2E-04 6.2E-04 6.5E-05 6.5E-04 6.3E-04 6.2E-04 6.2E-04 6.1E-05

INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT  
 FOR DATES 0 7 1 1 THRU 0 93024  
 T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME	PATHWAY, DIST GP= 1, 1716. METERS WINDS TOWARD E							
ADULT	4.9E-05	4.9E-05	4.9E-05	4.9E-05	4.9E-05	4.9E-05	4.9E-05	8.1E-05
TEEN	4.9E-05	4.9E-05	4.9E-05	4.9E-05	4.9E-05	4.9E-05	4.9E-05	8.1E-05
CHILD	4.9E-05	4.9E-05	4.9E-05	4.9E-05	4.9E-05	4.9E-05	4.9E-05	8.1E-05
INFNT	4.9E-05	4.9E-05	4.9E-05	4.9E-05	4.9E-05	4.9E-05	4.9E-05	8.1E-05
GROUND	PATHWAY, DIST GP= 1, 1716. METERS WINDS TOWARD E							
ADULT	5.7E-06	5.7E-06	5.7E-06	5.7E-06	5.7E-06	5.7E-06	5.7E-06	6.7E-06
TEEN	5.7E-06	5.7E-06	5.7E-06	5.7E-06	5.7E-06	5.7E-06	5.7E-06	6.7E-06
CHILD	5.7E-06	5.7E-06	5.7E-06	5.7E-06	5.7E-06	5.7E-06	5.7E-06	6.7E-06
INFNT	5.7E-06	5.7E-06	5.7E-06	5.7E-06	5.7E-06	5.7E-06	5.7E-06	6.7E-06
VEGET	PATHWAY, DIST GP= 1, 1705. METERS WINDS TOWARD E							
ADULT	5.6E-04	5.6E-04	3.7E-06	5.6E-04	5.6E-04	5.6E-04	5.6E-04	0.0E+00
TEEN	6.4E-04	6.4E-04	5.9E-06	6.4E-04	6.4E-04	6.4E-04	6.4E-04	0.0E+00
CHILD	9.8E-04	9.8E-04	1.4E-05	1.0E-03	9.9E-04	9.8E-04	9.8E-04	0.0E+00
INFNT	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
MEAT	PATHWAY, DIST GP= 1, 6810. METERS WINDS TOWARD E							
ADULT	1.1E-05	1.1E-05	3.5E-08	1.1E-05	1.1E-05	1.1E-05	1.1E-05	0.0E+00
TEEN	6.5E-06	6.5E-06	2.9E-08	6.5E-06	6.5E-06	6.5E-06	6.5E-06	0.0E+00
CHILD	7.8E-06	7.8E-06	5.3E-08	7.9E-06	7.8E-06	7.8E-06	7.8E-06	0.0E+00
INFNT	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
COW	PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD E							
ADULT	5.3E-05	5.3E-05	7.6E-07	5.4E-05	5.3E-05	5.3E-05	5.3E-05	0.0E+00
TEEN	6.9E-05	6.8E-05	1.4E-06	7.0E-05	6.9E-05	6.8E-05	6.9E-05	0.0E+00
CHILD	1.1E-04	1.1E-04	3.3E-06	1.1E-04	1.1E-04	1.1E-04	1.1E-04	0.0E+00
INFNT	1.6E-04	1.6E-04	5.3E-06	1.7E-04	1.7E-04	1.6E-04	1.6E-04	0.0E+00
GOAT	PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD E							
ADULT	1.1E-04	1.1E-04	2.3E-06	1.1E-04	1.1E-04	1.1E-04	1.1E-04	0.0E+00
TEEN	1.4E-04	1.4E-04	4.1E-06	1.5E-04	1.4E-04	1.4E-04	1.4E-04	0.0E+00
CHILD	2.2E-04	2.2E-04	1.0E-05	2.3E-04	2.2E-04	2.2E-04	2.2E-04	0.0E+00
INFNT	3.4E-04	3.4E-04	1.6E-05	3.5E-04	3.4E-04	3.4E-04	3.4E-04	0.0E+00
INHAL	PATHWAY, DIST GP= 1, 1716. METERS WINDS TOWARD E							
ADULT	3.0E-04	3.0E-04	3.4E-08	3.0E-04	3.0E-04	3.0E-04	3.0E-04	0.0E+00
TEEN	3.1E-04	3.1E-04	4.8E-08	3.1E-04	3.1E-04	3.1E-04	3.1E-04	0.0E+00
CHILD	2.7E-04	2.7E-04	6.4E-08	2.7E-04	2.7E-04	2.7E-04	2.7E-04	0.0E+00
INFNT	1.6E-04	1.6E-04	3.9E-08	1.6E-04	1.6E-04	1.6E-04	1.6E-04	0.0E+00
SUBTOTALS (NO PLUME)								
ADULT	1.0E-03	1.0E-03	1.3E-05	1.0E-03	1.0E-03	1.0E-03	1.0E-03	6.7E-06
TEEN	1.2E-03	1.2E-03	1.7E-05	1.2E-03	1.2E-03	1.2E-03	1.2E-03	6.7E-06
CHILD	1.6E-03	1.6E-03	3.3E-05	1.6E-03	1.6E-03	1.6E-03	1.6E-03	6.7E-06
INFNT	6.6E-04	6.6E-04	2.7E-05	6.9E-04	6.7E-04	6.6E-04	6.6E-04	6.7E-06
TOTALS								
ADULT	1.1E-03	1.1E-03	6.1E-05	1.1E-03	1.1E-03	1.1E-03	1.1E-03	8.7E-05
TEEN	1.2E-03	1.2E-03	6.6E-05	1.2E-03	1.2E-03	1.2E-03	1.2E-03	8.7E-05
CHILD	1.6E-03	1.6E-03	8.2E-05	1.7E-03	1.7E-03	1.6E-03	1.6E-03	8.7E-05
INFNT	7.1E-04	7.1E-04	7.6E-05	7.4E-04	7.2E-04	7.1E-04	7.1E-04	8.7E-05

INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT  
 FOR DATES 0 7 1 1 THRU 0 93024  
 T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME PATHWAY, DIST GP= 1, 1643. METERS WINDS TOWARD ESE  
 ADULT 2.7E-05 2.7E-05 2.7E-05 2.7E-05 2.7E-05 2.7E-05 2.7E-05 4.4E-05  
 TEEN 2.7E-05 2.7E-05 2.7E-05 2.7E-05 2.7E-05 2.7E-05 2.7E-05 4.4E-05  
 CHILD 2.7E-05 2.7E-05 2.7E-05 2.7E-05 2.7E-05 2.7E-05 2.7E-05 4.4E-05  
 INFNT 2.7E-05 2.7E-05 2.7E-05 2.7E-05 2.7E-05 2.7E-05 2.7E-05 4.4E-05

GROUND PATHWAY, DIST GP= 1, 1643. METERS WINDS TOWARD ESE  
 ADULT 5.1E-06 5.1E-06 5.1E-06 5.1E-06 5.1E-06 5.1E-06 5.1E-06 6.0E-06  
 TEEN 5.1E-06 5.1E-06 5.1E-06 5.1E-06 5.1E-06 5.1E-06 5.1E-06 6.0E-06  
 CHILD 5.1E-06 5.1E-06 5.1E-06 5.1E-06 5.1E-06 5.1E-06 5.1E-06 6.0E-06  
 INFNT 5.1E-06 5.1E-06 5.1E-06 5.1E-06 5.1E-06 5.1E-06 5.1E-06 6.0E-06

VEGET PATHWAY, DIST GP= 1, 1628. METERS WINDS TOWARD ESE  
 ADULT 2.9E-04 2.9E-04 3.3E-06 2.9E-04 2.9E-04 2.9E-04 2.9E-04 0.0E+00  
 TEEN 3.3E-04 3.3E-04 5.2E-06 3.4E-04 3.3E-04 3.3E-04 3.3E-04 0.0E+00  
 CHILD 5.1E-04 5.1E-04 1.2E-05 5.2E-04 5.2E-04 5.1E-04 5.1E-04 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

MEAT PATHWAY, DIST GP= 1, 2434. METERS WINDS TOWARD ESE  
 ADULT 2.2E-05 2.2E-05 1.7E-07 2.2E-05 2.2E-05 2.2E-05 2.2E-05 0.0E+00  
 TEEN 1.3E-05 1.3E-05 1.4E-07 1.3E-05 1.3E-05 1.3E-05 1.3E-05 0.0E+00  
 CHILD 1.6E-05 1.6E-05 2.6E-07 1.6E-05 1.6E-05 1.6E-05 1.6E-05 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

COW PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD ESE  
 ADULT 2.6E-05 2.5E-05 6.3E-07 2.6E-05 2.6E-05 2.5E-05 2.5E-05 0.0E+00  
 TEEN 3.4E-05 3.3E-05 1.1E-06 3.5E-05 3.4E-05 3.3E-05 3.3E-05 0.0E+00  
 CHILD 5.3E-05 5.2E-05 2.7E-06 5.5E-05 5.3E-05 5.2E-05 5.3E-05 0.0E+00  
 INFNT 8.0E-05 7.9E-05 4.4E-06 8.4E-05 8.1E-05 7.9E-05 8.0E-05 0.0E+00

GOAT PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD ESE  
 ADULT 5.4E-05 5.2E-05 1.9E-06 5.4E-05 5.3E-05 5.2E-05 5.2E-05 0.0E+00  
 TEEN 6.9E-05 6.8E-05 3.4E-06 7.2E-05 6.9E-05 6.7E-05 6.8E-05 0.0E+00  
 CHILD 1.1E-04 1.1E-04 8.3E-06 1.1E-04 1.1E-04 1.1E-04 1.1E-04 0.0E+00  
 INFNT 1.6E-04 1.6E-04 1.3E-05 1.8E-04 1.7E-04 1.6E-04 1.6E-04 0.0E+00

INHAL PATHWAY, DIST GP= 1, 1643. METERS WINDS TOWARD ESE  
 ADULT 1.6E-04 1.6E-04 1.1E-08 1.6E-04 1.6E-04 1.6E-04 1.6E-04 0.0E+00  
 TEEN 1.6E-04 1.6E-04 1.5E-08 1.6E-04 1.6E-04 1.6E-04 1.6E-04 0.0E+00  
 CHILD 1.4E-04 1.4E-04 2.1E-08 1.4E-04 1.4E-04 1.4E-04 1.4E-04 0.0E+00  
 INFNT 8.1E-05 8.1E-05 1.2E-08 8.1E-05 8.1E-05 8.1E-05 8.1E-05 0.0E+00

SUBTOTALS (NO PLUME)  
 ADULT 5.6E-04 5.5E-04 1.1E-05 5.6E-04 5.5E-04 5.5E-04 5.5E-04 6.0E-06  
 TEEN 6.1E-04 6.1E-04 1.5E-05 6.2E-04 6.1E-04 6.1E-04 6.1E-04 6.0E-06  
 CHILD 8.3E-04 8.3E-04 2.9E-05 8.5E-04 8.4E-04 8.3E-04 8.3E-04 6.0E-06  
 INFNT 3.3E-04 3.3E-04 2.3E-05 3.5E-04 3.3E-04 3.3E-04 3.3E-04 6.0E-06

TOTALS  
 ADULT 5.8E-04 5.8E-04 3.8E-05 5.9E-04 5.8E-04 5.8E-04 5.8E-04 5.0E-05  
 TEEN 6.4E-04 6.4E-04 4.2E-05 6.5E-04 6.4E-04 6.3E-04 6.4E-04 5.0E-05  
 CHILD 8.6E-04 8.6E-04 5.6E-05 8.8E-04 8.7E-04 8.6E-04 8.6E-04 5.0E-05  
 INFNT 3.6E-04 3.5E-04 5.0E-05 3.7E-04 3.6E-04 3.5E-04 3.6E-04 5.0E-05

INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT

FOR DATES 0 7 1 1 THRU 0 93024

T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME PATHWAY, DIST GP= 1, 1136. METERS WINDS TOWARD SE  
 ADULT 7.2E-05 7.2E-05 7.2E-05 7.2E-05 7.2E-05 7.2E-05 7.2E-05 7.2E-05 1.2E-04  
 TEEN 7.2E-05 7.2E-05 7.2E-05 7.2E-05 7.2E-05 7.2E-05 7.2E-05 7.2E-05 1.2E-04  
 CHILD 7.2E-05 7.2E-05 7.2E-05 7.2E-05 7.2E-05 7.2E-05 7.2E-05 7.2E-05 1.2E-04  
 INFNT 7.2E-05 7.2E-05 7.2E-05 7.2E-05 7.2E-05 7.2E-05 7.2E-05 7.2E-05 1.2E-04

GROUND PATHWAY, DIST GP= 1, 1136. METERS WINDS TOWARD SE  
 ADULT 8.0E-06 8.0E-06 8.0E-06 8.0E-06 8.0E-06 8.0E-06 8.0E-06 8.0E-06 9.3E-06  
 TEEN 8.0E-06 8.0E-06 8.0E-06 8.0E-06 8.0E-06 8.0E-06 8.0E-06 8.0E-06 9.3E-06  
 CHILD 8.0E-06 8.0E-06 8.0E-06 8.0E-06 8.0E-06 8.0E-06 8.0E-06 8.0E-06 9.3E-06  
 INFNT 8.0E-06 8.0E-06 8.0E-06 8.0E-06 8.0E-06 8.0E-06 8.0E-06 8.0E-06 9.3E-06

VEGET PATHWAY, DIST GP= 1, 914. METERS WINDS TOWARD SE  
 ADULT 9.5E-04 9.4E-04 7.3E-06 9.5E-04 9.4E-04 9.4E-04 9.4E-04 9.4E-04 0.0E+00  
 TEEN 1.1E-03 1.1E-03 1.2E-05 1.1E-03 1.1E-03 1.1E-03 1.1E-03 1.1E-03 0.0E+00  
 CHILD 1.7E-03 1.7E-03 2.7E-05 1.7E-03 1.7E-03 1.7E-03 1.7E-03 1.7E-03 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

MEAT PATHWAY, DIST GP= 1, 4354. METERS WINDS TOWARD SE  
 ADULT 1.3E-05 1.3E-05 5.6E-08 1.3E-05 1.3E-05 1.3E-05 1.3E-05 1.3E-05 0.0E+00  
 TEEN 7.9E-06 7.9E-06 4.6E-08 8.0E-06 7.9E-06 7.9E-06 7.9E-06 7.9E-06 0.0E+00  
 CHILD 9.6E-06 9.6E-06 8.5E-08 9.7E-06 9.6E-06 9.6E-06 9.6E-06 9.6E-06 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

COW PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD SE  
 ADULT 3.5E-05 3.4E-05 5.3E-07 3.5E-05 3.5E-05 3.4E-05 3.4E-05 3.4E-05 0.0E+00  
 TEEN 4.5E-05 4.5E-05 9.7E-07 4.6E-05 4.5E-05 4.5E-05 4.5E-05 4.5E-05 0.0E+00  
 CHILD 7.1E-05 7.1E-05 2.3E-06 7.3E-05 7.1E-05 7.1E-05 7.1E-05 7.1E-05 0.0E+00  
 INFNT 1.1E-04 1.1E-04 3.7E-06 1.1E-04 1.1E-04 1.1E-04 1.1E-04 1.1E-04 0.0E+00

GOAT PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD SE  
 ADULT 7.2E-05 7.0E-05 1.6E-06 7.2E-05 7.1E-05 7.0E-05 7.0E-05 7.0E-05 0.0E+00  
 TEEN 9.3E-05 9.1E-05 2.9E-06 9.5E-05 9.3E-05 9.1E-05 9.2E-05 9.2E-05 0.0E+00  
 CHILD 1.4E-04 1.4E-04 7.0E-06 1.5E-04 1.5E-04 1.4E-04 1.4E-04 1.4E-04 0.0E+00  
 INFNT 2.2E-04 2.2E-04 1.1E-05 2.3E-04 2.2E-04 2.2E-04 2.2E-04 2.2E-04 0.0E+00

INHAL PATHWAY, DIST GP= 1, 1136. METERS WINDS TOWARD SE  
 ADULT 3.8E-04 3.8E-04 9.9E-08 3.8E-04 3.8E-04 3.8E-04 3.8E-04 3.8E-04 0.0E+00  
 TEEN 3.8E-04 3.8E-04 1.4E-07 3.8E-04 3.8E-04 3.8E-04 3.8E-04 3.8E-04 0.0E+00  
 CHILD 3.4E-04 3.4E-04 1.9E-07 3.4E-04 3.4E-04 3.4E-04 3.4E-04 3.4E-04 0.0E+00  
 INFNT 1.9E-04 1.9E-04 1.1E-07 1.9E-04 1.9E-04 1.9E-04 1.9E-04 1.9E-04 0.0E+00

SUBTOTALS (NO PLUME)  
 ADULT 1.5E-03 1.4E-03 1.8E-05 1.5E-03 1.4E-03 1.4E-03 1.4E-03 1.4E-03 9.3E-06  
 TEEN 1.6E-03 1.6E-03 2.4E-05 1.6E-03 1.6E-03 1.6E-03 1.6E-03 1.6E-03 9.3E-06  
 CHILD 2.2E-03 2.2E-03 4.5E-05 2.3E-03 2.2E-03 2.2E-03 2.2E-03 2.2E-03 9.3E-06  
 INFNT 5.3E-04 5.3E-04 2.3E-05 5.5E-04 5.3E-04 5.3E-04 5.3E-04 5.3E-04 9.3E-06

TOTALS  
 ADULT 1.5E-03 1.5E-03 9.0E-05 1.5E-03 1.5E-03 1.5E-03 1.5E-03 1.5E-03 1.3E-04  
 TEEN 1.7E-03 1.7E-03 9.6E-05 1.7E-03 1.7E-03 1.7E-03 1.7E-03 1.7E-03 1.3E-04  
 CHILD 2.3E-03 2.3E-03 1.2E-04 2.3E-03 2.3E-03 2.3E-03 2.3E-03 2.3E-03 1.3E-04  
 INFNT 6.0E-04 6.0E-04 9.5E-05 6.2E-04 6.0E-04 6.0E-04 6.0E-04 6.0E-04 1.3E-04

INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT  
 FOR DATES 0 7 1 1 THRU 0 93024  
 T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME	PATHWAY, DIST GP= 1, 1507. METERS WINDS TOWARD SSE								
ADULT	6.1E-05	6.1E-05	6.1E-05	6.1E-05	6.1E-05	6.1E-05	6.1E-05	6.1E-05	1.0E-04
TEEN	6.1E-05	6.1E-05	6.1E-05	6.1E-05	6.1E-05	6.1E-05	6.1E-05	6.1E-05	1.0E-04
CHILD	6.1E-05	6.1E-05	6.1E-05	6.1E-05	6.1E-05	6.1E-05	6.1E-05	6.1E-05	1.0E-04
INFNT	6.1E-05	6.1E-05	6.1E-05	6.1E-05	6.1E-05	6.1E-05	6.1E-05	6.1E-05	1.0E-04
GROUND	PATHWAY, DIST GP= 1, 1507. METERS WINDS TOWARD SSE								
ADULT	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.2E-05
TEEN	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.2E-05
CHILD	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.2E-05
INFNT	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.0E-05	1.2E-05
VEGET	PATHWAY, DIST GP= 1, 1093. METERS WINDS TOWARD SSE								
ADULT	1.4E-03	1.3E-03	1.1E-05	1.4E-03	1.4E-03	1.3E-03	1.3E-03	1.3E-03	0.0E+00
TEEN	1.6E-03	1.5E-03	1.7E-05	1.6E-03	1.6E-03	1.5E-03	1.5E-03	1.5E-03	0.0E+00
CHILD	2.4E-03	2.4E-03	4.1E-05	2.4E-03	2.4E-03	2.4E-03	2.4E-03	2.4E-03	0.0E+00
INFNT	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
MEAT	PATHWAY, DIST GP= 1, 1093. METERS WINDS TOWARD SSE								
ADULT	1.9E-04	1.9E-04	1.1E-06	2.0E-04	1.9E-04	1.9E-04	1.9E-04	1.9E-04	0.0E+00
TEEN	1.2E-04	1.2E-04	9.0E-07	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04	0.0E+00
CHILD	1.4E-04	1.4E-04	1.7E-06	1.4E-04	1.4E-04	1.4E-04	1.4E-04	1.4E-04	0.0E+00
INFNT	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
COW	PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD SSE								
ADULT	6.4E-05	6.3E-05	1.1E-06	6.5E-05	6.4E-05	6.3E-05	6.3E-05	6.3E-05	0.0E+00
TEEN	8.3E-05	8.2E-05	2.0E-06	8.5E-05	8.3E-05	8.2E-05	8.3E-05	8.3E-05	0.0E+00
CHILD	1.3E-04	1.3E-04	4.7E-06	1.3E-04	1.3E-04	1.3E-04	1.3E-04	1.3E-04	0.0E+00
INFNT	2.0E-04	2.0E-04	7.5E-06	2.1E-04	2.0E-04	2.0E-04	2.0E-04	2.0E-04	0.0E+00
GOAT	PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD SSE								
ADULT	1.3E-04	1.3E-04	3.2E-06	1.3E-04	1.3E-04	1.3E-04	1.3E-04	1.3E-04	0.0E+00
TEEN	1.7E-04	1.7E-04	5.9E-06	1.8E-04	1.7E-04	1.7E-04	1.7E-04	1.7E-04	0.0E+00
CHILD	2.7E-04	2.6E-04	1.4E-05	2.8E-04	2.7E-04	2.6E-04	2.7E-04	2.7E-04	0.0E+00
INFNT	4.1E-04	4.0E-04	2.3E-05	4.3E-04	4.1E-04	4.0E-04	4.1E-04	4.1E-04	0.0E+00
INHAL	PATHWAY, DIST GP= 1, 1507. METERS WINDS TOWARD SSE								
ADULT	4.5E-04	4.5E-04	1.4E-07	4.5E-04	4.5E-04	4.5E-04	4.5E-04	4.5E-04	0.0E+00
TEEN	4.5E-04	4.5E-04	2.0E-07	4.5E-04	4.5E-04	4.5E-04	4.5E-04	4.5E-04	0.0E+00
CHILD	4.0E-04	4.0E-04	2.6E-07	4.0E-04	4.0E-04	4.0E-04	4.0E-04	4.0E-04	0.0E+00
INFNT	2.3E-04	2.3E-04	1.6E-07	2.3E-04	2.3E-04	2.3E-04	2.3E-04	2.3E-04	0.0E+00
SUBTOTALS (NO PLUME)									
ADULT	2.2E-03	2.2E-03	2.7E-05	2.2E-03	2.2E-03	2.2E-03	2.2E-03	2.2E-03	1.2E-05
TEEN	2.4E-03	2.4E-03	3.6E-05	2.4E-03	2.4E-03	2.4E-03	2.4E-03	2.4E-03	1.2E-05
CHILD	3.3E-03	3.3E-03	7.2E-05	3.4E-03	3.4E-03	3.3E-03	3.3E-03	3.3E-03	1.2E-05
INFNT	8.4E-04	8.4E-04	4.0E-05	8.8E-04	8.5E-04	8.4E-04	8.5E-04	8.5E-04	1.2E-05
TOTALS									
ADULT	2.3E-03	2.3E-03	8.7E-05	2.3E-03	2.3E-03	2.3E-03	2.3E-03	2.3E-03	1.1E-04
TEEN	2.4E-03	2.4E-03	9.7E-05	2.5E-03	2.4E-03	2.4E-03	2.4E-03	2.4E-03	1.1E-04
CHILD	3.4E-03	3.4E-03	1.3E-04	3.5E-03	3.4E-03	3.4E-03	3.4E-03	3.4E-03	1.1E-04
INFNT	9.1E-04	9.0E-04	1.0E-04	9.4E-04	9.1E-04	9.0E-04	9.1E-04	9.1E-04	1.1E-04

INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT

FOR DATES 0 7 1 1 THRU 0 93024

T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME PATHWAY, DIST GP= 1, 1026. METERS WINDS TOWARD S  
 ADULT 2.7E-04 2.7E-04 2.7E-04 2.7E-04 2.7E-04 2.7E-04 2.7E-04 4.4E-04  
 TEEN 2.7E-04 2.7E-04 2.7E-04 2.7E-04 2.7E-04 2.7E-04 2.7E-04 4.4E-04  
 CHILD 2.7E-04 2.7E-04 2.7E-04 2.7E-04 2.7E-04 2.7E-04 2.7E-04 4.4E-04  
 INFNT 2.7E-04 2.7E-04 2.7E-04 2.7E-04 2.7E-04 2.7E-04 2.7E-04 4.4E-04

GROUND PATHWAY, DIST GP= 1, 1026. METERS WINDS TOWARD S  
 ADULT 5.0E-05 5.0E-05 5.0E-05 5.0E-05 5.0E-05 5.0E-05 5.0E-05 5.8E-05  
 TEEN 5.0E-05 5.0E-05 5.0E-05 5.0E-05 5.0E-05 5.0E-05 5.0E-05 5.8E-05  
 CHILD 5.0E-05 5.0E-05 5.0E-05 5.0E-05 5.0E-05 5.0E-05 5.0E-05 5.8E-05  
 INFNT 5.0E-05 5.0E-05 5.0E-05 5.0E-05 5.0E-05 5.0E-05 5.0E-05 5.8E-05

VEGET PATHWAY, DIST GP= 1, 863. METERS WINDS TOWARD S  
 ADULT 3.4E-03 3.4E-03 4.2E-05 3.5E-03 3.4E-03 3.4E-03 3.4E-03 0.0E+00  
 TEEN 3.9E-03 3.9E-03 6.7E-05 4.0E-03 3.9E-03 3.9E-03 3.9E-03 0.0E+00  
 CHILD 6.0E-03 6.0E-03 1.6E-04 6.2E-03 6.1E-03 6.0E-03 6.0E-03 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

MEAT PATHWAY, DIST GP= 1, 6115. METERS WINDS TOWARD S  
 ADULT 2.5E-05 2.4E-05 1.6E-07 2.5E-05 2.5E-05 2.4E-05 2.5E-05 0.0E+00  
 TEEN 1.5E-05 1.5E-05 1.3E-07 1.5E-05 1.5E-05 1.5E-05 1.5E-05 0.0E+00  
 CHILD 1.8E-05 1.8E-05 2.4E-07 1.8E-05 1.8E-05 1.8E-05 1.8E-05 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

COW PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD S  
 ADULT 1.1E-04 1.1E-04 2.8E-06 1.1E-04 1.1E-04 1.1E-04 1.1E-04 0.0E+00  
 TEEN 1.4E-04 1.4E-04 5.1E-06 1.5E-04 1.4E-04 1.4E-04 1.4E-04 0.0E+00  
 CHILD 2.2E-04 2.2E-04 1.2E-05 2.3E-04 2.3E-04 2.2E-04 2.2E-04 0.0E+00  
 INFNT 3.4E-04 3.4E-04 2.0E-05 3.6E-04 3.4E-04 3.4E-04 3.4E-04 0.0E+00

GOAT PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD S  
 ADULT 2.3E-04 2.2E-04 8.4E-06 2.3E-04 2.2E-04 2.2E-04 2.2E-04 0.0E+00  
 TEEN 3.0E-04 2.9E-04 1.5E-05 3.1E-04 2.9E-04 2.9E-04 2.9E-04 0.0E+00  
 CHILD 4.6E-04 4.5E-04 3.7E-05 4.9E-04 4.6E-04 4.5E-04 4.6E-04 0.0E+00  
 INFNT 7.0E-04 6.9E-04 5.9E-05 7.6E-04 7.1E-04 6.9E-04 7.0E-04 0.0E+00

INHAL PATHWAY, DIST GP= 1, 1026. METERS WINDS TOWARD S  
 ADULT 1.4E-03 1.4E-03 3.4E-07 1.4E-03 1.4E-03 1.4E-03 1.4E-03 0.0E+00  
 TEEN 1.5E-03 1.5E-03 4.8E-07 1.5E-03 1.5E-03 1.5E-03 1.5E-03 0.0E+00  
 CHILD 1.3E-03 1.3E-03 6.4E-07 1.3E-03 1.3E-03 1.3E-03 1.3E-03 0.0E+00  
 INFNT 7.4E-04 7.4E-04 3.9E-07 7.4E-04 7.4E-04 7.4E-04 7.4E-04 0.0E+00

SUBTOTALS (NO PLUME)  
 ADULT 5.3E-03 5.2E-03 1.0E-04 5.3E-03 5.3E-03 5.2E-03 5.3E-03 5.8E-05  
 TEEN 5.9E-03 5.8E-03 1.4E-04 6.0E-03 5.9E-03 5.8E-03 5.9E-03 5.8E-05  
 CHILD 8.1E-03 8.0E-03 2.6E-04 8.2E-03 8.1E-03 8.0E-03 8.1E-03 5.8E-05  
 INFNT 1.8E-03 1.8E-03 1.3E-04 1.9E-03 1.8E-03 1.8E-03 1.8E-03 5.8E-05

TOTALS  
 ADULT 5.6E-03 5.5E-03 3.7E-04 5.6E-03 5.5E-03 5.5E-03 5.5E-03 5.0E-04  
 TEEN 6.1E-03 6.1E-03 4.1E-04 6.2E-03 6.1E-03 6.1E-03 6.1E-03 5.0E-04  
 CHILD 8.3E-03 8.3E-03 5.3E-04 8.5E-03 8.4E-03 8.3E-03 8.3E-03 5.0E-04  
 INFNT 2.1E-03 2.1E-03 4.0E-04 2.2E-03 2.1E-03 2.1E-03 2.1E-03 5.0E-04

INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT  
 FOR DATES 0 7 1 1 THRU 0 93024  
 T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME PATHWAY, DIST GP= 1, 942. METERS WINDS TOWARD SSW  
 ADULT 1.7E-04 1.7E-04 1.7E-04 1.7E-04 1.7E-04 1.7E-04 1.7E-04 2.9E-04  
 TEEN 1.7E-04 1.7E-04 1.7E-04 1.7E-04 1.7E-04 1.7E-04 1.7E-04 2.9E-04  
 CHILD 1.7E-04 1.7E-04 1.7E-04 1.7E-04 1.7E-04 1.7E-04 1.7E-04 2.9E-04  
 INFNT 1.7E-04 1.7E-04 1.7E-04 1.7E-04 1.7E-04 1.7E-04 1.7E-04 2.9E-04

GROUND PATHWAY, DIST GP= 1, 942. METERS WINDS TOWARD SSW  
 ADULT 3.6E-05 3.6E-05 3.6E-05 3.6E-05 3.6E-05 3.6E-05 3.6E-05 4.3E-05  
 TEEN 3.6E-05 3.6E-05 3.6E-05 3.6E-05 3.6E-05 3.6E-05 3.6E-05 4.3E-05  
 CHILD 3.6E-05 3.6E-05 3.6E-05 3.6E-05 3.6E-05 3.6E-05 3.6E-05 4.3E-05  
 INFNT 3.6E-05 3.6E-05 3.6E-05 3.6E-05 3.6E-05 3.6E-05 3.6E-05 4.3E-05

VEGET PATHWAY, DIST GP= 1, 770. METERS WINDS TOWARD SSW  
 ADULT 2.6E-03 2.6E-03 3.3E-05 2.6E-03 2.6E-03 2.6E-03 2.6E-03 0.0E+00  
 TEEN 3.0E-03 3.0E-03 5.2E-05 3.0E-03 3.0E-03 3.0E-03 3.0E-03 0.0E+00  
 CHILD 4.6E-03 4.6E-03 1.2E-04 4.7E-03 4.6E-03 4.6E-03 4.6E-03 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

MEAT PATHWAY, DIST GP= 1, 8045. METERS WINDS TOWARD SSW  
 ADULT 1.1E-05 1.1E-05 6.1E-08 1.1E-05 1.1E-05 1.1E-05 1.1E-05 0.0E+00  
 TEEN 6.5E-06 6.5E-06 5.0E-08 6.6E-06 6.5E-06 6.5E-06 6.5E-06 0.0E+00  
 CHILD 7.9E-06 7.9E-06 9.3E-08 8.0E-06 7.9E-06 7.9E-06 7.9E-06 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

COW PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD SSW  
 ADULT 7.1E-05 6.9E-05 1.8E-06 7.2E-05 7.0E-05 6.9E-05 7.0E-05 0.0E+00  
 TEEN 9.2E-05 9.1E-05 3.2E-06 9.5E-05 9.2E-05 9.0E-05 9.1E-05 0.0E+00  
 CHILD 1.4E-04 1.4E-04 7.8E-06 1.5E-04 1.5E-04 1.4E-04 1.4E-04 0.0E+00  
 INFNT 2.2E-04 2.2E-04 1.2E-05 2.3E-04 2.2E-04 2.2E-04 2.2E-04 0.0E+00

GOAT PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD SSW  
 ADULT 1.5E-04 1.4E-04 5.3E-06 1.5E-04 1.4E-04 1.4E-04 1.4E-04 0.0E+00  
 TEEN 1.9E-04 1.8E-04 9.7E-06 2.0E-04 1.9E-04 1.8E-04 1.9E-04 0.0E+00  
 CHILD 2.9E-04 2.9E-04 2.3E-05 3.1E-04 3.0E-04 2.9E-04 2.9E-04 0.0E+00  
 INFNT 4.5E-04 4.4E-04 3.7E-05 4.9E-04 4.6E-04 4.4E-04 4.5E-04 0.0E+00

INHAL PATHWAY, DIST GP= 1, 942. METERS WINDS TOWARD SSW  
 ADULT 1.0E-03 1.0E-03 2.4E-07 1.0E-03 1.0E-03 1.0E-03 1.0E-03 0.0E+00  
 TEEN 1.1E-03 1.1E-03 3.4E-07 1.1E-03 1.1E-03 1.1E-03 1.1E-03 0.0E+00  
 CHILD 9.3E-04 9.3E-04 4.6E-07 9.3E-04 9.3E-04 9.3E-04 9.3E-04 0.0E+00  
 INFNT 5.4E-04 5.4E-04 2.8E-07 5.4E-04 5.4E-04 5.4E-04 5.4E-04 0.0E+00

SUBTOTALS (NO PLUME)  
 ADULT 3.9E-03 3.9E-03 7.6E-05 3.9E-03 3.9E-03 3.9E-03 3.9E-03 4.3E-05  
 TEEN 4.4E-03 4.3E-03 1.0E-04 4.4E-03 4.4E-03 4.3E-03 4.3E-03 4.3E-05  
 CHILD 6.0E-03 6.0E-03 1.9E-04 6.1E-03 6.0E-03 6.0E-03 6.0E-03 4.3E-05  
 INFNT 1.2E-03 1.2E-03 8.6E-05 1.3E-03 1.2E-03 1.2E-03 1.2E-03 4.3E-05

TOTALS  
 ADULT 4.1E-03 4.1E-03 2.5E-04 4.1E-03 4.1E-03 4.1E-03 4.1E-03 3.3E-04  
 TEEN 4.5E-03 4.5E-03 2.8E-04 4.6E-03 4.5E-03 4.5E-03 4.5E-03 3.3E-04  
 CHILD 6.2E-03 6.2E-03 3.6E-04 6.3E-03 6.2E-03 6.2E-03 6.2E-03 3.3E-04  
 INFNT 1.4E-03 1.4E-03 2.6E-04 1.5E-03 1.4E-03 1.4E-03 1.4E-03 3.3E-04

## Summary of Maximum Individual Doses

4<sup>th</sup> Quarter

Effluent	Applicable Organ	Estimated Dose (mrem)	AGE GROUP	LOCATION DIST DIR (M) (Toward)	% OF APPLICABLE LIMIT	LIMIT (mrem) QTR
Liquid	Total Body	3.96E-03	Child	Receptor 1	2.64E-01	1.5
Liquid	GI-Tract	4.04E-03	Child	Receptor 1	8.08E-02	5.0
Noble Gas	Air Dose (Gamma-mrad)	1.42E-03		651 (N)	2.84E-02	5.0
Noble Gas	Air Dose (Beta-mrad)	6.27E-04		651 (N)	6.27E-03	10.0
Iodines and Particulates	Total Body	1.05E-02	Child	659 (N)	1.40E-01	7.5



LAST LIQUID DOSE ACCUMULATION (MREM)  
 START DATE 010 1 1      END DATE 0123124  
           BONE    LIVER   T.BODY   THYRD    KIDNEY    LUNG   GI-LLI    SKIN

WATER

ADULT	1.4E-06	2.7E-03	2.7E-03	2.7E-03	2.7E-03	2.7E-03	2.9E-03	0.0E+00
TEEN	1.3E-06	1.9E-03	1.9E-03	1.9E-03	1.9E-03	1.9E-03	2.0E-03	0.0E+00
CHILD	3.8E-06	3.7E-03	3.7E-03	3.7E-03	3.7E-03	3.7E-03	3.8E-03	0.0E+00
INFANT	4.2E-06	3.6E-03	3.6E-03	3.6E-03	3.6E-03	3.6E-03	3.7E-03	0.0E+00

SHORE

ADULT	4.4E-05	4.4E-05	4.4E-05	4.4E-05	4.4E-05	4.4E-05	4.4E-05	5.2E-05
TEEN	2.5E-04	2.5E-04	2.5E-04	2.5E-04	2.5E-04	2.5E-04	2.5E-04	2.9E-04
CHILD	5.2E-05	5.2E-05	5.2E-05	5.2E-05	5.2E-05	5.2E-05	5.2E-05	6.1E-05
INFANT	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

FW SPT FISH

ADULT	6.2E-05	3.1E-04	3.1E-04	1.8E-04	2.2E-04	1.9E-04	6.6E-04	0.0E+00
TEEN	6.6E-05	2.7E-04	2.4E-04	1.4E-04	1.8E-04	1.5E-04	4.7E-04	0.0E+00
CHILD	8.2E-05	2.3E-04	1.9E-04	1.2E-04	1.5E-04	1.3E-04	2.3E-04	0.0E+00
INFANT	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

TOTAL

ADULT	1.1E-04	3.1E-03	3.1E-03	3.0E-03	3.0E-03	3.0E-03	3.6E-03	5.2E-05
TEEN	3.1E-04	2.5E-03	2.4E-03	2.3E-03	2.3E-03	2.3E-03	2.7E-03	2.9E-04
CHILD	1.4E-04	4.0E-03	4.0E-03	3.8E-03	3.9E-03	3.9E-03	4.0E-03	6.1E-05
INFANT	4.2E-06	3.6E-03	3.6E-03	3.6E-03	3.6E-03	3.6E-03	3.7E-03	0.0E+00

DATES OF LAST AIR DOSE ACCUMULATION ARE FROM 010 1 1 0 TO 0123124 0  
DOSE ACCUMULATION FOR GAMMA MRAD

FOR RELEASE POINT 1

\*\*DIRECTION FROM N

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM NNE

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM NE

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM ENE

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM E

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM ESE

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM SE

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM SSE

2.9287E-08	1.4259E-09	8.5694E-10	6.1189E-10	4.7582E-10
2.8548E-10	1.4274E-10	8.5641E-11	6.1172E-11	4.2794E-11

\*\*DIRECTION FROM S

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM SSW

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM SW

1.3038E-08	6.3478E-10	3.8150E-10	2.7240E-10	2.1183E-10
1.2709E-10	6.3544E-11	3.8126E-11	2.7233E-11	1.9051E-11

\*\*DIRECTION FROM WSW

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM W

8.3055E-09	9.6096E-10	4.2238E-10	2.3924E-10	1.6124E-10
7.3744E-11	2.4980E-11	1.1375E-11	6.8266E-12	3.8759E-12

\*\*DIRECTION FROM WNW

1.8965E-07	1.7947E-08	7.7725E-09	4.4408E-09	3.0228E-09
1.4211E-09	5.0781E-10	2.4329E-10	1.5178E-10	9.0931E-11

\*\*DIRECTION FROM NW

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

\*\*DIRECTION FROM NNW

0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

DISTANCES USED IN CALCULATIONS

594.0	2416.0	4020.0	5630.0	7240.0
12067.0	24135.0	40225.0	56315.0	80500.0

DATES OF LAST AIR DOSE ACCUMULATION ARE FROM 010 1 1 0 TO 0123124 0  
DOSE ACCUMULATION FOR GAMMA MRAD

FOR RELEASE POINT 2

**DIRECTION FROM N				
3.3922E-04	3.5285E-05	1.5696E-05	9.0445E-06	6.1992E-06
2.9618E-06	1.0867E-06	5.3270E-07	3.3997E-07	2.1040E-07
**DIRECTION FROM NNE				
4.5826E-04	5.4633E-05	2.4971E-05	1.4524E-05	1.0074E-05
4.9282E-06	1.8460E-06	8.9538E-07	5.6368E-07	3.4621E-07
**DIRECTION FROM NE				
6.5767E-04	7.7635E-05	3.6301E-05	2.1507E-05	1.5012E-05
7.4213E-06	2.8515E-06	1.4071E-06	8.9605E-07	5.5762E-07
**DIRECTION FROM ENE				
6.7552E-04	7.6288E-05	3.5437E-05	2.0911E-05	1.4549E-05
7.1413E-06	2.7106E-06	1.3250E-06	8.3927E-07	5.2217E-07
**DIRECTION FROM E				
6.6643E-04	7.5897E-05	3.5521E-05	2.1067E-05	1.4711E-05
7.2725E-06	2.7870E-06	1.3665E-06	8.6616E-07	5.3976E-07
**DIRECTION FROM ESE				
1.0256E-03	1.2117E-04	5.9573E-05	3.6485E-05	2.5841E-05
1.3097E-05	5.2467E-06	2.6342E-06	1.6952E-06	1.0770E-06
**DIRECTION FROM SE				
1.4883E-03	1.6936E-04	8.2238E-05	4.9983E-05	3.5390E-05
1.7956E-05	7.1555E-06	3.5754E-06	2.2934E-06	1.4573E-06
**DIRECTION FROM SSE				
1.8975E-03	2.1105E-04	1.0417E-04	6.4014E-05	4.5500E-05
2.3214E-05	9.3421E-06	4.6829E-06	3.0082E-06	1.9216E-06
**DIRECTION FROM S				
1.6337E-03	1.8389E-04	9.0460E-05	5.5405E-05	3.9343E-05
2.0039E-05	8.0275E-06	4.0059E-06	2.5652E-06	1.6344E-06
**DIRECTION FROM SSW				
5.1761E-04	6.0313E-05	2.8779E-05	1.7319E-05	1.2119E-05
6.0054E-06	2.3410E-06	1.1672E-06	7.4973E-07	4.7182E-07
**DIRECTION FROM SW				
4.0490E-04	4.4512E-05	2.0751E-05	1.2313E-05	8.5986E-06
4.2563E-06	1.6416E-06	8.1446E-07	5.2135E-07	3.2748E-07
**DIRECTION FROM WSW				
4.5329E-04	5.0684E-05	2.2892E-05	1.3285E-05	9.1078E-06
4.3376E-06	1.5873E-06	7.6950E-07	4.8617E-07	2.9712E-07
**DIRECTION FROM W				
5.9232E-04	6.8750E-05	3.1910E-05	1.8829E-05	1.3035E-05
6.3192E-06	2.3725E-06	1.1558E-06	7.2966E-07	4.4832E-07
**DIRECTION FROM WNW				
7.1125E-04	7.8640E-05	3.4573E-05	1.9651E-05	1.3339E-05
6.2293E-06	2.1873E-06	1.0316E-06	6.3917E-07	3.8043E-07
**DIRECTION FROM NW				
5.9836E-04	6.4799E-05	2.8341E-05	1.6070E-05	1.0894E-05
5.0790E-06	1.7815E-06	8.4321E-07	5.2548E-07	3.1531E-07
**DIRECTION FROM NNW				
5.0184E-04	5.6880E-05	2.5838E-05	1.4997E-05	1.0360E-05
5.0207E-06	1.8596E-06	8.9785E-07	5.6398E-07	3.4596E-07

DISTANCES USED IN CALCULATIONS

594.0 2416.0 4020.0 5630.0 7240.0  
12067.0 24135.0 40225.0 56315.0 80500.0

DATES OF LAST AIR DOSE ACCUMULATION ARE FROM 010 1 1 0 TO 0123124 0  
DOSE ACCUMULATION FOR BETA MRAD

FOR RELEASE POINT 1

**DIRECTION FROM N				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM NNE				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM NE				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM ENE				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM E				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM ESE				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM SE				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM SSE				
3.3210E-06	1.6169E-07	9.7173E-08	6.9384E-08	5.3955E-08
3.2372E-08	1.6185E-08	9.7112E-09	6.9366E-09	4.8526E-09
**DIRECTION FROM S				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM SSW				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM SW				
1.4785E-06	7.1981E-08	4.3260E-08	3.0889E-08	2.4020E-08
1.4412E-08	7.2055E-09	4.3233E-09	3.0881E-09	2.1603E-09
**DIRECTION FROM WSW				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM W				
9.4180E-07	1.0897E-07	4.7895E-08	2.7128E-08	1.8284E-08
8.3621E-09	2.8326E-09	1.2899E-09	7.7410E-10	4.3950E-10
**DIRECTION FROM WNW				
2.1505E-05	2.0351E-06	8.8136E-07	5.0356E-07	3.4277E-07
1.6114E-07	5.7583E-08	2.7587E-08	1.7211E-08	1.0311E-08
**DIRECTION FROM NW				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
**DIRECTION FROM NNW				
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

DISTANCES USED IN CALCULATIONS

594.0 2416.0 4020.0 5630.0 7240.0  
12067.0 24135.0 40225.0 56315.0 80500.0

DATES OF LAST AIR DOSE ACCUMULATION ARE FROM 010 1 1 0 TO 0123124 0  
DOSE ACCUMULATION FOR BETA MRAD

FOR RELEASE POINT 2

**DIRECTION FROM N				
1.5022E-04	1.5638E-05	6.9563E-06	4.0080E-06	2.7471E-06
1.3123E-06	4.8137E-07	2.3591E-07	1.5053E-07	9.3135E-08
**DIRECTION FROM NNE				
2.0250E-04	2.4135E-05	1.1031E-05	6.4162E-06	4.4504E-06
2.1768E-06	8.1532E-07	3.9542E-07	2.4892E-07	1.5288E-07
**DIRECTION FROM NE				
2.9066E-04	3.4318E-05	1.6045E-05	9.5054E-06	6.6349E-06
3.2798E-06	1.2600E-06	6.2171E-07	3.9587E-07	2.4633E-07
**DIRECTION FROM ENE				
2.9920E-04	3.3805E-05	1.5705E-05	9.2681E-06	6.4487E-06
3.1659E-06	1.2019E-06	5.8755E-07	3.7219E-07	2.3158E-07
**DIRECTION FROM E				
2.9512E-04	3.3620E-05	1.5737E-05	9.3347E-06	6.5188E-06
3.2228E-06	1.2352E-06	6.0571E-07	3.8395E-07	2.3928E-07
**DIRECTION FROM ESE				
4.5438E-04	5.3697E-05	2.6398E-05	1.6166E-05	1.1450E-05
5.8026E-06	2.3244E-06	1.1670E-06	7.5096E-07	4.7708E-07
**DIRECTION FROM SE				
6.5878E-04	7.5002E-05	3.6414E-05	2.2129E-05	1.5668E-05
7.9491E-06	3.1675E-06	1.5826E-06	1.0151E-06	6.4503E-07
**DIRECTION FROM SSE				
8.3880E-04	9.3317E-05	4.6066E-05	2.8310E-05	2.0122E-05
1.0266E-05	4.1318E-06	2.0713E-06	1.3306E-06	8.4996E-07
**DIRECTION FROM S				
7.2294E-04	8.1371E-05	4.0029E-05	2.4518E-05	1.7410E-05
8.8681E-06	3.5525E-06	1.7728E-06	1.1352E-06	7.2331E-07
**DIRECTION FROM SSW				
2.2935E-04	2.6726E-05	1.2753E-05	7.6747E-06	5.3707E-06
2.6613E-06	1.0374E-06	5.1727E-07	3.3225E-07	2.0910E-07
**DIRECTION FROM SW				
1.7983E-04	1.9772E-05	9.2179E-06	5.4696E-06	3.8194E-06
1.8904E-06	7.2900E-07	3.6167E-07	2.3150E-07	1.4541E-07
**DIRECTION FROM WSW				
2.0123E-04	2.2508E-05	1.0168E-05	5.9011E-06	4.0457E-06
1.9267E-06	7.0511E-07	3.4181E-07	2.1594E-07	1.3196E-07
**DIRECTION FROM W				
2.6289E-04	3.0516E-05	1.4164E-05	8.3577E-06	5.7860E-06
2.8049E-06	1.0530E-06	5.1301E-07	3.2386E-07	1.9898E-07
**DIRECTION FROM WNW				
3.1505E-04	3.4846E-05	1.5321E-05	8.7080E-06	5.9114E-06
2.7607E-06	9.6940E-07	4.5720E-07	2.8327E-07	1.6859E-07
**DIRECTION FROM NW				
2.6543E-04	2.8766E-05	1.2582E-05	7.1345E-06	4.8367E-06
2.2553E-06	7.9118E-07	3.7446E-07	2.3334E-07	1.4001E-07
**DIRECTION FROM NNW				
2.2235E-04	2.5206E-05	1.1450E-05	6.6454E-06	4.5907E-06
2.2247E-06	8.2395E-07	3.9781E-07	2.4987E-07	1.5327E-07

DISTANCES USED IN CALCULATIONS

594.0 2416.0 4020.0 5630.0 7240.0  
12067.0 24135.0 40225.0 56315.0 80500.0

INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT

FOR DATES 010 1 1 THRU 0123124

T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME PATHWAY, DIST GP= 1, 659. METERS WINDS TOWARD N  
 ADULT 8.7E-04 8.7E-04 8.7E-04 8.7E-04 8.7E-04 8.7E-04 8.7E-04 1.4E-03  
 TEEN 8.7E-04 8.7E-04 8.7E-04 8.7E-04 8.7E-04 8.7E-04 8.7E-04 1.4E-03  
 CHILD 8.7E-04 8.7E-04 8.7E-04 8.7E-04 8.7E-04 8.7E-04 8.7E-04 1.4E-03  
 INFNT 8.7E-04 8.7E-04 8.7E-04 8.7E-04 8.7E-04 8.7E-04 8.7E-04 1.4E-03

GROUND PATHWAY, DIST GP= 1, 659. METERS WINDS TOWARD N  
 ADULT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 TEEN 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 CHILD 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

VEGET PATHWAY, DIST GP= 1, 8045. METERS WINDS TOWARD N  
 ADULT 2.5E-04 2.5E-04 0.0E+00 2.5E-04 2.5E-04 2.5E-04 2.5E-04 0.0E+00  
 TEEN 2.9E-04 2.9E-04 0.0E+00 2.9E-04 2.9E-04 2.9E-04 2.9E-04 0.0E+00  
 CHILD 4.5E-04 4.5E-04 0.0E+00 4.5E-04 4.5E-04 4.5E-04 4.5E-04 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

MEAT PATHWAY, DIST GP= 1, 8045. METERS WINDS TOWARD N  
 ADULT 3.7E-05 3.7E-05 0.0E+00 3.7E-05 3.7E-05 3.7E-05 3.7E-05 0.0E+00  
 TEEN 2.2E-05 2.2E-05 0.0E+00 2.2E-05 2.2E-05 2.2E-05 2.2E-05 0.0E+00  
 CHILD 2.6E-05 2.6E-05 0.0E+00 2.6E-05 2.6E-05 2.6E-05 2.6E-05 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

COW PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD N  
 ADULT 2.2E-04 2.2E-04 0.0E+00 2.2E-04 2.2E-04 2.2E-04 2.2E-04 0.0E+00  
 TEEN 2.9E-04 2.9E-04 0.0E+00 2.9E-04 2.9E-04 2.9E-04 2.9E-04 0.0E+00  
 CHILD 4.5E-04 4.5E-04 0.0E+00 4.5E-04 4.5E-04 4.5E-04 4.5E-04 0.0E+00  
 INFNT 6.9E-04 6.9E-04 0.0E+00 6.9E-04 6.9E-04 6.9E-04 6.9E-04 0.0E+00

GOAT PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD N  
 ADULT 4.5E-04 4.5E-04 0.0E+00 4.5E-04 4.5E-04 4.5E-04 4.5E-04 0.0E+00  
 TEEN 5.8E-04 5.8E-04 0.0E+00 5.8E-04 5.8E-04 5.8E-04 5.8E-04 0.0E+00  
 CHILD 9.2E-04 9.2E-04 0.0E+00 9.2E-04 9.2E-04 9.2E-04 9.2E-04 0.0E+00  
 INFNT 1.4E-03 1.4E-03 0.0E+00 1.4E-03 1.4E-03 1.4E-03 1.4E-03 0.0E+00

INHAL PATHWAY, DIST GP= 1, 659. METERS WINDS TOWARD N  
 ADULT 5.7E-03 5.7E-03 0.0E+00 5.7E-03 5.7E-03 5.7E-03 5.7E-03 0.0E+00  
 TEEN 5.7E-03 5.7E-03 0.0E+00 5.7E-03 5.7E-03 5.7E-03 5.7E-03 0.0E+00  
 CHILD 5.1E-03 5.1E-03 0.0E+00 5.1E-03 5.1E-03 5.1E-03 5.1E-03 0.0E+00  
 INFNT 2.9E-03 2.9E-03 0.0E+00 2.9E-03 2.9E-03 2.9E-03 2.9E-03 0.0E+00

SUBTOTALS (NO PLUME)  
 ADULT 6.6E-03 6.6E-03 0.0E+00 6.6E-03 6.6E-03 6.6E-03 6.6E-03 0.0E+00  
 TEEN 6.9E-03 6.9E-03 0.0E+00 6.9E-03 6.9E-03 6.9E-03 6.9E-03 0.0E+00  
 CHILD 6.9E-03 6.9E-03 0.0E+00 6.9E-03 6.9E-03 6.9E-03 6.9E-03 0.0E+00  
 INFNT 5.0E-03 5.0E-03 0.0E+00 5.0E-03 5.0E-03 5.0E-03 5.0E-03 0.0E+00

TOTALS  
 ADULT 7.5E-03 7.5E-03 8.7E-04 7.5E-03 7.5E-03 7.5E-03 7.5E-03 1.4E-03  
 TEEN 7.8E-03 7.8E-03 8.7E-04 7.8E-03 7.8E-03 7.8E-03 7.8E-03 1.4E-03  
 CHILD 7.8E-03 7.8E-03 8.7E-04 7.8E-03 7.8E-03 7.8E-03 7.8E-03 1.4E-03  
 INFNT 5.9E-03 5.9E-03 8.7E-04 5.9E-03 5.9E-03 5.9E-03 5.9E-03 1.4E-03

INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT  
 FOR DATES 010 1 1 THRU 0123124  
 T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME PATHWAY, DIST GP= 1, 660. METERS WINDS TOWARD NNE  
 ADULT 2.7E-04 2.7E-04 2.7E-04 2.7E-04 2.7E-04 2.7E-04 2.7E-04 4.5E-04  
 TEEN 2.7E-04 2.7E-04 2.7E-04 2.7E-04 2.7E-04 2.7E-04 2.7E-04 4.5E-04  
 CHILD 2.7E-04 2.7E-04 2.7E-04 2.7E-04 2.7E-04 2.7E-04 2.7E-04 4.5E-04  
 INFNT 2.7E-04 2.7E-04 2.7E-04 2.7E-04 2.7E-04 2.7E-04 2.7E-04 4.5E-04

GROUND PATHWAY, DIST GP= 1, 660. METERS WINDS TOWARD NNE  
 ADULT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 TEEN 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 CHILD 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

VEGET PATHWAY, DIST GP= 1, 814. METERS WINDS TOWARD NNE  
 ADULT 2.5E-03 2.5E-03 0.0E+00 2.5E-03 2.5E-03 2.5E-03 2.5E-03 0.0E+00  
 TEEN 2.8E-03 2.8E-03 0.0E+00 2.8E-03 2.8E-03 2.8E-03 2.8E-03 0.0E+00  
 CHILD 4.4E-03 4.4E-03 0.0E+00 4.4E-03 4.4E-03 4.4E-03 4.4E-03 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

MEAT PATHWAY, DIST GP= 1, 7725. METERS WINDS TOWARD NNE  
 ADULT 1.3E-05 1.3E-05 0.0E+00 1.3E-05 1.3E-05 1.3E-05 1.3E-05 0.0E+00  
 TEEN 7.5E-06 7.5E-06 0.0E+00 7.5E-06 7.5E-06 7.5E-06 7.5E-06 0.0E+00  
 CHILD 9.1E-06 9.1E-06 0.0E+00 9.1E-06 9.1E-06 9.1E-06 9.1E-06 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

COW PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD NNE  
 ADULT 7.5E-05 7.5E-05 0.0E+00 7.5E-05 7.5E-05 7.5E-05 7.5E-05 0.0E+00  
 TEEN 9.7E-05 9.7E-05 0.0E+00 9.7E-05 9.7E-05 9.7E-05 9.7E-05 0.0E+00  
 CHILD 1.5E-04 1.5E-04 0.0E+00 1.5E-04 1.5E-04 1.5E-04 1.5E-04 0.0E+00  
 INFNT 2.3E-04 2.3E-04 0.0E+00 2.3E-04 2.3E-04 2.3E-04 2.3E-04 0.0E+00

GOAT PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD NNE  
 ADULT 1.5E-04 1.5E-04 0.0E+00 1.5E-04 1.5E-04 1.5E-04 1.5E-04 0.0E+00  
 TEEN 2.0E-04 2.0E-04 0.0E+00 2.0E-04 2.0E-04 2.0E-04 2.0E-04 0.0E+00  
 CHILD 3.1E-04 3.1E-04 0.0E+00 3.1E-04 3.1E-04 3.1E-04 3.1E-04 0.0E+00  
 INFNT 4.8E-04 4.8E-04 0.0E+00 4.8E-04 4.8E-04 4.8E-04 4.8E-04 0.0E+00

INHAL PATHWAY, DIST GP= 1, 660. METERS WINDS TOWARD NNE  
 ADULT 1.9E-03 1.9E-03 0.0E+00 1.9E-03 1.9E-03 1.9E-03 1.9E-03 0.0E+00  
 TEEN 1.9E-03 1.9E-03 0.0E+00 1.9E-03 1.9E-03 1.9E-03 1.9E-03 0.0E+00  
 CHILD 1.7E-03 1.7E-03 0.0E+00 1.7E-03 1.7E-03 1.7E-03 1.7E-03 0.0E+00  
 INFNT 9.7E-04 9.7E-04 0.0E+00 9.7E-04 9.7E-04 9.7E-04 9.7E-04 0.0E+00

SUBTOTALS (NO PLUME)  
 ADULT 4.6E-03 4.6E-03 0.0E+00 4.6E-03 4.6E-03 4.6E-03 4.6E-03 0.0E+00  
 TEEN 5.1E-03 5.1E-03 0.0E+00 5.1E-03 5.1E-03 5.1E-03 5.1E-03 0.0E+00  
 CHILD 6.6E-03 6.6E-03 0.0E+00 6.6E-03 6.6E-03 6.6E-03 6.6E-03 0.0E+00  
 INFNT 1.7E-03 1.7E-03 0.0E+00 1.7E-03 1.7E-03 1.7E-03 1.7E-03 0.0E+00

TOTALS  
 ADULT 4.9E-03 4.9E-03 2.7E-04 4.9E-03 4.9E-03 4.9E-03 4.9E-03 4.5E-04  
 TEEN 5.3E-03 5.3E-03 2.7E-04 5.3E-03 5.3E-03 5.3E-03 5.3E-03 4.5E-04  
 CHILD 6.8E-03 6.8E-03 2.7E-04 6.8E-03 6.8E-03 6.8E-03 6.8E-03 4.5E-04  
 INFNT 2.0E-03 2.0E-03 2.7E-04 2.0E-03 2.0E-03 2.0E-03 2.0E-03 4.5E-04

INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT  
 FOR DATES 010 1 1 THRU 0123124  
 T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME	PATHWAY, DIST GP= 1, 943. METERS WINDS TOWARD NE							
ADULT	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04	2.0E-04
TEEN	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04	2.0E-04
CHILD	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04	2.0E-04
INFNT	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04	2.0E-04
GROUND	PATHWAY, DIST GP= 1, 943. METERS WINDS TOWARD NE							
ADULT	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
TEEN	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
CHILD	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
INFNT	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
VEGET	PATHWAY, DIST GP= 1, 1052. METERS WINDS TOWARD NE							
ADULT	1.3E-03	1.3E-03	0.0E+00	1.3E-03	1.3E-03	1.3E-03	1.3E-03	0.0E+00
TEEN	1.5E-03	1.5E-03	0.0E+00	1.5E-03	1.5E-03	1.5E-03	1.5E-03	0.0E+00
CHILD	2.4E-03	2.4E-03	0.0E+00	2.4E-03	2.4E-03	2.4E-03	2.4E-03	0.0E+00
INFNT	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
MEAT	PATHWAY, DIST GP= 1, 7725. METERS WINDS TOWARD NE							
ADULT	9.4E-06	9.4E-06	0.0E+00	9.4E-06	9.4E-06	9.4E-06	9.4E-06	0.0E+00
TEEN	5.6E-06	5.6E-06	0.0E+00	5.6E-06	5.6E-06	5.6E-06	5.6E-06	0.0E+00
CHILD	6.7E-06	6.7E-06	0.0E+00	6.7E-06	6.7E-06	6.7E-06	6.7E-06	0.0E+00
INFNT	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
COW	PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD NE							
ADULT	5.6E-05	5.6E-05	0.0E+00	5.6E-05	5.6E-05	5.6E-05	5.6E-05	0.0E+00
TEEN	7.3E-05	7.3E-05	0.0E+00	7.3E-05	7.3E-05	7.3E-05	7.3E-05	0.0E+00
CHILD	1.2E-04	1.2E-04	0.0E+00	1.2E-04	1.2E-04	1.2E-04	1.2E-04	0.0E+00
INFNT	1.8E-04	1.8E-04	0.0E+00	1.8E-04	1.8E-04	1.8E-04	1.8E-04	0.0E+00
GOAT	PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD NE							
ADULT	1.1E-04	1.1E-04	0.0E+00	1.1E-04	1.1E-04	1.1E-04	1.1E-04	0.0E+00
TEEN	1.5E-04	1.5E-04	0.0E+00	1.5E-04	1.5E-04	1.5E-04	1.5E-04	0.0E+00
CHILD	2.4E-04	2.4E-04	0.0E+00	2.4E-04	2.4E-04	2.4E-04	2.4E-04	0.0E+00
INFNT	3.6E-04	3.6E-04	0.0E+00	3.6E-04	3.6E-04	3.6E-04	3.6E-04	0.0E+00
INHAL	PATHWAY, DIST GP= 1, 943. METERS WINDS TOWARD NE							
ADULT	8.8E-04	8.8E-04	0.0E+00	8.8E-04	8.8E-04	8.8E-04	8.8E-04	0.0E+00
TEEN	8.9E-04	8.9E-04	0.0E+00	8.9E-04	8.9E-04	8.9E-04	8.9E-04	0.0E+00
CHILD	7.8E-04	7.8E-04	0.0E+00	7.8E-04	7.8E-04	7.8E-04	7.8E-04	0.0E+00
INFNT	4.5E-04	4.5E-04	0.0E+00	4.5E-04	4.5E-04	4.5E-04	4.5E-04	0.0E+00
SUBTOTALS (NO PLUME)								
ADULT	2.4E-03	2.4E-03	0.0E+00	2.4E-03	2.4E-03	2.4E-03	2.4E-03	0.0E+00
TEEN	2.6E-03	2.6E-03	0.0E+00	2.6E-03	2.6E-03	2.6E-03	2.6E-03	0.0E+00
CHILD	3.5E-03	3.5E-03	0.0E+00	3.5E-03	3.5E-03	3.5E-03	3.5E-03	0.0E+00
INFNT	9.9E-04	9.9E-04	0.0E+00	9.9E-04	9.9E-04	9.9E-04	9.9E-04	0.0E+00
TOTALS								
ADULT	2.5E-03	2.5E-03	1.2E-04	2.5E-03	2.5E-03	2.5E-03	2.5E-03	2.0E-04
TEEN	2.8E-03	2.8E-03	1.2E-04	2.8E-03	2.8E-03	2.8E-03	2.8E-03	2.0E-04
CHILD	3.6E-03	3.6E-03	1.2E-04	3.6E-03	3.6E-03	3.6E-03	3.6E-03	2.0E-04
INFNT	1.1E-03	1.1E-03	1.2E-04	1.1E-03	1.1E-03	1.1E-03	1.1E-03	2.0E-04



INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT  
 FOR DATES 010 1 1 THRU 0123124  
 T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME PATHWAY, DIST GP= 1, 1747. METERS WINDS TOWARD ENE  
 ADULT 4.9E-05 4.9E-05 4.9E-05 4.9E-05 4.9E-05 4.9E-05 4.9E-05 8.1E-05  
 TEEN 4.9E-05 4.9E-05 4.9E-05 4.9E-05 4.9E-05 4.9E-05 4.9E-05 8.1E-05  
 CHILD 4.9E-05 4.9E-05 4.9E-05 4.9E-05 4.9E-05 4.9E-05 4.9E-05 8.1E-05  
 INFNT 4.9E-05 4.9E-05 4.9E-05 4.9E-05 4.9E-05 4.9E-05 4.9E-05 8.1E-05

GROUND PATHWAY, DIST GP= 1, 1747. METERS WINDS TOWARD ENE  
 ADULT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 TEEN 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 CHILD 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

VEGET PATHWAY, DIST GP= 1, 1852. METERS WINDS TOWARD ENE  
 ADULT 5.9E-04 5.9E-04 0.0E+00 5.9E-04 5.9E-04 5.9E-04 5.9E-04 0.0E+00  
 TEEN 6.8E-04 6.8E-04 0.0E+00 6.8E-04 6.8E-04 6.8E-04 6.8E-04 0.0E+00  
 CHILD 1.1E-03 1.1E-03 0.0E+00 1.1E-03 1.1E-03 1.1E-03 1.1E-03 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

MEAT PATHWAY, DIST GP= 1, 3862. METERS WINDS TOWARD ENE  
 ADULT 2.7E-05 2.7E-05 0.0E+00 2.7E-05 2.7E-05 2.7E-05 2.7E-05 0.0E+00  
 TEEN 1.6E-05 1.6E-05 0.0E+00 1.6E-05 1.6E-05 1.6E-05 1.6E-05 0.0E+00  
 CHILD 2.0E-05 2.0E-05 0.0E+00 2.0E-05 2.0E-05 2.0E-05 2.0E-05 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

COW PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD ENE  
 ADULT 5.9E-05 5.9E-05 0.0E+00 5.9E-05 5.9E-05 5.9E-05 5.9E-05 0.0E+00  
 TEEN 7.7E-05 7.7E-05 0.0E+00 7.7E-05 7.7E-05 7.7E-05 7.7E-05 0.0E+00  
 CHILD 1.2E-04 1.2E-04 0.0E+00 1.2E-04 1.2E-04 1.2E-04 1.2E-04 0.0E+00  
 INFNT 1.8E-04 1.8E-04 0.0E+00 1.8E-04 1.8E-04 1.8E-04 1.8E-04 0.0E+00

GOAT PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD ENE  
 ADULT 1.2E-04 1.2E-04 0.0E+00 1.2E-04 1.2E-04 1.2E-04 1.2E-04 0.0E+00  
 TEEN 1.6E-04 1.6E-04 0.0E+00 1.6E-04 1.6E-04 1.6E-04 1.6E-04 0.0E+00  
 CHILD 2.5E-04 2.5E-04 0.0E+00 2.5E-04 2.5E-04 2.5E-04 2.5E-04 0.0E+00  
 INFNT 3.8E-04 3.8E-04 0.0E+00 3.8E-04 3.8E-04 3.8E-04 3.8E-04 0.0E+00

INHAL PATHWAY, DIST GP= 1, 1747. METERS WINDS TOWARD ENE  
 ADULT 3.6E-04 3.6E-04 0.0E+00 3.6E-04 3.6E-04 3.6E-04 3.6E-04 0.0E+00  
 TEEN 3.6E-04 3.6E-04 0.0E+00 3.6E-04 3.6E-04 3.6E-04 3.6E-04 0.0E+00  
 CHILD 3.2E-04 3.2E-04 0.0E+00 3.2E-04 3.2E-04 3.2E-04 3.2E-04 0.0E+00  
 INFNT 1.8E-04 1.8E-04 0.0E+00 1.8E-04 1.8E-04 1.8E-04 1.8E-04 0.0E+00

SUBTOTALS (NO PLUME)  
 ADULT 1.2E-03 1.2E-03 0.0E+00 1.2E-03 1.2E-03 1.2E-03 1.2E-03 0.0E+00  
 TEEN 1.3E-03 1.3E-03 0.0E+00 1.3E-03 1.3E-03 1.3E-03 1.3E-03 0.0E+00  
 CHILD 1.8E-03 1.8E-03 0.0E+00 1.8E-03 1.8E-03 1.8E-03 1.8E-03 0.0E+00  
 INFNT 7.4E-04 7.4E-04 0.0E+00 7.4E-04 7.4E-04 7.4E-04 7.4E-04 0.0E+00

TOTALS  
 ADULT 1.2E-03 1.2E-03 4.9E-05 1.2E-03 1.2E-03 1.2E-03 1.2E-03 8.1E-05  
 TEEN 1.3E-03 1.3E-03 4.9E-05 1.3E-03 1.3E-03 1.3E-03 1.3E-03 8.1E-05  
 CHILD 1.8E-03 1.8E-03 4.9E-05 1.8E-03 1.8E-03 1.8E-03 1.8E-03 8.1E-05  
 INFNT 7.9E-04 7.9E-04 4.9E-05 7.9E-04 7.9E-04 7.9E-04 7.9E-04 8.1E-05

INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT

FOR DATES 010 1 1 THRU 0123124

T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME PATHWAY, DIST GP= 1, 1716. METERS WINDS TOWARD E  
 ADULT 6.6E-05 6.6E-05 6.6E-05 6.6E-05 6.6E-05 6.6E-05 6.6E-05 6.6E-05 1.1E-04  
 TEEN 6.6E-05 6.6E-05 6.6E-05 6.6E-05 6.6E-05 6.6E-05 6.6E-05 6.6E-05 1.1E-04  
 CHILD 6.6E-05 6.6E-05 6.6E-05 6.6E-05 6.6E-05 6.6E-05 6.6E-05 6.6E-05 1.1E-04  
 INFNT 6.6E-05 6.6E-05 6.6E-05 6.6E-05 6.6E-05 6.6E-05 6.6E-05 6.6E-05 1.1E-04

GROUND PATHWAY, DIST GP= 1, 1716. METERS WINDS TOWARD E  
 ADULT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 TEEN 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 CHILD 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

VEGET PATHWAY, DIST GP= 1, 1705. METERS WINDS TOWARD E  
 ADULT 9.2E-04 9.2E-04 0.0E+00 9.2E-04 9.2E-04 9.2E-04 9.2E-04 9.2E-04 0.0E+00  
 TEEN 1.1E-03 1.1E-03 0.0E+00 1.1E-03 1.1E-03 1.1E-03 1.1E-03 1.1E-03 0.0E+00  
 CHILD 1.6E-03 1.6E-03 0.0E+00 1.6E-03 1.6E-03 1.6E-03 1.6E-03 1.6E-03 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

MEAT PATHWAY, DIST GP= 1, 6810. METERS WINDS TOWARD E  
 ADULT 1.6E-05 1.6E-05 0.0E+00 1.6E-05 1.6E-05 1.6E-05 1.6E-05 1.6E-05 0.0E+00  
 TEEN 9.7E-06 9.7E-06 0.0E+00 9.7E-06 9.7E-06 9.7E-06 9.7E-06 9.7E-06 0.0E+00  
 CHILD 1.2E-05 1.2E-05 0.0E+00 1.2E-05 1.2E-05 1.2E-05 1.2E-05 1.2E-05 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

COW PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD E  
 ADULT 8.3E-05 8.3E-05 0.0E+00 8.3E-05 8.3E-05 8.3E-05 8.3E-05 8.3E-05 0.0E+00  
 TEEN 1.1E-04 1.1E-04 0.0E+00 1.1E-04 1.1E-04 1.1E-04 1.1E-04 1.1E-04 0.0E+00  
 CHILD 1.7E-04 1.7E-04 0.0E+00 1.7E-04 1.7E-04 1.7E-04 1.7E-04 1.7E-04 0.0E+00  
 INFNT 2.6E-04 2.6E-04 0.0E+00 2.6E-04 2.6E-04 2.6E-04 2.6E-04 2.6E-04 0.0E+00

GOAT PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD E  
 ADULT 1.7E-04 1.7E-04 0.0E+00 1.7E-04 1.7E-04 1.7E-04 1.7E-04 1.7E-04 0.0E+00  
 TEEN 2.2E-04 2.2E-04 0.0E+00 2.2E-04 2.2E-04 2.2E-04 2.2E-04 2.2E-04 0.0E+00  
 CHILD 3.5E-04 3.5E-04 0.0E+00 3.5E-04 3.5E-04 3.5E-04 3.5E-04 3.5E-04 0.0E+00  
 INFNT 5.3E-04 5.3E-04 0.0E+00 5.3E-04 5.3E-04 5.3E-04 5.3E-04 5.3E-04 0.0E+00

INHAL PATHWAY, DIST GP= 1, 1716. METERS WINDS TOWARD E  
 ADULT 5.1E-04 5.1E-04 0.0E+00 5.1E-04 5.1E-04 5.1E-04 5.1E-04 5.1E-04 0.0E+00  
 TEEN 5.1E-04 5.1E-04 0.0E+00 5.1E-04 5.1E-04 5.1E-04 5.1E-04 5.1E-04 0.0E+00  
 CHILD 4.5E-04 4.5E-04 0.0E+00 4.5E-04 4.5E-04 4.5E-04 4.5E-04 4.5E-04 0.0E+00  
 INFNT 2.6E-04 2.6E-04 0.0E+00 2.6E-04 2.6E-04 2.6E-04 2.6E-04 2.6E-04 0.0E+00

SUBTOTALS (NO PLUME)  
 ADULT 1.7E-03 1.7E-03 0.0E+00 1.7E-03 1.7E-03 1.7E-03 1.7E-03 1.7E-03 0.0E+00  
 TEEN 1.9E-03 1.9E-03 0.0E+00 1.9E-03 1.9E-03 1.9E-03 1.9E-03 1.9E-03 0.0E+00  
 CHILD 2.6E-03 2.6E-03 0.0E+00 2.6E-03 2.6E-03 2.6E-03 2.6E-03 2.6E-03 0.0E+00  
 INFNT 1.0E-03 1.0E-03 0.0E+00 1.0E-03 1.0E-03 1.0E-03 1.0E-03 1.0E-03 0.0E+00

TOTALS  
 ADULT 1.8E-03 1.8E-03 6.6E-05 1.8E-03 1.8E-03 1.8E-03 1.8E-03 1.8E-03 1.1E-04  
 TEEN 2.0E-03 2.0E-03 6.6E-05 2.0E-03 2.0E-03 2.0E-03 2.0E-03 2.0E-03 1.1E-04  
 CHILD 2.7E-03 2.7E-03 6.6E-05 2.7E-03 2.7E-03 2.7E-03 2.7E-03 2.7E-03 1.1E-04  
 INFNT 1.1E-03 1.1E-03 6.6E-05 1.1E-03 1.1E-03 1.1E-03 1.1E-03 1.1E-03 1.1E-04

INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT  
 FOR DATES 010 1 1 THRU 0123124  
 T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME PATHWAY, DIST GP= 1, 1643. METERS WINDS TOWARD ESE  
 ADULT 8.5E-05 8.5E-05 8.5E-05 8.5E-05 8.5E-05 8.5E-05 8.6E-05 1.4E-04  
 TEEN 8.5E-05 8.5E-05 8.5E-05 8.5E-05 8.5E-05 8.5E-05 8.6E-05 1.4E-04  
 CHILD 8.5E-05 8.5E-05 8.5E-05 8.5E-05 8.5E-05 8.5E-05 8.6E-05 1.4E-04  
 INFNT 8.5E-05 8.5E-05 8.5E-05 8.5E-05 8.5E-05 8.5E-05 8.6E-05 1.4E-04

GROUND PATHWAY, DIST GP= 1, 1643. METERS WINDS TOWARD ESE  
 ADULT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 TEEN 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 CHILD 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

VEGET PATHWAY, DIST GP= 1, 1628. METERS WINDS TOWARD ESE  
 ADULT 1.1E-03 1.1E-03 0.0E+00 1.1E-03 1.1E-03 1.1E-03 1.1E-03 0.0E+00  
 TEEN 1.2E-03 1.2E-03 0.0E+00 1.2E-03 1.2E-03 1.2E-03 1.2E-03 0.0E+00  
 CHILD 1.9E-03 1.9E-03 0.0E+00 1.9E-03 1.9E-03 1.9E-03 1.9E-03 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

MEAT PATHWAY, DIST GP= 1, 2434. METERS WINDS TOWARD ESE  
 ADULT 8.2E-05 8.2E-05 0.0E+00 8.2E-05 8.2E-05 8.2E-05 8.2E-05 0.0E+00  
 TEEN 4.9E-05 4.9E-05 0.0E+00 4.9E-05 4.9E-05 4.9E-05 4.9E-05 0.0E+00  
 CHILD 5.9E-05 5.9E-05 0.0E+00 5.9E-05 5.9E-05 5.9E-05 5.9E-05 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

COW PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD ESE  
 ADULT 8.4E-05 8.4E-05 0.0E+00 8.4E-05 8.4E-05 8.4E-05 8.4E-05 0.0E+00  
 TEEN 1.1E-04 1.1E-04 0.0E+00 1.1E-04 1.1E-04 1.1E-04 1.1E-04 0.0E+00  
 CHILD 1.7E-04 1.7E-04 0.0E+00 1.7E-04 1.7E-04 1.7E-04 1.7E-04 0.0E+00  
 INFNT 2.6E-04 2.6E-04 0.0E+00 2.6E-04 2.6E-04 2.6E-04 2.6E-04 0.0E+00

GOAT PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD ESE  
 ADULT 1.7E-04 1.7E-04 0.0E+00 1.7E-04 1.7E-04 1.7E-04 1.7E-04 0.0E+00  
 TEEN 2.2E-04 2.2E-04 0.0E+00 2.2E-04 2.2E-04 2.2E-04 2.2E-04 0.0E+00  
 CHILD 3.5E-04 3.5E-04 0.0E+00 3.5E-04 3.5E-04 3.5E-04 3.5E-04 0.0E+00  
 INFNT 5.3E-04 5.3E-04 0.0E+00 5.3E-04 5.3E-04 5.3E-04 5.3E-04 0.0E+00

INHAL PATHWAY, DIST GP= 1, 1643. METERS WINDS TOWARD ESE  
 ADULT 5.8E-04 5.8E-04 0.0E+00 5.8E-04 5.8E-04 5.8E-04 5.8E-04 0.0E+00  
 TEEN 5.9E-04 5.9E-04 0.0E+00 5.9E-04 5.9E-04 5.9E-04 5.9E-04 0.0E+00  
 CHILD 5.2E-04 5.2E-04 0.0E+00 5.2E-04 5.2E-04 5.2E-04 5.2E-04 0.0E+00  
 INFNT 3.0E-04 3.0E-04 0.0E+00 3.0E-04 3.0E-04 3.0E-04 3.0E-04 0.0E+00

SUBTOTALS (NO PLUME)  
 ADULT 2.0E-03 2.0E-03 0.0E+00 2.0E-03 2.0E-03 2.0E-03 2.0E-03 0.0E+00  
 TEEN 2.2E-03 2.2E-03 0.0E+00 2.2E-03 2.2E-03 2.2E-03 2.2E-03 0.0E+00  
 CHILD 3.0E-03 3.0E-03 0.0E+00 3.0E-03 3.0E-03 3.0E-03 3.0E-03 0.0E+00  
 INFNT 1.1E-03 1.1E-03 0.0E+00 1.1E-03 1.1E-03 1.1E-03 1.1E-03 0.0E+00

TOTALS  
 ADULT 2.1E-03 2.1E-03 8.5E-05 2.1E-03 2.1E-03 2.1E-03 2.1E-03 1.4E-04  
 TEEN 2.3E-03 2.3E-03 8.5E-05 2.3E-03 2.3E-03 2.3E-03 2.3E-03 1.4E-04  
 CHILD 3.1E-03 3.1E-03 8.5E-05 3.1E-03 3.1E-03 3.1E-03 3.1E-03 1.4E-04  
 INFNT 1.2E-03 1.2E-03 8.5E-05 1.2E-03 1.2E-03 1.2E-03 1.2E-03 1.4E-04

INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT  
 FOR DATES 010 1 1 THRU 0123124  
 T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME PATHWAY, DIST GP= 1, 1136. METERS WINDS TOWARD SE  
 ADULT 1.3E-04 1.3E-04 1.3E-04 1.3E-04 1.3E-04 1.3E-04 1.3E-04 2.1E-04  
 TEEN 1.3E-04 1.3E-04 1.3E-04 1.3E-04 1.3E-04 1.3E-04 1.3E-04 2.1E-04  
 CHILD 1.3E-04 1.3E-04 1.3E-04 1.3E-04 1.3E-04 1.3E-04 1.3E-04 2.1E-04  
 INFNT 1.3E-04 1.3E-04 1.3E-04 1.3E-04 1.3E-04 1.3E-04 1.3E-04 2.1E-04

GROUND PATHWAY, DIST GP= 1, 1136. METERS WINDS TOWARD SE  
 ADULT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 TEEN 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 CHILD 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

VEGET PATHWAY, DIST GP= 1, 914. METERS WINDS TOWARD SE  
 ADULT 2.3E-03 2.3E-03 0.0E+00 2.3E-03 2.3E-03 2.3E-03 2.3E-03 0.0E+00  
 TEEN 2.6E-03 2.6E-03 0.0E+00 2.6E-03 2.6E-03 2.6E-03 2.6E-03 0.0E+00  
 CHILD 4.0E-03 4.0E-03 0.0E+00 4.0E-03 4.0E-03 4.0E-03 4.0E-03 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

MEAT PATHWAY, DIST GP= 1, 4354. METERS WINDS TOWARD SE  
 ADULT 2.7E-05 2.7E-05 0.0E+00 2.7E-05 2.7E-05 2.7E-05 2.7E-05 0.0E+00  
 TEEN 1.6E-05 1.6E-05 0.0E+00 1.6E-05 1.6E-05 1.6E-05 1.6E-05 0.0E+00  
 CHILD 2.0E-05 2.0E-05 0.0E+00 2.0E-05 2.0E-05 2.0E-05 2.0E-05 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

COW PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD SE  
 ADULT 7.1E-05 7.1E-05 0.0E+00 7.1E-05 7.1E-05 7.1E-05 7.1E-05 0.0E+00  
 TEEN 9.2E-05 9.2E-05 0.0E+00 9.2E-05 9.2E-05 9.2E-05 9.2E-05 0.0E+00  
 CHILD 1.5E-04 1.5E-04 0.0E+00 1.5E-04 1.5E-04 1.5E-04 1.5E-04 0.0E+00  
 INFNT 2.2E-04 2.2E-04 0.0E+00 2.2E-04 2.2E-04 2.2E-04 2.2E-04 0.0E+00

GOAT PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD SE  
 ADULT 1.4E-04 1.4E-04 0.0E+00 1.4E-04 1.4E-04 1.4E-04 1.4E-04 0.0E+00  
 TEEN 1.9E-04 1.9E-04 0.0E+00 1.9E-04 1.9E-04 1.9E-04 1.9E-04 0.0E+00  
 CHILD 3.0E-04 3.0E-04 0.0E+00 3.0E-04 3.0E-04 3.0E-04 3.0E-04 0.0E+00  
 INFNT 4.5E-04 4.5E-04 0.0E+00 4.5E-04 4.5E-04 4.5E-04 4.5E-04 0.0E+00

INHAL PATHWAY, DIST GP= 1, 1136. METERS WINDS TOWARD SE  
 ADULT 8.9E-04 8.9E-04 0.0E+00 8.9E-04 8.9E-04 8.9E-04 8.9E-04 0.0E+00  
 TEEN 8.9E-04 8.9E-04 0.0E+00 8.9E-04 8.9E-04 8.9E-04 8.9E-04 0.0E+00  
 CHILD 7.9E-04 7.9E-04 0.0E+00 7.9E-04 7.9E-04 7.9E-04 7.9E-04 0.0E+00  
 INFNT 4.5E-04 4.5E-04 0.0E+00 4.5E-04 4.5E-04 4.5E-04 4.5E-04 0.0E+00

SUBTOTALS (NO PLUME)

ADULT 3.4E-03 3.4E-03 0.0E+00 3.4E-03 3.4E-03 3.4E-03 3.4E-03 0.0E+00  
 TEEN 3.8E-03 3.8E-03 0.0E+00 3.8E-03 3.8E-03 3.8E-03 3.8E-03 0.0E+00  
 CHILD 5.2E-03 5.2E-03 0.0E+00 5.2E-03 5.2E-03 5.2E-03 5.2E-03 0.0E+00  
 INFNT 1.1E-03 1.1E-03 0.0E+00 1.1E-03 1.1E-03 1.1E-03 1.1E-03 0.0E+00

TOTALS

ADULT 3.5E-03 3.5E-03 1.3E-04 3.5E-03 3.5E-03 3.5E-03 3.5E-03 2.1E-04  
 TEEN 3.9E-03 3.9E-03 1.3E-04 3.9E-03 3.9E-03 3.9E-03 3.9E-03 2.1E-04  
 CHILD 5.4E-03 5.4E-03 1.3E-04 5.4E-03 5.4E-03 5.4E-03 5.4E-03 2.1E-04  
 INFNT 1.3E-03 1.3E-03 1.3E-04 1.3E-03 1.3E-03 1.3E-03 1.3E-03 2.1E-04

INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT  
 FOR DATES 010 1 1 THRU 0123124  
 T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME PATHWAY, DIST GP= 1, 1507. METERS WINDS TOWARD SSE  
 ADULT 6.4E-05 6.4E-05 6.4E-05 6.4E-05 6.4E-05 6.4E-05 6.4E-05 6.4E-05 1.1E-04  
 TEEN 6.4E-05 6.4E-05 6.4E-05 6.4E-05 6.4E-05 6.4E-05 6.4E-05 6.4E-05 1.1E-04  
 CHILD 6.4E-05 6.4E-05 6.4E-05 6.4E-05 6.4E-05 6.4E-05 6.4E-05 6.4E-05 1.1E-04  
 INFNT 6.4E-05 6.4E-05 6.4E-05 6.4E-05 6.4E-05 6.4E-05 6.4E-05 6.4E-05 1.1E-04

GROUND PATHWAY, DIST GP= 1, 1507. METERS WINDS TOWARD SSE  
 ADULT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 TEEN 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 CHILD 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

VEGET PATHWAY, DIST GP= 1, 1093. METERS WINDS TOWARD SSE  
 ADULT 1.5E-03 1.5E-03 0.0E+00 1.5E-03 1.5E-03 1.5E-03 1.5E-03 1.5E-03 0.0E+00  
 TEEN 1.7E-03 1.7E-03 0.0E+00 1.7E-03 1.7E-03 1.7E-03 1.7E-03 1.7E-03 0.0E+00  
 CHILD 2.6E-03 2.6E-03 0.0E+00 2.6E-03 2.6E-03 2.6E-03 2.6E-03 2.6E-03 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

MEAT PATHWAY, DIST GP= 1, 1093. METERS WINDS TOWARD SSE  
 ADULT 2.1E-04 2.1E-04 0.0E+00 2.1E-04 2.1E-04 2.1E-04 2.1E-04 2.1E-04 0.0E+00  
 TEEN 1.3E-04 1.3E-04 0.0E+00 1.3E-04 1.3E-04 1.3E-04 1.3E-04 1.3E-04 0.0E+00  
 CHILD 1.5E-04 1.5E-04 0.0E+00 1.5E-04 1.5E-04 1.5E-04 1.5E-04 1.5E-04 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

COW PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD SSE  
 ADULT 6.5E-05 6.5E-05 0.0E+00 6.5E-05 6.5E-05 6.5E-05 6.5E-05 6.5E-05 0.0E+00  
 TEEN 8.4E-05 8.4E-05 0.0E+00 8.4E-05 8.4E-05 8.4E-05 8.4E-05 8.4E-05 0.0E+00  
 CHILD 1.3E-04 1.3E-04 0.0E+00 1.3E-04 1.3E-04 1.3E-04 1.3E-04 1.3E-04 0.0E+00  
 INFNT 2.0E-04 2.0E-04 0.0E+00 2.0E-04 2.0E-04 2.0E-04 2.0E-04 2.0E-04 0.0E+00

GOAT PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD SSE  
 ADULT 1.3E-04 1.3E-04 0.0E+00 1.3E-04 1.3E-04 1.3E-04 1.3E-04 1.3E-04 0.0E+00  
 TEEN 1.7E-04 1.7E-04 0.0E+00 1.7E-04 1.7E-04 1.7E-04 1.7E-04 1.7E-04 0.0E+00  
 CHILD 2.7E-04 2.7E-04 0.0E+00 2.7E-04 2.7E-04 2.7E-04 2.7E-04 2.7E-04 0.0E+00  
 INFNT 4.1E-04 4.1E-04 0.0E+00 4.1E-04 4.1E-04 4.1E-04 4.1E-04 4.1E-04 0.0E+00

INHAL PATHWAY, DIST GP= 1, 1507. METERS WINDS TOWARD SSE  
 ADULT 5.0E-04 5.0E-04 0.0E+00 5.0E-04 5.0E-04 5.0E-04 5.0E-04 5.0E-04 0.0E+00  
 TEEN 5.0E-04 5.0E-04 0.0E+00 5.0E-04 5.0E-04 5.0E-04 5.0E-04 5.0E-04 0.0E+00  
 CHILD 4.4E-04 4.4E-04 0.0E+00 4.4E-04 4.4E-04 4.4E-04 4.4E-04 4.4E-04 0.0E+00  
 INFNT 2.5E-04 2.5E-04 0.0E+00 2.5E-04 2.5E-04 2.5E-04 2.5E-04 2.5E-04 0.0E+00

SUBTOTALS (NO PLUME)  
 ADULT 2.4E-03 2.4E-03 0.0E+00 2.4E-03 2.4E-03 2.4E-03 2.4E-03 2.4E-03 0.0E+00  
 TEEN 2.6E-03 2.6E-03 0.0E+00 2.6E-03 2.6E-03 2.6E-03 2.6E-03 2.6E-03 0.0E+00  
 CHILD 3.6E-03 3.6E-03 0.0E+00 3.6E-03 3.6E-03 3.6E-03 3.6E-03 3.6E-03 0.0E+00  
 INFNT 8.7E-04 8.7E-04 0.0E+00 8.7E-04 8.7E-04 8.7E-04 8.7E-04 8.7E-04 0.0E+00

TOTALS  
 ADULT 2.4E-03 2.4E-03 6.4E-05 2.4E-03 2.4E-03 2.4E-03 2.4E-03 2.4E-03 1.1E-04  
 TEEN 2.6E-03 2.6E-03 6.4E-05 2.6E-03 2.6E-03 2.6E-03 2.6E-03 2.6E-03 1.1E-04  
 CHILD 3.7E-03 3.7E-03 6.4E-05 3.7E-03 3.7E-03 3.7E-03 3.7E-03 3.7E-03 1.1E-04  
 INFNT 9.3E-04 9.3E-04 6.4E-05 9.3E-04 9.3E-04 9.3E-04 9.3E-04 9.3E-04 1.1E-04

INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT  
 FOR DATES 010 1 1 THRU 0123124  
 T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME PATHWAY, DIST GP= 1, 1026. METERS WINDS TOWARD S  
 ADULT 8.4E-05 8.4E-05 8.4E-05 8.4E-05 8.4E-05 8.4E-05 8.5E-05 1.4E-04  
 TEEN 8.4E-05 8.4E-05 8.4E-05 8.4E-05 8.4E-05 8.4E-05 8.5E-05 1.4E-04  
 CHILD 8.4E-05 8.4E-05 8.4E-05 8.4E-05 8.4E-05 8.4E-05 8.5E-05 1.4E-04  
 INFNT 8.4E-05 8.4E-05 8.4E-05 8.4E-05 8.4E-05 8.4E-05 8.5E-05 1.4E-04

GROUND PATHWAY, DIST GP= 1, 1026. METERS WINDS TOWARD S  
 ADULT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 TEEN 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 CHILD 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

VEGET PATHWAY, DIST GP= 1, 863. METERS WINDS TOWARD S  
 ADULT 1.4E-03 1.4E-03 0.0E+00 1.4E-03 1.4E-03 1.4E-03 1.4E-03 0.0E+00  
 TEEN 1.6E-03 1.6E-03 0.0E+00 1.6E-03 1.6E-03 1.6E-03 1.6E-03 0.0E+00  
 CHILD 2.5E-03 2.5E-03 0.0E+00 2.5E-03 2.5E-03 2.5E-03 2.5E-03 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

MEAT PATHWAY, DIST GP= 1, 6115. METERS WINDS TOWARD S  
 ADULT 9.0E-06 9.0E-06 0.0E+00 9.0E-06 9.0E-06 9.0E-06 9.0E-06 0.0E+00  
 TEEN 5.3E-06 5.3E-06 0.0E+00 5.3E-06 5.3E-06 5.3E-06 5.3E-06 0.0E+00  
 CHILD 6.4E-06 6.4E-06 0.0E+00 6.4E-06 6.4E-06 6.4E-06 6.4E-06 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

COW PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD S  
 ADULT 4.0E-05 4.0E-05 0.0E+00 4.0E-05 4.0E-05 4.0E-05 4.0E-05 0.0E+00  
 TEEN 5.2E-05 5.2E-05 0.0E+00 5.2E-05 5.2E-05 5.2E-05 5.2E-05 0.0E+00  
 CHILD 8.3E-05 8.3E-05 0.0E+00 8.3E-05 8.3E-05 8.3E-05 8.3E-05 0.0E+00  
 INFNT 1.3E-04 1.3E-04 0.0E+00 1.3E-04 1.3E-04 1.3E-04 1.3E-04 0.0E+00

GOAT PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD S  
 ADULT 8.2E-05 8.2E-05 0.0E+00 8.2E-05 8.2E-05 8.2E-05 8.2E-05 0.0E+00  
 TEEN 1.1E-04 1.1E-04 0.0E+00 1.1E-04 1.1E-04 1.1E-04 1.1E-04 0.0E+00  
 CHILD 1.7E-04 1.7E-04 0.0E+00 1.7E-04 1.7E-04 1.7E-04 1.7E-04 0.0E+00  
 INFNT 2.6E-04 2.6E-04 0.0E+00 2.6E-04 2.6E-04 2.6E-04 2.6E-04 0.0E+00

INHAL PATHWAY, DIST GP= 1, 1026. METERS WINDS TOWARD S  
 ADULT 5.9E-04 5.9E-04 0.0E+00 5.9E-04 5.9E-04 5.9E-04 5.9E-04 0.0E+00  
 TEEN 5.9E-04 5.9E-04 0.0E+00 5.9E-04 5.9E-04 5.9E-04 5.9E-04 0.0E+00  
 CHILD 5.3E-04 5.3E-04 0.0E+00 5.3E-04 5.3E-04 5.3E-04 5.3E-04 0.0E+00  
 INFNT 3.0E-04 3.0E-04 0.0E+00 3.0E-04 3.0E-04 3.0E-04 3.0E-04 0.0E+00

SUBTOTALS (NO PLUME)  
 ADULT 2.1E-03 2.1E-03 0.0E+00 2.1E-03 2.1E-03 2.1E-03 2.1E-03 0.0E+00  
 TEEN 2.4E-03 2.4E-03 0.0E+00 2.4E-03 2.4E-03 2.4E-03 2.4E-03 0.0E+00  
 CHILD 3.3E-03 3.3E-03 0.0E+00 3.3E-03 3.3E-03 3.3E-03 3.3E-03 0.0E+00  
 INFNT 6.9E-04 6.9E-04 0.0E+00 6.9E-04 6.9E-04 6.9E-04 6.9E-04 0.0E+00

TOTALS  
 ADULT 2.2E-03 2.2E-03 8.4E-05 2.2E-03 2.2E-03 2.2E-03 2.2E-03 1.4E-04  
 TEEN 2.5E-03 2.5E-03 8.4E-05 2.5E-03 2.5E-03 2.5E-03 2.5E-03 1.4E-04  
 CHILD 3.4E-03 3.4E-03 8.4E-05 3.4E-03 3.4E-03 3.4E-03 3.4E-03 1.4E-04  
 INFNT 7.7E-04 7.7E-04 8.4E-05 7.7E-04 7.7E-04 7.7E-04 7.7E-04 1.4E-04

INDIVIDUAL DOSES (MREM) DUE TO GASEOUS EFFLUENT  
 FOR DATES 010 1 1 THRU 0123124  
 T.BODY GI-TRCT BONE LIVER KIDNEY THYRD LUNG SKIN

PLUME PATHWAY, DIST GP= 1, 942. METERS WINDS TOWARD SSW  
 ADULT 1.4E-04 1.4E-04 1.4E-04 1.4E-04 1.4E-04 1.4E-04 1.4E-04 2.3E-04  
 TEEN 1.4E-04 1.4E-04 1.4E-04 1.4E-04 1.4E-04 1.4E-04 1.4E-04 2.3E-04  
 CHILD 1.4E-04 1.4E-04 1.4E-04 1.4E-04 1.4E-04 1.4E-04 1.4E-04 2.3E-04  
 INFNT 1.4E-04 1.4E-04 1.4E-04 1.4E-04 1.4E-04 1.4E-04 1.4E-04 2.3E-04

GROUND PATHWAY, DIST GP= 1, 942. METERS WINDS TOWARD SSW  
 ADULT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 TEEN 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 CHILD 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

VEGET PATHWAY, DIST GP= 1, 770. METERS WINDS TOWARD SSW  
 ADULT 2.2E-03 2.2E-03 0.0E+00 2.2E-03 2.2E-03 2.2E-03 2.2E-03 0.0E+00  
 TEEN 2.5E-03 2.5E-03 0.0E+00 2.5E-03 2.5E-03 2.5E-03 2.5E-03 0.0E+00  
 CHILD 3.9E-03 3.9E-03 0.0E+00 3.9E-03 3.9E-03 3.9E-03 3.9E-03 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

MEAT PATHWAY, DIST GP= 1, 8045. METERS WINDS TOWARD SSW  
 ADULT 8.8E-06 8.8E-06 0.0E+00 8.8E-06 8.8E-06 8.8E-06 8.8E-06 0.0E+00  
 TEEN 5.2E-06 5.2E-06 0.0E+00 5.2E-06 5.2E-06 5.2E-06 5.2E-06 0.0E+00  
 CHILD 6.3E-06 6.3E-06 0.0E+00 6.3E-06 6.3E-06 6.3E-06 6.3E-06 0.0E+00  
 INFNT 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00

COW PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD SSW  
 ADULT 5.7E-05 5.7E-05 0.0E+00 5.7E-05 5.7E-05 5.7E-05 5.7E-05 0.0E+00  
 TEEN 7.5E-05 7.5E-05 0.0E+00 7.5E-05 7.5E-05 7.5E-05 7.5E-05 0.0E+00  
 CHILD 1.2E-04 1.2E-04 0.0E+00 1.2E-04 1.2E-04 1.2E-04 1.2E-04 0.0E+00  
 INFNT 1.8E-04 1.8E-04 0.0E+00 1.8E-04 1.8E-04 1.8E-04 1.8E-04 0.0E+00

GOAT PATHWAY, DIST GP= 1, 4091. METERS WINDS TOWARD SSW  
 ADULT 1.2E-04 1.2E-04 0.0E+00 1.2E-04 1.2E-04 1.2E-04 1.2E-04 0.0E+00  
 TEEN 1.5E-04 1.5E-04 0.0E+00 1.5E-04 1.5E-04 1.5E-04 1.5E-04 0.0E+00  
 CHILD 2.4E-04 2.4E-04 0.0E+00 2.4E-04 2.4E-04 2.4E-04 2.4E-04 0.0E+00  
 INFNT 3.7E-04 3.7E-04 0.0E+00 3.7E-04 3.7E-04 3.7E-04 3.7E-04 0.0E+00

INHAL PATHWAY, DIST GP= 1, 942. METERS WINDS TOWARD SSW  
 ADULT 8.9E-04 8.9E-04 0.0E+00 8.9E-04 8.9E-04 8.9E-04 8.9E-04 0.0E+00  
 TEEN 8.9E-04 8.9E-04 0.0E+00 8.9E-04 8.9E-04 8.9E-04 8.9E-04 0.0E+00  
 CHILD 7.9E-04 7.9E-04 0.0E+00 7.9E-04 7.9E-04 7.9E-04 7.9E-04 0.0E+00  
 INFNT 4.5E-04 4.5E-04 0.0E+00 4.5E-04 4.5E-04 4.5E-04 4.5E-04 0.0E+00

SUBTOTALS (NO PLUME)  
 ADULT 3.2E-03 3.2E-03 0.0E+00 3.2E-03 3.2E-03 3.2E-03 3.2E-03 0.0E+00  
 TEEN 3.6E-03 3.6E-03 0.0E+00 3.6E-03 3.6E-03 3.6E-03 3.6E-03 0.0E+00  
 CHILD 5.0E-03 5.0E-03 0.0E+00 5.0E-03 5.0E-03 5.0E-03 5.0E-03 0.0E+00  
 INFNT 1.0E-03 1.0E-03 0.0E+00 1.0E-03 1.0E-03 1.0E-03 1.0E-03 0.0E+00

TOTALS  
 ADULT 3.4E-03 3.4E-03 1.4E-04 3.4E-03 3.4E-03 3.4E-03 3.4E-03 2.3E-04  
 TEEN 3.8E-03 3.8E-03 1.4E-04 3.8E-03 3.8E-03 3.8E-03 3.8E-03 2.3E-04  
 CHILD 5.1E-03 5.1E-03 1.4E-04 5.1E-03 5.1E-03 5.1E-03 5.1E-03 2.3E-04  
 INFNT 1.1E-03 1.1E-03 1.4E-04 1.1E-03 1.1E-03 1.1E-03 1.1E-03 2.3E-04

SITE: AEP COOK

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 00010101 - 00033124  
STABILITY CLASS: A DT/DZ  
ELEVATION: SPEED: SPD10M DIRECTION: DIR10M LAPSE: DT60M

-----

WIND DIRECTION	WIND SPEED (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	0	34	16	0	0	0	50
NNE	6	15	5	0	0	0	26
NE	2	5	11	1	0	0	19
ENE	1	9	9	0	0	0	19
E	1	7	2	0	0	0	10
ESE	2	4	2	0	0	0	8
SE	0	13	14	0	0	0	27
SSE	2	17	11	2	0	0	32
S	1	11	24	4	1	0	41
SSW	0	2	11	1	0	0	14
SW	0	5	27	2	0	0	34
WSW	0	17	47	6	0	0	70
W	0	19	13	0	0	0	32
WNW	1	14	7	0	0	0	22
NW	2	21	3	0	0	0	26
NNW	2	31	6	0	0	0	39
TOTAL	20	224	208	16	1	0	469

-----

PERIODS OF CALM(HOURS): 0  
VARIABLE DIRECTION: 0  
HOURS OF MISSING DATA: 18



SITE: AEP COOK

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 00010101 - 00033124  
STABILITY CLASS: B DT/DZ  
ELEVATION: SPEED: SPD10M DIRECTION: DIR10M LAPSE: DT60M

---

WIND DIRECTION	WIND SPEED (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	1	9	6	0	0	0	16
NNE	1	1	3	0	0	0	5
NE	0	1	0	0	0	0	1
ENE	1	3	3	0	0	0	7
E	0	5	3	0	0	0	8
ESE	1	3	0	0	0	0	4
SE	1	2	4	0	0	0	7
SSE	0	3	5	0	0	0	8
S	0	7	10	2	0	0	19
SSW	0	4	6	4	0	0	14
SW	0	10	9	1	0	0	20
WSW	0	8	7	3	0	0	18
W	0	3	4	0	0	0	7
WNW	0	3	0	0	0	0	3
NW	1	5	0	0	0	0	6
NNW	2	13	2	0	0	0	17
TOTAL	8	80	62	10	0	0	160

---

PERIODS OF CALM(HOURS) : 0  
VARIABLE DIRECTION: 0  
HOURS OF MISSING DATA: 18

SITE: AEP COOK

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 00010101 - 00033124  
STABILITY CLASS: C DT/DZ  
ELEVATION: SPEED: SPD10M DIRECTION: DIR10M LAPSE: DT60M

-----

WIND DIRECTION	WIND SPEED (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	1	7	8	0	0	0	16
NNE	0	9	2	0	0	0	11
NE	1	11	0	0	0	0	12
ENE	1	8	4	0	0	0	13
E	2	4	4	0	0	0	10
ESE	0	3	1	0	0	0	4
SE	1	8	1	0	0	0	10
SSE	0	10	3	0	0	0	13
S	0	11	21	1	0	0	33
SSW	1	3	1	1	0	0	6
SW	0	4	4	0	0	0	8
WSW	2	2	9	2	0	0	15
W	0	6	6	0	0	0	12
WNW	0	2	8	1	0	0	11
NW	2	10	0	0	0	0	12
NNW	2	12	9	1	0	0	24
TOTAL	13	110	81	6	0	0	210

-----

PERIODS OF CALM (HOURS): 0  
VARIABLE DIRECTION: 0  
HOURS OF MISSING DATA: 18

SITE: AEP COOK

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 00010101 - 00033124  
STABILITY CLASS: D DT/DZ  
ELEVATION: SPEED: SPD10M DIRECTION: DIR10M LAPSE: DT60M

-----

WIND DIRECTION	WIND SPEED (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	8	25	29	1	0	0	63
NNE	4	21	2	0	0	0	27
NE	5	19	6	0	0	0	30
ENE	1	17	12	0	0	0	30
E	9	43	13	0	0	0	65
ESE	5	22	5	0	0	0	32
SE	9	23	8	0	0	0	40
SSE	10	28	12	0	0	0	50
S	3	45	50	7	0	0	105
SSW	2	11	35	3	0	0	51
SW	2	11	28	7	0	0	48
WSW	1	9	23	2	0	0	35
W	0	21	34	5	0	0	60
WNW	2	30	22	0	0	0	54
NW	6	36	6	0	0	0	48
NNW	5	31	22	0	0	0	58
TOTAL	72	392	307	25	0	0	796

-----

PERIODS OF CALM (HOURS) : 0  
VARIABLE DIRECTION: 0  
HOURS OF MISSING DATA: 18

SITE: AEP COOK

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 00010101 - 00033124  
STABILITY CLASS: E DT/DZ  
ELEVATION: SPEED: SPD10M DIRECTION: DIR10M LAPSE: DT60M

-----

WIND DIRECTION	WIND SPEED (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	4	0	0	0	0	0	4
NNE	11	1	0	0	0	0	12
NE	6	4	0	0	0	0	10
ENE	9	3	0	0	0	0	12
E	8	12	0	0	0	0	20
ESE	6	9	0	0	0	0	15
SE	5	15	2	0	0	0	22
SSE	13	43	11	0	0	0	67
S	3	32	15	0	0	0	50
SSW	2	6	6	0	0	0	14
SW	6	12	16	2	0	0	36
WSW	4	9	12	0	0	0	25
W	3	5	9	0	0	0	17
WNW	2	7	2	0	0	0	11
NW	2	1	0	0	0	0	3
NNW	7	2	0	0	0	0	9
TOTAL	91	161	73	2	0	0	327

-----

PERIODS OF CALM(HOURS): 0  
VARIABLE DIRECTION: 0  
HOURS OF MISSING DATA: 18

SITE: AEP COOK

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 00010101 - 00033124  
STABILITY CLASS: F DT/DZ  
ELEVATION: SPEED: SPD10M DIRECTION: DIR10M LAPSE: DT60M

---

WIND DIRECTION	WIND SPEED (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	3	5	0	0	0	0	8
E	10	0	0	0	0	0	10
ESE	7	1	0	0	0	0	8
SE	13	7	0	0	0	0	20
SSE	2	10	0	0	0	0	12
S	3	10	0	0	0	0	13
SSW	2	3	0	0	0	0	5
SW	3	1	0	0	0	0	4
WSW	1	0	0	0	0	0	1
W	1	0	0	0	0	0	1
WNW	0	0	0	0	0	0	0
NW	1	0	0	0	0	0	1
NNW	0	0	0	0	0	0	0
TOTAL	46	37	0	0	0	0	83

---

PERIODS OF CALM(HOURS): 0  
VARIABLE DIRECTION: 0  
HOURS OF MISSING DATA: 18

SITE: AEP COOK

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 00010101 - 00033124  
STABILITY CLASS: G DT/DZ  
ELEVATION: SPEED: SPD10M DIRECTION: DIR10M LAPSE: DT60M

-----

WIND DIRECTION	WIND SPEED (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	5	1	0	0	0	0	6
ENE	12	2	0	0	0	0	14
E	9	1	0	0	0	0	10
ESE	11	1	0	0	0	0	12
SE	27	1	0	0	0	0	28
SSE	25	2	0	0	0	0	27
S	10	6	0	0	0	0	16
SSW	3	0	0	0	0	0	3
SW	2	0	0	0	0	0	2
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	1	0	0	0	0	0	1
NW	0	0	0	0	0	0	0
NNW	2	0	0	0	0	0	2
TOTAL	107	14	0	0	0	0	121

-----

PERIODS OF CALM(HOURS): 0  
VARIABLE DIRECTION: 0  
HOURS OF MISSING DATA: 18

SITE: AEP COOK

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 00010101 - 00033124  
STABILITY CLASS: ALL DT/DZ  
ELEVATION: SPEED: SPD10M DIRECTION: DIR10M LAPSE: DT60M

---

WIND DIRECTION	WIND SPEED (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	14	75	59	1	0	0	149
NNE	22	47	12	0	0	0	81
NE	19	41	17	1	0	0	78
ENE	28	47	28	0	0	0	103
E	39	72	22	0	0	0	133
ESE	32	43	8	0	0	0	83
SE	56	69	29	0	0	0	154
SSE	52	113	42	2	0	0	209
S	20	122	120	14	1	0	277
SSW	10	29	59	9	0	0	107
SW	13	43	84	12	0	0	152
WSW	8	45	98	13	0	0	164
W	4	54	66	5	0	0	129
WNW	6	56	39	1	0	0	102
NW	14	73	9	0	0	0	96
NNW	20	89	39	1	0	0	149
TOTAL	357	1018	731	59	1	0	2166

---

PERIODS OF CALM(HOURS): 0  
VARIABLE DIRECTION: 0  
HOURS OF MISSING DATA: 18

SITE: AEP COOK

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 00040101 - 00063024  
STABILITY CLASS: A DT/DZ  
ELEVATION: SPEED: SPD10M DIRECTION: DIR10M LAPSE: DT60M

-----

WIND DIRECTION	WIND SPEED (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	3	39	18	0	0	0	60
NNE	1	7	1	0	0	0	9
NE	0	2	3	0	0	0	5
ENE	1	8	3	0	0	0	12
E	1	4	1	0	0	0	6
ESE	0	3	0	0	0	0	3
SE	0	5	0	0	0	0	5
SSE	0	19	10	0	0	0	29
S	1	17	19	2	0	0	39
SSW	3	9	12	1	0	0	25
SW	3	33	40	1	0	0	77
WSW	0	39	28	2	0	0	69
W	1	40	9	0	0	0	50
WNW	1	33	4	0	0	0	38
NW	8	35	1	0	0	0	44
NNW	13	64	10	0	0	0	87
TOTAL	36	357	159	6	0	0	558

-----

PERIODS OF CALM(HOURS): 0  
VARIABLE DIRECTION: 0  
HOURS OF MISSING DATA: 5



SITE: AEP COOK

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 00040101 - 00063024  
STABILITY CLASS: B DT/DZ  
ELEVATION: SPEED: SPD10M DIRECTION: DIR10M LAPSE: DT60M

-----

WIND DIRECTION	WIND SPEED (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	7	2	0	0	0	0	9
NNE	0	0	0	0	0	0	0
NE	1	2	0	0	0	0	3
ENE	1	5	1	0	0	0	7
E	0	3	1	0	0	0	4
ESE	1	2	0	0	0	0	3
SE	1	4	0	0	0	0	5
SSE	4	3	4	0	0	0	11
S	1	6	3	0	0	0	10
SSW	1	2	1	3	0	0	7
SW	1	9	8	0	0	0	18
WSW	2	3	2	0	0	0	7
W	0	5	0	0	0	0	5
WNW	1	1	0	0	0	0	2
NW	2	2	0	0	0	0	4
NNW	4	5	1	0	0	0	10
TOTAL	27	54	21	3	0	0	105

-----

PERIODS OF CALM(HOURS): 0  
VARIABLE DIRECTION: 0  
HOURS OF MISSING DATA: 5

SITE: AEP COOK

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 00040101 - 00063024  
STABILITY CLASS: C DT/DZ  
ELEVATION: SPEED: SPD10M DIRECTION: DIR10M LAPSE: DT60M

---

WIND DIRECTION	WIND SPEED (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	1	3	5	0	0	0	9
NNE	3	7	0	0	0	0	10
NE	1	3	1	0	0	0	5
ENE	2	5	2	0	0	0	9
E	1	1	0	0	0	0	2
ESE	4	4	0	0	0	0	8
SE	3	3	0	0	0	0	6
SSE	2	7	0	0	0	0	9
S	2	7	4	0	0	0	13
SSW	2	5	5	2	0	0	14
SW	1	3	5	0	0	0	9
WSW	2	5	0	0	0	0	7
W	0	3	1	0	0	0	4
WNW	3	2	0	0	0	0	5
NW	0	3	0	0	0	0	3
NNW	3	9	0	0	0	0	12
TOTAL	30	70	23	2	0	0	125

---

PERIODS OF CALM (HOURS): 0  
VARIABLE DIRECTION: 0  
HOURS OF MISSING DATA: 5

SITE: AEP COOK

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 00040101 - 00063024  
STABILITY CLASS: D DT/DZ  
ELEVATION: SPEED: SPD10M DIRECTION: DIR10M LAPSE: DT60M

---

WIND DIRECTION	WIND SPEED (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	11	16	18	2	0	0	47
NNE	8	11	6	0	0	0	25
NE	9	24	13	0	0	0	46
ENE	6	21	10	0	0	0	37
E	3	17	12	1	0	0	33
ESE	10	16	6	0	0	0	32
SE	8	8	12	0	0	0	28
SSE	6	14	4	0	0	0	24
S	7	49	28	0	0	0	84
SSW	4	23	37	4	0	0	68
SW	10	22	26	0	0	0	58
WSW	12	8	6	0	0	0	26
W	10	6	11	0	0	0	27
WNW	13	4	1	0	0	0	18
NW	16	9	1	0	0	0	26
NNW	18	19	9	0	0	0	46
TOTAL	151	267	200	7	0	0	625

---

PERIODS OF CALM(HOURS): 0  
VARIABLE DIRECTION: 0  
HOURS OF MISSING DATA: 5

SITE: AEP COOK

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 00040101 - 00063024  
STABILITY CLASS: E DT/DZ  
ELEVATION: SPEED: SPD10M DIRECTION: DIR10M LAPSE: DT60M

---

WIND DIRECTION	WIND SPEED (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	16	4	0	2	0	0	22
NNE	12	5	0	0	0	0	17
NE	17	10	1	0	0	0	28
ENE	11	11	2	0	0	0	24
E	12	5	0	0	0	0	17
ESE	13	9	0	0	0	0	22
SE	18	7	1	0	0	0	26
SSE	18	12	3	0	0	0	33
S	10	65	5	1	0	0	81
SSW	5	13	20	0	0	0	38
SW	4	17	7	0	0	0	28
WSW	9	12	2	2	0	0	25
W	12	12	3	1	0	0	28
WNW	12	4	0	0	0	0	16
NW	5	1	0	0	0	0	6
NNW	7	3	0	0	0	0	10
TOTAL	181	190	44	6	0	0	421

---

PERIODS OF CALM (HOURS) : 0  
VARIABLE DIRECTION: 0  
HOURS OF MISSING DATA: 5

SITE: AEP COOK

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 00040101 - 00063024  
STABILITY CLASS: F DT/DZ  
ELEVATION: SPEED: SPD10M DIRECTION: DIR10M LAPSE: DT60M

-----

WIND DIRECTION	WIND SPEED (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	4	0	0	0	0	0	4
NNE	4	0	0	0	0	0	4
NE	9	2	0	0	0	0	11
ENE	8	1	0	0	0	0	9
E	19	1	0	0	0	0	20
ESE	7	0	0	0	0	0	7
SE	19	2	0	0	0	0	21
SSE	20	7	0	0	0	0	27
S	19	8	0	0	0	0	27
SSW	4	3	0	0	0	0	7
SW	3	2	0	0	0	0	5
WSW	5	1	0	0	0	0	6
W	6	2	0	0	0	0	8
WNW	6	0	0	0	0	0	6
NW	8	0	0	0	0	0	8
NNW	5	0	0	0	0	0	5
TOTAL	146	29	0	0	0	0	175

-----

PERIODS OF CALM(HOURS) : 0  
VARIABLE DIRECTION: 0  
HOURS OF MISSING DATA: 5

SITE: AEP COOK

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 00040101 - 00063024  
STABILITY CLASS: G DT/DZ  
ELEVATION: SPEED: SPD10M DIRECTION: DIR10M LAPSE: DT60M

-----

WIND DIRECTION	WIND SPEED (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	1	0	0	0	0	0	1
NNE	2	0	0	0	0	0	2
NE	3	0	0	0	0	0	3
ENE	10	2	0	0	0	0	12
E	13	2	0	0	0	0	15
ESE	7	0	0	0	0	0	7
SE	18	0	0	0	0	0	18
SSE	30	1	0	0	0	0	31
S	42	2	0	0	0	0	44
SSW	16	1	0	0	0	0	17
SW	1	0	0	0	0	0	1
WSW	2	0	0	0	0	0	2
W	7	0	0	0	0	0	7
WNW	3	0	0	0	0	0	3
NW	3	0	0	0	0	0	3
NNW	3	1	0	0	0	0	4
TOTAL	161	9	0	0	0	0	170

-----

PERIODS OF CALM(HOURS): 0  
VARIABLE DIRECTION: 0  
HOURS OF MISSING DATA: 5

SITE: AEP COOK

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 00040101 - 00063024  
STABILITY CLASS: ALL DT/DZ  
ELEVATION: SPEED: SPD10M DIRECTION: DIR10M LAPSE: DT60M

---

WIND DIRECTION	WIND SPEED (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	43	64	41	4	0	0	152
NNE	30	30	7	0	0	0	67
NE	40	43	18	0	0	0	101
ENE	39	53	18	0	0	0	110
E	49	33	14	1	0	0	97
ESE	42	34	6	0	0	0	82
SE	67	29	13	0	0	0	109
SSE	80	63	21	0	0	0	164
S	82	154	59	3	0	0	298
SSW	35	56	75	10	0	0	176
SW	23	86	86	1	0	0	196
WSW	32	68	38	4	0	0	142
W	36	68	24	1	0	0	129
WNW	39	44	5	0	0	0	88
NW	42	50	2	0	0	0	94
NNW	53	101	20	0	0	0	174
TOTAL	732	976	447	24	0	0	2179

---

PERIODS OF CALM(HOURS): 0  
VARIABLE DIRECTION: 0  
HOURS OF MISSING DATA: 5

SITE: AEP COOK

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 00070101 - 00093024  
STABILITY CLASS: A DT/DZ  
ELEVATION: SPEED: SPD10M DIRECTION: DIR10M LAPSE: DT60M

---

WIND DIRECTION	WIND SPEED (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	1	91	0	0	0	0	92
NNE	1	15	0	0	0	0	16
NE	0	12	3	0	0	0	15
ENE	0	18	4	0	0	0	22
E	1	20	1	0	0	0	22
ESE	2	18	0	0	0	0	20
SE	2	17	0	0	0	0	19
SSE	5	13	0	0	0	0	18
S	1	50	16	0	0	0	67
SSW	1	8	11	0	0	0	20
SW	0	33	18	0	0	0	51
WSW	2	35	6	0	0	0	43
W	3	25	0	0	0	0	28
WNW	11	33	0	0	0	0	44
NW	9	20	0	0	0	0	29
NNW	5	59	2	0	0	0	66
TOTAL	44	467	61	0	0	0	572

---

PERIODS OF CALM (HOURS): 0  
VARIABLE DIRECTION: 0  
HOURS OF MISSING DATA: 1



SITE: AEP COOK

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 00070101 - 00093024  
STABILITY CLASS: B DT/DZ  
ELEVATION: SPEED: SPD10M DIRECTION: DIR10M LAPSE: DT60M

---

WIND DIRECTION	WIND SPEED (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	1	4	2	0	0	0	7
NNE	1	3	0	0	0	0	4
NE	0	4	1	0	0	0	5
ENE	0	3	1	0	0	0	4
E	0	4	0	0	0	0	4
ESE	3	1	0	0	0	0	4
SE	0	1	0	0	0	0	1
SSE	0	0	0	0	0	0	0
S	1	7	6	1	0	0	15
SSW	0	7	3	0	0	0	10
SW	1	8	2	0	0	0	11
WSW	1	3	1	0	0	0	5
W	1	2	0	0	0	0	3
WNW	2	1	0	0	0	0	3
NW	2	0	0	0	0	0	2
NNW	8	1	0	0	0	0	9
TOTAL	21	49	16	1	0	0	87

---

PERIODS OF CALM(HOURS): 0  
VARIABLE DIRECTION: 0  
HOURS OF MISSING DATA: 1

SITE: AEP COOK

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 00070101 - 00093024  
STABILITY CLASS: C DT/DZ  
ELEVATION: SPEED: SPD10M DIRECTION: DIR10M LAPSE: DT60M

-----

WIND DIRECTION	WIND SPEED (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	2	8	0	0	0	0	10
NNE	3	4	1	0	0	0	8
NE	3	3	0	0	0	0	6
ENE	1	4	0	0	0	0	5
E	1	3	0	0	0	0	4
ESE	4	1	0	0	0	0	5
SE	1	1	0	0	0	0	2
SSE	1	0	0	0	0	0	1
S	2	14	2	1	0	0	19
SSW	0	7	5	0	0	0	12
SW	4	9	1	0	0	0	14
WSW	0	2	0	0	0	0	2
W	2	1	0	0	0	0	3
WNW	2	1	0	0	0	0	3
NW	0	0	0	0	0	0	0
NNW	4	1	1	0	0	0	6
TOTAL	30	59	10	1	0	0	100

-----

PERIODS OF CALM(HOURS): 0  
VARIABLE DIRECTION: 0  
HOURS OF MISSING DATA: 1

SITE: AEP COOK

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 00070101 - 00093024  
STABILITY CLASS: D DT/DZ  
ELEVATION: SPEED: SPD10M DIRECTION: DIR10M LAPSE: DT60M

-----

WIND DIRECTION	WIND SPEED (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	28	51	2	0	0	0	81
NNE	18	28	1	0	0	0	47
NE	10	21	1	0	0	0	32
ENE	11	19	0	0	0	0	30
E	11	6	1	0	0	0	18
ESE	5	9	1	0	0	0	15
SE	3	3	0	0	0	0	6
SSE	5	4	0	0	0	0	9
S	13	50	7	0	0	0	70
SSW	4	29	14	0	0	0	47
SW	4	28	5	2	0	0	39
WSW	4	4	2	0	0	0	10
W	7	6	5	1	0	0	19
WNW	3	2	3	0	0	0	8
NW	8	2	0	0	0	0	10
NNW	10	3	1	0	0	0	14
TOTAL	144	265	43	3	0	0	455

-----

PERIODS OF CALM (HOURS) : 0  
VARIABLE DIRECTION: 0  
HOURS OF MISSING DATA: 1

SITE: AEP COOK

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 00070101 - 00093024  
STABILITY CLASS: E DT/DZ  
ELEVATION: SPEED: SPD10M DIRECTION: DIR10M LAPSE: DT60M

-----

WIND DIRECTION	WIND SPEED (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	36	20	1	0	0	0	57
NNE	16	4	0	0	0	0	20
NE	22	15	0	0	0	0	37
ENE	27	16	0	0	0	0	43
E	19	4	0	0	0	0	23
ESE	30	4	0	0	0	0	34
SE	23	2	0	0	0	0	25
SSE	25	3	0	0	0	0	28
S	27	67	7	0	0	0	101
SSW	8	25	5	0	0	0	38
SW	6	20	2	1	0	0	29
WSW	3	2	0	1	0	0	6
W	9	4	0	0	0	0	13
WNW	3	0	0	0	0	0	3
NW	8	1	0	0	0	0	9
NNW	12	1	1	0	0	0	14
TOTAL	274	188	16	2	0	0	480

-----

PERIODS OF CALM (HOURS): 0  
VARIABLE DIRECTION: 0  
HOURS OF MISSING DATA: 1

SITE: AEP COOK

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 00070101 - 00093024  
STABILITY CLASS: F DT/DZ  
ELEVATION: SPEED: SPD10M DIRECTION: DIR10M LAPSE: DT60M

-----

WIND DIRECTION	WIND SPEED (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	2	0	0	0	0	0	2
NNE	5	0	0	0	0	0	5
NE	18	1	0	0	0	0	19
ENE	31	3	0	0	0	0	34
E	35	0	0	0	0	0	35
ESE	39	1	0	0	0	0	40
SE	20	0	0	0	0	0	20
SSE	18	0	0	0	0	0	18
S	42	12	0	0	0	0	54
SSW	8	7	1	0	0	0	16
SW	4	2	0	0	0	0	6
WSW	3	0	0	0	0	0	3
W	5	0	0	0	0	0	5
WNW	4	0	0	0	0	0	4
NW	3	0	0	0	0	0	3
NNW	5	0	0	0	0	0	5
TOTAL	242	26	1	0	0	0	269

-----

PERIODS OF CALM(HOURS): 0  
VARIABLE DIRECTION: 0  
HOURS OF MISSING DATA: 1

SITE: AEP COOK

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 00070101 - 00093024  
STABILITY CLASS: G DT/DZ  
ELEVATION: SPEED: SPD10M DIRECTION: DIR10M LAPSE: DT60M

-----

WIND DIRECTION	WIND SPEED (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	1	0	0	0	0	0	1
NNE	3	0	0	0	0	0	3
NE	7	0	0	0	0	0	7
ENE	17	0	0	0	0	0	17
E	21	0	0	0	0	0	21
ESE	14	0	0	0	0	0	14
SE	29	0	0	0	0	0	29
SSE	47	0	0	0	0	0	47
S	43	5	0	0	0	0	48
SSW	33	2	0	0	0	0	35
SW	11	0	0	0	0	0	11
WSW	5	0	0	0	0	0	5
W	3	0	0	0	0	0	3
WNW	1	0	0	0	0	0	1
NW	0	0	0	0	0	0	0
NNW	2	0	0	0	0	0	2
TOTAL	237	7	0	0	0	0	244

-----

PERIODS OF CALM(HOURS): 0  
VARIABLE DIRECTION: 0  
HOURS OF MISSING DATA: 1

SITE: AEP COOK

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 00070101 - 00093024  
STABILITY CLASS: ALL DT/DZ  
ELEVATION: SPEED: SPD10M DIRECTION: DIR10M LAPSE: DT60M

---

WIND DIRECTION	WIND SPEED (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	71	174	5	0	0	0	250
NNE	47	54	2	0	0	0	103
NE	60	56	5	0	0	0	121
ENE	87	63	5	0	0	0	155
E	88	37	2	0	0	0	127
ESE	97	34	1	0	0	0	132
SE	78	24	0	0	0	0	102
SSE	101	20	0	0	0	0	121
S	129	205	38	2	0	0	374
SSW	54	85	39	0	0	0	178
SW	30	100	28	3	0	0	161
WSW	18	46	9	1	0	0	74
W	30	38	5	1	0	0	74
WNW	26	37	3	0	0	0	66
NW	30	23	0	0	0	0	53
NNW	46	65	5	0	0	0	116
TOTAL	992	1061	147	7	0	0	2207

---

PERIODS OF CALM(HOURS): 0  
VARIABLE DIRECTION: 0  
HOURS OF MISSING DATA: 1

SITE: AEP COOK

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 00100101 - 00123124  
STABILITY CLASS: A DT/DZ  
ELEVATION: SPEED: SPD10M DIRECTION: DIR10M LAPSE: DT60M

-----

WIND DIRECTION	WIND SPEED (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	4	13	6	3	0	0	26
NNE	1	9	0	0	0	0	10
NE	2	3	13	3	0	0	21
ENE	0	7	9	0	0	0	16
E	0	10	1	0	0	0	11
ESE	1	4	0	0	0	0	5
SE	1	21	6	0	0	0	28
SSE	2	22	7	0	0	0	31
S	0	5	12	3	0	0	20
SSW	0	1	7	2	0	0	10
SW	1	14	19	1	0	0	35
WSW	0	12	12	0	0	0	24
W	1	10	7	0	0	0	18
WNW	2	20	4	0	0	0	26
NW	0	9	1	0	0	0	10
NNW	3	12	4	1	0	0	20
TOTAL	18	172	108	13	0	0	311

-----

PERIODS OF CALM(HOURS): 0  
VARIABLE DIRECTION: 0  
HOURS OF MISSING DATA: 0



SITE: AEP COOK

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 00100101 - 00123124  
STABILITY CLASS: B DT/DZ  
ELEVATION: SPEED: SPD10M DIRECTION: DIR10M LAPSE: DT60M

---

WIND DIRECTION	WIND SPEED (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	3	5	0	0	0	0	8
NNE	2	0	0	0	0	0	2
NE	3	2	0	0	0	0	5
ENE	0	3	0	0	0	0	3
E	1	4	0	0	0	0	5
ESE	0	6	1	0	0	0	7
SE	1	12	7	0	0	0	20
SSE	0	13	3	0	0	0	16
S	0	3	3	1	0	0	7
SSW	0	2	6	1	0	0	9
SW	0	9	7	0	0	0	16
WSW	0	4	8	0	0	0	12
W	0	3	5	0	0	0	8
WNW	0	9	8	0	0	0	17
NW	1	6	7	0	0	0	14
NNW	2	1	0	0	0	0	3
TOTAL	13	82	55	2	0	0	152

---

PERIODS OF CALM(HOURS): 0  
VARIABLE DIRECTION: 0  
HOURS OF MISSING DATA: 0

SITE: AEP COOK

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 00100101 - 00123124  
STABILITY CLASS: C DT/DZ  
ELEVATION: SPEED: SPD10M DIRECTION: DIR10M LAPSE: DT60M

-----

WIND DIRECTION	WIND SPEED (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	5	5	1	0	0	0	11
NNE	0	3	0	0	0	0	3
NE	0	3	0	0	0	0	3
ENE	2	7	2	0	0	0	11
E	4	1	0	0	0	0	5
ESE	2	4	0	0	0	0	6
SE	3	7	3	1	0	0	14
SSE	2	12	3	0	0	0	17
S	2	10	7	1	0	0	20
SSW	0	5	16	0	0	0	21
SW	0	6	8	0	0	0	14
WSW	0	4	14	1	0	0	19
W	1	1	4	0	0	0	6
WNW	0	11	14	0	0	0	25
NW	5	7	10	0	0	0	22
NNW	2	8	0	0	0	0	10
TOTAL	28	94	82	3	0	0	207

-----

PERIODS OF CALM(HOURS): 0  
VARIABLE DIRECTION: 0  
HOURS OF MISSING DATA: 0

SITE: AEP COOK

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 00100101 - 00123124  
STABILITY CLASS: D DT/DZ  
ELEVATION: SPEED: SPD10M DIRECTION: DIR10M LAPSE: DT60M

-----

WIND DIRECTION	WIND SPEED (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	12	27	3	0	0	0	42
NNE	12	23	0	0	0	0	35
NE	12	28	4	0	0	0	44
ENE	10	37	2	0	0	0	49
E	8	30	2	0	0	0	40
ESE	8	14	8	0	0	0	30
SE	7	41	11	1	0	0	60
SSE	5	49	8	0	0	0	62
S	3	37	42	0	0	0	82
SSW	1	14	33	1	0	0	49
SW	5	20	13	6	0	0	44
WSW	4	12	45	27	1	0	89
W	5	34	47	2	0	0	88
WNW	11	63	33	4	0	0	111
NW	8	53	18	0	0	0	79
NNW	9	29	5	0	0	0	43
TOTAL	120	511	274	41	1	0	947

-----

PERIODS OF CALM(HOURS): 0  
VARIABLE DIRECTION: 0  
HOURS OF MISSING DATA: 0

SITE: AEP COOK

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 00100101 - 00123124  
STABILITY CLASS: E DT/DZ  
ELEVATION: SPEED: SPD10M DIRECTION: DIR10M LAPSE: DT60M

-----

WIND DIRECTION	WIND SPEED (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	4	1	1	0	0	0	6
NNE	9	7	0	0	0	0	16
NE	7	16	0	0	0	0	23
ENE	10	9	0	0	0	0	19
E	8	11	0	0	0	0	19
ESE	21	7	0	0	0	0	28
SE	16	34	3	0	0	0	53
SSE	12	18	3	0	0	0	33
S	4	48	16	0	0	0	68
SSW	2	13	5	0	0	0	20
SW	1	21	0	0	0	0	22
WSW	1	7	1	0	0	0	9
W	2	10	0	0	0	0	12
WNW	3	12	2	0	0	0	17
NW	5	6	1	0	0	0	12
NNW	7	2	0	0	0	0	9
TOTAL	112	222	32	0	0	0	366

-----

PERIODS OF CALM(HOURS): 0  
VARIABLE DIRECTION: 0  
HOURS OF MISSING DATA: 0

SITE: AEP COOK

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 00100101 - 00123124  
STABILITY CLASS: F DT/DZ  
ELEVATION: SPEED: SPD10M DIRECTION: DIR10M LAPSE: DT60M

---

WIND DIRECTION	WIND SPEED (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	1	0	0	0	0	0	1
NNE	2	0	0	0	0	0	2
NE	4	1	0	0	0	0	5
ENE	3	3	0	0	0	0	6
E	4	2	0	0	0	0	6
ESE	20	3	0	0	0	0	23
SE	11	5	0	0	0	0	16
SSE	15	10	0	0	0	0	25
S	5	18	1	0	0	0	24
SSW	10	1	0	0	0	0	11
SW	4	0	0	0	0	0	4
WSW	3	0	0	0	0	0	3
W	5	1	0	0	0	0	6
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
TOTAL	87	44	1	0	0	0	132

---

PERIODS OF CALM (HOURS): 0  
VARIABLE DIRECTION: 0  
HOURS OF MISSING DATA: 0

SITE: AEP COOK

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 00100101 - 00123124  
STABILITY CLASS: G DT/DZ  
ELEVATION: SPEED: SPD10M DIRECTION: DIR10M LAPSE: DT60M

-----

WIND DIRECTION	WIND SPEED (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	0	0	0	0	0	0	0
NNE	1	0	0	0	0	0	1
NE	2	0	0	0	0	0	2
ENE	2	0	0	0	0	0	2
E	7	1	0	0	0	0	8
ESE	7	0	0	0	0	0	7
SE	12	0	0	0	0	0	12
SSE	20	3	0	0	0	0	23
S	20	11	0	0	0	0	31
SSW	3	0	0	0	0	0	3
SW	1	1	0	0	0	0	2
WSW	0	0	0	0	0	0	0
W	1	0	0	0	0	0	1
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	1	0	0	0	0	0	1
TOTAL	77	16	0	0	0	0	93

-----

PERIODS OF CALM(HOURS): 0  
VARIABLE DIRECTION: 0  
HOURS OF MISSING DATA: 0

SITE: AEP COOK

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 00100101 - 00123124  
STABILITY CLASS: ALL DT/DZ  
ELEVATION: SPEED: SPD10M DIRECTION: DIR10M LAPSE: DT60M

---

WIND DIRECTION	WIND SPEED (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	29	51	11	3	0	0	94
NNE	27	42	0	0	0	0	69
NE	30	53	17	3	0	0	103
ENE	27	66	13	0	0	0	106
E	32	59	3	0	0	0	94
ESE	59	38	9	0	0	0	106
SE	51	120	30	2	0	0	203
SSE	56	127	24	0	0	0	207
S	34	132	81	5	0	0	252
SSW	16	36	67	4	0	0	123
SW	12	71	47	7	0	0	137
WSW	8	39	80	28	1	0	156
W	15	59	63	2	0	0	139
WNW	16	115	61	4	0	0	196
NW	19	81	37	0	0	0	137
NNW	24	52	9	1	0	0	86
TOTAL	455	1141	552	59	1	0	2208

---

PERIODS OF CALM(HOURS): 0  
VARIABLE DIRECTION: 0  
HOURS OF MISSING DATA: 0

Appendix A3.0

OFFSITE DOSE CALCULATION MANUAL (ODCM) REVISIONS

The Offsite Dose Calculation Manual, 12 PMP 6010 OSD.001, was revised twice during the reporting period. The reasons for each revision and the Plant Operations Review Committee approvals are documented on the procedure Review and Approval Tracking Form and the changes are indicated by marginal bars.

These revisions were determined to maintain the level of radioactive effluent control required by 10 CFR 20.1302, 40 CFR 190, 10 CFR 50.36a, and Appendix I to 10 CFR 50 and not adversely impact the accuracy or reliability of effluent, dose, or setpoint calculations.



REVIEW AND APPROVAL TRACKING FORM

RECORD COPY

Procedure Information:		
Number: <u>PMP-6010.OSD.001</u>	Revision: <u>14</u>	Change: <u>0</u>
Title: <u>OFF-SITE DOSE CALCULATION MANUAL</u>		
Category:		
<input checked="" type="checkbox"/> Change (Full Procedure) with Review of Change Only	<input type="checkbox"/> Correction (Full Procedure)	
<input type="checkbox"/> Change (Page Substitution) with Review of Change Only	<input type="checkbox"/> Correction (Page Substitution)	
<input type="checkbox"/> New Procedure or Change with Full Review	<input type="checkbox"/> Cancellation	
<input type="checkbox"/> Superseded By: _____		
Required Reviews:		
<input checked="" type="checkbox"/> Operations	<input type="checkbox"/> ALARA	<input type="checkbox"/> Nuc. Doc. Management
<input type="checkbox"/> Maintenance	<input type="checkbox"/> Training	<input type="checkbox"/> None Required
<input type="checkbox"/> Design Engineering	<input type="checkbox"/> Surveillance Section	
<input type="checkbox"/> Plant Engineering	<input type="checkbox"/> Performance Assurance	
<input checked="" type="checkbox"/> Chemistry/RP	<input checked="" type="checkbox"/> Business Services Procedure Group	
<input type="checkbox"/> Other: (Includes Technical Reviewer Determined Reviews)		
<u>E PLAP</u>		
<u>ENVIRONMENTAL</u>		
Writer Task Reviews:		
Revision Summary attached?		<input type="checkbox"/> Yes
Safety Screening complete?	SS/SE Tracking No: <u>2000-0017-00</u>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> N/A
Implementation Plan developed?	(Ref. Step 3.4.15)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> N/A
Periodic Review conducted?	(Data Sheet 7 Complete)	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Cognizant Org Review: <u>[Signature]</u>		Date: <u>2/9/00</u>
Technical Review: <u>[Signature]</u>		Date: <u>2/9/00</u>
Ops Mgr Concurrence: <u>NA</u>		Date: <u>1/1</u>
Owner Concurrence: <u>[Signature]</u>		Date: <u>2/9/00</u>
Writer Review: <u>[Signature]</u>		Date: <u>2/9/00</u>
Approvals:		
PORC Review Required:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Mtg. No.: <u>3633</u>
Approval Authority Review/Approval: <u>[Signature]</u>		Date: <u>2/11/00</u>
		Effective Date: <u>2/15/00</u>

## REVISION SUMMARY

Number: PMP-6010.OSD.001 Revision: 14 Change: 0  
Title: OFF-SITE DOSE CALCULATION MANUAL

The majority of the changes/corrections to PMP-6010.OSD.001, Offsite Dose Calculation Manual, are administrative in nature. They include reformatting the procedure in its entirety to comply with the requirements of PMP-2010.PRC.001, Procedure Writing, and rewording sections that result in no technical changes to the text per PMP-2010.PRC.002. All changes and the reasons for those changes are as follows:

1. This procedure was reformatted in its entirety to comply with PMP-2010.PRC.001, Procedure Writing.
2. Section 1 – Purpose and Scope, NOTE – Added NOTE, ‘Only applicable Sections, Subsections, and Attachments within this procedure need to be performed’. Implements requirements of PMP-2010.PRC.003 while advising the user that individual Sections, Subsections, and Attachments can be performed without a requirement of the entire procedure being performed.
3. Section 1 – Purpose and Scope – (Rev. 13, Objective, page 1) – Broke down paragraph into bulleted items. This is an editorial correction for ease of reading and interpretation.
4. (Rev. 13, Section 2 – References, page 1) – Moved to Section 5 in new format per PRC.002.
5. Section 2 – Definition and Abbreviations – This section has been added under the new format process. Abbreviations describe sampling frequency letters, (example: D, W, Q, S/A, etc.). Clarification of abbreviations shown throughout attachments, in accordance with TS Table 1.2 (Definitions). This information was lost when the ODCM was originally moved out of the TS. Definition for sampling evolution has been added to define the actions associated with fulfilling a surveillance requirement.
6. (Rev. 13, Section 3 – List of Attachments, page 2) – This section has been incorporated into the Table of Contents per PRC.001.
7. Throughout the entire procedure, added the title of each attachment after each reference to the attachment. This is to eliminate the possibility of human error.
8. Section 3 – (Rev. 13, Section 4) - Details – This entire section has been reformatted per PRC.001.
9. Step 3.1.1a (Rev. 13, page 3) – Reworded from passive voice to active voice; Editorial clarification.
10. Step 3.1.1c - (Rev. 13, page 3) – Changed ‘air dose is taken from Reg Guide 1.109 (Eq 7)’ to ‘air dose is generated from site specific parameters and Reg. Guide 1.109 (Eq 7)’. Change was made to provide clarification to the source of formulas.
11. Throughout procedure changed all calibration subscript abbreviations, such as i and p to “i” and “p” for clarification and to eliminate the possibility of human error.
12. Step 3.1.1c (Description of Parameters for equation, Rev. 13, page 3) – Deleted comma in  $D_y$ ,  $D_b$  air and changed 3.17E-8 description from ‘inverse number of seconds/year, years/second’ to ‘number of years in a second (years/second)’. These corrections are made to provide consistency and clarification in formula format and variables.
13. Step 3.1.1d - (Rev. 13, page 3) – Added ‘Formula used for the calculation is generated from parameters contained in MIDAS, XDCALC (Eq 2).’ Addition was made to provide clarification to source of formulas.
14. Step 3.1.1d (equation, Rev. 13, page 3) – Changed multiplication symbol from ‘x’ to ‘•’ to eliminate the possibility of human error.
15. Step 3.1.1d ( $\sigma_{Zg}$ , Rev. 13, page 3) – Added ‘(Reg. Guide 1.111 Fig 1)’ to provide clarification to source of description of formula parameter.

### Office Information For Form Tracking Only – Not Part of Form

This is a free-form as called out in PMP-2010.PRC.002, Procedure Correction, Change, and Review.

Page 2 of 4

## REVISION SUMMARY

Number: PMP-6010.OSD.001 Revision: 14 Change: 0  
Title: OFF-SITE DOSE CALCULATION MANUAL

16. Step 3.1.1d (H<sub>c</sub>, Rev. 13, page 3) – Added '(Containment Building – 49.4 meters)' to provide clarification for description of formula parameter.
17. Step 3.1.1g - (Rev. 13, page 4) – Changed 'taken from Reg Guide 1.109' to 'generated from site specific parameters and Reg. Guide 1.109'. Change was made to provide clarification to the source of formulas.
18. Step 3.1.1j2 - (Rev. 13, page 5) – Added '(Plant established formula)'. To clarify 'source of formula.
19. Step 3.1.1j4 - (Rev. 13, page 5) – Changed 'a dose calculation is performed' to 'dose calculations (liquid and gas) are performed'. Editorial clarification.
20. Step 3.1.1j6 - (Rev. 13, page 5) – Added 'Use the following plant established equation:'. This statement was added for clarification of the equation that follows this step.
21. Step 3.1.1j7 - (Rev. 13, page 6) – This step has been rewritten from a passive voice to an active voice. (Rewritten from 'The calculated release rate shall be assumed to be the release rate until the next determination and used in the monthly dose projections to ensure compliance.....' to now read 'Use the calculated release rate in monthly dose projections until the next determination to ensure compliance.....' This correction is a MicroSoft Word correction.
22. Step 3.1.2c - (Rev. 13, page 6) – Changed 'are taken from Reg Guide 1.109 Appendix A' to 'are generated from site specific data and Reg. Guide 1.109'. Change was made to provide clarification to the source of formulas.
23. Step 3.1.2c1 (F) - (Rev. 13, page 6) – Changed description 'the dilution water flow rate in gpm' to 'the circulation water system water flow rate, in gpm, is used for evaluating dose via these pathways as dilution flow'. Editorial clarification.
24. Step 3.1.2c1 (t<sub>p</sub>) - (Rev. 13, page 6) – Added '(t<sub>p</sub> = 12 hours). Editorial clarification.
25. Step 3.1.2c2 (formula) - (Rev. 13, page 7) – Changed the multiplication symbol from 'X' to '•' to eliminate the possibility of human error.
26. Step 3.1.2c2 (t<sub>p</sub>) - (Rev. 13, page 7) - Added '(t<sub>p</sub> = 24 hours). Editorial clarification.
27. Step 3.1.2c2 (M<sub>p</sub>) - (Rev. 13, page 7) - Added 'Given in Parameter 5 of MIDEL as 1.0.' This statement was omitted in previous revision to this procedure, as it appears within Step 3.1.2c1.
28. Step 3.1.2c3 (formula) - (Rev. 13, page 7) - Changed the multiplication symbol from 'X' to '•' to eliminate the possibility of human error.
29. Step 3.1.2d (substeps 1-3) - (Rev. 13, page 6) – Changed '0.0' to '0'. Editorial change/clarification.
30. Subsection 3.2 - (Rev. 13, pages 8-11) – The following note and substeps within this Subsection all have been rewritten to reflect a correction from passive voice to active voice, which is a MicroSoft Word grammatical correction and PRC.001 recommends writing in active voice. In most cases the passive voice sentences consist of 'shall be'. The NOTE preceding Subsection 3.2, steps 3.2.1a, 3.2.1e, 3.2.1f, 3.2.2a, 3.2.2e, 3.2.2f, 3.2.3a3, 3.2.3a4, 3.2.3b1, 3.2.3b3, 3.2.3b4, 3.2.3c1, 3.2.3c3, 3.2.3d1, 3.2.3d2, 3.2.4a1, 3.2.4a3, 3.2.4a4, 3.2.4b1, 3.2.4b3, 3.2.4c1, 3.2.4c3, 3.2.4d1, 3.2.4d2, 3.2.5c.
31. End of Step 3.2.1, - (Rev. 13, page 8) - Added 'Bases' section from original Technical Specifications. This section was moved to this document per the guidance of General Letter 89-01.
32. End of Step 3.2.2, - (Rev. 13, page 8) - Added 'Bases' section from original Technical Specifications. This section was moved to this document per the guidance of General Letter 89-01.
33. Step 3.2.3a - (Rev. 13, page 9) – Added acronym '(TRS)' for the Turbine Room Sump and replaced Turbine Room Sump with 'TRS' throughout remainder of body of procedure per PRC.002.
34. Step 3.2.3b2 - (Rev. 13, page 9) – Added 'as applicable'. Editorial clarification.

**Office Information For Form Tracking Only – Not Part of Form**

This is a free-form as called out in PMP-2010.PRC.002, Procedure Correction, Change, and Review.

Page 3 of 11

## REVISION SUMMARY

Number: PMP-6010.OSD.001

Revision: 14

Change: 0

Title: OFF-SITE DOSE CALCULATION MANUAL

35. Step 3.2.3c2 - (Rev. 13, page 9) – Corrected ‘from the above limits’ to ‘of the limits in Steps 3.2.3a, 3.2.3b, or 3.2.3c1 above’. This is a correction per PRC.002 to eliminate the possibility of human error.
36. Step 3.2.3e – This step has been added to provide general guidance for the effluent controls program.
37. End of Step 3.2.3, - (Rev. 13, page 10) - Added ‘Bases’ section from original Technical Specifications. This section was moved to this document per the guidance of General Letter 89-01.
38. End of Step 3.2.4, - (Rev. 13, page 11) - Added ‘Bases’ section from original Technical Specifications. This section was moved to this document per the guidance of General Letter 89-01.
39. End of Step 3.2.5, - (Rev. 13, page 11) - Added ‘Bases’ section from original Technical Specifications. This section was moved to this document per the guidance of General Letter 89-01.
40. Subsection 3.3 - (Rev. 13, pages 12-18) – The following substeps within this Subsection have been rewritten to reflect a correction from passive voice to active voice, which is a MicroSoft Word grammatical correction and PRC.001 recommends writing in active voice. In most cases the passive voice sentences consist of ‘shall be’. Steps 3.3.1 and 3.3.a4.
41. Subsection 3.3 – (Rev. 13, page 12) - Added 3<sup>rd</sup> paragraph for the Site stance on instrument uncertainty. This paragraph was added to provide clarification on instrument uncertainty.
42. Step 3.3.1a3 - (Rev. 13, page 12) – Added ‘from Addendum AA1 of NUREG-0133:’. This was added to provide clarification of reference document.
43. Step 3.3.1b4 - (Rev. 13, page 13) - Added ‘from Addendum AA1 of NUREG-0133:’. This was added to provide clarification of reference document.
44. Step 3.3.1b4 (C) - (Rev. 13, page 13) – Added ‘(The limiting nuclide concentration will be evaluated periodically and adjusted appropriately)’. To identify the source of 5E-7 and to provide periodic evaluation.
45. Step 3.3.2 - (Rev. 13, page 14) – Added second paragraph ‘Gaseous effluent monitor hi alarm setpoints will routinely be established. ....’ This was added for ALARA purposes in allowing setpoint to be established below the calculated setpoint.
46. Step 3.3.2a1 - (Rev. 13, page 14) – Added ‘unit analysis’. This was added to provide reference for the equation source.
47. Step 3.3.2a1 (MRP), fourth bullet - (Rev. 13, page 14) – Reworded ‘repeat 1) through 3)’ to ‘Repeat the above bullets’. This was reworded so the sentence would correspond with the reformatted bulleted steps.
48. Step 3.3.2a1 (F<sub>p</sub>) - (Rev. 13, page 15) – Corrected unit vent flow rate values from ‘139,600 cfm for Unit 1 and 103,500 for Unit 2’ to 186,600 cfm for Unit 1 and 143,400 cfm for Unit 2’. These exhaust flow rates were corrected to match D.C. Cook Plant drawings.
49. Step 3.3.2a1 (x/Q) - (Rev. 13, page 15) – Added ‘worst case’ before annual average relative concentration. Added to provide clarification.
50. Step 3.3.2a2 - (Rev. 13, page 16) – Broke down previous (rev. 13) paragraph into step 2 – 6. Per PRC.002, for ease of reading and understanding, and to eliminate the possibility of human error.
51. Step 3.3.2b - (Rev. 13, page 16) – Changed title of step from ‘Waste Gas Decay Tanks’ to ‘Waste Gas Storage Tanks’. Changed to include CVCS hold up tanks.
52. Step 3.3.2b2 - (Rev. 13, page 16) – Corrected ‘Due to a’ to ‘In the event of a’. Editorial/grammatical correction.
53. Step 3.3.2b2 - (Rev. 13, page 16) – Added paragraph, ‘Chemical and Volume Control System Hold Up Tanks (CVCS Hut) may be released. ....’ This was added to provide guidance in accordance with current plant practices and allow operational flexibility to provide for plant safety and operation.

### Office Information For Form Tracking Only – Not Part of Form

This is a free-form as called out in PMP-2010.PRC.002, Procedure Correction, Change, and Review.

Page 4 of 11

## REVISION SUMMARY

Number: PMP-6010.OSD.001 Revision: 14 Change: 0

Title: OFF-SITE DOSE CALCULATION MANUAL

54. Step 3.3.2b3 – Added this step. ‘It is normally prudent to allow 45 days of decay.....’ This was added to provide guidance in accordance with current plant practices and allow operational flexibility to provide for plant safety and operation.
55. Step 3.3.2c2 - (Rev. 13, page 16) – Added ‘ During purges, these monitor setpoints will give a Purge and Exhaust Isolation upon actuation of high alarm setpoints for particulate and noble gas channels.’ This was added to provide more detailed information on roles and responsibilities.
56. Step 3.3.2c4 - (Rev. 13, page 16) – Added ‘prior to release, but there is a bimonthly sample program’. This was added to provide detail on plant operational policy.
57. Step 3.3.2d1 - (Rev. 13, page 17) - Added ‘unit analysis’. This was added to provide reference for the equation source.
58. Step 3.3.2e1 - (Rev. 13, page 17) - Added ‘unit analysis’. This was added to provide reference for the equation source.
59. Step 3.3.2f (Rev. 13, step 4.3.2.6 – Emergency Gaseous Setpoint Methodology, page 17) – This step has been deleted as Emergency Gaseous Setpoint Methodology is not part of this procedure.
60. Subsection 3.5 - (Rev. 13, pages 18-20) - The following substeps within this Subsection all have been rewritten to reflect a correction from passive voice to active voice, which is a MicroSoft Word grammatical correction and PRC.001 recommends writing in active voice. In most cases the passive voice sentences consist of ‘shall be’. Step 3.5.2a, 3.5.2a1, 3.5.2a2 (both paragraphs), 3.5.2a3 (2<sup>nd</sup> paragraph), 3.5.2a4, 3.5.2a4c, 3.5.3a, 3.5.3c, 3.5.4a.
61. Step 3.5.1a - (Rev. 13, page 18) – Previous (rev.13) paragraph has been broken down into bulleted steps for ease of reading and understanding, per PRC.002.
62. Step 3.5.2a3 - (Rev. 13, page 19) – Deleted the word ‘then’ after Attachment 3.21. This is a grammatical correction.
63. End of Step 3.5.2 - (Rev. 13, page 19) - Added ‘Bases’ section from original Technical Specifications. This section was moved to this document per the guidance of General Letter 89-01.
64. End of Step 3.5.3 - (Rev. 13, page 19) - Added ‘Bases’ section from original Technical Specifications. This section was moved to this document per the guidance of General Letter 89-01.
65. Step 3.5.4a - (Rev. 13, page 20) – Added Reg. Guide 4.1. This was added to provide clarification of reference document.
66. End of Step 3.5.4 - (Rev. 13, page 20) - Added ‘Bases’ section from original Technical Specifications. This section was moved to this document per the guidance of General Letter 89-01.
67. Step 3.6.2a - (Rev. 13, page 20) – Correction from passive voice to active voice, which is a MicroSoft Word grammatical correction and PRC.001 recommends writing in active voice.
68. Step 3.7.2 - (Rev. 13, page 20) – Changed ‘the MIDAS’ to ‘a meteorological software’ to be more generic in the event Cook Plant changes to another system.
69. Subsection 3.8 - (Rev. 13, pages 20-21)– The following steps have all been rewritten to reflect a correction from passive voice to active voice, which is a MicroSoft Word grammatical correction and PRC.001 recommends writing in active voice. Step 3.8.1a, 3.8.1b (and bulleted items), 3.8.2a, 3.8.2b, 3.8.2c (and bulleted items), 3.8.2d, 3.8.2e, 3.8.2f, 3.8.2g.
70. Step 3.8.1b (Rev. 13, Step 4.8.1, 2<sup>nd</sup>, 3<sup>rd</sup>, and 4<sup>th</sup> paragraphs, page 20) – All three paragraphs have been broken down into bulleted items for ease of reading and understanding.
71. Step 3.8.2c - (Rev. 13, page 21) has been broken down into bulleted items for ease of reading and understanding.

### Office Information For Form Tracking Only – Not Part of Form

This is a free-form as called out in PMP-2010.PRC.002, Procedure Correction, Change, and Review.

Page 5 of 11

## REVISION SUMMARY

Number: PMP-6010.OSD.001 Revision: 14 Change: 0  
Title: OFF-SITE DOSE CALCULATION MANUAL

72. Step 3.8.2c, fourth bullet (Rev. 13, step 4.8.2 3<sup>rd</sup> para, last sentence, page 21) – Deleted last sentence ‘Perform the assessment of radiation doses in accordance with this procedure’. This has been deleted as it contains no value to this bulleted item (paragraph).
73. Step 3.8.2c, fifth bullet – Added this bullet, ‘Inoperable radiation monitor periods exceeding 30 continuous days.....’ This bullet has been added as it is a requirement by the NRC for completing the Annual Radiological Effluent Release Report (ARERR).
74. Subsection 3.9 – 10 CFR 50.75 (g) Implementation – This subsection has been added to provide guidance on 10 CFR 50.75 (g) implementation.
75. Steps 3.10.1 thru 3.10.5 - (Rev. 13, Section 4.9, page 21) - Rewritten to reflect a correction from passive voice to active voice, which is a MicroSoft Word grammatical correction and PRC.001 recommends writing in active voice.
76. Step 5.1.3 – Added reference 12-THP-6010.RPP.639. Appropriate reference added.
77. Step 5.2.1j - (Rev. 13, page 1) – Added Technical Specifications 6.8.4a, 6.8.4b, 6.9.1.6, and 6.9.1.7. These are appropriate Technical Specifications that should be referenced.
78. Step 5.2.1n - (Rev. 13, page 1) – Deleted Calculation RS-C-0202 and added Calculation RS-C-200. This is the appropriate calculation that should be referenced.
79. Step 5.2.1p - (Rev. 13, page 1) – Added reference item HPPOS-223, Consideration of Measurement Uncertainty When Measuring Radiation Levels Approaching Regulatory Limits. This reference has been added to provide plant standpoint on instrumentation uncertainty associated with radiation measurements.
80. Step 5.2.1q – Added reference item Watts – Bar Jones (WBJ) document, R-86-C001, The Primary Calibration of Eberline Instrument Corporation SPING – 3/4 Low, Mid, and High Range Noble Gas Detectors. Appropriate reference added.
81. Step 5.2.1r – Added reference item WBJ Document, R-86-C-003, The Primary Calibration of Eberline Instrument Corporation DAM-4 and Water Monitor. Appropriate reference added.
82. Step 5.2.1s – Added reference item 40 CFR 190, Environmental Radiation Protection Standards for Nuclear Power Operations. Appropriate reference added.
83. Step 5.2.2b – Added reference item Letter from B.P. Lauzau, Venting of Middle CVCS Hold-Up Tank Directly to Unit Vent, May 1, 1992. Appropriate reference added.
84. Step 5.2.2c – Added reference AEP Design Information Transmittal on Aux Building Ventilation Systems. Appropriate reference added.
85. Step 5.2.2d – Added reference PMP-4030.EIS.001, Event-Initiated Surveillance Testing. Appropriate reference added.
86. Attachment 3.1 –  
(Rev. 13, page 1) - Updated R<sub>i</sub> values/information in the Pathway table to reflect data taken from the MIDAS tech manual.  
(Rev. 13, pages2-5) - Added references at the bottom of the applicable pages for clarification.
87. Attachment 3.2 - (Rev. 13, page 2) – Added footnote ‘Compensatory actions are governed by PMP-4030.EIS.001, Event-Initiated Surveillance Testing’. This was added to indicate what administrative controls are in place to implement actions.

### Office Information For Form Tracking Only – Not Part of Form

This is a free-form as called out in PMP-2010.PRC.002, Procedure Correction, Change, and Review.

Page 6 of 11

## REVISION SUMMARY

Number: PMP-6010.OSD.001 Revision: 14 Change: 0  
Title: OFF-SITE DOSE CALCULATION MANUAL

### 88. Attachment 3.3 –

(Rev. 13, page 1) - Added applicability asterisk to Section 3.a. (CHANNEL CHECK D) to clarify channel checks are not required if no release is ongoing. Applicability statement is relevant to Turbine Room Sump. If the sampler is not running, a check is not necessary, since the check is to verify operation of the sampler when it is in use. - (Rev. 13, page 2) - Rewrote Table Notations to correct from passive voice to active voice. (Rev. 13, page 2) - Added current responsibility for performance by department at end of attachment. This was added to provide organizational responsibility for the Effluent Controls Program.

### 89. Attachment 3.4 –

(Rev. 13, page 1) - Item 3, added Pressure Relief to title for clarification.  
(Rev. 13, page 1) - Item 4.a, changed 'Gas Decay Tank' to 'Waste Gas' for clarification.  
(Rev. 13, page 2) - Table Notations, Item 2, rewrote from passive voice to active voice, per PRC.002.  
(Rev. 13, page 2) - Action item 8, added 'd' to 'require', grammatical correction.  
(Rev. 13, page 2) - Action item 8, added 'Sampling evolutions are not an interruption of a continuous release or sampling period', added to provide Operations with guidance on how to properly meet the surveillances required when the Unit Vent Radiation monitoring system is inoperable. Currently Operations interpretation is that continuous sampling means that no interruption of flow is allowable. This definition would require that the effluent release throughout the unit vent would have to be suspended or additional backup sampling equipment installed in order to obtain the filter media required to fulfill the weekly sample analysis required by the ODCM. This definition and guidance is based upon the definitions provided in Reg. Guide 1.21 and License Amendment Unit 1 No. 54 and Unit 2 No. 40 to the Cook Nuclear Plant, Technical Specifications, Generic Letter 89-01, and PMP-4030.EIS.001, Event-Initiated Surveillance Testing. Added footnote at end of attachment that states 'Compensatory actions are governed by PMP-4030-EIS.001, Event-Initiated Surveillance Testing', to indicate what administrative controls are in place, to implement actions, and to provide organizational responsibility for the Effluent controls Program.

### 90. Attachment 3.5 –

(Rev. 13, page 1) - Added information on alarm or trip function association to provide consistency with Attachment 3.2.  
(Rev. 13, page 1) - Added 'Unit' to Item 2 title, for consistency.  
(Rev. 13, page 1) - Added 'Pressure Relief' to Item 3 title, for clarification.  
(Rev. 13, page 1) - Added 'Including CVCS HUT' to Item 4 title, for clarification to include both tanks.  
(Rev. 13, page 2) - Rewrote the Table Notations from a passive voice to an active voice, per PRC.001.  
(Rev. 13, page 2) - Added current responsibility for performance by department at end of attachment to provide organizational responsibility for the Effluent Controls Program.

### Office Information For Form Tracking Only – Not Part of Form

This is a free-form as called out in PMP-2010.PRC.002, Procedure Correction, Change, and Review.

Page 7 of 11

## REVISION SUMMARY

Number: PMP-6010.OSD.001 Revision: 14 Change: 0  
Title: OFF-SITE DOSE CALCULATION MANUAL

### 91. Attachment 3.6 –

(Rev. 13, page 1) - Added applicability asterisk to Item B to indicate 'during releases via this pathway'. This pathway is continuous liquid releases (example: TRS). Samples are not possible if a release is not ongoing. This change provides clarification.

(Rev. 13, page 1) - Table Notations, added step f, 'WHEN the gross beta gamma (including tritium) concentration in the turbine room sump is greater than.....', requirement was added to comply with UFSAR Appendix Q, Question 320.8.

### 92. Attachment 3.7 –

(Rev. 13, page 1) - Item b, (Frequency) – changed 'Each Tank' to 'Each Purge' for clarification.  
(Rev. 13, page 1) - Added CPR with Frequency and Minimum Analysis Frequency as Bimonthly for clarification.

(Rev. 13, page 1) - Added applicability asterisk to Items 'c' and 'd' to indicate 'During releases via this pathway'. This pathway is for 1500, 1800, and 1900 RMS Monitors (gaseous). Samples are not possible if a release is not ongoing. For example, during shutdown, 1800 and 1900 are inoperable since there is no flow. This change provides clarification.

(Rev. 13, page 2) - Table Notations items were rewritten from a passive voice to active voice per PRC.002.

(Rev. 13, page 2) - Table Notations, Item b – Changed 'Analyses shall also be performed following any operational.....' to 'Following start-up or 15% increase per hour power changes, perform.....' The same requirements are provided, but with better clarity. The purpose of the analysis is stepped up frequency for discovering primary to secondary leaks. These leaks would be created during stressful operational conditions, which include startup and severe (>15%/hr) power level changes. These conditional and the normal monthly grab samples are adequate for detecting primary to secondary leakage in a timely manner. Table Notations, Item 'd', added 'Sampling evolutions are not an interruption of a continuous release or sampling period', to provide Operations with guidance on how to properly meet the surveillances required when the Unit Vent Radiation monitoring system is inoperable. Currently Operations' interpretation is that continuous sampling means that no interruption of flow is allowable. This definition would require that the effluent release throughout the unit vent would have to be suspended or additional backup sampling equipment installed in order to obtain the filter media required to fulfill the weekly sample analysis required by the ODCM. This definition and guidance is based upon the definitions provided in Reg. Guide 1.21 and License Amendment Unit 1 No. 54 and Unit 2 No. 40 to the Cook Nuclear Plant, Technical Specifications, Generic Letter 89-01, and PMP-4030.EIS.001, Event-Initiated Surveillance Testing.

### 93. Attachment 3.8 –

(Rev. 13, page 1) - Added # notation to liquid MRP to indicate nominal value to indicate nominal value due to changes that can be made.

(Rev. 13, page 1) - Corrected flow rates for Unit 1 Vent from '139,000' to '186,600' and for Unit 2 Vent from '103,500' to '143,400'. These exhaust flow rates were corrected to match D.C. Cook Plant drawings.

### Office Information For Form Tracking Only – Not Part of Form

This is a free-form as called out in PMP-2010.PRC.002, Procedure Correction, Change, and Review.

Page 8 of 11



## REVISION SUMMARY

Number: PMP-6010.OSD.001 Revision: 14 Change: 0

Title: OFF-SITE DOSE CALCULATION MANUAL

94. Attachment 3.9 –  
(Rev. 13, page 1) - Changed 'Turbine Building Sump' to 'Turbine Room Sump' for consistency.  
(Rev. 13, page 1) - Added 'potential' to Blowdown, ESW, and TRS paths on diagram, in response to Technical Reviewer preference.  
(Rev. 13, page 2) - Deleted page of notes listing plant flow diagrams as this information provided no useful information and is prone to frequent revision.
95. Attachment 3.12 –  
(Rev. 13, pages 1-2) - Redrew graphs using computer, previous graphs were of poor quality and source file is no longer available.  
(Rev. 13, pages 1-2) - Added source references with nuclides to provide reference documentation for graph creation.
96. Attachment 3.13 -  
(Rev. 13, page 1) – Redrew graph using computer, previous graph was of poor quality and source file is no longer available.  
(Rev. 13, page 1) - Added source reference with nuclide to provide reference documentation for graph creation.
97. Attachment 3.14 –  
(Rev. 13, page 1) - Added 'and CVCS HUT' to Waste Gas Decay Tanks title, for clarification.  
(Rev. 13, page 2) - Deleted page of notes listing plant flow diagrams as this information provided no useful information and is prone to frequent revision.
98. Attachment 3.15 –  
(Rev. 13, page 1) - Item 1, added 'Auxiliary Building' to title, for consistency.  
(Rev. 13, page 1) - Added '(8) and Chemical & Volume Control System Hold Up Tanks (3)' to second item to provide guidance in accordance with current plant practices and allow operational flexibility to provide for plant safety and operation.  
(Rev. 13, page 1) - Added '28,741 ft<sup>3</sup> max @ 8#, 0 level' in the Capacity column to provide guidance in accordance with current plant practices and allow operational flexibility to provide for plant safety and operation.  
(Rev. 13, page 1) - Changed flow rates from '139,600' and '103,500' to '186,600' and '143,400' (respectively), '64,500' to '35,000', and '12,000' to '32,000' to match plant drawings (1-5147A-44 and 2-5147A-47).
99. Attachment 3.16 –  
(Rev. 13, pages 1-2) - All data within this attachment has been updated to reflect the latest 10-year averages.  
(Rev. 13, page 1) - Changed Worst Case Chi/Q from 1.28E-5 sec/m<sup>3</sup> in Sector A 1994' to '1.54E-5 sec/m<sup>3</sup> in Sector J 1998' as the analysis of 1998 meteorological data shows worst case has increased since the previous value.

### Office Information For Form Tracking Only – Not Part of Form

This is a free-form as called out in PMP-2010.PRC.002, Procedure Correction, Change, and Review.

Page 9 of 11

## REVISION SUMMARY

Number: PMP-6010.OSD.001 Revision: 14 Change: 0  
Title: OFF-SITE DOSE CALCULATION MANUAL

100. Attachment 3.17 –  
(Rev. 13, page 1) - Item 1, added 'Performed or' and 'Provide a description of what has been received', to provide documentation and clarification.  
(Rev. 13, page 1) - Item 2, added 'Provide an evaluation', to provide documentation and clarification.  
(Rev. 13, page 1) - Added new Item 3, 'review nuclide mix for gaseous and liquid release....' to ensure periodic review of dose factors.  
(Rev. 13, page 1) - Changed all 'R.P. Department' signatures to 'Environmental Department', due to departmental responsibility change.
101. Attachment 3.18 –  
(Rev. 13, page 1) - Added footnote <sup>(1)</sup> to title 'Dose Factors', footnote states 'Site specific calculated using guidance provided in NUREG 0133, Rev. 1, Section 5.2.', for clarification of source document.
102. Attachment 3.19 –  
(Rev. 13, page 2) - Changed Drinking Water LTW from '0.4 mi S.' to '0.6 mi S.', CR 98-04943 provides new references to documents that provide the new measurement. Related plant documents will be updated concurrently.  
(Rev. 13, page 3) - Added asterisk indicator after INGESTION – MILK Indicator Farms. (Rev. 13, page 4) - Added asterisk footnote at end of attachment which states, 'The three milk indicator farms will be determined by the Annual Land Use Census and those that are willing to participate'. This was added due to the farm turnover rate and 12-THP-6010.RPP.635, Collection of Milk Samples, controls which farm is sampled.  
(Rev. 13, page 4) - Rewrote first paragraph on last page of attachment from passive voice to active voice, per PRC.002.  
(Rev. 13, page 4) - Deleted definitions as end of attachment, as they have been incorporated into Section 2 of the procedure.
103. Attachment 3.20 –  
(Rev. 13, page 1) - Added 'REMP' to title of attachment, for clarification.  
(Rev. 13, page 1) - Added 'This Data is directly from our plant-specific Technical Specifications', for clarification of source document.  
(Rev. 13, page 1) - Notes, Item A, second paragraph and Item B, rewrote from passive voice to active voice, per PRC.002.
104. Attachment 3.21 –  
(Rev. 13, page 1) - Added, 'This Data is directly from our plant-specific Technical Specification.', for clarification of source document.
105. Attachment 3.22 –  
(Rev. 13, page 1) - Updated new map per land use census.

### Office Information For Form Tracking Only – Not Part of Form

This is a free-form as called out in PMP-2010.PRC.002, Procedure Correction, Change, and Review.

Page 10 of 11

## REVISION SUMMARY

Number: PMP-6010.OSD.001 Revision: 14 Change: 0  
Title: OFF-SITE DOSE CALCULATION MANUAL


106. Attachment 3.23 –  
(Rev. 13, page 1) - Updated new map per land use census.  
(Rev. 13, page 1) - Removed 'Sue Dorman....Goat' from map as this goat is no longer part of the REMP program, as described in the 1998 Land Use Census. (12-THP-610.RPP.640, Attachment 1).  
(Rev. 13, page 1) - Added footnote, 'The current milk indicator farms are indicated here, but they will be determined and controlled.....' This was added due to the farm turnover rate and 12-THP-6010.RPP.635, Collection of Milk Samples, controls which farm is sampled.
107. Attachment 3.24 –  
(Rev. 13, page 1) - Added '(This is a 10 CFR 50.75 (g) item)' as a reference in the title to provide clear identification.
108. Attachment 3.25 -  
(Rev. 13, page 1) - Added '(This is a 10 CFR 50.75 (g) item)' as a reference at the beginning of the attachment to provide clear identification.

INSTRUCTIONS: Replace entire previous revision (13) with this revision (14).

**Office Information For Form Tracking Only – Not Part of Form**

This is a free-form as called out in PMP-2010.PRC.002, Procedure Correction, Change, and Review.

Page 11 of 11

 <small>AMP - America's Energy Partner</small>	PMP-6010.OSD.001	Rev. 14	Page 1 of 102
OFF-SITE DOSE CALCULATION MANUAL			<b>RECORD COPY</b>
Information			Effective Date: <u>2/15/00</u>
<u>Doug Foster</u> Writer	<u>John Carlson</u> Owner	<u>Environmental</u> Cognizant Organization	

**TABLE OF CONTENTS**

**VOID-SUPERCEDED BY**  
**NOT FOR PLANT USE**  
**SEE**  
**DOCUMENT # Rev. 15**  
**5**  
**5-3-00**

1	PURPOSE AND SCOPE.....	6
2	DEFINITIONS AND ABBREVIATIONS.....	5
3	DETAILS.....	6
3.1	Calculation of Off-Site Doses.....	6
3.1.1	Gaseous Effluent Releases.....	6
3.1.2	Liquid Effluent Releases.....	12
3.2	Limits of Operation and Surveillances of the Effluent Release Points.....	16
3.2.1	Radioactive Liquid Effluent Monitoring Instrumentation.....	16
3.2.2	Radioactive Gaseous Effluent Monitoring Instrumentation.....	17
3.2.3	Liquid Effluents.....	18
	a. Concentration Excluding Releases via the Turbine Room Sump (TRS) Discharge.....	18
	b. Concentration of Releases from the TRS Discharge.....	19
	c. Dose.....	19
	d. Liquid Radwaste Treatment System.....	20
3.2.4	Gaseous Effluents.....	23
	a. Dose Rate.....	23
	b. Dose – Noble Gases.....	24
	c. Dose – Iodine-131, Iodine-133, Tritium, and Radioactive Material in Particulate Form.....	24
	d. Gaseous Radwaste Treatment.....	25
3.2.5	Radioactive Effluents – Total Dose.....	28
3.3	Calculation of Alarm/Trip Setpoints.....	29
3.3.1	Liquid Monitors.....	30
	a. Liquid Batch Monitor Setpoint Methodology.....	30
	b. Liquid Continuous Monitor Setpoint Methodology.....	32
3.3.2	Gaseous Monitors.....	34
	a. Plant Unit Vent.....	35
	b. Waste Gas Storage Tanks.....	39
	c. Containment Purge and Exhaust System.....	39
	d. Steam Jet Air Ejector System (SJAE).....	40
	e. Gland Seal Condenser Exhaust.....	41
3.4	Radioactive Effluents Total Dose.....	41

**OFF-SITE DOSE CALCULATION MANUAL**

**Information**


Effective Date: 2/15/00

Doug Foster  
Writer

John Carlson  
Owner

Environmental  
Cognizant Organization

3.5	Radiological Environmental Monitoring Program (REMP).....	42
3.5.1	Purpose of the REMP .....	42
3.5.2	Conduct of the REMP.....	43
3.5.3	Annual Land Use Census.....	45
3.5.4	Interlaboratory Comparison Program .....	46
3.6	Steam Generator Storage Facility Groundwater Monitoring Program .....	47
3.6.1	Purpose of the Steam Generator Storage Facility Groundwater Radiological Monitoring Program .....	47
3.6.2	Conduct of the Steam Generator Storage Facility Groundwater Radiological Monitoring Program .....	47
3.7	Meteorological Model .....	47
3.8	Reporting Requirements .....	48
3.8.1	Annual Radiological Environmental Operating Report (AREOR) .....	48
3.8.2	Annual Radiological Effluent Release Report (ARERR).....	49
3.9	10 CFR 50.75 (g) Implementation.....	51
3.10	Reporting/Management Review .....	51
4	<b>FINAL CONDITIONS .....</b>	<b>51</b>
5	<b>REFERENCES .....</b>	<b>52</b>

	PMP-6010.OSD.001	Rev. 14	Page 3 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
<b>Information</b>			Effective Date: <u>2/15/00</u>
<u>Doug Foster</u> Writer	<u>John Carlson</u> Owner	<u>Environmental</u> Cognizant Organization	

### SUPPLEMENTS

Attachment 3.1	Dose Factors for Various Pathways .....	Pages 54 - 58
Attachment 3.2	Radioactive Liquid Effluent Monitoring Instruments.....	Pages 59 - 60
Attachment 3.3	Radioactive Liquid Effluent Monitoring Instrumentation Surveillance Requirements .....	Pages 61 - 62
Attachment 3.4	Radioactive Gaseous Effluent Monitoring Instrumentation.....	Pages 63 - 65
Attachment 3.5	Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Requirements .....	Pages 66 - 67
Attachment 3.6	Radioactive Liquid Waste Sampling and Analysis Program.....	Pages 68 - 69
Attachment 3.7	Radioactive Gaseous Waste Sampling and Analysis Program .....	Pages 70 - 71
Attachment 3.8	Multiple Release Point Factors for Release Points.....	Page 72
Attachment 3.9	Liquid Effluent Release Systems .....	Page 73
Attachment 3.10	Plant Liquid Effluent Parameters .....	Page 74
Attachment 3.11	Volumetric Detection Efficiencies for Principle Gamma Emitting Radionuclides for Eberline Liquid Monitors .....	Page 75
Attachment 3.12	Counting Efficiency Curves for R-19, and R-24 .....	Pages 76 - 77
Attachment 3.13	Counting Efficiency Curve for R-20, and R-28 .....	Page 78
Attachment 3.14	Gaseous Effluent Release Systems .....	Page 79
Attachment 3.15	Plant Gaseous Effluent Parameters .....	Page 80
Attachment 3.16	10 Year Average of 1989-1998 Data.....	Pages 81 - 82
Attachment 3.17	Annual Evaluation of $\overline{x/Q}$ and $\overline{D/Q}$ Values For All Sectors .....	Page 83

**OFF-SITE DOSE CALCULATION MANUAL**

**Information**

Effective Date: 2/15/00

Doug Foster  
Writer

John Carlson  
Owner

Environmental  
Cognizant Organization

Attachment 3.18 Dose Factors .....Pages 84 - 86

Attachment 3.19 Radiological Environmental Monitoring Program Sample  
Stations, Sample Types, Sample Frequencies.....Pages 87 - 90

Attachment 3.20 Maximum Values for Lower Limits of Detections<sup>A,B</sup> -  
REMP .....Pages 91 - 92

Attachment 3.21 Reporting Levels for Radioactivity Concentrations in  
Environmental Samples .....Page 93

Attachment 3.22 On-Site Monitoring Location - REMP .....Page 94

Attachment 3.23 Off-Site Monitoring Locations - REMP .....Page 95

Attachment 3.24 Safety Evaluation By The Office Of Nuclear Reactor  
Regulation .....Pages 96 - 98

Attachment 3.25 Approval To Retain Contaminated Concrete On-Site at  
Donald C. Cook Nuclear Plant..... Pages 99 - 102

## 1 PURPOSE AND SCOPE

**NOTE:** Only applicable Sections, Subsections, and Attachments within this procedure need to be performed.

- The Off-Site Dose Calculation Manual (ODCM) is the top tier document for the Radiological Environmental Monitoring Program (REMP), the Radioactive Effluent Controls Program (RECP), and contains criteria pertaining to the previous Radiological Effluent Technical Specifications (RETS) as defined in NUREG-0472.
- The ODCM contains the methodology and parameters to be used in the calculation of off-site doses due to radioactive liquid and gaseous effluents and in the calculation of liquid and gaseous monitoring instrumentation alarm/trip setpoints.
- The ODCM provides flow diagrams detailing the treatment path and the major components of the radioactive liquid and gaseous waste management systems.
- The ODCM presents maps of the sample locations and the meteorological model used to estimate the atmospheric dispersion and deposition parameters.
- The ODCM specifically addresses the design characteristics of the Donald C. Cook Nuclear Plant based on the flow diagrams contained on the "OP Drawings" and plant "System Description" documents.

## 2 DEFINITIONS AND ABBREVIATIONS

Term:	Meaning:
S or shiftly	At least once per 12 hours
D or daily	At least once per 24 hours
W or weekly	At least once per 7 days
M or monthly	At least once per 31 days
Q or quarterly	At least once per 92 days
SA or semi-annually	At least once per 184 days
R	At least once per 549 days – based on 18 month fuel cycle; period may change with cycle.
S/U	Prior to each reactor startup
P	Completed prior to each release
Sampling evolution	Process of changing filters or obtaining grab samples



## OFF-SITE DOSE CALCULATION MANUAL

## 3 DETAILS

## 3.1 Calculation of Off-Site Doses

## 3.1.1 Gaseous Effluent Releases

- a. The computer program MIDAS (Meteorological Information and Dose Assessment System) performs the calculation of doses from effluent releases. The site-specific parameters associated with MIDAS reside in the following subprograms:
- MIDER
  - MIDEX
  - MIDEL
  - MIDEQ
  - MIDEN
- b. The subprogram used to enter and edit gaseous release data is called MD1EQ (EQ). The data entered in EQ can be used to calculate the accumulation of dose to individual land based receptors based on hourly meteorology and release data. The air dose from this data is calculated via the XDAIR subprogram in MIDAS. It computes air dose results for use in Reg. Guide 1.21 reports and 10 CFR 50 Appendix I calculations based on routine releases.
- c. The formula used for the calculation of the air dose is generated from site specific parameters and Reg. Guide 1.109 (Eq 7):

$$D_{\gamma}, D_{\beta} \text{ air} = \frac{\bar{\chi}}{Q} \times \sum [(M_i \text{ or } N_i) \times Q_i \times 3.17E-8]$$

Where;

$D_{\gamma}, D_{\beta} \text{ air}$  = the gamma or beta air dose in mrad/yr to an individual receptor

$\frac{\bar{\chi}}{Q}$  = the annual average or real time atmospheric dispersion factor over land, sec/m<sup>3</sup>

$M_i$  = the gamma air dose factor, mrad m<sup>3</sup> / yr μCi, from Attachment 3.18, Dose Factors

Information	PMP-6010.OSD.001	Rev. 14	Page 7 of 102
OFF-SITE DOSE CALCULATION MANUAL			

$N_i$  = the beta air dose factor,  $\text{mrad m}^3 / \text{yr } \mu\text{Ci}$ , from Attachment 3.18, Dose Factors

$Q_i$  = the release rate of radionuclide, "i", in  $\mu\text{Ci}/\text{yr}$ .

$3.17\text{E}-8$  = number of years in a second (years/second).

- d. The value for the ground average  $\overline{\chi/Q}$  for each sector is calculated using equations shown below. Formula used for the calculation is generated from parameters contained in MIDAS Technical Manual, XDCALC (Eq 2).

$$\overline{\chi/Q} = \frac{2.03}{\overline{u_{m_g}} \cdot x \cdot \Sigma_g} \cdot x T_f$$

Where;

$$\Sigma_g = \text{minimum of } \sqrt{\sigma_{z_g}^2 + \frac{H_c^2}{2\pi}} \text{ or } \Sigma_g = \sqrt{3} \sigma_{z_g}$$

$x$  = distance downwind of the source, meters. This information is found in parameter 5 of MIDEEX.

$\overline{u_{m_g}}$  = wind speed for ground release, (meters/second)

$\sigma_{z_g}$  = vertical dispersion coefficient for ground release, (meters), (Reg. Guide 1.111 Fig.1)

$H_c$  = building height (meters) from parameter 28 of MIDER. (Containment Building = 49.4 meters)

$T_f$  = terrain factor (= 1 for Cook Nuclear Plant) because we consider all our releases to be ground level (see parameter 5 in MIDEEX).

$$2.03 = \sqrt{2 \div \pi} \div 0.393 \text{ radians } (22.5^\circ)$$

## OFF-SITE DOSE CALCULATION MANUAL

- e. The dose due to gaseous releases, other than the air dose, is calculated by the MIDAS subprogram GASPRO. GASPRO computes the accumulation of dose to individual receptors based on hourly meteorology and release data. Calculations consider the effect of each important radionuclide for each pathway, organ, age group, distance and direction.
- f. Calculations are based on the environmental pathways-to-man models in Reg. Guide 1.109. The program considers 7 pathways, 8 organs, and 4 age groups in 16 direction sectors. The distances used are taken from the MIDEQ file.
- g. The formulas used for the following calculations are generated from site specific parameters and Reg. Guide 1.109:
1. Total Body Plume Pathway (Eq 10)

$$\text{Dose (mrem/year)} = 3.17E-8 \times \sum (Q_i \times \overline{\chi/Q} \times S_f \times DFB_i)$$

Where;

$S_f$  = shielding factor that accounts for the dose reduction due to shielding provided by residential structures during occupancy (maximum exposed individual = 0.7 per Table E-15 of Reg. Guide 1.109)

$DFB_i$  = the whole body dose factor from Table B-1 of Reg. Guide 1.109, mrem -  $m^3$  per  $\mu\text{Ci} - \text{yr}$ . See Attachment 3.18, Dose Factors.

$Q_i$  = the release rate of radionuclide "i", in  $\mu\text{Ci}/\text{yr}$

$\overline{\chi/Q}$  = the annual average or real time atmospheric dispersion factor,  $\text{sec}/m^3$

2. Skin Plume Pathway (Eq 11)

$$Dose (mrem/yr) = 3.17E - 8 \times S_f \times \frac{\lambda}{Q} \times [\sum(Q_i \times 1.11 \times DF_i^{\gamma}) + \sum(Q_i \times DFS_i)]$$

Where;

1.11 = conversion factor, tissue to air, mrem/mrad

$DF_i^{\gamma}$  = the gamma air dose factor for a uniform semi-infinite cloud of radionuclide "i", in mrad m<sup>3</sup>/μCi yr from Table B-1, Reg. Guide 1.109. See Attachment 3.18, Dose Factors.

$DFS_i$  = the beta skin dose factor for a semi-infinite cloud of radionuclide "i", in mrem m<sup>3</sup>/μCi yr from Table B-1, Reg. Guide 1.109. See Attachment 3.18, Dose Factors.

3. Radionuclide and Radioactive Particulate Doses (Eq 13 & 14)

- a) The dose,  $D_{IP}$  in mrem/yr, to an individual from radionuclides, other than noble gases, with half-lives greater than eight days in gaseous effluents released to unrestricted areas will be determined as follows:

$$D_{IP} (mrem/year) = 3.17E - 8 \times \sum(R_i \times W \times Q_{ic})$$

Where;

$R_i$  = the most restrictive dose factor for each identified radionuclide "i", in m<sup>2</sup> mrem sec / yr μCi (for food and ground pathways) or mrem m<sup>3</sup> / yr μCi (for inhalation pathway), for the appropriate pathway

For sectors with existing pathways within five miles of the site, use the values of  $R_i$  for these real pathways, otherwise use pathways distance of five miles. See Attachment 3.1, Dose Factors for Various Pathways, for the maximum  $R_i$  values for the most controlling age group for selected radionuclides.  $R_i$  values were generated by computer code PARTS, see NUREG-0133, Appendix D.

## OFF-SITE DOSE CALCULATION MANUAL

W = the annual average or real time atmospheric dispersion parameters for estimating doses to an individual at the worst case location, and where W is further defined as:

$$W_{in} = \overline{\chi / Q} \text{ for the inhalation pathway, in } \text{sec/m}^3$$

-OR-

$$W_{fg} = \overline{D / Q} \text{ for the food and ground pathways in } 1/\text{m}^2$$

Q<sub>ic</sub> = the release rate of those radioiodines, radioactive materials in particulate form and radionuclides other than noble gases with half-lives greater than eight days, in  $\mu\text{Ci/yr}$

- h. This calculation is made for each pathway. The maximum computed dose at any receptor for each pathway is selected. These are summed together to get the dose to compare to the limits. Only the maximum of the cow milk or goat milk pathway (not both) is included in the total.
- i. In addition to the above routines, the QUICKG routine of the MIDAS system is used to provide data used in the monthly reports due to its ability to use annual average meteorological data rather than real time data, thus shortening the run time involved.
- j. Steam Generator Blowdown System (Start Up Flash Tank Vent)
  1. The amount of radioiodine and other radionuclides that are released via the start up flash tank and its vent are calculated through actual sample results while the start up flash tank is in service.
  2. The following calculation is performed to determine the amount of curies released through this pathway. (Plant established formula.)

$$\text{Curies} = \frac{\mu\text{Ci}}{\text{ml}} \times \text{GPM} \times \text{time on flash tank (min)} \times 3.785\text{E} - 3$$

Where; 3.785E-3 = conversion factor, ml Ci/ $\mu\text{Ci}$  gal.

3. The flow rate is determined from the blowdown valve position and the time on the start up tank. Chemistry Department performs the sampling and analysis of the samples.

4. This data is provided to the MIDAS computer and dose calculations (liquid and gas) are performed to ensure compliance with Subsection 3.2, Limits of Operation and Surveillances of the Effluent Release Points, dose limits. MIDAS uses the formulas given in step 3.1.2, Liquid Effluent Releases, to calculate doses to members of the public.

**NOTE:** This section provides the minimum requirements to be followed at Donald C. Cook Nuclear Plant. This would be used if actual sample data was not available each time the start up flash tank was in service.

5. The radioiodine release rate must be determined in accordance with the following equation every 31 day period whenever the specific activity of the secondary coolant system is greater than 0.01  $\mu\text{Ci/g}$  dose equivalent I-131.
6. **IF** the specific activity of the secondary coolant system is less than 0.01  $\mu\text{Ci/g}$  dose equivalent I-131, **THEN** the release rate must be determined once every six months. Use the following plant established equation:

$$Q_y = (C_i) (IPF) (R_{sgb})$$

Where;

$Q_y$  = the release rate of I-131 from the steam generator flash tank vent, in  $\mu\text{Ci/sec}$

$C_i$  = the concentration ( $\mu\text{Ci/cc}$ ) of I-131 in the secondary coolant averaged over a period not exceeding seven days

IPF = the iodine partition factor for the Start Up Flash Tank, 0.05, in accordance with NUREG-0017

$R_{sgb}$  = the steam generator blowdown rate to the start up flash tank, in  $\text{cc/sec}$

7. Use the calculated release rate in monthly dose projections until the next determination to ensure compliance with Subsection 3.2, Limits of Operation and Surveillances of the Effluent Release Points, dose limits. Report the release rate calculations in the Annual Radioactive Effluent Release Report.

<b>OFF-SITE DOSE CALCULATION MANUAL</b>
---

8. Steam Generators are sparged, sampled, and drained as batches early in outages to facilitate cooldown for entry into the steam generator. This is repeated prior to startup to improve steam generator chemistry for the startup.

### 3.1.2 Liquid Effluent Releases

- a. The calculation of doses from liquid effluent releases is also performed by the MIDAS program. The subprogram used to enter and edit liquid release data is called MD1EB (EB).
- b. To calculate the individual dose (mrem), the program DS1LI (LD) is used. It computes the individual dose for up to 5 receptors for 14 liquid pathways due to release of radioactive liquid effluents. The pathways can be selected using the MDEL program and changing the values in parameter 1. D.C. Cook Nuclear Plant uses 3 pathways: potable water, shoreline, and aquatic foods (fresh water sport fishing).
- c. The equations used are generated from site specific data and Reg. Guide 1.109. They are as follows:
  1. Potable Water (Eq 1)

$$R_{apj} = 1100 \times \frac{U_{ap}}{M_p \times F \times 2.23E-3} \times \sum_i Q_i \times D_{aipj} e^{-\lambda_i t_p}$$

Where;

$R_{apj}$  = the total annual dose to organ "j" to individuals of age groups "a" from all of the nuclides "i" in pathway "p", in mrem/year

1100 = conversion factor, yr ft<sup>3</sup> pCi / Ci sec L

$U_{ap}$  = a usage factor that specifies the exposure time or intake rate for an individual of age group "a" associated with pathway "p". Given in #29-84 of parameter 4 in MDEL and Reg. Guide 1.109 Table E-5. See Attachment 3.1, Dose Factors for Various Pathways.

Information	PMP-6010.OSD.001	Rev. 14	Page 13 of 102
OFF-SITE DOSE CALCULATION MANUAL			

$M_p$  = the dilution factor at the point of exposure (or the point of withdrawal of drinking water or point of harvest of aquatic food). Given in parameter 5 of MIDEAL as 2.6.

F = the circulation water system water flow rate, in gpm, is used for evaluating dose via these pathways as dilution flow

2.23E-3 = conversion factor,  $\text{ft}^3 \text{ min} / \text{sec gal}$

$Q_i$  = the release rate of nuclide "i" for the time period of the run input via MIDEAL, Curies/year

$D_{aijp}$  = the dose factor, specific to a given age group "a", radionuclide "i", pathway "p", and organ "j", which can be used to calculate the radiation dose from an intake of a radionuclide, in  $\text{mrem}/\rho\text{Ci}$ . These values are taken from tables E-11 through E-14 of Reg. Guide 1.109 and are located within the MIDAS code.

$\lambda_i$  = the radioactive decay constant for radionuclide "i", in  $\text{hours}^{-1}$

$t_p$  = the average transit time required for nuclides to reach the point of exposure, 12 hours. This allows for nuclide transport through the water purification plant and the water distribution system. For internal dose,  $t_p$  is the total elapsed time between release of the nuclides and ingestion of food or water, in hours. Given as #25 of parameter 4 in MIDEAL. ( $t_p = 12$  hours)



## OFF-SITE DOSE CALCULATION MANUAL

## 2. Aquatic Foods (Eq 2)

$$R_{apj} = 1100 \times \frac{U_{ap}}{M_p \times F \times 2.23E-3} \times \sum_i Q_i \cdot B_{ip} \cdot D_{aipj} e^{-\lambda_i t_p}$$

Where,

$B_{ip}$  = the equilibrium bioaccumulation factor for nuclide "i" in pathway "p", expressed as  $\rho\text{Ci L} / \text{kg } \rho\text{Ci}$ . The factors are located within the MIDAS code and are taken from Table A-1 of Reg. Guide 1.109. See Attachment 3.1, Dose Factors for Various Pathways.

$t_p$  = the average transit time required for nuclides to reach the point of exposure, 24 hours. This allows for decay during transit through the food chain, as well as during food preparation. Given as #26 of parameter 4 in MIDEL. ( $t_p = 24$  hours)

$M_p$  = the dilution factor at the point of exposure, 1.0 for Aquatic Foods. Given in parameter 5 of MIDEL as 1.0.

## 3. Shoreline Deposits (Eq 3)

$$R_{apj} = 110,000 \times \frac{U_{ap} \times W}{M_p \times F \times 2.23E-3} \times \sum_i Q_i \cdot T_i \cdot D_{aipj} [e^{-\lambda_i t_p}] \times [1 - e^{-\lambda_i t_b}]$$

Where;

$W$  = the shoreline width factor. Given as an input of 0.3 when running the program, based on Table A-2 in Reg. Guide 1.109.

$T_i$  = the radioactive half-life of the nuclide, "i", in days

$D_{aipj}$  = the dose factor for standing on contaminated ground, in  $\text{mrem m}^2 / \text{hr } \rho\text{Ci}$ . The values are taken from table E-6 of Reg. Guide 1.109 and are located within the MIDAS code. See Attachment 3.1, Dose Factors for Various Pathways.

$t_b$  = the period of time for which sediment or soil is exposed to the contaminated water,  $1.31E+5$  hours. Given in MIDEL as item 6 of parameter 4.

Information	PMP-6010.OSD.001	Rev. 14	Page 15 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			

$t_p$  = the average transit time required for nuclides to reach the point of exposure, 0 hours. Given as #28 of parameter 4 in MIDEL.

110,000 = conversion factor  $\text{yr ft}^3 \text{ pCi} / \text{Ci sec m}^2 \text{ day}$ , this accounts for proportionality constant in the sediment radioactivity model

$M_p$  = the dilution factor at the point of exposure (or the point of withdrawal of drinking water or point of harvest of aquatic food). Given in parameter 5 of MIDEL as 2.6.

- d. The MIDAS program uses the following plant specific parameters, which are entered by the operator.
1. Irrigation rate = 0
  2. Fraction of time on pasture = 0
  3. Fraction of feed on pasture = 0
  4. Shore width factor = 0.3 (from Reg. Guide 1.109, Table A-2)
- e. The results of DS1LI are printed in LDRPT (LP). These results are used in the monthly report of liquid releases.
- f. In addition, the program DOSUM (DM) is used to search the results files of DS1LI to find the maximum liquid pathway individual doses. The highest exposures are then printed in a summary table. Each line is compared with the appropriate dose limit. The table provides a concise summary of off-site environmental dose calculations for inclusion in Reg. Guide 1.21 reports.

**OFF-SITE DOSE CALCULATION MANUAL**

**NOTE:** The performance of each surveillance requirement must be within the specified time interval with a maximum allowable extension not to exceed 25% of the specified surveillance interval.

### 3.2 Limits of Operation and Surveillances of the Effluent Release Points

#### 3.2.1 Radioactive Liquid Effluent Monitoring Instrumentation

- a. The radioactive liquid effluent monitoring instrumentation channels shown in Attachment 3.2, Radioactive Liquid Effluent Monitoring Instruments, are operable with their alarm/trip setpoints set to ensure that the limits of step 3.2.3a, Concentration Excluding Releases via the Turbine Room Sump (TRS) Discharge, are not exceeded.
- b. The applicability of each channel is shown in Attachment 3.2, Radioactive Liquid Effluent Monitoring Instruments.
- c. With a radioactive liquid effluent monitoring instrumentation channel alarm/trip setpoint less conservative than a value which will ensure the limits of step 3.2.3a, Concentration Excluding Releases via the Turbine Room Sump (TRS) Discharge, are met without delay, suspend the release of radioactive liquid effluents monitored by the affected channel and reset or declare the monitor inoperable.
- d. With one or more radioactive liquid effluent monitoring instrumentation channels inoperable, take the applicable action shown in Attachment 3.2, Radioactive Liquid Effluent Monitoring Instruments, with a maximum allowable extension not to exceed 25% of the surveillance interval, excluding the initial performance.
- e. Determine the setpoints in accordance with the methodology described in step 3.3.1, Liquid Monitors. Record the setpoints.
- f. Demonstrate each radioactive liquid effluent monitoring instrumentation channel is operable by performing the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION and CHANNEL FUNCTIONAL TEST at the frequencies shown in Attachment 3.3, Radioactive Liquid Effluent Monitoring Instrumentation Surveillance Requirements.

Information	PMP-6010.OSD.001	Rev. 14	Page 17 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			

## BASES – LIQUID

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 NRC approved methods in the ODCM to ensure the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria specified in Section 11.3 of the Final Safety Analysis Report for the Donald C. Cook Nuclear Plant.

### 3.2.2 Radioactive Gaseous Effluent Monitoring Instrumentation

- a. The radioactive gaseous process and effluent monitoring instrumentation channels shown in Attachment 3.4, Radioactive Gaseous Effluent Monitoring Instrumentation, are operable with their alarm/trip setpoints set to ensure that the limits of step 3.2.4a, Dose Rate, are not exceeded.
- b. The applicability of each channel is shown in Attachment 3.4, Radioactive Gaseous Effluent Monitoring Instrumentation.
- c. With a radioactive gaseous process or effluent monitoring instrumentation channel alarm/trip setpoint less conservative than a value which will ensure that the limits of step 3.2.4a, Dose Rate, are met, without delay, suspend the release of radioactive gaseous effluents monitored by the affected channel and reset or declare the channel inoperable.
- d. With less than the minimum number of radioactive gaseous effluent monitoring instrumentation channels operable, take the action shown in Attachment 3.4, Radioactive Gaseous Effluent Monitoring Instrumentation, with a maximum allowable extension not to exceed 25% of the surveillance interval, excluding the initial performance.

<b>NOTE:</b>	This surveillance requirement does not apply to the waste gas holdup system hydrogen and oxygen monitors, as their setpoints are not addressed in this document.
--------------	--

- e. Determine the setpoints in accordance with the methodology as described in step 3.3.2, Gaseous Monitors. Record the setpoints.

**OFF-SITE DOSE CALCULATION MANUAL**

- f. Demonstrate each radioactive gaseous process or effluent monitoring instrumentation channel is operable by performing the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION, and CHANNEL FUNCTIONAL TEST operations at the frequencies shown in Attachment 3.5, Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Requirements.

**BASES – GASEOUS**

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 NRC approved methods in the ODCM to ensure the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria specified in Section 11.3 of the Final Safety Analysis Report for the Donald C. Cook Nuclear Plant.

**3.2.3 Liquid Effluents**

- a. Concentration Excluding Releases via the Turbine Room Sump (TRS) Discharge
  1. Limit the concentration of radioactive material released via the Batch Release Tanks or Plant Continuous Releases (excluding only TRS discharge to the Absorption Pond) to unrestricted areas to the concentrations in 10 CFR 20, Appendix B, Table 2, Column 2, for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, limit the concentration to  $2E-4$   $\mu\text{Ci/ml}$  total activity.
  2. With the concentration of radioactive material released from the site via the Batch Release Tanks or Plant Continuous Releases (other than the TRS to the Absorption Pond) exceeding the above limits, without delay restore the concentration to within the above limits.
  3. Sample and analyze radioactive liquid wastes according to the sampling and analysis program of Attachment 3.6, Radioactive Liquid Waste Sampling and Analysis Program.
  4. Use the results of radioactive analysis in accordance with the methods of this document to assure that all concentrations at the point of release are maintained within limits.

Information	PMP-6010.OSD.001	Rev. 14	Page 19 of 102
OFF-SITE DOSE CALCULATION MANUAL			

b. Concentration of Releases from the TRS Discharge

1. Limit releases via the TRS discharge to the on-site Absorption Pond to the concentrations specified in 10 CFR 20, Appendix B, Table 2, Column 2. For dissolved or entrained noble gases, limit the concentration to  $2E-4$   $\mu\text{Ci/ml}$  total activity.
2. With releases from the TRS exceeding the above limits, perform a dose projection due to liquid releases to UNRESTRICTED AREAS to determine if the limits of step 3.2.3c.1 have been exceeded. **IF** the dose limits have been exceeded, **THEN** follow the directions in step 3.2.3c.2, as applicable.
3. Sample and analyze radioactive liquid wastes according to the program in Attachment 3.6, Radioactive Liquid Waste Sampling and Analysis Program.
4. Use the results of radioactive analysis in accordance with the methods of this document to assure that all concentrations at the point of release are maintained within the limits stated above.

c. Dose

1. Limit the dose or dose commitment to an individual from radioactive material in liquid effluents released to unrestricted areas during any calendar quarter to  $\leq 1.5$  mrem to the total body and to  $\leq 5$  mrem to any organ, and during any calendar year to  $\leq 3$  mrem to the total body and to  $\leq 10$  mrem to any organ.
2. With the calculated release of radioactive materials in liquid effluents exceeding ten times any of the limits in Steps 3.2.3a, 3.2.3b, or 3.2.3c.1 above, prepare and submit a Written Report, pursuant to 10 CFR 20.2203, within 30 days after learning of the event. This report must describe the extent of exposure of individuals to radiation and radioactive material, including, as appropriate:
  - a) Estimate of each individual's dose,
  - b) Levels of radiation and concentration of radioactive material involved,
  - c) Cause of elevated exposures, dose rates or concentrations,  
-AND-
  - d) Corrective steps taken or planned to ensure against recurrence, including schedule for achieving conformance with applicable limits.

**OFF-SITE DOSE CALCULATION MANUAL**

These reports must be formatted in accordance with PMP-7030.001.002, Licensee Event Reports, Special and Routine Reports, even though this is not an LER.

3. Determine cumulative dose contributions from liquid effluents in accordance with this document at least once per 31 days. Dose may be projected based on estimates from previous monthly projections and current or future plant conditions.
- d. Liquid Radwaste Treatment System
1. Use the liquid radwaste treatment system to reduce the radioactive materials in liquid wastes prior to their discharge when the projected doses due to the liquid effluent from the site when averaged over 31 days, would exceed 0.06 mrem to the total body or 0.2 mrem to any organ.
  2. Project doses due to liquid releases to UNRESTRICTED AREAS at least once per 31 days, in accordance with this document, whenever liquid releases are being made without being processed by the liquid radwaste treatment system.
- e. During times of primary to secondary leakage, the use of the startup flash tank should be minimized to reduce the release of curies from the secondary system and to maintain the dose to the public ALARA. Operation of the North Boric Acid Evaporator (NBAE) should be done in a manner so as to allow the recycle of the distillate water to the Primary Water Storage Tank for reuse. This will provide a large reduction in liquid curies of tritium released to the environment, as there is approximately 40 curies of tritium released with every monitor tank of NBAE distillate.

Information	PMP-6010.OSD.001	Rev. 14	Page 21 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			

Drainage of high conductivity water (Component Cooling Water and ice melt water containing sodium tetraborate) shall be evaluated to decide whether it should be drained to waste (small volumes only), the Turbine Room Sump (low activity water only) or routed without demineralization processing to a monitor tank for release. This is necessary in order to minimize the detrimental affect that high conductivity water has on the radioactive wastewater demineralization system. The standard concentration and volume equation can be utilized to determine the impact on each method and is given here. The units for concentration and volume need to be consistent across the equation:

$$(C_i)(V_i)+(C_a)(V_a)=(C_t)(V_t)$$

Where;

- $C_i$  = the initial concentration of the system being added to
- $V_i$  = the initial volume of the system being added to
- $C_a$  = the concentration of the water that is being added to the system
- $V_a$  = the volume of the water that is being added to the system
- $C_t$  = the final concentration of the system after the addition
- $V_t$  = the final volume of the system after the addition

The intent is to keep the:

- WDS below 500  $\mu$ mhos/cc.
- TRS below 1E-5  $\mu$ C/cc.
- Monitor Tank release ALARA to members of the public.

Wastewater leakage into the liquid waste disposal system will be monitored routinely. In the event the leak rate is determined to be over two gallons per minute (the assumed plant design leakage based on the original 2 gpm waste evaporator), increased scrutiny will be placed on locating inleakage, timeliness of job order activities, and/or activities causing increased production of waste water.



**OFF-SITE DOSE CALCULATION MANUAL****BASES – CONCENTRATION**

This specification is provided to ensure 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 2. This limitation provides additional assurance that the levels of radioactive materials in bodies of water outside the site will not result in exposures within 1) the Section II.A design objectives of Appendix I, 10 CFR Part 50, to an individual and 2) the limits of 10 CFR Part 20. The concentration limit for noble gasses is based upon the assumption that Xe-135 is the controlling radionuclide and its Effluent Concentration Unit in air (submersion) was converted to an equivalent concentration in water using the methods described in the International Commission on Radiological Protection (ICRP) Publication 2.

**DOSE**

This specification is provided to implement the requirements of Sections II.A, III.A, and IV.A of Appendix I, 10 CFR Part 50. The Limiting Condition for Operation implements the guides set forth in Section II.A 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 the releases of radioactive material in liquid effluents will be kept “as low as is reasonably achievable”. Also, for fresh water sites with drinking water supplies which can be potentially affected by plant operations, there is reasonable assurance that the operation of the facility will not result in radionuclide concentrations in the finished drinking water that are in excess of the requirements of 40 CFR 141. The dose calculations in the ODCM 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 an individual through appropriate pathways is unlikely to be substantially underestimated. The equations specified in the ODCM for calculating the doses due to the actual release rates of radioactive materials in liquid effluents, will be 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. NUREG-0133 provides methods for dose calculations consistent with Regulatory Guide 1.109 and 1.113.

This specification applies to the release of liquid effluents from each reactor at the site. The liquid effluents from the shared system are proportioned among the units sharing the system.

## OFF-SITE DOSE CALCULATION MANUAL

## LIQUID WASTE TREATMENT

The operability of the liquid radwaste treatment system ensures that this system will be available for use whenever liquid effluents require treatment prior to release to the environment. The requirements that the appropriate portions of this system be used when specified provide assurance that the releases of radioactive materials in liquid effluents will be kept "as low as is reasonably achievable". This specification implements the requirements of 10 CFR Part 50.36a, General Design Criteria Section 11.1 of the Final Safety Analysis Report for the Donald C. Cook Nuclear Plant, and design objective Section II.D of Appendix I to 10 CFR Part 50. 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.

## 3.2.4 Gaseous Effluents

## a. Dose Rate

1. Limit the dose rate due to radioactive materials released in gaseous effluents from the site to  $\leq 500$  mrem/yr to the total body and  $\leq 3000$  mrem/yr to the skin for noble gases. Limit the dose rate due to all radioiodines and for all radioactive materials in particulate form and radionuclides (other than noble gases) with half-lives greater than eight days to  $\leq 1500$  mrem/yr to any organ.
2. With the dose rate(s) exceeding the above limits, without delay decrease the release rate to within the above limit(s).
3. Determine the dose rate due to noble gases in gaseous effluents to be within the above limits in accordance with the methods and procedures described in this document.
4. Determine the dose rate due to radioactive materials, other than noble gases, in gaseous effluents to be within the above limits in accordance with the methods and procedures of this document by obtaining representative samples and performing analyses in accordance with the sampling and analysis program in Attachment 3.7, Radioactive Gaseous Waste Sampling and Analysis Program.

**OFF-SITE DOSE CALCULATION MANUAL**

## b. Dose - Noble Gases

1. Limit the air dose in unrestricted areas due to noble gases released in gaseous effluents during any calendar quarter, to  $\leq 5$  mrad for gamma radiation and  $\leq 10$  mrad for beta radiation and during any calendar year, to  $\leq 10$  mrad for gamma radiation and  $\leq 20$  mrad for beta radiation.
2. With the calculated air dose from radioactive noble gases in gaseous effluents exceeding ten times any of the above limits, prepare and submit a Written Report, pursuant to 10 CFR 20.2203 and addressed in step 3.2.3c.2, within 30 days after learning of the event.
3. Determine cumulative dose contributions for the total time period in accordance with this document at least once every 31 days.

## c. Dose - Iodine-131, Iodine-133, Tritium, and Radioactive Material in Particulate Form

1. Limit the dose to a MEMBER OF THE PUBLIC from radioiodine, radioactive materials in particulate form, and radionuclides other than noble gases with half-lives greater than eight days in gaseous effluents released to unrestricted areas (site boundary) to the following:
  - a) During any calendar quarter to less than or equal to 7.5 mrem to any organ
  - b) During any calendar year to less than or equal to 15 mrem to any organ.
2. With the calculated dose from the release of radioiodines, radioactive materials in particulate form, or radionuclides other than noble gases in gaseous effluents exceeding ten times any of the above limits, prepare and submit a Written Report, pursuant to 10 CFR 20.2203 and addressed in step 3.2.3c.2, within 30 days after learning of the event.
3. Determine cumulative dose contributions for the total time period in accordance with this document at least once every 31 days.

d. Gaseous Radwaste Treatment

1. Use the gaseous radwaste treatment system and the ventilation exhaust treatment system to reduce radioactive materials in gaseous wastes prior to their discharge when projected gaseous effluent air doses due to gaseous effluent releases to unrestricted areas when averaged over 31 days, would exceed 0.2 mrad for gamma radiation and 0.4 mrad for beta radiation. Use the ventilation exhaust treatment system to reduce radioactive materials in gaseous waste prior to their discharge when the projected doses due to gaseous effluent releases to unrestricted areas when averaged over 31 days would exceed 0.3 mrem to any organ.
2. Project doses due to gaseous releases to UNRESTRICTED AREAS at least once per 31 days in accordance with this document, whenever the gaseous waste treatment system or ventilation exhaust treatment system is not operational.

**BASES -- GASEOUS EFFLUENTS**

This specification is provided to ensure that the dose rate any time at the SITE BOUNDARY from gaseous effluents from all units on the site will be within the annual dose limits of 10 CFR Part 20 for unrestricted areas. The annual dose limits are the doses associated with the concentrations of 10 CFR Part 20, Appendix B, Table 2. 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 2 of 10 CFR Part 20. For individuals who may at times be within the site boundary, the occupancy of the individual will be sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the site boundary. The specified instantaneous release rate limits restrict, at all times, the corresponding gamma and beta dose rates above background to an individual at or beyond the site boundary to  $\leq (500)$  mrem/yr to the total body or to  $\leq (3000)$  mrem/yr to the skin. These instantaneous release rate limits also restrict, at all times, the corresponding thyroid dose rate above background to an infant via the cow-milk-infant pathway to  $\leq 1500$  mrem/yr for the nearest cow to the plant.

This specification applies to the release of gaseous effluents from all reactors at the site. The gaseous effluents from the shared system are proportioned among the units sharing that system.

**OFF-SITE DOSE CALCULATION MANUAL****DOSE, NOBLE GASES**

This specification is provided to implement the requirements of Sections II.B, III.A, and IV.A of Appendix I, 10 CFR Part 50. The Limiting Condition for Operation 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 Requirements implement the requirements in Section III.A of Appendix I that conform with the guides of Appendix I to be shown by calculational procedures based on models and data such that the actual exposure of an individual through the appropriate pathways is unlikely to be substantially underestimated. The dose calculations established in the ODCM for calculating the doses due to the actual release rates of radioactive noble gases in gaseous effluents will be 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 ODCM equations provided for determining the air doses at the site boundary will be based upon the historical average atmospherical conditions. NUREG-0133 provides methods for dose calculations consistent with Regulatory Guides 1.109 and 1.111.

**DOSE, RADIOIODINES, RADIOACTIVE MATERIAL IN PARTICULATE FORM, AND RADIONUCLIDES OTHER THAN NOBLE GASES**

This specification 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.

## OFF-SITE DOSE CALCULATION MANUAL

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 ODCM calculational methods specified in the surveillance requirements implement the requirements in Section III.A of Appendix I that conform with the guides of Appendix I to be shown by calculational procedures based on models and data such that the actual exposure of an individual through the appropriate pathways is unlikely to be substantially underestimated. The ODCM calculational methods approved by the NRC for calculating the doses due to the actual release rates of the subject materials are required to be 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 specifications for radioiodines, radioactive material in particulate form, and radionuclides, other than noble gases, are dependent on the existing radionuclide pathways to man, in the unrestricted area. The pathways which are examined in the development of these calculations are: 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.

## GASEOUS WASTE TREATMENT

The operability of the gaseous radwaste treatment system and the ventilation exhaust treatment systems ensures that the systems will be available for use whenever gaseous effluents require treatment prior to release to the environment. 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 specification implements the requirements of 10 CFR Part 50.36a, General Design Criterion Section 11.1 of the Final Safety Analysis Report for the Donald C. Cook Nuclear Plant, and design objective 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 guides forth in Sections II.B and II.C of Appendix I, 10 CFR Part 50, for gaseous effluents.

**OFF-SITE DOSE CALCULATION MANUAL**

## 3.2.5 Radioactive Effluents - Total Dose

- a. The dose or dose commitment to a real individual from all uranium fuel cycle sources is limited to  $\leq 25$  mrem to the total body or any organ (except the thyroid, which is limited to  $\leq 75$  mrem) over a period of 12 consecutive months.
- b. With the calculated doses from the release of radioactive materials in liquid or gaseous effluents exceeding one half the annual limits of steps 3.2.3c (Dose), 3.2.4b (Dose - Noble Gases), or 3.2.4c (Dose - Iodine-131, Iodine-133, Tritium, and Radioactive Material in Particulate Form) during any calendar quarter perform the following:
  - Investigate and identify the causes for such release rates;
  - Define and initiate a program for corrective action;
  - Report these actions to the NRC within 30 days from the end of the quarter during which the release occurred.

**IF** the estimated dose(s) exceeds the limits above, and **IF** the release condition resulting in violation has not already been corrected prior to violation of 40 CFR 190, **THEN** include in the report a request for a variance in accordance with the provisions of 40 CFR 190 and including the specified information of paragraph 190.11(b). Submittal of the report is considered a timely request, and a variance is granted until staff action on the request is complete. The variance only relates to the limits of 40 CFR 190, and does not apply in any way to the requirements for dose limitation of 10 CFR 50, as addressed in other sections of this document.

- c. Determine cumulative dose contributions from liquid and gaseous effluents in accordance with this document (including steps 3.2.3c [Dose], 3.2.4b [Dose - Noble Gases], or 3.2.4c [Dose - Iodine-131, Iodine-133, Tritium, and Radioactive Material in Particulate Form]).

## OFF-SITE DOSE CALCULATION MANUAL

## BASES -- TOTAL DOSE

This specification is provided to meet the dose limitations of 40 CFR 190. The specification 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, which should result in the limitations of dose to a member of the public for 12 consecutive months to within the 40 CFR 190 limits. For the purposes of the Special Report, it may be assumed that the dose commitment to any 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 5 miles must be considered. **IF** the dose to any member of the public is estimated to exceed the requirements of 40 CFR 190, **THEN** 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 provision of 40 CFR 190.11), is considered to be a timely request and fulfills the requirements of 40 CFR 190 until NRC staff action is completed. An individual is not considered a member of the public during any period in which he/she is engaged in carrying out any operation, which is part of the nuclear fuel cycle.

## 3.3 Calculation of Alarm/Trip Setpoints

The alarm and trip setpoints are to provide monitoring, indication, and control of liquid and gaseous effluents. The setpoints are used in conjunction with sampling programs to assure that the releases are kept within the limits of 10 CFR 20, Appendix B, Table 2. Establish setpoints for liquid and gaseous monitors. Depending on the monitor function, it would be a continuous or batch monitor. The different types of monitors are subject to different setpoint methodologies.

One variable used in setpoint calculations is the multiple release point (MRP) factor. The MRP is a factor used such that when all the releases are integrated, the applicable LIMIT value will not be exceeded. The MRP is determined such that the sum of the MRP's for that effluent type (liquid or gaseous) is less than or equal to 1. The value of the MRP is arbitrary, and it should be assigned based on operational performance. The values of the MRP's for each liquid release point are given in Attachment 3.8, Multiple Release Point Factors for Release Points.

The Site stance on instrument uncertainty is taken from HPP0S-223, Consideration of Measurement Uncertainty When Measuring Radiation Levels Approaching Regulatory Limits, which states the NRC position is the result of a valid measurement obtained by a method, which provides a reasonable demonstration of compliance. This value should be accepted and the uncertainty in that measured value need not be considered.



**OFF-SITE DOSE CALCULATION MANUAL**

### 3.3.1 Liquid Monitors

Establish liquid monitor setpoints for each monitor of the liquid effluent release systems. A schematic of the liquid effluent release systems is shown as Attachment 3.9, Liquid Effluent Release Systems. A list of the Plant Liquid Effluent Parameters is in Attachment 3.10, Plant Liquid Effluent Parameters. The details of each system design and operation can be found in the system descriptions. The setpoints are intended to keep releases within the limits of 10 CFR 20, Appendix B, Table 2, Column 2. Determine setpoints using either the batch or the continuous methodology.

#### a. Liquid Batch Monitor Setpoint Methodology

1. There is only one monitor used on the Waste Disposal System for liquid batch releases. This monitor is identified as RRS-1000. Steam Generator Blowdown radiation monitors also can be used to monitor batch releases while draining steam generators. The function of these monitors is to act as a check on the sampling program. The sampling program determines the nuclides and concentrations of those nuclides prior to release. The discharge and dilution flow rates are then adjusted to keep the release within the limits of 10 CFR 20. Based on the concentrations of nuclides in the release, the count rate on the monitor can be predicted. The high alarm setpoint can then be set above the predicted value up to the maximum setpoint of the system.
2. The radioactive concentration of each batch of radioactive liquid waste to be discharged is determined prior to each release by sampling and analysis in accordance with Attachment 3.6, Radioactive Liquid Waste Sampling and Analysis Program.

3. The flow rates are determined in order to keep the release within the requirements of 10 CFR 20, Appendix B, Table 2, Column 2. The equation to calculate the flow rate is from Addendum AA1 of NUREG-0133:

$$\left[ \frac{\sum C_i}{LIMIT_i} \right] \times \frac{f}{MRP} \leq F + f$$

Where;

$C_i$  = the concentration of nuclide "i" in  $\mu\text{Ci/ml}$

$LIMIT_i$  = the 10 CFR 20, Appendix B, Table 2, Column 2 limit of nuclide "i" in  $\mu\text{Ci/ml}$

$f$  = the effluent flow rate in gpm (Attachment 3.10, Plant Liquid Effluent Parameters)

$F$  = the dilution water flow rate as estimated prior to release. The dilution flow rate is a multiple of 230,000 gpm depending on the number of circulation pumps in operation.

$MRP$  = the multiple release point factor. A factor such that when all the release points are operating at one time the limits of 10 CFR 20 will not be exceeded.

4. This equation must be true during the batch release. Before the release is started, substitute the maximum effluent flow rate and the minimum dilution flow rate for  $f$  and  $F$ , respectively. **IF** the equation is true, **THEN** the release can proceed with those flow rates as the limits of operation. **IF** the equation is not true, **THEN** the effluent flow rate can be reduced or the dilution flow rate can be increased to make the equation true. This equation may be rearranged to solve for the maximum effluent release flow rate ( $f$ ).

## OFF-SITE DOSE CALCULATION MANUAL

5. The setpoint is used as a quality check on the sampling program. The setpoint is used to stop the effluent flow when the monitor reading is greater than the predicted value from the sampling program. The predicted value is generated by converting the effluent concentration for each gamma emitting radionuclide to counts per unit of time as per Attachment 3.11, Volumetric Detection Efficiencies for Principle Gamma Emitting Radionuclides for Eberline Liquid Monitors, or Attachment 3.12, Counting Efficiency Curves for R-19, and R-24. The sum of all the counts per unit of time is the predicted count rate. The predicted count rate can then be multiplied by a factor to determine the high alarm setpoint that will provide a high degree of conservatism and eliminate spurious alarms.
- b. Liquid Continuous Monitor Setpoint Methodology
1. There are eight monitors used as potential continuous liquid release monitors. These monitors are used in the steam generator blowdown (SGBD), blowdown treatment (BDT), and essential service water (ESW) systems.
  2. The Westinghouse monitors (R) are being replaced by Eberline monitors (DRS, WRA) and are identified as:
    - R-19 or DRS 3100/4100 for SGBD
    - R-24 or DRS 3200/4200 for BDT
    - R-20 or WRA 3500/4500 for the east ESW system
    - R-28 or WRA 3600/4600 for the west ESW system

The function of these monitors is to assure that releases are kept within the concentration limits of 10 CFR 20, Appendix B, Table 2, Column 2.

3. The monitors on steam generator blowdown and blowdown treatment systems have trip functions associated with their setpoints. Essential service water monitors are equipped with an alarm function only and monitor effluent in the event the Containment Spray Heat Exchangers are used.

4. The equation used to determine the setpoint for continuous monitors is from Addendum AA1 of NUREG-0133:

$$S_p \leq \frac{C \times Eff \times MRP \times F \times SF}{f}$$

Where;

$S_p$  = setpoint of monitor (cpm)

$C$  =  $5E-7 \mu\text{Ci/ml}$ , maximum effluent control limit from 10 CFR 20, Appendix B, Table 2, Column 2 of a known possible nuclide in effluent stream. (The limiting nuclide concentration will be evaluated periodically and adjusted appropriately.)

**-OR-**

if a mixture is to be specified,

$$\frac{\sum C_i}{\sum \frac{C_i}{LIMIT_i}}$$

$Eff$  = Efficiency, this information is located in Attachment 3.11, Volumetric Detection Efficiencies for Principle Gamma Emitting Radionuclides for Eberline Liquid Monitors, through Attachment 3.13, Counting Efficiency Curve for R-20, and R-28, for the specific monitors. For Eberline monitors the efficiency is nuclide specific and the calculation changes slightly to:

$$\frac{\sum(C_i \times Eff_i)}{\sum \frac{C_i}{LIMIT_i}} \text{ replaces } C \times Eff$$

$MRP$  = multiple release point factor. A factor such that when all the release points are operating at one time the limits of 10 CFR 20 will not be exceeded (Attachment 3.8, Multiple Release Point Factors for Release Points). The  $MRP$  for ESW monitors is set to 1.

**OFF-SITE DOSE CALCULATION MANUAL**

F = dilution water (circ water) flow rate in gpm obtained from Attachment 3.10, Plant Liquid Effluent Parameters. For routine operation, the setpoint should be calculated using the minimum dilution flow rate of 230,000 gpm.

SF = Safety Factor, 0.9.

f = applicable effluent release flow rate in gpm. For routine operation, the setpoint should be calculated using maximum effluent flow rate (Attachment 3.10, Plant Liquid Effluent Parameters).

### 3.3.2 Gaseous Monitors

For the purpose of implementing Step 3.2.2, Radioactive Gaseous Effluent Monitoring Instrumentation, and Substep 3.2.4a, Dose Rate, the alarm setpoints for gaseous effluents released into unrestricted areas will be established using the following methodology. In addition, the above steps do not apply to instantaneous alarm and trip setpoints for integrating radiation monitors sampling radioiodines, radioactive materials in particulate form and radionuclides other than noble gases. A schematic of the gaseous effluent release systems is presented in Attachment 3.14, Gaseous Effluent Release Systems. Attachment 3.15, Plant Gaseous Effluent Parameters, presents the effluent flow rate parameter(s).

Gaseous effluent monitor high alarm setpoints will routinely be established at a fraction of the maximum allowable setpoint (typically 10% of the setpoint) for ALARA purposes. Alert alarms will normally be set to provide adequate indications of small changes in radiological conditions.

Information	PMP-6010.OSD.001	Rev. 14	Page 35 of 102
OFF-SITE DOSE CALCULATION MANUAL			

a. Plant Unit Vent

- The gaseous effluents discharged from the plant vent will be monitored by the plant vent radiation monitor low range noble gas channel [Tag No. VRS-1505 (Unit 1), VRS-2505 (Unit 2)] to assure that alarms and trip actions (isolation of gaseous release) will occur prior to exceeding the limits in step 3.2.4, Gaseous Effluents. The alarm setpoint values will be established using the following unit analysis equation:

$$S_p = \frac{SF \times MRP \times DL_j}{F_p \times \chi/Q \times \sum_i (W_i \times DCF_{ij})}$$

Where;

$S_p$  = the maximum setpoint of the monitor in  $\mu\text{Ci}/\text{cc}$  for release point p, based on the most limiting organ

SF = an administrative operation safety factor, less than 1.0

MRP = a weighted multiple release point factor ( $\leq 1.0$ ), such that when all site gaseous releases are integrated, the applicable dose will not be exceeded based on the release rate of each effluent point. The MRP is an arbitrary value based on the ratio of the release rate or the volumetric flow rate of each effluent point to the total respective flow rate value of the plant and will be consistent with past operational experience. The MRP is computed as follows:

- Compute the average release rate,  $Q_p$ , (or the volumetric flow rate,  $f_p$ ) from each release point p.
- Compute  $\Sigma Q_p$  (or  $\Sigma f_p$ ) for all release points.
- Ratio  $Q_p/\Sigma Q_p$  (or  $f_p/\Sigma f_p$ ) for each release point. This ratio is the MRP for that specific release point
- Repeat the above bullets for each of the site's eight gaseous release points.

$F_p$  = the maximum volumetric flow rate of release point "p", at the time of the release, in cc/sec. The maximum Unit Vent flow rate, by design, is 186,600 cfm for Unit 1 and 143,400 cfm for Unit 2.

## OFF-SITE DOSE CALCULATION MANUAL

$DL_j$  = dose rate limit to organ "j" in an unrestricted area (mrem/yr).

Based on continuous releases, the dose rate limits,  $DL_j$ , from step 3.2.4a, Dose Rate, are as follows:

- Total Body  $\leq$  500 mrem/year
- Skin  $\leq$  3000 mrem/year
- Any Organ  $\leq$  1500 mrem/year

$\overline{\chi/Q}$  = The worst case annual average relative concentration in the applicable sector or area, in  $\text{sec}/\text{m}^3$  (see Attachment 3.16, 10 Year Average of 1989-1998 Data). The  $\overline{\chi/Q}$  values will be evaluated on an annual basis against the 10 year averages and documented by completing Attachment 3.17, Annual Evaluation of  $\overline{\chi/Q}$  and  $\overline{D/Q}$  Values For All Sectors, and filing in accordance with the retention schedule.

$W_i$  = weighted factor for the radionuclide:

$$W_i = \frac{C_i}{\sum C_k}$$

Where,

$C_i$  = concentration of the most abundant radionuclide "i"

$C_k$  = total concentration of all identified radionuclides in that release pathway. For batch releases, this value may be set to 1 for conservatism.

$DCF_{ij}$  = dose conversion factor used to relate radiation dose to organ "j", from exposure to radionuclide "i" in  $\text{mrem m}^3 / \text{yr } \mu\text{Ci}$ . See following equations.

The dose conversion factor,  $DCF_{ij}$ , is dependent upon the organ of concern.

Information	PMP-6010.OSD.001	Rev. 14	Page 37 of 102
OFF-SITE DOSE CALCULATION MANUAL			

For the whole body:  $DCF_{ij} = K_i$

Where;

$K_i$  = whole body dose factor due to gamma emissions for each identified noble gas radionuclide in  $mrem\ m^3 / yr\ \mu Ci$ . See Attachment 3.18, Dose Factors.

For the skin:  $DCF_{ij} = L_i + 1.1M_i$

Where;

$L_i$  = skin dose factor due to beta emissions for each identified noble gas radionuclide, in  $mrem\ m^3 / yr\ \mu Ci$ . See Attachment 3.18, Dose Factors.

1.1 = the ratio of tissue to air absorption coefficient over the energy range of photons of interest. This ratio converts absorbed dose (mrad) to dose equivalent (mrem).

$M_i$  = the air dose factor due to gamma emissions for each identified noble gas radionuclide in  $mrad\ m^3 / yr\ \mu Ci$ . See Attachment 3.18, Dose Factors.

For the thyroid, via inhalation:  $DCF_{ij} = P_i$

Where;

$P_i$  = the dose parameter, for radionuclides other than noble gas, for the inhalation pathway in  $mrem\ m^3 / yr\ \mu Ci$ . See Attachment 3.18, Dose Factors.



## OFF-SITE DOSE CALCULATION MANUAL

2. The plant vent radiation monitor low range noble gas high alarm channel setpoint,  $S_p$ , will be set such that the dose rate in unrestricted areas to the whole body, skin and thyroid (or any other organ), whichever is most limiting, will be less than or equal to 500 mrem/yr, 3000 mrem/yr, and 1500 mrem/yr respectively.
3. The thyroid dose is limited to the inhalation pathway only.
4. The plant vent radiation monitor low range noble gas setpoint,  $S_p$ , will be recomputed whenever gaseous releases like Containment Purge, Gas Decay Tanks and CVCS HUTs are discharged through the plant vent to determine the most limiting organ.
5. The high alarm setpoint,  $S_p$ , may be established at a lower value than the lowest computed value via the setpoint equation.
6. Containment Pressure Reliefs will not have a recomputed high alarm setpoint, but will use the normal high alarm setpoint due to their randomness and the time constraints involved in recomputation.
7. At certain times, it may be desirable to increase the high alarm setpoint, if the vent flow rate is decreased. This may be accomplished in one of two ways.

$$\frac{\text{Max Conc } (\mu\text{Ci/cc}) \times \text{Max Flowrate (cfm)}}{\text{New Max Concentration } (\mu\text{Ci/cc})} = \text{New Max cfm}$$

-OR-

$$\frac{\text{Max Conc } (\mu\text{Ci/cc}) \times \text{Max Flowrate (cfm)}}{\text{New Max Flowrate (cfm)}} = \text{New Max } \mu\text{Ci/cc}$$

Information	PMP-6010.OSD.001	Rev. 14	Page 39 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			

b. Waste Gas Storage Tanks

1. The gaseous effluents discharged from the Waste Gas System will be monitored by the vent stack monitors VRS-1505 and VRS-2505.
2. In the event of a high radiation alarm, an automatic termination of the release from the waste gas system will be initiated from the plant vent radiation monitor low range noble gas channel (VRS-1505 or VRS-2505). Therefore, for any gaseous release configuration, which includes normal operation and waste gas system gaseous discharges, the alarm setpoint of the plant vent radiation monitor will be recomputed to determine the most limiting organ based on all gaseous effluent source terms.

Chemical and Volume Control System Hold Up Tanks (CVCS HUT), containing high gaseous oxygen concentrations, may be released under the guidance of waste gas storage tank utilizing approved Operations' procedures.

3. It is normally prudent to allow 45 days of decay prior to releasing a Gas Decay Tank (GDT). There are extenuating, operational circumstances that may prevent this from occurring. Under these circumstances, such as high oxygen concentration creating a combustible atmosphere, it is prudent to waive the 45-day decay for safety's sake.

c. Containment Purge and Exhaust System

1. The gaseous effluents discharged by the Containment Purge and Exhaust Systems and Instrumentation Room Purge and Exhaust System will be monitored by the plant vent radiation monitor noble gas channels (VRS-1505 for Unit 1, VRS-2505 for Unit 2); and alarms and trip actions will occur prior to exceeding the limits in step 3.2.4a, Dose Rate.
2. For the Containment System, a continuous air sample from the containment atmosphere is drawn through a closed, sealed system to the radiation monitors (Tag No. ERS-1300/1400 for Unit 1 and ERS-2300/2400 for Unit 2). During purges, these monitor setpoints will give a Purge and Exhaust Isolation upon actuation of high alarm setpoints for particulate and noble gas channels. The sample is then returned to containment. Grab sample analysis is performed for a Containment purge before release.

## OFF-SITE DOSE CALCULATION MANUAL

3. The Upper Containment area is monitored by normal range area gamma monitors (Tag No. VRS-1101/1201 for Unit 1 and VRS-2101/2201 for Unit 2), which also give Purge and Exhaust Isolation Trip signals upon actuation of their high alarm.
  4. For the Containment Pressure Relief System, no sample is routinely taken prior to release, but there is a bimonthly sample program.
  5. The containment airborne and area monitors, upon actuation of their high alarm, will automatically initiate closure of the Containment and Instrument Room purge supply and exhaust duct valves and containment pressure relief system valves. Complete trip of all isolation control devices requires high alarm of one of the two Train A monitors (ERS-1300/2300 or VRS-1101/2101) and one of the two Train B monitors (ERS-1400/2400 or VRS-1201/2201).
- d. Steam Jet Air Ejector System (SJAE)
1. The gaseous effluents from the Steam Jet Air Ejector System discharged to the environment are continuously monitored by radiation monitor (Tag No. SRA-1900 for Unit 1 and SRA-2900 for Unit 2). The monitor will alarm prior to exceeding the limits of step 3.2.4a, Dose Rate. The alarm setpoint for the Condenser Air Ejector System monitor will be based on the maximum air ejector exhaust flow rate, (Attachment 3.15, Plant Gaseous Effluent Parameters). The alarm setpoint value will be established using the following unit analysis equation:

$$S_{SJAE} = \frac{SF \times MRP \times DL_j}{F_p \times \chi/Q \times \sum_i (W_i \times DCF_{ij})}$$

Where;

$S_{SJAE}$  = the maximum setpoint, based on the most limiting organ, in  $\mu\text{Ci/cc}$  and where the other terms are as previously defined

e. Gland Seal Condenser Exhaust

1. The gaseous effluents from the Gland Seal Condenser Exhaust discharged to the environment are continuously monitored by radiation monitor (Tag No. SRA-1800 for Unit 1 and SRA-2800 for Unit 2). The radiation monitor will alarm prior to exceeding the limits of step 3.2.4a, Dose Rate. The alarm setpoint for the GSCE monitor will be based on the maximum condenser exhaust flow rate (1260 CFM for Unit 1, 2754 CFM each for the two Unit 2 vents). The alarm setpoint value will be established using the following unit analysis equation:

$$S_{GSCE} = \frac{SF \times MRP \times DL_j}{F_p \times \chi/Q \times \sum_i (W_i \times DCF_{ij})}$$

Where;

$S_{GSCE}$  = the maximum setpoint, based on the most limiting organ, in  $\mu\text{Ci/cc}$  and where the other terms are as previously defined

3.4 Radioactive Effluents Total Dose

- 3.4.1 The cumulative dose contributions from liquid and gaseous effluents will be determined by summing the cumulative doses as derived in steps 3.2.3c (Dose), 3.2.4b (Dose - Noble Gases), and 3.2.4c (Dose - Iodine-131, Iodine-133, Tritium, and Radioactive Material in Particulate Form) of this procedure. Dose contribution from direct radiation exposure will be based on the results of the direct radiation monitoring devices located at the REMP monitoring stations. See NUREG-0133, section 3.8.

**OFF-SITE DOSE CALCULATION MANUAL****3.5 Radiological Environmental Monitoring Program (REMP)****3.5.1 Purpose of the REMP**

- a. The purpose of the REMP is to:
  - Establish baseline radiation and radioactivity concentrations in the environs prior to reactor operations,
  - Monitor critical environmental exposure pathways,
  - Determine the radiological impact, if any, caused by the operation of the Donald C. Cook Nuclear Plant upon the local environment.
- b. The first purpose of the REMP was completed prior to the initial operation of either of the two nuclear units at the Donald C. Cook Nuclear Plant Site. The second and third purposes of the REMP are an on-going operation and as such various environmental media and exposure pathways are examined. The various pathways and sample media used are delineated in Attachment 3.19, Radiological Environmental Monitoring Program Sample Stations, Sample Types, Sample Frequencies. Included is a list of the sample media, analysis required, sample stations, and frequency requirements for both collection and analysis. Attachment 3.19, Radiological Environmental Monitoring Program Sample Stations, Sample Types, Sample Frequencies, defines the scope of the REMP for the Donald C. Cook Nuclear Plant.

Information	PMP-6010.OSD.001	Rev. 14	Page 43 of 102
OFF-SITE DOSE CALCULATION MANUAL			

### 3.5.2 Conduct of the REMP

- a. Conduct sample collection and analysis for the REMP in accordance with Attachment 3.19, Radiological Environmental Monitoring Program Sample Stations, Sample Types, Sample Frequencies, Attachment 3.20, Maximum Values for Lower Limits of Detections<sup>A,B</sup> - REMP, and Attachment 3.21, Reporting Levels for Radioactivity Concentrations in Environmental Samples. These are applicable at all times. The on-site monitoring locations are shown on Attachment 3.22, On-Site Monitoring Location - REMP, and the off-site monitoring locations are shown on Attachment 3.23, Off-Site Monitoring Locations - REMP.
  1. Perform each surveillance requirement within the specified time interval in Attachment 3.19, Radiological Environmental Monitoring Program Sample Stations, Sample Types, Sample Frequencies, with a maximum allowable extension not to exceed 25% of the surveillance interval.
  2. **IF** an environmental sample cannot be collected in accordance with step 3.5.2a, **THEN** submit a description of the reasons for deviation and the actions taken to prevent a reoccurrence as part of the Annual Radiological Environmental Operating Report (AREOR).

Deviations from the required sampling schedule are permitted if specimens are unobtainable due to hazardous conditions, seasonal unavailability, or malfunction of automatic sampling equipment. **IF** the deviation from the required sampling schedule is due to the malfunction of automatic sampling equipment, **THEN** make every effort to complete the corrective action prior to the end of the next sampling period.

## OFF-SITE DOSE CALCULATION MANUAL

3. **IF** a radionuclide is detected in any sample medium exceeding the limit established in Attachment 3.21, Reporting Levels for Radioactivity Concentrations in Environmental Samples, or **IF** more than one radionuclide is detected in any sample medium and the Total Fractional Level (TFL), when averaged over the calendar quarter, is greater than or equal to 1, based on the following formula:

$$TFL = \frac{C_{(1)}}{L_{(1)}} + \frac{C_{(2)}}{L_{(2)}} + \dots \geq 1$$

Where;

$C_{(1)}$  = Concentration of 1<sup>st</sup> detected nuclide

$C_{(2)}$  = Concentration of 2<sup>nd</sup> detected nuclide

$L_{(1)}$  = Reporting Level of 1<sup>st</sup> nuclide from Attachment 3.21, Reporting Levels for Radioactivity Concentrations in Environmental Samples.

$L_{(2)}$  = Reporting Level of 2<sup>nd</sup> nuclide from Attachment 3.21, Reporting Levels for Radioactivity Concentrations in Environmental Samples.

And, **IF** the activity is the result of plant effluents, **THEN** evaluate the release conditions, environmental factors, or other aspects, which may have contributed to the identified levels for inclusion in the AREOR. **IF** the radioactivity was not a result of plant effluents, **THEN** describe the results in the AREOR.

4. **IF** a currently sampled milk farm location becomes unavailable, **THEN** conduct a special milk farm survey, for that sector, within 15 days.
- a) **IF** the unavailable location was an indicator farm, **THEN** an alternate sample location may be established in the same sector within eight miles of the Donald C. Cook Nuclear Plant, if one is available.
  - b) **IF** the unavailable location was a background farm, **THEN** an alternate sample location may be established greater than 15 but less than 25 miles of the Donald C. Cook Nuclear Plant in one of the less prevalent wind direction sectors, if one is available.

- c) **IF** a replacement farm is unobtainable and the total number of indicator farms is less than three or the background farms is less than one, **THEN** perform monthly vegetation sampling in lieu of milk sampling.

### **BASES – RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM (REMP)**

The REMP provides measurements of radiation and 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. Thereby, this monitoring program supplements the radiological effluent monitoring program by verifying the measurable concentration 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 REMP will be effective for at least the first three years of commercial operation. Program changes may be initiated based on operational experience in accordance with the requirements of technical specification 6.8.4.b.

The detection capabilities, required by Attachment 3.20, Maximum Values for Lower Limits of Detections<sup>A,B</sup> - REMP, are the state-of-the-art for routine environmental measurements in industrial laboratories.

It should be recognized that the LLD is defined as a priori (before the fact) limit representing the capability of a measurement system and not as a posteriori (after the fact) limit for a particular measurement. Analyses shall be performed in such a manner that the stated LLDs will be achieved under routine analysis conditions. Occasionally, background fluctuations, unavoidably small sample sizes, the presence of interfering nuclides, or other uncontrollable circumstances may render these LLDs unachievable. In such cases, the contributing factors will be identified and described in the Annual Radiological Environmental Operating Report.

#### **3.5.3 Annual Land Use Census**

- a. Conduct a land use census and 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 ten land sectors within a distance of five miles.
- b. In lieu of the garden census, grape and broad leaf vegetation sampling may be performed as close to the site boundary as possible in a land sector, containing sample media, with the highest average deposition factor (D/Q) value.



**OFF-SITE DOSE CALCULATION MANUAL**

- c. Conduct this land use census annually between the dates of June 1 and October 1 by door-to-door survey, aerial survey, or by consulting local agricultural authorities.
  1. With a land use census identifying a location(s), which yields a calculated dose or dose commitment greater than the values currently being calculated in this document, make appropriate changes to incorporate the new location(s) within 30 days, if possible.

**BASES -- LAND USE CENSUS**

This is provided to ensure changes in the use of unrestricted areas are identified and modifications to the monitoring program are made in accordance with requirements of TS 6.8.4b, if required by the results of the 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 pathways via leafy vegetables will be identified and monitored since a garden of this size is the minimum required to produce the quantity (25 kg/yr) of leafy vegetables assumed in Regulatory Guide 1.109 for consumption of 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 (that is, similar to lettuce and cabbage), and 2) a vegetation field of 2 kg/square meter.

**3.5.4 Interlaboratory Comparison Program**

- a. In order to comply with Reg. Guides 4.1 and 4.15, the analytical vendor participates in an Interlaboratory Comparison Program, for radioactive materials. Address program results and identified deficiencies in the AREOR.
  1. With analyses not being performed as required above, report the corrective actions taken to prevent a recurrence to the Commission in the AREOR.

**BASES -- INTERLABORATORY COMPARISON PROGRAM**

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

Information	PMP-6010.OSD.001	Rev. 14	Page 47 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			

### 3.6 Steam Generator Storage Facility Groundwater Monitoring Program

#### 3.6.1 Purpose of the Steam Generator Storage Facility Groundwater Radiological Monitoring Program

- a. The purpose of the temporary on-site Steam Generator Storage Facility Radiological Monitoring Program is to establish baseline radiological data for the groundwater surrounding the facility prior to the storage of the Unit 2 Steam Generator Lower Assemblies. Thereafter, the purpose is to monitor the groundwater through observation wells with locations as shown in Attachment 3.22, On-Site Monitoring Location - REMP, to determine the radiological impact, if any, caused by the use of the Storage Facility.

#### 3.6.2 Conduct of the Steam Generator Storage Facility Groundwater Radiological Monitoring Program

- a. Collect and analyze groundwater samples in accordance with Attachment 3.19, Radiological Environmental Monitoring Program Sample Stations, Sample Types, Sample Frequencies. Apply the values from Attachment 3.20, Maximum Values for Lower Limits of Detections<sup>A,B</sup> - REMP, (excluding I-131) and Attachment 3.21, Reporting Levels for Radioactivity Concentrations in Environmental Samples, (excluding I-131).

### 3.7 Meteorological Model

3.7.1 Three towers are used to determine the meteorological conditions at Donald C. Cook Nuclear Plant. One of the towers is located at the Lake Michigan shoreline to determine the meteorological parameters associated with unmodified shoreline air. The data is accumulated by microprocessors at the tower sites and normally transferred to the central computer every 15 minutes.

3.7.2 The central computer uses a meteorological software program to provide atmospheric dispersion and deposition parameters. The meteorological model used is based on guidance provided in Reg. Guide 1.111 for routine releases. All calculations use the Gaussian plume model.

**OFF-SITE DOSE CALCULATION MANUAL****3.8 Reporting Requirements****3.8.1 Annual Radiological Environmental Operating Report (AREOR)**

- a. Submit routine radiological environmental operating reports covering the operation of the units during the previous calendar year prior to May 1 of each year.
- b. Include in the AREOR:
  - Summaries, interpretations, and statistical evaluation of the results of the radiological environmental surveillance activities for the reporting period.
  - A comparison with pre-operational studies, operational controls (as appropriate), and previous environmental surveillance reports and an assessment of the observed impacts of the plant operation on the environment.
  - The results of the land use censuses required by step 3.5.3, Annual Land Use Census.
  - **IF** harmful effects or evidence of irreversible damage are detected by the monitoring, **THEN** provide in the report an analysis of the problem and a planned course of action to alleviate the problem.
  - Summarized and tabulated results of all radiological environmental samples taken during the reporting period. In the event that some results are not available for inclusion with the report, submit the report noting and explaining the reasons for the missing results. Submit the missing data as soon as possible in a supplementary report.
  - A summary description of the REMP including sampling methods for each sample type, size and physical characteristics of each sample type, sample preparation methods, analytical methods, and measuring equipment used.
  - A map of all sample locations keyed to a table giving distances and directions from one reactor.

Information	PMP-6010.OSD.001	Rev. 14	Page 49 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			

- The results of participation in the Interlaboratory Comparison Program required by step 3.5.4, Interlaboratory Comparison Program.

3.8.2 Annual Radiological Effluent Release Report (ARERR)

- a. Submit routine ARERR covering the operation of the unit during the previous 12 months of operation within 90 days after January 1 of each year.
- b. Include in the ARERR a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the units as outlined in Reg. Guide 1.21, "Measuring, Evaluating and Reporting in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water Cooled Nuclear Power Plants," with data summarized on a quarterly basis following the format of Appendix B, thereof.
- c. Submit in the ARERR 90 days after January 1 of each year and include a quarterly summary of hourly meteorological data collected during the reporting period.
  - This summary may be in the form of an hour-by-hour listing of wind speed, wind direction, atmospheric stability, and precipitation (if measured) on magnetic tape, or in the form of joint frequency distributions of wind speed, wind direction and atmospheric stability.
  - Include an assessment of the radiation doses due to the radioactive liquid and gaseous effluents released from the unit or station during the previous calendar year.
  - Include an assessment of the radiation doses from radioactive liquid and gaseous effluents to members of the public due to their activities inside the site boundary during the reporting period. Include all assumptions used in making these assessments (that is, specific activity, exposure time and location) in these reports.
  - Use the meteorological conditions concurrent with the time of release of radioactive materials in gaseous effluents (as determined by sampling frequency and measurement) for determining the gaseous pathway doses.
  - Inoperable radiation monitor periods exceeding 30 continuous days; explain causes of inoperability and actions taken to prevent reoccurrence.

**OFF-SITE DOSE CALCULATION MANUAL**

- d. Submit the ARERR 90 days after January 1 of each year and include an assessment of radiation doses to the likely most exposed member of the public from reactor releases and other nearby uranium fuel cycle sources (including doses from primary effluent pathways and direct radiation) for the previous 12 consecutive months to show conformance with 40 CFR 190, Environmental Radiation Protection Standards for Nuclear Power Operation. Acceptable methods for calculating the dose contribution from liquid and gaseous effluents are given in Reg. Guide 1.109, Rev.1.
- e. Include in the ARERR the following information for each type of solid waste shipped off-site during the report period:
- Volume (cubic meters),
  - Total curie quantity (specify whether determined by measurement or estimate),
  - Principle radionuclides (specify whether determined by measurement or estimate),
  - Type of waste (example: spent resin, compacted dry waste, evaporator bottoms),
  - Type of container (example: LSA, Type A, Type B, Large Quantity),  
-AND-
  - Solidification agent (example: cement).
- f. Include in the ARERR unplanned releases of radioactive materials in gaseous and liquid effluent from the site to unrestricted areas on a quarterly basis.
- g. Include in the ARERR any change to this procedure made during the reporting period.

Information	PMP-6010.OSD.001	Rev. 14	Page 51 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			

3.9 10 CFR 50.75 (g) Implementation

3.9.1 Records of spills or other unusual occurrences involving the spread of contamination in and around the site. These records may be limited to instances when significant contamination remains after decontamination or when there is a reasonable likelihood that contaminants may have spread to inaccessible areas, as in the case of possible seepages.

3.9.2 These records shall include any known information or identification of involved nuclides, quantities, and concentrations.

3.9.3 This information is necessary to ensure all areas outside the radiological-restricted area are documented for surveying and remediation during decommissioning. There is a retention schedule file number where this information is filed in Nuclear Documents Management to ensure all required areas are listed to prevent their omission.

3.10 Reporting/Management Review

3.10.1 Incorporate any changes to this procedure in the ARERR.

3.10.2 Update this procedure when the Radiation Monitoring System, its instruments, or the specifications of instruments are changed.

3.10.3 Review or revise this procedure as appropriate based on the results of the land use census and REMP.

3.10.4 Evaluate any changes to this procedure for potential impact on other related Department Procedures.

3.10.5 Review this procedure during the first quarter of each year and update it if necessary. Reviewed Attachment 3.16, 10 Year Average of 1989-1998 Data, and document using Attachment 3.17, Annual Evaluation of  $\bar{\chi}/Q$  and  $\bar{D}/Q$  Values For All Sectors.

4 FINAL CONDITIONS

4.1 None.

## OFF-SITE DOSE CALCULATION MANUAL

## 5 REFERENCES

### 5.1 Use References:

- 5.1.1 "Implementation of Programmatic Controls for Radiological Effluent Technical Specifications in the Administrative Controls Section of the Technical Specifications and the Relocation of Procedural Details of RETS to the Off-Site Dose Calculation Manual or to the Process Control Program (Generic Letter 89-01)", United States Nuclear Regulatory Commission, January 31, 1989
- 5.1.2 12-THP-6010.RPP.601, Preparation of the Annual Radioactive Effluent Release Report
- 5.1.3 12-THP-6010.RPP.639, Annual Radiological Environmental Operating Report (AREOR) Preparation And Submittal

### 5.2 Writing References:

#### 5.2.1 Source References:

- a. 10 CFR 20, Standards for Protection Against Radiation
- b. 10 CFR 50, Domestic Licensing of Production and Utilization Facilities
- c. PMI-6010, Radiation Protection Plan
- d. NUREG-0472
- e. NUREG-0133
- f. Regulatory Guide 1.109
- g. Regulatory Guide 1.111
- h. Regulatory Guide 1.113
- i. Final Safety Analysis Report (FSAR)
- j. Technical Specifications, Appendix A, Sections 6.8.1.e, 6.8.4.a, 6.8.4.b, 6.9.1.6, 6.9.1.7, and 6.14, Off-Site Dose Calculation Manual

Information	PMP-6010.OSD.001	Rev. 14	Page 53 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			

- k. Final Environmental Statement Donald. C. Cook Nuclear Plant, August 1973
- l. NUREG-0017
- m. ODCM Setpoints for Liquid Effluent Monitors (Bases), ENGR 107-04 8112.1 Environs Rad Monitor System
- n. Radiological Support Section Calculation RS-C-200, Determination of P<sub>i</sub> Dose Rates
- o. Radiological Support Section Calculation RS-C-0106, March 19, 1987
- p. HPPOS-223, Consideration of Measurement Uncertainty When Measuring Radiation Levels Approaching Regulatory Limits
- q. Watts – Bar Jones (WBJ) Document, R-86-C-001, The Primary Calibration of Eberline Instrument Corporation SPING – 3/4 Low, Mid, and High Range Noble Gas Detectors
- r. WBJ Document, R-86-C-003, The Primary Calibration of Eberline Instrument Corporation DAM-4 and Water Monitor
- s. 40 CFR 190, Environmental Radiation Protection Standards for Nuclear Power Operations
- t. NRC Commitment 6309 (N94083 dated 11/10/94)
- u. NRC Commitment 2417 (N88097 dated 8/30/88)

#### 5.2.2 General References

- a. Cook Nuclear Plant Start-Up Flash Tank Flow Rate letter from D. L. Boston dated January 21, 1997
- b. Letter from B.P. Lauzau, Venting of Middle CVCS Hold-Up Tank Directly to Unit Vent, May 1, 1992
- c. AEP Design Information Transmittal on Aux Building Ventilation Systems
- d. PMP-4030.EIS.001, Event-Initiated Surveillance Testing



Information	PMP-6010.OSD.001	Rev. 14	Page 54 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.1	Dose Factors for Various Pathways		Pages: 54 - 58

R<sub>i</sub> Dose Factors

PATHWAY

Nuclide	Ground	Vegetable	Meat	Cow Milk	Goat Milk	Inhalation
H-3	0.0E+00	4.0E+03	3.3E+02	2.4E+03	4.9E+03	1.3E+03
C-14	0.0E+00	3.5E+06	5.3E+05	3.2E+06	3.2E+06	3.6E+04
Cr-51	5.4E+06	1.1E+07	1.5E+06	6.9E+06	8.3E+05	2.1E+04
Mn-54	1.6E+09	9.4E+08	2.1E+07	2.9E+07	3.5E+06	2.0E+06
Fe-59	3.2E+08	9.6E+08	1.7E+09	3.1E+08	4.0E+07	1.5E+06
Co-58	4.4E+08	6.0E+08	2.9E+08	8.4E+07	1.0E+07	1.3E+06
Co-60	2.5E+10	3.2E+09	1.0E+09	2.7E+08	3.2E+07	8.6E+06
Zn-65	8.5E+08	2.7E+09	9.5E+08	1.6E+10	1.9E+09	1.2E+06
Sr-89	2.5E+04	3.5E+10	3.8E+08	9.9E+09	2.1E+10	2.4E+06
Sr-90	0.0E+00	1.4E+12	9.6E+09	9.4E+10	2.0E+11	1.1E+08
Zr-95	2.9E+08	1.2E+09	1.5E+09	9.3E+05	1.1E+05	2.7E+06
Sb-124	6.9E+08	3.0E+09	4.4E+08	7.2E+08	8.6E+07	3.8E+06
I-131	1.0E+07	2.4E+10	2.5E+09	4.8E+11	5.8E+11	1.6E+07
I-133	1.5E+06	4.0E+08	6.0E+01	4.4E+09	5.3E+09	3.8E+06
Cs-134	7.9E+09	2.5E+10	1.1E+09	5.0E+10	1.5E+11	1.1E+06
Cs-136	1.7E+08	2.2E+08	4.2E+07	5.1E+09	1.5E+10	1.9E+05
Cs-137	1.2E+10	2.5E+10	1.0E+09	4.5E+10	1.4E+11	9.0E+05
Ba-140	2.3E+07	2.7E+08	5.2E+07	2.1E+08	2.6E+07	2.0E+06
Ce-141	1.5E+07	5.3E+08	3.0E+07	8.3E+07	1.0E+07	6.1E+05
Ce-144	7.9E+07	1.3E+10	3.6E+08	7.3E+08	8.7E+07	1.3E+07

Units for all except inhalation pathway are m<sup>2</sup> mr sec / yr μCi, inhalation pathway units are mr m<sup>3</sup> / yr μCi.

Information	PMP-6010.OSD.001	Rev. 14	Page 55 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.1	Dose Factors for Various Pathways		Pages: 54 - 58

**U<sub>ap</sub> Values to be Used For the Maximum Exposed Individual**

Pathway	Infant	Child	Teen	Adult
Fruits, vegetables and grain (kg/yr)	--	520	630	520
Leafy vegetables (kg/yr)	--	26	42	64
Milk (L/yr)	330	330	400	310
Meat and poultry (kg/yr)	--	41	65	110
Fish (kg/yr)	--	6.9	16	21
Drinking water (L/yr)	330	510	510	730
Shoreline recreation (hr/yr)	--	14	67	12
Inhalation (m <sup>3</sup> /yr)	1400	3700	8000	8000

Table E-5 of Reg. Guide 1.109.

Information	PMP-6010.OSD.001	Rev. 14	Page 56 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.1	Dose Factors for Various Pathways		Pages: 54 - 58

**B<sub>ip</sub> Factors for Aquatic Foods**  
 $\rho\text{Ci l / kg } \rho\text{Ci}$

Element	Fish	Invertebrate
H	9.0E-1	9.0E-1
C	4.6E3	9.1E3
Na	1.0E2	2.0E2
P	1.0E5	2.0E4
Cr	2.0E2	2.0E3
Mn	4.0E2	9.0E4
Fe	1.0E2	3.2E3
Co	5.0E1	2.0E2
Ni	1.0E2	1.0E2
Cu	5.0E1	4.0E2
Zn	2.0E3	1.0E4
Br	4.2E2	3.3E2
Rb	2.0E3	1.0E3
Sr	3.0E1	1.0E2
Y	2.5E1	1.0E3
Zr	3.3E0	6.7E0
Nb	3.0E4	1.0E2
Mo	1.0E1	1.0E1
Tc	1.5E1	5.0E0
Ru	1.0E1	3.0E2
Rh	1.0E1	3.0E2
Te	4.0E2	6.1E3
I	1.5E1	5.0E0
Cs	2.0E3	1.0E3
Ba	4.0E0	2.0E2
La	2.5E1	1.0E3
Ce	1.0E0	1.0E3
Pr	2.5E1	1.0E3
Nd	2.5E1	1.0E3
W	1.2E3	1.0E1
Np	1.0E1	4.0E2

Table A-1 of Reg. Guide 1.109.

Information	PMP-6010.OSD.001	Rev. 14	Page 57 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.1	Dose Factors for Various Pathways		Pages: 54 - 58

**D<sub>aipj</sub> External Dose Factors for Standing on Contaminated Ground**  
mrem m<sup>2</sup> / hr  $\rho$ Ci

Radionuclide	Total Body	Skin
H-3	0	0
C-14	0	0
Na-24	2.5E-8	2.9E-8
P-32	0	0
Cr-51	2.2E-10	2.6E-10
Mn-54	5.8E-9	6.8E-9
Mn-56	1.1E-8	1.3E-8
Fe-55	0	0
Fe-59	8.0E-9	9.4E-9
Co-58	7.0E-9	8.2E-9
Co-60	1.7E-8	2.0E-8
Ni-63	0	0
Ni-65	3.7E-9	4.3E-9
Cu-64	1.5E-9	1.7E-9
Zn-65	4.0E-9	4.6E-9
Zn-69	0	0
Br-83	6.4E-11	9.3E-11
Br-84	1.2E-8	1.4E-8
Br-85	0	0
Rb-86	6.3E-10	7.2E-10
Rb-88	3.5E-9	4.0E-9
Rb-89	1.5E-8	1.8E-8
Sr-89	5.6E-13	6.5E-13
Sr-91	7.1E-9	8.3E-9
Sr-92	9.0E-9	1.0E-8
Y-90	2.2E-12	2.6E-12
Y-91m	3.8E-9	4.4E-9
Y-91	2.4E-11	2.7E-11
Y-92	1.6E-9	1.9E-9
Y-93	5.7E-10	7.8E-10
Zr-95	5.0E-9	5.8E-9
Zr-91	5.5E-9	6.4E-9
Nb-95	5.1E-9	6.0E-9
Mo-99	1.9E-9	2.2E-9
Tc-99m	9.6E-10	1.1E-9
Tc-101	2.7E-9	3.0E-9
Ru-103	3.6E-9	4.2E-9

Information	PMP-6010.OSD.001	Rev. 14	Page 58 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.1	Dose Factors for Various Pathways		Pages: 54 - 58

Radionuclide	Total Body	Skin
Ru-105	4.5E-9	5.1E-9
Ru-106	1.5E-9	1.8E-9
Ag-110m	1.8E-8	2.1E-8
Te-125m	3.5E-11	4.8E-11
Te-127m	1.1E-12	1.3E-12
Te-127	1.0E-11	1.1E-11
Te-129m	7.7E-10	9.0E-10
Te-129	7.1E-10	8.4E-10
Te-131m	8.4E-9	9.9E-9
Te-131	2.2E-9	2.6E-6
Te-132	1.7E-9	2.0E-9
I-130	1.4E-8	1.7E-8
I-131	2.8E-9	3.4E-9
I-132	1.7E-8	2.0E-8
I-133	3.7E-9	4.5E-9
I-134	1.6E-8	1.9E-8
I-135	1.2E-8	1.4E-8
Cs-134	1.2E-8	1.4E-8
Cs-136	1.5E-8	1.7E-8
Cs-137	4.2E-9	4.9E-9
Cs-138	2.1E-8	2.4E-8
Ba-139	2.4E-9	2.7E-9
Ba-140	2.1E-9	2.4E-9
Ba-141	4.3E-9	4.9E-9
Ba-142	7.9E-9	9.0E-9
La-140	1.5E-8	1.7E-8
La-142	1.5E-8	1.8E-8
Ce-141	5.5E-10	6.2E-10
Ce-143	2.2E-9	2.5E-9
Ce-144	3.2E-10	3.7E-10
Pr-143	0	0
Pr-144	2.0E-10	2.3E-10
Nd-147	1.0E-9	1.2E-9
W-187	3.1E-9	3.6E-9
Np-239	9.5E-10	1.1E-9

Table E-6 of Reg Guide 1.109.

Information	PMP-6010.OSD.001	Rev. 14	Page 59 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.2	Radioactive Liquid Effluent Monitoring Instruments	Pages: 59 - 60	

Instrument	Minimum Channels Operable <sup>a</sup>	Applicability	Action
1. Gross Radioactivity Monitors Providing Automatic Release Termination			
a. Liquid Radwaste Effluent Line (RRS-1001)	(1)#	At times of release	1
b. Steam Generator Blowdown Line (R-19, DRS 3/4100 +)	(1)	At times of release**	2
c. Steam Generator Blowdown Treatment Effluent (R-24, DRS 3/4200 +)	(1)	At times of release	2
2. Gross Radioactivity Monitors Not Providing Automatic Release Termination			
a. Service Water System Effluent Line (R-20, R-28, WRA 3/4500 and WRA 3/4600 +)	(1) per train	At all times	3
3. Continuous Composite Sampler Flow Monitor			
a. Turbine Building Sump Effluent Line	(1)	At all times	3
4. Flow Rate Measurement Devices			
a. Liquid Radwaste Line (RFI-285)	(1)	At times of release	4
b. Discharge Pipes*	(1)	At all times	NA
c. Steam Generator Blowdown Treatment Effluent (DFI-352)	(1)	At times of release	4

\* Pump curves and valve settings may be utilized to estimate flow; in such cases, Action Statement 4 is not applicable.

# OPERABILITY OF RRS-1001 includes OPERABILITY of flow switch RFS-1010, which is an attendant instrument as defined by Technical Specification 1.6.

\*\* Since these monitors can be used for either batch or continuous release the appropriate action statement of 1 or 2 should apply (that is, Action 1 if a steam generator drain is being performed in lieu of Action 2).

+ Westinghouse (R) radiation monitors are being replaced by Eberline (WRS & WRA) monitors. Either monitor can fulfill the operability requirement.

Information	PMP-6010.OSD.001	Rev. 14	Page 60 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.2	Radioactive Liquid Effluent Monitoring Instruments	Pages: 59 - 60	

a IF an RMS monitor is inoperable solely as the result of the loss of its control room alarm annunciation, THEN one of the following actions is acceptable to satisfy the ODCM action statement compensatory surveillance requirement:

1. Collect grab samples and conduct laboratory analyses per the specific monitor's action statement,  
-OR-
2. Collect local monitor readings at a frequency equal to or greater than (more frequently than) the action frequency.

IF the RMS monitor is inoperable for reasons other than the loss of control room annunciation, THEN the only acceptable action is taking grab samples and conducting laboratory analyses as the reading is equivalent to a grab sample when the monitor is functional.

#### TABLE NOTATION

- Action 1 With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases may continue, provided that prior to initiating a release:
1. At least two independent samples are analyzed in accordance with Step 3.2.3a and;
  2. At least two technically qualified members of the Facility Staff independently verify the discharge valving. 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 for up to 30 days provided grab samples are analyzed for gross radioactivity (beta or gamma) at a limit of detection of at least 10<sup>-7</sup> µCi/gram:
1. At least once per shift when the specific activity of the secondary coolant is > 0.01 µCi/gram DOSE EQUIVALENT I-131.
  2. At least once per 24 hours when the specific activity of the secondary coolant is ≤ 0.01 µCi/gram DOSE EQUIVALENT I-131.
- Action 3 With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue for up to 30 days provided that at least once per shift, grab samples are collected and analyzed for gross radioactivity (beta or gamma) at a lower limit of detection of at least 10<sup>-7</sup> µCi/ml. Since the ESW monitors (R-20, R-28, WRA-3/4500 and WRA-3/4600) are only used for post LOCA leak detection and have no auto trip function associated with them, grab samples are only needed if the Containment Spray Heat Exchanger is in service.
- Action 4 With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue for up to 30 days provided the flow rate is estimated at least once per 4 hours during actual releases.

Compensatory actions are governed by PMP-4030.EIS.001, Event-Initiated Surveillance Testing

Information	PMP-6010.OSD.001	Rev. 14	Page 61 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.3	Radioactive Liquid Effluent Monitoring Instrumentation Surveillance Requirements		Pages: 61 - 62

Instrument	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST
1. Gross Beta or Gamma Radioactivity Monitors Providing Alarm and Automatic Isolation				
a. Liquid Radwaste Effluent Line (RRS-1001)	D*	P	R(3)	Q(5)
b. Steam Generator Blowdown Effluent Line	D*	M	R(3)	Q(1)
c. Steam Generator Blowdown Treatment Effluent Line	D*	M	R(3)	Q(1)
2. Gross Beta or Gamma Radioactivity Monitors Providing Alarm But Not Isolation				
a. Service Water System Effluent Line	D	M	R(3)	Q(2)
3. Continuous Composite Samplers				
a. Turbine Building Sump Effluent Line	D*	N/A	N/A	N/A
4. Flow Rate Monitors				
a. Liquid Radwaste Effluent	D(4)*	N/A	R	Q
b. Steam Generator Blowdown Treatment Line	D(4)*	N/A	N/A	N/A

\* During releases via this pathway



Information	PMP-6010.OSD.001	Rev. 14	Page 62 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.3	Radioactive Liquid Effluent Monitoring Instrumentation Surveillance Requirements		Pages: 61 - 62

### TABLE NOTATION

1. Demonstrate with the CHANNEL FUNCTIONAL TEST that automatic isolation of this pathway and control room alarm annunciation occurs if any of the following conditions exists:
  1. Instrument indicates measured levels above the alarm/trip setpoint.
  2. Circuit failure.\*
  3. Instrument indicates a downscale failure.\*
  4. Instrument control not set in operating mode.\*
  
2. Demonstrate with the CHANNEL FUNCTIONAL TEST that control room alarm annunciation occurs if any of the following conditions exists:
  1. Instrument indicates measured levels above the alarm setpoint.
  2. Circuit failure.
  3. Instrument indicates a downscale failure.
  4. Instrument controls not set in operating mode.
  
3. Perform the initial CHANNEL CALIBRATION using one or more sources with traceability back to the National Institute of Standards and Technology (NIST). These sources 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 may be used.
  
4. Verify indication of flow during periods of release with the CHANNEL CHECK. Perform the CHANNEL CHECK at least once per 24 hours on days on which continuous, periodic or batch releases are made.
  
5. Demonstrate with the CHANNEL FUNCTIONAL TEST that automatic isolation of this pathway and control room alarm annunciation occurs if any of the following conditions exists:
  1. Instrument indicates measured levels above the alarm/trip setpoint.
  2. Circuit failure.\*\*
  3. Instrument indicates a downscale failure.\*\*
  4. Instrument control not set in operating mode.\*
  5. Loss of sample flow.

\* Instrument indicates, but does not provide for automatic isolation

\*\* Instrument indicates, but does not necessarily cause automatic isolation. No credit is taken for the automatic isolation on such occurrences.

Operations currently performs the routine channel checks and source checks. Maintenance and Radiation Protection perform channel calibrations and channel functional tests. Chemistry performs the channel check on the continuous composite sampler. These responsibilities are subject to change without revision to this document.

Information	PMP-6010.OSD.001	Rev. 14	Page 63 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.4	Radioactive Gaseous Effluent Monitoring Instrumentation		Pages: 63 - 65

Instrument (Instrument#)	Operable <sup>1</sup>	Minimum Channels Action	Action
<b>1. Condenser Evacuation System</b>			
a. Noble Gas Activity Monitor (SRA-1905/2905)	(1)	****	6
b. Flow Rate Monitor (SFR-401, 1/2-MR-054 and/or SRA- 1910/2910)	(1)	****	5
<b>2. Unit Vent. Auxiliary Building Ventilation System</b>			
a. Noble Gas Activity Monitor (VRS-1505/2505)	(1)	*	6
b. Iodine Sampler Cartridge for VRA-1503/2503	(1)	*	8
c. Particulate Sampler Filter for VRA-1501/2501	(1)	*	8
d. Effluent System Flow Rate Measuring Device (VFR-315, MR-054 and/or VFR-1510/2510)	(1)	*	5
e. Sampler Flow Rate Measuring Device (VFS-1521/2521)	(1)	*	5
<b>3. Containment Purge and Pressure Relief Systems</b>			
a. Aux. Building Vent. System Noble Gas Activity Monitor (VRS-1505/2505)	(1)	**** <sup>2,3</sup>	7
b. Aux. Building Vent. System Particulate Sampler for VRA-1501/2501	(1)	****	8
<b>4. Waste Gas Holdup System</b>			
a. Noble Gas Activity Alarm and Termination of Waste Gas Releases (VRS-1505/2505)	(1)	**** <sup>4</sup>	9
<b>5. Gland Seal Exhaust</b>			
a. Noble Gas Activity Monitor (SRA--1805/2805)	(1)	****	6
b. Flow Rate Monitor (SFR-201, MR-054 or SFR-1810/2810)	(1)	****	5

\* At all times

\*\*\*\* During releases via this pathway

Information	PMP-6010.OSD.001	Rev. 14	Page 64 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.4	Radioactive Gaseous Effluent Monitoring Instrumentation		Pages: 63 - 65

**TABLE NOTATIONS**

1. **IF** an RMS monitor is inoperable solely as the result of the loss of its control room alarm annunciation, **THEN** one of the following actions is acceptable to satisfy the ODCM action statement compensatory surveillance requirement:
  1. Take grab samples and conduct laboratory analyses per the specific monitor's action statement,  
**-OR-**
  2. Take local monitor readings at a frequency equal to or greater than (more frequently than) the action frequency.

**IF** the RMS monitor is inoperable for reasons other than the loss of control room annunciation, **THEN** the only acceptable action is taking grab samples and conducting laboratory analyses as the reading is equivalent to a grab sample when the monitor is functional.

2. Consider releases as occurring "via this pathway" under the following conditions:
  - The Containment Purge System is in operation and Containment integrity is established/required,  
**-OR-**
  - The Containment Purge System is in operation and is being used as the vent path for the venting of contaminated systems within the containment building prior to completing both degas and depressurization of the RCS.

**IF** neither of the above are applicable, **THEN** the containment purge system is acting as a ventilation system and is covered by Item 2 of this Attachment.

3. For purge purposes only. See Attachment 3.4, Radioactive Gaseous Effluent Monitoring Instrumentation, (Items 2a, 4a) and Attachment 3.5, Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Requirements, (Items 2a, 4a) for other requirements associated with this instrument.
4. For waste gas releases only, see Item 2 (Unit Vent, Auxiliary Building Ventilation System) for additional requirements.

**ACTIONS**

5. With the number of channels **OPERABLE** less than required by the Minimum Channels **OPERABLE** requirement, effluent releases via this pathway may continue for up to 30 days provided the flow rate is estimated at least once per 4 hours. After 30 days, **IF** the channels are not **OPERABLE**, **THEN** continue releases with estimation of the flow rate once per 4 hours and provide a description of why the inoperability was not corrected in the next Annual Radiological Effluent Release Report.
6. With the number of channels **OPERABLE** less required by the Minimum Channels **OPERABLE** requirement, effluent releases via this pathway may continue for up to 30 days provided grab samples are taken at least once per shift and these samples are analyzed for gross activity within 24 hours. After 30 days, **IF** the channels are not **OPERABLE**, **THEN** continue releases with grab samples once per shift and provide a description of why the inoperability was not corrected in the next Annual Radiological Effluent release Report.

Information	PMP-6010.OSD.001	Rev. 14	Page 65 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.4	Radioactive Gaseous Effluent Monitoring Instrumentation		Pages: 63 - 65

7. With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirements, immediately suspend PURGING of radioactive effluents via this pathway.
8. With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via the affected pathway may continue for up to 30 days provided samples required for weekly analysis are continuously collected with auxiliary sampling equipment as required in Attachment 3.7, Radioactive Gaseous Waste Sampling and Analysis Program. After 30 days, IF the channels are not OPERABLE, THEN continue releases with sample collection by auxiliary sampling equipment and provide a description of why the inoperability was not corrected in the next Annual Radiological Effluent Release Report.

Sampling evolutions are not an interruption of a continuous release or sampling period.

9. With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, the contents of the tank(s) may be released to the environment for up to 14 days 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 release rate calculations and discharge valve lineups; otherwise, suspend release of radioactive effluents via this pathway.

Compensatory actions are governed by PMP-4030.EIS.001, Event-Initiated Surveillance Testing.

Information	PMP-6010.OSD.001	Rev. 14	Page 66 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.5	Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Requirements		Pages: 66 - 67

Instrument	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST
1. Condenser Evacuation System	Alarm Only			
a. Noble Gas Activity Monitor (SRA-1905/2905)	D**	M	R(2)	Q(1)
b. System Effluent Flow Rate (SFR-401, MR-054, SRA-1910/2910)	D**	NA	R	Q
2. Auxiliary Building Unit Ventilation System	Alarm and Trip			
a. Noble Gas Activity Monitor (VRS-1505/2505)	D*	M	R(2)	Q(1)
b. Iodine Sampler (For VRA-1503/2503)	W*	NA	NA	NA
c. Particulate Sampler (For VRA-1501/2501)	W*	NA	NA	NA
d. System Effluent Flow Rate Measurement Device (VFR-315, MR-054, VRS-1510/2510)	D*	NA	R	Q
e. Sampler Flow Rate Measuring Device (VFS-1521/2521)	D*	N/A	R	Q
3. Containment Purge System and Pressure Relief	Alarm Only			
a. Aux. Building Vent. System Noble Gas Activity Monitor (VRS-1505/2505)	D**	P	R(2)	Q(1)
b. Aux. Building Vent. System Particulate Sampler (For VRA-1501/2501)	W**	NA	NA	NA

Instrument	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST
4. Waste Gas Holdup System Including CVCS HUT	Alarm and Trip			
a. Noble Gas Activity Monitor Providing Alarm and Termination and CVCS HUT Releases (VRS-1505/2505)	P**	P	R(2)	Q(3)
5. Gland Seal Exhaust	Alarm Only			
a. Noble Gas Activity (SRA-1805/2805)	D**	M	R(2)	Q(1)
b. System Effluent Flow Rate (SFR-201, MR-054, SRA-1810/2810)	D**	NA	R	Q

\* At all times

\*\* During releases via this pathway

**TABLE NOTATIONS**

1. Demonstrate with the CHANNEL FUNCTIONAL TEST that control room alarm annunciation occurs if any of the following conditions exists:
  1. Instrument indicates measured levels above the alarm setpoint.
  2. Circuit failure.
  3. Instrument indicates a downscale failure.
  4. Instrument controls not set in operate mode.
  
2. Perform the initial CHANNEL CALIBRATION using one or more sources with traceability back to the NIST. These sources 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 may be used.
  
3. Demonstrate with the CHANNEL CALIBRATION TEST that automatic isolation of this pathway and control room alarm annunciation occurs if any of the following conditions exists:
  1. Instrument indicates measured levels above the alarm/trip setpoint.
  2. Circuit failure.\*
  3. Instrument indicates a downscale failure.\*
  4. Instrument controls not set in operate mode.\*

\* Instrument indicates, but does not provide automatic isolation.

Operations currently performs the routine channel checks, and source checks. Maintenance and Radiation Protection perform channel calibrations and channel functional tests. These responsibilities are subject to change without revision to this document.

Information	PMP-6010.OSD.001	Rev. 14	Page 68 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.6	Radioactive Liquid Waste Sampling and Analysis Program		Pages: 68 - 69

LIQUID RELEASE TYPE	SAMPLING FREQUENCY	MINIMUM ANALYSIS FREQUENCY	TYPE OF ACTIVITY ANALYSIS	LOWER LIMIT OF DETECTION (LLD) ( $\mu\text{Ci/ml}$ ) <sup>a</sup>
A. Batch Waste Release Tanks <sup>c</sup>	P Each Batch	P Each Batch	Principal Gamma Emitters <sup>e</sup>	$5 \times 10^{-7}$
			I-131	$1 \times 10^{-6}$
	P Each Batch	P Each Batch	Dissolved and Entrained Gases (Gamma Emitters)	$1 \times 10^{-5}$
			P Each Batch	M Composite <sup>b</sup>
	Gross Alpha	$1 \times 10^{-7}$		
	P Each Batch	Q Composite <sup>b</sup>	Sr-89, Sr-90	$5 \times 10^{-8}$
			Fe-55	$1 \times 10^{-6}$
B. Plant Continuous Releases <sup>d*</sup>	Daily	W Composite <sup>b</sup>	Principal Gamma Emitters <sup>e</sup>	$5 \times 10^{-7}$
			I-131	$1 \times 10^{-6}$
	M Grab Sample	M	Dissolved and Entrained Gases (Gamma Emitters)	$1 \times 10^{-5}$
			Daily <sup>f</sup>	M Composite <sup>b</sup>
	Gross Alpha	$1 \times 10^{-7}$		
	Daily	Q Composite <sup>b</sup>	Sr-89, Sr-90	$5 \times 10^{-8}$
			Fe-55	$1 \times 10^{-6}$

\*During releases via this pathway

Information	PMP-6010.OSD.001	Rev. 14	Page 69 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.6	Radioactive Liquid Waste Sampling and Analysis Program		Pages: 68 - 69

**TABLE NOTATION**

- a. The lower limit of detection (LLD) is defined in Table Notation A. of Attachment 3.20, Maximum Values for Lower Limits of Detections A, B - REMP.
- b. 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.
- c. A batch release is the discharge of liquid wastes of a discrete volume. Prior to sampling for analysis, isolate, recirculate or sparge each batch to ensure thorough mixing.
- d. A continuous release is the discharge of liquid of a non-discrete volume; e.g. from a volume of system that has an input flow during the continuous release.
- e. The principal gamma emitters for which the LLD specification applies exclusively are 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. Identify and report other peaks, which are measurable and identifiable, together with the above nuclides.
- f. **WHEN** the gross beta gamma (including tritium) concentration in the turbine room sump is greater than  $1 \text{ E } -05 \text{ } \mu\text{Ci/ml}$ , **THEN** increase sampling frequency to a grab sample every four hours [UFSAR Appendix Q Question 320.8].



Information	PMP-6010.OSD.001	Rev. 14	Page 70 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.7	Radioactive Gaseous Waste Sampling and Analysis Program		Pages: 70 - 71

Gaseous Release Type	Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection ( $\mu\text{Ci}/\text{m}^3$ ) <sup>a</sup>
a. Waste Gas Storage Tanks	P Each Tank Grab Sample	P Each Tank	Principal Gamma Emitters <sup>c</sup>	$1 \times 10^{-4}$
			H-3	$1 \times 10^{-6}$
b. Containment Purge  CPR	P Each Purge Grab Sample  Bimonthly	P Each Purge  Bimonthly	Principal Gamma Emitters <sup>c</sup>	$1 \times 10^{-4}$
			H-3	$1 \times 10^{-6}$
c. Condenser Evacuation System and Gland Seal Exhaust <sup>j*</sup>	M Grab Sample <sup>b</sup>	M <sup>b</sup> Particulate Sample	Principal Gamma Emitters <sup>c</sup>	$1 \times 10^{-4}$
			H-3	$1 \times 10^{-6}$
		M <sup>b</sup> Iodine Adsorbing Media	I-131	$1 \times 10^{-12}$
	Continuous	W <sup>h</sup> Noble Gas Sample	Noble Gases	$1 \times 10^{-6}$
d. Auxiliary Building Unit Vent <sup>*</sup>	Continuous <sup>d</sup>	W <sup>c</sup> Iodine Adsorbing Media	I-131	$1 \times 10^{-12}$
	Continuous <sup>d</sup>	W <sup>c</sup> Particulate Sample	Principal Gamma Emitters <sup>c</sup>	$1 \times 10^{-11}$
	Continuous <sup>d</sup>	M Composite Particulate Sample	Gross Alpha	$1 \times 10^{-11}$
	W Grab Sample <sup>b, i</sup>	W H-3 Sample	H-3	$1 \times 10^{-6}$
	Continuous <sup>d</sup>	Q Composite Particulate Sample	Sr-89, Sr-90	$1 \times 10^{-11}$
	Continuous <sup>d</sup>	W <sup>h</sup> Noble Gas Sample	Noble Gases	$1 \times 10^{-6}$
e. Incinerated Oil <sup>f</sup>	P Each Batch <sup>z</sup>	P Each Batch <sup>z</sup>	Principal Gamma Emitters <sup>c</sup>	$5 \times 10^{-7}$

\*During releases via this pathway

Information	PMP-6010.OSD.001	Rev. 14	Page 71 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.7	Radioactive Gaseous Waste Sampling and Analysis Program		Pages: 70 - 71

### TABLE NOTATION

- a. The lower limit of detection (LLD) is defined in Table Notation A. of Attachment 3.20, Maximum Values for Lower Limits of Detections A,B - REMP.
- b. Following start-up or  $\geq 15\%$  increase per hour power changes, perform an analysis for indication of primary to secondary leakage when limits in note j are exceeded.
- c. Change samples at least once per 7 days and complete analyses within 48 hours after changing. Perform analyses at least once per 24 hours for 7 days following each shutdown, startup or THERMAL POWER change  $> 15\%$  per hour of RATED THERMAL POWER. WHEN samples collected for 24 hours are analyzed, THEN the corresponding LLDs may be increased by a factor of 10. This requirement does not apply IF (1) analysis shows that DOSEQ I131 concentration in the RCS has not increased more than a factor of 3; and (2) the noble gas monitor shows that effluent activity has not increased more than a factor of 3.
- d. Know the ratio of the sample flow rate to the sampled stream flow rate for the time period covered by each dose or dose rate calculation made in accordance with steps 3.2.4a, 3.2.4b, and 3.2.4c of this document.  
  
Sampling evolutions are not an interruption of a continuous release or sampling period.
- e. The principal gamma emitters for which the LLD specification applies exclusively are 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. Identify and report other peaks, which are measurable and identifiable, together with the above nuclides.
- f. Releases from incinerated oil are discharged through the Auxiliary Boiler System. Account for releases based on pre-release grab sample data.
- g. Collect samples of waste oil to be incinerated from the container in which the waste oil is stored (example: waste oil storage tanks, 55 gal. drums) prior to transfer to the Auxiliary Boiler System. Ensure samples are representative of container contents.
- h. Obtain and analyze a gas marinelli grab sample weekly for noble gases effluent quantification.
- i. Take tritium grab samples at least once per 24 hours when the refueling cavity is flooded.
- j. Grab sampling of the Gland Seal Exhaust pathway need not be performed if the RMS low range channel (SRA-1805/2805) readings are less than  $1E-6 \mu\text{C}/\text{cc}$ . Attach the RMS daily averages in lieu of sampling. This is based on operating experience indicating no activity is detected in the Gland Seal Exhaust below this value. Compensatory sampling for out of service monitor is still required.

Information	PMP-6010.OSD.001	Rev. 14	Page 72 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.8	Multiple Release Point Factors for Release Points		Page: 72

Liquid Factors		
Monitor Description	Monitor Number	MRP #
U 1 SG Blowdown	1R19/24, DRS 3100/3200*	0.35
U 2 SG Blowdown	2R19/24, DRS 4100/4200*	0.35
U 1 & 2 Liquid Waste Discharge	RRS-1000	0.30

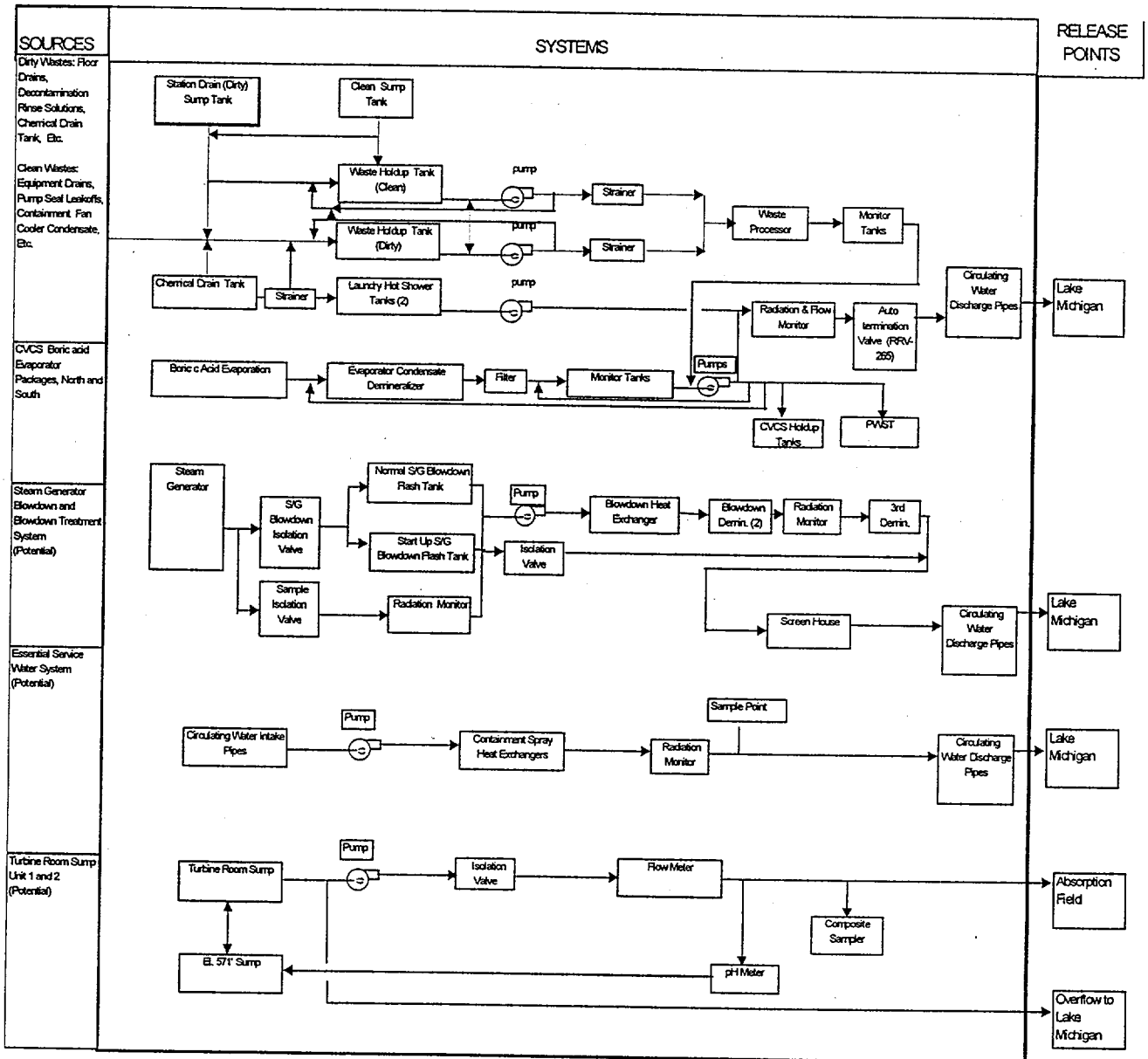
Gaseous Factors			
Monitor Description	Monitor Number	Flow Rate (cfm)	MRP #
<b>Unit 1</b>			
Unit Vent	VRS-1500	186,600	0.54
Gland Seal Vent	SRA-1800	1,260	0.00363
Steam Jet Air Ejector	SRA-1900	3,600 (b)	0.01
Start Up FT Vent		1,536	0.004
Total		192,996	
<b>Unit 2</b>			
Unit Vent	VRS-2500	143,400	0.41
Gland Seal Vent	SRA-2800	5,508 (a)	0.02
Steam Jet Air Ejector	SRA-2900	3,600 (b)	0.01
Start Up FT Vent		1,536	0.004
Total		154,044	

\* Either R-19, 24, DRS 3/4100 or 3/4200 can be used for blowdown monitoring as the Eberline monitors (DRS) are replacing the Westinghouse (R) monitors.

# Nominal Values

a Two release points of 2,754 cfm each are totaled for this value.

b This is the total design maximum of the Start Up Air Ejectors. This is a conservative value for unit 1.



Information	PMP-6010.OSD.001	Rev. 14	Page 74 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.10	Plant Liquid Effluent Parameters		Page: 74

SYSTEM	COMPONENTS		CAPACITY (EACH)	FLOW RATE (EACH)*
	TANKS	PUMPS		

#### I Waste Disposal System

+ Chemical Drain Tank	1	1	600 GAL.	20 GPM
+ Laundry & Hot Shower Tanks	2	1	600 GAL.	20 GPM
+ Monitor Tanks	4	2	21,600 GAL.	150 GPM
+ Waste Holdup Tanks	2		25,000 GAL.	
+ Waste Evaporators	3			30 GPM
+ Waste Evaporator Condensate Tanks	2	2	6,450 GAL	150 GPM

#### II Steam Generator Blowdown and Blowdown Treatment Systems

+ Start-up Flash Tank (Vented)#	1		1,800 GAL.	580 GPM
+ Normal Flash Tank (Not Vented)	1		525 GAL.	100 GPM
+ Blowdown Treatment System		1		60 GPM

#### III Essential Service Water System

+ Water Pumps		4		10,000 GPM
+ Containment Spray Heat Exchanger Outlet	4			3,300 GPM

#### IV Circulating Water Pumps

Unit 1		3		230,000 GPM
Unit 2		4		230,000 GPM

\* Nominal Values

# The 580 gpm value is calculated from the Estimated Steam Generator Blowdown Flow vs. DRV Valve Position letter prepared by M. J. O'Keefe, dated 9/27/93. This is 830 gpm times the 70% that remains as liquid while the other 30% flashes to steam and exhausts out the flash tank vent.

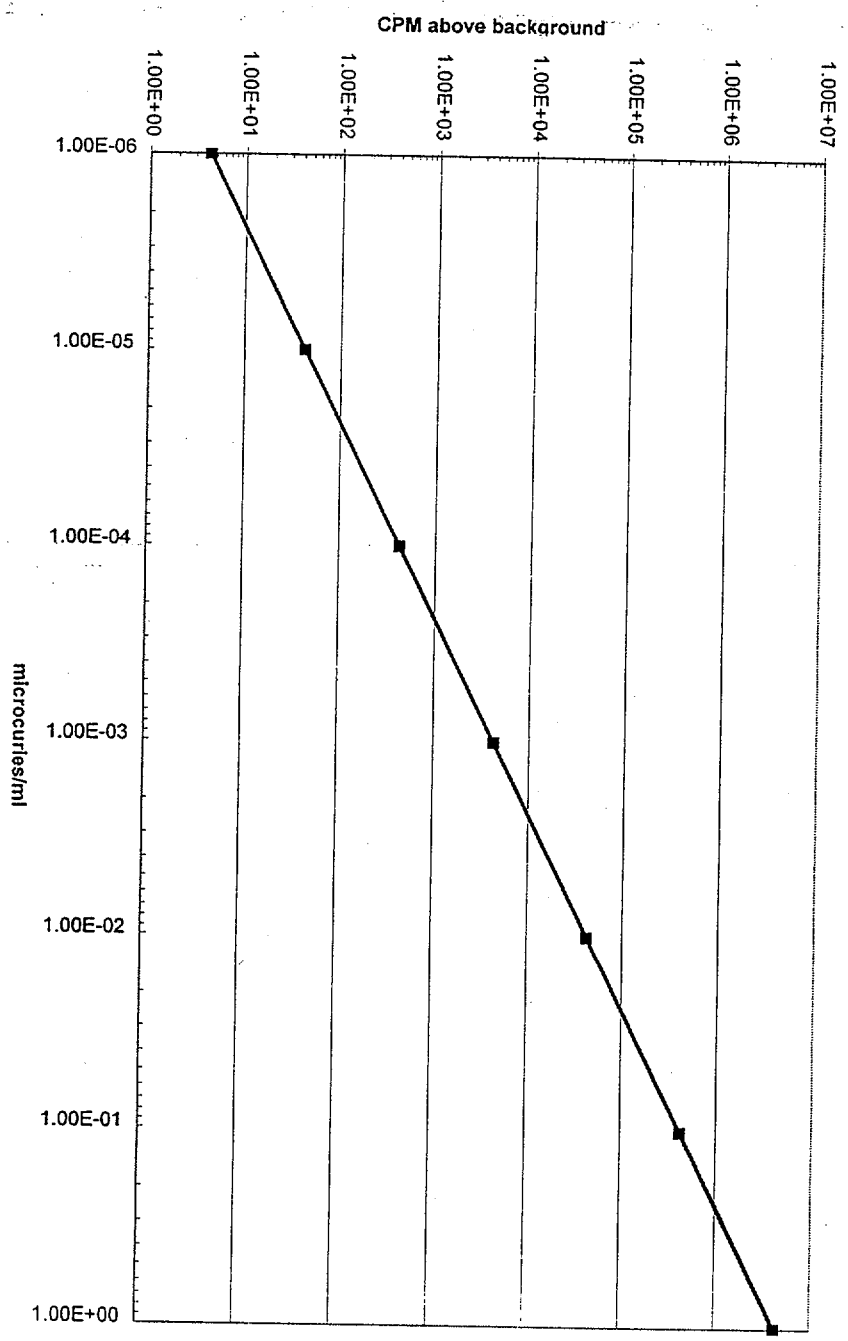
Information	PMP-6010.OSD.001	Rev. 14	Page 75 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.11	Volumetric Detection Efficiencies for Principle Gamma Emitting Radionuclides for Eberline Liquid Monitors		Page: 75

This includes the following monitors: RRS-1000, DRS 3100, DRS 3200, DRS 4100, DRS 4200, WRA 3500, WRA 3600, WRA 4500 and WRA 4600. [Ref. 5.2.1r]

NUCLIDE	EFFICIENCY (cpm/ $\mu$ Ci/cc)
I-131	3.78 E7
Cs-137	3.00 E7
Cs-134	7.93 E7
Co-60	5.75 E7
Co-58	4.58 E7
Cr-51	3.60 E6
Mn-54	3.30 E7
Zn-65	1.58 E7
Ag-110M	9.93 E7
Ba-133	4.85 E7
Ba-140	1.92 E7
Cd-109	9.58 E5
Ce-139	3.28 E7
Ce-141	1.92 E8
Ce-144	4.83 E6
Co-57	3.80 E7
Cs-136	1.07 E8
Fe-59	2.83 E7
Sb-124	5.93 E7
I-133	3.40 E7
I-134	7.23 E7
I-135	3.95 E7
Mo-99	8.68 E6
Na-24	4.45 E7
Nb-95	3.28 E7
Nb-97	3.50 E7
Rb-89	5.00 E7
Ru-103	3.48 E7
Ru-106	1.23 E7
Sb-122	2.55 E7
Sb-125	3.15 E7
Sn-113	7.33 E5
Sr-85	3.70 E7
Sr-89	2.88 E3
Sr-92	3.67 E7
Tc-99M	3.60 E7
Y-88	5.25 E7
Zr-95	3.38 E7
Zr-97	3.10 E7
Kr-85	1.56 E5
Kr-85M	3.53 E7
Kr-88	4.10 E7
Xe-131M	8.15 E5
Xe-133	7.78 E6
Xe-133M	5.75 E6
Xe-135	3.83 E7

Information	PMP-6010.OSD.001	Rev. 14	Page 76 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.12	Counting Efficiency Curves for R-19, and R-24		Pages: 76 - 77

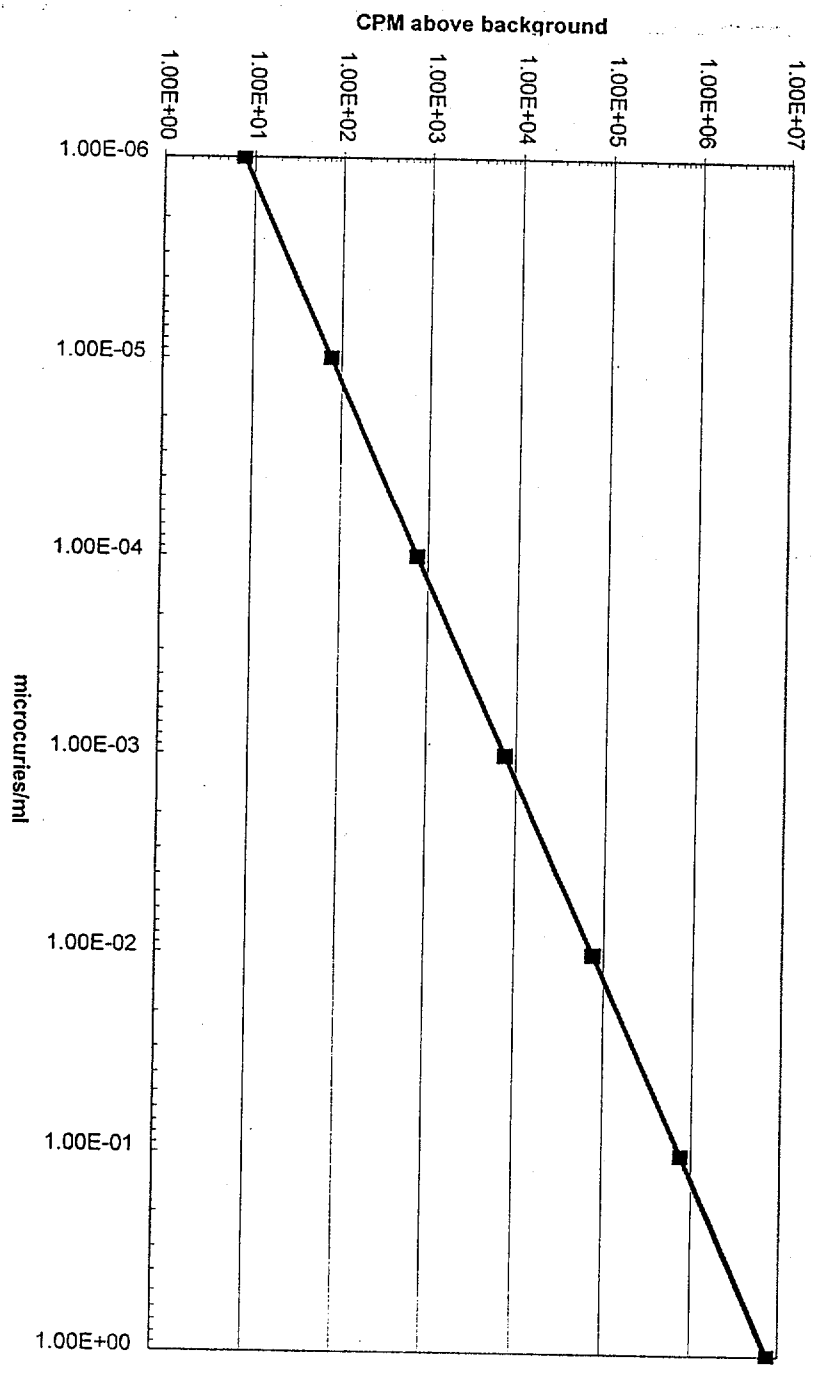
**Counting Efficiency Curve for R-19**  
 Efficiency Factor = 4.2 E6 cpm/μCi/ml  
 (Based on empirical data taken during pre-operational testing with Cs-137)



Information	PMP-6010.OSD.001	Rev. 14	Page 77 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.12	Counting Efficiency Curves for R-19, and R-24		Pages: 76 - 77

Counting Efficiency Curve for R-24  
Efficiency Factor = 7.5E6 cpm/uCi/ml

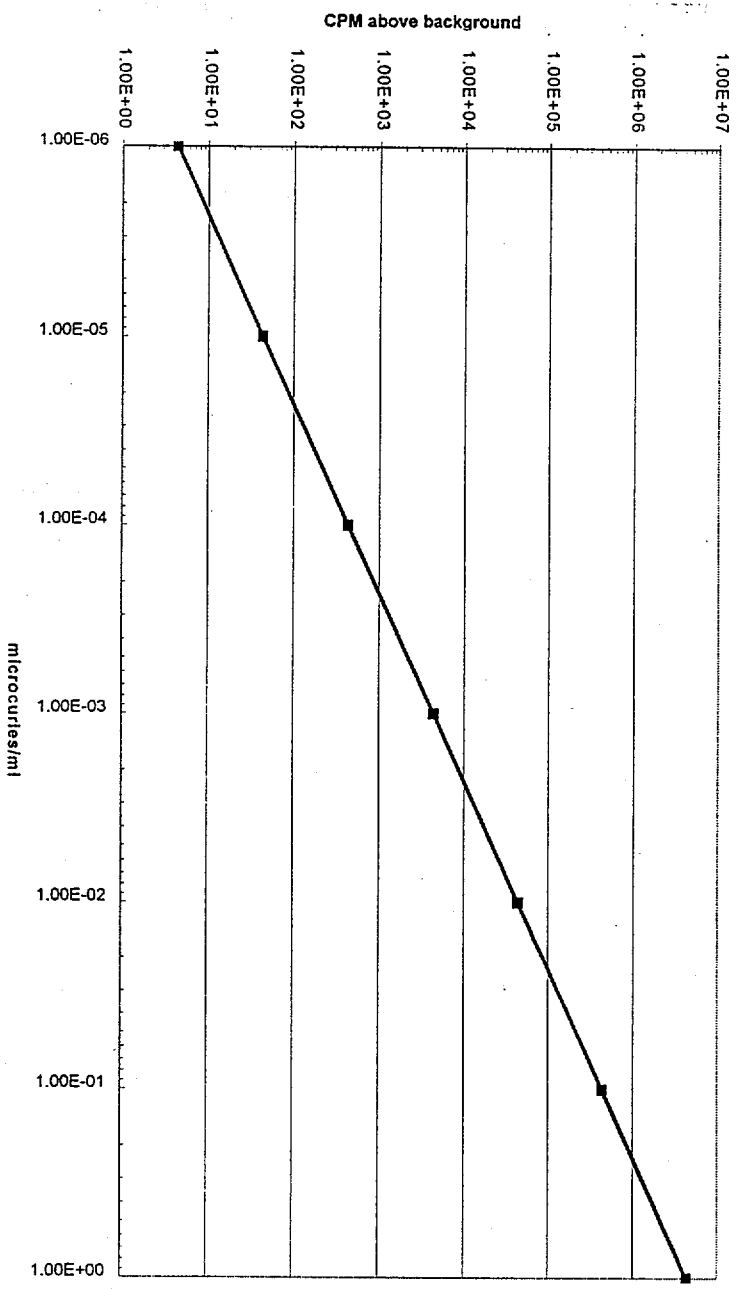
(Based on empirical data taken during pre-operational testing with Mn-54)

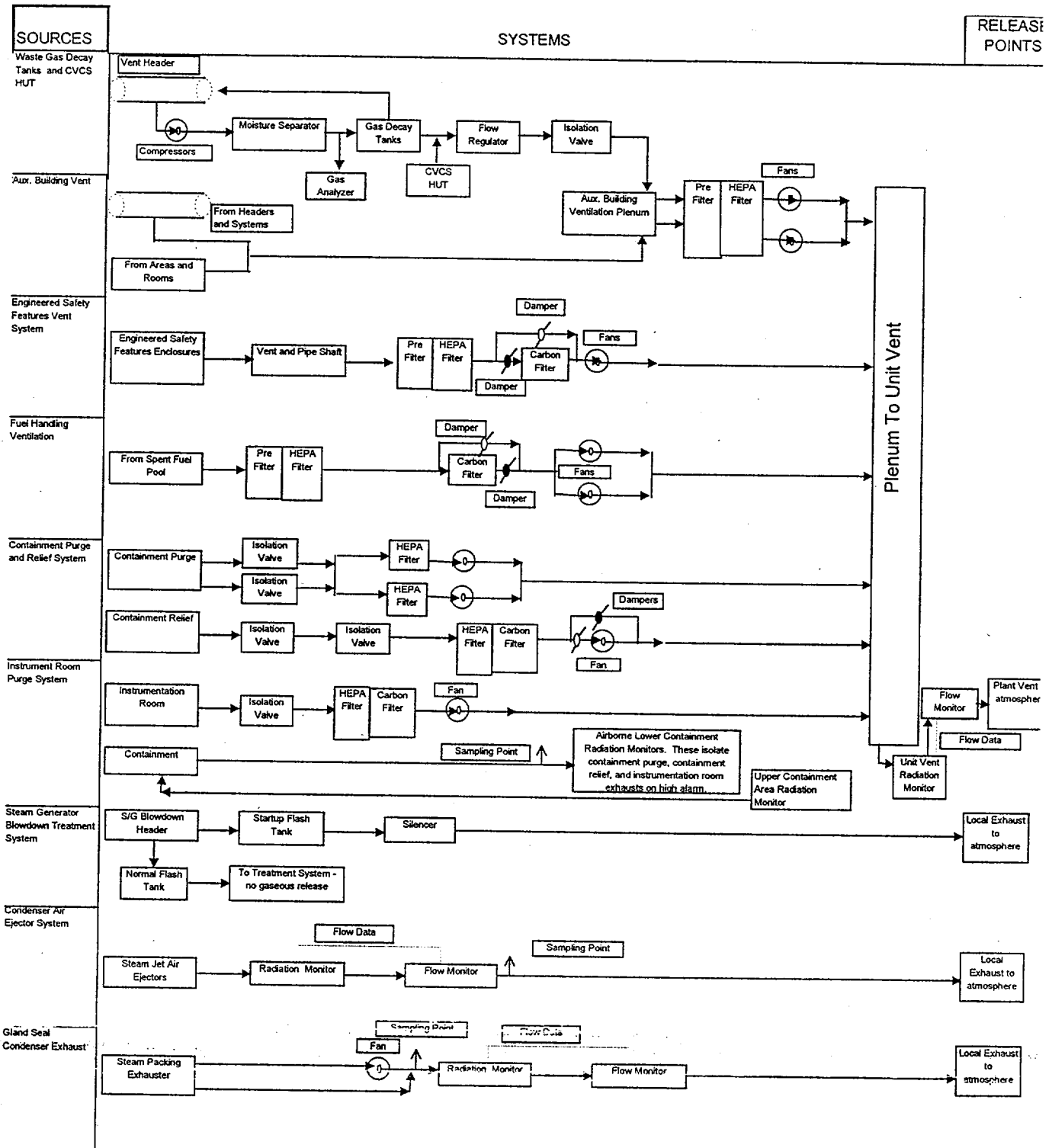




Information	PMP-6010.OSD.001	Rev. 14	Page 78 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.13	Counting Efficiency Curve for R-20, and R-28		Page: 78

Counting Efficiency Curve for R-20 and R-28  
Efficiency Factor = 4.3 Bq cpm/ $\mu$ Ci/ml  
(Based on empirical data taken during pre-operational testing with Co-58)





Information	PMP-6010.OSD.001	Rev. 14	Page 80 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.15	Plant Gaseous Effluent Parameters		Page: 80

SYSTEM	UNIT	EXHAUST FLOW RATE (CFM)	CAPACITY
I PLANT AUXILIARY BUILDING UNIT VENT	1 2	186,600 max 143,400 max	
WASTE GAS DECAY TANKS (8) AND CHEMICAL & VOLUME CONTROL SYSTEM HOLD UP TANKS (3)	1	125	4082 FT <sup>3</sup> @100 psig 28,741 ft <sup>3</sup> max @ 8#, 0 level
+ AUXILIARY BUILDING EXHAUST	1 2	72,600 35,000	
+ ENG. SAFETY FEATURES VENT	1 & 2	25,500	
+ FUEL HANDLING AREA VENT SYSTEM	1	30,000	
CONTAINMENT PURGE SYSTEM	1 & 2	32,000	
CONTAINMENT PRESSURE RELIEF SYSTEM	1 & 2	1,000	
INSTRUMENT ROOM PURGE SYSTEM	1 & 2	1,000	

II CONDENSER AIR EJECTOR SYSTEM			2 Release Points One for Each Unit
NORMAL STEAM JET AIR EJECTORS	1 & 2	230	
START UP STEAM JET AIR EJECTORS	1 & 2	3,600	

III TURBINE SEALS SYSTEM	1	1,260	
	2	5,508	2 Release Points for Unit 2

IV START UP FLASH TANK VENT	1	1,536	
	2	1,536	

+ Designates total flow for all fans.

Information	PMP-6010.OSD.001	Rev. 14	Page 81 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.16	10 Year Average of 1989-1998 Data		Pages: 81 - 82

$\overline{\chi/Q}$  GROUND AVERAGE (sec/m<sup>3</sup>)

DIRECTION (WIND TO)	DISTANCE (METERS)				
	594	2416	4020	5630	7240
N	3.50E-06	4.23E-07	1.97E-07	1.16E-07	8.13E-08
NNE	2.69E-06	3.22E-07	1.53E-07	9.16E-08	6.44E-08
NE	3.64E-06	4.51E-07	2.20E-07	1.33E-07	9.43E-08
ENE	5.94E-06	6.70E-07	3.35E-07	2.07E-07	1.48E-07
E	8.68E-06	9.50E-07	4.84E-07	3.03E-07	2.17E-07
ESE	8.45E-06	9.36E-07	4.75E-07	2.96E-07	2.12E-07
SE	9.71E-06	1.05E-06	5.38E-07	3.37E-07	2.42E-07
SSE	1.09E-05	1.20E-06	6.14E-07	3.86E-07	2.77E-07
S	1.16E-05	1.30E-06	6.53E-07	4.05E-07	2.89E-07
SSW	5.87E-06	6.70E-07	3.30E-07	2.01E-07	1.43E-07
SW	3.66E-06	4.26E-07	2.04E-07	1.23E-07	8.64E-08
WSW	2.84E-06	3.14E-07	1.50E-07	1.57E-07	6.32E-08
W	3.29E-06	3.69E-07	1.75E-07	1.04E-07	7.32E-08
WNW	3.20E-06	3.61E-07	1.69E-07	1.01E-07	7.05E-08
NW	2.98E-06	3.33E-07	1.58E-07	9.44E-08	6.61E-08
NNW	3.41E-06	3.81E-07	1.78E-07	1.06E-07	7.41E-08

DIRECTION (WIND TO)	DISTANCE (METERS)				
	12067	24135	40225	56315	80500
N	4.03E-08	1.55E-08	7.71E-09	4.93E-09	3.09E-09
NNE	3.23E-08	1.26E-08	6.27E-09	4.01E-09	2.52E-09
NE	4.78E-08	1.91E-08	9.52E-09	6.11E-09	3.88E-09
ENE	7.59E-08	3.08E-08	1.55E-08	9.95E-09	6.37E-09
E	1.12E-07	4.62E-08	2.33E-08	1.50E-08	9.64E-09
ESE	1.10E-07	4.50E-08	2.27E-08	1.46E-08	9.38E-09
SE	1.26E-07	5.20E-08	2.62E-08	1.55E-08	1.09E-08
SSE	1.44E-07	5.94E-08	2.99E-08	1.93E-08	1.24E-08
S	1.50E-07	6.09E-08	3.06E-08	1.97E-08	1.26E-08
SSW	7.31E-08	2.94E-08	1.47E-08	9.39E-09	5.97E-09
SW	4.35E-08	1.72E-08	8.56E-09	5.48E-09	3.47E-09
WSW	3.18E-08	1.25E-08	6.22E-09	3.99E-09	2.53E-09
W	3.66E-08	1.43E-08	7.07E-09	4.55E-09	2.85E-09
WNW	3.50E-08	1.35E-08	6.70E-09	4.28E-09	2.69E-09
NW	3.30E-08	1.28E-08	6.38E-09	4.09E-09	2.57E-09
NNW	3.68E-08	1.43E-08	7.08E-09	4.54E-09	2.85E-09

DIRECTION - SECTOR			
N = A	E = E	S = J	W = N
NNE = B	ESE = F	SSW = K	WNW = P
NE = C	SE = G	SW = L	NW = Q
ENE = D	SSE = H	WSW = M	NNW = R

Worst Case  $\overline{\chi/Q}$  = 1.54E-5 sec/m<sup>3</sup> in Sector J 1998

Information	PMP-6010.OSD.001	Rev. 14	Page 82 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.16	10 Year Average of 1989-1998 Data		Pages: 81 - 82

D/Q DEPOSITION (1/m<sup>2</sup>)

DIRECTION	DISTANCE (METERS)				
(WIND TO)	594	2416	4020	5630	7240

N	2.46E-08	2.38E-09	1.08E-09	5.66E-10	3.62E-10
NNE	1.06E-08	1.02E-09	4.62E-10	2.43E-10	1.55E-10
NE	1.31E-08	1.27E-09	5.75E-10	3.02E-10	1.93E-10
ENE	1.62E-08	1.56E-09	7.09E-10	3.72E-10	2.37E-10
E	1.92E-08	1.85E-09	8.39E-10	4.4E-10	2.81E-10
ESE	1.82E-08	1.76E-09	7.98E-10	4.19E-10	2.67E-10
SE	1.85E-08	1.79E-09	8.09E-10	4.25E-10	2.71E-10
SSE	2.24E-08	2.17E-09	9.84E-10	5.15E-10	3.29E-10
S	3.5E-08	3.38E-09	1.53E-09	8.03E-10	5.13E-10
SSW	2.31E-08	2.24E-09	1.01E-09	5.31E-10	3.39E-10
SW	2.14E-08	2.07E-09	9.38E-10	4.91E-10	3.14E-10
WSW	2.08E-08	2.01E-09	9.12E-10	4.78E-10	3.05E-10
W	2.13E-08	2.06E-09	9.33E-10	4.9E-10	3.13E-10
WNW	1.95E-08	1.89E-09	8.54E-10	4.48E-10	2.86E-10
NW	1.62E-08	1.57E-09	7.11E-10	3.73E-10	2.38E-10
NNW	2.18E-08	2.11E-09	9.56E-10	5.01E-10	3.2E-10

DIRECTION	DISTANCE (METERS)				
(WIND TO)	12067	24135	40225	56315	80500

N	1.51E-10	4.91E-11	1.81E-11	9.65E-12	4.84E-12
NNE	6.78E-11	2.1E-11	7.75E-12	4.13E-12	2.07E-12
NE	8.18E-11	2.62E-11	9.64E-12	5.15E-12	2.58E-12
ENE	9.95E-11	3.23E-11	1.19E-11	6.34E-12	3.18E-12
E	1.16E-10	3.82E-11	1.41E-11	7.5E-12	3.76E-12
ESE	1.12E-10	3.64E-11	1.34E-11	7.14E-12	3.58E-12
SE	1.13E-10	3.68E-11	1.36E-11	7.24E-12	3.63E-12
SSE	1.37E-10	4.47E-11	1.65E-11	8.79E-12	4.41E-12
S	2.14E-10	6.97E-11	2.57E-11	1.37E-11	6.87E-12
SSW	1.42E-10	4.61E-11	1.7E-11	9.06E-12	4.54E-12
SW	1.31E-10	4.27E-11	1.57E-11	8.38E-12	4.21E-12
WSW	1.27E-10	4.15E-11	1.53E-11	8.16E-12	4.09E-12
W	1.3E-10	4.25E-11	1.56E-11	1.73E-11	4.19E-12
WNW	1.19E-10	3.89E-11	1.43E-11	7.64E-12	3.83E-12
NW	1.78E-10	3.24E-11	1.19E-11	6.36E-12	3.19E-12
NNW	1.34E-10	4.35E-11	1.6E-11	8.55E-12	4.29E-12

DIRECTION - SECTOR			
N = A	E = E	S = J	W = N
NNE = B	ESE = F	SSW = K	WNW = P
NE = C	SE = G	SW = L	NW = Q
ENE = D	SSE = H	WSW = M	NNW = R

Worst Case D/Q = 4.41E-08 1/m<sup>2</sup> in Sector A 1990



Information	PMP-6010.OSD.001	Rev. 14	Page 84 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.18	Dose Factors <sup>(1)</sup>		Pages: 84 - 86

**DOSE FACTORS FOR NOBLE GASES AND DAUGHTERS\***

RADIONUCLIDE	TOTAL BODY DOSE FACTOR $K_i$ (DF $^B_i$ )	SKIN DOSE FACTOR $L_i$ (DF $^S_i$ )	GAMMA AIR DOSE FACTOR $M_i$ (DF $^Y_i$ )	BETA AIR DOSE FACTOR $N_i$ (DF $^B_i$ )
	mrem m <sup>3</sup> per $\mu$ Ci yr)	(mrem m <sup>3</sup> per $\mu$ Ci yr)	(mrad m <sup>3</sup> per $\mu$ Ci yr)	(mrad m <sup>3</sup> per $\mu$ Ci yr)
Kr-83m	7.56E-02	---	1.93E+01	2.88E+02
Kr-85m	1.17E+03	1.46E+03	1.23E+03	1.97E+03
Kr-85	1.61E+01	1.34E+03	1.72E+01	1.95E+03
Kr-87	5.92E+03	9.73E+03	6.17E+03	1.03E+04
Kr-88	1.47E+04	2.37E+03	1.52E+04	2.93E+03
Kr-89	1.66E+04	1.01E+04	1.73E+04	1.06E+04
Kr-90	1.56E+04	7.29E+03	1.63E+04	7.83E+03
Xe-131m	9.15E+01	4.76E+02	1.56E+02	1.11E+03
Xe-133m	2.51E+02	9.94E+02	3.27E+02	1.48E+03
Xe-133	2.94E+02	3.06E+02	3.53E+02	1.05E+03
Xe-135m	3.12E+03	7.11E+02	3.36E+03	7.39E+02
Xe-135	1.81E+03	1.86E+03	1.92E+03	2.46E+03
Xe-137	1.42E+03	1.22E+04	1.51E+03	1.27E+04
Xe-138	8.83E+03	4.13E+03	9.21E+03	4.75E+03
Ar-41	8.84E+03	2.69E+03	9.30E+03	3.28E+03

\* The listed dose factors are for radionuclides that may be detected in gaseous effluents, from Reg. Guide 1.109, Table B-1.

Information	PMP-6010.OSD.001	Rev. 14	Page 85 of 102
OFF-SITE DOSE CALCULATION MANUAL			
Attachment 3.18	Dose Factors <sup>(1)</sup>		Pages: 84 - 86

**DOSE FACTORS FOR RADIOIODINES AND RADIOACTIVE PARTICULATE,  
GASEOUS EFFLUENTS\***

RADIONUCLIDE	P <sub>i</sub> INHALATION PATHWAY (mrem m <sup>3</sup> per μCi yr)	P <sub>i</sub> FOOD & GROUND PATHWAYS (m <sup>2</sup> mrem sec per μCi yr)
H-3	6.47E+02	2.40E+03
C-14	2.65E+04	2.38E+09
Na-24	1.06E+04	3.28E+07
P-32	2.03E+06	1.63E+11
Cr-51	1.28E+04	1.15E+07
Mn-56	7.17E+04	1.29E+06
Fe-55	8.69E+04	1.38E+08
Fe-59	1.02E+06	7.89E+08
Co-58	7.77E+05	5.89E+08
Co-60	4.51E+06	4.62E+09
Ni-63	3.39E+05	3.56E+10
Ni-65	5.01E+04	4.43E+05
Cu-64	1.50E+04	4.75E+06
Zn-65	6.47E+05	2.01E+10
Zn-69	1.32E+04	3.01E-09
Rb-86	1.90E+05	2.27E+10
Te-131m	1.99E+05	3.48E+07
Te-131	8.22E+03	4.18E+04
Te-132	3.40E+05	7.26E+07
I-130	1.60E+06	8.99E+08
I-131	1.48E+07	1.07E+12
I-132	1.69E+05	1.79E+06
I-133	3.56E+06	9.78E+09
I-134	4.45E+04	6.40E+05
I-135	6.96E+05	2.40E+07
Cs-134	7.03E+05	7.21E+10
Cs-136	1.35E+05	6.13E+09
Cs-137	6.12E+05	6.25E+10
Cs-138	8.76E+02	5.15E+05
Ra-139	5.10E+04	1.52E+05
Ba-140	1.60E+06	2.75E+08
Ba-141	4.75E+03	5.98E+04
Ba-142	1.55E+03	6.43E+04



Information	PMP-6010.OSD.001	Rev. 14	Page 86 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.18	Dose Factors <sup>(1)</sup>		Pages: 84 - 86

RADIONUCLIDE	P <sub>i</sub> INHALATION PATHWAY (mrem m <sup>3</sup> per μCi yr)	P <sub>i</sub> FOOD & GROUND PATHWAYS (m <sup>2</sup> mrem sec per μCi yr)
La-140	1.68E+05	2.77E+07
La-142	5.95E+04	1.09E+06
Ce-141	5.17E+05	3.35E+07
Rb-88	5.57E+02	4.74E+04
Rb-89	3.21E+02	1.76E+05
Sr-89	2.03E+06	1.28E+10
Sr-90	4.09E+07	1.24E+11
Sr-91	7.34E+04	1.11E+06
Y-90	2.69E+05	9.64E+05
Y-91m	2.79E+03	1.44E+05
Y-91	2.45E+06	6.86E+06
Y-92	1.27E+05	2.59E+05
Y-93	1.67E+05	2.80E+05
Zr-95	1.75E+06	3.45E+08
Zr-97	1.40E+05	4.29E+06
Nb-95	4.79E+05	4.06E+08
Mo-99	1.35E+05	3.23E+08
Tc-99m	2.03E+03	2.81E+05
Tc-101	8.44E+02	2.92E+04
Ru-103	5.52E+05	1.55E+08
Ru-105	4.84E+04	9.12E+05
Ru-106	1.16E+07	3.02E+08
Ag-110m	3.67E+06	1.80E+10
Te-125m	4.47E+05	1.56E+08
Te-127m	1.31E+06	1.06E+09
Te-127	2.44E+04	1.53E+05
Te-129m	1.68E+06	1.45E+09
Te-129	2.63E+04	3.76E+04
Ce-143	1.16E+05	4.88E+06
Ce-144	9.84E+06	1.95E+08
Pr-143	4.33E+05	7.98E+05
Pr-144	4.28E+03	2.63E+03
Nd-147	3.22E+05	1.26E+07
W-187	3.96E+04	5.90E+06
Np-239	5.95E+04	2.55E+06

\*IF Sr-90 analysis is performed, THEN use P<sub>i</sub> given in Ru-106 for unidentified components.

IF Sr-90 and Ru-106 analyses are performed, THEN use P<sub>i</sub> given in I-131 for unidentified components.

IF Sr-90, Ru-106 and I-131 analyses are performed, THEN use P<sub>i</sub> given in P-32 for unidentified components.

<sup>(1)</sup> Site specific calculated using guidance provided in NUREG 0133, Rev. 1, Section 5.2.

Information	PMP-6010.OSD.001	Rev. 14	Page 87 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.19	Radiological Environmental Monitoring Program Sample Stations, Sample Types, Sample Frequencies		Pages: 87 - 90

SAMPLE STATION	DESCRIPTION/ LOCATION	SAMPLE TYPE	SAMPLE FREQUENCY	ANALYSIS TYPE	ANALYSIS FREQUENCY
<b>ON-SITE AIRBORNE AND DIRECT RADIATION (TLD) STATIONS</b>					
ONS-1 (T-1)	1945 ft @ 18° from Plant Axis	Airborne Particulate	Weekly	Gross beta	Weekly
		Airborne Radioiodine	Weekly	Gamma Isotopic	Quart. Comp.
		TLD	Weekly	I-131	Weekly
			Quarterly	Direct Radiation	Quarterly
ONS-2 (T-2)	2338 ft @ 48° from Plant Axis	Airborne Particulate	Weekly	Gross Beta	Weekly
			Weekly	Gamma Isotopic	Quart. Comp.
		Airborne Radioiodine	Weekly	I-131	Weekly
		TLD	Quarterly	Direct Radiation	Quarterly
ONS-3 (T-3)	2407 ft @ 90° from Plant Axis	Airborne Particulate	Weekly	Gross Beta	Weekly
			Weekly	Gamma Isotopic	Quart. Comp.
		Airborne Radioiodine	Weekly	I-131	Weekly
		TLD	Quarterly	Direct Radiation	Quarterly
ONS-4 (T-4)	1852 ft. @ 118° from Plant Axis	Airborne Particulate	Weekly	Gross Beta	Weekly
			Weekly	Gamma Isotopic	Quart. Comp.
		Airborne Radioiodine	Weekly	I-131	Weekly
		TLD	Quarterly	Direct Radiation	Quarterly
ONS-5 (T-5)	1895 ft @ 189° from Plant Axis	Airborne Particulate	Weekly	Gross Beta	Weekly
			Weekly	Gamma Isotopic	Quart. Comp.
		Airborne Radioiodine	Weekly	I-131	Weekly
		TLD	Quarterly	Direct Radiation	Quarterly
ONS-6 (T-6)	1917 ft @ 210° from Plant Axis	Airborne Particulate	Weekly	Gross Beta	Weekly
			Weekly	Gamma Isotopic	Quart. Comp.
		Airborne Radioiodine	Weekly	I-131	Weekly
		TLD	Quarterly	Direct Radiation	Quarterly
T-7	2103 ft @ 36° from Plant Axis	TLD	Quarterly	Direct Radiation	Quarterly
T-8	2208 ft @ 82° from Plant Axis	TLD	Quarterly	Direct Radiation	Quarterly
T-9	1368 ft @ 149° from Plant Axis	TLD	Quarterly	Direct Radiation	Quarterly
T-10	1390 ft @ 127° from Plant Axis	TLD	Quarterly	Direct Radiation	Quarterly
T-11	1969 ft @ 11° from Plant Axis	TLD	Quarterly	Direct Radiation	Quarterly
T-12	2292 ft @ 63° from Plant Axis	TLD	Quarterly	Direct Radiation	Quarterly

<b>CONTROL AIRBORNE AND DIRECT RADIATION (TLD) STATIONS</b>					
NBF	15.6 miles SSW New Buffalo, MI	Airborne Particulate	Weekly	Gross Beta	Weekly
			Weekly	Gamma Isotopic	Quart. Comp.
		Airborne Radioiodine	Weekly	I-131	Weekly
		TLD	Quarterly	Direct Radiation	Quarterly
SBN	26.2 miles SE South Bend, IN	Airborne Particulate	Weekly	Gross Beta	Weekly
			Weekly	Gamma Isotopic	Quart. Comp.
		Airborne Radioiodine	Weekly	I-131	Weekly
		TLD	Quarterly	Direct Radiation	Quarterly
DOW	24.3 miles ENE Dowagiac, MI	Airborne Particulate	Weekly	Gross Beta	Weekly
			Weekly	Gamma Isotopic	Quart. Comp.
		Airborne Radioiodine	Weekly	I-131	Weekly
		TLD	Quarterly	Direct Radiation	Quarterly
COL	18.9 miles NNE Coloma, MI	Airborne Particulate	Weekly	Gross Beta	Weekly
			Weekly	Gamma Isotopic	Quart. Comp.
		Airborne Radioiodine	Weekly	I-131	Weekly
		TLD	Quarterly	Direct Radiation	Quarterly

Information	PMP-6010.OSD.001	Rev. 14	Page 88 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.19	Radiological Environmental Monitoring Program Sample Stations, Sample Types, Sample Frequencies		Pages: 87 - 90

SAMPLE STATION	DESCRIPTION/ LOCATION	SAMPLE TYPE	SAMPLE FREQUENCY	ANALYSIS TYPE	ANALYSIS FREQUENCY
<b>OFF-SITE AIRBORNE AND DIRECT RADIATION (TLD) STATIONS</b>					
OFT-1	4.5 miles NE, Pole #B294-44	TLD	Quarterly	Direct Radiation	Quarterly
OFT-2	3.6 miles, NE, Stevensville Substation	TLD	Quarterly	Direct Radiation	Quarterly
OFT-3	5.1 miles NE, Pole #B296-13	TLD	Quarterly	Direct Radiation	Quarterly
OFT-4	4.1 miles, E, Pole #B350-72	TLD	Quarterly	Direct Radiation	Quarterly
OFT-5	4.2 miles ESE, Pole #B387-32	TLD	Quarterly	Direct Radiation	Quarterly
OFT-6	4.9 miles SE, Pole #B426-1	TLD	Quarterly	Direct Radiation	Quarterly
OFT-7	2.5 miles S, Bridgman Substation	TLD	Quarterly	Direct Radiation	Quarterly
OFT-8	4.0 miles S, Pole #B424-20	TLD	Quarterly	Direct Radiation	Quarterly
OFT-9	4.4 miles ESE, Pole #B369-214	TLD	Quarterly	Direct Radiation	Quarterly
OFT-10	3.8 miles S, Pole #B422-152	TLD	Quarterly	Direct Radiation	Quarterly
OFT-11	3.8 miles S, Pole #B423-12	TLD	Quarterly	Direct Radiation	Quarterly

<b>GROUNDWATER (WELL WATER) SAMPLE STATIONS</b>					
W-1	1969 ft @ 11° from Plant Axis	Groundwater	Quarterly	Gamma Isotopic	Quarterly
				Tritium	Quarterly
W-2	2292 ft @ 63° from Plant Axis	Groundwater	Quarterly	Gamma Isotopic	Quarterly
				Tritium	Quarterly
W-3	3279 ft @ 107° from Plant Axis	Groundwater	Quarterly	Gamma Isotopic	Quarterly
				Tritium	Quarterly
W-4	418 ft @ 301° from Plant Axis	Groundwater	Quarterly	Gamma Isotopic	Quarterly
				Tritium	Quarterly
W-5	404 ft @ 290° from Plant Axis	Groundwater	Quarterly	Gamma Isotopic	Quarterly
				Tritium	Quarterly
W-6	424 ft @ 273° from Plant Axis	Groundwater	Quarterly	Gamma Isotopic	Quarterly
				Tritium	Quarterly
W-7	1895 ft @ 189° from Plant Axis	Groundwater	Quarterly	Gamma Isotopic	Quarterly
				Tritium	Quarterly
W-8	1279 ft @ 53° from Plant Axis	Groundwater	Quarterly	Gamma Isotopic	Quarterly
				Tritium	Quarterly
W-9	1447 ft @ 22° from Plant Axis	Groundwater	Quarterly	Gamma Isotopic	Quarterly
				Tritium	Quarterly
W-10	4216 ft @ 129° from Plant Axis	Groundwater	Quarterly	Gamma Isotopic	Quarterly
				Tritium	Quarterly
W-11	3206 ft @ 153° from Plant Axis	Groundwater	Quarterly	Gamma Isotopic	Quarterly
				Tritium	Quarterly
W-12	2631 ft @ 162° from Plant Axis	Groundwater	Quarterly	Gamma Isotopic	Quarterly
				Tritium	Quarterly
W-13	2152 ft @ 182° from Plant Axis	Groundwater	Quarterly	Gamma Isotopic	Quarterly
				Tritium	Quarterly
W-14	1780 ft @ 164° from Plant Axis	Groundwater	Quarterly	Gamma Isotopic	Quarterly
				Tritium	Quarterly

Information	PMP-6010.OSD.001	Rev. 14	Page 89 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.19	Radiological Environmental Monitoring Program Sample Stations, Sample Types, Sample Frequencies		Pages: 87 - 90

SAMPLE STATION	DESCRIPTION/ LOCATION	SAMPLE TYPE	SAMPLE FREQUENCY	ANALYSIS TYPE	ANALYSIS FREQUENCY
<b>DRINKING WATER</b>					
STJ	St. Joseph Public Intake Sta. 9 mi. NE	Drinking water	Daily	Gross Beta	14 day Comp.
				Gamma Isotopic	14 day Comp.
				I-131	14 day Comp.
LTW	Lake Twp. Public Intake Sta. 0.6 mi. S	Drinking water	Daily	Tritium	Quart. Comp.
				Gross Beta	14 day Comp.
				Gamma Isotopic	14 day Comp.
				I-131	14 day Comp.
				Tritium	Quart. Comp.

<b>SURFACE WATER</b>					
SWL-1	Condenser Circulating Water Intake	Surface Water	Daily	Gamma Isotopic	Month. Comp.
SWL-2	Plant Site Boundary - South 500 ft. south of Plant Centerline	Surface Water	Daily	Tritium	Quart. Comp.
				Gamma Isotopic	Month. Comp.
SWL-3	Plant Site Boundary - North 500 ft. north of Plant Centerline	Surface Water	Daily	Tritium	Quart. Comp.
				Gamma Isotopic	Month. Comp.
				Tritium	Quart. Comp.

<b>SEDIMENT</b>					
SL-2	Plant Site Boundary - South 500 ft. south of Plant Centerline	Sediment	Semi-Ann.	Gamma Isotopic	Semi-Annual
SL-3	Plant Site Boundary - North 500 ft. north of Plant Centerline	Sediment	Semi-Ann.	Gamma Isotopic	Semi-Annual
SL-4	Plant Site Boundary - South South storm drain culvert to lake	Sediment	Quarterly	Gamma Isotopic	Quarterly
SL-5	Plant Site Boundary - North North storm drain culvert to lake	Sediment	Quarterly	Gamma Isotopic	Quarterly

SL-4 & 5 are data collection points only not actual REMP samples

<b>GROUNDWATER (STEAM GENERATOR STORAGE FACILITY) SAMPLE STATIONS</b>					
SG-1	0.8 mi. @ 95° from Plant Axis	Groundwater	Quarterly	Gross Alpha	Quarterly
				Gross Beta	Quarterly
SG-2	0.7 mi. @ 92° from Plant Axis	Groundwater	Quarterly	Gamma Isotopic	Quarterly
				Gross Alpha	Quarterly
				Gross Beta	Quarterly
SG-4	0.7 mi. @ 93° from Plant Axis	Groundwater	Quarterly	Gamma Isotopic	Quarterly
				Gross Alpha	Quarterly
				Gross Beta	Quarterly
SG-5	0.7 mi. @ 92° from Plant Axis	Groundwater	Quarterly	Gamma Isotopic	Quarterly
				Gross Alpha	Quarterly
				Gross Beta	Quarterly
				Gamma Isotopic	Quarterly

<b>INGESTION MILK Indicator Farms*</b>					
		Milk	Once every	I-131	per sample
			15 days	Gamma Isotopic	per sample
		Milk	Once every	I-131	per sample
			15 days	Gamma Isotopic	per sample
		Milk	Once every	I-131	per sample
			15 days	Gamma Isotopic	per sample

Information	PMP-6010.OSD.001	Rev. 14	Page 90 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.19	Radiological Environmental Monitoring Program Sample Stations, Sample Types, Sample Frequencies		Pages: 87 - 90

SAMPLE STATION	DESCRIPTION/ LOCATION	SAMPLE TYPE	SAMPLE FREQUENCY	ANALYSIS TYPE	ANALYSIS FREQUENCY
<b>INGESTION - MILK Background Farms</b>					
Livinghouse Farm	20 miles S, La Porte, IN	Milk	Once every	I-131	per sample
			15 days	Gamma Isotopic	per sample
Wyant Farm	20.7 miles E, Dowagiac	Milk	Once every	I-131	per sample
			15 days	Gamma Isotopic	per sample

<b>INGESTION - FISH</b>					
ONS-N	0.3 mile N, Lake Michigan	Fish	2/year	Gamma Isotopic	per sample
ONS-S	0.4 mile S, Lake Michigan	Fish	2/year	Gamma Isotopic	per sample
OFS-N	3.5 mile N, Lake Michigan	Fish	2/year	Gamma Isotopic	per sample
OFS-S	5.0 mile S, Lake Michigan	Fish	2/year	Gamma Isotopic	per sample

<b>INGESTION - FOOD PRODUCTS</b>					
<b>On Site</b>					
ONS-G	Nearest sample to Plant in the highest D/Q land sector containing media.	Grapes	At time of harvest	Gamma Isotopic	At time of harvest
ONS-V		Broadleaf vegetation	At time of harvest	Gamma Isotopic	At time of harvest
<b>Off Site</b>					
OFS-G	In a land sector containing grapes, approximately 20 miles from the plant, in one of the less prevalent D/Q land sectors	Grapes	At time of harvest	Gamma Isotopic	At time of harvest

<b>INGESTION - BROADLEAF IN LIEU OF MILK</b>					
3 indicator samples of broad leaf vegetation collected at different locations, within eight miles of the plant in the highest annual average D/Q land sector.		Broadleaf vegetation	Monthly when available	Gamma Isotopic I131	Monthly when available
1 background sample of similar vegetation grown 15-25 miles distant in one of the less prevalent wind directions.		Broadleaf vegetation	Monthly when available	Gamma Isotopic I131	Monthly when available

Collect composite samples of Drinking and Surface water at least daily. Analyze particulate sample filters for gross beta activity 24 or more hours following filter removal. This will allow for radon and thoron daughter decay. IF gross beta activity in air or water is greater than 10 times the yearly mean of control samples for any medium, THEN perform gamma isotopic analysis on the individual samples.

IF at least three indicator milk samples and one background milk sample cannot be obtained, THEN three indicator broad leaf samples will be collected at different locations, within eight miles of the plant, in the land sector with the highest D/Q (refers to the highest annual average D/Q). Also, one background broad leaf sample will be collected 15 to 25 miles from the plant in one of the less prevalent D/Q land sectors.

\* The three mild indicator farms will be determined by the Annual Land Use Census and those that are willing to participate.

Information	PMP-6010.OSD.001	Rev. 14	Page 91 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.20	Maximum Values for Lower Limits of Detections <sup>A,B</sup> - REMP		Pages: 91 - 92

Radionuclides	Food Product ρCi/kg, wet	Water ρCi/l	Milk ρCi/l	Air Filter ρCi/m <sup>3</sup>	Fish ρCi/kg, wet	Sediment ρCi/kg, dry
Gross Beta		4*		0.01		
H-3		2000				
Ba-140		60	60			
La-140		15	15			
Cs-134	60	15	15	0.06	130	150
Cs-137	60	18	18	0.06	150	180
Zr-95		30				
Nb-95		15				
Mn-54		15			130	
Fe-59		30			260	
Zn-65		30			260	
Co-58		15			130	
Co-60		15			130	
I-131	60	1	1	0.07		

This Data is directly from our plant-specific Technical Specification.

\* LLD for drinking water

Information	PMP-6010.OSD.001	Rev. 14	Page 92 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.20	Maximum Values for Lower Limits of Detections <sup>A,B</sup> - REMP		Pages: 91 - 92

#### NOTES

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

For a particular measurement system (which may include radiochemical separation), the LLD is given by the equation:

$$LLD = \frac{4.66^{\alpha} \times S}{E \times V \times 2.22 \times Y \times e^{(-\lambda \times \Delta t)}}$$

Where LLD is the a priori lower limit of detection as defined above (as pCi per unit mass or volume). Perform analysis in such a manner that the stated LLDs will be achieved under routine conditions. Occasionally background fluctuations, unavoidably small sample sizes, the presence of interfering radionuclides, or other uncontrollable circumstances may render these LLDs unachievable.

S 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 of the detection equipment as counts per transformation (that is, disintegration)

V is the sample size in appropriate mass or volume units

2.22 is the conversion factor from picocuries (pCi) to transformations (disintegrations) per minute

Y is the fractional radiochemical yield as appropriate

$\lambda$  is the radioactive decay constant for the particular radionuclide

$\Delta t$  is the elapsed time between sample collection (or end of sample collection period) and time of counting.

- B. Identify and report other peaks which are measurable and identifiable, together with the radionuclides listed in Attachment 3.20, Maximum Values for Lower Limits of Detections<sup>A,B</sup> - REMP.

<sup>$\alpha$</sup>  A 2.71 value may be added to the equation to provide correction for deviations in the Poisson distribution at low count rates, that is,  $2.71 + 4.66 \times S$ .

Information	PMP-6010.OSD.001	Rev. 14	Page 93 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.21	Reporting Levels for Radioactivity Concentrations in Environmental Samples		Page: 93

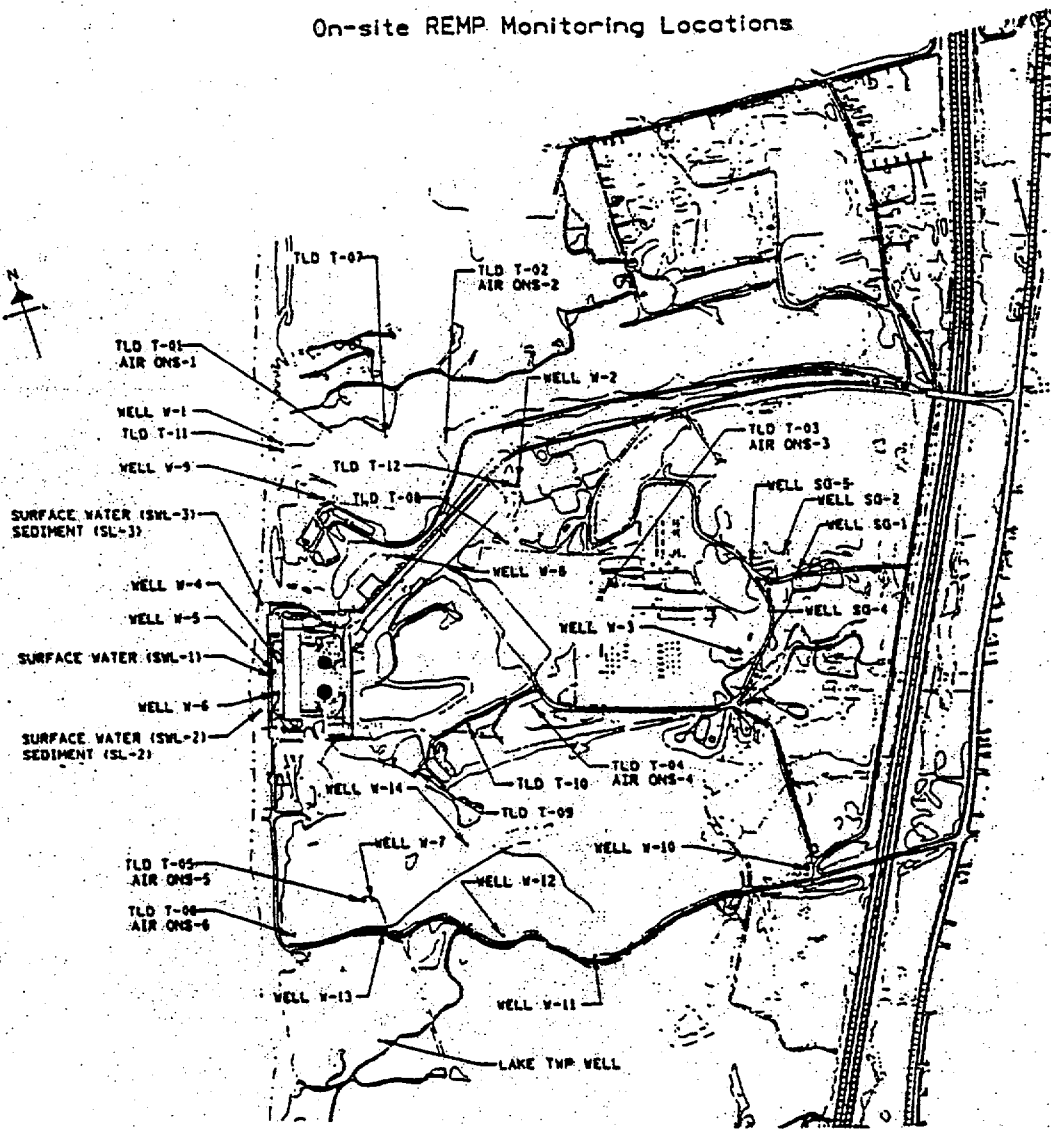
Radionuclides	Food Product $\rho\text{Ci/kg, wet}$	Water $\rho\text{Ci/l}$	Milk $\rho\text{Ci/l}$	Air Filter $\rho\text{Ci/m}^3$	Fish $\rho\text{Ci/kg, wet}$
H-3		20000			
Ba-140		200	300		
La-140		200	300		
Cs-134	1000	30	60	10	1000
Cs-137	2000	50	70	20	2000
Zr-95		400			
Nb-95		400			
Mn-54		1000			30000
Fe-59		400			10000
Zn-65		300			20000
Co-58		1000			30000
Co-60		300			10000
I-131	100	2	3	0.90	

This Data is directly from our plant-specific Technical Specification.



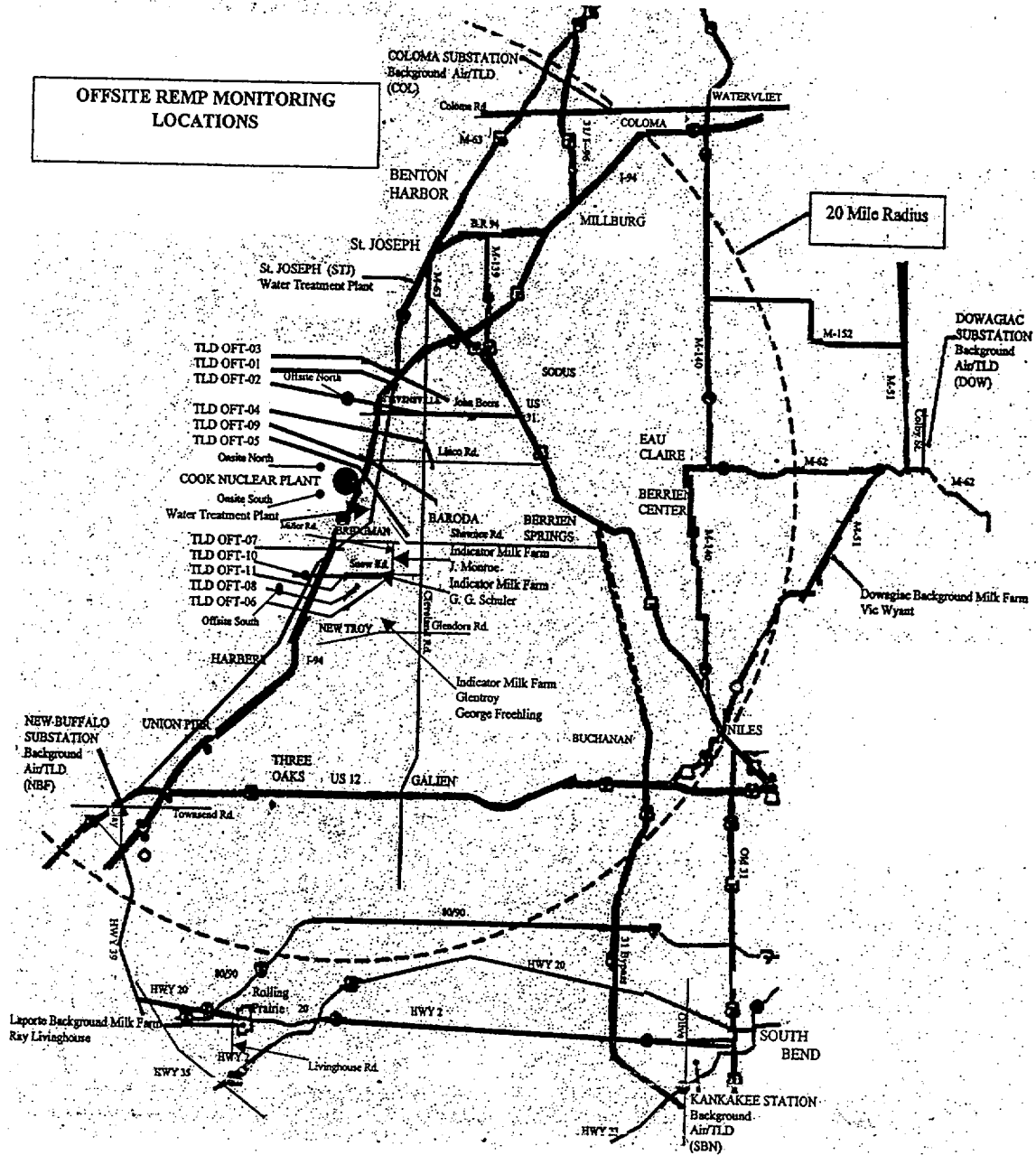
Information	PMP-6010.OSD.001	Rev. 14	Page 94 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.22	On-Site Monitoring Location - REMP		Page: 94

On-site REMP Monitoring Locations



LEGEND	
ONS-1 - ONS-6	Air Sampling Stations
T-01 - T-12	TLD Sampling Stations
W-1 - W-14	REMP T/S Groundwater Wells
SG-1, SG-2, SG-4, SG-5	REMP Non T/S Groundwater Wells
SWL-1, 2, 3	Surface Water Sampling Stations
SL-2, SL-3	Sediment Sampling Stations

Information	PMP-6010.OSD.001	Rev. 14	Page 95 of 102
OFF-SITE DOSE CALCULATION MANUAL			
Attachment 3.23	Off-Site Monitoring Locations - REMP		Page: 95



The current milk indicator farms are indicated here, but they will be determined and controlled by the Annual Land Use Census, those that are willing to participate, and 12-THP-6010.RPP.635, Collection of Milk Samples.

Information	PMP-6010.OSD.001	Rev. 14	Page 96 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.24	Safety Evaluation By The Office Of Nuclear Reactor Regulation		Pages: 96 - 98

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION  
RELATED TO DISPOSAL OF SLIGHTLY CONTAMINATED SLUDGE  
INDIANA MICHIGAN POWER COMPANY  
DONALD C. COOK NUCLEAR PLANT, UNIT NOS. 1 AND 2  
DOCKET NOS. 50-315 AND 50-316 [Ref. 5.2.1t]  
(This is a 10 CFR 50.75 (g) item)

1. INTRODUCTION

By letters dated October 9, 1991, October 23, 1991, September 3, 1993, and September 29, 1993, Indiana Michigan Power Company (I&M) requested approval pursuant to 10 CFR 20.2002 for the on-site disposal of licensed material not previously considered in the Donald C. Cook Nuclear Plant Final Environmental Statement dated August 1973. Specifically, this request addresses actions taken in 1982 in which approximately 942 cubic meters of slightly contaminated sludge were removed from the turbine room sump absorption pond and pumped to the upper parking lot located within the exclusion area of the Donald C. Cook Nuclear Plant. The contaminated sludge was spread over an area of approximately 4.7 acres. The sludge contained a total radionuclide inventory of 8.89 millicuries (mCi) of Cesium-137, Cesium-136, Cesium-134, Cobalt-60 and Iodine-131.

In its submittal, the licensee addressed specific information requested in accordance with 10 CFR 20.2002(a), provided a detailed description of the licensed material, thoroughly analyzed and evaluated information pertinent to the impacts on the environment of the proposed disposal of licensed material, and committed to follow specific procedures to minimize the risk of unexpected exposures.

2. DESCRIPTION OF WASTE

The turbine room sump absorption pond is a collection place for water released from the plant's turbine room sump. The contamination was caused by a primary-to-secondary steam generator leak that entered the pond from the turbine building sump, a recognized release pathway. Sludge, consisting mainly of leaves and roots mixed with sand, built up in the pond. As a result, the licensee dredged the pond in 1982. The radioactive sludge removed by the dredging activities was pumped to a containment area located within the exclusion area. The total volume of 942 cubic meters of the radioactive sludge that was dredged from the bottom of the turbine room absorption pond was subsequently spread and made into a graveled road over the upper parking lot area of approximately 4.7 acres.

The principal radionuclides identified in the dredged material are listed below.

**TABLE 1**

NUCLIDE (half-life)	ACTIVITY (mCi) 1982	ACTIVITY (mCi) 1991
<sup>136</sup> Cs (13.2 d)	0.03	NA*
<sup>134</sup> Cs (2.1 y)	2.34	0.18
<sup>137</sup> Cs (30.2 y)	5.59	4.57
<sup>60</sup> Co (5.6 y)	0.90	0.27
<sup>131</sup> I (8.04 d)	0.03	NA*
<b>TOTAL:</b>	<b>8.89</b>	<b>5.02</b>

\* NA: not applicable due to decay

Information	PMP-6010.OSD.001	Rev. 14	Page 97 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.24	Safety Evaluation By The Office Of Nuclear Reactor Regulation		Pages: 96 - 98

### 3. RADIOLOGICAL IMPACTS

The licensee in 1982 evaluated the following potential exposure pathways to members of the general public from the radionuclides in the sludge:

- (1) external exposure caused by groundshine from the disposal site;
- (2) internal exposure caused by inhalation of re suspended radionuclide;
- AND-
- (3) internal exposure from ingesting ground water.

The staff has reviewed the licensee's calculational methods and assumptions and finds that they are consistent with NUREG-1101, "Onsite Disposal of Radioactive Waste," Volumes 1 and 2, November 1986 and February 1987, respectively. The staff finds the assessment methodology acceptable. Table 2 lists the doses calculated by the licensee for the maximally exposed member of the public based on a total activity of 8.89 mCi disposed in that year.

**TABLE 2**

Pathway	Whole Body Dose Received by Maximally Exposed Individual (mrem/year)
Groundshine	0.94
Inhalation	0.94
Groundwater Ingestion	0.73
<b>Total</b>	<b>2.61</b>

On July 5, 1991, the licensee re-sampled the onsite disposal area to assure that no significant impacts and adverse effects had occurred. A counting procedure based on the appropriate environmental low-level doses was used by the licensee; however, no activity was detected during the re-sampling. This is consistent with the original activity of the material and the decay time. The 1991 re-sampling process used by the licensee confirms that the environmental impact of the 1982 disposal was very small. The staff finds the licensee's methodology acceptable.

### 4. ENVIRONMENTAL FINDING AND CONCLUSION

The staff has evaluated the environmental impact of the proposal to leave in place approximately 942 cubic meters of slightly contaminated sludge underneath the upper parking lot on the Donald C. Cook Nuclear Plant site.

In 1982, the licensee evaluated the potential exposure to members of the general public from the radionuclides in the sludge and calculated the potential dose to the maximally exposed member of the public, based on a total activity of 8.89 mCi disposed in that year, to be 2.61 mrem/yr. The staff has reviewed the licensee's calculational methods and assumptions and found that they are consistent with NUREG-1101, Onsite Disposal of Radioactive Waste, Volumes 1 and 2, November 1986 and February 1987, respectively. The staff finds the assessment methodology acceptable. For comparison, the radiation from the naturally occurring radionuclides in soils and rocks plus cosmic radiation gives a person in Michigan a whole-body dose rate of about 89 mrem per year outdoors. Subsequent licensee sampling in 1991 identified no detectable activity. The staff evaluated the licensee's sampling and analysis methodology and finds it acceptable. The results, of the 1991 re-sampling by the licensee, confirm that the environmental impact of the 1982 disposal was very small.

Based on the above the staff finds that the potential environmental impacts of leaving the contaminated sludge in place are insignificant. With regard to the non-radiological impacts, the staff has determined that leaving the soil in place represents the least impact to the environment.

<b>Information</b>	<b>PMP-6010.OSD.001</b>	<b>Rev. 14</b>	<b>Page 98 of 102</b>
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
<b>Attachment 3.24</b>	<b>Safety Evaluation By The Office Of Nuclear Reactor Regulation</b>		<b>Pages: 96 - 98</b>

5. CONCLUSION

Based on the staff's review of the licensee's discussion, the staff finds the licensee's proposal to retain the material in its present location as documented in this Safety Evaluation acceptable. Also, this Safety Evaluation shall be permanently incorporated as an appendix to the licensee's Offsite Dose Calculation Manual (ODCM), and any future modifications shall be reported to NRC in accordance with the applicable ODCM change protocol.

<sup>1</sup> I&M letter from E. E. Fitzpatrick to the NRC Document Control Desk, September 29, 1993

Therefore, the licensee's proposal to consider the slightly contaminated sludge disposed by retention in place in the manner described in the Donald C. Cook Nuclear Plant submittals date October 9, 1991, October 23, 1991, September 3, 1993, and September 29, 1993, is acceptable.

The guidelines used by the NRC staff for onsite disposal of licensed material and the staff's evaluation of how each guideline has been satisfied are given in Table 3.

Pursuant to 10 CFR 51.32, the Commission has determined that granting of this approval will have no significant impact on the environment (October 31, 1994, 59 FR 54477).

Principal Contributor: J. Minns

Date: November 10, 1994

**TABLE 3**

<b>20.2002 GUIDELINE FOR ONSITE DISPOSAL<sup>2</sup></b>	<b>STAFF'S EVALUATION</b>
1. The radioactive material should be disposed of in such a manner that it is unlikely that the material would be recycled.	1. Due to the nature of the disposed material, recycling to the general public is not considered likely.
2. Doses to the total body and any body organ of a maximally exposed individuals (a member of the general public or a non-occupationally exposed worker) from the probable pathways of exposure to the disposed material should be less than 1 mrem/year.	2. This guideline was addressed in Table 2. Although the 2.61 mrem/yr is greater than staff's guidelines, the staff finds it acceptable due to 9 yrs decay following analysis and the expected lack of activity detected in the 1991 survey.
3. Doses to the total body and any body organ of an inadvertent intruder from the probable pathways of exposure should be less than 5 mrem/year.	3. Because the material will be land-spread, the staff considers the maximally exposed individual scenario to also address the intruder scenario.
4. Doses to the total body and any body organ of an individual from assumed recycling of the disposed material at the time the disposal site is released from regulatory control from all likely pathways of exposure should be less than 1 mrem.	4. Even if recycling were to occur after release from regulatory control, the dose to a maximally exposed member of the public is not expected to exceed 1 mrem/year, based on exposure scenarios considered in this analysis.

<sup>2</sup> E. F. Branagan, Jr. and F. J. Congel, "Disposal of Contaminated Radioactive Wastes from Nuclear Power Plants," presented at the Health Physics Society's Mid-Year Symposium on Health Physics Consideration in Decontamination/Decommissioning, Knoxville, Tennessee, February 1986, (CONF-860203).

Information	PMP-6010.OSD.001	Rev. 14	Page 99 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.25	Approval To Retain Contaminated Concrete On-Site at Donald C. Cook Nuclear Plant		Pages: 99 - 102

(This is a 10 CFR 50.75 (g) item)  
[Ref. 5.2.1u]

1. Environmental Assessment and Finding of No Significant Impact

The U.S. Nuclear Regulatory Commission (the Commission) is considering the approval of a procedure for the disposal of contaminated concrete at the Donald C. Cook Nuclear Plant, pursuant to 10 CFR 20.302, as requested by Indiana Michigan Power Company (the licensee). Donald C. Cook Nuclear Plant is located in Berrien County, Michigan.

2. Environmental Assessment

2.1 Identification of Proposed Action

The proposed action would approve the onsite disposal of contaminated concrete resulting from the replacement of the steam generators in Donald C. Cook Nuclear Plant Unit No. 2.

2.2 The Need for the Proposed Action

To provide access for complete replacement of the four steam generator lower assemblies, a large opening will be cut in each of the reinforced concrete doghouses surrounding the steam generators. Large sections of reinforced concrete will need to be removed from the Unit 2 steam generator doghouse enclosures and must be disposed of. The licensee proposes to decontaminate the concrete to the extent practical. Following decontamination of the concrete, the licensee intends to dispose of the concrete outside the protected area fence, but within the Donald C. Cook Nuclear Plant site boundary. The chosen site is presently the site of concrete spoils and other construction remnants left from the construction of the plant.

2.3 Environmental Impacts of the Proposed Action

By letter dated February 29, 1988 the licensee submitted an application for the onsite disposal of contaminated concrete slabs, a licensed material not previously considered by the Commission's staff in the Donald C. Cook Nuclear Plant Final Environmental Statement (FES) dated August 1973. The application, prepared in accordance with 10 CFR 20.302(a), contains a detailed description of the licensed material, thoroughly analyzes and evaluates the information pertinent to the effects on the environment of the disposal of the licensed material, and commits the licensee to follow specific procedures to minimize the risk of unexpected or hazardous exposure.

The proposed action would allow the licensee to retain contaminated concrete on site at the Donald C. Cook Nuclear Plant. Large sections of reinforced concrete will be removed from the Donald C. Cook Nuclear Plant Unit No. 2 steam generator doghouse enclosures and must be disposed of. Decontamination by mechanical removal of paint, and surface concrete to a depth of 1/16", will eliminate the majority of the contamination accumulated in the concrete. However, the concrete sections will have trace quantities of Cobalt-60 (Co-60), Cesium-134 (Cs-134), and Cesium-137 (Cs-137) distributed in the remaining outer surfaces. The concrete will be removed in 24 to 30 large slabs ranging in weight from 25 to 70 tons each. It is planned to dispose of the material in this form, as large structural segments. The roof sections are three feet thick, and the wall portions are two feet thick. The estimated total weight of the slabs is 920 tons. This total includes an estimated 65 tons of reinforcing steel and steel structural supports.

The outer surfaces of the doghouse structures are in the upper containment volume. The surfaces were painted with nuclear Grade I paint prior to operation of the unit. However, the airborne contamination inside containment, arising due to normal operations, has brought small amounts of radioactive contamination into contact with the surfaces. Over the ten years of plant operation, the small amounts of contamination have diffused through the paint and into the outer layer of concrete. Inside the doghouse structure, airborne contamination again has contributed to the deposition of radioactivity on the walls.

Information	PMP-6010.OSD.001	Rev. 14	Page 100 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.25	Approval To Retain Contaminated Concrete On-Site at Donald C. Cook Nuclear Plant		Pages: 99 - 102

Radiological analysis was performed on samples of paints and underlying concrete from the outside wall of the doghouse structures. Three nuclides were found in the concrete: Co-60, Cs-134, and Cs-137. The average of the measured sample concentration of each nuclide is given in the licensee's application and is shown in Table 1. The licensee indicated in the application that the concentrations represent the activity expected in the surface of the concrete when it is disposed of after decontamination. The licensee used maximum measured sample concentration in portions of the radiological impact assessment to insure conservatism in the calculations, and these values are summarized in Table 1 also.

To calculate the total activity present in the concrete, the licensee's estimate was made, based on the sample data, of the amount of diffusion of the radionuclides into the concrete. Diffusion is a physical phenomena generally applied to gaseous and liquid materials 'migrating' into a host material. The amount of diffusion of one material into another is dependent on the properties of both materials, the temperature, and the concentration of the diffusing material at the surface of contact. Water evaporating into air is an example of diffusion. The process of diffusion for the subject concrete was modeled mathematically according to Fick's Law, which is a natural exponential function. The concentration of the diffusing material (that is, the radioisotopes) at the contact surface migrates into the host material, here being the concrete, and gradually decreases with depth from the surface. The mathematical model never reaches zero concentration due to the properties of exponential functions, therefore practically, one chooses a very small cut off point at which it can be assumed the concentration has essentially reached zero. The licensee chose the cut off in this case to be the depth at which the surface activity concentration was decreased by 100,000 times. Actual activity at this level would be impossible to measure and is several times below natural background levels of radiation. This depth was calculated to be approximately one inch. To be more conservative, the licensee assumed that all of the calculated activity in the one-inch of concrete was uniformly near the surface. Based on this conservative assumption it would be contained in the first one-tenth of an inch. This assumption was used in the exposure pathway dose calculations. The licensee calculated the total activity by integrating the concentration to this depth over the entire surface area of the concrete blocks.

The licensee indicated in the application that several conservative assumptions were made in calculating the total activity content of the concrete. First, the surface areas as calculated based on total volume of concrete and a uniform thickness of two feet. This effectively creates approximately 25 percent more potentially contaminated surface area than actually exists. Second, all surfaces were assumed to be equally contaminated. Due to the presence of the protective steel liner plate, any contamination on the inner concrete surface is expected to be small relative to that measured on the outer surface. Table 1 indicates the licensee's total calculated activity of each radionuclide based on both the average of the sample concentrations and on the maximum concentrations measured in the surface.

**TABLE 1**

Nuclide	Half-life (years)	Ave. Conc. (pCi/gm)	Max. Conc. (pCi/gm)	Ave. Based Activity (μCi)	Max. Based Activity (μCi)
Co-60	5.3	1.33	2.7	7.8	16.0
Cs-134	2.1	0.33	0.7	1.9	4.1
Cs-137	30.0	2.6	7.7	15.4	45.6
Total		4.26	11.1	25.1	65.7

Information	PMP-6010.OSD.001	Rev. 14	Page 101 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.25	Approval To Retain Contaminated Concrete On-Site at Donald C. Cook Nuclear Plant		Pages: 99 - 102

Prior to disposal, items embedded in the concrete such as equipment supports, anchor bolts, and conduit and piping restraints shall be cut off flush with the concrete surface. The painted surface of the concrete will be removed to a minimum depth of 1/16" into the underlying concrete by a mechanical scarifying process.

The decontaminated blocks will again be surveyed prior to release for disposal. Any areas on the blocks which do not meet radiation protection release criteria, or exceed the assumptions made in the radiation dose evaluation of the application, will be further decontaminated prior to release for disposal.

The proposed disposal method for the concrete blocks is to remove them to an area outside the protected area fence, but within the Donald C. Cook Nuclear Plant site boundary. The Donald C. Cook Nuclear Plant is located in Lake Township, Berrien County, Michigan, approximately 11 miles south-southwest of the center of Benton Harbor, Michigan. The plant site consists of approximately 650 acres situated along the eastern shore of Lake Michigan. A more detailed description of the plant site area can be found in the "Final Environmental Statement Related to Operation of Donald C. Cook Nuclear Plant Units 1 and 2" (FES), August 1973.

The chosen site is presently the site of concrete spoils and other construction remnants left from the construction of the plant. The site is more than 200 yards away from any area occupied by plant personnel on any regular basis, and is 150 yards away from Thornton Road. Earthen mounds also surround the site on all sides, with the exception of the access point.

Once the concrete is in place, it will not be visible except at the access point. It has not yet been determined whether or not the slabs will be stacked or individually lain down, but the maximum actual area occupied by the blocks will be less than 20 x 25 yards.

An evaluation of the potential dose to the plant site worker and to a member of the general public was performed by the licensee to determine the radiological impact of placing the concrete in the proposed location. The calculations were performed using applicable methodologies in Regulatory Guide 1.109, NUREG/CR-3332, and Introduction to Health Physics, Cember.

The licensee, in the application, stated all potential exposure pathways recommended by Regulatory Guide 1.109 were evaluated with the exception of potential dose from incineration of the waste. There is no feasible scenario by which the concrete would be burned. The licensee's evaluation consisted of a determination of the environmental pathways through which radiological exposure could be expected to occur and an evaluation of the radiological consequences of the disposal of the concrete for each of the pathways considered. The following environmental pathways were considered:

- (1) External exposure from concrete - occupational and intruder
- (2) Internal exposure due to release of contaminants to surface and ground water - ingestion of drinking water, fish and other aquatic foods, and well water
- (3) Internal exposure due to agricultural activities on the disposal site following loss of institutional control - ingestion of vegetables, meat and dairy products
- (4) Internal exposure due to inhalation of re-suspended contaminated concrete dusts - occupational, and intruder following loss of institutional control

This evaluation demonstrates that any doses to occupational workers, intruders, and members of the general public would be very small, and far lower than the levels permitted for unrestricted areas by 10 CFR 20.105.



Information	PMP-6010.OSD.001	Rev. 14	Page 102 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.25	Approval To Retain Contaminated Concrete On-Site at Donald C. Cook Nuclear Plant		Pages: 99 - 102

In the FES for the operation of Donald C. Cook Nuclear Plant, the Commission's staff considered the potential effects on the environment of licensed material from operation of the plant and, in the summary of radiological impacts, concluded that "... the routine operation of the Cook Station is expected to add only a small increment to the natural background dose." "... these doses correspond to concentrations which are a small percentage of permissible standards set forth in 10 CFR Part 20."

Since the disposal proposed in the licensee's application dated February 29, 1988, involves licensed materials containing much less than 0.1 percent of the radioactivity, primarily Co-60, Cs-134, and Cs-137, already considered acceptable in the FES, and involve exposure pathways much less significant and radiochemical forms much less mobile than those considered in the FES, the Commission's staff considers this site-specific application for the Donald C. Cook Nuclear Plant to have insignificant radiological impact. The Commission's staff accepts the evaluations of the licensee documented in Attachment 3.1, Dose Factors for Various Pathways, of the February 29, 1988, application as further assurance that the proposed disposal procedures will have a negligible effect on the environment and on the general population in comparison to normal background radiation.

#### 2.4 Alternatives to the Proposed Action

An alternative to on-site burial would be to ship and dispose of the concrete slabs at an offsite licensed disposal site. The overall benefit from the proposed method for the disposal of these slightly contaminated concrete slabs will be a cost saving of approximately \$1.6 million and a saving of burial site space of approximately 16,000 cubic feet, which can be used for other radwaste of higher activity. The alternative would not be environmentally preferable.

#### 2.5 Alternative Use of Resources

This action involves no use of resources not previously considered in connection with the "Final Environmental Statement Related to Operation of Donald C. Cook Nuclear Plant Units 1 and 2" dated, August 1973.

#### 2.6 Agencies and Persons Consulted

The Commission's staff reviewed the licensee's request and did not consult other agencies or persons.

### 3. Finding of No Significant Impact

The Commission has determined not to prepare an environmental impact statement for the proposed action.

Based upon the foregoing environmental assessment, the Commission concludes that the proposed action will not have a significant effect on the quality of the human environment.

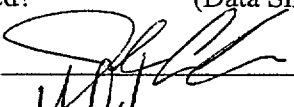

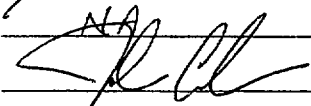
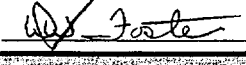
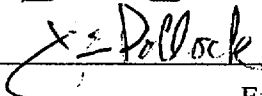
For further details with respect to this action, see the application dated February 29, 1988, which is available for public inspection at the Commission's Public Document Room, 1717 H Street, NW., Washington, DC, and at the Maude Preston Palenski Memorial Library, 500 Market Street, St. Joseph, Michigan 49805

Dated at Rockville, Maryland, this 23(rd) day of August 1988.

For the Nuclear Regulatory Commission

Martin J. Virgilio, Director  
Project Directorate III-1  
Division of Reactor Projects - III, IV, V & Special Projects

## REVIEW AND APPROVAL TRACKING FORM

Procedure Information:		
Number: <u>PMP-6010.OSD.001</u>	Revision: <u>15</u>	Change: <u>0</u>
Title: <u>Off-Site Dose Calculation Manual</u>		
Category:		
<input checked="" type="checkbox"/> Change (Full Procedure) with Review of Change Only	<input type="checkbox"/> Correction (Full Procedure)	
<input type="checkbox"/> Change (Page Substitution) with Review of Change Only	<input type="checkbox"/> Correction (Page Substitution)	
<input type="checkbox"/> New Procedure or Change with Full Review	<input type="checkbox"/> Cancellation	
<input type="checkbox"/> Superseded By: _____		
Required Reviews:		
<input checked="" type="checkbox"/> Operations	<input type="checkbox"/> ALARA	<input type="checkbox"/> Nuc. Doc. Management
<input type="checkbox"/> Maintenance	<input type="checkbox"/> Training	<input type="checkbox"/> None Required
<input type="checkbox"/> Design Engineering	<input checked="" type="checkbox"/> Surveillance Section	
<input type="checkbox"/> Plant Engineering	<input type="checkbox"/> Performance Assurance	
<input checked="" type="checkbox"/> Chemistry/RP	<input checked="" type="checkbox"/> Business Services Procedure Group	
<input checked="" type="checkbox"/> Other: (Includes Technical Reviewer Determined Reviews)		
<u>Technical</u>		
Writer Task Reviews:		
Revision Summary attached?		<input checked="" type="checkbox"/> Yes
Safety Screening complete?	SS/SE Tracking No: <u>2000-0879-00</u>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> Exempt <input type="checkbox"/> N/A
Implementation Plan developed?	(Ref. Step 3.4.17)	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> N/A
Periodic Review conducted?	(Data Sheet 5 Complete)	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Cognizant Org Review:		Date: <u>4/21/00</u>
Technical Review:		Date: <u>4/21/00</u>
Ops Mgr Concurrence:	<u>N/A</u>	Date: <u>N/A</u>
Owner Concurrence:		Date: <u>4/27/00</u>
Writer Review:		Date: <u>4/27/00</u>
Approvals:		
PORC Review Required:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Mtg. No.: <u>3651</u>
Approval Authority Review/Approval:		Date: <u>5/1/00</u>
		Effective Date: <u>5/3/00</u>

## REVISION SUMMARY

Number: PMP-6010.OSD.001 Revision: 15 Change: 0  
Title: OFF-SITE DOSE CALCULATION MANUAL

The majority of the changes/corrections to PMP-6010.OSD.001, Offsite Dose Calculation Manual, are administrative in nature. All changes are marginally marked and the reasons for these changes are as follows:

1. Section 3.5.2a.4 – Conduct of the REMP – Changed wording to allow a special milk farm survey to include all sectors, not just the one the milk source had been in. This was done due to increase chances of determining that another milk source was available to continue the milk sampling program as dairy farms are becoming less plentiful in the area. This is a correction based on Step 3.1.6a, item 18 of PMP 2010 PRC.002.
2. Section 3.5.2a.4a – Changed wording to allow alternate sampling location in another sector to support the change made above for the same reasons. If a dairy source is found in another sector, this allows us to use it for sampling even though it is in another sector. This is a correction based on Step 3.1.6a, item 18 of PMP 2010 PRC.002.
3. Attachment 3.2 Footnote corrected to DRS from WRS. Typo. Correctly referenced in item 1.b of same attachment. This is a correction based on Step 3.1.6a, item 13 of PMP 2010 PRC.002.
4. Attachment 3.4, Radioactive Gaseous Effluent Monitoring Instrumentation. Determined that the appropriate monitors which are applicable for containment purge and pressure relief should be ERS-13/1405, ERS-23/2405, ERS-13/1401 and ERS-23/2401, as described in the original Radiological Effluent Technical Specification. This was decided during investigation into CR 00-3770 where it was determined that this is the applicable monitor for this item to be covered under. Changed the Table Notations and Actions to reflect the inclusion of Containment Pressure Relief (CPR). Added clarifying statements in Table Notations 2 and 3 and Action 7 in support of these changes. This is a change as based on Step 3.1.6b of PMP 2010 PRC.002. Added “and CVCS HUT” under item 4 for clarity and consistency, this is a correction based on Step 3.1.6a, item 18 of PMP 2010 PRC.002.
5. Attachment 3.5, Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Requirements. This was done to comply with Attachment 3.4 which determined that the applicable monitors should be the containment monitors, not the unit vent, since the containment monitors have the isolation function for containment. Also indicated that VRS-1505/2505 is an alarm only for Auxiliary Ventilation System, no trip is associated with the unit vent, the trip function is only associated with Waste Gas Holdup system, section 4. Added Technical Specification requirements for surveillance requirements for the containment monitors in section 3. This is a change as based on Step 3.1.6b of PMP 2010 PRC.002. Took redundant wording out of 4a that stated CVCS HUT which is established in item 4. This is a correction based on Step 3.1.6a, item 6 of PMP 2010 PRC.002. Corrected notation #3 to indicate “functional” test not “calibration”. This is a correction based on Step 3.1.6a, item 13 of PMP 2010 PRC.002.
6. Attachment 3.6, Radioactive Liquid Waste Sampling and Analysis Program. Deleted reference to UFSAR Appendix Q, Question 320.8 since this requirement was made moot with the implementation of the Radiological Environmental Technical Specifications (RETS). There are several programs in place to implement the requirements of the RETS and ensure compliance of the

**Office Information For Form Tracking Only - Not Part of Form**

This is a free-form as called out in PMP-2010.PRC.002, Procedure Correction, Change, and Review.

Page 2 of 3

5/2/00

5/2/00

## REVISION SUMMARY

Number: PMP-6010.OSD.001 Revision: 15 Change: 0  
Title: OFF-SITE DOSE CALCULATION MANUAL

Turbine Room Sump release point. This is a correction based on Step 3.1.6a, item 13 of PMP 2010 PRC.002.

7. Section 5.2.1o, deleted reference to Radiological Support Section Calculation RS-C-0106, March 19, 1987 per CR 99-8232. Calculation RS-C-0106 is entitled "Setpoints for the Unit Vent Switchover" and the CR determined that it is not clear where or how it was used in the ODCM and why it was referenced. This is a correction as based on Step 3.1.6a, item 15 of PMP 2010 PRC.002.
8. Attachment 3.7, Radioactive Gaseous Waste Sampling and Analysis Program. Added "and CVCS HUT" under item "a" for clarity and consistency, this is a correction based on Step 3.1.6a, item 18 of PMP 2010 PRC.002.  
A note was added to detail that only a twice per month containment sample for noble gases and H3 is applicable for the CPR sample program that is implemented through RPSO 004. Reference to sampling the Condenser Evacuation System and Gland Seal Exhaust system after 15% power change was removed as it is not necessary for monitoring primary to secondary leakage. We have a well defined steam generator program (PMI-5037) which details our primary to secondary leak rate program. Our secondary system radiation monitors have setpoints established through EPRI guidance that is specifically for identifying low levels of primary to secondary leakage and reacting to those alarms in order to respond quickly to changing leak rate conditions. Also added clarification on Gland Seal Exhaust compensatory sampling. These are changes based on Step 3.1.6b of PMP 2010 PRC.002.
9. Attachment 3.14, Gaseous Effluent Release System. Added information to block for Upper Ctmt. Area Rad Monitor to be consistent with similar block for lower ctmt. rad monitor. This information is for clarification and is already described in section 3.3.2.c. This is a correction based on Step 3.1.6a, item 18 of PMP 2010 PRC.002.
10. 3.3.2c4, changed bimonthly to twice per month for clarification in that the samples are collected and analyzed twice a month. This is not a change as based on Step 3.1.6a, item 8 of PMP 2010 PRC.002.
11. Attachment 3.16, 10 Year Average of 1989-1998 Data. Corrected typographical error pertaining to the worst case  $\chi/Q$  sector which is Sector A, not J. This is not a change as based on Step 3.1.6a, item 13 of PMP 2010 PRC.002.
12. Attachment 3.19, Radiological Environmental Monitoring Program Sample Stations, Sample Types, Sample Frequencies. Corrected typographical error from "mild" to "milk" in last footnote. This is not a change as based on Step 3.1.6a, item 4 of PMP 2010 PRC.002.


INSTRUCTIONS: Replace entire previous revision (14) with this revision (15).

### Office Information For Form Tracking Only - Not Part of Form

This is a free-form as called out in PMP-2010.PRC.002, Procedure Correction, Change, and Review.

Page 3 of 3

5/2/00 5/6/00

 <small>AEP: America's Energy Partner</small>	PMP-6010.OSD.001	Rev. 15	Page 1 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
<b>Information</b>			Effective Date: <u>5/3/00</u>
<u>Doug Foster</u> Writer	<u>John Carlson</u> Owner	<u>Environmental</u> Cognizant Organization	

## TABLE OF CONTENTS

<b>1</b>	<b>PURPOSE AND SCOPE .....</b>	<b>5</b>
<b>2</b>	<b>DEFINITIONS AND ABBREVIATIONS .....</b>	<b>5</b>
<b>3</b>	<b>DETAILS .....</b>	<b>5</b>
3.1	Calculation of Off-Site Doses .....	6
3.1.1	Gaseous Effluent Releases .....	6
3.1.2	Liquid Effluent Releases .....	12
3.2	Limits of Operation and Surveillances of the Effluent Release Points .....	16
3.2.1	Radioactive Liquid Effluent Monitoring Instrumentation .....	16
3.2.2	Radioactive Gaseous Effluent Monitoring Instrumentation .....	17
3.2.3	Liquid Effluents .....	18
	a. Concentration Excluding Releases via the Turbine Room Sump (TRS) Discharge .....	18
	b. Concentration of Releases from the TRS Discharge .....	19
	c. Dose .....	19
	d. Liquid Radwaste Treatment System .....	20
3.2.4	Gaseous Effluents .....	23
	a. Dose Rate .....	23
	b. Dose – Noble Gases .....	24
	c. Dose – Iodine-131, Iodine-133, Tritium, and Radioactive Material in Particulate Form .....	24
	d. Gaseous Radwaste Treatment .....	25
3.2.5	Radioactive Effluents – Total Dose .....	28
3.3	Calculation of Alarm/Trip Setpoints .....	29
3.3.1	Liquid Monitors .....	30
	a. Liquid Batch Monitor Setpoint Methodology .....	30
	b. Liquid Continuous Monitor Setpoint Methodology .....	32
3.3.2	Gaseous Monitors .....	34
	a. Plant Unit Vent .....	35
	b. Waste Gas Storage Tanks .....	39
	c. Containment Purge and Exhaust System .....	39
	d. Steam Jet Air Ejector System (SJAE) .....	40
	e. Gland Seal Condenser Exhaust .....	41
3.4	Radioactive Effluents Total Dose .....	41



**OFF-SITE DOSE CALCULATION MANUAL**

**Information**


Effective Date: 5/3/00

Doug Foster  
Writer

John Carlson  
Owner

Environmental  
Cognizant Organization

3.5	Radiological Environmental Monitoring Program (REMP).....	42
3.5.1	Purpose of the REMP.....	42
3.5.2	Conduct of the REMP.....	43
3.5.3	Annual Land Use Census.....	45
3.5.4	Interlaboratory Comparison Program.....	46
3.6	Steam Generator Storage Facility Groundwater Monitoring Program.....	47
3.6.1	Purpose of the Steam Generator Storage Facility Groundwater Radiological Monitoring Program.....	47
3.6.2	Conduct of the Steam Generator Storage Facility Groundwater Radiological Monitoring Program.....	47
3.7	Meteorological Model.....	47
3.8	Reporting Requirements .....	48
3.8.1	Annual Radiological Environmental Operating Report (AREOR).....	48
3.8.2	Annual Radiological Effluent Release Report (ARERR).....	49
3.9	10 CFR 50.75 (g) Implementation .....	51
3.10	Reporting/Management Review.....	51
4	<b>FINAL CONDITIONS.....</b>	<b>51</b>
5	<b>REFERENCES.....</b>	<b>52</b>

 <small>AEP, America's Energy Partner</small>	PMP-6010.OSD.001	Rev. 15	Page 3 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
<b>Information</b>			Effective Date: <u>5/3/00</u>
<u>Doug Foster</u> Writer	<u>John Carlson</u> Owner	<u>Environmental</u> Cognizant Organization	

### SUPPLEMENTS

Attachment 3.1	Dose Factors for Various Pathways .....	Pages 54 - 58
Attachment 3.2	Radioactive Liquid Effluent Monitoring Instruments .....	Pages 59 - 60
Attachment 3.3	Radioactive Liquid Effluent Monitoring Instrumentation Surveillance Requirements.....	Pages 61 - 62
Attachment 3.4	Radioactive Gaseous Effluent Monitoring Instrumentation.....	Pages 63 - 65
Attachment 3.5	Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Requirements.....	Pages 66 - 67
Attachment 3.6	Radioactive Liquid Waste Sampling and Analysis Program .....	Pages 68 - 69
Attachment 3.7	Radioactive Gaseous Waste Sampling and Analysis Program .....	Pages 70 - 71
Attachment 3.8	Multiple Release Point Factors for Release Points .....	Page 72
Attachment 3.9	Liquid Effluent Release Systems .....	Page 73
Attachment 3.10	Plant Liquid Effluent Parameters .....	Page 74
Attachment 3.11	Volumetric Detection Efficiencies for Principle Gamma Emitting Radionuclides for Eberline Liquid Monitors.....	Page 75
Attachment 3.12	Counting Efficiency Curves for R-19, and R-24.....	Pages 76 - 77
Attachment 3.13	Counting Efficiency Curve for R-20, and R-28 .....	Page 78
Attachment 3.14	Gaseous Effluent Release Systems.....	Page 79
Attachment 3.15	Plant Gaseous Effluent Parameters .....	Page 80
Attachment 3.16	10 Year Average of 1989-1998 Data .....	Pages 81 - 82
Attachment 3.17	Annual Evaluation of $\bar{x}/Q$ and $\bar{D}/Q$ Values For All Sectors .....	Page 83
Attachment 3.18	Dose Factors .....	Pages 84 - 86
Attachment 3.19	Radiological Environmental Monitoring Program Sample Stations, Sample Types, Sample Frequencies .....	Pages 87 - 90



PMP-6010.OSD.001

Rev. 15

Page 4 of 102

**OFF-SITE DOSE CALCULATION MANUAL**

**Information**

Effective Date: 5/3/00

Doug Foster  
Writer

John Carlson  
Owner

Environmental  
Cognizant Organization

Attachment 3.20 Maximum Values for Lower Limits of Detections<sup>A,B</sup> - REMP..... Pages 91 - 92

Attachment 3.21 Reporting Levels for Radioactivity Concentrations in  
Environmental Samples..... Page 93

Attachment 3.22 On-Site Monitoring Location - REMP..... Page 94

Attachment 3.23 Off-Site Monitoring Locations - REMP..... Page 95

Attachment 3.24 Safety Evaluation By The Office Of Nuclear Reactor  
Regulation..... Pages 96 - 98

Attachment 3.25 Approval To Retain Contaminated Concrete On-Site at  
Donald C. Cook Nuclear Plant..... Pages 99 - 102



## 1 PURPOSE AND SCOPE

**NOTE:** Only applicable Sections, Subsections, and Attachments within this procedure need to be performed.

- The Off-Site Dose Calculation Manual (ODCM) is the top tier document for the Radiological Environmental Monitoring Program (REMP), the Radioactive Effluent Controls Program (RECP), and contains criteria pertaining to the previous Radiological Effluent Technical Specifications (RETS) as defined in NUREG-0472.
- The ODCM contains the methodology and parameters to be used in the calculation of off-site doses due to radioactive liquid and gaseous effluents and in the calculation of liquid and gaseous monitoring instrumentation alarm/trip setpoints.
- The ODCM provides flow diagrams detailing the treatment path and the major components of the radioactive liquid and gaseous waste management systems.
- The ODCM presents maps of the sample locations and the meteorological model used to estimate the atmospheric dispersion and deposition parameters.
- The ODCM specifically addresses the design characteristics of the Donald C. Cook Nuclear Plant based on the flow diagrams contained on the "OP Drawings" and plant "System Description" documents.

## 2 DEFINITIONS AND ABBREVIATIONS

<b>Term:</b>	<b>Meaning:</b>
S or shiftly	At least once per 12 hours
D or daily	At least once per 24 hours
W or weekly	At least once per 7 days
M or monthly	At least once per 31 days
Q or quarterly	At least once per 92 days
SA or semi-annually	At least once per 184 days
R	At least once per 549 days – based on 18 month fuel cycle; period may change with cycle.
S/U	Prior to each reactor startup
P	Completed prior to each release
Sampling evolution	Process of changing filters or obtaining grab samples

## 3 DETAILS

### 3.1 Calculation of Off-Site Doses

#### 3.1.1 Gaseous Effluent Releases

- a. The computer program MIDAS (Meteorological Information and Dose Assessment System) performs the calculation of doses from effluent releases. The site-specific parameters associated with MIDAS reside in the following subprograms:
  - MIDER
  - MIDEX
  - MIDEL
  - MIDEQ
  - MIDEN
- b. The subprogram used to enter and edit gaseous release data is called MD1EQ (EQ). The data entered in EQ can be used to calculate the accumulation of dose to individual land based receptors based on hourly meteorology and release data. The air dose from this data is calculated via the XDAIR subprogram in MIDAS. It computes air dose results for use in Reg. Guide 1.21 reports and 10 CFR 50 Appendix I calculations based on routine releases.
- c. The formula used for the calculation of the air dose is generated from site specific parameters and Reg. Guide 1.109 (Eq 7):

$$D_{\gamma}, D_{\beta} \text{ air} = \frac{\bar{\chi}}{Q} \times \sum [(M_i \text{ or } N_i) \times Q_i \times 3.17E - 8]$$

Where;

$D_{\gamma}, D_{\beta} \text{ air}$  = the gamma or beta air dose in mrad/yr to an individual receptor

$\frac{\bar{\chi}}{Q}$  = the annual average or real time atmospheric dispersion factor over land, sec/m<sup>3</sup>

$M_i$  = the gamma air dose factor, mrad m<sup>3</sup> / yr μCi, from Attachment 3.18, Dose Factors

$N_i$  = the beta air dose factor, mrad m<sup>3</sup> / yr μCi, from Attachment 3.18, Dose Factors

Information	PMP-6010.OSD.001	Rev. 15	Page 7 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			

$Q_i$  = the release rate of radionuclide, "i", in  $\mu\text{Ci}/\text{yr}$ .

$3.17\text{E}-8$  = number of years in a second (years/second).

- d. The value for the ground average  $\overline{\chi/Q}$  for each sector is calculated using equations shown below. Formula used for the calculation is generated from parameters contained in MIDAS Technical Manual, XDCALC (Eq 2).

$$\overline{\chi/Q} = \frac{2.03}{u_{m_g} \cdot x \cdot \Sigma_g} \cdot T_f$$

Where;

$$\Sigma_g = \text{minimum of } \sqrt{\sigma_{z_g}^2 + \frac{H_c^2}{2\pi}} \text{ or } \Sigma_g = \sqrt{3} \sigma_{z_g}$$

$x$  = distance downwind of the source, meters. This information is found in parameter 5 of MIDEEX.

$\overline{u_{m_g}}$  = wind speed for ground release, (meters/second)

$\sigma_{z_g}$  = vertical dispersion coefficient for ground release, (meters), (Reg. Guide 1.111 Fig.1)

$H_c$  = building height (meters) from parameter 28 of MIDER. (Containment Building = 49.4 meters)

$T_f$  = terrain factor (= 1 for Cook Nuclear Plant) because we consider all our releases to be ground level (see parameter 5 in MIDEEX).

$$2.03 = \sqrt{2 \div \pi} \div 0.393 \text{ radians } (22.5^\circ)$$

## OFF-SITE DOSE CALCULATION MANUAL

- e. The dose due to gaseous releases, other than the air dose, is calculated by the MIDAS subprogram GASPRO. GASPRO computes the accumulation of dose to individual receptors based on hourly meteorology and release data. Calculations consider the effect of each important radionuclide for each pathway, organ, age group, distance and direction.
- f. Calculations are based on the environmental pathways-to-man models in Reg. Guide 1.109. The program considers 7 pathways, 8 organs, and 4 age groups in 16 direction sectors. The distances used are taken from the MIDEQ file.
- g. The formulas used for the following calculations are generated from site specific parameters and Reg. Guide 1.109:
1. Total Body Plume Pathway (Eq 10)

$$Dose (mrem/year) = 3.17E-8 \times \sum (Q_i \times \overline{\chi/Q} \times S_f \times DFB_i)$$

Where;

$S_f$  = shielding factor that accounts for the dose reduction due to shielding provided by residential structures during occupancy (maximum exposed individual = 0.7 per Table E-15 of Reg. Guide 1.109)

$DFB_i$  = the whole body dose factor from Table B-1 of Reg. Guide 1.109, mrem - m<sup>3</sup> per  $\mu$ Ci - yr. See Attachment 3.18, Dose Factors.

$Q_i$  = the release rate of radionuclide "i", in  $\mu$ Ci/yr

$\overline{\chi/Q}$  = the annual average or real time atmospheric dispersion factor, sec/m<sup>3</sup>

2. Skin Plume Pathway (Eq 11)

$$Dose (mrem/yr) = 3.17E - 8 \times S_f \times \frac{\bar{X}}{Q} \times [\sum(Q_i \times 1.11 \times DF_i^{\gamma}) + \sum(Q_i \times DFS_i)]$$

Where;

1.11 = conversion factor, tissue to air, mrem/mrad

$DF_i^{\gamma}$  = the gamma air dose factor for a uniform semi-infinite cloud of radionuclide "i", in mrad m<sup>3</sup>/μCi yr from Table B-1, Reg. Guide 1.109. See Attachment 3.18, Dose Factors.

$DFS_i$  = the beta skin dose factor for a semi-infinite cloud of radionuclide "i", in mrem m<sup>3</sup>/μCi yr from Table B-1, Reg. Guide 1.109. See Attachment 3.18, Dose Factors.

3. Radionuclide and Radioactive Particulate Doses (Eq 13 & 14)

- a) The dose,  $D_{IP}$  in mrem/yr, to an individual from radionuclides, other than noble gases, with half-lives greater than eight days in gaseous effluents released to unrestricted areas will be determined as follows:

$$D_{IP} (mrem/year) = 3.17E - 8 \times \sum(R_i \times W \times Q_{ic})$$

Where;

$R_i$  = the most restrictive dose factor for each identified radionuclide "i", in m<sup>2</sup> mrem sec / yr μCi (for food and ground pathways) or mrem m<sup>3</sup> / yr μCi (for inhalation pathway), for the appropriate pathway

For sectors with existing pathways within five miles of the site, use the values of  $R_i$  for these real pathways, otherwise use pathways distance of five miles. See Attachment 3.1, Dose Factors for Various Pathways, for the maximum  $R_i$  values for the most controlling age group for selected radionuclides.  $R_i$  values were generated by computer code PARTS, see NUREG-0133, Appendix D.

## OFF-SITE DOSE CALCULATION MANUAL

W = the annual average or real time atmospheric dispersion parameters for estimating doses to an individual at the worst case location, and where W is further defined as:

$$W_{in} = \overline{\chi/Q} \text{ for the inhalation pathway, in sec/m}^3$$

-OR-

$$W_{fg} = \overline{D/Q} \text{ for the food and ground pathways in 1/m}^2$$

Q<sub>ic</sub> = the release rate of those radioiodines, radioactive materials in particulate form and radionuclides other than noble gases with half-lives greater than eight days, in  $\mu\text{Ci/yr}$

- h. This calculation is made for each pathway. The maximum computed dose at any receptor for each pathway is selected. These are summed together to get the dose to compare to the limits. Only the maximum of the cow milk or goat milk pathway (not both) is included in the total.
- i. In addition to the above routines, the QUICKG routine of the MIDAS system is used to provide data used in the monthly reports due to its ability to use annual average meteorological data rather than real time data, thus shortening the run time involved.
- j. Steam Generator Blowdown System (Start Up Flash Tank Vent)
  1. The amount of radioiodine and other radionuclides that are released via the start up flash tank and its vent are calculated through actual sample results while the start up flash tank is in service.
  2. The following calculation is performed to determine the amount of curies released through this pathway. (Plant established formula.)

$$\text{Curies} = \frac{\mu\text{Ci}}{\text{ml}} \times \text{GPM} \times \text{time on flash tank (min)} \times 3.785\text{E} - 3$$

Where; 3.785E-3 = conversion factor, ml Ci/ $\mu\text{Ci}$  gal.

3. The flow rate is determined from the blowdown valve position and the time on the start up tank. Chemistry Department performs the sampling and analysis of the samples.

Information	PMP-6010.OSD.001	Rev. 15	Page 11 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			

4. This data is provided to the MIDAS computer and dose calculations (liquid and gas) are performed to ensure compliance with Subsection 3.2, Limits of Operation and Surveillances of the Effluent Release Points, dose limits. MIDAS uses the formulas given in step 3.1.2, Liquid Effluent Releases, to calculate doses to members of the public.

**NOTE:** This section provides the minimum requirements to be followed at Donald C. Cook Nuclear Plant. This would be used if actual sample data was not available each time the start up flash tank was in service.

5. The radioiodine release rate must be determined in accordance with the following equation every 31 day period whenever the specific activity of the secondary coolant system is greater than 0.01  $\mu\text{Ci/g}$  dose equivalent I-131.
6. **IF** the specific activity of the secondary coolant system is less than 0.01  $\mu\text{Ci/g}$  dose equivalent I-131, **THEN** the release rate must be determined once every six months. Use the following plant established equation:

$$Q_y = (C_i) (IPF) (R_{sgb})$$

Where;

$Q_y$  = the release rate of I-131 from the steam generator flash tank vent, in  $\mu\text{Ci/sec}$

$C_i$  = the concentration ( $\mu\text{Ci/cc}$ ) of I-131 in the secondary coolant averaged over a period not exceeding seven days

IPF = the iodine partition factor for the Start Up Flash Tank, 0.05, in accordance with NUREG-0017

$R_{sgb}$  = the steam generator blowdown rate to the start up flash tank, in cc/sec

7. Use the calculated release rate in monthly dose projections until the next determination to ensure compliance with Subsection 3.2, Limits of Operation and Surveillances of the Effluent Release Points, dose limits. Report the release rate calculations in the Annual Radioactive Effluent Release Report.

Information	PMP-6010.OSD.001	Rev. 15	Page 12 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			

8. Steam Generators are sparged, sampled, and drained as batches early in outages to facilitate cooldown for entry into the steam generator. This is repeated prior to startup to improve steam generator chemistry for the startup.

### 3.1.2 Liquid Effluent Releases

- a. The calculation of doses from liquid effluent releases is also performed by the MIDAS program. The subprogram used to enter and edit liquid release data is called MD1EB (EB).
- b. To calculate the individual dose (mrem), the program DS1LI (LD) is used. It computes the individual dose for up to 5 receptors for 14 liquid pathways due to release of radioactive liquid effluents. The pathways can be selected using the MIDEI program and changing the values in parameter 1. D.C. Cook Nuclear Plant uses 3 pathways: potable water, shoreline, and aquatic foods (fresh water sport fishing).
- c. The equations used are generated from site specific data and Reg. Guide 1.109. They are as follows:
  1. Potable Water (Eq 1)

$$R_{apj} = 1100 \times \frac{U_{ap}}{M_p \times F \times 2.23E-3} \times \sum_i Q_i \times D_{nipy} e^{-\lambda_i t_p}$$

Where;

$R_{apj}$  = the total annual dose to organ "j" to individuals of age groups "a" from all of the nuclides "i" in pathway "p", in mrem/year

1100 = conversion factor, yr ft<sup>3</sup> pCi / Ci sec L

$U_{ap}$  = a usage factor that specifies the exposure time or intake rate for an individual of age group "a" associated with pathway "p". Given in #29-84 of parameter 4 in MIDEI and Reg. Guide 1.109 Table E-5. See Attachment 3.1, Dose Factors for Various Pathways.



Information	PMP-6010.OSD.001	Rev. 15	Page 13 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			

$M_p$  = the dilution factor at the point of exposure (or the point of withdrawal of drinking water or point of harvest of aquatic food). Given in parameter 5 of MIDEAL as 2.6.

$F$  = the circulation water system water flow rate, in gpm, is used for evaluating dose via these pathways as dilution flow

2.23E-3 = conversion factor,  $\text{ft}^3 \text{ min} / \text{sec gal}$

$Q_i$  = the release rate of nuclide "i" for the time period of the run input via MIDEAL, Curies/year

$D_{aipj}$  = the dose factor, specific to a given age group "a", radionuclide "i", pathway "p", and organ "j", which can be used to calculate the radiation dose from an intake of a radionuclide, in mrem/pCi. These values are taken from tables E-11 through E-14 of Reg. Guide 1.109 and are located within the MIDAS code.

$\lambda_i$  = the radioactive decay constant for radionuclide "i", in  $\text{hours}^{-1}$

$t_p$  = the average transit time required for nuclides to reach the point of exposure, 12 hours. This allows for nuclide transport through the water purification plant and the water distribution system. For internal dose,  $t_p$  is the total elapsed time between release of the nuclides and ingestion of food or water, in hours. Given as #25 of parameter 4 in MIDEAL. ( $t_p = 12$  hours)

## OFF-SITE DOSE CALCULATION MANUAL

## 2. Aquatic Foods (Eq 2)

$$R_{apj} = 1100 \times \frac{U_{ap}}{M_p \times F \times 2.23E-3} \times \sum_i Q_i \cdot B_{ip} \cdot D_{aipj} e^{-\lambda_i t_p}$$

Where,

$B_{ip}$  = the equilibrium bioaccumulation factor for nuclide "i" in pathway "p", expressed as  $\rho\text{Ci L} / \text{kg } \rho\text{Ci}$ . The factors are located within the MIDAS code and are taken from Table A-1 of Reg. Guide 1.109. See Attachment 3.1, Dose Factors for Various Pathways.

$t_p$  = the average transit time required for nuclides to reach the point of exposure, 24 hours. This allows for decay during transit through the food chain, as well as during food preparation. Given as #26 of parameter 4 in MIDEL. ( $t_p = 24$  hours)

$M_p$  = the dilution factor at the point of exposure, 1.0 for Aquatic Foods. Given in parameter 5 of MIDEL as 1.0.

## 3. Shoreline Deposits (Eq 3)

$$R_{apj} = 110,000 \times \frac{U_{ap} \times W}{M_p \times F \times 2.23E-3} \times \sum_i Q_i \cdot T_i \cdot D_{aipj} \left[ e^{-\lambda_i t_p} \right] \times \left[ 1 - e^{-\lambda_i t_b} \right]$$

Where;

$W$  = the shoreline width factor. Given as an input of 0.3 when running the program, based on Table A-2 in Reg. Guide 1.109.

$T_i$  = the radioactive half-life of the nuclide, "i", in days

$D_{aipj}$  = the dose factor for standing on contaminated ground, in  $\text{mrem m}^2 / \text{hr } \rho\text{Ci}$ . The values are taken from table E-6 of Reg. Guide 1.109 and are located within the MIDAS code. See Attachment 3.1, Dose Factors for Various Pathways.

$t_b$  = the period of time for which sediment or soil is exposed to the contaminated water,  $1.31E+5$  hours. Given in MIDEL as item 6 of parameter 4.

$t_p$  = the average transit time required for nuclides to reach the point of exposure, 0 hours. Given as #28 of parameter 4 in MDEL.

110,000 = conversion factor  $\text{yr ft}^3 \rho\text{Ci} / \text{Ci sec m}^2 \text{ day}$ , this accounts for proportionality constant in the sediment radioactivity model

$M_p$  = the dilution factor at the point of exposure (or the point of withdrawal of drinking water or point of harvest of aquatic food). Given in parameter 5 of MDEL as 2.6.

- d. The MIDAS program uses the following plant specific parameters, which are entered by the operator.
  1. Irrigation rate = 0
  2. Fraction of time on pasture = 0
  3. Fraction of feed on pasture = 0
  4. Shore width factor = 0.3 (from Reg. Guide 1.109, Table A-2)
- e. The results of DS1LI are printed in LDRPT (LP). These results are used in the monthly report of liquid releases.
- f. In addition, the program DOSUM (DM) is used to search the results files of DS1LI to find the maximum liquid pathway individual doses. The highest exposures are then printed in a summary table. Each line is compared with the appropriate dose limit. The table provides a concise summary of off-site environmental dose calculations for inclusion in Reg. Guide 1.21 reports.

**OFF-SITE DOSE CALCULATION MANUAL**

**NOTE:** The performance of each surveillance requirement must be within the specified time interval with a maximum allowable extension not to exceed 25% of the specified surveillance interval.

### 3.2 Limits of Operation and Surveillances of the Effluent Release Points

#### 3.2.1 Radioactive Liquid Effluent Monitoring Instrumentation

- a. The radioactive liquid effluent monitoring instrumentation channels shown in Attachment 3.2, Radioactive Liquid Effluent Monitoring Instruments, are operable with their alarm/trip setpoints set to ensure that the limits of step 3.2.3a, Concentration Excluding Releases via the Turbine Room Sump (TRS) Discharge, are not exceeded.
- b. The applicability of each channel is shown in Attachment 3.2, Radioactive Liquid Effluent Monitoring Instruments.
- c. With a radioactive liquid effluent monitoring instrumentation channel alarm/trip setpoint less conservative than a value which will ensure the limits of step 3.2.3a, Concentration Excluding Releases via the Turbine Room Sump (TRS) Discharge, are met without delay, suspend the release of radioactive liquid effluents monitored by the affected channel and reset or declare the monitor inoperable.
- d. With one or more radioactive liquid effluent monitoring instrumentation channels inoperable, take the applicable action shown in Attachment 3.2, Radioactive Liquid Effluent Monitoring Instruments, with a maximum allowable extension not to exceed 25% of the surveillance interval, excluding the initial performance.
- e. Determine the setpoints in accordance with the methodology described in step 3.3.1, Liquid Monitors. Record the setpoints.
- f. Demonstrate each radioactive liquid effluent monitoring instrumentation channel is operable by performing the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION and CHANNEL FUNCTIONAL TEST at the frequencies shown in Attachment 3.3, Radioactive Liquid Effluent Monitoring Instrumentation Surveillance Requirements.

Information	PMP-6010.OSD.001	Rev. 15	Page 17 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			

## BASES – LIQUID

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 NRC approved methods in the ODCM to ensure the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria specified in Section 11.3 of the Final Safety Analysis Report for the Donald C. Cook Nuclear Plant.

### 3.2.2 Radioactive Gaseous Effluent Monitoring Instrumentation

- a. The radioactive gaseous process and effluent monitoring instrumentation channels shown in Attachment 3.4, Radioactive Gaseous Effluent Monitoring Instrumentation, are operable with their alarm/trip setpoints set to ensure that the limits of step 3.2.4a, Dose Rate, are not exceeded.
- b. The applicability of each channel is shown in Attachment 3.4, Radioactive Gaseous Effluent Monitoring Instrumentation.
- c. With a radioactive gaseous process or effluent monitoring instrumentation channel alarm/trip setpoint less conservative than a value which will ensure that the limits of step 3.2.4a, Dose Rate, are met, without delay, suspend the release of radioactive gaseous effluents monitored by the affected channel and reset or declare the channel inoperable.
- d. With less than the minimum number of radioactive gaseous effluent monitoring instrumentation channels operable, take the action shown in Attachment 3.4, Radioactive Gaseous Effluent Monitoring Instrumentation, with a maximum allowable extension not to exceed 25% of the surveillance interval, excluding the initial performance.

<b>NOTE:</b>	This surveillance requirement does not apply to the waste gas holdup system hydrogen and oxygen monitors, as their setpoints are not addressed in this document.
--------------	--

- e. Determine the setpoints in accordance with the methodology as described in step 3.3.2, Gaseous Monitors. Record the setpoints.

**OFF-SITE DOSE CALCULATION MANUAL**

- f. Demonstrate each radioactive gaseous process or effluent monitoring instrumentation channel is operable by performing the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION, and CHANNEL FUNCTIONAL TEST operations at the frequencies shown in Attachment 3.5, Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Requirements.

**BASES – GASEOUS**

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 NRC approved methods in the ODCM to ensure the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria specified in Section 11.3 of the Final Safety Analysis Report for the Donald C. Cook Nuclear Plant.

**3.2.3 Liquid Effluents**

- a. Concentration Excluding Releases via the Turbine Room Sump (TRS) Discharge
  1. Limit the concentration of radioactive material released via the Batch Release Tanks or Plant Continuous Releases (excluding only TRS discharge to the Absorption Pond) to unrestricted areas to the concentrations in 10 CFR 20, Appendix B, Table 2, Column 2, for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, limit the concentration to  $2E-4$   $\mu\text{Ci/ml}$  total activity.
  2. With the concentration of radioactive material released from the site via the Batch Release Tanks or Plant Continuous Releases (other than the TRS to the Absorption Pond) exceeding the above limits, without delay restore the concentration to within the above limits.
  3. Sample and analyze radioactive liquid wastes according to the sampling and analysis program of Attachment 3.6, Radioactive Liquid Waste Sampling and Analysis Program.
  4. Use the results of radioactive analysis in accordance with the methods of this document to assure that all concentrations at the point of release are maintained within limits.

Information	PMP-6010.OSD.001	Rev. 15	Page 19 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			

- b. Concentration of Releases from the TRS Discharge
1. Limit releases via the TRS discharge to the on-site Absorption Pond to the concentrations specified in 10 CFR 20, Appendix B, Table 2, Column 2. For dissolved or entrained noble gases, limit the concentration to  $2E-4$   $\mu\text{Ci/ml}$  total activity.
  2. With releases from the TRS exceeding the above limits, perform a dose projection due to liquid releases to UNRESTRICTED AREAS to determine if the limits of step 3.2.3c.1 have been exceeded. **IF** the dose limits have been exceeded, **THEN** follow the directions in step 3.2.3c.2, as applicable.
  3. Sample and analyze radioactive liquid wastes according to the program in Attachment 3.6, Radioactive Liquid Waste Sampling and Analysis Program.
  4. Use the results of radioactive analysis in accordance with the methods of this document to assure that all concentrations at the point of release are maintained within the limits stated above.
- c. Dose
1. Limit the dose or dose commitment to an individual from radioactive material in liquid effluents released to unrestricted areas during any calendar quarter to  $\leq 1.5$  mrem to the total body and to  $\leq 5$  mrem to any organ, and during any calendar year to  $\leq 3$  mrem to the total body and to  $\leq 10$  mrem to any organ.
  2. With the calculated release of radioactive materials in liquid effluents exceeding ten times any of the limits in Steps 3.2.3a, 3.2.3b, or 3.2.3c.1 above, prepare and submit a Written Report, pursuant to 10 CFR 20.2203, within 30 days after learning of the event. This report must describe the extent of exposure of individuals to radiation and radioactive material, including, as appropriate:
    - a) Estimate of each individual's dose,
    - b) Levels of radiation and concentration of radioactive material involved,
    - c) Cause of elevated exposures, dose rates or concentrations,  
-AND-
    - d) Corrective steps taken or planned to ensure against recurrence, including schedule for achieving conformance with applicable limits.

**OFF-SITE DOSE CALCULATION MANUAL**

These reports must be formatted in accordance with PMP-7030.001.002, Licensee Event Reports, Special and Routine Reports, even though this is not an LER.

3. Determine cumulative dose contributions from liquid effluents in accordance with this document at least once per 31 days. Dose may be projected based on estimates from previous monthly projections and current or future plant conditions.
- d. Liquid Radwaste Treatment System
1. Use the liquid radwaste treatment system to reduce the radioactive materials in liquid wastes prior to their discharge when the projected doses due to the liquid effluent from the site when averaged over 31 days, would exceed 0.06 mrem to the total body or 0.2 mrem to any organ.
  2. Project doses due to liquid releases to UNRESTRICTED AREAS at least once per 31 days, in accordance with this document, whenever liquid releases are being made without being processed by the liquid radwaste treatment system.
- e. During times of primary to secondary leakage, the use of the startup flash tank should be minimized to reduce the release of curies from the secondary system and to maintain the dose to the public ALARA. Operation of the North Boric Acid Evaporator (NBAE) should be done in a manner so as to allow the recycle of the distillate water to the Primary Water Storage Tank for reuse. This will provide a large reduction in liquid curies of tritium released to the environment, as there is approximately 40 curies of tritium released with every monitor tank of NBAE distillate.



Information	PMP-6010.OSD.001	Rev. 15	Page 21 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			

Drainage of high conductivity water (Component Cooling Water and ice melt water containing sodium tetraborate) shall be evaluated to decide whether it should be drained to waste (small volumes only), the Turbine Room Sump (low activity water only) or routed without demineralization processing to a monitor tank for release. This is necessary in order to minimize the detrimental affect that high conductivity water has on the radioactive wastewater demineralization system. The standard concentration and volume equation can be utilized to determine the impact on each method and is given here. The units for concentration and volume need to be consistent across the equation:

$$(C_i)(V_i) + (C_a)(V_a) = (C_t)(V_t)$$

Where;

- $C_i$  = the initial concentration of the system being added to
- $V_i$  = the initial volume of the system being added to
- $C_a$  = the concentration of the water that is being added to the system
- $V_a$  = the volume of the water that is being added to the system
- $C_t$  = the final concentration of the system after the addition
- $V_t$  = the final volume of the system after the addition

The intent is to keep the:

- WDS below 500  $\mu$ mhos/cc.
- TRS below 1E-5  $\mu$ C/cc.
- Monitor Tank release ALARA to members of the public.

Wastewater leakage into the liquid waste disposal system will be monitored routinely. In the event the leak rate is determined to be over two gallons per minute (the assumed plant design leakage based on the original 2 gpm waste evaporator), increased scrutiny will be placed on locating inleakage, timeliness of job order activities, and/or activities causing increased production of waste water.

Information	PMP-6010.OSD.001	Rev. 15	Page 22 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			

## **BASES – CONCENTRATION**

This specification is provided to ensure 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 2. This limitation provides additional assurance that the levels of radioactive materials in bodies of water outside the site will not result in exposures within 1) the Section II.A design objectives of Appendix I, 10 CFR Part 50, to an individual and 2) the limits of 10 CFR Part 20. The concentration limit for noble gasses is based upon the assumption that Xe-135 is the controlling radionuclide and its Effluent Concentration Unit in air (submersion) was converted to an equivalent concentration in water using the methods described in the International Commission on Radiological Protection (ICRP) Publication 2.

## **DOSE**

This specification is provided to implement the requirements of Sections II.A, III.A, and IV.A of Appendix I, 10 CFR Part 50. The Limiting Condition for Operation implements the guides set forth in Section II.A 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 the releases of radioactive material in liquid effluents will be kept “as low as is reasonably achievable”. Also, for fresh water sites with drinking water supplies which can be potentially affected by plant operations, there is reasonable assurance that the operation of the facility will not result in radionuclide concentrations in the finished drinking water that are in excess of the requirements of 40 CFR 141. The dose calculations in the ODCM 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 an individual through appropriate pathways is unlikely to be substantially underestimated. The equations specified in the ODCM for calculating the doses due to the actual release rates of radioactive materials in liquid effluents, will be 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. NUREG-0133 provides methods for dose calculations consistent with Regulatory Guide 1.109 and 1.113.

This specification applies to the release of liquid effluents from each reactor at the site. The liquid effluents from the shared system are proportioned among the units sharing the system.

Information	PMP-6010.OSD.001	Rev. 15	Page 23 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			

## LIQUID WASTE TREATMENT

The operability of the liquid radwaste treatment system ensures that this system will be available for use whenever liquid effluents require treatment prior to release to the environment. The requirements that the appropriate portions of this system be used when specified provide assurance that the releases of radioactive materials in liquid effluents will be kept "as low as is reasonably achievable". This specification implements the requirements of 10 CFR Part 50.36a, General Design Criteria Section 11.1 of the Final Safety Analysis Report for the Donald C. Cook Nuclear Plant, and design objective Section II.D of Appendix I to 10 CFR Part 50. 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.

### 3.2.4 Gaseous Effluents

#### a. Dose Rate

1. Limit the dose rate due to radioactive materials released in gaseous effluents from the site to  $\leq 500$  mrem/yr to the total body and  $\leq 3000$  mrem/yr to the skin for noble gases. Limit the dose rate due to all radioiodines and for all radioactive materials in particulate form and radionuclides (other than noble gases) with half-lives greater than eight days to  $\leq 1500$  mrem/yr to any organ.
2. With the dose rate(s) exceeding the above limits, without delay decrease the release rate to within the above limit(s).
3. Determine the dose rate due to noble gases in gaseous effluents to be within the above limits in accordance with the methods and procedures described in this document.
4. Determine the dose rate due to radioactive materials, other than noble gases, in gaseous effluents to be within the above limits in accordance with the methods and procedures of this document by obtaining representative samples and performing analyses in accordance with the sampling and analysis program in Attachment 3.7, Radioactive Gaseous Waste Sampling and Analysis Program.

Information	PMP-6010.OSD.001	Rev. 15	Page 24 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			

b. Dose - Noble Gases

1. Limit the air dose in unrestricted areas due to noble gases released in gaseous effluents during any calendar quarter, to  $\leq 5$  mrad for gamma radiation and  $\leq 10$  mrad for beta radiation and during any calendar year, to  $\leq 10$  mrad for gamma radiation and  $\leq 20$  mrad for beta radiation.
2. With the calculated air dose from radioactive noble gases in gaseous effluents exceeding ten times any of the above limits, prepare and submit a Written Report, pursuant to 10 CFR 20.2203 and addressed in step 3.2.3c.2, within 30 days after learning of the event.
3. Determine cumulative dose contributions for the total time period in accordance with this document at least once every 31 days.

c. Dose – Iodine-131, Iodine-133, Tritium, and Radioactive Material in Particulate Form

1. Limit the dose to a MEMBER OF THE PUBLIC from radioiodine, radioactive materials in particulate form, and radionuclides other than noble gases with half-lives greater than eight days in gaseous effluents released to unrestricted areas (site boundary) to the following:
  - a) During any calendar quarter to less than or equal to 7.5 mrem to any organ
  - b) During any calendar year to less than or equal to 15 mrem to any organ.
2. With the calculated dose from the release of radioiodines, radioactive materials in particulate form, or radionuclides other than noble gases in gaseous effluents exceeding ten times any of the above limits, prepare and submit a Written Report, pursuant to 10 CFR 20.2203 and addressed in step 3.2.3c.2, within 30 days after learning of the event.
3. Determine cumulative dose contributions for the total time period in accordance with this document at least once every 31 days.

Information	PMP-6010.OSD.001	Rev. 15	Page 25 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			

d. Gaseous Radwaste Treatment

1. Use the gaseous radwaste treatment system and the ventilation exhaust treatment system to reduce radioactive materials in gaseous wastes prior to their discharge when projected gaseous effluent air doses due to gaseous effluent releases to unrestricted areas when averaged over 31 days, would exceed 0.2 mrad for gamma radiation and 0.4 mrad for beta radiation. Use the ventilation exhaust treatment system to reduce radioactive materials in gaseous waste prior to their discharge when the projected doses due to gaseous effluent releases to unrestricted areas when averaged over 31 days would exceed 0.3 mrem to any organ.
2. Project doses due to gaseous releases to UNRESTRICTED AREAS at least once per 31 days in accordance with this document, whenever the gaseous waste treatment system or ventilation exhaust treatment system is not operational.

**BASES -- GASEOUS EFFLUENTS**

This specification is provided to ensure that the dose rate any time at the SITE BOUNDARY from gaseous effluents from all units on the site will be within the annual dose limits of 10 CFR Part 20 for unrestricted areas. The annual dose limits are the doses associated with the concentrations of 10 CFR Part 20, Appendix B, Table 2. 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 2 of 10 CFR Part 20. For individuals who may at times be within the site boundary, the occupancy of the individual will be sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the site boundary. The specified instantaneous release rate limits restrict, at all times, the corresponding gamma and beta dose rates above background to an individual at or beyond the site boundary to  $\leq (500)$  mrem/yr to the total body or to  $\leq (3000)$  mrem/yr to the skin. These instantaneous release rate limits also restrict, at all times, the corresponding thyroid dose rate above background to an infant via the cow-milk-infant pathway to  $\leq 1500$  mrem/yr for the nearest cow to the plant.

This specification applies to the release of gaseous effluents from all reactors at the site. The gaseous effluents from the shared system are proportioned among the units sharing that system.

**OFF-SITE DOSE CALCULATION MANUAL****DOSE, NOBLE GASES**

This specification is provided to implement the requirements of Sections II.B, III.A, and IV.A of Appendix I, 10 CFR Part 50. The Limiting Condition for Operation 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 Requirements implement the requirements in Section III.A of Appendix I that conform with the guides of Appendix I to be shown by calculational procedures based on models and data such that the actual exposure of an individual through the appropriate pathways is unlikely to be substantially underestimated. The dose calculations established in the ODCM for calculating the doses due to the actual release rates of radioactive noble gases in gaseous effluents will be 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 ODCM equations provided for determining the air doses at the site boundary will be based upon the historical average atmospheric conditions. NUREG-0133 provides methods for dose calculations consistent with Regulatory Guides 1.109 and 1.111.

**DOSE, RADIOIODINES, RADIOACTIVE MATERIAL IN PARTICULATE FORM, AND RADIONUCLIDES OTHER THAN NOBLE GASES**

This specification 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.

Information	PMP-6010.OSD.001	Rev. 15	Page 27 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			

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 ODCM calculational methods specified in the surveillance requirements implement the requirements in Section III.A of Appendix I that conform with the guides of Appendix I to be shown by calculational procedures based on models and data such that the actual exposure of an individual through the appropriate pathways is unlikely to be substantially underestimated. The ODCM calculational methods approved by the NRC for calculating the doses due to the actual release rates of the subject materials are required to be 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 specifications for radioiodines, radioactive material in particulate form, and radionuclides, other than noble gases, are dependent on the existing radionuclide pathways to man, in the unrestricted area. The pathways which are examined in the development of these calculations are: 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.

#### GASEOUS WASTE TREATMENT

The operability of the gaseous radwaste treatment system and the ventilation exhaust treatment systems ensures that the systems will be available for use whenever gaseous effluents require treatment prior to release to the environment. 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 specification implements the requirements of 10 CFR Part 50.36a, General Design Criterion Section 11.1 of the Final Safety Analysis Report for the Donald C. Cook Nuclear Plant, and design objective 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 guides forth in Sections II.B and II.C of Appendix I, 10 CFR Part 50, for gaseous effluents.

**OFF-SITE DOSE CALCULATION MANUAL**

## 3.2.5 Radioactive Effluents - Total Dose

- a. The dose or dose commitment to a real individual from all uranium fuel cycle sources is limited to  $\leq 25$  mrem to the total body or any organ (except the thyroid, which is limited to  $\leq 75$  mrem) over a period of 12 consecutive months.
- b. With the calculated doses from the release of radioactive materials in liquid or gaseous effluents exceeding one half the annual limits of steps 3.2.3c (Dose), 3.2.4b (Dose - Noble Gases), or 3.2.4c (Dose - Iodine-131, Iodine-133, Tritium, and Radioactive Material in Particulate Form) during any calendar quarter perform the following:
  - Investigate and identify the causes for such release rates;
  - Define and initiate a program for corrective action;
  - Report these actions to the NRC within 30 days from the end of the quarter during which the release occurred.

**IF** the estimated dose(s) exceeds the limits above, and **IF** the release condition resulting in violation has not already been corrected prior to violation of 40 CFR 190, **THEN** include in the report a request for a variance in accordance with the provisions of 40 CFR 190 and including the specified information of paragraph 190.11(b). Submittal of the report is considered a timely request, and a variance is granted until staff action on the request is complete. The variance only relates to the limits of 40 CFR 190, and does not apply in any way to the requirements for dose limitation of 10 CFR 50, as addressed in other sections of this document.

- c. Determine cumulative dose contributions from liquid and gaseous effluents in accordance with this document (including steps 3.2.3c [Dose], 3.2.4b [Dose - Noble Gases], or 3.2.4c [Dose - Iodine-131, Iodine-133, Tritium, and Radioactive Material in Particulate Form]).



**OFF-SITE DOSE CALCULATION MANUAL****BASES -- TOTAL DOSE**

This specification is provided to meet the dose limitations of 40 CFR 190. The specification 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, which should result in the limitations of dose to a member of the public for 12 consecutive months to within the 40 CFR 190 limits. For the purposes of the Special Report, it may be assumed that the dose commitment to any 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 5 miles must be considered. **IF** the dose to any member of the public is estimated to exceed the requirements of 40 CFR 190, **THEN** 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 provision of 40 CFR 190.11), is considered to be a timely request and fulfills the requirements of 40 CFR 190 until NRC staff action is completed. An individual is not considered a member of the public during any period in which he/she is engaged in carrying out any operation, which is part of the nuclear fuel cycle.

**3.3 Calculation of Alarm/Trip Setpoints**

The alarm and trip setpoints are to provide monitoring, indication, and control of liquid and gaseous effluents. The setpoints are used in conjunction with sampling programs to assure that the releases are kept within the limits of 10 CFR 20, Appendix B, Table 2. Establish setpoints for liquid and gaseous monitors. Depending on the monitor function, it would be a continuous or batch monitor. The different types of monitors are subject to different setpoint methodologies.

One variable used in setpoint calculations is the multiple release point (MRP) factor. The MRP is a factor used such that when all the releases are integrated, the applicable LIMIT value will not be exceeded. The MRP is determined such that the sum of the MRP's for that effluent type (liquid or gaseous) is less than or equal to 1. The value of the MRP is arbitrary, and it should be assigned based on operational performance. The values of the MRP's for each liquid release point are given in Attachment 3.8, Multiple Release Point Factors for Release Points.

The Site stance on instrument uncertainty is taken from HPPOS-223, Consideration of Measurement Uncertainty When Measuring Radiation Levels Approaching Regulatory Limits, which states the NRC position is the result of a valid measurement obtained by a method, which provides a reasonable demonstration of compliance. This value should be accepted and the uncertainty in that measured value need not be considered.

**OFF-SITE DOSE CALCULATION MANUAL****3.3.1 Liquid Monitors**

Establish liquid monitor setpoints for each monitor of the liquid effluent release systems. A schematic of the liquid effluent release systems is shown as Attachment 3.9, Liquid Effluent Release Systems. A list of the Plant Liquid Effluent Parameters is in Attachment 3.10, Plant Liquid Effluent Parameters. The details of each system design and operation can be found in the system descriptions. The setpoints are intended to keep releases within the limits of 10 CFR 20, Appendix B, Table 2, Column 2. Determine setpoints using either the batch or the continuous methodology.

**a. Liquid Batch Monitor Setpoint Methodology**

1. There is only one monitor used on the Waste Disposal System for liquid batch releases. This monitor is identified as RRS-1000. Steam Generator Blowdown radiation monitors also can be used to monitor batch releases while draining steam generators. The function of these monitors is to act as a check on the sampling program. The sampling program determines the nuclides and concentrations of those nuclides prior to release. The discharge and dilution flow rates are then adjusted to keep the release within the limits of 10 CFR 20. Based on the concentrations of nuclides in the release, the count rate on the monitor can be predicted. The high alarm setpoint can then be set above the predicted value up to the maximum setpoint of the system.
2. The radioactive concentration of each batch of radioactive liquid waste to be discharged is determined prior to each release by sampling and analysis in accordance with Attachment 3.6, Radioactive Liquid Waste Sampling and Analysis Program.

3. The flow rates are determined in order to keep the release within the requirements of 10 CFR 20, Appendix B, Table 2, Column 2. The equation to calculate the flow rate is from Addendum AA1 of NUREG-0133:

$$\left[ \sum \frac{C_i}{LIMIT_i} \right] \times \frac{f}{MRP} \leq F + f$$

Where;

$C_i$  = the concentration of nuclide "i" in  $\mu\text{Ci/ml}$

$LIMIT_i$  = the 10 CFR 20, Appendix B, Table 2, Column 2 limit of nuclide "i" in  $\mu\text{Ci/ml}$

$f$  = the effluent flow rate in gpm (Attachment 3.10, Plant Liquid Effluent Parameters)

$F$  = the dilution water flow rate as estimated prior to release. The dilution flow rate is a multiple of 230,000 gpm depending on the number of circulation pumps in operation.

$MRP$  = the multiple release point factor. A factor such that when all the release points are operating at one time the limits of 10 CFR 20 will not be exceeded.

4. This equation must be true during the batch release. Before the release is started, substitute the maximum effluent flow rate and the minimum dilution flow rate for  $f$  and  $F$ , respectively. **IF** the equation is true, **THEN** the release can proceed with those flow rates as the limits of operation. **IF** the equation is not true, **THEN** the effluent flow rate can be reduced or the dilution flow rate can be increased to make the equation true. This equation may be rearranged to solve for the maximum effluent release flow rate ( $f$ ).

**OFF-SITE DOSE CALCULATION MANUAL**

5. The setpoint is used as a quality check on the sampling program. The setpoint is used to stop the effluent flow when the monitor reading is greater than the predicted value from the sampling program. The predicted value is generated by converting the effluent concentration for each gamma emitting radionuclide to counts per unit of time as per Attachment 3.11, Volumetric Detection Efficiencies for Principle Gamma Emitting Radionuclides for Eberline Liquid Monitors, or Attachment 3.12, Counting Efficiency Curves for R-19, and R-24. The sum of all the counts per unit of time is the predicted count rate. The predicted count rate can then be multiplied by a factor to determine the high alarm setpoint that will provide a high degree of conservatism and eliminate spurious alarms.

b. Liquid Continuous Monitor Setpoint Methodology

1. There are eight monitors used as potential continuous liquid release monitors. These monitors are used in the steam generator blowdown (SGBD), blowdown treatment (BDT), and essential service water (ESW) systems.
2. The Westinghouse monitors (R) are being replaced by Eberline monitors (DRS, WRA) and are identified as:
  - R-19 or DRS 3100/4100 for SGBD
  - R-24 or DRS 3200/4200 for BDT
  - R-20 or WRA 3500/4500 for the east ESW system
  - R-28 or WRA 3600/4600 for the west ESW system

The function of these monitors is to assure that releases are kept within the concentration limits of 10 CFR 20, Appendix B, Table 2, Column 2.

3. The monitors on steam generator blowdown and blowdown treatment systems have trip functions associated with their setpoints. Essential service water monitors are equipped with an alarm function only and monitor effluent in the event the Containment Spray Heat Exchangers are used.

Information	PMP-6010.OSD.001	Rev. 15	Page 33 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			

4. The equation used to determine the setpoint for continuous monitors is from Addendum AA1 of NUREG-0133:

$$S_p \leq \frac{C \times Eff \times MRP \times F \times SF}{f}$$

Where;

$S_p$  = setpoint of monitor (cpm)

$C$  =  $5E-7$   $\mu$ Ci/ml, maximum effluent control limit from 10 CFR 20, Appendix B, Table 2, Column 2 of a known possible nuclide in effluent stream. (The limiting nuclide concentration will be evaluated periodically and adjusted appropriately.)

**-OR-**

if a mixture is to be specified,

$$\frac{\sum C_i}{\sum \frac{C_i}{LIMIT_i}}$$

$Eff$  = Efficiency, this information is located in Attachment 3.11, Volumetric Detection Efficiencies for Principle Gamma Emitting Radionuclides for Eberline Liquid Monitors, through Attachment 3.13, Counting Efficiency Curve for R-20, and R-28, for the specific monitors. For Eberline monitors the efficiency is nuclide specific and the calculation changes slightly to:

$$\frac{\sum (C_i \times Eff_i)}{\sum \frac{C_i}{LIMIT_i}} \text{ replaces } C \times Eff$$

$MRP$  = multiple release point factor. A factor such that when all the release points are operating at one time the limits of 10 CFR 20 will not be exceeded (Attachment 3.8, Multiple Release Point Factors for Release Points). The  $MRP$  for ESW monitors is set to 1.

**OFF-SITE DOSE CALCULATION MANUAL**

F = dilution water (circ water) flow rate in gpm obtained from Attachment 3.10, Plant Liquid Effluent Parameters. For routine operation, the setpoint should be calculated using the minimum dilution flow rate of 230,000 gpm.

SF = Safety Factor, 0.9.

f = applicable effluent release flow rate in gpm. For routine operation, the setpoint should be calculated using maximum effluent flow rate (Attachment 3.10, Plant Liquid Effluent Parameters).

### 3.3.2 Gaseous Monitors

For the purpose of implementing Step 3.2.2, Radioactive Gaseous Effluent Monitoring Instrumentation, and Substep 3.2.4a, Dose Rate, the alarm setpoints for gaseous effluents released into unrestricted areas will be established using the following methodology. In addition, the above steps do not apply to instantaneous alarm and trip setpoints for integrating radiation monitors sampling radioiodines, radioactive materials in particulate form and radionuclides other than noble gases. A schematic of the gaseous effluent release systems is presented in Attachment 3.14, Gaseous Effluent Release Systems. Attachment 3.15, Plant Gaseous Effluent Parameters, presents the effluent flow rate parameter(s).

Gaseous effluent monitor high alarm setpoints will routinely be established at a fraction of the maximum allowable setpoint (typically 10% of the setpoint) for ALARA purposes. Alert alarms will normally be set to provide adequate indications of small changes in radiological conditions.

Information	PMP-6010.OSD.001	Rev. 15	Page 35 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			

a. Plant Unit Vent

1. The gaseous effluents discharged from the plant vent will be monitored by the plant vent radiation monitor low range noble gas channel [Tag No. VRS-1505 (Unit 1), VRS-2505 (Unit 2)] to assure that alarms and trip actions (isolation of gaseous release) will occur prior to exceeding the limits in step 3.2.4, Gaseous Effluents. The alarm setpoint values will be established using the following unit analysis equation:

$$S_p = \frac{SF \times MRP \times DL_j}{F_p \times \chi/Q \times \sum_i (W_i \times DCF_{ij})}$$

Where;

$S_p$  = the maximum setpoint of the monitor in  $\mu\text{Ci/cc}$  for release point p, based on the most limiting organ

SF = an administrative operation safety factor, less than 1.0

MRP = a weighted multiple release point factor ( $\leq 1.0$ ), such that when all site gaseous releases are integrated, the applicable dose will not be exceeded based on the release rate of each effluent point. The MRP is an arbitrary value based on the ratio of the release rate or the volumetric flow rate of each effluent point to the total respective flow rate value of the plant and will be consistent with past operational experience. The MRP is computed as follows:

- Compute the average release rate,  $Q_p$ , (or the volumetric flow rate,  $f_p$ ) from each release point p.
- Compute  $\Sigma Q_p$  (or  $\Sigma f_p$ ) for all release points.
- Ratio  $Q_p/\Sigma Q_p$  (or  $f_p/\Sigma f_p$ ) for each release point. This ratio is the MRP for that specific release point
- Repeat the above bullets for each of the site's eight gaseous release points.

$F_p$  = the maximum volumetric flow rate of release point "p", at the time of the release, in cc/sec. The maximum Unit Vent flow rate, by design, is 186,600 cfm for Unit 1 and 143,400 cfm for Unit 2.

$DL_j$  = dose rate limit to organ "j" in an unrestricted area (mrem/yr).

Based on continuous releases, the dose rate limits,  $DL_j$ , from step 3.2.4a, Dose Rate, are as follows:

- Total Body  $\leq$  500 mrem/year
- Skin  $\leq$  3000 mrem/year
- Any Organ  $\leq$  1500 mrem/year

$\overline{\chi/Q}$  = The worst case annual average relative concentration in the applicable sector or area, in  $\text{sec}/\text{m}^3$  (see Attachment 3.16, 10 Year Average of 1989-1998 Data). The  $\overline{\chi/Q}$  values will be evaluated on an annual basis against the 10 year averages and documented by completing Attachment 3.17, Annual Evaluation of  $\overline{\chi/Q}$  and  $\overline{D/Q}$  Values For All Sectors, and filing in accordance with the retention schedule.

$W_i$  = weighted factor for the radionuclide:

$$W_i = \frac{C_i}{\sum C_k}$$

Where,

$C_i$  = concentration of the most abundant radionuclide "i"

$C_k$  = total concentration of all identified radionuclides in that release pathway. For batch releases, this value may be set to 1 for conservatism.

$DCF_{ij}$  = dose conversion factor used to relate radiation dose to organ "j", from exposure to radionuclide "i" in  $\text{mrem m}^3 / \text{yr } \mu\text{Ci}$ . See following equations.

The dose conversion factor,  $DCF_{ij}$ , is dependent upon the organ of concern.



Information	PMP-6010.OSD.001	Rev. 15	Page 37 of 102
OFF-SITE DOSE CALCULATION MANUAL			

For the whole body:  $DCF_{ij} = K_i$

Where;

$K_i$  = whole body dose factor due to gamma emissions for each identified noble gas radionuclide in  $mrem\ m^3 / yr\ \mu Ci$ . See Attachment 3.18, Dose Factors.

For the skin:  $DCF_{ij} = L_i + 1.1M_i$

Where;

$L_i$  = skin dose factor due to beta emissions for each identified noble gas radionuclide, in  $mrem\ m^3 / yr\ \mu Ci$ . See Attachment 3.18, Dose Factors.

1.1 = the ratio of tissue to air absorption coefficient over the energy range of photons of interest. This ratio converts absorbed dose (mrad) to dose equivalent (mrem).

$M_i$  = the air dose factor due to gamma emissions for each identified noble gas radionuclide in  $mrad\ m^3 / yr\ \mu Ci$ . See Attachment 3.18, Dose Factors.

For the thyroid, via inhalation:  $DCF_{ij} = P_i$

Where;

$P_i$  = the dose parameter, for radionuclides other than noble gas, for the inhalation pathway in  $mrem\ m^3 / yr\ \mu Ci$ . See Attachment 3.18, Dose Factors.

<b>OFF-SITE DOSE CALCULATION MANUAL</b>
---

2. The plant vent radiation monitor low range noble gas high alarm channel setpoint,  $S_p$ , will be set such that the dose rate in unrestricted areas to the whole body, skin and thyroid (or any other organ), whichever is most limiting, will be less than or equal to 500 mrem/yr, 3000 mrem/yr, and 1500 mrem/yr respectively.
3. The thyroid dose is limited to the inhalation pathway only.
4. The plant vent radiation monitor low range noble gas setpoint,  $S_p$ , will be recomputed whenever gaseous releases like Containment Purge, Gas Decay Tanks and CVCS HUTs are discharged through the plant vent to determine the most limiting organ.
5. The high alarm setpoint,  $S_p$ , may be established at a lower value than the lowest computed value via the setpoint equation.
6. Containment Pressure Reliefs will not have a recomputed high alarm setpoint, but will use the normal high alarm setpoint due to their randomness and the time constraints involved in recomputation.
7. At certain times, it may be desirable to increase the high alarm setpoint, if the vent flow rate is decreased. This may be accomplished in one of two ways.

$$\frac{\text{Max Conc } (\mu\text{Ci/cc}) \times \text{Max Flowrate (cfm)}}{\text{New Max Concentration } (\mu\text{Ci/cc})} = \text{New Max cfm}$$

-OR-

$$\frac{\text{Max Conc } (\mu\text{Ci/cc}) \times \text{Max Flowrate (cfm)}}{\text{New Max Flowrate (cfm)}} = \text{New Max } \mu\text{Ci/cc}$$

Information	PMP-6010.OSD.001	Rev. 15	Page 39 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			

b. Waste Gas Storage Tanks

1. The gaseous effluents discharged from the Waste Gas System will be monitored by the vent stack monitors VRS-1505 and VRS-2505.
2. In the event of a high radiation alarm, an automatic termination of the release from the waste gas system will be initiated from the plant vent radiation monitor low range noble gas channel (VRS-1505 or VRS-2505). Therefore, for any gaseous release configuration, which includes normal operation and waste gas system gaseous discharges, the alarm setpoint of the plant vent radiation monitor will be recomputed to determine the most limiting organ based on all gaseous effluent source terms.

Chemical and Volume Control System Hold Up Tanks (CVCS HUT), containing high gaseous oxygen concentrations, may be released under the guidance of waste gas storage tank utilizing approved Operations' procedures.

3. It is normally prudent to allow 45 days of decay prior to releasing a Gas Decay Tank (GDT). There are extenuating, operational circumstances that may prevent this from occurring. Under these circumstances, such as high oxygen concentration creating a combustible atmosphere, it is prudent to waive the 45-day decay for safety's sake.

c. Containment Purge and Exhaust System

1. The gaseous effluents discharged by the Containment Purge and Exhaust Systems and Instrumentation Room Purge and Exhaust System will be monitored by the plant vent radiation monitor noble gas channels (VRS-1505 for Unit 1, VRS-2505 for Unit 2); and alarms and trip actions will occur prior to exceeding the limits in step 3.2.4a, Dose Rate.
2. For the Containment System, a continuous air sample from the containment atmosphere is drawn through a closed, sealed system to the radiation monitors (Tag No. ERS-1300/1400 for Unit 1 and ERS-2300/2400 for Unit 2). During purges, these monitor setpoints will give a Purge and Exhaust Isolation upon actuation of high alarm setpoints for particulate and noble gas channels. The sample is then returned to containment. Grab sample analysis is performed for a Containment purge before release.

Information	PMP-6010.OSD.001	Rev. 15	Page 40 of 102
OFF-SITE DOSE CALCULATION MANUAL			

3. The Upper Containment area is monitored by normal range area gamma monitors (Tag No. VRS-1101/1201 for Unit 1 and VRS-2101/2201 for Unit 2), which also give Purge and Exhaust Isolation Trip signals upon actuation of their high alarm.
4. For the Containment Pressure Relief System, no sample is routinely taken prior to release, but a sample is obtained twice per month.
5. The containment airborne and area monitors, upon actuation of their high alarm, will automatically initiate closure of the Containment and Instrument Room purge supply and exhaust duct valves and containment pressure relief system valves. Complete trip of all isolation control devices requires high alarm of one of the two Train A monitors (ERS-1300/2300 or VRS-1101/2101) and one of the two Train B monitors (ERS-1400/2400 or VRS-1201/2201).

d. Steam Jet Air Ejector System (SJAE)

1. The gaseous effluents from the Steam Jet Air Ejector System discharged to the environment are continuously monitored by radiation monitor (Tag No. SRA-1900 for Unit 1 and SRA-2900 for Unit 2). The monitor will alarm prior to exceeding the limits of step 3.2.4a, Dose Rate. The alarm setpoint for the Condenser Air Ejector System monitor will be based on the maximum air ejector exhaust flow rate, (Attachment 3.15, Plant Gaseous Effluent Parameters). The alarm setpoint value will be established using the following unit analysis equation:

$$S_{SJAE} = \frac{SF \times MRP \times DL_j}{F_p \times \bar{X}/Q \times \sum_i (W_i \times DCF_{ij})}$$

Where;

$S_{SJAE}$  = the maximum setpoint, based on the most limiting organ, in  $\mu\text{Ci}/\text{cc}$  and where the other terms are as previously defined

Information	PMP-6010.OSD.001	Rev. 15	Page 41 of 102
OFF-SITE DOSE CALCULATION MANUAL			

e. Gland Seal Condenser Exhaust

1. The gaseous effluents from the Gland Seal Condenser Exhaust discharged to the environment are continuously monitored by radiation monitor (Tag No. SRA-1800 for Unit 1 and SRA-2800 for Unit 2). The radiation monitor will alarm prior to exceeding the limits of step 3.2.4a, Dose Rate. The alarm setpoint for the GSCE monitor will be based on the maximum condenser exhaust flow rate (1260 CFM for Unit 1, 2754 CFM each for the two Unit 2 vents). The alarm setpoint value will be established using the following unit analysis equation:

$$S_{GSCE} = \frac{SF \times MRP \times DL_j}{F_p \times \chi/Q \times \sum_i (W_i \times DCF_{ij})}$$

Where;

$S_{GSCE}$  = the maximum setpoint, based on the most limiting organ, in  $\mu\text{Ci}/\text{cc}$  and where the other terms are as previously defined

3.4 Radioactive Effluents Total Dose

- 3.4.1 The cumulative dose contributions from liquid and gaseous effluents will be determined by summing the cumulative doses as derived in steps 3.2.3c (Dose), 3.2.4b (Dose - Noble Gases), and 3.2.4c (Dose - Iodine-131, Iodine-133, Tritium, and Radioactive Material in Particulate Form) of this procedure. Dose contribution from direct radiation exposure will be based on the results of the direct radiation monitoring devices located at the REMP monitoring stations. See NUREG-0133, section 3.8.

**OFF-SITE DOSE CALCULATION MANUAL****3.5 Radiological Environmental Monitoring Program (REMP)****3.5.1 Purpose of the REMP**

- a. The purpose of the REMP is to:
  - Establish baseline radiation and radioactivity concentrations in the environs prior to reactor operations,
  - Monitor critical environmental exposure pathways,
  - Determine the radiological impact, if any, caused by the operation of the Donald C. Cook Nuclear Plant upon the local environment.
- b. The first purpose of the REMP was completed prior to the initial operation of either of the two nuclear units at the Donald C. Cook Nuclear Plant Site. The second and third purposes of the REMP are an on-going operation and as such various environmental media and exposure pathways are examined. The various pathways and sample media used are delineated in Attachment 3.19, Radiological Environmental Monitoring Program Sample Stations, Sample Types, Sample Frequencies. Included is a list of the sample media, analysis required, sample stations, and frequency requirements for both collection and analysis. Attachment 3.19, Radiological Environmental Monitoring Program Sample Stations, Sample Types, Sample Frequencies, defines the scope of the REMP for the Donald C. Cook Nuclear Plant.

## OFF-SITE DOSE CALCULATION MANUAL

## 3.5.2 Conduct of the REMP

- a. Conduct sample collection and analysis for the REMP in accordance with Attachment 3.19, Radiological Environmental Monitoring Program Sample Stations, Sample Types, Sample Frequencies, Attachment 3.20, Maximum Values for Lower Limits of Detections<sup>A,B</sup> - REMP, and Attachment 3.21, Reporting Levels for Radioactivity Concentrations in Environmental Samples. These are applicable at all times. The on-site monitoring locations are shown on Attachment 3.22, On-Site Monitoring Location - REMP, and the off-site monitoring locations are shown on Attachment 3.23, Off-Site Monitoring Locations - REMP.
  1. Perform each surveillance requirement within the specified time interval in Attachment 3.19, Radiological Environmental Monitoring Program Sample Stations, Sample Types, Sample Frequencies, with a maximum allowable extension not to exceed 25% of the surveillance interval.
  2. **IF** an environmental sample cannot be collected in accordance with step 3.5.2a, **THEN** submit a description of the reasons for deviation and the actions taken to prevent a reoccurrence as part of the Annual Radiological Environmental Operating Report (AREOR).

Deviations from the required sampling schedule are permitted if specimens are unobtainable due to hazardous conditions, seasonal unavailability, or malfunction of automatic sampling equipment. **IF** the deviation from the required sampling schedule is due to the malfunction of automatic sampling equipment, **THEN** make every effort to complete the corrective action prior to the end of the next sampling period.

## OFF-SITE DOSE CALCULATION MANUAL

3. **IF** a radionuclide is detected in any sample medium exceeding the limit established in Attachment 3.21, Reporting Levels for Radioactivity Concentrations in Environmental Samples, or **IF** more than one radionuclide is detected in any sample medium and the Total Fractional Level (TFL), when averaged over the calendar quarter, is greater than or equal to 1, based on the following formula:

$$TFL = \frac{C_{(1)}}{L_{(1)}} + \frac{C_{(2)}}{L_{(2)}} + \dots \geq 1$$

Where;

$C_{(1)}$  = Concentration of 1<sup>st</sup> detected nuclide

$C_{(2)}$  = Concentration of 2<sup>nd</sup> detected nuclide

$L_{(1)}$  = Reporting Level of 1<sup>st</sup> nuclide from Attachment 3.21, Reporting Levels for Radioactivity Concentrations in Environmental Samples.

$L_{(2)}$  = Reporting Level of 2<sup>nd</sup> nuclide from Attachment 3.21, Reporting Levels for Radioactivity Concentrations in Environmental Samples.

And, **IF** the activity is the result of plant effluents, **THEN** evaluate the release conditions, environmental factors, or other aspects, which may have contributed to the identified levels for inclusion in the AREOR. **IF** the radioactivity was not a result of plant effluents, **THEN** describe the results in the AREOR.

4. **IF** a currently sampled milk farm location becomes unavailable, **THEN** conduct a special milk farm survey within 15 days.
- IF** the unavailable location was an indicator farm, **THEN** an alternate sample location may be established within eight miles of the Donald C. Cook Nuclear Plant, if one is available.
  - IF** the unavailable location was a background farm, **THEN** an alternate sample location may be established greater than 15 but less than 25 miles of the Donald C. Cook Nuclear Plant in one of the less prevalent wind direction sectors, if one is available.



Information	PMP-6010.OSD.001	Rev. 15	Page 45 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			

- c) **IF** a replacement farm is unobtainable and the total number of indicator farms is less than three or the background farms is less than one, **THEN** perform monthly vegetation sampling in lieu of milk sampling.

### **BASES – RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM (REMP)**

The REMP provides measurements of radiation and 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. Thereby, this monitoring program supplements the radiological effluent monitoring program by verifying the measurable concentration 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 REMP will be effective for at least the first three years of commercial operation. Program changes may be initiated based on operational experience in accordance with the requirements of technical specification 6.8.4.b.

The detection capabilities, required by Attachment 3.20, Maximum Values for Lower Limits of Detections<sup>A,B</sup> - REMP, are the state-of-the-art for routine environmental measurements in industrial laboratories.

It should be recognized that the LLD is defined as a priori (before the fact) limit representing the capability of a measurement system and not as a posteriori (after the fact) limit for a particular measurement. Analyses shall be performed in such a manner that the stated LLDs will be achieved under routine analysis conditions. Occasionally, background fluctuations, unavoidably small sample sizes, the presence of interfering nuclides, or other uncontrollable circumstances may render these LLDs unachievable. In such cases, the contributing factors will be identified and described in the Annual Radiological Environmental Operating Report.

#### **3.5.3 Annual Land Use Census**

- a. Conduct a land use census and 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 ten land sectors within a distance of five miles.
- b. In lieu of the garden census, grape and broad leaf vegetation sampling may be performed as close to the site boundary as possible in a land sector, containing sample media, with the highest average deposition factor (D/Q) value.

**OFF-SITE DOSE CALCULATION MANUAL**

- c. Conduct this land use census annually between the dates of June 1 and October 1 by door-to-door survey, aerial survey, or by consulting local agricultural authorities.
  1. With a land use census identifying a location(s), which yields a calculated dose or dose commitment greater than the values currently being calculated in this document, make appropriate changes to incorporate the new location(s) within 30 days, if possible.

**BASES -- LAND USE CENSUS**

This is provided to ensure changes in the use of unrestricted areas are identified and modifications to the monitoring program are made in accordance with requirements of TS 6.8.4b, if required by the results of the 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 pathways via leafy vegetables will be identified and monitored since a garden of this size is the minimum required to produce the quantity (25 kg/yr) of leafy vegetables assumed in Regulatory Guide 1.109 for consumption of 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 (that is, similar to lettuce and cabbage), and 2) a vegetation field of 2 kg/square meter.

**3.5.4 Interlaboratory Comparison Program**

- a. In order to comply with Reg. Guides 4.1 and 4.15, the analytical vendor participates in an Interlaboratory Comparison Program, for radioactive materials. Address program results and identified deficiencies in the AREOR.
  1. With analyses not being performed as required above, report the corrective actions taken to prevent a recurrence to the Commission in the AREOR.

**BASES -- INTERLABORATORY COMPARISON PROGRAM**

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

Information	PMP-6010.OSD.001	Rev. 15	Page 47 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			

### 3.6 Steam Generator Storage Facility Groundwater Monitoring Program

#### 3.6.1 Purpose of the Steam Generator Storage Facility Groundwater Radiological Monitoring Program

- a. The purpose of the temporary on-site Steam Generator Storage Facility Radiological Monitoring Program is to establish baseline radiological data for the groundwater surrounding the facility prior to the storage of the Unit 2 Steam Generator Lower Assemblies. Thereafter, the purpose is to monitor the groundwater through observation wells with locations as shown in Attachment 3.22, On-Site Monitoring Location - REMP, to determine the radiological impact, if any, caused by the use of the Storage Facility.

#### 3.6.2 Conduct of the Steam Generator Storage Facility Groundwater Radiological Monitoring Program

- a. Collect and analyze groundwater samples in accordance with Attachment 3.19, Radiological Environmental Monitoring Program Sample Stations, Sample Types, Sample Frequencies. Apply the values from Attachment 3.20, Maximum Values for Lower Limits of Detections<sup>A,B</sup> - REMP, (excluding I-131) and Attachment 3.21, Reporting Levels for Radioactivity Concentrations in Environmental Samples, (excluding I-131).

### 3.7 Meteorological Model

3.7.1 Three towers are used to determine the meteorological conditions at Donald C. Cook Nuclear Plant. One of the towers is located at the Lake Michigan shoreline to determine the meteorological parameters associated with unmodified shoreline air. The data is accumulated by microprocessors at the tower sites and normally transferred to the central computer every 15 minutes.

3.7.2 The central computer uses a meteorological software program to provide atmospheric dispersion and deposition parameters. The meteorological model used is based on guidance provided in Reg. Guide 1.111 for routine releases. All calculations use the Gaussian plume model.

Information	PMP-6010.OSD.001	Rev. 15	Page 48 of 102
OFF-SITE DOSE CALCULATION MANUAL			

### 3.8 Reporting Requirements

#### 3.8.1 Annual Radiological Environmental Operating Report (AREOR)

- a. Submit routine radiological environmental operating reports covering the operation of the units during the previous calendar year prior to May 1 of each year.
- b. Include in the AREOR:
  - Summaries, interpretations, and statistical evaluation of the results of the radiological environmental surveillance activities for the reporting period.
  - A comparison with pre-operational studies, operational controls (as appropriate), and previous environmental surveillance reports and an assessment of the observed impacts of the plant operation on the environment.
  - The results of the land use censuses required by step 3.5.3, Annual Land Use Census.
  - **IF** harmful effects or evidence of irreversible damage are detected by the monitoring, **THEN** provide in the report an analysis of the problem and a planned course of action to alleviate the problem.
  - Summarized and tabulated results of all radiological environmental samples taken during the reporting period. In the event that some results are not available for inclusion with the report, submit the report noting and explaining the reasons for the missing results. Submit the missing data as soon as possible in a supplementary report.
  - A summary description of the REMP including sampling methods for each sample type, size and physical characteristics of each sample type, sample preparation methods, analytical methods, and measuring equipment used.
  - A map of all sample locations keyed to a table giving distances and directions from one reactor.

Information	PMP-6010.OSD.001	Rev. 15	Page 49 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			

- The results of participation in the Interlaboratory Comparison Program required by step 3.5.4, Interlaboratory Comparison Program.

### 3.8.2 Annual Radiological Effluent Release Report (ARERR)

- a. Submit routine ARERR covering the operation of the unit during the previous 12 months of operation within 90 days after January 1 of each year.
- b. Include in the ARERR a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the units as outlined in Reg. Guide 1.21, "Measuring, Evaluating and Reporting in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water Cooled Nuclear Power Plants," with data summarized on a quarterly basis following the format of Appendix B, thereof.
- c. Submit in the ARERR 90 days after January 1 of each year and include a quarterly summary of hourly meteorological data collected during the reporting period.
  - This summary may be in the form of an hour-by-hour listing of wind speed, wind direction, atmospheric stability, and precipitation (if measured) on magnetic tape, or in the form of joint frequency distributions of wind speed, wind direction and atmospheric stability.
  - Include an assessment of the radiation doses due to the radioactive liquid and gaseous effluents released from the unit or station during the previous calendar year.
  - Include an assessment of the radiation doses from radioactive liquid and gaseous effluents to members of the public due to their activities inside the site boundary during the reporting period. Include all assumptions used in making these assessments (that is, specific activity, exposure time and location) in these reports.
  - Use the meteorological conditions concurrent with the time of release of radioactive materials in gaseous effluents (as determined by sampling frequency and measurement) for determining the gaseous pathway doses.
  - Inoperable radiation monitor periods exceeding 30 continuous days; explain causes of inoperability and actions taken to prevent reoccurrence.

Information	PMP-6010.OSD.001	Rev. 15	Page 50 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			

- d. Submit the ARERR 90 days after January 1 of each year and include an assessment of radiation doses to the likely most exposed member of the public from reactor releases and other nearby uranium fuel cycle sources (including doses from primary effluent pathways and direct radiation) for the previous 12 consecutive months to show conformance with 40 CFR 190, Environmental Radiation Protection Standards for Nuclear Power Operation. Acceptable methods for calculating the dose contribution from liquid and gaseous effluents are given in Reg. Guide 1.109, Rev.1.
- e. Include in the ARERR the following information for each type of solid waste shipped off-site during the report period:
- Volume (cubic meters),
  - Total curie quantity (specify whether determined by measurement or estimate),
  - Principle radionuclides (specify whether determined by measurement or estimate),
  - Type of waste (example: spent resin, compacted dry waste, evaporator bottoms),
  - Type of container (example: LSA, Type A, Type B, Large Quantity),  
-AND-
  - Solidification agent (example: cement).
- f. Include in the ARERR unplanned releases of radioactive materials in gaseous and liquid effluent from the site to unrestricted areas on a quarterly basis.
- g. Include in the ARERR any change to this procedure made during the reporting period.

Information	PMP-6010.OSD.001	Rev. 15	Page 51 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			

3.9 10 CFR 50.75 (g) Implementation

- 3.9.1 Records of spills or other unusual occurrences involving the spread of contamination in and around the site. These records may be limited to instances when significant contamination remains after decontamination or when there is a reasonable likelihood that contaminants may have spread to inaccessible areas, as in the case of possible seepages.
- 3.9.2 These records shall include any known information or identification of involved nuclides, quantities, and concentrations.
- 3.9.3 This information is necessary to ensure all areas outside the radiological-restricted area are documented for surveying and remediation during decommissioning. There is a retention schedule file number where this information is filed in Nuclear Documents Management to ensure all required areas are listed to prevent their omission.

3.10 Reporting/Management Review

- 3.10.1 Incorporate any changes to this procedure in the ARERR.
- 3.10.2 Update this procedure when the Radiation Monitoring System, its instruments, or the specifications of instruments are changed.
- 3.10.3 Review or revise this procedure as appropriate based on the results of the land use census and REMP.
- 3.10.4 Evaluate any changes to this procedure for potential impact on other related Department Procedures.
- 3.10.5 Review this procedure during the first quarter of each year and update it if necessary. Reviewed Attachment 3.16, 10 Year Average of 1989-1998 Data, and document using Attachment 3.17, Annual Evaluation of  $\bar{x}/Q$  and  $\bar{D}/Q$  Values For All Sectors.

**4 FINAL CONDITIONS**

- 4.1 None.

Information	PMP-6010.OSD.001	Rev. 15	Page 52 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			

## 5 REFERENCES

### 5.1 Use References:

- 5.1.1 "Implementation of Programmatic Controls for Radiological Effluent Technical Specifications in the Administrative Controls Section of the Technical Specifications and the Relocation of Procedural Details of RETS to the Off-Site Dose Calculation Manual or to the Process Control Program (Generic Letter 89-01)", United States Nuclear Regulatory Commission, January 31, 1989
- 5.1.2 12-THP-6010.RPP.601, Preparation of the Annual Radioactive Effluent Release Report
- 5.1.3 12-THP-6010.RPP.639, Annual Radiological Environmental Operating Report (AREOR) Preparation And Submittal

### 5.2 Writing References:

#### 5.2.1 Source References:

- a. 10 CFR 20, Standards for Protection Against Radiation
- b. 10 CFR 50, Domestic Licensing of Production and Utilization Facilities
- c. PMI-6010, Radiation Protection Plan
- d. NUREG-0472
- e. NUREG-0133
- f. Regulatory Guide 1.109
- g. Regulatory Guide 1.111
- h. Regulatory Guide 1.113
- i. Final Safety Analysis Report (FSAR)
- j. Technical Specifications, Appendix A, Sections 6.8.1.e, 6.8.4.a, 6.8.4.b, 6.9.1.6, 6.9.1.7, and 6.14, Off-Site Dose Calculation Manual



<b>Information</b>	<b>PMP-6010.OSD.001</b>	<b>Rev. 15</b>	<b>Page 53 of 102</b>
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			

- k. Final Environmental Statement Donald. C. Cook Nuclear Plant, August 1973
- l. NUREG-0017
- m. ODCM Setpoints for Liquid Effluent Monitors (Bases), ENGR 107-04 8112.1 Environs Rad Monitor System
- n. Radiological Support Section Calculation RS-C-200, Determination of P<sub>i</sub> Dose Rates
- o. HPPOS-223, Consideration of Measurement Uncertainty When Measuring Radiation Levels Approaching Regulatory Limits
- p. Watts – Bar Jones (WBJ) Document, R-86-C-001, The Primary Calibration of Eberline Instrument Corporation SPING – 3/4 Low, Mid, and High Range Noble Gas Detectors
- q. WBJ Document, R-86-C-003, The Primary Calibration of Eberline Instrument Corporation DAM-4 and Water Monitor
- r. 40 CFR 190, Environmental Radiation Protection Standards for Nuclear Power Operations
- s. NRC Commitment 6309 (N94083 dated 11/10/94)
- t. NRC Commitment 2417 (N88097 dated 8/30/88)

#### 5.2.2 General References

- a. Cook Nuclear Plant Start-Up Flash Tank Flow Rate letter from D. L. Boston dated January 21, 1997
- b. Letter from B.P. Lauzau, Venting of Middle CVCS Hold-Up Tank Directly to Unit Vent, May 1, 1992
- c. AEP Design Information Transmittal on Aux Building Ventilation Systems
- d. PMP-4030.EIS.001, Event-Initiated Surveillance Testing

Information	PMP-6010.OSD.001	Rev. 15	Page 54 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.1	Dose Factors for Various Pathways		Pages: 54 - 58

R<sub>i</sub> Dose Factors

PATHWAY

Nuclide	Ground	Vegetable	Meat	Cow Milk	Goat Milk	Inhalation
H-3	0.0E+00	4.0E+03	3.3E+02	2.4E+03	4.9E+03	1.3E+03
C-14	0.0E+00	3.5E+06	5.3E+05	3.2E+06	3.2E+06	3.6E+04
Cr-51	5.4E+06	1.1E+07	1.5E+06	6.9E+06	8.3E+05	2.1E+04
Mn-54	1.6E+09	9.4E+08	2.1E+07	2.9E+07	3.5E+06	2.0E+06
Fe-59	3.2E+08	9.6E+08	1.7E+09	3.1E+08	4.0E+07	1.5E+06
Co-58	4.4E+08	6.0E+08	2.9E+08	8.4E+07	1.0E+07	1.3E+06
Co-60	2.5E+10	3.2E+09	1.0E+09	2.7E+08	3.2E+07	8.6E+06
Zn-65	8.5E+08	2.7E+09	9.5E+08	1.6E+10	1.9E+09	1.2E+06
Sr-89	2.5E+04	3.5E+10	3.8E+08	9.9E+09	2.1E+10	2.4E+06
Sr-90	0.0E+00	1.4E+12	9.6E+09	9.4E+10	2.0E+11	1.1E+08
Zr-95	2.9E+08	1.2E+09	1.5E+09	9.3E+05	1.1E+05	2.7E+06
Sb-124	6.9E+08	3.0E+09	4.4E+08	7.2E+08	8.6E+07	3.8E+06
I-131	1.0E+07	2.4E+10	2.5E+09	4.8E+11	5.8E+11	1.6E+07
I-133	1.5E+06	4.0E+08	6.0E+01	4.4E+09	5.3E+09	3.8E+06
Cs-134	7.9E+09	2.5E+10	1.1E+09	5.0E+10	1.5E+11	1.1E+06
Cs-136	1.7E+08	2.2E+08	4.2E+07	5.1E+09	1.5E+10	1.9E+05
Cs-137	1.2E+10	2.5E+10	1.0E+09	4.5E+10	1.4E+11	9.0E+05
Ba-140	2.3E+07	2.7E+08	5.2E+07	2.1E+08	2.6E+07	2.0E+06
Ce-141	1.5E+07	5.3E+08	3.0E+07	8.3E+07	1.0E+07	6.1E+05
Ce-144	7.9E+07	1.3E+10	3.6E+08	7.3E+08	8.7E+07	1.3E+07

Units for all except inhalation pathway are m<sup>2</sup> mr sec / yr μCi, inhalation pathway units are mr m<sup>3</sup> / yr μCi.

<b>Information</b>	<b>PMP-6010.OSD.001</b>	<b>Rev. 15</b>	<b>Page 55 of 102</b>
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.1	Dose Factors for Various Pathways		Pages: 54 - 58

**U<sub>ap</sub> Values to be Used For the Maximum Exposed Individual**

<b>Pathway</b>	<b>Infant</b>	<b>Child</b>	<b>Teen</b>	<b>Adult</b>
Fruits, vegetables and grain (kg/yr)	--	520	630	520
Leafy vegetables (kg/yr)	--	26	42	64
Milk (L/yr)	330	330	400	310
Meat and poultry (kg/yr)	--	41	65	110
Fish (kg/yr)	--	6.9	16	21
Drinking water (L/yr)	330	510	510	730
Shoreline recreation (hr/yr)	--	14	67	12
Inhalation (m <sup>3</sup> /yr)	1400	3700	8000	8000

Table E-5 of Reg. Guide 1.109.

Information	PMP-6010.OSD.001	Rev. 15	Page 56 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.1	Dose Factors for Various Pathways		Pages: 54 - 58

**B<sub>ip</sub> Factors for Aquatic Foods**  
 $\rho\text{Ci l} / \text{kg } \rho\text{Ci}$

Element	Fish	Invertebrate
H	9.0E-1	9.0E-1
C	4.6E3	9.1E3
Na	1.0E2	2.0E2
P	1.0E5	2.0E4
Cr	2.0E2	2.0E3
Mn	4.0E2	9.0E4
Fe	1.0E2	3.2E3
Co	5.0E1	2.0E2
Ni	1.0E2	1.0E2
Cu	5.0E1	4.0E2
Zn	2.0E3	1.0E4
Br	4.2E2	3.3E2
Rb	2.0E3	1.0E3
Sr	3.0E1	1.0E2
Y	2.5E1	1.0E3
Zr	3.3E0	6.7E0
Nb	3.0E4	1.0E2
Mo	1.0E1	1.0E1
Tc	1.5E1	5.0E0
Ru	1.0E1	3.0E2
Rh	1.0E1	3.0E2
Te	4.0E2	6.1E3
I	1.5E1	5.0E0
Cs	2.0E3	1.0E3
Ba	4.0E0	2.0E2
La	2.5E1	1.0E3
Ce	1.0E0	1.0E3
Pr	2.5E1	1.0E3
Nd	2.5E1	1.0E3
W	1.2E3	1.0E1
Np	1.0E1	4.0E2

Table A-1 of Reg. Guide 1.109.

Information	PMP-6010.OSD.001	Rev. 15	Page 57 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.1	Dose Factors for Various Pathways		Pages: 54 - 58

**D<sub>aipj</sub> External Dose Factors for Standing on Contaminated Ground**  
mrem m<sup>2</sup> / hr pCi

Radionuclide	Total Body	Skin
H-3	0	0
C-14	0	0
Na-24	2.5E-8	2.9E-8
P-32	0	0
Cr-51	2.2E-10	2.6E-10
Mn-54	5.8E-9	6.8E-9
Mn-56	1.1E-8	1.3E-8
Fe-55	0	0
Fe-59	8.0E-9	9.4E-9
Co-58	7.0E-9	8.2E-9
Co-60	1.7E-8	2.0E-8
Ni-63	0	0
Ni-65	3.7E-9	4.3E-9
Cu-64	1.5E-9	1.7E-9
Zn-65	4.0E-9	4.6E-9
Zn-69	0	0
Br-83	6.4E-11	9.3E-11
Br-84	1.2E-8	1.4E-8
Br-85	0	0
Rb-86	6.3E-10	7.2E-10
Rb-88	3.5E-9	4.0E-9
Rb-89	1.5E-8	1.8E-8
Sr-89	5.6E-13	6.5E-13
Sr-91	7.1E-9	8.3E-9
Sr-92	9.0E-9	1.0E-8
Y-90	2.2E-12	2.6E-12
Y-91m	3.8E-9	4.4E-9
Y-91	2.4E-11	2.7E-11
Y-92	1.6E-9	1.9E-9
Y-93	5.7E-10	7.8E-10
Zr-95	5.0E-9	5.8E-9
Zr-97	5.5E-9	6.4E-9
Nb-95	5.1E-9	6.0E-9
Mo-99	1.9E-9	2.2E-9
Tc-99m	9.6E-10	1.1E-9
Tc-101	2.7E-9	3.0E-9
Ru-103	3.6E-9	4.2E-9
Ru-105	4.5E-9	5.1E-9

Information	PMP-6010.OSD.001	Rev. 15	Page 58 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.1	Dose Factors for Various Pathways		Pages: 54 - 58

Radionuclide	Total Body	Skin
Ru-106	1.5E-9	1.8E-9
Ag-110m	1.8E-8	2.1E-8
Te-125m	3.5E-11	4.8E-11
Te-127m	1.1E-12	1.3E-12
Te-127	1.0E-11	1.1E-11
Te-129m	7.7E-10	9.0E-10
Te-129	7.1E-10	8.4E-10
Te-131m	8.4E-9	9.9E-9
Te-131	2.2E-9	2.6E-6
Te-132	1.7E-9	2.0E-9
I-130	1.4E-8	1.7E-8
I-131	2.8E-9	3.4E-9
I-132	1.7E-8	2.0E-8
I-133	3.7E-9	4.5E-9
I-134	1.6E-8	1.9E-8
I-135	1.2E-8	1.4E-8
Cs-134	1.2E-8	1.4E-8
Cs-136	1.5E-8	1.7E-8
Cs-137	4.2E-9	4.9E-9
Cs-138	2.1E-8	2.4E-8
Ba-139	2.4E-9	2.7E-9
Ba-140	2.1E-9	2.4E-9
Ba-141	4.3E-9	4.9E-9
Ba-142	7.9E-9	9.0E-9
La-140	1.5E-8	1.7E-8
La-142	1.5E-8	1.8E-8
Ce-141	5.5E-10	6.2E-10
Ce-143	2.2E-9	2.5E-9
Ce-144	3.2E-10	3.7E-10
Pr-143	0	0
Pr-144	2.0E-10	2.3E-10
Nd-147	1.0E-9	1.2E-9
W-187	3.1E-9	3.6E-9
Np-239	9.5E-10	1.1E-9

Table E-6 of Reg. Guide 1.109.

Information	PMP-6010.OSD.001	Rev. 15	Page 59 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.2	Radioactive Liquid Effluent Monitoring Instruments		Pages: 59 - 60

Instrument	Minimum Channels Operable <sup>a</sup>	Applicability	Action
1. Gross Radioactivity Monitors Providing Automatic Release Termination			
a. Liquid Radwaste Effluent Line (RRS-1001)	(1)#	At times of release	1
b. Steam Generator Blowdown Line (R-19, DRS 3/4100 +)	(1)	At times of release**	2
c. Steam Generator Blowdown Treatment Effluent (R-24, DRS 3/4200 +)	(1)	At times of release	2
2. Gross Radioactivity Monitors Not Providing Automatic Release Termination			
a. Service Water System Effluent Line(R-20, R-28, WRA 3/4500 and WRA 3/4600 +)	(1) per train	At all times	3
3. Continuous Composite Sampler Flow Monitor			
a. Turbine Building Sump Effluent Line	(1)	At all times	3
4. Flow Rate Measurement Devices			
a. Liquid Radwaste Line (RFI-285)	(1)	At times of release	4
b. Discharge Pipes*	(1)	At all times	NA
c. Steam Generator Blowdown Treatment Effluent (DFI-352)	(1)	At times of release	4

\* Pump curves and valve settings may be utilized to estimate flow; in such cases, Action Statement 4 is not applicable.

# OPERABILITY of RRS-1001 includes OPERABILITY of flow switch RFS-1010, which is an attendant instrument as defined by Technical Specification 1.6.

\*\* Since these monitors can be used for either batch or continuous release the appropriate action statement of 1 or 2 should apply (that is, Action 1 if a steam generator drain is being performed in lieu of Action 2).

+ Westinghouse (R) radiation monitors are being replaced by Eberline (DRS & WRA) monitors. Either monitor can fulfill the operability requirement.

Information	PMP-6010.OSD.001	Rev. 15	Page 60 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.2	Radioactive Liquid Effluent Monitoring Instruments	Pages: 59 - 60	

- a **IF** an RMS monitor is inoperable solely as the result of the loss of its control room alarm annunciation, **THEN** one of the following actions is acceptable to satisfy the ODCM action statement compensatory surveillance requirement:
1. Collect grab samples and conduct laboratory analyses per the specific monitor's action statement,
  - OR-**
  2. Collect local monitor readings at a frequency equal to or greater than (more frequently than) the action frequency.

**IF** the RMS monitor is inoperable for reasons other than the loss of control room annunciation, **THEN** the only acceptable action is taking grab samples and conducting laboratory analyses as the reading is equivalent to a grab sample when the monitor is functional.

#### TABLE NOTATION

- Action 1 With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases may continue, provided that prior to initiating a release:
1. At least two independent samples are analyzed in accordance with Step 3.2.3a and;
  2. At least two technically qualified members of the Facility Staff independently verify the discharge valving. 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 for up to 30 days provided grab samples are analyzed for gross radioactivity (beta or gamma) at a limit of detection of at least  $10^{-7}$   $\mu\text{Ci}/\text{gram}$ :
1. At least once per shift when the specific activity of the secondary coolant is  $> 0.01$   $\mu\text{Ci}/\text{gram}$  DOSE EQUIVALENT I-131.
  2. At least once per 24 hours when the specific activity of the secondary coolant is  $\leq 0.01$   $\mu\text{Ci}/\text{gram}$  DOSE EQUIVALENT I-131.
- Action 3 With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue for up to 30 days provided that at least once per shift, grab samples are collected and analyzed for gross radioactivity (beta or gamma) at a lower limit of detection of at least  $10^{-7}$   $\mu\text{Ci}/\text{ml}$ . Since the ESW monitors (R-20, R-28, WRA-3/4500 and WRA-3/4600) are only used for post LOCA leak detection and have no auto trip function associated with them, grab samples are only needed if the Containment Spray Heat Exchanger is in service.
- Action 4 With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue for up to 30 days provided the flow rate is estimated at least once per 4 hours during actual releases.

Compensatory actions are governed by PMP-4030.EIS.001, Event-Initiated Surveillance Testing



<b>Information</b>	<b>PMP-6010.OSD.001</b>	<b>Rev. 15</b>	<b>Page 61 of 102</b>
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.3	Radioactive Liquid Effluent Monitoring Instrumentation Surveillance Requirements		Pages: 61 - 62

<b>Instrument</b>	<b>CHANNEL CHECK</b>	<b>SOURCE CHECK</b>	<b>CHANNEL CALIBRATION</b>	<b>CHANNEL FUNCTIONAL TEST</b>
<b>1. Gross Beta or Gamma Radioactivity Monitors Providing Alarm and Automatic Isolation</b>				
a. Liquid Radwaste Effluent Line (RRS-1001)	D*	P	R(3)	Q(5)
b. Steam Generator Blowdown Effluent Line	D*	M	R(3)	Q(1)
c. Steam Generator Blowdown Treatment Effluent Line	D*	M	R(3)	Q(1)
<b>2. Gross Beta or Gamma Radioactivity Monitors Providing Alarm But Not Isolation</b>				
a. Service Water System Effluent Line	D	M	R(3)	Q(2)
<b>3. Continuous Composite Samplers</b>				
a. Turbine Building Sump Effluent Line	D*	N/A	N/A	N/A
<b>4. Flow Rate Monitors</b>				
a. Liquid Radwaste Effluent	D(4)*	N/A	R	Q
b. Steam Generator Blowdown Treatment Line	D(4)*	N/A	N/A	N/A

\* During releases via this pathway

Information	PMP-6010.OSD.001	Rev. 15	Page 62 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.3	Radioactive Liquid Effluent Monitoring Instrumentation Surveillance Requirements		Pages: 61 - 62

### TABLE NOTATION

1. Demonstrate with the CHANNEL FUNCTIONAL TEST that automatic isolation of this pathway and control room alarm annunciation occurs if any of the following conditions exists:
  1. Instrument indicates measured levels above the alarm/trip setpoint.
  2. Circuit failure.\*
  3. Instrument indicates a downscale failure.\*
  4. Instrument control not set in operating mode.\*
  
2. Demonstrate with the CHANNEL FUNCTIONAL TEST that control room alarm annunciation occurs if any of the following conditions exists:
  1. Instrument indicates measured levels above the alarm setpoint.
  2. Circuit failure.
  3. Instrument indicates a downscale failure.
  4. Instrument controls not set in operating mode.
  
3. Perform the initial CHANNEL CALIBRATION using one or more sources with traceability back to the National Institute of Standards and Technology (NIST). These sources 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 may be used.
  
4. Verify indication of flow during periods of release with the CHANNEL CHECK. Perform the CHANNEL CHECK at least once per 24 hours on days on which continuous, periodic or batch releases are made.
  
5. Demonstrate with the CHANNEL FUNCTIONAL TEST that automatic isolation of this pathway and control room alarm annunciation occurs if any of the following conditions exists:
  1. Instrument indicates measured levels above the alarm/trip setpoint.
  2. Circuit failure.\*\*
  3. Instrument indicates a downscale failure.\*\*
  4. Instrument control not set in operating mode.\*
  5. Loss of sample flow.

\* Instrument indicates, but does not provide for automatic isolation

\*\* Instrument indicates, but does not necessarily cause automatic isolation. No credit is taken for the automatic isolation on such occurrences.

Operations currently performs the routine channel checks and source checks. Maintenance and Radiation Protection perform channel calibrations and channel functional tests. Chemistry performs the channel check on the continuous composite sampler. These responsibilities are subject to change without revision to this document.

<b>Information</b>	<b>PMP-6010.OSD.001</b>	<b>Rev. 15</b>	<b>Page 63 of 102</b>
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.4	Radioactive Gaseous Effluent Monitoring Instrumentation		Pages: 63 - 65

<b>Instrument (Instrument #)</b>	<b>Operable<sup>1</sup></b>	<b>Minimum Channels Action</b>	<b>Action</b>
<b>1. Condenser Evacuation System</b>			
a. Noble Gas Activity Monitor (SRA-1905/2905)	(1)	****	6
b. Flow Rate Monitor (SFR-401, 1/2-MR-054 and/or SRA- 1910/2910)	(1)	****	5
<b>2. Unit Vent. Auxiliary Building Ventilation System</b>			
a. Noble Gas Activity Monitor (VRS-1505/2505)	(1)	*	6
b. Iodine Sampler Cartridge for VRA-1503/2503	(1)	*	8
c. Particulate Sampler Filter for VRA-1501/2501	(1)	*	8
d. Effluent System Flow Rate Measuring Device (VFR-315, MR-054 and/or VFR-1510/2510)	(1)	*	5
e. Sampler Flow Rate Measuring Device (VFS-1521/2521)	(1)	*	5
<b>3. Containment Purge and Containment Pressure Relief (Vent)</b>			
a. Containment Noble Gas Activity Monitor ERS-13/1405 (ERS-23/2405)	(1)	**** <sup>2,3</sup>	7
b. Containment Particulate Sampler Filter ERS-13/1401 (ERS-23/2401)	(1)	****	8
<b>4. Waste Gas Holdup System and CVCS HUT</b>			
a. Noble Gas Activity Alarm and Termination of Waste Gas Releases (VRS-1505/2505)	(1)	**** <sup>4</sup>	9
<b>5. Gland Seal Exhaust</b>			
a. Noble Gas Activity Monitor (SRA-1805/2805)	(1)	****	6
b. Flow Rate Monitor (SFR-201, MR-054 or SFR-1810/2810)	(1)	****	5

\* At all times

\*\*\*\* During releases via this pathway

Information	PMP-6010.OSD.001	Rev. 15	Page 64 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.4	Radioactive Gaseous Effluent Monitoring Instrumentation		Pages: 63 - 65

**TABLE NOTATIONS**

1. **IF** an RMS monitor is inoperable solely as the result of the loss of its control room alarm annunciation, **THEN** one of the following actions is acceptable to satisfy the ODCM action statement compensatory surveillance requirement:

1. Take grab samples and conduct laboratory analyses per the specific monitor's action statement,
- OR-**
2. Take local monitor readings at a frequency equal to or greater than (more frequently than) the action frequency.

**IF** the RMS monitor is inoperable for reasons other than the loss of control room annunciation, **THEN** the only acceptable action is taking grab samples and conducting laboratory analyses as the reading is equivalent to a grab sample when the monitor is functional.

2. Consider releases as occurring "via this pathway" under the following conditions:

- The Containment Purge System is in operation and Containment integrity is established/required,
- OR-**
- The Containment Purge System is in operation and is being used as the vent path for the venting of contaminated systems within the containment building prior to completing both degas and depressurization of the RCS.

**IF** neither of the above are applicable, **THEN** the containment purge system is acting as a ventilation system and is covered by Item 2 of this Attachment.

- OR-**
- A Containment Pressure Relief (CPR) is being performed.

3. For purge (including pressure relief) purposes only. See Technical Specification table 3.3-6 for additional information.
4. For waste gas releases only, see Item 2 (Unit Vent, Auxiliary Building Ventilation System) for additional requirements.

**ACTIONS**

5. With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue for up to 30 days provided the flow rate is estimated at least once per 4 hours. After 30 days, **IF** the channels are not OPERABLE, **THEN** continue releases with estimation of the flow rate once per 4 hours and provide a description of why the inoperability was not corrected in the next Annual Radiological Effluent Release Report.
6. With the number of channels OPERABLE less required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue for up to 30 days provided grab samples are taken at least once per shift and these samples are analyzed for gross activity within 24 hours. After 30 days, **IF** the channels are not OPERABLE, **THEN** continue releases with grab samples once per shift and provide a description of why the inoperability was not corrected in the next Annual Radiological Effluent release Report.

Information	PMP-6010.OSD.001	Rev. 15	Page 65 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.4	Radioactive Gaseous Effluent Monitoring Instrumentation		Pages: 63 - 65

7. With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirements, immediately suspend PURGING or VENTING (CPR) of radioactive effluents via this pathway.
8. With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via the affected pathway may continue for up to 30 days provided samples required for weekly analysis are continuously collected with auxiliary sampling equipment as required in Attachment 3.7, Radioactive Gaseous Waste Sampling and Analysis Program. After 30 days, **IF** the channels are not OPERABLE, **THEN** continue releases with sample collection by auxiliary sampling equipment and provide a description of why the inoperability was not corrected in the next Annual Radiological Effluent Release Report.  
  
Sampling evolutions are not an interruption of a continuous release or sampling period.
9. With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, the contents of the tank(s) may be released to the environment for up to 14 days 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 release rate calculations and discharge valve lineups; otherwise, suspend release of radioactive effluents via this pathway.

Compensatory actions are governed by PMP-4030.EIS.001, Event-Initiated Surveillance Testing.

<b>Information</b>	<b>PMP-6010.OSD.001</b>	<b>Rev. 15</b>	<b>Page 66 of 102</b>
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.5	Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Requirements		Pages: 66 - 67

<b>Instrument</b>	<b>CHANNEL CHECK</b>	<b>SOURCE CHECK</b>	<b>CHANNEL CALIBRATION</b>	<b>CHANNEL FUNCTIONAL TEST</b>
1. Condenser Evacuation System	Alarm Only			
a. Noble Gas Activity Monitor (SRA-1905/2905)	D**	M	R(2)	Q(1)
b. System Effluent Flow Rate (SFR-401, MR-054, SRA-1910/2910)	D**	NA	R	Q
2. Auxiliary Building Unit Ventilation System	Alarm Only			
a. Noble Gas Activity Monitor (VRS-1505/2505)	D*	M	R(2)	Q(1)
b. Iodine Sampler (For VRA-1503/2503)	W*	NA	NA	NA
c. Particulate Sampler (For VRA-1501/2501)	W*	NA	NA	NA
d. System Effluent Flow Rate Measurement Device (VFR-315, MR-054, VRS-1510/2510)	D*	NA	R	Q
e. Sampler Flow Rate Measuring Device (VFS-1521/2521)	D*	N/A	R	Q
3. Containment Purge System and Containment Pressure Relief	Alarm and Trip			
a. Containment Noble Gas Activity Monitor (ERS-13/1405 and ERS-23/2405)	S**	P	R(2)	Q(1)
b. Containment Particulate Sampler (ERS-13/1401 and ERS-23/2401)	S**	NA	R	Q(1)

Information	PMP-6010.OSD.001	Rev. 15	Page 67 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.5	Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Requirements		Pages: 66 - 67

Instrument	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST
4. Waste Gas Holdup System Including CVCS HUT	Alarm and Trip			
a. Noble Gas Activity Monitor Providing Alarm and Termination (VRS-1505/2505)	P**	P	R(2)	Q(3)
5. Gland Seal Exhaust	Alarm Only			
a. Noble Gas Activity (SRA-1805/2805)	D**	M	R(2)	Q(1)
b. System Effluent Flow Rate (SFR-201, MR-054, SRA-1810/2810)	D**	NA	R	Q

\* At all times

\*\* During releases via this pathway

#### TABLE NOTATIONS

1. Demonstrate with the CHANNEL FUNCTIONAL TEST that control room alarm annunciation occurs if any of the following conditions exists:
  1. Instrument indicates measured levels above the alarm setpoint.
  2. Circuit failure.
  3. Instrument indicates a downscale failure.
  4. Instrument controls not set in operate mode.
  
2. Perform the initial CHANNEL CALIBRATION using one or more sources with traceability back to the NIST. These sources 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 may be used.
  
3. Demonstrate with the CHANNEL FUNCTIONAL TEST that automatic isolation of this pathway and control room alarm annunciation occurs if any of the following conditions exists:
  1. Instrument indicates measured levels above the alarm/trip setpoint.
  2. Circuit failure.\*
  3. Instrument indicates a downscale failure.\*
  4. Instrument controls not set in operate mode.\*

\* Instrument indicates, but does not provide automatic isolation.

Operations currently performs the routine channel checks, and source checks. Maintenance and Radiation Protection perform channel calibrations and channel functional tests. These responsibilities are subject to change without revision to this document.

Information	PMP-6010.OSD.001	Rev. 15	Page 68 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.6	Radioactive Liquid Waste Sampling and Analysis Program		Pages: 68 - 69

LIQUID RELEASE TYPE	SAMPLING FREQUENCY	MINIMUM ANALYSIS FREQUENCY	TYPE OF ACTIVITY ANALYSIS	LOWER LIMIT OF DETECTION (LLD) ( $\mu\text{Ci/ml}$ ) <sup>a</sup>
A. Batch Waste Release Tanks <sup>c</sup>	P Each Batch	P Each Batch	Principal Gamma Emitters <sup>e</sup>	$5 \times 10^{-7}$
			I-131	$1 \times 10^{-6}$
	P Each Batch	P Each Batch	Dissolved and Entrained Gases (Gamma Emitters)	$1 \times 10^{-5}$
			P Each Batch	M Composite <sup>b</sup>
	Gross Alpha	$1 \times 10^{-7}$		
	P Each Batch	Q Composite <sup>b</sup>	Sr-89, Sr-90	$5 \times 10^{-8}$
Fe-55			$1 \times 10^{-6}$	
B. Plant Continuous Releases* <sup>d</sup>	Daily	W Composite <sup>b</sup>	Principal Gamma Emitters <sup>e</sup>	$5 \times 10^{-7}$
			I-131	$1 \times 10^{-6}$
	M Grab Sample	M	Dissolved and Entrained Gases (Gamma Emitters)	$1 \times 10^{-5}$
			Daily	M Composite <sup>b</sup>
	Gross Alpha	$1 \times 10^{-7}$		
	Daily	Q Composite <sup>b</sup>	Sr-89, Sr-90	$5 \times 10^{-8}$
Fe-55			$1 \times 10^{-6}$	

\*During releases via this pathway



<b>Information</b>	<b>PMP-6010.OSD.001</b>	<b>Rev. 15</b>	<b>Page 69 of 102</b>
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.6	Radioactive Liquid Waste Sampling and Analysis Program		Pages: 68 - 69

**TABLE NOTATION**

- a. The lower limit of detection (LLD) is defined in Table Notation A. of Attachment 3.20, Maximum Values for Lower Limits of Detections A,B - REMP.
- b. 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.
- c. A batch release is the discharge of liquid wastes of a discrete volume. Prior to sampling for analysis, isolate, recirculate or sparge each batch to ensure thorough mixing.
- d. A continuous release is the discharge of liquid of a non-discrete volume; e.g. from a volume of system that has an input flow during the continuous release.
- e. The principal gamma emitters for which the LLD specification applies exclusively are 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. Identify and report other peaks, which are measurable and identifiable, together with the above nuclides.

Information	PMP-6010.OSD.001	Rev. 15	Page 70 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.7	Radioactive Gaseous Waste Sampling and Analysis Program		Pages: 70 - 71

Gaseous Release Type	Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection ( $\mu\text{Ci/ml}$ ) <sup>a</sup>	
a. Waste Gas Storage Tanks and CVCS HUTs	P Each Tank Grab Sample	P Each Tank	Principal Gamma Emitters <sup>d</sup>	$1 \times 10^{-4}$	
			H-3	$1 \times 10^{-6}$	
b. Containment Purge	P Each Purge Grab Sample	P Each Purge	Principal Gamma Emitters <sup>d</sup>	$1 \times 10^{-4}$	
			CPR (vent)**	Twice per Month	Twice per Month
c. Condenser Evacuation System Gland Seal Exhaust* <sup>i</sup>	W or M Grab Sample	M Particulate Sample	Principal Gamma Emitters <sup>d</sup>	$1 \times 10^{-11}$	
			H-3	$1 \times 10^{-6}$	
			W <sup>g</sup> Noble Gas	Principle Gamma Emitters <sup>d</sup>	$1 \times 10^{-4}$
			M Iodine Adsorbing Media	I-131	$1 \times 10^{-12}$
	Continuous	W <sup>g</sup> Noble Gas Monitor	Noble Gases	$1 \times 10^{-6}$	
d. Auxiliary Building Unit Vent*	Continuous <sup>c</sup>	W <sup>b</sup> Iodine Adsorbing Media	I-131	$1 \times 10^{-12}$	
	Continuous <sup>c</sup>	W <sup>b</sup> Particulate Sample	Principal Gamma Emitters <sup>d</sup>	$1 \times 10^{-11}$	
	Continuous <sup>c</sup>	M Composite Particulate Sample	Gross Alpha	$1 \times 10^{-11}$	
	W Grab Sample	W <sup>h</sup> H-3 Sample	H-3	$1 \times 10^{-6}$	
			W <sup>g</sup> Noble Gas	Principle Gamma Emitters <sup>d</sup>	$1 \times 10^{-4}$
	Continuous <sup>c</sup>	Q Composite Particulate Sample	Sr-89, Sr-90	$1 \times 10^{-11}$	
	Continuous <sup>c</sup>	Noble Gas Monitor	Noble Gases	$1 \times 10^{-6}$	
e. Incinerated Oil <sup>e</sup>	P Each Batch <sup>f</sup>	P Each Batch <sup>f</sup>	Principal Gamma Emitters <sup>d</sup>	$5 \times 10^{-7}$	

\*During releases via this pathway

\*\*Only a twice per month sampling program for containment noble gases and H<sub>3</sub> is required

Information	PMP-6010.OSD.001	Rev. 15	Page 71 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.7	Radioactive Gaseous Waste Sampling and Analysis Program		Pages: 70 - 71

**TABLE NOTATION**

- a. The lower limit of detection (LLD) is defined in Table Notation A. of Attachment 3.20, Maximum Values for Lower Limits of Detections A,B - REMP.
- b. Change samples at least once per 7 days and complete analyses within 48 hours after changing. Perform analyses at least once per 24 hours for 7 days following each shutdown, startup or THERMAL POWER change > 15% per hour of RATED THERMAL POWER. **WHEN** samples collected for 24 hours are analyzed, **THEN** the corresponding LLDs may be increased by a factor of 10. This requirement does not apply **IF** (1) analysis shows that DOSEQ 1131 concentration in the RCS has not increased more than a factor of 3; and (2) the noble gas monitor shows that effluent activity has not increased more than a factor of 3.
- c. Know the ratio of the sample flow rate to the sampled stream flow rate for the time period covered by each dose or dose rate calculation made in accordance with steps 3.2.4a, 3.2.4b, and 3.2.4c of this document.  
  
Sampling evolutions are not an interruption of a continuous release or sampling period.
- d. The principal gamma emitters for which the LLD specification applies exclusively are 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. Identify and report other peaks, which are measurable and identifiable, together with the above nuclides.
- e. Releases from incinerated oil are discharged through the Auxiliary Boiler System. Account for releases based on pre-release grab sample data.
- f. Collect samples of waste oil to be incinerated from the container in which the waste oil is stored (example: waste oil storage tanks, 55 gal. drums) prior to transfer to the Auxiliary Boiler System. Ensure samples are representative of container contents.
- g. Obtain and analyze a gas marinelli grab sample weekly for noble gases effluent quantification.
- h. Take tritium grab samples at least once per 24 hours when the refueling cavity is flooded.
- i. Grab sampling of the Gland Seal Exhaust pathway need not be performed if the RMS low range channel (SRA-1805/2805) readings are less than  $1E-6 \mu\text{C}/\text{cc}$ . Attach the RMS daily averages in lieu of sampling. This is based on operating experience indicating no activity is detected in the Gland Seal Exhaust below this value. Compensatory sampling for out of service monitor is still required in the event 1805/2805 is inoperable.

Information	PMP-6010.OSD.001	Rev. 15	Page 72 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.8	Multiple Release Point Factors for Release Points		Page: 72

Liquid Factors		
Monitor Description	Monitor Number	MRP #
U 1 SG Blowdown	1R19/24, DRS 3100/3200*	0.35
U 2 SG Blowdown	2R19/24, DRS 4100/4200*	0.35
U 1 & 2 Liquid Waste Discharge	RRS-1000	0.30

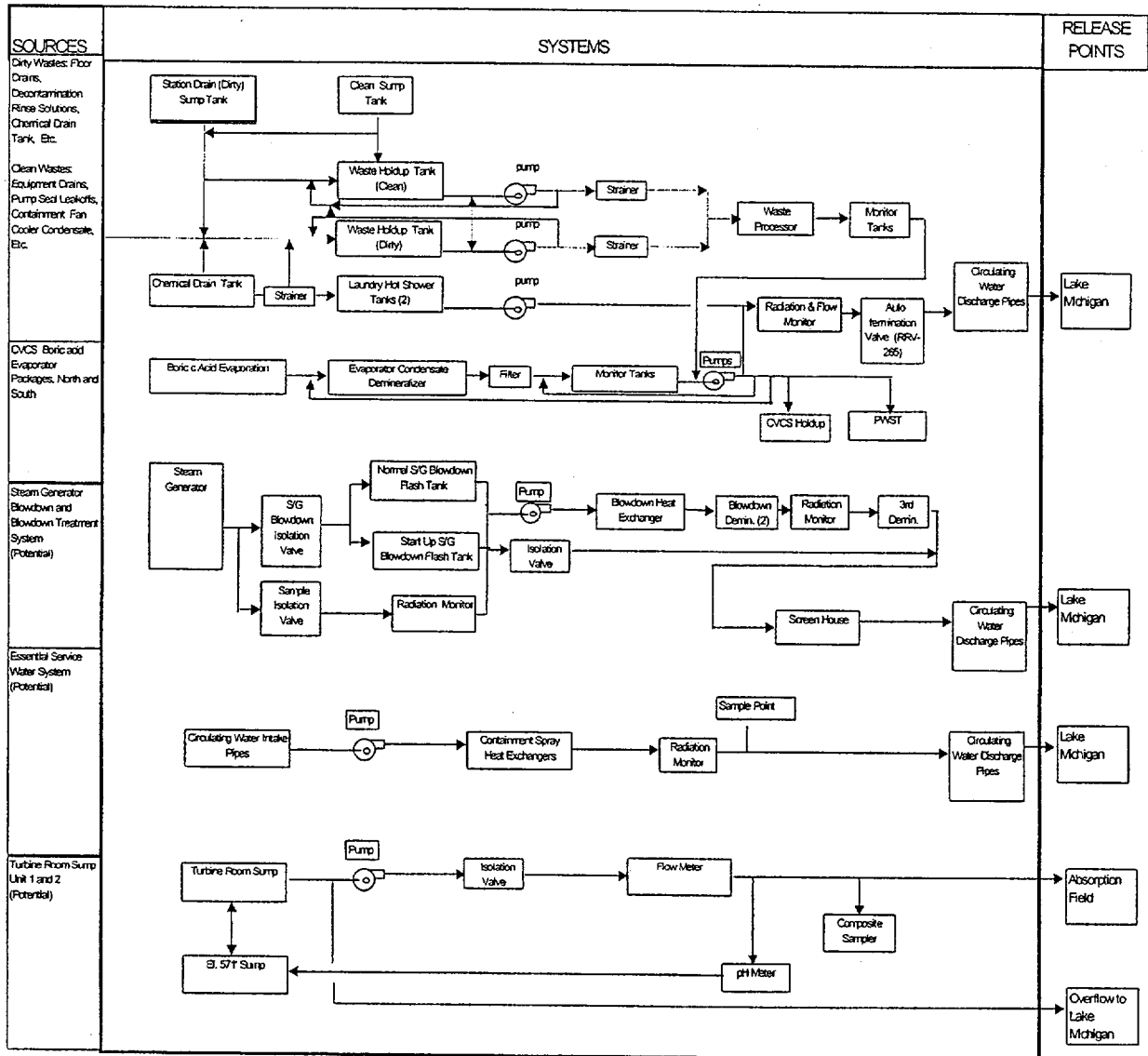
Gaseous Factors			
Monitor Description	Monitor Number	Flow Rate (cfm)	MRP #
<b>Unit 1</b>			
Unit Vent	VRS-1500	186,600	0.54
Gland Seal Vent	SRA-1800	1,260	0.00363
Steam Jet Air Ejector	SRA-1900	3,600 (b)	0.01
Start Up FT Vent		1,536	0.004
<b>Total</b>		<b>192,996</b>	
<b>Unit 2</b>			
Unit Vent	VRS-2500	143,400	0.41
Gland Seal Vent	SRA-2800	5,508 (a)	0.02
Steam Jet Air Ejector	SRA-2900	3,600 (b)	0.01
Start Up FT Vent		1,536	0.004
<b>Total</b>		<b>154,044</b>	

\* Either R-19, 24, DRS 3/4100 or 3/4200 can be used for blowdown monitoring as the Eberline monitors (DRS) are replacing the Westinghouse (R) monitors.

# Nominal Values

a Two release points of 2,754 cfm each are totaled for this value.

b This is the total design maximum of the Start Up Air Ejectors. This is a conservative value for unit 1.



Information	PMP-6010.OSD.001	Rev. 15	Page 74 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.10	Plant Liquid Effluent Parameters		Page: 74

SYSTEM	COMPONENTS		CAPACITY (EACH)	FLOW RATE (EACH)*
	TANKS	PUMPS		
<b>I Waste Disposal System</b>				
+ Chemical Drain Tank	1	1	600 GAL.	20 GPM
+ Laundry & Hot Shower Tanks	2	1	600 GAL.	20 GPM
+ Monitor Tanks	4	2	21,600 GAL.	150 GPM
+ Waste Holdup Tanks	2		25,000 GAL.	
+ Waste Evaporators	3			30 GPM
+ Waste Evaporator Condensate Tanks	2	2	6,450 GAL	150 GPM
<b>II Steam Generator Blowdown and Blowdown Treatment Systems</b>				
+ Start-up Flash Tank (Vented)#	1		1,800 GAL.	580 GPM
+ Normal Flash Tank (Not Vented)	1		525 GAL.	100 GPM
+ Blowdown Treatment System		1		60 GPM
<b>III Essential Service Water System</b>				
+ Water Pumps		4		10,000 GPM
+ Containment Spray Heat Exchanger Outlet	4			3,300 GPM
<b>IV Circulating Water Pumps</b>				
Unit 1		3		230,000 GPM
Unit 2		4		230,000 GPM

\* Nominal Values

# The 580 gpm value is calculated from the Estimated Steam Generator Blowdown Flow vs. DRV Valve Position letter prepared by M. J. O'Keefe, dated 9/27/93. This is 830 gpm times the 70% that remains as liquid while the other 30% flashes to steam and exhausts out the flash tank vent.

Information	PMP-6010.OSD.001	Rev. 15	Page 75 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.11	Volumetric Detection Efficiencies for Principle Gamma Emitting Radionuclides for Eberline Liquid Monitors		Page: 75

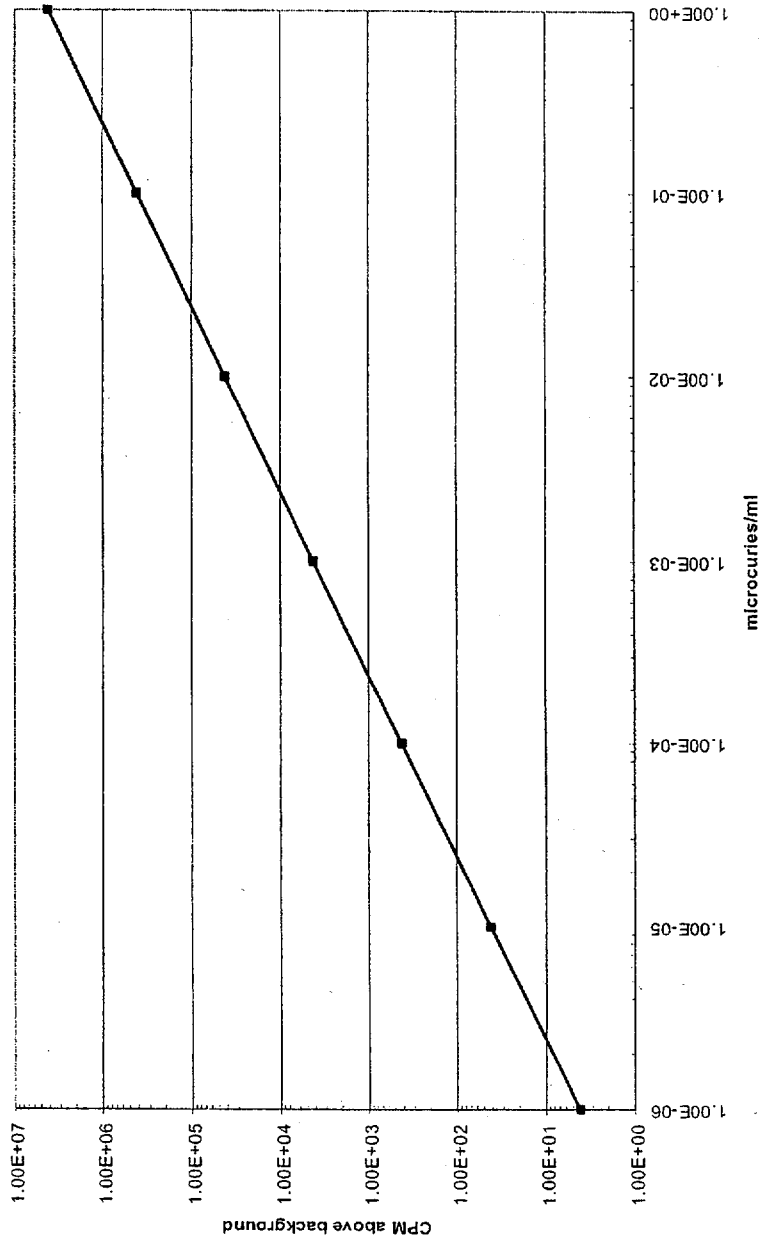
This includes the following monitors: RRS-1000, DRS 3100, DRS 3200, DRS 4100, DRS 4200, WRA 3500, WRA 3600, WRA 4500 and WRA 4600. [Ref. 5.2.1q]

NUCLIDE	EFFICIENCY (cpm/ $\mu$ Ci/cc)
I-131	3.78 E7
Cs-137	3.00 E7
Cs-134	7.93 E7
Co-60	5.75 E7
Co-58	4.58 E7
Cr-51	3.60 E6
Mn-54	3.30 E7
Zn-65	1.58 E7
Ag-110M	9.93 E7
Ba-133	4.85 E7
Ba-140	1.92 E7
Cd-109	9.58 E5
Ce-139	3.28 E7
Ce-141	1.92 E8
Ce-144	4.83 E6
Co-57	3.80 E7
Cs-136	1.07 E8
Fe-59	2.83 E7
Sb-124	5.93 E7
I-133	3.40 E7
I-134	7.23 E7
I-135	3.95 E7
Mo-99	8.68 E6
Na-24	4.45 E7
Nb-95	3.28 E7
Nb-97	3.50 E7
Rb-89	5.00 E7
Ru-103	3.48 E7
Ru-106	1.23 E7
Sb-122	2.55 E7
Sb-125	3.15 E7
Sn-113	7.33 E5
Sr-85	3.70 E7
Sr-89	2.88 E3
Sr-92	3.67 E7
Tc-99M	3.60 E7
Y-88	5.25 E7
Zr-95	3.38 E7
Zr-97	3.10 E7
Kr-85	1.56 E5
Kr-85M	3.53 E7
Kr-88	4.10 E7
Xe-131M	8.15 E5
Xe-133	7.78 E6
Xe-133M	5.75 E6
Xe-135	3.83 E7

Information	PMP-6010.OSD.001		Rev. 15	Page 76 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>				
Attachment 3.12	Counting Efficiency Curves for R-19, and R-24			Pages: 76 - 77

**Counting Efficiency Curve for R-19**  
Efficiency Factor = 4.2 E6 cpm/ $\mu$ Ci/ml

(Based on empirical data taken during pre-operational testing with Cs-137)

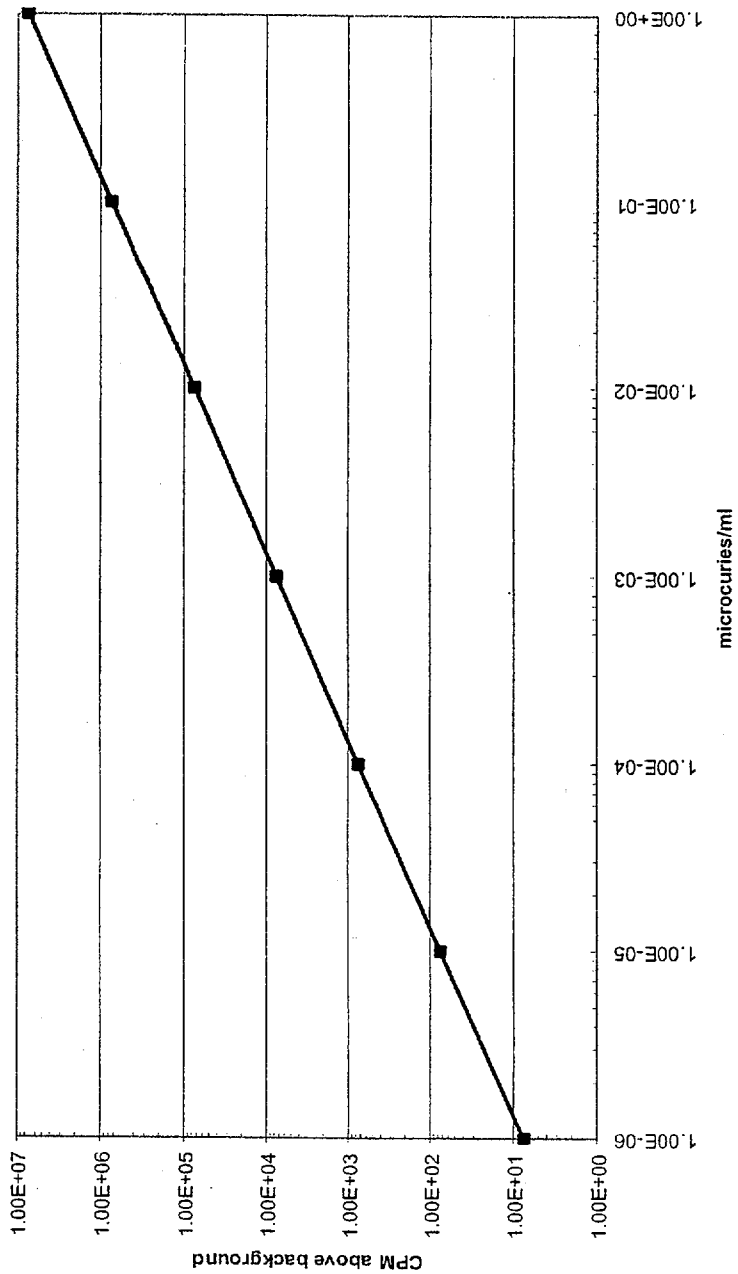




Information	PMP-6010.OSD.001	Rev. 15	Page 77 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.12	Counting Efficiency Curves for R-19, and R-24		Pages: 76 - 77

**Counting Efficiency Curve for R-24**  
Efficiency Factor = 7.5E6 cpm/uCi/ml

(Based on empirical data taken during pre-operational testing with Mn-54)



OFF-SITE DOSE CALCULATION MANUAL

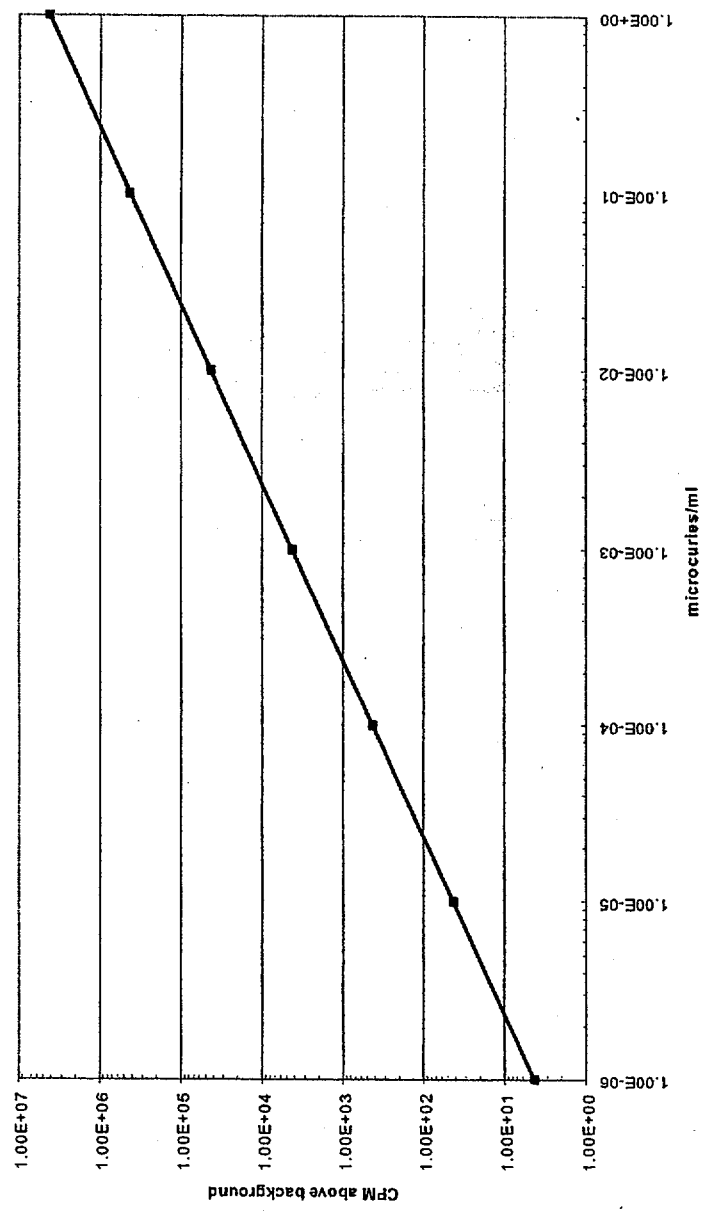
Attachment 3.13

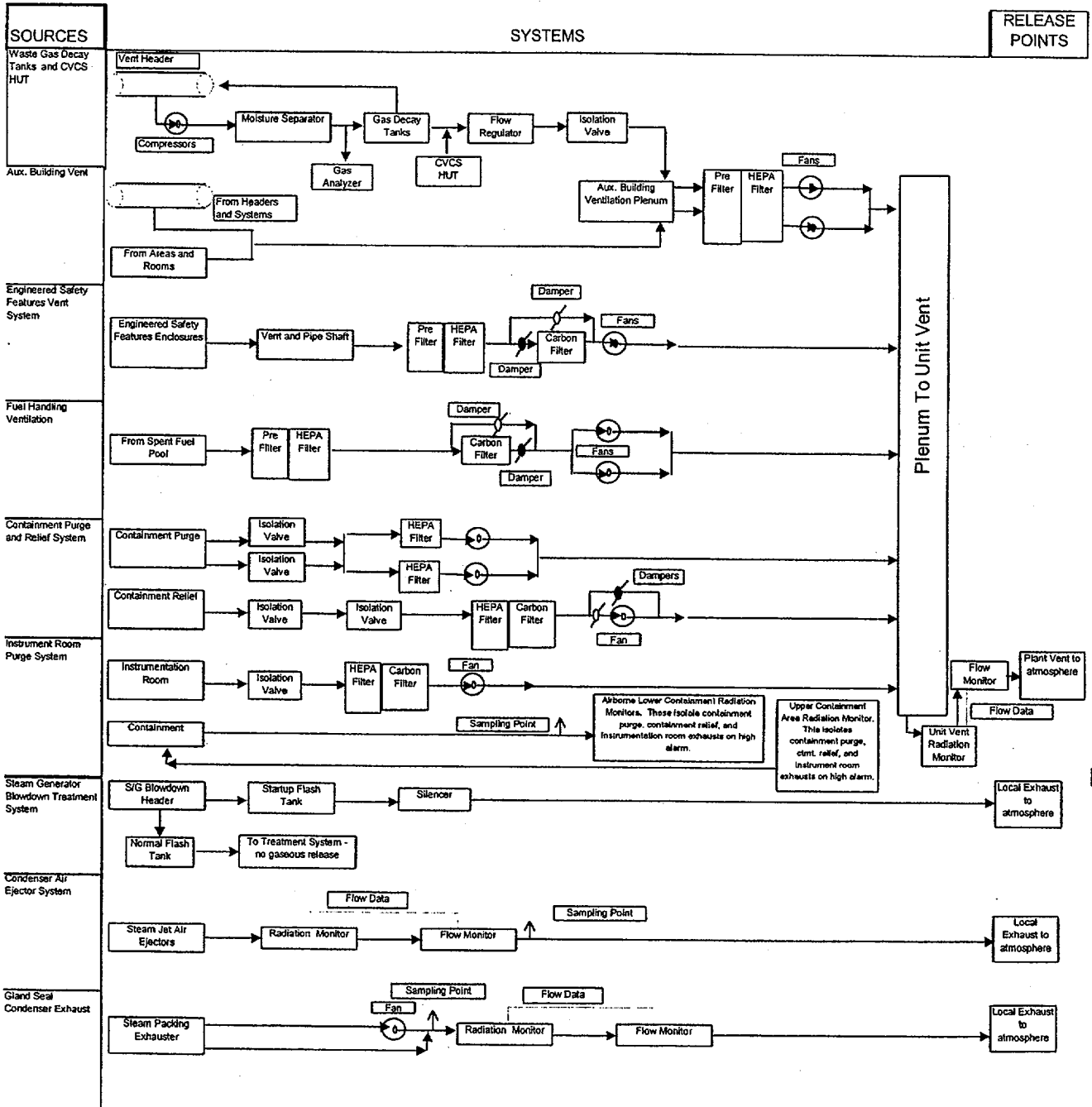
Counting Efficiency Curve for R-20, and R-28

Page:  
78

Counting Efficiency Curve for R-20 and R-28  
Efficiency Factor =  $4.3 \text{ E}6 \text{ cpm}/\mu\text{Ci}/\text{ml}$

(Based on empirical data taken during pre-operational testing with Co-58)





Information	PMP-6010.OSD.001	Rev. 15	Page 80 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.15	Plant Gaseous Effluent Parameters		Page: 80

SYSTEM	UNIT	EXHAUST FLOW RATE (CFM)	CAPACITY
I PLANT AUXILIARY BUILDING UNIT VENT	1 2	186,600 max 143,400 max	
WASTE GAS DECAY TANKS (8) AND CHEMICAL & VOLUME CONTROL SYSTEM HOLD UP TANKS (3)	1	125	4082 FT <sup>3</sup> @100 psig 28,741 ft <sup>3</sup> max @ 8#, 0 level
+ AUXILIARY BUILDING EXHAUST	1 2	72,600 35,000	
+ ENG. SAFETY FEATURES VENT	1 & 2	25,500	
+ FUEL HANDLING AREA VENT SYSTEM	1	30,000	
CONTAINMENT PURGE SYSTEM	1 & 2	32,000	
CONTAINMENT PRESSURE RELIEF SYSTEM	1 & 2	1,000	
INSTRUMENT ROOM PURGE SYSTEM	1 & 2	1,000	
II CONDENSER AIR EJECTOR SYSTEM			2 Release Points One for Each Unit
NORMAL STEAM JET AIR EJECTORS	1 & 2	230	
START UP STEAM JET AIR EJECTORS	1 & 2	3,600	
III TURBINE SEALS SYSTEM	1	1,260	
	2	5,508	2 Release Points for Unit 2
IV START UP FLASH TANK VENT	1	1,536	
	2	1,536	

+ Designates total flow for all fans.

Information	PMP-6010.OSD.001	Rev. 15	Page 81 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.16	10 Year Average of 1989-1998 Data		Pages: 81 - 82

$\overline{\chi/Q}$  GROUND AVERAGE (sec/m<sup>3</sup>)

DIRECTION (WIND TO)	DISTANCE (METERS)				
	594	2416	4020	5630	7240
N	3.50E-06	4.23E-07	1.97E-07	1.16E-07	8.13E-08
NNE	2.69E-06	3.22E-07	1.53E-07	9.16E-08	6.44E-08
NE	3.64E-06	4.51E-07	2.20E-07	1.33E-07	9.43E-08
ENE	5.94E-06	6.70E-07	3.35E-07	2.07E-07	1.48E-07
E	8.68E-06	9.50E-07	4.84E-07	3.03E-07	2.17E-07
ESE	8.45E-06	9.36E-07	4.75E-07	2.96E-07	2.12E-07
SE	9.71E-06	1.05E-06	5.38E-07	3.37E-07	2.42E-07
SSE	1.09E-05	1.20E-06	6.14E-07	3.86E-07	2.77E-07
S	1.16E-05	1.30E-06	6.53E-07	4.05E-07	2.89E-07
SSW	5.87E-06	6.70E-07	3.30E-07	2.01E-07	1.43E-07
SW	3.66E-06	4.26E-07	2.04E-07	1.23E-07	8.64E-08
WSW	2.84E-06	3.14E-07	1.50E-07	1.57E-07	6.32E-08
W	3.29E-06	3.69E-07	1.75E-07	1.04E-07	7.32E-08
WNW	3.20E-06	3.61E-07	1.69E-07	1.01E-07	7.05E-08
NW	2.98E-06	3.33E-07	1.58E-07	9.44E-08	6.61E-08
NNW	3.41E-06	3.81E-07	1.78E-07	1.06E-07	7.41E-08

DIRECTION (WIND TO)	DISTANCE (METERS)				
	12067	24135	40225	56315	80500
N	4.03E-08	1.55E-08	7.71E-09	4.93E-09	3.09E-09
NNE	3.23E-08	1.26E-08	6.27E-09	4.01E-09	2.52E-09
NE	4.78E-08	1.91E-08	9.52E-09	6.11E-09	3.88E-09
ENE	7.59E-08	3.08E-08	1.55E-08	9.95E-09	6.37E-09
E	1.12E-07	4.62E-08	2.33E-08	1.50E-08	9.64E-09
ESE	1.10E-07	4.50E-08	2.27E-08	1.46E-08	9.38E-09
SE	1.26E-07	5.20E-08	2.62E-08	1.55E-08	1.09E-08
SSE	1.44E-07	5.94E-08	2.99E-08	1.93E-08	1.24E-08
S	1.50E-07	6.09E-08	3.06E-08	1.97E-08	1.26E-08
SSW	7.31E-08	2.94E-08	1.47E-08	9.39E-09	5.97E-09
SW	4.35E-08	1.72E-08	8.56E-09	5.48E-09	3.47E-09
WSW	3.18E-08	1.25E-08	6.22E-09	3.99E-09	2.53E-09
W	3.66E-08	1.43E-08	7.07E-09	4.55E-09	2.85E-09
WNW	3.50E-08	1.35E-08	6.70E-09	4.28E-09	2.69E-09
NW	3.30E-08	1.28E-08	6.38E-09	4.09E-09	2.57E-09
NNW	3.68E-08	1.43E-08	7.08E-09	4.54E-09	2.85E-09

DIRECTION - SECTOR			
N = A	E = E	S = J	W = N
NNE = B	ESE = F	SSW = K	WNW = P
NE = C	SE = G	SW = L	NW = Q
ENE = D	SSE = H	WSW = M	NNW = R

Worst Case  $\overline{\chi/Q}$  = 1.54E-5 sec/m<sup>3</sup> in Sector A 1998

Information	PMP-6010.OSD.001	Rev. 15	Page 82 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.16	10 Year Average of 1989-1998 Data		Pages: 81 - 82

D/Q DEPOSITION (1/m<sup>3</sup>)

DIRECTION (WIND TO)	DISTANCE (METERS)				
	594	2416	4020	5630	7240

N	2.46E-08	2.38E-09	1.08E-09	5.66E-10	3.62E-10
NNE	1.06E-08	1.02E-09	4.62E-10	2.43E-10	1.55E-10
NE	1.31E-08	1.27E-09	5.75E-10	3.02E-10	1.93E-10
ENE	1.62E-08	1.56E-09	7.09E-10	3.72E-10	2.37E-10
E	1.92E-08	1.85E-09	8.39E-10	4.4E-10	2.81E-10
ESE	1.82E-08	1.76E-09	7.98E-10	4.19E-10	2.67E-10
SE	1.85E-08	1.79E-09	8.09E-10	4.25E-10	2.71E-10
SSE	2.24E-08	2.17E-09	9.84E-10	5.15E-10	3.29E-10
S	3.5E-08	3.38E-09	1.53E-09	8.03E-10	5.13E-10
SSW	2.31E-08	2.24E-09	1.01E-09	5.31E-10	3.39E-10
SW	2.14E-08	2.07E-09	9.38E-10	4.91E-10	3.14E-10
WSW	2.08E-08	2.01E-09	9.12E-10	4.78E-10	3.05E-10
W	2.13E-08	2.06E-09	9.33E-10	4.9E-10	3.13E-10
WNW	1.95E-08	1.89E-09	8.54E-10	4.48E-10	2.86E-10
NW	1.62E-08	1.57E-09	7.11E-10	3.73E-10	2.38E-10
NNW	2.18E-08	2.11E-09	9.56E-10	5.01E-10	3.2E-10

DIRECTION (WIND TO)	DISTANCE (METERS)				
	12067	24135	40225	56315	80500

N	1.51E-10	4.91E-11	1.81E-11	9.65E-12	4.84E-12
NNE	6.78E-11	2.1E-11	7.75E-12	4.13E-12	2.07E-12
NE	8.18E-11	2.62E-11	9.64E-12	5.15E-12	2.58E-12
ENE	9.95E-11	3.23E-11	1.19E-11	6.34E-12	3.18E-12
E	1.16E-10	3.82E-11	1.41E-11	7.5E-12	3.76E-12
ESE	1.12E-10	3.64E-11	1.34E-11	7.14E-12	3.58E-12
SE	1.13E-10	3.68E-11	1.36E-11	7.24E-12	3.63E-12
SSE	1.37E-10	4.47E-11	1.65E-11	8.79E-12	4.41E-12
S	2.14E-10	6.97E-11	2.57E-11	1.37E-11	6.87E-12
SSW	1.42E-10	4.61E-11	1.7E-11	9.06E-12	4.54E-12
SW	1.31E-10	4.27E-11	1.57E-11	8.38E-12	4.21E-12
WSW	1.27E-10	4.15E-11	1.53E-11	8.16E-12	4.09E-12
W	1.3E-10	4.25E-11	1.56E-11	1.73E-11	4.19E-12
WNW	1.19E-10	3.89E-11	1.43E-11	7.64E-12	3.83E-12
NW	1.78E-10	3.24E-11	1.19E-11	6.36E-12	3.19E-12
NNW	1.34E-10	4.35E-11	1.6E-11	8.55E-12	4.29E-12

DIRECTION - SECTOR			
N = A	E = E	S = J	W = N
NNE = B	ESE = F	SSW = K	WNW = P
NE = C	SE = G	SW = L	NW = Q
ENE = D	SSE = H	WSW = M	NNW = R

Worst Case D/Q = 4.41E-08 1/m<sup>2</sup> in Sector A 1990

Information	PMP-6010.OSD.001	Rev. 15	Page 83 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.17	Annual Evaluation of $\overline{\chi/Q}$ and $\overline{D/Q}$ Values For All Sectors		Page: 83

1. Performed or received annual update of  $\overline{\chi/Q}$  and  $\overline{D/Q}$  values. Provide a description of what has been received.

\_\_\_\_\_/\_\_\_\_\_  
Signature                      Date

Environmental Department  
(print name, title)

2. Worst  $\overline{\chi/Q}$  and  $\overline{D/Q}$  value and sector determined. PMP-6010.OSD.001 has been updated, if necessary. Provide an evaluation.

\_\_\_\_\_/\_\_\_\_\_  
Signature                      Date

Environmental Department  
(print name, title)

3. Review nuclide mix for gaseous and liquid release paths to determine if the dose conversion factor of total body is still applicable. Provide an evaluation.

\_\_\_\_\_/\_\_\_\_\_  
Signature                      Date

Environmental Department  
(print name, title)

4. Approved and verified by:

\_\_\_\_\_/\_\_\_\_\_  
Signature                      Date

Environmental Department  
(print name, title)

Information	PMP-6010.OSD.001	Rev. 15	Page 84 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.18	Dose Factors <sup>(1)</sup>		Pages: 84 - 86

**DOSE FACTORS FOR NOBLE GASES AND DAUGHTERS\***

RADIONUCLIDE	TOTAL BODY DOSE FACTOR $K_i$ (DF <sub>B</sub> )	SKIN DOSE FACTOR $L_i$ (DF <sub>S</sub> )	GAMMA AIR DOSE FACTOR $M_i$ (DF <sub>γ</sub> )	BETA AIR DOSE FACTOR $N_i$ (DF <sub>β</sub> )
	mrem m <sup>3</sup> per μCi yr)	(mrem m <sup>3</sup> per μCi yr)	(mrad m <sup>3</sup> per μCi yr)	(mrad m <sup>3</sup> per μCi yr)
Kr-83m	7.56E-02	---	1.93E+01	2.88E+02
Kr-85m	1.17E+03	1.46E+03	1.23E+03	1.97E+03
Kr-85	1.61E+01	1.34E+03	1.72E+01	1.95E+03
Kr-87	5.92E+03	9.73E+03	6.17E+03	1.03E+04
Kr-88	1.47E+04	2.37E+03	1.52E+04	2.93E+03
Kr-89	1.66E+04	1.01E+04	1.73E+04	1.06E+04
Kr-90	1.56E+04	7.29E+03	1.63E+04	7.83E+03
Xe-131m	9.15E+01	4.76E+02	1.56E+02	1.11E+03
Xe-133m	2.51E+02	9.94E+02	3.27E+02	1.48E+03
Xe-133	2.94E+02	3.06E+02	3.53E+02	1.05E+03
Xe-135m	3.12E+03	7.11E+02	3.36E+03	7.39E+02
Xe-135	1.81E+03	1.86E+03	1.92E+03	2.46E+03
Xe-137	1.42E+03	1.22E+04	1.51E+03	1.27E+04
Xe-138	8.83E+03	4.13E+03	9.21E+03	4.75E+03
Ar-41	8.84E+03	2.69E+03	9.30E+03	3.28E+03

\* The listed dose factors are for radionuclides that may be detected in gaseous effluents, from Reg. Guide 1.109, Table B-1.



Information	PMP-6010.OSD.001	Rev. 15	Page 85 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.18	Dose Factors <sup>(1)</sup>		Pages: 84 - 86

**DOSE FACTORS FOR RADIOIODINES AND RADIOACTIVE PARTICULATE,  
GASEOUS EFFLUENTS\***

RADIONUCLIDE	P <sub>i</sub> INHALATION PATHWAY (mrem m <sup>3</sup> per μCi yr)	P <sub>i</sub> FOOD & GROUND PATHWAYS (m <sup>2</sup> mrem sec per μCi yr)
H-3	6.47E+02	2.40E+03
C-14	2.65E+04	2.38E+09
Na-24	1.06E+04	3.28E+07
P-32	2.03E+06	1.63E+11
Cr-51	1.28E+04	1.15E+07
Mn-56	7.17E+04	1.29E+06
Fe-55	8.69E+04	1.38E+08
Fe-59	1.02E+06	7.89E+08
Co-58	7.77E+05	5.89E+08
Co-60	4.51E+06	4.62E+09
Ni-63	3.39E+05	3.56E+10
Ni-65	5.01E+04	4.43E+05
Cu-64	1.50E+04	4.75E+06
Zn-65	6.47E+05	2.01E+10
Zn-69	1.32E+04	3.01E-09
Rb-86	1.90E+05	2.27E+10
Te-131m	1.99E+05	3.48E+07
Te-131	8.22E+03	4.18E+04
Te-132	3.40E+05	7.26E+07
I-130	1.60E+06	8.99E+08
I-131	1.48E+07	1.07E+12
I-132	1.69E+05	1.79E+06
I-133	3.56E+06	9.78E+09
I-134	4.45E+04	6.40E+05
I-135	6.96E+05	2.40E+07
Cs-134	7.03E+05	7.21E+10
Cs-136	1.35E+05	6.13E+09
Cs-137	6.12E+05	6.25E+10
Cs-138	8.76E+02	5.15E+05
Ba-139	5.10E+04	1.52E+05
Ba-140	1.60E+06	2.75E+08
Ba-141	4.75E+03	5.98E+04
Ba-142	1.55E+03	6.43E+04

Information	PMP-6010.OSD.001	Rev. 15	Page 86 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.18	Dose Factors <sup>(1)</sup>		Pages: 84 - 86

RADIONUCLIDE	P <sub>i</sub> INHALATION PATHWAY (mrem m <sup>3</sup> per μCi yr)	P <sub>i</sub> FOOD & GROUND PATHWAYS (m <sup>2</sup> mrem sec per μCi yr)
La-140	1.68E+05	2.77E+07
La-142	5.95E+04	1.09E+06
Ce-141	5.17E+05	3.35E+07
Rb-88	5.57E+02	4.74E+04
Rb-89	3.21E+02	1.76E+05
Sr-89	2.03E+06	1.28E+10
Sr-90	4.09E+07	1.24E+11
Sr-91	7.34E+04	1.11E+06
Y-90	2.69E+05	9.64E+05
Y-91m	2.79E+03	1.44E+05
Y-91	2.45E+06	6.86E+06
Y-92	1.27E+05	2.59E+05
Y-93	1.67E+05	2.80E+05
Zr-95	1.75E+06	3.45E+08
Zr-97	1.40E+05	4.29E+06
Nb-95	4.79E+05	4.06E+08
Mo-99	1.35E+05	3.23E+08
Tc-99m	2.03E+03	2.81E+05
Tc-101	8.44E+02	2.92E+04
Ru-103	5.52E+05	1.55E+08
Ru-105	4.84E+04	9.12E+05
Ru-106	1.16E+07	3.02E+08
Ag-110m	3.67E+06	1.80E+10
Te-125m	4.47E+05	1.56E+08
Te-127m	1.31E+06	1.06E+09
Te-127	2.44E+04	1.53E+05
Te-129m	1.68E+06	1.45E+09
Te-129	2.63E+04	3.76E+04
Ce-143	1.16E+05	4.88E+06
Ce-144	9.84E+06	1.95E+08
Pr-143	4.33E+05	7.98E+05
Pr-144	4.28E+03	2.63E+03
Nd-147	3.22E+05	1.26E+07
W-187	3.96E+04	5.90E+06
Np-239	5.95E+04	2.55E+06

\*IF Sr-90 analysis is performed, THEN use P<sub>i</sub> given in Ru-106 for unidentified components.

IF Sr-90 and Ru-106 analyses are performed, THEN use P<sub>i</sub> given in I-131 for unidentified components.

IF Sr-90, Ru-106 and I-131 analyses are performed, THEN use P<sub>i</sub> given in P-32 for unidentified components.

<sup>(1)</sup> Site specific calculated using guidance provided in NUREG 0133, Rev. 1, Section 5.2.

Information	PMP-6010.OSD.001	Rev. 15	Page 87 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.19	Radiological Environmental Monitoring Program Sample Stations, Sample Types, Sample Frequencies		Pages: 87 - 90

SAMPLE STATION	DESCRIPTION/ LOCATION	SAMPLE TYPE	SAMPLE FREQUENCY	ANALYSIS TYPE	ANALYSIS FREQUENCY
<b>ON-SITE AIRBORNE AND DIRECT RADIATION (TLD) STATIONS</b>					
ONS-1 (T-1)	1945 ft @ 18° from Plant Axis	Airborne Particulate	Weekly	Gross beta	Weekly
		Airborne Radioiodine	Weekly	Gamma Isotopic	Quart. Comp.
		TLD	Weekly	I-131	Weekly
			Quarterly	Direct Radiation	Quarterly
ONS-2 (T-2)	2338 ft @ 48° from Plant Axis	Airborne Particulate	Weekly	Gross Beta	Weekly
			Weekly	Gamma Isotopic	Quart. Comp.
		Airborne Radioiodine	Weekly	I-131	Weekly
		TLD	Quarterly	Direct Radiation	Quarterly
ONS-3 (T-3)	2407 ft @ 90° from Plant Axis	Airborne Particulate	Weekly	Gross Beta	Weekly
			Weekly	Gamma Isotopic	Quart. Comp.
		Airborne Radioiodine	Weekly	I-131	Weekly
		TLD	Quarterly	Direct Radiation	Quarterly
ONS-4 (T-4)	1852 ft. @ 118° from Plant Axis	Airborne Particulate	Weekly	Gross Beta	Weekly
			Weekly	Gamma Isotopic	Quart. Comp.
		Airborne Radioiodine	Weekly	I-131	Weekly
		TLD	Quarterly	Direct Radiation	Quarterly
ONS-5 (T-5)	1895 ft @ 189° from Plant Axis	Airborne Particulate	Weekly	Gross Beta	Weekly
			Weekly	Gamma Isotopic	Quart. Comp.
		Airborne Radioiodine	Weekly	I-131	Weekly
		TLD	Quarterly	Direct Radiation	Quarterly
ONS-6 (T-6)	1917 ft @ 210° from Plant Axis	Airborne Particulate	Weekly	Gross Beta	Weekly
			Weekly	Gamma Isotopic	Quart. Comp.
		Airborne Radioiodine	Weekly	I-131	Weekly
		TLD	Quarterly	Direct Radiation	Quarterly
T-7	2103 ft @ 36° from Plant Axis	TLD	Quarterly	Direct Radiation	Quarterly
T-8	2208 ft @ 82° from Plant Axis	TLD	Quarterly	Direct Radiation	Quarterly
T-9	1368 ft @ 149° from Plant Axis	TLD	Quarterly	Direct Radiation	Quarterly
T-10	1390 ft @ 127° from Plant Axis	TLD	Quarterly	Direct Radiation	Quarterly
T-11	1969 ft @ 11° from Plant Axis	TLD	Quarterly	Direct Radiation	Quarterly
T-12	2292 ft @ 63° from Plant Axis	TLD	Quarterly	Direct Radiation	Quarterly

<b>CONTROL AIRBORNE AND DIRECT RADIATION (TLD) STATIONS</b>					
NBF	15.6 miles SSW New Buffalo, MI	Airborne Particulate	Weekly	Gross Beta	Weekly
			Weekly	Gamma Isotopic	Quart. Comp.
		Airborne Radioiodine	Weekly	I-131	Weekly
		TLD	Quarterly	Direct Radiation	Quarterly
SBN	26.2 miles SE South Bend, IN	Airborne Particulate	Weekly	Gross Beta	Weekly
			Weekly	Gamma Isotopic	Quart. Comp.
		Airborne Radioiodine	Weekly	I-131	Weekly
		TLD	Quarterly	Direct Radiation	Quarterly
DOW	24.3 miles ENE Dowagiac, MI	Airborne Particulate	Weekly	Gross Beta	Weekly
			Weekly	Gamma Isotopic	Quart. Comp.
		Airborne Radioiodine	Weekly	I-131	Weekly
		TLD	Quarterly	Direct Radiation	Quarterly
COL	18.9 miles NNE Coloma, MI	Airborne Particulate	Weekly	Gross Beta	Weekly
			Weekly	Gamma Isotopic	Quart. Comp.
		Airborne Radioiodine	Weekly	I-131	Weekly
		TLD	Quarterly	Direct Radiation	Quarterly

Information	PMP-6010.OSD.001	Rev. 15	Page 88 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.19	Radiological Environmental Monitoring Program Sample Stations, Sample Types, Sample Frequencies		Pages: 87 - 90

SAMPLE STATION	DESCRIPTION/ LOCATION	SAMPLE TYPE	SAMPLE FREQUENCY	ANALYSIS TYPE	ANALYSIS FREQUENCY
<b>OFF-SITE AIRBORNE AND DIRECT RADIATION (TLD) STATIONS</b>					
OFT-1	4.5 miles NE, Pole #B294-44	TLD	Quarterly	Direct Radiation	Quarterly
OFT-2	3.6 miles, NE, Stevensville Substation	TLD	Quarterly	Direct Radiation	Quarterly
OFT-3	5.1 miles NE, Pole #B296-13	TLD	Quarterly	Direct Radiation	Quarterly
OFT-4	4.1 miles, E, Pole #B350-72	TLD	Quarterly	Direct Radiation	Quarterly
OFT-5	4.2 miles ESE, Pole #B387-32	TLD	Quarterly	Direct Radiation	Quarterly
OFT-6	4.9 miles SE, Pole #B426-1	TLD	Quarterly	Direct Radiation	Quarterly
OFT-7	2.5 miles S, Bridgman Substation	TLD	Quarterly	Direct Radiation	Quarterly
OFT-8	4.0 miles S, Pole #B424-20	TLD	Quarterly	Direct Radiation	Quarterly
OFT-9	4.4 miles ESE, Pole #B369-214	TLD	Quarterly	Direct Radiation	Quarterly
OFT-10	3.8 miles S, Pole #B422-152	TLD	Quarterly	Direct Radiation	Quarterly
OFT-11	3.8 miles S, Pole #B423-12	TLD	Quarterly	Direct Radiation	Quarterly

<b>GROUNDWATER (WELL WATER) SAMPLE STATIONS</b>					
W-1	1969 ft @ 11° from Plant Axis	Groundwater	Quarterly	Gamma Isotopic	Quarterly
				Tritium	Quarterly
W-2	2292 ft @ 63° from Plant Axis	Groundwater	Quarterly	Gamma Isotopic	Quarterly
				Tritium	Quarterly
W-3	3279 ft @ 107° from Plant Axis	Groundwater	Quarterly	Gamma Isotopic	Quarterly
				Tritium	Quarterly
W-4	418 ft @ 301° from Plant Axis	Groundwater	Quarterly	Gamma Isotopic	Quarterly
				Tritium	Quarterly
W-5	404 ft @ 290° from Plant Axis	Groundwater	Quarterly	Gamma Isotopic	Quarterly
				Tritium	Quarterly
W-6	424 ft @ 273° from Plant Axis	Groundwater	Quarterly	Gamma Isotopic	Quarterly
				Tritium	Quarterly
W-7	1895 ft @ 189° from Plant Axis	Groundwater	Quarterly	Gamma Isotopic	Quarterly
				Tritium	Quarterly
W-8	1279 ft @ 53° from Plant Axis	Groundwater	Quarterly	Gamma Isotopic	Quarterly
				Tritium	Quarterly
W-9	1447 ft @ 22° from Plant Axis	Groundwater	Quarterly	Gamma Isotopic	Quarterly
				Tritium	Quarterly
W-10	4216 ft @ 129° from Plant Axis	Groundwater	Quarterly	Gamma Isotopic	Quarterly
				Tritium	Quarterly
W-11	3206 ft @ 153° from Plant Axis	Groundwater	Quarterly	Gamma Isotopic	Quarterly
				Tritium	Quarterly
W-12	2631 ft @ 162° from Plant Axis	Groundwater	Quarterly	Gamma Isotopic	Quarterly
				Tritium	Quarterly
W-13	2152 ft @ 182° from Plant Axis	Groundwater	Quarterly	Gamma Isotopic	Quarterly
				Tritium	Quarterly
W-14	1780 ft @ 164° from Plant Axis	Groundwater	Quarterly	Gamma Isotopic	Quarterly
				Tritium	Quarterly

Information	PMP-6010.OSD.001	Rev. 15	Page 89 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.19	Radiological Environmental Monitoring Program Sample Stations, Sample Types, Sample Frequencies		Pages: 87 - 90

SAMPLE STATION	DESCRIPTION/ LOCATION	SAMPLE TYPE	SAMPLE FREQUENCY	ANALYSIS TYPE	ANALYSIS FREQUENCY
<b>DRINKING WATER</b>					
STJ	St. Joseph Public Intake Sta. 9 mi. NE	Drinking water	Daily	Gross Beta	14 day Comp.
				Gamma Isotopic	14 day Comp.
				I-131	14 day Comp.
LTW	Lake Twp. Public Intake Sta. 0.6 mi. S	Drinking water	Daily	Tritium	Quart. Comp.
				Gross Beta	14 day Comp.
				Gamma Isotopic	14 day Comp.
				I-131	14 day Comp.
				Tritium	Quart. Comp.

<b>SURFACE WATER</b>					
SWL-1	Condenser Circulating Water Intake	Surface Water	Daily	Gamma Isotopic	Month. Comp.
				Tritium	Quart. Comp.
SWL-2	Plant Site Boundary - South 500 ft. south of Plant Centerline	Surface Water	Daily	Gamma Isotopic	Month. Comp.
				Tritium	Quart. Comp.
SWL-3	Plant Site Boundary - North 500 ft. north of Plant Centerline	Surface Water	Daily	Gamma Isotopic	Month. Comp.
				Tritium	Quart. Comp.

<b>SEDIMENT</b>					
SL-2	Plant Site Boundary - South 500 ft. south of Plant Centerline	Sediment	Semi-Ann.	Gamma Isotopic	Semi-Annual
SL-3	Plant Site Boundary - North 500 ft. north of Plant Centerline	Sediment	Semi-Ann.	Gamma Isotopic	Semi-Annual
SL-4	Plant Site Boundary - South South storm drain culvert to lake	Sediment	Quarterly	Gamma Isotopic	Quarterly
SL-5	Plant Site Boundary - North North storm drain culvert to lake	Sediment	Quarterly	Gamma Isotopic	Quarterly

SL-4 & 5 are data collection points only not actual REMP samples

<b>GROUNDWATER (STEAM GENERATOR STORAGE FACILITY) SAMPLE STATIONS</b>					
SG-1	0.8 mi. @ 95° from Plant Axis	Groundwater	Quarterly	Gross Alpha	Quarterly
				Gross Beta	Quarterly
				Gamma Isotopic	Quarterly
SG-2	0.7 mi. @ 92° from Plant Axis	Groundwater	Quarterly	Gross Alpha	Quarterly
				Gross Beta	Quarterly
				Gamma Isotopic	Quarterly
SG-4	0.7 mi. @ 93° from Plant Axis	Groundwater	Quarterly	Gross Alpha	Quarterly
				Gross Beta	Quarterly
				Gamma Isotopic	Quarterly
SG-5	0.7 mi. @ 92° from Plant Axis	Groundwater	Quarterly	Gross Alpha	Quarterly
				Gross Beta	Quarterly
				Gamma Isotopic	Quarterly

<b>INGESTION - MILK Indicator Farms*</b>					
		Milk	Once every	I-131	per sample
			15 days	Gamma Isotopic	per sample
		Milk	Once every	I-131	per sample
			15 days	Gamma Isotopic	per sample
Milk	Once every	I-131	per sample		
	15 days	Gamma Isotopic	per sample		

Information	PMP-6010.OSD.001	Rev. 15	Page 90 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.19	Radiological Environmental Monitoring Program Sample Stations, Sample Types, Sample Frequencies		Pages: 87 - 90

SAMPLE STATION	DESCRIPTION/ LOCATION	SAMPLE TYPE	SAMPLE FREQUENCY	ANALYSIS TYPE	ANALYSIS FREQUENCY
INGESTION - MILK Background Farms					
Livinghouse Farm	20 miles S, La Porte, IN	Milk	Once every 15 days	I-131 Gamma Isotopic	per sample per sample
Wyant Farm	20.7 miles E, Dowagiac	Milk	Once every 15 days	I-131 Gamma Isotopic	per sample per sample

INGESTION - FISH					
ONS-N	0.3 mile N, Lake Michigan	Fish	2/year	Gamma Isotopic	per sample
ONS-S	0.4 mile S, Lake Michigan	Fish	2/year	Gamma Isotopic	per sample
OFS-N	3.5 mile N, Lake Michigan	Fish	2/year	Gamma Isotopic	per sample
OFS-S	5.0 mile S, Lake Michigan	Fish	2/year	Gamma Isotopic	per sample

INGESTION - FOOD PRODUCTS					
On Site					
ONS-G	Nearest sample to Plant in the highest D/Q land sector containing media.	Grapes	At time of harvest	Gamma Isotopic	At time of harvest
ONS-V		Broadleaf vegetation	At time of harvest	Gamma Isotopic	At time of harvest
Off Site					
OFS-G	In a land sector containing grapes, approximately 20 miles from the plant, in one of the less prevalent D/Q land sectors	Grapes	At time of harvest	Gamma Isotopic	At time of harvest

INGESTION - BROADLEAF IN LIEU OF MILK					
3 indicator samples of broad leaf vegetation collected at different locations, within eight miles of the plant in the highest annual average D/Q land sector.		Broadleaf vegetation	Monthly when available	Gamma Isotopic I131	Monthly when available
1 background sample of similar vegetation grown 15-25 miles distant in one of the less prevalent wind directions.		Broadleaf vegetation	Monthly when available	Gamma Isotopic I131	Monthly when available

Collect composite samples of Drinking and Surface water at least daily. Analyze particulate sample filters for gross beta activity 24 or more hours following filter removal. This will allow for radon and thoron daughter decay. **IF** gross beta activity in air or water is greater than 10 times the yearly mean of control samples for any medium, **THEN** perform gamma isotopic analysis on the individual samples.

**IF** at least three indicator milk samples and one background milk sample cannot be obtained, **THEN** three indicator broad leaf samples will be collected at different locations, within eight miles of the plant, in the land sector with the highest D/Q (refers to the highest annual average D/Q). Also, one background broad leaf sample will be collected 15 to 25 miles from the plant in one of the less prevalent D/Q land sectors.

\* The three milk indicator farms will be determined by the Annual Land Use Census and those that are willing to participate.

Information	PMP-6010.OSD.001	Rev. 15	Page 91 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.20	Maximum Values for Lower Limits of Detections <sup>A,B</sup> - REMP		Pages: 91 - 92

Radionuclides	Food Product pCi/kg, wet	Water pCi/l	Milk pCi/l	Air Filter pCi/m <sup>3</sup>	Fish pCi/kg, wet	Sediment pCi/kg, dry
Gross Beta		4*		0.01		
H-3		2000				
Ba-140		60	60			
La-140		15	15			
Cs-134	60	15	15	0.06	130	150
Cs-137	60	18	18	0.06	150	180
Zr-95		30				
Nb-95		15				
Mn-54		15			130	
Fe-59		30			260	
Zn-65		30			260	
Co-58		15			130	
Co-60		15			130	
I-131	60	1	1	0.07		

This Data is directly from our plant-specific Technical Specification.

\* LLD for drinking water

Information	PMP-6010.OSD.001	Rev. 15	Page 92 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.20	Maximum Values for Lower Limits of Detections <sup>A,B</sup> - REMP		Pages: 91 - 92

#### NOTES

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

For a particular measurement system (which may include radiochemical separation), the LLD is given by the equation:

$$LLD = \frac{4.66^{\alpha} \times S}{E \times V \times 2.22 \times Y \times e^{(-\lambda \times \Delta t)}}$$

Where LLD is the a priori lower limit of detection as defined above (as pCi per unit mass or volume). Perform analysis in such a manner that the stated LLDs will be achieved under routine conditions. Occasionally background fluctuations, unavoidably small sample sizes, the presence of interfering radionuclides, or other uncontrollable circumstances may render these LLDs unachievable.

S 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 of the detection equipment as counts per transformation (that is, disintegration)

V is the sample size in appropriate mass or volume units

2.22 is the conversion factor from picocuries (pCi) to transformations (disintegrations) per minute

Y is the fractional radiochemical yield as appropriate

$\lambda$  is the radioactive decay constant for the particular radionuclide

$\Delta t$  is the elapsed time between sample collection (or end of sample collection period) and time of counting.

- B. Identify and report other peaks which are measurable and identifiable, together with the radionuclides listed in Attachment 3.20, Maximum Values for Lower Limits of Detections<sup>A,B</sup> - REMP.

<sup>$\alpha$</sup>  A 2.71 value may be added to the equation to provide correction for deviations in the Poisson distribution at low count rates, that is,  $2.71 + 4.66 \times S$ .



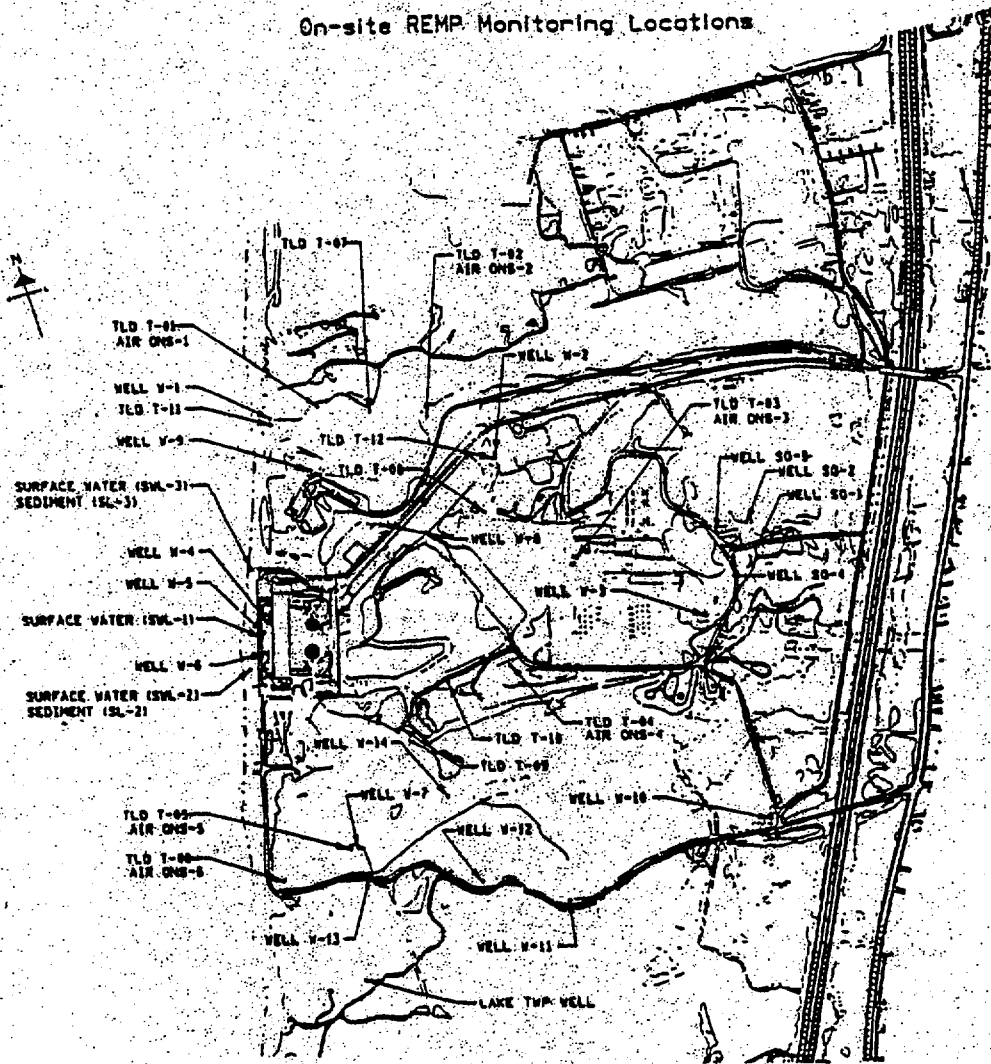
Information	PMP-6010.OSD.001	Rev. 15	Page 93 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.21	Reporting Levels for Radioactivity Concentrations in Environmental Samples		Page: 93

Radionuclides	Food Product $\rho\text{Ci/kg, wet}$	Water $\rho\text{Ci/l}$	Milk $\rho\text{Ci/l}$	Air Filter $\rho\text{Ci/m}^3$	Fish $\rho\text{Ci/kg, wet}$
H-3		20000			
Ba-140		200	300		
La-140		200	300		
Cs-134	1000	30	60	10	1000
Cs-137	2000	50	70	20	2000
Zr-95		400			
Nb-95		400			
Mn-54		1000			30000
Fe-59		400			10000
Zn-65		300			20000
Co-58		1000			30000
Co-60		300			10000
I-131	100	2	3	0.90	

This Data is directly from our plant-specific Technical Specification.

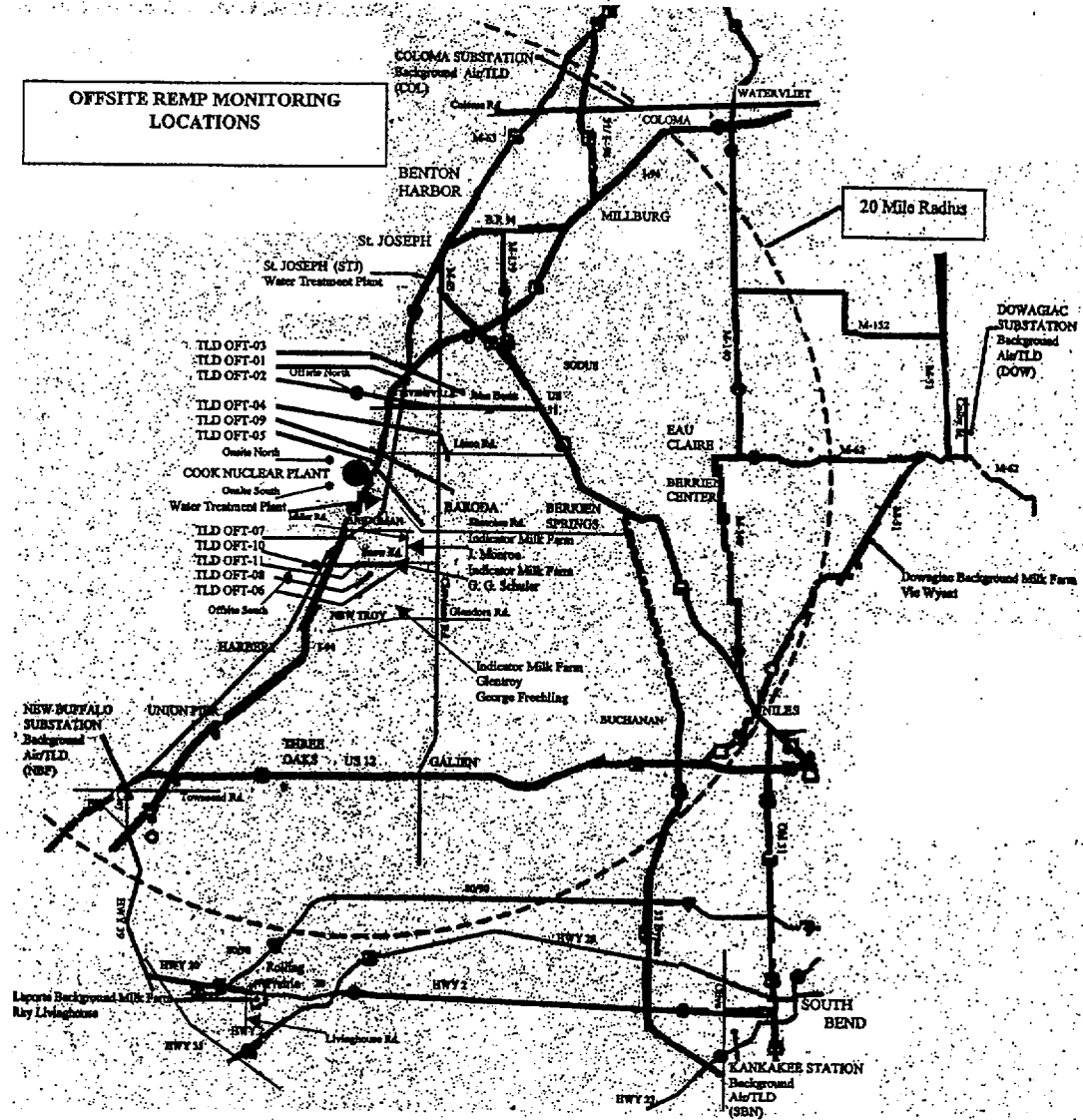
Information	PMP-6010.OSD.001	Rev. 15	Page 94 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.22	On-Site Monitoring Location - REMP		Page: 94

On-site REMP Monitoring Locations



**LEGEND**

- ONS-1 - ONS-6: Air Sampling Stations
- T-01 - T-12: TLD Sampling Stations
- W-1 - W-14: REMP T/S Groundwater Wells
- SG-1, SG-2, SG-4, SG-5: REMP Non T/S Groundwater Wells
- SWL-1, 2, 3: Surface Water Sampling Stations
- SL-2, SL-3: Sediment Sampling Stations



Information	PMP-6010.OSD.001	Rev. 15	Page 96 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.24	Safety Evaluation By The Office Of Nuclear Reactor Regulation		Pages: 96 - 98

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION  
RELATED TO DISPOSAL OF SLIGHTLY CONTAMINATED SLUDGE  
INDIANA MICHIGAN POWER COMPANY  
DONALD C. COOK NUCLEAR PLANT, UNIT NOS. 1 AND 2  
DOCKET NOS. 50-315 AND 50-316 [Ref. 5.2.1s]  
(This is a 10 CFR 50.75 (g) item)

1. INTRODUCTION

By letters dated October 9, 1991, October 23, 1991, September 3, 1993, and September 29, 1993, Indiana Michigan Power Company (I&M) requested approval pursuant to 10 CFR 20.2002 for the on-site disposal of licensed material not previously considered in the Donald C. Cook Nuclear Plant Final Environmental Statement dated August 1973. Specifically, this request addresses actions taken in 1982 in which approximately 942 cubic meters of slightly contaminated sludge were removed from the turbine room sump absorption pond and pumped to the upper parking lot located within the exclusion area of the Donald C. Cook Nuclear Plant. The contaminated sludge was spread over an area of approximately 4.7 acres. The sludge contained a total radionuclide inventory of 8.89 millicuries (mCi) of Cesium-137, Cesium-136, Cesium-134, Cobalt-60 and Iodine-131.

In its submittal, the licensee addressed specific information requested in accordance with 10 CFR 20.2002(a), provided a detailed description of the licensed material, thoroughly analyzed and evaluated information pertinent to the impacts on the environment of the proposed disposal of licensed material, and committed to follow specific procedures to minimize the risk of unexpected exposures.

2. DESCRIPTION OF WASTE

The turbine room sump absorption pond is a collection place for water released from the plant's turbine room sump. The contamination was caused by a primary-to-secondary steam generator leak that entered the pond from the turbine building sump, a recognized release pathway. Sludge, consisting mainly of leaves and roots mixed with sand, built up in the pond. As a result, the licensee dredged the pond in 1982. The radioactive sludge removed by the dredging activities was pumped to a containment area located within the exclusion area. The total volume of 942 cubic meters of the radioactive sludge that was dredged from the bottom of the turbine room absorption pond was subsequently spread and made into a graveled road over the upper parking lot area of approximately 4.7 acres.

The principal radionuclides identified in the dredged material are listed below.

**TABLE 1**

NUCLIDE (half-life)	ACTIVITY (mCi) 1982	ACTIVITY (mCi) 1991
<sup>136</sup> Cs (13.2 d)	0.03	NA*
<sup>134</sup> Cs (2.1 y)	2.34	0.18
<sup>137</sup> Cs (30.2 y)	5.59	4.57
<sup>60</sup> Co (5.6 y)	0.90	0.27
<sup>131</sup> I (8.04 d)	0.03	NA*
<b>TOTAL:</b>	<b>8.89</b>	<b>5.02</b>

\* NA: not applicable due to decay

<b>Information</b>	<b>PMP-6010.OSD.001</b>	<b>Rev. 15</b>	<b>Page 97 of 102</b>
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.24	Safety Evaluation By The Office Of Nuclear Reactor Regulation		Pages: 96 - 98

### 3. RADIOLOGICAL IMPACTS

The licensee in 1982 evaluated the following potential exposure pathways to members of the general public from the radionuclides in the sludge:

- (1) external exposure caused by groundshine from the disposal site;
- (2) internal exposure caused by inhalation of re suspended radionuclide;
- AND-
- (3) internal exposure from ingesting ground water.

The staff has reviewed the licensee's calculational methods and assumptions and finds that they are consistent with NUREG-1101, "Onsite Disposal of Radioactive Waste," Volumes 1 and 2, November 1986 and February 1987, respectively. The staff finds the assessment methodology acceptable. Table 2 lists the doses calculated by the licensee for the maximally exposed member of the public based on a total activity of 8.89 mCi disposed in that year.

**TABLE 2**

Pathway	Whole Body Dose Received by Maximally Exposed Individual (mrem/year)
Groundshine	0.94
Inhalation	0.94
Groundwater Ingestion	0.73
<b>Total</b>	<b>2.61</b>

On July 5, 1991, the licensee re-sampled the onsite disposal area to assure that no significant impacts and adverse effects had occurred. A counting procedure based on the appropriate environmental low-level doses was used by the licensee; however, no activity was detected during the re-sampling<sup>1</sup>. This is consistent with the original activity of the material and the decay time. The 1991 re-sampling process used by the licensee confirms that the environmental impact of the 1982 disposal was very small. The staff finds the licensee's methodology acceptable.

### 4. ENVIRONMENTAL FINDING AND CONCLUSION

The staff has evaluated the environmental impact of the proposal to leave in place approximately 942 cubic meters of slightly contaminated sludge underneath the upper parking lot on the Donald C. Cook Nuclear Plant site.

In 1982, the licensee evaluated the potential exposure to members of the general public from the radionuclides in the sludge and calculated the potential dose to the maximally exposed member of the public, based on a total activity of 8.89 mCi disposed in that year, to be 2.61 mrem/yr. The staff has reviewed the licensee's calculational methods and assumptions and found that they are consistent with NUREG-1101, Onsite Disposal of Radioactive Waste, Volumes 1 and 2, November 1986 and February 1987, respectively. The staff finds the assessment methodology acceptable. For comparison, the radiation from the naturally occurring radionuclides in soils and rocks plus cosmic radiation gives a person in Michigan a whole-body dose rate of about 89 mrem per year outdoors. Subsequent licensee sampling in 1991 identified no detectable activity. The staff evaluated the licensee's sampling and analysis methodology and finds it acceptable. The results, of the 1991 re-sampling by the licensee, confirm that the environmental impact of the 1982 disposal was very small.

Based on the above the staff finds that the potential environmental impacts of leaving the contaminated sludge in place are insignificant. With regard to the non-radiological impacts, the staff has determined that leaving the soil in place represents the least impact to the environment.

Information	PMP-6010.OSD.001	Rev. 15	Page 98 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.24	Safety Evaluation By The Office Of Nuclear Reactor Regulation		Pages: 96 - 98

5. CONCLUSION

Based on the staff's review of the licensee's discussion, the staff finds the licensee's proposal to retain the material in its present location as documented in this Safety Evaluation acceptable. Also, this Safety Evaluation shall be permanently incorporated as an appendix to the licensee's Offsite Dose Calculation Manual (ODCM), and any future modifications shall be reported to NRC in accordance with the applicable ODCM change protocol.

<sup>1</sup> I&M letter from E. E. Fitzpatrick to the NRC Document Control Desk, September 29, 1993

Therefore, the licensee's proposal to consider the slightly contaminated sludge disposed by retention in place in the manner described in the Donald C. Cook Nuclear Plant submittals date October 9, 1991, October 23, 1991, September 3, 1993, and September 29, 1993, is acceptable.

The guidelines used by the NRC staff for onsite disposal of licensed material and the staff's evaluation of how each guideline has been satisfied are given in Table 3.

Pursuant to 10 CFR 51.32, the Commission has determined that granting of this approval will have no significant impact on the environment (October 31, 1994, 59 FR 54477).

Principal Contributor: J. Minns

Date: November 10, 1994

**TABLE 3**

20.2002 GUIDELINE FOR ONSITE DISPOSAL <sup>2</sup>	STAFF'S EVALUATION
1. The radioactive material should be disposed of in such a manner that it is unlikely that the material would be recycled.	1. Due to the nature of the disposed material, recycling to the general public is not considered likely.
2. Doses to the total body and any body organ of a maximally exposed individuals (a member of the general public or a non-occupationally exposed worker) from the probable pathways of exposure to the disposed material should be less than 1 mrem/year.	2. This guideline was addressed in Table 2. Although the 2.61 mrem/yr is greater than staff's guidelines, the staff finds it acceptable due to 9 yrs decay following analysis and the expected lack of activity detected in the 1991 survey.
3. Doses to the total body and any body organ of an inadvertent intruder from the probable pathways of exposure should be less than 5 mrem/year.	3. Because the material will be land-spread, the staff considers the maximally exposed individual scenario to also address the intruder scenario.
4. Doses to the total body and any body organ of an individual from assumed recycling of the disposed material at the time the disposal site is released from regulatory control from all likely pathways of exposure should be less than 1 mrem.	4. Even if recycling were to occur after release from regulatory control, the dose to a maximally exposed member of the public is not expected to exceed 1 mrem/year, based on exposure scenarios considered in this analysis.

<sup>2</sup> E. F. Branagan, Jr. and F. J. Congel, "Disposal of Contaminated Radioactive Wastes from Nuclear Power Plants," presented at the Health Physics Society's Mid-Year Symposium on Health Physics Consideration in Decontamination/Decommissioning, Knoxville, Tennessee, February 1986, (CONF-860203).

<b>Information</b>	<b>PMP-6010.OSD.001</b>	<b>Rev. 15</b>	<b>Page 99 of 102</b>
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.25	Approval To Retain Contaminated Concrete On-Site at Donald C. Cook Nuclear Plant		Pages: 99 - 102

(This is a 10 CFR 50.75 (g) item)  
[Ref. 5.2.1t]

1. Environmental Assessment and Finding of No Significant Impact

The U.S. Nuclear Regulatory Commission (the Commission) is considering the approval of a procedure for the disposal of contaminated concrete at the Donald C. Cook Nuclear Plant, pursuant to 10 CFR 20.302, as requested by Indiana Michigan Power Company (the licensee). Donald C. Cook Nuclear Plant is located in Berrien County, Michigan.

2. Environmental Assessment

2.1 Identification of Proposed Action

The proposed action would approve the onsite disposal of contaminated concrete resulting from the replacement of the steam generators in Donald C. Cook Nuclear Plant Unit No. 2.

2.2 The Need for the Proposed Action

To provide access for complete replacement of the four steam generator lower assemblies, a large opening will be cut in each of the reinforced concrete doghouses surrounding the steam generators. Large sections of reinforced concrete will need to be removed from the Unit 2 steam generator doghouse enclosures and must be disposed of. The licensee proposes to decontaminate the concrete to the extent practical. Following decontamination of the concrete, the licensee intends to dispose of the concrete outside the protected area fence, but within the Donald C. Cook Nuclear Plant site boundary. The chosen site is presently the site of concrete spoils and other construction remnants left from the construction of the plant.

2.3 Environmental Impacts of the Proposed Action

By letter dated February 29, 1988 the licensee submitted an application for the onsite disposal of contaminated concrete slabs, a licensed material not previously considered by the Commission's staff in the Donald C. Cook Nuclear Plant Final Environmental Statement (FES) dated August 1973. The application, prepared in accordance with 10 CFR 20.302(a), contains a detailed description of the licensed material, thoroughly analyzes and evaluates the information pertinent to the effects on the environment of the disposal of the licensed material, and commits the licensee to follow specific procedures to minimize the risk of unexpected or hazardous exposure.

The proposed action would allow the licensee to retain contaminated concrete on site at the Donald C. Cook Nuclear Plant. Large sections of reinforced concrete will be removed from the Donald C. Cook Nuclear Plant Unit No. 2 steam generator doghouse enclosures and must be disposed of. Decontamination by mechanical removal of paint, and surface concrete to a depth of 1/16", will eliminate the majority of the contamination accumulated in the concrete. However, the concrete sections will have trace quantities of Cobalt-60 (Co-60), Cesium-134 (Cs-134), and Cesium-137 (Cs-137) distributed in the remaining outer surfaces. The concrete will be removed in 24 to 30 large slabs ranging in weight from 25 to 70 tons each. It is planned to dispose of the material in this form, as large structural segments. The roof sections are three feet thick, and the wall portions are two feet thick. The estimated total weight of the slabs is 920 tons. This total includes an estimated 65 tons of reinforcing steel and steel structural supports.

The outer surfaces of the doghouse structures are in the upper containment volume. The surfaces were painted with nuclear Grade I paint prior to operation of the unit. However, the airborne contamination inside containment, arising due to normal operations, has brought small amounts of radioactive contamination into contact with the surfaces. Over the ten years of plant operation, the small amounts of contamination have diffused through the paint and into the outer layer of concrete. Inside the doghouse structure, airborne contamination again has contributed to the deposition of radioactivity on the walls.

<b>Information</b>	<b>PMP-6010.OSD.001</b>	<b>Rev. 15</b>	<b>Page 100 of 102</b>
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.25	Approval To Retain Contaminated Concrete On-Site at Donald C. Cook Nuclear Plant		Pages: 99 - 102

Radiological analysis was performed on samples of paints and underlying concrete from the outside wall of the doghouse structures. Three nuclides were found in the concrete: Co-60, Cs-134, and Cs-137. The average of the measured sample concentration of each nuclide is given in the licensee's application and is shown in Table 1. The licensee indicated in the application that the concentrations represent the activity expected in the surface of the concrete when it is disposed of after decontamination. The licensee used maximum measured sample concentration in portions of the radiological impact assessment to insure conservatism in the calculations, and these values are summarized in Table 1 also.

To calculate the total activity present in the concrete, the licensee's estimate was made, based on the sample data, of the amount of diffusion of the radionuclides into the concrete. Diffusion is a physical phenomena generally applied to gaseous and liquid materials 'migrating' into a host material. The amount of diffusion of one material into another is dependent on the properties of both materials, the temperature, and the concentration of the diffusing material at the surface of contact. Water evaporating into air is an example of diffusion. The process of diffusion for the subject concrete was modeled mathematically according to Fick's Law, which is a natural exponential function. The concentration of the diffusing material (that is, the radioisotopes) at the contact surface migrates into the host material, here being the concrete, and gradually decreases with depth from the surface. The mathematical model never reaches zero concentration due to the properties of exponential functions, therefore practically, one chooses a very small cut off point at which it can be assumed the concentration has essentially reached zero. The licensee chose the cut off in this case to be the depth at which the surface activity concentration was decreased by 100,000 times. Actual activity at this level would be impossible to measure and is several times below natural background levels of radiation. This depth was calculated to be approximately one inch. To be more conservative, the licensee assumed that all of the calculated activity in the one-inch of concrete was uniformly near the surface. Based on this conservative assumption it would be contained in the first one-tenth of an inch. This assumption was used in the exposure pathway dose calculations. The licensee calculated the total activity by integrating the concentration to this depth over the entire surface area of the concrete blocks.

The licensee indicated in the application that several conservative assumptions were made in calculating the total activity content of the concrete. First, the surface areas as calculated based on total volume of concrete and a uniform thickness of two feet. This effectively creates approximately 25 percent more potentially contaminated surface area than actually exists. Second, all surfaces were assumed to be equally contaminated. Due to the presence of the protective steel liner plate, any contamination on the inner concrete surface is expected to be small relative to that measured on the outer surface. Table 1 indicates the licensee's total calculated activity of each radionuclide based on both the average of the sample concentrations and on the maximum concentrations measured in the surface.

**TABLE 1**

<b>Nuclide</b>	<b>Half-life (years)</b>	<b>Ave. Conc. (pCi/gm)</b>	<b>Max. Conc. (pCi/gm)</b>	<b>Ave. Based Activity (μCi)</b>	<b>Max. Based Activity (μCi)</b>
Co-60	5.3	1.33	2.7	7.8	16.0
Cs-134	2.1	0.33	0.7	1.9	4.1
Cs-137	30.0	2.6	7.7	15.4	45.6
Total		4.26	11.1	25.1	65.7



Information	PMP-6010.OSD.001	Rev. 15	Page 101 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.25	Approval To Retain Contaminated Concrete On-Site at Donald C. Cook Nuclear Plant		Pages: 99 - 102

Prior to disposal, items embedded in the concrete such as equipment supports, anchor bolts, and conduit and piping restraints shall be cut off flush with the concrete surface. The painted surface of the concrete will be removed to a minimum depth of 1/16" into the underlying concrete by a mechanical scarifying process.

The decontaminated blocks will again be surveyed prior to release for disposal. Any areas on the blocks which do not meet radiation protection release criteria, or exceed the assumptions made in the radiation dose evaluation of the application, will be further decontaminated prior to release for disposal.

The proposed disposal method for the concrete blocks is to remove them to an area outside the protected area fence, but within the Donald C. Cook Nuclear Plant site boundary. The Donald C. Cook Nuclear Plant is located in Lake Township, Berrien County, Michigan, approximately 11 miles south-southwest of the center of Benton Harbor, Michigan. The plant site consists of approximately 650 acres situated along the eastern shore of Lake Michigan. A more detailed description of the plant site area can be found in the "Final Environmental Statement Related to Operation of Donald C. Cook Nuclear Plant Units 1 and 2" (FES), August 1973.

The chosen site is presently the site of concrete spoils and other construction remnants left from the construction of the plant. The site is more than 200 yards away from any area occupied by plant personnel on any regular basis, and is 150 yards away from Thornton Road. Earthen mounds also surround the site on all sides, with the exception of the access point.

Once the concrete is in place, it will not be visible except at the access point. It has not yet been determined whether or not the slabs will be stacked or individually lain down, but the maximum actual area occupied by the blocks will be less than 20 x 25 yards.

An evaluation of the potential dose to the plant site worker and to a member of the general public was performed by the licensee to determine the radiological impact of placing the concrete in the proposed location. The calculations were performed using applicable methodologies in Regulatory Guide 1.109, NUREG/CR-3332, and Introduction to Health Physics, Cember.

The licensee, in the application, stated all potential exposure pathways recommended by Regulatory Guide 1.109 were evaluated with the exception of potential dose from incineration of the waste. There is no feasible scenario by which the concrete would be burned. The licensee's evaluation consisted of a determination of the environmental pathways through which radiological exposure could be expected to occur and an evaluation of the radiological consequences of the disposal of the concrete for each of the pathways considered. The following environmental pathways were considered:

- (1) External exposure from concrete - occupational and intruder
- (2) Internal exposure due to release of contaminants to surface and ground water - ingestion of drinking water, fish and other aquatic foods, and well water
- (3) Internal exposure due to agricultural activities on the disposal site following loss of institutional control - ingestion of vegetables, meat and dairy products
- (4) Internal exposure due to inhalation of re-suspended contaminated concrete dusts - occupational, and intruder following loss of institutional control

This evaluation demonstrates that any doses to occupational workers, intruders, and members of the general public would be very small, and far lower than the levels permitted for unrestricted areas by 10 CFR 20.105.

Information	PMP-6010.OSD.001	Rev. 15	Page 102 of 102
<b>OFF-SITE DOSE CALCULATION MANUAL</b>			
Attachment 3.25	Approval To Retain Contaminated Concrete On-Site at Donald C. Cook Nuclear Plant		Pages: 99 - 102

In the FES for the operation of Donald C. Cook Nuclear Plant, the Commission's staff considered the potential effects on the environment of licensed material from operation of the plant and, in the summary of radiological impacts, concluded that "... the routine operation of the Cook Station is expected to add only a small increment to the natural background dose." "... these doses correspond to concentrations which are a small percentage of permissible standards set forth in 10 CFR Part 20."

Since the disposal proposed in the licensee's application dated February 29, 1988, involves licensed materials containing much less than 0.1 percent of the radioactivity, primarily Co-60, Cs-134, and Cs-137, already considered acceptable in the FES, and involve exposure pathways much less significant and radiochemical forms much less mobile than those considered in the FES, the Commission's staff considers this site-specific application for the Donald C. Cook Nuclear Plant to have insignificant radiological impact. The Commission's staff accepts the evaluations of the licensee documented in Attachment 3.1, Dose Factors for Various Pathways, of the February 29, 1988, application as further assurance that the proposed disposal procedures will have a negligible effect on the environment and on the general population in comparison to normal background radiation.

#### 2.4 Alternatives to the Proposed Action

An alternative to on-site burial would be to ship and dispose of the concrete slabs at an offsite licensed disposal site. The overall benefit from the proposed method for the disposal of these slightly contaminated concrete slabs will be a cost saving of approximately \$1.6 million and a saving of burial site space of approximately 16,000 cubic feet, which can be used for other radwaste of higher activity. The alternative would not be environmentally preferable.

#### 2.5 Alternative Use of Resources

This action involves no use of resources not previously considered in connection with the "Final Environmental Statement Related to Operation of Donald C. Cook Nuclear Plant Units 1 and 2" dated, August 1973.

#### 2.6 Agencies and Persons Consulted

The Commission's staff reviewed the licensee's request and did not consult other agencies or persons.

### 3. Finding of No Significant Impact

The Commission has determined not to prepare an environmental impact statement for the proposed action.

Based upon the foregoing environmental assessment, the Commission concludes that the proposed action will not have a significant effect on the quality of the human environment.

For further details with respect to this action, see the application dated February 29, 1988, which is available for public inspection at the Commission's Public Document Room, 1717 H Street, NW., Washington, DC, and at the Maude Preston Palenski Memorial Library, 500 Market Street, St. Joseph, Michigan 49805

Dated at Rockville, Maryland, this 23(rd) day of August 1988.

For the Nuclear Regulatory Commission

Martin J. Virgilio, Director  
Project Directorate III-1  
Division of Reactor Projects - III, IV, V & Special Projects