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T.S. 6.9.1.8

April 29, 2005

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

Limerick Generating Station, Unit 1 and 2
Facility Operating License Nos. NPF-39 and NPF-85
NRC Docket Nos. 50-352 and 50-353

Subject: 2004 Annual Radioactive Effluent Release Report

In accordance with Section 6.9.1.8 of Limerick Generating Station (LGS) Technical Specifications and Section 6.2 of the Offsite Dose Calculation Manual, attached is the 2004 Annual Radioactive Effluent Release Report No. 30 for LGS. In addition, a complete copy of revision 22 to the Limerick Offsite Dose Calculation Manual is attached.

If you have any questions or require additional information, please do not hesitate to contact us.

Sincerely,

Ron J. DeGregorio
Vice President-LGS
Exelon Generation Company, LLC

Attachments: 2004 Annual Radioactive Effluent Release Report No. 30 for LGS
Offsite Dose Calculation Manual, Rev 22

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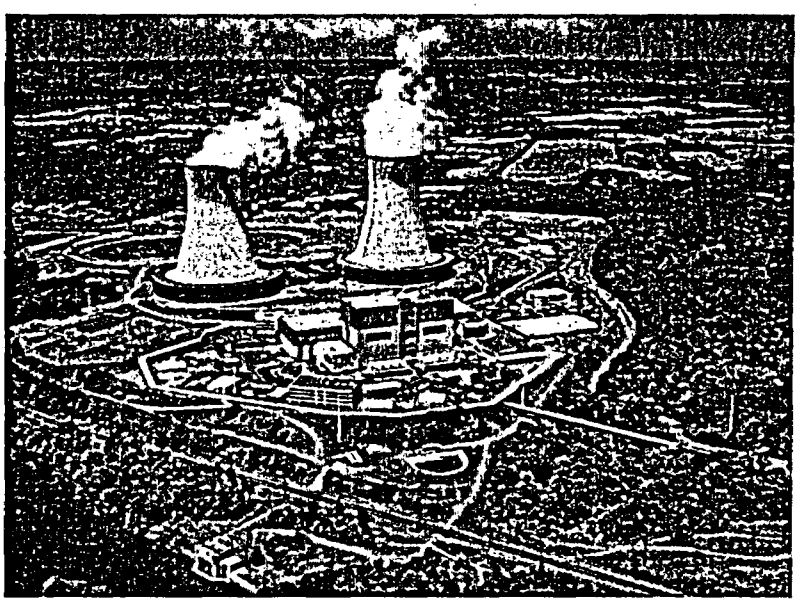

Annual Radioactive Effluent Release Report

2004

Limerick Generating Station

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

NO. 30

January 1, 2004 Through December 31, 2004

EXELON GENERATION COMPANY, LLC

LIMERICK GENERATING STATION
UNITS NO. 1 AND 2

DOCKET NO. 50-352 (Unit 1)

DOCKET NO. 50-353 (Unit 2)

Submitted to
The United States Nuclear Regulatory Commission
Pursuant to
Facility Operating License NPF-39 (Unit 1)
and NPF-85 (Unit 2)

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

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SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

1. Introduction

In accordance with the reporting requirements of Technical Specification 6.9.1.8 applicable during the reporting period, this report summarizes the effluent release data for Limerick Generating Station Units 1 and 2 for the period January 1, 2004 through December 31, 2004. This submittal complies with the format described in Regulatory Guide 1.21, "Measuring, Evaluating and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water Cooled Nuclear Power Plants", Revision 1, June, 1974.

All vendor results were received and included in the report calculations. Therefore the 2004 report is complete.

2. Supplemental Information

A. Regulatory Limits

	Limit	Units	Receptor	ODCM Control
1. Noble Gases:				
a.	≤ 500	mRem/Yr	- Total body	3.2.2.1.a
	≤ 3000	mRem/Yr	- Skin	
b.	≤ 10	mRad	- Air gamma	Quarterly air dose limits
	≤ 20	mRad	- Air beta	3.2.2.2.a
c.	≤ 20	mRad	- Air gamma	Yearly air dose limits
	≤ 40	mRad	- Air beta	3.2.2.2.b
2. Iodines, Tritium, Particulates with Half Life >8 days:				
a.	≤ 1500	mRem/Yr	- Any organ	3.2.2.1.b
b.	≤ 15	mRem	- Any organ	Quarterly dose limits 3.2.2.3.a
c.	≤ 30	mRem	- Any organ	Yearly dose limits 3.2.2.3.b
3. Liquid Effluents				
a.	Concentration 10 CFR 20, Appendix B, Table II Col. 2 (pre 1994)			3.2.1.1
b.	≤ 3	mRem	- total body	Quarterly dose limits
	≤ 10	mRem	- any organ	3.2.1.2.a
c.	≤ 6	mRem	- total body	Yearly dose limits
	≤ 20	mRem	- any organ	3.2.1.2.b
4. 40CFR 190				
	≤ 25	mRem	- total body	Yearly dose limits
	≤ 75	mRem	- thyroid	3.2.3

B. Maximum Permissible Concentrations:

Gaseous dose rates rather than effluent concentrations are used to calculate permissible release rates for gaseous releases. The maximum permissible dose rates for gaseous releases are defined in ODCM Controls 3.2.2.2.a and 3.2.2.2.b.

The Maximum Permissible Concentrations (MPC) specified in 10 CFR 20, Appendix B, Table II, Column 2 (pre 1994) for identified nuclides, were used to calculate permissible release rates and concentrations for liquid release per the Limerick Offsite Dose Calculation Manual Control 3.2.1.1. The total activity concentration for all dissolved or entrained gases is limited to $\leq$ 2E-04 µCi/ml.

C. Average Energy ($\bar{E}$):

The Limerick ODCM limits the dose equivalent rates due to the release of noble gases to less than or equal to 500 mrem/year to the total body and less than or equal to 3000 mrem/year to the skin. Therefore, the average beta and gamma energies ($\bar{E}$) of the radionuclide mixture in releases of fission and activation gases as described in Regulatory Guide 1.21, "Measuring, Evaluation, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants," are not applicable to Limerick.

D. Measurements and Approximations of Total Radioactivity:

1. Fission and Activation Gases

The method used for Gamma Isotopic Analysis is the Canberra Genie System with a gas Marinelli beaker. Airborne effluent gaseous activity was continuously monitored and recorded in accordance with ODCM Table 4.2-2. Additional vent grab samples are taken and analyzed at least monthly to determine the isotopic mixture of noble gas activity released for the month. The data from the noble gas radiation monitor was analyzed to report noble gas effluent activities. When no activity was found in the grab isotopic analysis, the isotopic mixture was assumed to be that evaluated in the UFSAR (Section 11.5, Table 11.5-4). If activity was found in the grab isotopic analysis, the isotopic mixture for the Noble Gas Monitor was determined from that isotopic mixture. When no isotopic activity was identified in the grab noble gas samples, the noble gas radiation monitor 15-minute average data for one-hour prior to and one-hour post noble gas grab sampling were used to determine monitor background for the month. The mean plus two standard deviations was used as background for each Noble Gas Monitor. When activity was identified the background determination was made from the last month that no activity was found.

2. Iodines and Particulates

The method used is the Canberra Genie System with a particulate filter (47 mm) or charcoal cartridge, respectively. Particulate and iodine activity was continuously sampled and analyzed in accordance with ODCM Table 4.2-2. Charcoal and particulate samples are taken from the North Stack, Unit 1 South Stack, Unit 2 South Stack and the Hot Maintenance Shop exhausts and analyzed at least weekly to determine the total activity released from the plant based on the highest vent flow rates recorded for sampling period.

3. Liquid Effluents

Each batch of liquid effluent was sampled and analyzed for gamma isotopic activity in accordance with ODCM Table 4.2-1 prior to release. The total activity of each released

batch was determined by multiplying each nuclide's concentration by the total volume discharged and then summing. The total activity released during a month was then determined by summing the activity content of all batch releases discharged during the month.

4. Tritium in Liquid and Gaseous Effluents:

Tritium in Liquid Effluents is analyzed using a Liquid Scintillation Counter.

Air from stack effluents was passed through two bubblers in series and an aliquot of the water from each bubbler was analyzed using a Liquid Scintillation Counter.

5. Composite Samples and Lower Limit of Detection (LLD)

Particulate air samples were composited quarterly and analyzed for gross alpha, Fe-55, Sr--89 and Sr-90. Liquid radwaste samples were composited monthly and quarterly and analyzed for gross alpha (monthly) and Fe-55, Sr-89 and Sr-90 (quarterly). These composites submitted to an offsite vendor laboratory for analysis. The ODCM required lower limit of detection for airborne and liquid releases are as follows:

Airborne:	**LLD**
Gross Alpha	1E-11 uCi/cc
Sr-89, Sr-90	1E-11 uCi/cc
I-131	1E-12 uCi/cc
I-133	1E-10 uCi/cc
Principal Gamma Emitters (Mn-54, Fe-59, Co-58, Co-60, Zn-65, I-131, Cs-134, Cs-137,Ce-141, Ce-144)	1E-11 uCi/cc
Noble Gas (Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, Xe-135m, Xe-138)	1E-06 uCi/cc
H-3	1E-06 uCi/cc
Liquid:	
Principal Gamma Emitters (Mn-54, Fe-59, Co-58, Co-60, Zn-65, Cs-134, Cs-137, Ce-141, Ce-144)	5E-07 uCi/ml
I-131	1E-06 uCi/ml
Entrained Gases (Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, Xe-135m, Xe-138)	1E-05 uCi/ml
H-3	1E-05 uCi/ml
Gross Alpha	1E-07 uCi/ml
Sr-89, Sr-90	5E-08 uCi/ml
Fe-55	1E-06 uCi/ml

6. Estimated Total Error Present

Procedure CY-AA-170-2100, Estimated Errors of Effluent Measurements, provides the methodology to obtain an overall estimate of the error associated with radioactive effluents.

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

E. Batch Releases:

1. Liquid

	Qtr 1	Qtr 2	Qtr 3	Qtr 4
Number of Batch Releases	5.00E+01	2.70E+01	3.10E+01	1.80E+01
Total time period for batch releases (min)	4.82E+04	3.20E+04	1.98E+03	1.21E+03
Maximum time period for batch release (min)	4.46E+04	3.02E+04	7.80E+01	8.00E+01
Average time period for batch release (min)	9.65E+02	1.18E+03	6.40E+01	6.75E+01
Minimum time period for batch release (min)	3.23E+01	4.91E+01	1.78E+01	4.43E+01
Average stream flow (Schuylkill River) during periods of release of effluents into a flowing stream (gpm)	1.20E+06	1.18E+06	2.83E+06	1.92E+06

2. Gaseous

Oil Incineration				
	Qtr 1	Qtr 2	Qtr 3	Qtr 4
Number of Batch Releases	1.00E+00	0.00E+00	0.00E+00	0.00E+00
Total time period for batch releases (min)	4.43E+03	0.00E+00	0.00E+00	0.00E+00
Maximum time period for batch release (min)	4.43E+03	0.00E+00	0.00E+00	0.00E+00
Average time period for batch release (min)	4.43E+03	0.00E+00	0.00E+00	0.00E+00
Minimum time period for batch release (min)	4.43E+03	0.00E+00	0.00E+00	0.00E+00

Other Batch Releases				
	Qtr 1	Qtr 2	Qtr 3	Qtr 4
Number of Batch Releases	4.00E+00	4.00E+00	2.00E+00	0.00E+00
Total time period for batch releases (min)	3.79E+04	4.03E+04	1.28E+04	0.00E+00
Maximum time period for batch release (min)	7.51E+03	1.01E+04	3.54E+03	0.00E+00
Average time period for batch release (min)	9.48E+03	1.01E+04	6.41E+03	0.00E+00
Minimum time period for batch release (min)	1.00E+04	1.01E+04	9.28E+03	0.00E+00

F. Abnormal Releases:

1. Liquid	Qtr 1	Qtr 2	Qtr 3	Qtr 4
Number of Releases	1	1	0	0
Total Activity Released (Ci)	1.71E-02	6.72E-02	0	0
2. Gaseous				
Number of Releases	0	0	0	0
Total Activity Released (Ci)	0	0	0	0

Hold Pond Contaminated with Tritium

On April 16, 2004 the tritium analysis for the March 2004 Hold Pond composite sample for the non-contaminated systems (I.E. 80-10) showed tritium activity at 4.58E-07 uCi/ml. Immediately, daily Hold Pond samples were analyzed for tritium prior to discharge. The investigation (CR00215401) indicated that a small leak to the Hold Pond was occurring from the Unit 1 Condensate Storage Tank. Specifically, the leak was intermittent and traced to the CST fill line valve 008-1022. The

valve was repaired on 4/23/04. To document this abnormal release the total gallons released from the Hold Pond for March was multiplied by the concentration found. Similarly, the March activity was also used for each of the daily discharges from April 1 through April 15, 2004. The daily tritium activity value was used for April 16 through April 22, 2004. The summary of tritium activity released is as follows:

Month	No. of Release Days	Gallons Released	Average Activity uCi/ml	Curies Released
March	31	9.88E+06	4.58E-07	1.71E-02
April	21	4.27E+06	4.15E-7	6.72E-02

The total curies released from the Station as reported in Appendix A include these releases.

G. ODCM and PCP Revisions

The station's ODCM was revised to comply with the standard procedure CY-AA-170-300, Offsite Dose Calculation Manual Administration. There were no changes to the Process Control Program during this reporting period.

H. Compliance to 40 CFR 190 Limits

The radioactive material released during this reporting period and the doses listed in this report were within the limits of the ODCM and 40CFR Part 190.

Appendix A
Effluent and Waste Disposal Summary

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

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SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

TABLE 1 GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES PERIOD 2004

A. FISSION AND ACTIVATION GASSES

	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Est. Total Error %
1. Total Release	Ci	1.80E+01	1.20E+01	5.91E+00	1.23E+01	3.66E+01
2. Average Release Rate for Period	uCi/sec	1.99E+00	1.53E+00	7.51E-01	1.55E+00	
3. Percent of ODCM Limit - Gamma	%	2.90E-01	1.86E-01	6.02E-02	1.22E-01	
- Beta		8.75E-02	5.50E-02	1.87E-04	3.79E-02	

B. IODINES

	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Est. Total Error %
1. Total – I-131	Ci	1.16E-04	7.99E-05	< LLD	< LLD	2.04E+01
2. Average Release Rate for Period	uCi/sec	1.28E-05	1.02E-05	< LLD	< LLD	
3. Percent of Limit	%	*	*	*	*	

C. PARTICULATES

	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Est. Total Error %
1. Particulates with T 1/2 > 8 days	Ci	2.39E-05	1.55E-06	3.42E-05	< LLD	2.26E+01
2. Average Release Rate for Period	uCi/sec	2.64E-06	1.98E-07	4.34E-06	< LLD	
3. Percent of ODCM Limit	%	*	*	*	*	
4. Gross Alpha	Ci	< LLD	< LLD	< LLD	< LLD	

D. TRITIUM

	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Est. Total Error %
1. Total Release	Ci	1.65E+00	4.54E+00	< LLD	< LLD	1.57E+01
2. Average Release Rate for Period	uCi/sec	1.82E-01	5.79E-01	< LLD	< LLD	
3. Percent of ODCM Limit	%	*	*	*	*	

E. Iodine 131 & 133, Tritium & Particulate

	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4
1. Percent of ODCM Limit	%	3.67E-02	7.93E-02	4.15E-05	< LLD

* ODCM Limit is for combined Iodine, tritium and particulate only, which is shown in Item E.

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

TABLE 2 GASEOUS EFFLUENTS FOR RELEASE POINT – NORTH STACK PERIOD 2004

1. FISSION AND ACTIVATION GASSES

Nuclide Released	Continuous Mode				
	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4
AR-41	Ci	< LLD	< LLD	< LLD	< LLD
KR-83M	Ci	< LLD	< LLD	< LLD	< LLD
KR-85	Ci	1.68E+00	5.12E-01	1.42E-02	5.03E-03
KR-85M	Ci	2.40E-01	1.36E-01	3.75E-03	1.33E-03
KR-87	Ci	4.20E-01	2.38E-01	6.57E-03	2.33E-03
KR-88	Ci	7.42E-01	4.20E-01	1.16E-02	4.12E-03
KR-89	Ci	< LLD	< LLD	< LLD	< LLD
KR-90	Ci	< LLD	< LLD	< LLD	< LLD
XE-131M	Ci	2.27E-02	1.28E-02	3.55E-04	1.26E-04
XE-133	Ci	8.45E-02	4.78E-02	1.32E-03	4.69E-04
XE-133M	Ci	< LLD	< LLD	< LLD	< LLD
XE-135	Ci	3.30E+00	1.87E+00	5.17E-02	1.84E-02
XE-135M	Ci	2.11E+00	1.19E+00	3.30E-02	1.17E-02
XE-137	Ci	< LLD	< LLD	< LLD	< LLD
XE-138	Ci	4.52E+00	2.56E+00	7.07E-02	2.51E-02
Total for Period	Ci	1.31E+01	6.98E+00	1.93E-01	6.86E-02

2. IODINES

Nuclide Released	Continuous Mode				
	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4
I-130	Ci	< LLD	< LLD	< LLD	< LLD
I-131	Ci	3.18E-05	< LLD	< LLD	< LLD
I-132	Ci	< LLD	< LLD	< LLD	< LLD
I-133	Ci	< LLD	< LLD	< LLD	< LLD
I-134	Ci	< LLD	< LLD	< LLD	< LLD
I-135	Ci	< LLD	< LLD	< LLD	< LLD
Total for Period	Ci	3.18E-05	< LLD	< LLD	< LLD

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

TABLE 2 GASEOUS EFFLUENTS FOR RELEASE POINT – NORTH STACK PERIOD 2004

3. PARTICULATES (T 1/2 > 8 DAYS)

Nuclide Released	Continuous Mode				
	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4
CR-51	Ci	< LLD	< LLD	< LLD	< LLD
MN-54	Ci	< LLD	< LLD	< LLD	< LLD
FE-55	Ci	< LLD	< LLD	< LLD	< LLD
FE-59	Ci	< LLD	< LLD	< LLD	< LLD
CO-58	Ci	< LLD	< LLD	< LLD	< LLD
CO-60	Ci	< LLD	< LLD	< LLD	< LLD
NI-63	Ci	< LLD	< LLD	< LLD	< LLD
ZN-65	Ci	< LLD	< LLD	< LLD	< LLD
RB-86	Ci	< LLD	< LLD	< LLD	< LLD
SR-89	Ci	< LLD	< LLD	< LLD	< LLD
SR-90	Ci	< LLD	< LLD	< LLD	< LLD
Y-91	Ci	< LLD	< LLD	< LLD	< LLD
ZR-95	Ci	< LLD	< LLD	< LLD	< LLD
NB-95	Ci	< LLD	< LLD	< LLD	< LLD
RU-103	Ci	< LLD	< LLD	< LLD	< LLD
RU-106	Ci	< LLD	< LLD	< LLD	< LLD
AG-110M	Ci	< LLD	< LLD	< LLD	< LLD
TE-125M	Ci	< LLD	< LLD	< LLD	< LLD
TE-127M	Ci	< LLD	< LLD	< LLD	< LLD
TE-129M	Ci	< LLD	< LLD	< LLD	< LLD
CS-134	Ci	< LLD	< LLD	< LLD	< LLD
CS-136	Ci	< LLD	< LLD	< LLD	< LLD
CS-137	Ci	< LLD	< LLD	< LLD	< LLD
BA-140	Ci	< LLD	< LLD	< LLD	< LLD
CE-141	Ci	< LLD	< LLD	< LLD	< LLD
CE-144	Ci	< LLD	< LLD	< LLD	< LLD
PR-143	Ci	< LLD	< LLD	< LLD	< LLD
ND-147	Ci	< LLD	< LLD	3.30E-05	< LLD
Total for Period	Ci	< LLD	< LLD	3.30E-05	< LLD

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

TABLE 3 GASEOUS EFFLUENTS FOR RELEASE POINT – UNIT 1 SOUTH STACK PERIOD 2004

1. FISSION AND ACTIVATION GASSES

Nuclide Released	Continuous Mode				
	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4
AR-41	Ci	1.23E-04	3.27E-01	3.98E-01	3.33E-01
KR-83M	Ci	< LLD	< LLD	< LLD	< LLD
KR-85	Ci	< LLD	< LLD	< LLD	< LLD
KR-85M	Ci	2.95E-05	7.82E-02	9.52E-02	7.98E-02
KR-87	Ci	2.95E-05	7.82E-02	9.52E-02	7.98E-02
KR-88	Ci	2.95E-05	7.82E-02	9.52E-02	7.98E-02
KR-89	Ci	< LLD	< LLD	< LLD	< LLD
KR-90	Ci	< LLD	< LLD	< LLD	< LLD
XE-131M	Ci	< LLD	< LLD	< LLD	< LLD
XE-133	Ci	6.40E-04	1.70E+00	2.06E+00	1.73E+00
XE-133M	Ci	< LLD	< LLD	< LLD	< LLD
XE-135	Ci	3.34E-04	8.86E-01	1.08E+00	9.05E-01
XE-135M	Ci	4.53E-04	1.20E+00	1.46E+00	1.22E+00
XE-137	Ci	< LLD	< LLD	< LLD	< LLD
XE-138	Ci	6.88E-05	1.83E-01	2.23E-01	1.87E-01
Total for Period	Ci	1.71E-03	4.53E+00	5.51E+00	4.62E+00

2. IODINES

Nuclide Released	Continuous Mode				
	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4
I-130	Ci	< LLD	< LLD	< LLD	< LLD
I-131	Ci	< LLD	< LLD	< LLD	< LLD
I-132	Ci	< LLD	< LLD	< LLD	< LLD
I-133	Ci	< LLD	< LLD	< LLD	< LLD
I-134	Ci	< LLD	< LLD	< LLD	< LLD
I-135	Ci	< LLD	< LLD	< LLD	< LLD
Total for Period	Ci	< LLD	< LLD	< LLD	< LLD

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

TABLE 3 GASEOUS EFFLUENTS FOR RELEASE POINT – UNIT 1 SOUTH STACK PERIOD 2004

3. PARTICULATES (T 1/2 > 8 DAYS)

Nuclide Released	Continuous Mode				
	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4
CR-51	Ci	< LLD	< LLD	< LLD	< LLD
MN-54	Ci	< LLD	< LLD	< LLD	< LLD
FE-55	Ci	< LLD	< LLD	< LLD	< LLD
FE-59	Ci	< LLD	< LLD	< LLD	< LLD
CO-58	Ci	< LLD	< LLD	< LLD	< LLD
CO-60	Ci	< LLD	< LLD	< LLD	< LLD
NI-63	Ci	< LLD	< LLD	< LLD	< LLD
ZN-65	Ci	< LLD	< LLD	< LLD	< LLD
RB-86	Ci	< LLD	< LLD	< LLD	< LLD
SR-89	Ci	< LLD	< LLD	< LLD	< LLD
SR-90	Ci	< LLD	< LLD	< LLD	< LLD
Y-91	Ci	< LLD	< LLD	< LLD	< LLD
ZR-95	Ci	< LLD	< LLD	< LLD	< LLD
NB-95	Ci	< LLD	< LLD	< LLD	< LLD
RU-103	Ci	< LLD	< LLD	< LLD	< LLD
RU-106	Ci	< LLD	< LLD	< LLD	< LLD
AG-110M	Ci	< LLD	< LLD	< LLD	< LLD
TE-125M	Ci	< LLD	< LLD	< LLD	< LLD
TE-127M	Ci	< LLD	< LLD	< LLD	< LLD
TE-129M	Ci	< LLD	< LLD	< LLD	< LLD
CS-134	Ci	< LLD	< LLD	< LLD	< LLD
CS-136	Ci	< LLD	< LLD	< LLD	< LLD
CS-137	Ci	< LLD	< LLD	< LLD	< LLD
BA-140	Ci	< LLD	< LLD	< LLD	< LLD
CE-141	Ci	< LLD	< LLD	< LLD	< LLD
CE-144	Ci	< LLD	< LLD	< LLD	< LLD
PR-143	Ci	< LLD	< LLD	< LLD	< LLD
ND-147	Ci	< LLD	< LLD	< LLD	< LLD
Total for Period	Ci	< LLD	< LLD	< LLD	< LLD

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

TABLE 4 GASEOUS EFFLUENTS FOR RELEASE POINT – UNIT 2 SOUTH STACK PERIOD 2004

1. FISSION AND ACTIVATION GASSES

Nuclide Released	Continuous Mode				
	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4
AR-41	Ci	3.53E-01	3.65E-02	1.46E-02	5.48E-01
KR-83M	Ci	< LLD	< LLD	< LLD	< LLD
KR-85	Ci	< LLD	< LLD	< LLD	< LLD
KR-85M	Ci	8.45E-02	8.75E-03	3.50E-03	1.31E-01
KR-87	Ci	8.45E-02	8.75E-03	3.50E-03	1.31E-01
KR-88	Ci	8.45E-02	8.75E-03	3.50E-03	1.31E-01
KR-89	Ci	< LLD	< LLD	< LLD	< LLD
KR-90	Ci	< LLD	< LLD	< LLD	< LLD
XE-131M	Ci	< LLD	< LLD	< LLD	< LLD
XE-133	Ci	1.83E+00	1.90E-01	7.59E-02	2.84E+00
XE-133M	Ci	< LLD	< LLD	< LLD	< LLD
XE-135	Ci	9.57E-01	9.92E-02	3.97E-02	1.49E+00
XE-135M	Ci	1.30E+00	1.34E-01	5.38E-02	2.01E+00
XE-137	Ci	< LLD	< LLD	< LLD	< LLD
XE-138	Ci	1.97E-01	2.04E-02	8.19E-03	3.07E-01
Total for Period	Ci	4.89E+00	5.06E-01	2.03E-01	7.59E+00

2. IODINES

Nuclide Released	Continuous Mode				
	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4
I-130	Ci	< LLD	< LLD	< LLD	< LLD
I-131	Ci	8.38E-05	7.99E-05	< LLD	< LLD
I-132	Ci	< LLD	< LLD	< LLD	< LLD
I-133	Ci	< LLD	< LLD	< LLD	< LLD
I-134	Ci	< LLD	< LLD	< LLD	< LLD
I-135	Ci	< LLD	< LLD	< LLD	< LLD
Total for Period	Ci	8.38E-05	7.99E-05	< LLD	< LLD

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

TABLE 4 GASEOUS EFFLUENTS FOR RELEASE POINT – UNIT 2 SOUTH STACK PERIOD 2004

3. PARTICULATES (T 1/2 > 8 DAYS)

Nuclide Released	Continuous Mode				
	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4
CR-51	Ci	< LLD	< LLD	< LLD	< LLD
MN-54	Ci	2.22E-05	< LLD	< LLD	< LLD
FE-55	Ci	< LLD	< LLD	< LLD	< LLD
FE-59	Ci	< LLD	< LLD	< LLD	< LLD
CO-58	Ci	< LLD	< LLD	< LLD	< LLD
CO-60	Ci	< LLD	< LLD	< LLD	< LLD
NI-63	Ci	< LLD	< LLD	< LLD	< LLD
ZN-65	Ci	< LLD	< LLD	< LLD	< LLD
RB-86	Ci	< LLD	< LLD	< LLD	< LLD
SR-89	Ci	< LLD	< LLD	< LLD	< LLD
SR-90	Ci	< LLD	< LLD	< LLD	< LLD
Y-91	Ci	< LLD	< LLD	< LLD	< LLD
ZR-95	Ci	< LLD	< LLD	< LLD	< LLD
NB-95	Ci	< LLD	< LLD	< LLD	< LLD
RU-103	Ci	< LLD	< LLD	< LLD	< LLD
RU-106	Ci	< LLD	< LLD	< LLD	< LLD
AG-110M	Ci	< LLD	< LLD	< LLD	< LLD
TE-125M	Ci	< LLD	< LLD	< LLD	< LLD
TE-127M	Ci	< LLD	< LLD	< LLD	< LLD
TE-129M	Ci	< LLD	< LLD	< LLD	< LLD
CS-134	Ci	< LLD	< LLD	< LLD	< LLD
CS-136	Ci	< LLD	< LLD	< LLD	< LLD
CS-137	Ci	< LLD	< LLD	< LLD	< LLD
BA-140	Ci	< LLD	< LLD	< LLD	< LLD
CE-141	Ci	< LLD	< LLD	< LLD	< LLD
CE-144	Ci	< LLD	< LLD	< LLD	< LLD
PR-143	Ci	< LLD	< LLD	< LLD	< LLD
ND-147	Ci	< LLD	< LLD	< LLD	< LLD
Total for Period	Ci	2.22E-05	< LLD	< LLD	< LLD

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

TABLE 5 GASEOUS EFFLUENTS FOR RELEASE POINT – HOT MAINTENANCE SHOP PERIOD 2004

1. FISSION AND ACTIVATION GASSES

Nuclide Released	Continuous Mode				
	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4
AR-41	Ci	< LLD	< LLD	< LLD	< LLD
KR-83M	Ci	< LLD	< LLD	< LLD	< LLD
KR-85	Ci	< LLD	< LLD	< LLD	< LLD
KR-85M	Ci	< LLD	< LLD	< LLD	< LLD
KR-87	Ci	< LLD	< LLD	< LLD	< LLD
KR-88	Ci	< LLD	< LLD	< LLD	< LLD
KR-89	Ci	< LLD	< LLD	< LLD	< LLD
KR-90	Ci	< LLD	< LLD	< LLD	< LLD
XE-131M	Ci	< LLD	< LLD	< LLD	< LLD
XE-133	Ci	< LLD	< LLD	< LLD	< LLD
XE-133M	Ci	< LLD	< LLD	< LLD	< LLD
XE-135	Ci	< LLD	< LLD	< LLD	< LLD
XE-135M	Ci	< LLD	< LLD	< LLD	< LLD
XE-137	Ci	< LLD	< LLD	< LLD	< LLD
XE-138	Ci	< LLD	< LLD	< LLD	< LLD
Total for Period	Ci	< LLD	< LLD	< LLD	< LLD

2. IODINES

Nuclide Released	Continuous Mode				
	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4
I-130	Ci	< LLD	< LLD	< LLD	< LLD
I-131	Ci	< LLD	< LLD	< LLD	< LLD
I-132	Ci	< LLD	< LLD	< LLD	< LLD
I-133	Ci	< LLD	< LLD	< LLD	< LLD
I-134	Ci	< LLD	< LLD	< LLD	< LLD
I-135	Ci	< LLD	< LLD	< LLD	< LLD
Total for Period	Ci	< LLD	< LLD	< LLD	< LLD

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

TABLE 5 GASEOUS EFFLUENTS FOR RELEASE POINT – HOT MAINTENANCE SHOP PERIOD 2004

3. PARTICULATES (T 1/2 > 8 DAYS)

Nuclide Released	Continuous Mode				
	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4
CR-51	Ci	< LLD	< LLD	< LLD	< LLD
MN-54	Ci	< LLD	< LLD	< LLD	< LLD
FE-55	Ci	< LLD	< LLD	< LLD	< LLD
FE-59	Ci	< LLD	< LLD	< LLD	< LLD
CO-58	Ci	< LLD	< LLD	< LLD	< LLD
CO-60	Ci	< LLD	< LLD	< LLD	< LLD
NI-63	Ci	< LLD	< LLD	< LLD	< LLD
ZN-65	Ci	< LLD	< LLD	< LLD	< LLD
RB-86	Ci	< LLD	< LLD	< LLD	< LLD
SR-89	Ci	< LLD	< LLD	< LLD	< LLD
SR-90	Ci	< LLD	< LLD	< LLD	< LLD
Y-91	Ci	< LLD	< LLD	< LLD	< LLD
ZR-95	Ci	< LLD	< LLD	< LLD	< LLD
NB-95	Ci	< LLD	< LLD	< LLD	< LLD
RU-103	Ci	< LLD	< LLD	< LLD	< LLD
RU-106	Ci	< LLD	< LLD	< LLD	< LLD
AG-110M	Ci	< LLD	< LLD	< LLD	< LLD
TE-125M	Ci	< LLD	< LLD	< LLD	< LLD
TE-127M	Ci	< LLD	< LLD	< LLD	< LLD
TE-129M	Ci	< LLD	< LLD	< LLD	< LLD
CS-134	Ci	< LLD	< LLD	< LLD	< LLD
CS-136	Ci	< LLD	< LLD	< LLD	< LLD
CS-137	Ci	< LLD	< LLD	< LLD	< LLD
BA-140	Ci	< LLD	< LLD	< LLD	< LLD
CE-141	Ci	< LLD	< LLD	< LLD	< LLD
CE-144	Ci	< LLD	< LLD	< LLD	< LLD
PR-143	Ci	< LLD	< LLD	< LLD	< LLD
ND-147	Ci	< LLD	< LLD	2.28E-07	< LLD
Total for Period	Ci	< LLD	< LLD	2.28E-07	< LLD

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

TABLE 6 GASEOUS EFFLUENTS FOR RELEASE POINT – OIL INCINERATION PERIOD 2004

1. FISSION AND ACTIVATION GASSES

Nuclide Released	Batch Release				
	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4
AR-41	Ci	< LLD	< LLD	< LLD	< LLD
KR-83M	Ci	< LLD	< LLD	< LLD	< LLD
KR-85	Ci	< LLD	< LLD	< LLD	< LLD
KR-85M	Ci	< LLD	< LLD	< LLD	< LLD
KR-87	Ci	< LLD	< LLD	< LLD	< LLD
KR-88	Ci	< LLD	< LLD	< LLD	< LLD
KR-89	Ci	< LLD	< LLD	< LLD	< LLD
KR-90	Ci	< LLD	< LLD	< LLD	< LLD
XE-131M	Ci	< LLD	< LLD	< LLD	< LLD
XE-133	Ci	< LLD	< LLD	< LLD	< LLD
XE-133M	Ci	< LLD	< LLD	< LLD	< LLD
XE-135	Ci	< LLD	< LLD	< LLD	< LLD
XE-135M	Ci	< LLD	< LLD	< LLD	< LLD
XE-137	Ci	< LLD	< LLD	< LLD	< LLD
XE-138	Ci	< LLD	< LLD	< LLD	< LLD
Total for Period	Ci	< LLD	< LLD	< LLD	< LLD

2. IODINES

Nuclide Released	Batch Release				
	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4
I-130	Ci	< LLD	< LLD	< LLD	< LLD
I-131	Ci	< LLD	< LLD	< LLD	< LLD
I-132	Ci	< LLD	< LLD	< LLD	< LLD
I-133	Ci	< LLD	< LLD	< LLD	< LLD
I-134	Ci	< LLD	< LLD	< LLD	< LLD
I-135	Ci	< LLD	< LLD	< LLD	< LLD
Total for Period	Ci	< LLD	< LLD	< LLD	< LLD

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

TABLE 6 GASEOUS EFFLUENTS FOR RELEASE POINT – OIL INCINERATION PERIOD 2004

3. PARTICULATES (T 1/2 > 8 DAYS)

Nuclide Released	Batch Release				
	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4
CR-51	Ci	< LLD	< LLD	< LLD	< LLD
MN-54	Ci	< LLD	< LLD	< LLD	< LLD
FE-55	Ci	< LLD	< LLD	< LLD	< LLD
FE-59	Ci	< LLD	< LLD	< LLD	< LLD
CO-58	Ci	< LLD	< LLD	< LLD	< LLD
CO-60	Ci	1.68E-07	< LLD	< LLD	< LLD
NI-63	Ci	< LLD	< LLD	< LLD	< LLD
ZN-65	Ci	7.72E-08	< LLD	< LLD	< LLD
RB-86	Ci	< LLD	< LLD	< LLD	< LLD
SR-89	Ci	< LLD	< LLD	< LLD	< LLD
SR-90	Ci	< LLD	< LLD	< LLD	< LLD
Y-91	Ci	< LLD	< LLD	< LLD	< LLD
ZR-95	Ci	< LLD	< LLD	< LLD	< LLD
NB-95	Ci	< LLD	< LLD	< LLD	< LLD
RU-103	Ci	< LLD	< LLD	< LLD	< LLD
RU-106	Ci	< LLD	< LLD	< LLD	< LLD
AG-110M	Ci	< LLD	< LLD	< LLD	< LLD
TE-125M	Ci	< LLD	< LLD	< LLD	< LLD
TE-127M	Ci	< LLD	< LLD	< LLD	< LLD
TE-129M	Ci	< LLD	< LLD	< LLD	< LLD
CS-134	Ci	< LLD	< LLD	< LLD	< LLD
CS-136	Ci	< LLD	< LLD	< LLD	< LLD
CS-137	Ci	< LLD	< LLD	< LLD	< LLD
BA-140	Ci	< LLD	< LLD	< LLD	< LLD
CE-141	Ci	< LLD	< LLD	< LLD	< LLD
CE-144	Ci	< LLD	< LLD	< LLD	< LLD
PR-143	Ci	< LLD	< LLD	< LLD	< LLD
ND-147	Ci	< LLD	< LLD	< LLD	< LLD
Total for Period	Ci	2.45E-07	< LLD	< LLD	< LLD

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

TABLE 7 GASEOUS EFFLUENTS FOR RELEASE POINT – OTHER BATCH RELEASES PERIOD 2004

1. FISSION AND ACTIVATION GASSES

Nuclide Released	Batch Release				
	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4
AR-41	Ci	< LLD	< LLD	< LLD	< LLD
KR-83M	Ci	< LLD	< LLD	< LLD	< LLD
KR-85	Ci	< LLD	< LLD	< LLD	< LLD
KR-85M	Ci	< LLD	< LLD	< LLD	< LLD
KR-87	Ci	< LLD	< LLD	< LLD	< LLD
KR-88	Ci	< LLD	< LLD	< LLD	< LLD
KR-89	Ci	< LLD	< LLD	< LLD	< LLD
KR-90	Ci	< LLD	< LLD	< LLD	< LLD
XE-131M	Ci	< LLD	< LLD	< LLD	< LLD
XE-133	Ci	< LLD	< LLD	< LLD	< LLD
XE-133M	Ci	< LLD	< LLD	< LLD	< LLD
XE-135	Ci	< LLD	< LLD	< LLD	< LLD
XE-135M	Ci	< LLD	< LLD	< LLD	< LLD
XE-137	Ci	< LLD	< LLD	< LLD	< LLD
XE-138	Ci	< LLD	< LLD	< LLD	< LLD
Total for Period	Ci	< LLD	< LLD	< LLD	< LLD

2. IODINES

Nuclide Released	Batch Release				
	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4
I-130	Ci	< LLD	< LLD	< LLD	< LLD
I-131	Ci	4.17E-07	< LLD	< LLD	< LLD
I-132	Ci	< LLD	< LLD	< LLD	< LLD
I-133	Ci	< LLD	< LLD	< LLD	< LLD
I-134	Ci	< LLD	< LLD	< LLD	< LLD
I-135	Ci	< LLD	< LLD	< LLD	< LLD
Total for Period	Ci	4.17E-07	< LLD	< LLD	< LLD

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

TABLE 7 GASEOUS EFFLUENTS FOR RELEASE POINT – OTHER BATCH RELEASES PERIOD 2004

3. PARTICULATES (T 1/2 > 8 DAYS)

Nuclide Released	Batch Release				
	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4
CR-51	Ci	< LLD	< LLD	< LLD	< LLD
MN-54	Ci	3.99E-07	4.15E-07	4.84E-07	< LLD
FE-55	Ci	< LLD	< LLD	< LLD	< LLD
FE-59	Ci	< LLD	< LLD	< LLD	< LLD
CO-58	Ci	< LLD	< LLD	< LLD	< LLD
CO-60	Ci	3.53E-07	1.14E-06	4.81E-07	< LLD
NI-63	Ci	< LLD	< LLD	< LLD	< LLD
ZN-65	Ci	< LLD	< LLD	< LLD	< LLD
RB-86	Ci	< LLD	< LLD	< LLD	< LLD
SR-89	Ci	< LLD	< LLD	< LLD	< LLD
SR-90	Ci	< LLD	< LLD	< LLD	< LLD
Y-91	Ci	< LLD	< LLD	< LLD	< LLD
ZR-95	Ci	< LLD	< LLD	< LLD	< LLD
NB-95	Ci	< LLD	< LLD	< LLD	< LLD
RU-103	Ci	< LLD	< LLD	< LLD	< LLD
RU-106	Ci	< LLD	< LLD	< LLD	< LLD
AG-110M	Ci	< LLD	< LLD	< LLD	< LLD
TE-125M	Ci	< LLD	< LLD	< LLD	< LLD
TE-127M	Ci	< LLD	< LLD	< LLD	< LLD
TE-129M	Ci	< LLD	< LLD	< LLD	< LLD
CS-134	Ci	< LLD	< LLD	< LLD	< LLD
CS-136	Ci	< LLD	< LLD	< LLD	< LLD
CS-137	Ci	< LLD	< LLD	< LLD	< LLD
BA-140	Ci	< LLD	< LLD	< LLD	< LLD
CE-141	Ci	< LLD	< LLD	< LLD	< LLD
CE-144	Ci	< LLD	< LLD	< LLD	< LLD
PR-143	Ci	< LLD	< LLD	< LLD	< LLD
ND-147	Ci	7.01E-07	< LLD	< LLD	< LLD
Total for Period	Ci	1.45E-06	1.55E-06	9.65E-07	< LLD

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

TABLE 8 LIQUID EFFLUENTS – SUMMATION OF ALL RELEASES PERIOD 2004

A. FISSION AND ACTIVATION PRODUCTS

	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Est. Total Error %
1. Total release (not including tritium, gasses & alpha)	Ci	4.24E-04	3.49E-04	5.01E-04	3.89E-04	2.11E+01
2. Average diluted concentration during batch discharge for the period	uCi/ml	4.30E-10	5.54E-10	1.04E-08	1.38E-08	
3. % of ODCM Limit - Whole Body Dose*	%	1.68E-02	6.67E-03	6.80E-03	1.22E-02	
- Organ Dose*		5.04E-03	2.01E-03	2.89E-03	5.29E-03	

B. TRITIUM

	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Est. Total Error %
1. Total Release	Ci	1.16E+01	4.42E+00	4.34E+00	3.50E+00	6.43E+00
2. Average diluted concentration during batch discharge for the period	uCi/ml	1.20E-05	7.01E-06	8.96E-05	1.24E-04	
3. % of ODCM Limit - MPC	%	4.00E-01	2.34E-01	2.99E+00	4.13E+00	

C. DISSOLVED AND ENTRAINED GASSES

	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Est. Total Error %
1. Total release	Ci	4.03E-04	< LLD	< LLD	< LLD	2.11E+01
2. Average diluted concentration during batch discharge for the period	uCi/ml	4.16E-10	< LLD	< LLD	< LLD	
3. %of ODCM Limit - MPC	%	2.08E-04	0.00E+00	0.00E+00	0.00E+00	

D. GROSS ALPHA RADIOACTIVITY

	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Est. Total Error %
1. Total release	Ci	< LLD	< LLD	< LLD	< LLD	2.30E+01
2. Average diluted concentration during batch discharge for the period	uCi/ml	< LLD	< LLD	< LLD	< LLD	

	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Est. Total Error %
E. Volume of waste released (prior to dilution)	Liters	4.03E+07	1.76E+07	1.60E+06	9.97E+05	5.00E+00
F. Volume of dilution water used during period	Liters	9.28E+08	6.13E+08	4.68E+07	2.72E+07	3.56E+00

* Percent of limit includes tritium.

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

TABLE 9 LIQUID EFFLUENTS FOR RELEASE POINT – LIQUID RADWASTE PERIOD 2004

Nuclide Released	Batch Release				
	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4
AG-110M	Ci	< LLD	2.73E-06	1.19E-05	3.94E-06
BA-139	Ci	7.05E-06	< LLD	< LLD	< LLD
BA-140	Ci	< LLD	< LLD	< LLD	< LLD
BA-141	Ci	< LLD	< LLD	< LLD	< LLD
BA-142	Ci	< LLD	< LLD	< LLD	< LLD
BR-83	Ci	< LLD	< LLD	< LLD	< LLD
BR-84	Ci	< LLD	< LLD	< LLD	< LLD
BR-85	Ci	< LLD	< LLD	< LLD	< LLD
CE-141	Ci	< LLD	< LLD	< LLD	< LLD
CE-143	Ci	< LLD	< LLD	< LLD	< LLD
CE-144	Ci	< LLD	< LLD	< LLD	< LLD
CO-58	Ci	1.04E-05	2.46E-06	< LLD	< LLD
CO-60	Ci	2.08E-04	1.97E-04	2.53E-04	1.70E-04
CR-51	Ci	4.42E-06	< LLD	1.25E-05	< LLD
CS-134	Ci	< LLD	< LLD	< LLD	9.63E-06
CS-136	Ci	< LLD	< LLD	5.90E-07	< LLD
CS-137	Ci	8.24E-06	6.80E-06	1.03E-04	1.20E-04
CS-138	Ci	< LLD	< LLD	< LLD	< LLD
CU-64	Ci	< LLD	< LLD	< LLD	< LLD
FE-55	Ci	< LLD	< LLD	< LLD	< LLD
FE-59	Ci	4.57E-06	< LLD	< LLD	< LLD
H-3	Ci	1.16E+01	4.42E+00	4.34E+00	3.50E+00
I-130	Ci	< LLD	< LLD	< LLD	< LLD
I-131	Ci	< LLD	< LLD	< LLD	< LLD
I-132	Ci	< LLD	< LLD	< LLD	< LLD
I-133	Ci	< LLD	< LLD	< LLD	< LLD
I-134	Ci	< LLD	< LLD	< LLD	< LLD
I-135	Ci	< LLD	< LLD	< LLD	< LLD
LA-140	Ci	< LLD	< LLD	< LLD	< LLD
LA-142	Ci	< LLD	< LLD	< LLD	< LLD
MN-54	Ci	1.78E-04	1.36E-04	1.05E-04	8.04E-05
MN-56	Ci	< LLD	< LLD	< LLD	< LLD
MO-99	Ci	< LLD	< LLD	< LLD	< LLD
NA-24	Ci	< LLD	< LLD	< LLD	< LLD
NB-95	Ci	< LLD	< LLD	< LLD	< LLD
ND-147	Ci	2.66E-06	< LLD	< LLD	< LLD
NI-63	Ci	< LLD	< LLD	< LLD	< LLD

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

TABLE 9 LIQUID EFFLUENTS FOR RELEASE POINT – LIQUID RADWASTE PERIOD 2004

Nuclide Released	Batch Release				
	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4
NI-65	Ci	< LLD	< LLD	< LLD	< LLD
NP-239	Ci	< LLD	< LLD	< LLD	< LLD
PR-143	Ci	< LLD	< LLD	< LLD	< LLD
PR-144	Ci	< LLD	< LLD	< LLD	< LLD
RB-86	Ci	< LLD	< LLD	< LLD	< LLD
RB-88	Ci	< LLD	< LLD	< LLD	< LLD
RB-89	Ci	< LLD	< LLD	< LLD	< LLD
RU-103	Ci	< LLD	< LLD	< LLD	< LLD
RU-105	Ci	< LLD	< LLD	< LLD	< LLD
RU-106	Ci	< LLD	< LLD	< LLD	< LLD
SB-124	Ci	< LLD	< LLD	< LLD	< LLD
SB-125	Ci	< LLD	< LLD	1.17E-05	< LLD
SR-89	Ci	< LLD	< LLD	< LLD	< LLD
SR-90	Ci	< LLD	< LLD	< LLD	< LLD
SR-91	Ci	< LLD	< LLD	< LLD	< LLD
SR-92	Ci	< LLD	< LLD	< LLD	< LLD
TC-101	Ci	< LLD	< LLD	< LLD	< LLD
TC-99M	Ci	< LLD	< LLD	< LLD	< LLD
TE-125M	Ci	< LLD	< LLD	< LLD	< LLD
TE-127M	Ci	< LLD	< LLD	< LLD	< LLD
TE-127	Ci	< LLD	< LLD	< LLD	< LLD
TE-129M	Ci	< LLD	< LLD	< LLD	< LLD
TE-129	Ci	< LLD	< LLD	< LLD	< LLD
TE-131M	Ci	< LLD	< LLD	< LLD	< LLD
TE-131	Ci	< LLD	< LLD	< LLD	< LLD
TE-132	Ci	< LLD	< LLD	< LLD	< LLD
W-187	Ci	< LLD	< LLD	< LLD	< LLD
Y-90	Ci	< LLD	< LLD	< LLD	< LLD
Y-91M	Ci	< LLD	< LLD	< LLD	< LLD
Y-91	Ci	< LLD	< LLD	< LLD	< LLD
Y-92	Ci	< LLD	< LLD	< LLD	< LLD
Y-93	Ci	< LLD	< LLD	< LLD	< LLD
ZN-65	Ci	< LLD	3.98E-06	2.90E-06	5.22E-06
ZN-69	Ci	< LLD	< LLD	< LLD	< LLD
ZR-95	Ci	< LLD	< LLD	< LLD	< LLD
ZR-97	Ci	< LLD	< LLD	< LLD	< LLD
Total For Above	Ci	1.16E+01	4.41E+00	4.34E+00	3.50E+00

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

TABLE 9 LIQUID EFFLUENTS FOR RELEASE POINT – LIQUID RADWASTE PERIOD 2004

Nuclide Released	Batch Release				
	Units	Qtr 1	Qtr 2	Qtr 3	Qtr 4
AR-41	Ci	< LLD	< LLD	< LLD	< LLD
KR-83M	Ci	< LLD	< LLD	< LLD	< LLD
KR-85	Ci	< LLD	< LLD	< LLD	< LLD
KR-85M	Ci	< LLD	< LLD	< LLD	< LLD
KR-87	Ci	< LLD	< LLD	< LLD	< LLD
KR-88	Ci	< LLD	< LLD	< LLD	< LLD
KR-89	Ci	< LLD	< LLD	< LLD	< LLD
KR-90	Ci	< LLD	< LLD	< LLD	< LLD
XE-131M	Ci	4.51E-05	< LLD	< LLD	< LLD
XE-133	Ci	3.34E-04	< LLD	< LLD	< LLD
XE-133M	Ci	< LLD	< LLD	< LLD	< LLD
XE-135	Ci	2.36E-05	< LLD	< LLD	< LLD
XE-135M	Ci	< LLD	< LLD	< LLD	< LLD
XE-137	Ci	< LLD	< LLD	< LLD	< LLD
XE-138	Ci	< LLD	< LLD	< LLD	< LLD
Total For Above	Ci	4.03E-04	< LLD	< LLD	< LLD

Appendix B
Solid Waste and Irradiated Fuel Shipments

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

A. Solid waste shipped offsite for burial or disposal (not irradiated fuel) 1/1/04 – 12/31/04

1. Type of waste

Type of waste	Units	2004	Estimated Error %
a. Spent resin, filters sludges, evaporator bottoms, etc	m^3	4.18E+01	25%
	Ci	7.53E+02	
b. Dry compressible waste, contaminated equipment, etc.	m^3	1.38E+02	25%
	Ci	3.61E+00	
c. Irradiated components, control rods, etc.	m^3	None	< LLD
	Ci	None	
d. Other (Describe)	m^3	None	< LLD
	Ci	None	

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

Category A – Spent Resin, Filters, Sludges, Evaporator Bottoms, etc.

Isotope	Waste Class A Curies *	Percent Abundance	Waste Class B Curies *	Percent Abundance	Waste Class C Curies *	Percent Abundance
C-14	2.42E-01	0.03%	5.04E-02	0.28%	< LLD	0.00%
Cr-51	1.57E-01	0.03%	1.76E-01	0.98%	< LLD	0.00%
Mn-54	1.18E+02	16.08%	6.69E+00	37.37%	< LLD	0.00%
Fe-55	2.04E+02	27.80%	2.65E-01	1.48%	< LLD	0.00%
Co-58	3.57E+00	0.49%	3.19E-01	1.78%	< LLD	0.00%
Co-60	3.04E+02	41.42%	6.28E+00	35.08%	< LLD	0.00%
Ni-63	4.07E+00	0.56%	4.95E-01	2.76%	< LLD	0.00%
Zn-65	9.02E+01	12.29%	1.44E+00	8.04%	< LLD	0.00%
Cs-134	3.73E-01	0.05%	6.81E-01	3.80%	< LLD	0.00%
Cs-137	5.30E+00	0.73%	1.31E+00	7.31%	< LLD	0.00%
Ce-144	3.79E+00	0.52%	2.02E-01	1.12%	< LLD	0.00%
TOTALS	7.34E+02	100.00%	1.79E+01	100.00%	< LLD	0.00%

Category B – Dry Compressible Waste, Contaminated Equipment, etc.

Isotope	Waste Class A Curies (estimated)	Percent Abundance
Cr-51	1.93E+00	54.29%
Mn-54	5.70E-01	16.04%
Fe-55	4.77E-02	1.34%
Co-58	1.71E-01	4.81%
Co-60	4.42E-01	12.44%
Fe-59	2.98E-01	8.38%
Zn-65	9.58E-02	2.70%
TOTALS	3.56E+00	100.00%

3. Solid Waste (Disposition)

Number of Shipments	Mode of Transportation	Destination
3	Truck	Studsvik (THOR) to Barnwell
2	Truck	Studsvik (THOR) to Envirocare
52	Truck	Duratek to Envirocare
4	Rail	Alaron to Envirocare
6	Truck	Limerick Generating Station to Envirocare
2	Truck	Limerick Generating Station to Barnwell

Comments:
17 Shipments were made from Limerick to Duratek for processing
5 Shipments were made from Limerick to Alaron for processing
3 Shipments were made from Limerick to Studsvik (THOR) for processing
3 Shipments were made from Limerick to RACE LLC. for processing
No solidifications were performed

Category A - 8 shipments Type A LSA
Category A - 4 shipments > Type A LSA
Category A - 1 shipment Type B
Category B - 56 shipments Type A LSA
Category C - No shipments made
Category D - No shipments made

B. Irradiated Fuel Shipments (disposition)

Number of Shipments	Mode of Transportation	Destination
0	< LLD	< LLD

C. Changes to the Process Control Program

There were no revisions to procedure RW-AA-100, "Process Control Program For Radioactive Wastes" in 2004.

Appendix C
Dose Calculations

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

Per ODCM Control 6.2, the Annual Effluent Release Report shall include an assessment of the radiation doses to radiation doses to the hypothetically highest exposed MEMBER OF THE PUBLIC from reactor releases and other nearby uranium fuel cycle sources. For purposes of this calculation the following assumptions were made:

Gaseous
- Yearly average meteorology and actual gaseous effluent releases.
- Beta air dose attributed to noble gas releases.
- The sector with the highest x/Q, x/Q depleted and D/Q was the ESE sector at Site Boundary 762 meters.
- All significant pathways were assumed to be present
- Occupancy factor was considered 100%.

Liquid
- Average river flow rate for the year (3.416E+03 cfs) was used.

A summary of gaseous and liquid radiation doses to members of the public at these locations is as follows:

Effluent	Applicable Organ	Estimated Dose	Age Group	Location		% of Applicable Limit	Limit	Unit
				Distance (meters)	Direction (toward)			
Noble Gas	Gamma - Air Dose	3.25E-03	All	762	ESE	1.62E-02	20	mRad
Noble Gas	Beta – Air Dose	1.96E-03	All	762	ESE	4.90E-03	40	mRad
Noble Gas	Total Body (Gamma)	2.08E-03	All	762	ESE	1.04E-02	20	mrem
Noble Gas	Skin (Beta)	3.93E-03	All	762	ESE	9.83E-03	40	mrem
Iodine, Particulate & Tritium	Thyroid	7.13E-03	Infant	762	ESE	2.38E-02	30	mrem
Liquid	Total Body	1.51E-03	Adult	LGS Outfall		2.52E-02	6	mrem
Liquid	Liver	2.06E-03	Teen	LGS Outfall		1.03E-02	20	mrem

Doses calculated were well below all ODCM and 40 CFR Part 190 limits.

ODCM Control 6.2 also requires that the Annual Effluent Release Report shall include an assessment of the radiation doses from radioactive liquid and gaseous effluents to members of the public due to activities inside the Site Boundary during the report period. ODCM Controls state that MEMBER OF THE PUBLIC shall include all persons not occupationally associated with the plant. This category does not include employees of the utility or contractors. Also excluded from this category are persons who enter the site to service equipment or to make deliveries. This category does include persons who use portions of the site for recreational, occupational education, or other purposes not associated with the plant. Areas within the site boundary, where radiation dose of this type could occur include the Limerick Information Center on Longview Road near the rear exit of the plant, Frick's Lock on the west shore of the river and the railroad tracks that runs along the east shore of the Schuylkill River. The dose to LGS Guards, State Police and National Guard personnel around the location of the Security Checkpoint at the entrance to the parking lot was also included in this report. The radiation doses to Members of the Public have been estimated using methodology stated in the ODCM. The maximum gaseous dose to members of the public at these locations is based on the following assumptions:

- Yearly average meteorology and actual effluent releases.
- Beta air dose attributed to noble gas releases.
- Dose is from ground plane and inhalation only. No ingestion dose.
- Adult age group was used for the National Guard Dose.
- Highest exposed sector of the railroad tracks (W), and the sectors enclosing Security Checkpoint, Frick's Lock and the Information Center available for occupancy.
- The maximum expected occupancy factor is 25% of a working year in all locations.

- Distance to the railroad tracks, which pass through the Site Boundary in the W sector, is approximately 225 meters.
- Distance to the Limerick Information Center is approximately 884 meters in the ESE sector.
- Distance to Frick's Lock is approximately 450 meters in the WSW sector.
- Distance to Security Checkpoint is approximately 682 meters in the NNE sector.

A summary of gaseous radiation doses to members of the public at these locations is as follows:

Location	Sector	Approx. Distance (meters)	GAMMA AIR DOSE, MRAD[1]	Beta Air Dose, MRAD[2]	Iodine/Part/H3 Organ Dose, MREM[3]
Frick's Lock	WSW	450	1.01E-03	6.08E-04	5.89E-05
Info. Center	ESE	884	2.60E-03	1.57E-03	1.46E-04
R.R. Tracks	W	225	4.52E-03	2.73E-03	2.68E-04
National Guard / Security Check Point	NNE	682	1.16E-03	6.98E-04	6.43E-05

Notes:

(1) The limit for Gamma Air Dose = 20 mrad/y (ref. ODCM 3.2.2.2b)
(2) The limit for Beta Air Dose = 40 mrad/y (ref. ODCM 3.2.2.2b)
(3) The limit for Iodine/Particulate/H3 Organ Dose = 30 mrem/y (ref. ODCM 3.2.2.3b)

Appendix D
Meteorological Data

LIMERICK GENERATING STATION

DIGLAPSE VERSION 1.0

LAPSE RATE WIND ROSE PROGRAM TO COMPUTE

JOINT FREQUENCY DISTRIBUTIONS OF WIND DIRECTION

AND SPEED BY ATMOSPHERIC STABILITY CLASS

DIGLAPSE ALSO COMPUTES THE JOINT DATA RECOVERY RATE AS REQUIRED BY REGULATORY GUIDE 1.23. FOR BOTH THE JOINT FREQUENCY DISTRIBUTION AND DATA RECOVERY CALCULATIONS BOTH THE PRIMARY AND BACKUP SENSORS SPECIFIED IN TABLE I3.1-1 OF THE LGS OFFSITE DOSE CALCULATION MANUAL ARE USED.

THE PRIMARY AND BACK UP SENSORS USED IN THE ATTACHED DISTRIBUTIONS ARE AS FOLLOWS:

PARAMETER	TOWER 1 (PRIMARY)		TOWER 2 (BACKUP)
WIND SPEED			
LEVEL 1	30 FT.	OR	159 FT.
LEVEL 2	175 FT.	OR	304 FT.
WIND DIRECTION			
LEVEL 1	30 FT.	OR	159 FT.
LEVEL 2	175 FT.	OR	304 FT.
DELTA TEMPERATURE			
LEVELS 1 & 2	266-26 FT.	OR	300-26 FT.

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

LIMERICK MET DATA 1/04-12/04 JOINT DISTRIBUTION OF WIND DIRECTION AND SPEED
BY ATMOSPHERIC STABILITY CLASS
WIND: LEVEL 1
DELTA T: (266-26FT)
LAPSE RATE: LE -1.9 DEG C/100M
CLASS A

WIND SPEED GROUPS (MPH)

	0.0-0.5		0.6-3.5		3.6-7.5		7.6-12.5		12.6-18.5		18.6-24.5		GE 24.6		SUM	PERCENT
DIRECTION	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT		
N	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
NNE	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
NE	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
ENE	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
E	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
ESE	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
SE	0	0.0	0	0.0	0	0.0	1	0.0	0	0.0	0	0.0	0	0.0	1	0.0
SSE	0	0.0	0	0.0	0	0.0	1	0.0	0	0.0	0	0.0	0	0.0	1	0.0
S	0	0.0	0	0.0	1	0.0	2	0.0	0	0.0	0	0.0	0	0.0	3	0.0
SSW	0	0.0	0	0.0	1	0.0	2	0.0	0	0.0	0	0.0	0	0.0	3	0.0
SW	0	0.0	0	0.0	0	0.0	1	0.0	0	0.0	0	0.0	0	0.0	1	0.0
WSW	0	0.0	0	0.0	2	0.0	3	0.0	0	0.0	0	0.0	0	0.0	5	0.1
W	0	0.0	1	0.0	2	0.0	1	0.0	0	0.0	0	0.0	0	0.0	4	0.0
WNW	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
NW	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
NNW	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	0	0.0	1	0.0	6	0.1	11	0.1	0	0.0	0	0.0	0	0.0	18	0.2

MEAN WIND SPEED: 7.8
MISSING: 0

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

LIMERICK MET DATA 1/04-12/04

JOINT DISTRIBUTION OF WIND DIRECTION AND SPEED
BY ATMOSPHERIC STABILITY CLASS
WIND: LEVEL 1
DELTA T: (266-26FT)

LAPSE RATE: -1.8 TO -1.7 DEG C/100M
CLASS B

WIND SPEED GROUPS (MPH)

	0.0-0.5		0.6-3.5		3.6-7.5		7.6-12.5		12.6-18.5		18.6-24.5		GE 24.6		SUM	PERCENT
DIRECTION	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT		
N	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
NNE	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
NE	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
ENE	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
E	0	0.0	0	0.0	0	0.0	1	0.0	0	0.0	0	0.0	0	0.0	1	0.0
ESE	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
SE	0	0.0	0	0.0	1	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.0
SSE	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
S	0	0.0	0	0.0	4	0.0	1	0.0	0	0.0	0	0.0	0	0.0	5	0.1
SSW	0	0.0	0	0.0	5	0.1	6	0.1	0	0.0	0	0.0	0	0.0	11	0.1
SW	0	0.0	0	0.0	7	0.1	4	0.0	0	0.0	0	0.0	0	0.0	11	0.1
WSW	0	0.0	0	0.0	4	0.0	1	0.0	0	0.0	0	0.0	0	0.0	5	0.1
W	0	0.0	0	0.0	6	0.1	3	0.0	3	0.0	0	0.0	0	0.0	12	0.1
WNW	0	0.0	0	0.0	3	0.0	4	0.0	2	0.0	0	0.0	0	0.0	9	0.1
NW	0	0.0	0	0.0	0	0.0	3	0.0	0	0.0	0	0.0	0	0.0	3	0.0
NNW	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	0	0.0	0	0.0	30	0.3	23	0.3	5	0.1	0	0.0	0	0.0	58	0.7

MEAN WIND SPEED: 8.2
MISSING: 0

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

LIMERICK MET DATA 1/04-12/04

JOINT DISTRIBUTION OF WIND DIRECTION AND SPEED
BY ATMOSPHERIC STABILITY CLASS
WIND: LEVEL 1
DELTA T: (266-26FT)

LAPSE RATE: -1.6 TO -1.5 DEG C/100M
CLASS C

WIND SPEED GROUPS (MPH)

	0.0-0.5		0.6-3.5		3.6-7.5		7.6-12.5		12.6-18.5		18.6-24.5		GE 24.6		SUM	PERCENT
DIRECTION	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT		
N	0	0.0	1	0.0	4	0.0	4	0.0	0	0.0	0	0.0	0	0.0	9	0.1
NNE	0	0.0	1	0.0	2	0.0	1	0.0	0	0.0	0	0.0	0	0.0	4	0.0
NE	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
ENE	0	0.0	0	0.0	2	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	0.0
E	0	0.0	0	0.0	1	0.0	3	0.0	1	0.0	0	0.0	0	0.0	5	0.1
ESE	0	0.0	0	0.0	2	0.0	0	0.0	2	0.0	0	0.0	0	0.0	4	0.0
SE	0	0.0	1	0.0	0	0.0	1	0.0	0	0.0	0	0.0	0	0.0	2	0.0
SSE	0	0.0	1	0.0	1	0.0	2	0.0	0	0.0	0	0.0	0	0.0	4	0.0
S	0	0.0	0	0.0	7	0.1	7	0.1	1	0.0	0	0.0	0	0.0	15	0.2
SSW	0	0.0	2	0.0	12	0.1	14	0.2	0	0.0	0	0.0	0	0.0	28	0.3
SW	0	0.0	1	0.0	17	0.2	6	0.1	0	0.0	0	0.0	0	0.0	24	0.3
WSW	0	0.0	1	0.0	15	0.2	7	0.1	0	0.0	0	0.0	0	0.0	23	0.3
W	0	0.0	3	0.0	17	0.2	13	0.1	4	0.0	0	0.0	0	0.0	37	0.4
WNW	0	0.0	0	0.0	19	0.2	25	0.3	28	0.3	5	0.1	0	0.0	77	0.9
NW	0	0.0	1	0.0	9	0.1	10	0.1	11	0.1	6	0.1	2	0.0	39	0.4
NNW	0	0.0	0	0.0	3	0.0	9	0.1	3	0.0	0	0.0	0	0.0	15	0.2
	0	0.0	12	0.1	111	1.3	102	1.2	50	0.6	11	0.1	2	0.0	288	3.3

MEAN WIND SPEED: 9.3
MISSING: 0

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

LIMERICK MET DATA 1/04-12/04

JOINT DISTRIBUTION OF WIND DIRECTION AND SPEED
BY ATMOSPHERIC STABILITY CLASS
WIND: LEVEL 1
DELTA T: (266-26FT)

LAPSE RATE: -1.4 TO -0.5 DEG C/100M
CLASS D

WIND SPEED GROUPS (MPH)

	0.0-0.5		0.6-3.5		3.6-7.5		7.6-12.5		12.6-18.5		18.6-24.5		GE 24.6		SUM	PERCENT
DIRECTION	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT		
N	0	0.0	64	0.7	85	1.0	55	0.6	3	0.0	0	0.0	0	0.0	207	2.4
NNE	1	0.0	60	0.7	110	1.3	27	0.3	1	0.0	0	0.0	0	0.0	199	2.3
NE	1	0.0	75	0.9	154	1.8	24	0.3	0	0.0	0	0.0	0	0.0	254	2.9
ENE	0	0.0	90	1.0	184	2.1	46	0.5	1	0.0	0	0.0	0	0.0	321	3.7
E	1	0.0	56	0.6	144	1.6	95	1.1	15	0.2	0	0.0	0	0.0	311	3.5
ESE	0	0.0	42	0.5	47	0.5	33	0.4	6	0.1	0	0.0	0	0.0	128	1.5
SE	0	0.0	34	0.4	44	0.5	9	0.1	0	0.0	0	0.0	0	0.0	87	1.0
SSE	0	0.0	40	0.5	64	0.7	34	0.4	0	0.0	0	0.0	0	0.0	138	1.6
S	0	0.0	42	0.5	98	1.1	44	0.5	1	0.0	0	0.0	0	0.0	185	2.1
SSW	1	0.0	57	0.6	139	1.6	33	0.4	0	0.0	0	0.0	0	0.0	230	2.6
SW	1	0.0	77	0.9	99	1.1	23	0.3	0	0.0	0	0.0	0	0.0	200	2.3
WSW	0	0.0	54	0.6	80	0.9	29	0.3	2	0.0	0	0.0	0	0.0	165	1.9
W	1	0.0	60	0.7	112	1.3	118	1.3	34	0.4	6	0.1	0	0.0	331	3.8
WNW	0	0.0	84	1.0	196	2.2	204	2.3	135	1.5	12	0.1	0	0.0	631	7.2
NW	0	0.0	66	0.8	203	2.3	277	3.2	187	2.1	34	0.4	1	0.0	768	8.8
NNW	0	0.0	44	0.5	77	0.9	116	1.3	23	0.3	12	0.1	1	0.0	273	3.1
	6	0.1	945	10.8	1836	20.9	1167	13.3	408	4.6	64	0.7	2	0.0	4428	50.5

MEAN WIND SPEED: 7.0
MISSING: 0

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

LIMERICK MET DATA 1/04-12/04

JOINT DISTRIBUTION OF WIND DIRECTION AND SPEED
BY ATMOSPHERIC STABILITY CLASS
WIND: LEVEL 1
DELTA T: (266-26FT)

LAPSE RATE: -0.4 TO 1.5 DEG C/100M
CLASS E

WIND SPEED GROUPS (MPH)

	0.0-0.5		0.6-3.5		3.6-7.5		7.6-12.5		12.6-18.5		18.6-24.5		GE 24.6		SUM	PERCENT
DIRECTION	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT		
N	1	0.0	88	1.0	24	0.3	7	0.1	2	0.0	0	0.0	0	0.0	122	1.4
NNE	2	0.0	86	1.0	43	0.5	2	0.0	1	0.0	0	0.0	0	0.0	134	1.5
NE	4	0.0	86	1.0	34	0.4	0	0.0	0	0.0	0	0.0	0	0.0	124	1.4
ENE	2	0.0	102	1.2	45	0.5	7	0.1	0	0.0	0	0.0	0	0.0	156	1.8
E	4	0.0	63	0.7	62	0.7	30	0.3	3	0.0	0	0.0	0	0.0	162	1.8
ESE	3	0.0	50	0.6	26	0.3	7	0.1	3	0.0	1	0.0	0	0.0	90	1.0
SE	1	0.0	52	0.6	40	0.5	8	0.1	2	0.0	0	0.0	0	0.0	103	1.2
SSE	1	0.0	46	0.5	57	0.6	10	0.1	4	0.0	0	0.0	0	0.0	118	1.3
S	0	0.0	70	0.8	131	1.5	20	0.2	3	0.0	0	0.0	0	0.0	224	2.6
SSW	0	0.0	114	1.3	89	1.0	14	0.2	0	0.0	0	0.0	0	0.0	217	2.5
SW	3	0.0	108	1.2	56	0.6	2	0.0	1	0.0	0	0.0	0	0.0	170	1.9
WSW	3	0.0	123	1.4	38	0.4	3	0.0	0	0.0	0	0.0	0	0.0	167	1.9
W	3	0.0	152	1.7	71	0.8	20	0.2	1	0.0	0	0.0	0	0.0	247	2.8
WNW	3	0.0	157	1.8	127	1.4	22	0.3	6	0.1	0	0.0	0	0.0	315	3.6
NW	2	0.0	118	1.3	118	1.3	43	0.5	2	0.0	0	0.0	0	0.0	283	3.2
NNW	4	0.0	76	0.9	45	0.5	12	0.1	0	0.0	0	0.0	0	0.0	137	1.6
	36	0.4	1491	17.0	1006	11.5	207	2.4	28	0.3	1	0.0	0	0.0	2769	31.5

MEAN WIND SPEED: 3.9
MISSING: 0

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

LIMERICK MET DATA 1/04-12/04

JOINT DISTRIBUTION OF WIND DIRECTION AND SPEED
BY ATMOSPHERIC STABILITY CLASS
WIND: LEVEL 1
DELTA T: (266-26FT)

LAPSE RATE: 1.6 TO 4.0 DEG C/100M
CLASS F

WIND SPEED GROUPS (MPH)

	0.0-0.5		0.6-3.5		3.6-7.5		7.6-12.5		12.6-18.5		18.6-24.5		GE 24.6		SUM	PERCENT
DIRECTION	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT		
N	6	0.1	39	0.4	2	0.0	0	0.0	0	0.0	0	0.0	0	0.0	47	0.5
NNE	3	0.0	40	0.5	6	0.1	0	0.0	0	0.0	0	0.0	0	0.0	49	0.6
NE	6	0.1	43	0.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	49	0.6
ENE	6	0.1	30	0.3	1	0.0	0	0.0	0	0.0	0	0.0	0	0.0	37	0.4
E	2	0.0	31	0.4	3	0.0	0	0.0	0	0.0	0	0.0	0	0.0	36	0.4
ESE	1	0.0	15	0.2	3	0.0	0	0.0	0	0.0	0	0.0	0	0.0	19	0.2
SE	0	0.0	14	0.2	2	0.0	0	0.0	0	0.0	0	0.0	0	0.0	16	0.2
SSE	1	0.0	15	0.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	16	0.2
S	0	0.0	14	0.2	5	0.1	0	0.0	0	0.0	0	0.0	0	0.0	19	0.2
SSW	0	0.0	20	0.2	12	0.1	0	0.0	0	0.0	0	0.0	0	0.0	32	0.4
SW	3	0.0	27	0.3	5	0.1	0	0.0	0	0.0	0	0.0	0	0.0	35	0.4
WSW	2	0.0	50	0.6	9	0.1	1	0.0	0	0.0	0	0.0	0	0.0	62	0.7
W	1	0.0	90	1.0	8	0.1	0	0.0	0	0.0	0	0.0	0	0.0	99	1.1
WNW	5	0.1	137	1.6	17	0.2	0	0.0	0	0.0	0	0.0	0	0.0	159	1.8
NW	6	0.1	98	1.1	24	0.3	1	0.0	0	0.0	0	0.0	0	0.0	129	1.5
NNW	4	0.0	54	0.6	1	0.0	0	0.0	0	0.0	0	0.0	0	0.0	59	0.7
	46	0.5	717	8.2	98	1.1	2	0.0	0	0.0	0	0.0	0	0.0	863	9.8

MEAN WIND SPEED: 2.0
MISSING: 0

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

LIMERICK MET DATA 1/04-12/04

JOINT DISTRIBUTION OF WIND DIRECTION AND SPEED
BY ATMOSPHERIC STABILITY CLASS
WIND: LEVEL 1
DELTA T: (266-26FT)

LAPSE RATE: GT 4.0 DEG C/100M
CLASS G

WIND SPEED GROUPS (MPH)

	0.0-0.5		0.6-3.5		3.6-7.5		7.6-12.5		12.6-18.5		18.6-24.5		GE 24.6		SUM	PERCENT
DIRECTION	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT		
N	2	0.0	26	0.3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	28	0.3
NNE	5	0.1	21	0.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	26	0.3
NE	1	0.0	11	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	12	0.1
ENE	2	0.0	9	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	11	0.1
E	1	0.0	6	0.1	1	0.0	0	0.0	0	0.0	0	0.0	0	0.0	8	0.1
ESE	0	0.0	5	0.1	2	0.0	0	0.0	0	0.0	0	0.0	0	0.0	7	0.1
SE	0	0.0	2	0.0	3	0.0	0	0.0	0	0.0	0	0.0	0	0.0	5	0.1
SSE	0	0.0	2	0.0	3	0.0	0	0.0	0	0.0	0	0.0	0	0.0	5	0.1
S	1	0.0	6	0.1	3	0.0	0	0.0	0	0.0	0	0.0	0	0.0	10	0.1
SSW	1	0.0	8	0.1	1	0.0	0	0.0	0	0.0	0	0.0	0	0.0	10	0.1
SW	0	0.0	6	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	6	0.1
WSW	1	0.0	17	0.2	1	0.0	0	0.0	0	0.0	0	0.0	0	0.0	19	0.2
W	5	0.1	40	0.5	3	0.0	1	0.0	0	0.0	0	0.0	0	0.0	49	0.6
WNW	3	0.0	69	0.8	6	0.1	0	0.0	0	0.0	0	0.0	0	0.0	78	0.9
NW	2	0.0	32	0.4	6	0.1	0	0.0	0	0.0	0	0.0	0	0.0	40	0.5
NNW	0	0.0	39	0.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	39	0.4
	24	0.3	299	3.4	29	0.3	1	0.0	0	0.0	0	0.0	0	0.0	353	4.0

MEAN WIND SPEED: 1.8
MISSING: 0

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

LIMERICK MET DATA 1/04-12/04

JOINT DISTRIBUTION OF WIND DIRECTION AND SPEED
BY ATMOSPHERIC STABILITY CLASS
WIND: LEVEL 1
DELTA T: (266-26FT)

ALL STABILITY CLASSES

WIND SPEED GROUPS (MPH)

	0.0-0.5		0.6-3.5		3.6-7.5		7.6-12.5		12.6-18.5		18.6-24.5		GE 24.6		SUM	PERCENT
DIRECTION	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT		
N	9	0.1	218	2.5	115	1.3	66	0.8	5	0.1	0	0.0	0	0.0	413	4.7
NNE	11	0.1	208	2.4	161	1.8	30	0.3	2	0.0	0	0.0	0	0.0	412	4.7
NE	12	0.1	215	2.4	188	2.1	24	0.3	0	0.0	0	0.0	0	0.0	439	5.0
ENE	10	0.1	231	2.6	232	2.6	53	0.6	1	0.0	0	0.0	0	0.0	527	6.0
E	8	0.1	156	1.8	211	2.4	129	1.5	19	0.2	0	0.0	0	0.0	523	6.0
ESE	4	0.0	112	1.3	80	0.9	40	0.5	11	0.1	1	0.0	0	0.0	248	2.8
SE	1	0.0	103	1.2	90	1.0	19	0.2	2	0.0	0	0.0	0	0.0	215	2.4
SSE	2	0.0	104	1.2	125	1.4	47	0.5	4	0.0	0	0.0	0	0.0	282	3.2
S	1	0.0	132	1.5	249	2.8	74	0.8	5	0.1	0	0.0	0	0.0	461	5.3
SSW	2	0.0	201	2.3	259	3.0	69	0.8	0	0.0	0	0.0	0	0.0	531	6.0
SW	7	0.1	219	2.5	184	2.1	36	0.4	1	0.0	0	0.0	0	0.0	447	5.1
WSW	6	0.1	245	2.8	149	1.7	44	0.5	2	0.0	0	0.0	0	0.0	446	5.1
W	10	0.1	346	3.9	219	2.5	156	1.8	42	0.5	6	0.1	0	0.0	779	8.9
WNW	11	0.1	447	5.1	368	4.2	255	2.9	171	1.9	17	0.2	0	0.0	1269	14.5
NW	10	0.1	315	3.6	360	4.1	334	3.8	200	2.3	40	0.5	3	0.0	1262	14.4
NNW	8	0.1	213	2.4	126	1.4	137	1.6	26	0.3	12	0.1	1	0.0	523	6.0
	112	1.3	3465	39.5	3116	35.5	1513	17.2	491	5.6	76	0.9	4	0.0	8777	100.0

MISSING HOURS: 7

MEAN WIND SPEED: 5.4

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

LIMERICK MET DATA 1/04-12/04

JOINT DISTRIBUTION OF WIND DIRECTION AND SPEED
BY ATMOSPHERIC STABILITY CLASS
WIND: LEVEL 1
DELTA T: (266-26FT)

DIRECTION VS SPEED ONLY

WIND SPEED GROUPS (MPH)

	0.0-0.5		0.6-3.5		3.6-7.5		7.6-12.5		12.6-18.5		18.6-24.5		GE 24.6		SUM	PERCENT
DIRECTION	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT		
N	9	0.1	218	2.5	115	1.3	66	0.8	5	0.1	0	0.0	0	0.0	413	4.7
NNE	11	0.1	208	2.4	161	1.8	30	0.3	2	0.0	0	0.0	0	0.0	412	4.7
NE	12	0.1	215	2.4	188	2.1	24	0.3	0	0.0	0	0.0	0	0.0	439	5.0
ENE	10	0.1	231	2.6	232	2.6	53	0.6	1	0.0	0	0.0	0	0.0	527	6.0
E	8	0.1	156	1.8	211	2.4	129	1.5	19	0.2	0	0.0	0	0.0	523	6.0
ESE	4	0.0	112	1.3	80	0.9	40	0.5	11	0.1	1	0.0	0	0.0	248	2.8
SE	1	0.0	103	1.2	90	1.0	19	0.2	2	0.0	0	0.0	0	0.0	215	2.4
SSE	2	0.0	104	1.2	125	1.4	47	0.5	4	0.0	0	0.0	0	0.0	282	3.2
S	1	0.0	132	1.5	249	2.8	74	0.8	5	0.1	0	0.0	0	0.0	461	5.3
SSW	2	0.0	201	2.3	259	3.0	69	0.8	0	0.0	0	0.0	0	0.0	531	6.0
SW	7	0.1	219	2.5	184	2.1	36	0.4	1	0.0	0	0.0	0	0.0	447	5.1
WSW	6	0.1	245	2.8	149	1.7	44	0.5	2	0.0	0	0.0	0	0.0	446	5.1
W	10	0.1	346	3.9	219	2.5	156	1.8	42	0.5	6	0.1	0	0.0	779	8.9
WNW	11	0.1	447	5.1	368	4.2	255	2.9	171	1.9	17	0.2	0	0.0	1269	14.5
NW	10	0.1	315	3.6	360	4.1	334	3.8	200	2.3	40	0.5	3	0.0	1262	14.4
NNW	8	0.1	213	2.4	126	1.4	137	1.6	26	0.3	12	0.1	1	0.0	523	6.0
	112	1.3	3465	39.5	3116	35.5	1513	17.2	491	5.6	76	0.9	4	0.0	8777	100.0

MISSING HOURS: 7

MEAN WIND SPEED: 5.4

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

LIMERICK MET DATA 1/04-12/04

LIMERICK GENERATING STATION
DATA RECOVERY SUMMARY

LEVEL 1 - TOWER 1 30' OR TOWER 2 159'

PARAMETER	COUNT	PERCENT
PRIMARY SPEED GOOD HOURS	8259	94.02%
BACKUP SPEED GOOD HOURS	7567	86.15%
BACKUP SPEED HOURS USED	518	5.90%
TOTAL AVAILABLE SPEED HOURS	8777	99.92%
PRIMARY DIRECTION GOOD HOURS	8267	94.11%
BACKUP DIRECTION GOOD HOURS	7777	88.54%
BACKUP DIRECTION HOURS USED	510	5.81%
TOTAL AVAILABLE DIRECTION HOURS	8777	99.92%
PRIMARY (266-26') DELTA TEMP HOURS	8267	94.11%
BACKUP (300-26') DELTA TEMP HOURS	7771	88.47%
BACKUP DELTA TEMP HOURS USED	510	5.81%
TOTAL AVAILABLE DELTA TEMP HOURS	8777	99.92%
LEVEL 1 JOINT DATA RECOVERY:	8777	99.92%

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

LIMERICK MET DATA 1/04-12/04

JOINT DISTRIBUTION OF WIND DIRECTION AND SPEED
BY ATMOSPHERIC STABILITY CLASS
WIND: LEVEL 2
DELTA T: (266-26FT)

LAPSE RATE: LE -1.9 DEG C/100M
CLASS A

WIND SPEED GROUPS (MPH)

	0.0-0.5		0.6-3.5		3.6-7.5		7.6-12.5		12.6-18.5		18.6-24.5		GE 24.6		SUM	PERCENT
DIRECTION	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT		
N	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
NNE	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
NE	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
ENE	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
E	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
ESE	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
SE	0	0.0	0	0.0	0	0.0	1	0.0	0	0.0	0	0.0	0	0.0	1	0.0
SSE	0	0.0	0	0.0	0	0.0	1	0.0	0	0.0	0	0.0	0	0.0	1	0.0
S	0	0.0	0	0.0	0	0.0	2	0.0	1	0.0	0	0.0	0	0.0	3	0.0
SSW	0	0.0	0	0.0	0	0.0	1	0.0	2	0.0	0	0.0	0	0.0	3	0.0
SW	0	0.0	0	0.0	0	0.0	1	0.0	4	0.0	0	0.0	0	0.0	5	0.1
WSW	0	0.0	1	0.0	0	0.0	1	0.0	1	0.0	0	0.0	0	0.0	3	0.0
W	0	0.0	0	0.0	0	0.0	1	0.0	1	0.0	0	0.0	0	0.0	2	0.0
WNW	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
NW	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
NNW	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	0	0.0	1	0.0	0	0.0	8	0.1	9	0.1	0	0.0	0	0.0	18	0.2

MEAN WIND SPEED: 12.8
MISSING: 0

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

LIMERICK MET DATA 1/04-12/04

JOINT DISTRIBUTION OF WIND DIRECTION AND SPEED
BY ATMOSPHERIC STABILITY CLASS
WIND: LEVEL 2
DELTA T: (266-26FT)

LAPSE RATE: -1.8 TO -1.7 DEG C/100M
CLASS B

WIND SPEED GROUPS (MPH)

	0.0-0.5		0.6-3.5		3.6-7.5		7.6-12.5		12.6-18.5		18.6-24.5		GE 24.6		SUM	PERCENT
DIRECTION	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT		
N	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
NNE	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
NE	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
ENE	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
E	0	0.0	0	0.0	0	0.0	1	0.0	0	0.0	0	0.0	0	0.0	1	0.0
ESE	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
SE	0	0.0	0	0.0	1	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.0
SSE	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
S	0	0.0	0	0.0	2	0.0	3	0.0	1	0.0	0	0.0	0	0.0	6	0.1
SSW	0	0.0	0	0.0	1	0.0	7	0.1	6	0.1	0	0.0	0	0.0	14	0.2
SW	0	0.0	0	0.0	1	0.0	4	0.0	2	0.0	1	0.0	0	0.0	8	0.1
WSW	0	0.0	0	0.0	1	0.0	4	0.0	2	0.0	0	0.0	0	0.0	7	0.1
W	0	0.0	0	0.0	1	0.0	5	0.1	5	0.1	3	0.0	1	0.0	15	0.2
WNW	0	0.0	0	0.0	0	0.0	1	0.0	2	0.0	0	0.0	0	0.0	3	0.0
NW	0	0.0	0	0.0	0	0.0	1	0.0	1	0.0	0	0.0	0	0.0	2	0.0
NNW	0	0.0	0	0.0	0	0.0	0	0.0	1	0.0	0	0.0	0	0.0	1	0.0
	0	0.0	0	0.0	7	0.1	26	0.3	20	0.2	4	0.0	1	0.0	58	0.7

MEAN WIND SPEED: 12.6
MISSING: 0

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

LIMERICK MET DATA 1/04-12/04

JOINT DISTRIBUTION OF WIND DIRECTION AND SPEED
BY ATMOSPHERIC STABILITY CLASS
WIND: LEVEL 2
DELTA T: (266-26FT)

LAPSE RATE: -1.6 TO -1.5 DEG C/100M
CLASS C

WIND SPEED GROUPS (MPH)

	0.0-0.5		0.6-3.5		3.6-7.5		7.6-12.5		12.6-18.5		18.6-24.5		GE 24.6		SUM	PERCENT
DIRECTION	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT		
N	0	0.0	0	0.0	1	0.0	6	0.1	5	0.1	0	0.0	0	0.0	12	0.1
NNE	0	0.0	0	0.0	0	0.0	3	0.0	0	0.0	0	0.0	0	0.0	3	0.0
NE	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
ENE	0	0.0	0	0.0	1	0.0	1	0.0	0	0.0	0	0.0	0	0.0	2	0.0
E	0	0.0	0	0.0	1	0.0	3	0.0	0	0.0	0	0.0	0	0.0	4	0.0
ESE	0	0.0	0	0.0	0	0.0	0	0.0	3	0.0	0	0.0	0	0.0	3	0.0
SE	0	0.0	0	0.0	1	0.0	2	0.0	0	0.0	0	0.0	0	0.0	3	0.0
SSE	0	0.0	2	0.0	0	0.0	1	0.0	1	0.0	0	0.0	0	0.0	4	0.0
S	0	0.0	0	0.0	3	0.0	11	0.1	2	0.0	2	0.0	0	0.0	18	0.2
SSW	0	0.0	1	0.0	4	0.0	13	0.1	11	0.1	1	0.0	0	0.0	30	0.3
SW	0	0.0	0	0.0	5	0.1	11	0.1	10	0.1	1	0.0	0	0.0	27	0.3
WSW	0	0.0	0	0.0	6	0.1	13	0.1	4	0.0	2	0.0	0	0.0	25	0.3
W	0	0.0	1	0.0	8	0.1	19	0.2	26	0.3	13	0.1	3	0.0	70	0.8
WNW	0	0.0	1	0.0	7	0.1	5	0.1	20	0.2	17	0.2	8	0.1	58	0.7
NW	0	0.0	0	0.0	3	0.0	7	0.1	3	0.0	3	0.0	4	0.0	20	0.2
NNW	0	0.0	0	0.0	1	0.0	3	0.0	2	0.0	3	0.0	0	0.0	9	0.1
	0	0.0	5	0.1	41	0.5	98	1.1	87	1.0	42	0.5	15	0.2	288	3.3

MEAN WIND SPEED: 13.4
MISSING: 0

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

LIMERICK MET DATA 1/04-12/04

JOINT DISTRIBUTION OF WIND DIRECTION AND SPEED
BY ATMOSPHERIC STABILITY CLASS
WIND: LEVEL 2
DELTA T: (266-26FT)

LAPSE RATE: -1.4 TO -0.5 DEG C/100M
CLASS D

WIND SPEED GROUPS (MPH)

	0.0-0.5		0.6-3.5		3.6-7.5		7.6-12.5		12.6-18.5		18.6-24.5		GE 24.6		SUM	PERCENT
DIRECTION	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT		
N	0	0.0	34	0.4	77	0.9	69	0.8	36	0.4	3	0.0	0	0.0	219	2.5
NNE	0	0.0	23	0.3	84	1.0	86	1.0	17	0.2	1	0.0	1	0.0	212	2.4
NE	0	0.0	36	0.4	131	1.5	112	1.3	9	0.1	0	0.0	0	0.0	288	3.3
ENE	0	0.0	35	0.4	127	1.4	107	1.2	15	0.2	1	0.0	0	0.0	285	3.2
E	0	0.0	28	0.3	103	1.2	128	1.5	56	0.6	4	0.0	0	0.0	319	3.6
ESE	0	0.0	16	0.2	36	0.4	41	0.5	25	0.3	3	0.0	0	0.0	121	1.4
SE	0	0.0	20	0.2	40	0.5	21	0.2	9	0.1	0	0.0	0	0.0	90	1.0
SSE	0	0.0	18	0.2	38	0.4	80	0.9	18	0.2	1	0.0	0	0.0	155	1.8
S	0	0.0	20	0.2	62	0.7	100	1.1	35	0.4	4	0.0	0	0.0	221	2.5
SSW	0	0.0	23	0.3	79	0.9	96	1.1	29	0.3	3	0.0	0	0.0	230	2.6
SW	0	0.0	21	0.2	84	1.0	64	0.7	31	0.4	4	0.0	0	0.0	204	2.3
WSW	0	0.0	24	0.3	50	0.6	54	0.6	33	0.4	7	0.1	1	0.0	169	1.9
W	0	0.0	29	0.3	101	1.2	102	1.2	140	1.6	57	0.6	18	0.2	447	5.1
WNW	0	0.0	20	0.2	112	1.3	192	2.2	232	2.6	117	1.3	35	0.4	708	8.1
NW	0	0.0	20	0.2	69	0.8	151	1.7	142	1.6	91	1.0	19	0.2	492	5.6
NNW	1	0.0	23	0.3	51	0.6	83	0.9	92	1.0	14	0.2	4	0.0	268	3.1
	1	0.0	390	4.4	1244	14.2	1486	16.9	919	10.5	310	3.5	78	0.9	4428	50.5

MEAN WIND SPEED: 10.2
MISSING: 0

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

LIMERICK MET DATA 1/04-12/04

JOINT DISTRIBUTION OF WIND DIRECTION AND SPEED
BY ATMOSPHERIC STABILITY CLASS
WIND: LEVEL 2
DELTA T: (266-26FT)

LAPSE RATE: -0.4 TO 1.5 DEG C/100M
CLASS E

WIND SPEED GROUPS (MPH)

	0.0-0.5		0.6-3.5		3.6-7.5		7.6-12.5		12.6-18.5		18.6-24.5		GE 24.6		SUM	PERCENT
DIRECTION	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT		
N	0	0.0	29	0.3	37	0.4	25	0.3	5	0.1	0	0.0	1	0.0	97	1.1
NNE	0	0.0	29	0.3	70	0.8	40	0.5	6	0.1	1	0.0	1	0.0	147	1.7
NE	0	0.0	30	0.3	74	0.8	32	0.4	0	0.0	0	0.0	0	0.0	136	1.5
ENE	0	0.0	25	0.3	64	0.7	30	0.3	4	0.0	0	0.0	0	0.0	123	1.4
E	0	0.0	29	0.3	28	0.3	56	0.6	26	0.3	1	0.0	0	0.0	140	1.6
ESE	0	0.0	16	0.2	29	0.3	28	0.3	15	0.2	4	0.0	0	0.0	92	1.0
SE	0	0.0	16	0.2	47	0.5	13	0.1	9	0.1	5	0.1	0	0.0	90	1.0
SSE	0	0.0	26	0.3	46	0.5	53	0.6	17	0.2	3	0.0	2	0.0	147	1.7
S	0	0.0	13	0.1	88	1.0	146	1.7	29	0.3	2	0.0	1	0.0	279	3.2
SSW	0	0.0	20	0.2	108	1.2	89	1.0	24	0.3	1	0.0	1	0.0	243	2.8
SW	0	0.0	20	0.2	103	1.2	62	0.7	13	0.1	0	0.0	0	0.0	198	2.3
WSW	0	0.0	16	0.2	69	0.8	53	0.6	8	0.1	1	0.0	1	0.0	148	1.7
W	1	0.0	28	0.3	96	1.1	94	1.1	29	0.3	5	0.1	2	0.0	255	2.9
WNW	1	0.0	31	0.4	126	1.4	131	1.5	37	0.4	2	0.0	0	0.0	328	3.7
NW	6	0.1	40	0.5	51	0.6	84	1.0	19	0.2	1	0.0	0	0.0	201	2.3
NNW	2	0.0	26	0.3	48	0.5	56	0.6	13	0.1	0	0.0	0	0.0	145	1.7
	10	0.1	394	4.5	1084	12.4	992	11.3	254	2.9	26	0.3	9	0.1	2769	31.5

MEAN WIND SPEED: 7.6
MISSING: 0

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

LIMERICK MET DATA 1/04-12/04

JOINT DISTRIBUTION OF WIND DIRECTION AND SPEED
BY ATMOSPHERIC STABILITY CLASS
WIND: LEVEL 2
DELTA T: (266-26FT)

LAPSE RATE: 1.6 TO 4.0 DEG C/100M
CLASS F

WIND SPEED GROUPS (MPH)

	0.0-0.5		0.6-3.5		3.6-7.5		7.6-12.5		12.6-18.5		18.6-24.5		GE 24.6		SUM	PERCENT
DIRECTION	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT		
N	0	0.0	9	0.1	21	0.2	12	0.1	0	0.0	0	0.0	0	0.0	42	0.5
NNE	0	0.0	14	0.2	9	0.1	7	0.1	1	0.0	0	0.0	0	0.0	31	0.4
NE	0	0.0	18	0.2	10	0.1	1	0.0	0	0.0	0	0.0	0	0.0	29	0.3
ENE	0	0.0	6	0.1	14	0.2	1	0.0	1	0.0	0	0.0	0	0.0	22	0.3
E	0	0.0	16	0.2	9	0.1	4	0.0	1	0.0	0	0.0	0	0.0	30	0.3
ESE	0	0.0	13	0.1	2	0.0	2	0.0	1	0.0	0	0.0	0	0.0	18	0.2
SE	0	0.0	7	0.1	4	0.0	0	0.0	0	0.0	0	0.0	0	0.0	11	0.1
SSE	0	0.0	8	0.1	11	0.1	4	0.0	0	0.0	0	0.0	0	0.0	23	0.3
S	0	0.0	11	0.1	19	0.2	6	0.1	2	0.0	0	0.0	0	0.0	38	0.4
SSW	0	0.0	17	0.2	18	0.2	10	0.1	0	0.0	0	0.0	0	0.0	45	0.5
SW	0	0.0	10	0.1	28	0.3	14	0.2	1	0.0	0	0.0	0	0.0	53	0.6
WSW	0	0.0	12	0.1	30	0.3	19	0.2	0	0.0	0	0.0	0	0.0	61	0.7
W	0	0.0	29	0.3	77	0.9	26	0.3	0	0.0	0	0.0	0	0.0	132	1.5
WNW	0	0.0	27	0.3	94	1.1	72	0.8	5	0.1	0	0.0	0	0.0	198	2.3
NW	0	0.0	20	0.2	49	0.6	10	0.1	0	0.0	0	0.0	0	0.0	79	0.9
NNW	1	0.0	17	0.2	25	0.3	8	0.1	0	0.0	0	0.0	0	0.0	51	0.6
	1	0.0	234	2.7	420	4.8	196	2.2	12	0.1	0	0.0	0	0.0	863	9.8

MEAN WIND SPEED: 5.5
MISSING: 0

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

LIMERICK MET DATA 1/04-12/04

JOINT DISTRIBUTION OF WIND DIRECTION AND SPEED
BY ATMOSPHERIC STABILITY CLASS
WIND: LEVEL 2
DELTA T: (266-26FT)

LAPSE RATE: GT 4.0 DEG C/100M
CLASS G

WIND SPEED GROUPS (MPH)

	0.0-0.5		0.6-3.5		3.6-7.5		7.6-12.5		12.6-18.5		18.6-24.5		GE 24.6		SUM	PERCENT
DIRECTION	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT		
N	0	0.0	5	0.1	3	0.0	0	0.0	0	0.0	0	0.0	0	0.0	8	0.1
NNE	0	0.0	6	0.1	6	0.1	0	0.0	0	0.0	0	0.0	0	0.0	12	0.1
NE	0	0.0	2	0.0	3	0.0	0	0.0	0	0.0	0	0.0	0	0.0	5	0.1
ENE	0	0.0	4	0.0	2	0.0	0	0.0	0	0.0	0	0.0	0	0.0	6	0.1
E	0	0.0	1	0.0	1	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	0.0
ESE	0	0.0	3	0.0	0	0.0	1	0.0	0	0.0	0	0.0	0	0.0	4	0.0
SE	0	0.0	4	0.0	0	0.0	1	0.0	0	0.0	0	0.0	0	0.0	5	0.1
SSE	0	0.0	2	0.0	2	0.0	0	0.0	0	0.0	0	0.0	0	0.0	4	0.0
S	0	0.0	2	0.0	5	0.1	1	0.0	0	0.0	0	0.0	0	0.0	8	0.1
SSW	0	0.0	5	0.1	10	0.1	2	0.0	0	0.0	0	0.0	0	0.0	17	0.2
SW	0	0.0	5	0.1	16	0.2	2	0.0	0	0.0	0	0.0	0	0.0	23	0.3
WSW	0	0.0	7	0.1	16	0.2	0	0.0	1	0.0	0	0.0	0	0.0	24	0.3
W	0	0.0	16	0.2	36	0.4	9	0.1	2	0.0	0	0.0	0	0.0	63	0.7
WNW	0	0.0	21	0.2	70	0.8	46	0.5	2	0.0	0	0.0	0	0.0	139	1.6
NW	0	0.0	5	0.1	11	0.1	6	0.1	0	0.0	0	0.0	0	0.0	22	0.3
NNW	0	0.0	6	0.1	4	0.0	1	0.0	0	0.0	0	0.0	0	0.0	11	0.1
	0	0.0	94	1.1	185	2.1	69	0.8	5	0.1	0	0.0	0	0.0	353	4.0

MEAN WIND SPEED: 5.4
MISSING: 0

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

LIMERICK MET DATA 1/04-12/04

JOINT DISTRIBUTION OF WIND DIRECTION AND SPEED
BY ATMOSPHERIC STABILITY CLASS
WIND: LEVEL 2
DELTA T: (266-26FT)

ALL STABILITY CLASSES

WIND SPEED GROUPS (MPH)

	0.0-0.5		0.6-3.5		3.6-7.5		7.6-12.5		12.6-18.5		18.6-24.5		GE 24.6		SUM	PERCENT
DIRECTION	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT		
N	0	0.0	77	0.9	139	1.6	112	1.3	46	0.5	3	0.0	1	0.0	378	4.3
NNE	0	0.0	72	0.8	169	1.9	136	1.5	24	0.3	2	0.0	2	0.0	405	4.6
NE	0	0.0	86	1.0	218	2.5	145	1.7	9	0.1	0	0.0	0	0.0	458	5.2
ENE	0	0.0	70	0.8	208	2.4	139	1.6	20	0.2	1	0.0	0	0.0	438	5.0
E	0	0.0	74	0.8	142	1.6	192	2.2	83	0.9	5	0.1	0	0.0	496	5.7
ESE	0	0.0	48	0.5	67	0.8	72	0.8	44	0.5	7	0.1	0	0.0	238	2.7
SE	0	0.0	47	0.5	93	1.1	38	0.4	18	0.2	5	0.1	0	0.0	201	2.3
SSE	0	0.0	56	0.6	97	1.1	139	1.6	36	0.4	4	0.0	2	0.0	334	3.8
S	0	0.0	46	0.5	179	2.0	269	3.1	70	0.8	8	0.1	1	0.0	573	6.5
SSW	0	0.0	66	0.8	220	2.5	218	2.5	72	0.8	5	0.1	1	0.0	582	6.6
SW	0	0.0	56	0.6	237	2.7	158	1.8	61	0.7	6	0.1	0	0.0	518	5.9
WSW	0	0.0	60	0.7	172	2.0	144	1.6	49	0.6	10	0.1	2	0.0	437	5.0
W	1	0.0	103	1.2	319	3.6	256	2.9	203	2.3	78	0.9	24	0.3	984	11.2
WNW	1	0.0	100	1.1	409	4.7	447	5.1	298	3.4	136	1.5	43	0.5	1434	16.3
NW	6	0.1	85	1.0	183	2.1	259	3.0	165	1.9	95	1.1	23	0.3	816	9.3
NNW	4	0.0	72	0.8	129	1.5	151	1.7	108	1.2	17	0.2	4	0.0	485	5.5
	12	0.1	1118	12.7	2981	34.0	2875	32.8	1306	14.9	382	4.4	103	1.2	8777	100.0

MISSING HOURS: 7

MEAN WIND SPEED: 8.9

SITE: LIMERICK GENERATING STATION – UNITS 1 & 2
LICENSEE: EXELON GENERATION COMPANY, LLC

LIMERICK MET DATA 1/04-12/04

JOINT DISTRIBUTION OF WIND DIRECTION AND SPEED
BY ATMOSPHERIC STABILITY CLASS
WIND: LEVEL 2
DELTA T: (266-26FT)

DIRECTION VS SPEED ONLY

WIND SPEED GROUPS (MPH)

	0.0-0.5		0.6-3.5		3.6-7.5		7.6-12.5		12.6-18.5		18.6-24.5		GE 24.6		SUM	PERCENT
DIRECTION	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT	SUM	PERCENT		
N	0	0.0	77	0.9	139	1.6	112	1.3	46	0.5	3	0.0	1	0.0	378	4.3
NNE	0	0.0	72	0.8	169	1.9	136	1.5	24	0.3	2	0.0	2	0.0	405	4.6
NE	0	0.0	86	1.0	218	2.5	145	1.7	9	0.1	0	0.0	0	0.0	458	5.2
ENE	0	0.0	70	0.8	208	2.4	139	1.6	20	0.2	1	0.0	0	0.0	438	5.0
E	0	0.0	74	0.8	142	1.6	192	2.2	83	0.9	5	0.1	0	0.0	496	5.7
ESE	0	0.0	48	0.5	67	0.8	72	0.8	44	0.5	7	0.1	0	0.0	238	2.7
SE	0	0.0	47	0.5	93	1.1	38	0.4	18	0.2	5	0.1	0	0.0	201	2.3
SSE	0	0.0	56	0.6	97	1.1	139	1.6	36	0.4	4	0.0	2	0.0	334	3.8
S	0	0.0	46	0.5	179	2.0	269	3.1	70	0.8	8	0.1	1	0.0	573	6.5
SSW	0	0.0	66	0.8	220	2.5	218	2.5	72	0.8	5	0.1	1	0.0	582	6.6
SW	0	0.0	56	0.6	237	2.7	158	1.8	61	0.7	6	0.1	0	0.0	518	5.9
WSW	0	0.0	60	0.7	172	2.0	144	1.6	49	0.6	10	0.1	2	0.0	437	5.0
W	1	0.0	103	1.2	319	3.6	256	2.9	203	2.3	78	0.9	24	0.3	984	11.2
WNW	1	0.0	100	1.1	409	4.7	447	5.1	298	3.4	136	1.5	43	0.5	1434	16.3
NW	6	0.1	85	1.0	183	2.1	259	3.0	165	1.9	95	1.1	23	0.3	816	9.3
NNW	4	0.0	72	0.8	129	1.5	151	1.7	108	1.2	17	0.2	4	0.0	485	5.5
	12	0.1	1118	12.7	2981	34.0	2875	32.8	1306	14.9	382	4.4	103	1.2	8777	100.0

MISSING HOURS: 7

MEAN WIND SPEED: 8.9

LIMERICK MET DATA 1/04-12/04

LIMERICK GENERATING STATION
DATA RECOVERY SUMMARY

LEVEL 2 - TOWER 1 175' OR TOWER 2 304'

PARAMETER	COUNT	PERCENT
PRIMARY SPEED GOOD HOURS	8259	94.02%
BACKUP SPEED GOOD HOURS	6156	70.08%
BACKUP SPEED HOURS USED	518	5.90%
TOTAL AVAILABLE SPEED HOURS	8777	99.92%
PRIMARY DIRECTION GOOD HOURS	8264	94.08%
BACKUP DIRECTION GOOD HOURS	7777	88.54%
BACKUP DIRECTION HOURS USED	513	5.84%
TOTAL AVAILABLE DIRECTION HOURS	8777	99.92%
PRIMARY (266-26') DELTA TEMP HOURS	8267	94.11%
BACKUP (300-26') DELTA TEMP HOURS	7771	88.47%
BACKUP DELTA TEMP HOURS USED	510	5.81%
TOTAL AVAILABLE DELTA TEMP HOURS	8777	99.92%
LEVEL 2 JOINT DATA RECOVERY:	8777	99.92%

LIMERICK GENERATING STATION

UNITS 1 AND 2

OFFSITE DOSE CALCULATION MANUAL

Revision 22

EXELON NUCLEAR

DOCKET NOS. 50-352 AND 50-353

Limerick Generating Station
Offsite Dose Calculation Manual

PURPOSE:

The OFFSITE DOSE CALCULATION MANUAL (ODCM) shall contain the methodology and parameters used in the calculation of offsite doses resulting from radioactive gaseous and liquid effluent, in the calculation of gaseous and liquid effluent monitoring alarm/trip setpoints, and in the conduct of the Radiological Environmental Monitoring Program.

SCOPE:

The ODCM shall also contain the Radioactive Effluent Controls Programs, the Meteorological Monitoring Program, the Radiological Environmental Monitoring Program required by Tech. Spec. Section 6.8.4 and the descriptions of the information that should be included in the Annual Radiological Environmental Operating and Annual Radioactive Effluent Release Reports required by Tech Spec. Sections 6.9.1.7 and 6.9.1.8, respectively.

Change Matrix

The following details the linkage between the Revision 21 of the ODCM and Revision 22 regarding the renumbering of the various sections. The purpose of this section is to permit a cross-reference from the old to new revision of the ODCM for procedures and surveillance tests. Changes to procedures to address the new numbering will occur as the procedures are revised on their normal revision process cycle.

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2.0 Bases	Bases
—	3.0 Applicability 3.0.1 3.0.2 3.0.3 3.0.4 4.0 Surveillance Requirement 4.0.1 4.0.2 4.0.3 4.0.4
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3.2.4 Liquid Radwaste Treatment System 3.2.4-1 —	3.2.1.3 Liquid Radwaste Treatment System 4.2.1.3.1 4.2.1.3.2

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None	3.2.2.4 Gaseous Radwaste Treatment System
3.3.5 Ventilation Exhaust Treatment System 3.3.5-1 —	3.2.2.5 Ventilation Exhaust Treatment System 4.2.2.5.1 4.2.2.5.2
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3.3.7 Total Dose 3.3.7-1 3.3.7-2	3.2.3 Total Dose 4.2.3.1 4.2.3.2
3.3.8 Dose – Incineration of Radioactive Waste Oil 3.3.8-1 3.3.8-2	3.2.2.6 Incineration of Radioactive Waste Oil 4.2.2.6.1 4.2.2.6.2
3.4.1 Radiological Environmental Monitoring Program 3.4.1-1 Table I3.4-1 REMP Table I3.4-2 Reporting Levels Table I3.4-3 Lower Limit of Detection	3.3.1 Radiological Environmental Monitoring Program 4.3.1 Table 3.3-1 REMP Table 4.3-1 Reporting Levels Table 4.3-2 Lower Limit of Detection
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Revision 21 – Old	Revision 22 - New
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1.4 Liquid Effluent Dose Projection	1.3.2 Liquid Effluent Dose Projection
Appendix A Technical Specification/ODCM Matrix	Deleted
Appendix B - Radiological Environmental Monitoring Program – Sample Type, Location and Analysis	Appendix A - Radiological Environmental Monitoring Program – Sample Type, Location and Analysis
Appendix C – ODCM Revision Process	Part I, Section 6.4 Changes to the ODCM

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PART I

RADIOLOGICAL EFFLUENT CONTROLS

1.0 DEFINITIONS

The following terms are taken from LGS Unit 1/Unit 2 Tech Specs. unless otherwise noted:

1.1 ACTION

ACTION shall be that part of a specification, which prescribes remedial measures, required under designated conditions.

1.2 CHANNEL CALIBRATION

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

1.3 CHANNEL CHECK

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

1.4 CHANNEL FUNCTIONAL TEST

A CHANNEL FUNCTIONAL TEST shall be:

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

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

The CHANNEL FUNCTIONAL TEST may be performed by any series of sequential, overlapping or total channel steps such that the entire channel is tested.

1.5 CONTINUOUS SAMPLING

Per ASTM Standard (1987) Section II (Water and Environmental Technology), Volume 11.03, Article D1356; is defined as "sampling without interruptions throughout an operation or for a predetermined time." A CONTINUOUS SAMPLE is

the opposite of a GRAB SAMPLE. The time period involved to secure (shut-down) ventilation or re-establish sampling of the release pathway shall meet the intent of CONTINUOUS SAMPLING. Consistent with industry standards, the time allowance shall not exceed 8 hours.

1.6 CONTROLLED AREA

CONTROLLED AREA means an area, outside of a restricted area but inside the site boundary, access to which can be limited by the licensee for any reason.

1.7 DOSE EQUIVALENT I-131

DOSE EQUIVALENT I-131 shall be that concentration of I-131, microcuries per gram, which alone would produce the same thyroid dose as the quantity and isotopic mixture of I-131, I-132, I-133, I-134 and I-135 actually present. The thyroid dose conversion factors used for this calculation shall be those listed in Table III of TID-14844, "Calculation of Distance Factors for Power and Test Reactor Sites."

1.8 FREQUENCY NOTATION

The FREQUENCY NOTATION specified for the performance of Surveillance Requirements shall correspond to the intervals defined in Table 1-1.

1.9 MEMBER(S) OF THE PUBLIC

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

1.10 OPERABLE - OPERABILITY

A system, subsystem, train, component or device shall be OPERABLE or have OPERABILITY when it is capable of performing its specified functions(s) and when all necessary attendant instrumentation, controls, electrical power, cooling or seal water, lubrication or other auxiliary equipment that are required for the system, subsystem, train, component or device to perform its function(s) are also capable of performing their related support function(s).

1.0 DEFINITIONS

1.11 OPERATIONAL CONDITION - CONDITION

An OPERATIONAL CONDITION, i.e., CONDITION, shall be any one inclusive combination of mode switch position and average reactor coolant temperature as defined in the Technical Specifications.

1.12 PURGE - PURGING

PURGE or PURGING shall be the controlled process of discharging air or gas from a confinement to maintain temperature, pressure, humidity, concentration or other operating condition, in such a manner that replacement air or gas is required to purify the confinement.

1.13 RATED THERMAL POWER

See current LGS Tech Spec definition.

1.14 REPORTABLE EVENT

A REPORTABLE EVENT shall be any of those conditions specified in Section 50.73 of 10 CFR Part 50.

1.16 RESTRICTED AREA

The RESTRICTED AREA means an area, access to which is limited by the licensee for the purpose of protecting individuals against undue risks from exposure to radiation and radioactive materials (Figure 1-1).

1.17 SITE BOUNDARY

The SITE BOUNDARY shall be that line beyond which the land or property is not owned, leased, or otherwise controlled by the licensee (Figure 1-1).

1.18 SOURCE CHECK

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

1.19 THERMAL POWER

THERMAL POWER shall be the total reactor core heat transfer rate to the reactor coolant.

1.0 DEFINITIONS

1.20 UNRESTRICTED AREA

An UNRESTRICTED AREA shall be any area at or beyond the SITE BOUNDARY access to which is not controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials, or any area within the SITE BOUNDARY used for residential quarters or for industrial, commercial, institutional, and/or recreational purposes.

1.21 VENTILATION EXHAUST TREATMENT SYSTEM

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

1.22 VENTING

VENTING shall be the controlled process of discharging air or gas from a confinement to maintain temperature, pressure, humidity, concentration or other operating condition, in such a manner that replacement air or gas is not provided or required during VENTING. Vent, used in system names, does not imply a VENTING process.

1.0 DEFINITIONS

TABLE 1-1

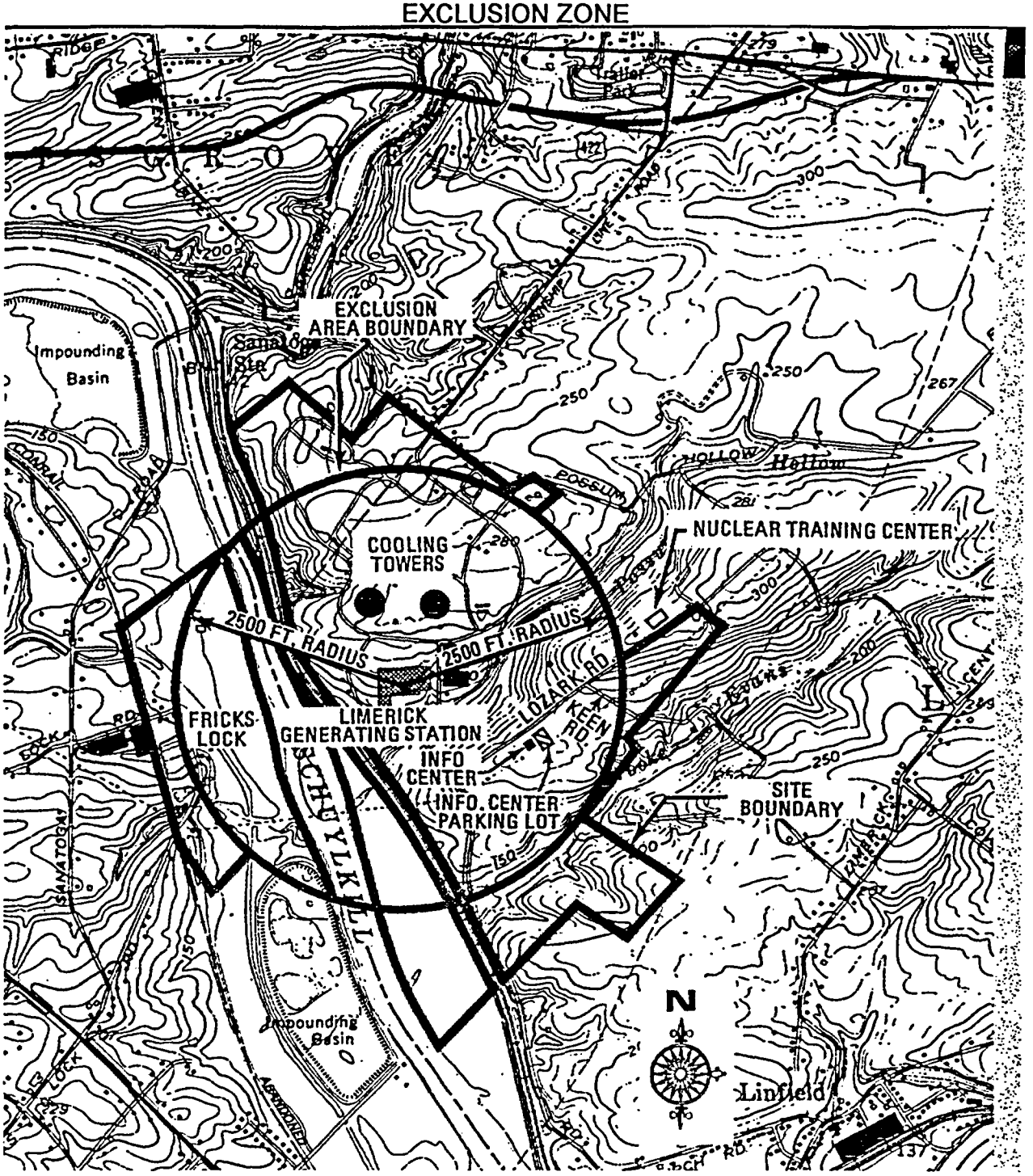
SURVEILLANCE FREQUENCY NOTATION

NOTATION	FREQUENCY
S (Shift)	At least once per 12 hours.
D (Daily)	At least once per 24 hours.
W (Weekly)	At least once per 7 days.
M (Monthly)	At least once per 31 days.
Q (Quarterly)	At least once per 92 days.
SA (Semi-annual)	At least once per 184 days.
A (Annual)	At least once per 366 days.
E	At least once per 18 months (550 days).
R	At least once per 24 months (731 days).
S/U	Prior to each reactor startup.
P	Prior to each radioactive release.
N.A.	Not applicable

1.0 DEFINITIONS

FIGURE 1-1

EXCLUSION ZONE



1.0 DEFINITIONS

FIGURE 1-2

LOW POPULATION ZONE

3/4 CONTROLS AND SURVEILLANCE REQUIREMENTS

3/4.0 APPLICABILITY

CONTROLS

3.0.1 Compliance with the Controls contained in the succeeding controls is required during the OPERATIONAL CONDITIONS or other conditions specified therein; except that upon failure to meet the Control, the associated ACTION requirements shall be met.

3.0.2 Noncompliance with a Control shall exist when the requirements of the Control and associated ACTION requirements are not met within the specified time intervals. If the Control is restored prior to expiration of the specified time intervals, completion of the ACTION requirements is not required.

3.0.3 When a Control is not met, except as provide in the associated ACTION requirements, within 1 hour action shall be initiated to place the unit in an

a. At least STARTUP within the next 6 hours

b. At least HOT SHUTDOWN within the following 6 hours, and

c. At least COLD SHUTDOWN within the subsequent 24 hours.

Where corrective measures are completed that permit operation under the ACTION requirements, the ACTION may be taken in accordance with the specified time limits as measured from the time of failure to meet the Control. Exceptions to these requirements are stated in the individual controls.

This control is not applicable in OPERATIONAL CONDITIONS 4 or 5.

3.0.4 When a Limiting Condition for Operation is not met, entry into an OPERATIONAL CONDITION or other specified condition in the Applicability shall only be made:

a. When the associated ACTION requirements to be entered permit continued operation in the OPERATIONAL CONDITION or other specified condition in the Applicability for an unlimited period of time; or

b. After performance of a risk assessment addressing inoperable systems and components, consideration of the results, determination of the acceptability of entering the OPERATIONAL CONDITION or other specified condition in the Applicability, and establishment of risk management actions, if appropriate; exceptions to this Control are stated in the individual Controls; or

c. When an allowance is stated in the individual value, parameter, or other Control.

3/4 CONTROLS AND SURVEILLANCE REQUIREMENTS

3/4.0 APPLICABILITY

SURVEILLANCE REQUIREMENTS

4.0.1 Surveillance Requirements shall be met during the OPERATIONAL CONDITIONS or other specified conditions in the Applicability for individual Controls, unless otherwise stated in the Surveillance Requirement. Failure to meet a Surveillance, whether such failure is experienced during the performance of the Surveillance or between performances of the Surveillance, shall be failure to meet the Control. Failure to perform a Surveillance within the specified Surveillance time interval and allowed extension per Surveillance Requirement 4.0.2, shall be failure to meet the Control except as provided in Surveillance Requirement 4.0.3. Surveillances do not have to be performed on inoperable equipment or variables outside specified limits.

4.0.2 Each Surveillance Requirement shall be performed within the specified surveillance time interval with a maximum allowable extension not to exceed 25% of the surveillance interval.

4.0.3 If it is discovered that a Surveillance was not performed within its specified Surveillance time interval and allowed extension per Surveillance Requirement 4.0.2, then compliance with the requirement to declare the Control not met may be delayed, from the time of discovery, up to 24 hours or up to the limit of the specified Surveillance time interval, whichever is greater. This delay period is permitted to allow performance of the Surveillance. A risk evaluation shall be performed for any Surveillance delayed greater than 24 hours and the risk impact shall be managed.

If the Surveillance is not performed within the delay period, the Control must immediately be declared not met, and the applicable ACTION requirements must be entered.

When the Surveillance is performed within the delay period and the Surveillance is not met, the Control must immediately be declared not met, and the applicable ACTION requirements must be entered.

4.0.4 Entry into an OPERATIONAL CONDITION or other specified condition in the Applicability of a Control shall only be made when the Control's Surveillance Requirements have been met within their Surveillance time interval, except as provided in Surveillance Requirement 4.0.3. When a Control is not met due to its Surveillance Requirements not having been met, entry into an OPERATIONAL CONDITION or other specified condition in the Applicability shall only be made in accordance with Control 3.0.4.

3/4.1 INSTRUMENTATION

3/4.1.1 RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

CONTROLS

3.1.1 The radioactive liquid effluent monitoring instrumentation channels shown in Table 3.1-1 shall be OPERABLE with their alarm/trip setpoints set to ensure that Control 3.2.1.1 is not exceeded. The alarm/setpoints* of these channels shall be determined and adjusted in accordance with the methodology and parameters in ODCM Part II, Section 1.2.

APPLICABILITY: At all times.

ACTION:

a. With a radioactive liquid effluent monitoring instrumentation channel alarm/trip setpoint less conservative than required by the above control, immediately suspend the release of radioactive liquid effluents monitored by the affected channel, and declare the channel inoperable.

b. With less than the minimum number of radioactive liquid effluent monitoring instrumentation channels OPERABLE, take the ACTION shown in Table 3.1-1. Restore the inoperable instrumentation to OPERABLE status within the time specified in the ACTION or explain in the next Annual Radioactive Effluent Release Report why this inoperability was not corrected within the time specified.

c. The provisions of Controls 3.0.3 and 3.0.4 are not applicable. Report all deviations in the Annual Radioactive Effluent Release Report.

SURVEILLANCE REQUIREMENTS

4.1.1 Each radioactive liquid effluent monitoring instrumentation channel shall be demonstrated OPERABLE by performance of the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION and CHANNEL FUNCTIONAL TEST operations at the frequencies shown in Table 4.1-1.

* Excluding the flow rate measuring devices which are not determined and adjusted in accordance with the ODCM.

TABLE 3.1-1

RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

	INSTRUMENT	MINIMUM CHANNELS OPERABLE	ACTION
1.	Gross Radioactivity Monitors Providing Automatic Termination of Release		
	a. Liquid Radwaste Effluent Line	1	100
	b. A/B RHR Service Water Effluent Line *	1/loop	101
2.	Gross Radioactivity Monitors Not Providing Automatic Termination of Release		
	a. Service Water Effluent Line	1	101
3	Flow Rate Measurement Devices		
	a. Liquid Radwaste Effluent Line	1	102
	b. Discharge Line	1	102

* Termination of the release is accomplished by auto trip of the RHRSW pumps and remote manual closure of isolation valves.

TABLE 3.1-1 (Continued)

ACTION STATEMENTS

Action 100 - With less than the Minimum Required Channels operable, effluent releases may continue for up to 14 days provided that prior to initiating a release:

a. At least two independent samples are analyzed in accordance with SURVEILLANCE REQUIREMENT 4.2.1.1.1, and

b. At least two technically qualified members of the facility staff independently verify the release rate calculations and discharge line valving;

Otherwise, suspend release of radioactive effluents via this pathway.

Action 101 - With less than the Minimum Required Channels operable, effluent releases via this pathway may continue for up to 30 days provided that, at least once per 8 hours, grab samples are collected and analyzed for radioactivity by gamma isotopic analysis (Principal Gamma Emitters, I-131, and Dissolved/ Entrained Gases) at a Lower Limit of Detection as specified in Table 4.2-1 or gross radioactivity (beta or gamma). Gross Beta is analyzed at an LLD of at least 1E-7 uCi/ml. Gross Gamma is analyzed at an LLD of at least 5E-7 uCi/ml.

If the A or B RHRSW Process Rad Monitor should become inoperable, sampling is required at least once every eight (8) hours at a sample point common with the inoperable A and/or B RHRSW Process Rad Monitor(s). If a monitor is inoperable but will still continuously sample and annunciate on high activity, i.e. rad monitor bypass switch placed in "Bypass", Chemistry sampling is not required as the continuous monitor sampling complies with the periodic sampling requirement.

Action 102 - With less than the Minimum Required Channels operable, 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. Pump curves generated in situ may be used to estimate flow.

TABLE 4.1-1

RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

	INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST
1.	Gross Radioactivity Monitors Providing Automatic Termination of Release				
	a. Liquid Radwaste Effluent Line	D*	D*	R(3)	Q(1)
	b. RHR Service Water System Effluent Line	D	M	R(3)	Q(1)
2.	Gross Radioactivity Monitored Not Providing Automatic Termination of Release				
	a. Service Water System Effluent Line	D	M	R(3)	Q(2)
3.	Flow Rate Measurement Devices				
	a. Liquid Radwaste Effluent Line	D(4)	N.A.	R	Q
	b. Discharge Line	D(4)	N.A.	R	Q

* Daily when in use

TABLE 4.1-1 (Continued)

TABLE NOTATIONS

(1) The CHANNEL FUNCTIONAL TEST shall also demonstrate that automatic isolation of this pathway and control room alarm annunciation will occur 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.

(2) The CHANNEL FUNCTIONAL TEST shall also demonstrate 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.

(3) The initial CHANNEL CALIBRATION shall be performed using reference standards certified by the National Institute of Standards and Technology (NIST) obtained from suppliers that participate in measurement assurance activities with NIST. These standards shall permit calibrating the system over its intended range of energy and measurements range. For subsequent CHANNEL CALIBRATION, sources that have been related to the initial calibration shall be used.

(4) CHANNEL CHECK shall consist of verifying indication of flow during periods of release. CHANNEL CHECK shall be made at least once per 24 hours on days on which batch releases are made.

3/4.1 INSTRUMENTATION

3/4.1.2 RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION CONTROLS

3.1.2 The radioactive gaseous effluents monitoring instrumentation channels in Table 3.1-2 shall be OPERABLE with their alarm/trip setpoints set to ensure that the limits of Control 3.2.2.1.a are not exceeded. The alarm/trip setpoints of the applicable channels shall be determined in accordance with the methodology and parameters in ODCM Part II, Section 2.2.

APPLICABILITY: As shown in Table 3.1-2.

ACTION:

a. With a radioactive gaseous effluent monitoring instrumentation channel alarm/trip setpoints less conservative than required by ODCM Part II, Section 2.2, immediately suspend the release of radioactive gaseous effluents monitored by the affected channel or declare the channel inoperable.

b. With less than the minimum number of radioactive gaseous effluent monitoring instrumentation channels OPERABLE, take the ACTION shown in Table 3.1-2. Restore the inoperable instrumentation to OPERABLE status within the time specified in the ACTION or explain in the next Annual Radioactive Effluent Release Report why this inoperability was not corrected within the time specified.

c. The provisions of Controls 3.0.3 and 3.0.4 are not applicable. Report all deviations in the Annual Radioactive Effluent Release Report.

SURVEILLANCE REQUIREMENTS

4.1.2 Each radioactive gaseous effluent monitoring instrumentation channel shall be demonstrated OPERABLE by performance of the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION AND CHANNEL FUNCTIONAL TEST operations at the frequencies shown in Table 4.1-2.

TABLE 3.1-2

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

	INSTRUMENT	MINIMUM CHANNELS OPERABLE	APPLICABILITY	ACTION
1.	SOUTH STACK EFFLUENT MONITORING SYSTEM			
	a. Noble Gas Activity Monitor	1	*	111
	b. Iodine Sampler	1	*	112
	c. Particulate Sampler	1	*	112
	d. Effluent System Flow Rate Monitor	1	*	113
	e. Sampler Flow Rate Monitor	1	*	113
2.	NORTH STACK EFFLUENT MONITORING SYSTEM +			
	a. Noble Gas Activity Monitor	1	*	114
	b. Iodine Sampler	1	*	112
	c. Particulate Sampler	1	*	112
	d. Effluent System Flow Rate Monitor	1	*	113
	e. Sampler Flow Rate Monitor	1	*	113
3.	HOT MAINTENANCE SHOP VENTILATION EXHAUST RADIATION MONITOR++			
	a. Iodine Sampler	1	**	115
	b. Particulate Sampler	1	**	115
	c. Effluent System Flow Rate Monitor	1	**	113
	d. Sampler Flow Rate Monitor	1	**	113

TABLE NOTATIONS

\+ The (A or B) North Stack Normal Range Radiation Monitors OR the Wide Range Accident Monitor (Low Range) may be used to satisfy requirements for the North Stack Effluent Monitoring System.

++ Particulate filter and iodine cartridge replacement does not affect the operability of the system.

* At all times.

** During operation of the hot maintenance shop ventilation system.

TABLE 3.1-2 (Continued)

TABLE NOTATIONS

ACTION STATEMENTS

ACTION 111 - (SS Noble Gas)	With less than the minimum Required Channels OPERABLE, effluent releases via this pathway may continue for up to 30 days provided grab samples are taken at least once per 8 hours and these samples are analyzed for radioactivity by gamma isotopic analysis within 24 hours. **IE** monitor readings are available from local computer output, **THEN** GRAB SAMPLES ARE NOT REQUIRED. Obtain monitor readings at least once per 8 hours.
ACTION 112 - (NS and SS Iodine & Part.)	With less than the minimum Required Channels OPERABLE, effluent releases via this pathway may continue for up to 30 days provided samples are continuously collected with auxiliary sampling equipment as required in Table 4.2-2. **IE** the Sample Pump is operable, a particulate and iodine sample can be obtained; **AND** the Minimum Channels Operable requirements are satisfied.
ACTION 113 - (Eff. & Smpl. Flow Rate)	With less than the minimum Required Channels OPERABLE, effluent releases via NS, SS or HMS may continue for up to 30 days provided the flow rate is estimated by adding the nominal flow rates indicated in P&ID M-26 for each in-service fan. This shall be documented in the MCR operations Shift Log at least once per 4 hours.
ACTION 114 - (NS Noble Gas)	With less than the minimum Required Channels OPERABLE, effluent releases via this pathway may continue for up to 30 days provided grab samples are taken at least once per 8 hours and these samples are analyzed for radioactivity by gamma isotopic analysis within 24 hours. The Mechanical Vacuum Pumps may not be operated while in this action statement. **IE** monitor readings are available from local computer output, **THEN** GRAB SAMPLES ARE NOT REQUIRED. Obtain monitor readings at least once per 8 hours.
ACTION 115 - (HMS)	With less than the minimum Required Channels OPERABLE, then secure Hot Maintenance Shop Ventilation.

TABLE 4.1-2

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

	INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBR.	CHANNEL FUNCT. TEST	MODES IN WHICH SURVEILLANCE IS REQUIRED
1.	SOUTH STACK EFFLUENT MONITORING SYSTEM					
	a. Noble Gas Activity Monitor	D	M	R(2)	Q(1)	*
	b. Iodine Sampler	W(3)	N.A.	N.A.	N.A.	*
	c. Particulate Sampler	W(3)	N.A.	N.A.	N.A.	*
	d. Effluent System Flow Rate Monitor	D	N.A.	R	Q	*
	e. Sampler Flow Rate Monitor	D	N.A.	R	Q	*
2.	NORTH STACK EFFLUENT MONITORING SYSTEM #					
	a. Noble Gas Activity Monitor	D	M	R(2)	Q(1)	*
	b. Iodine Sampler	W(3)	N.A.	N.A.	N.A.	*
	c. Particulate Sampler	W(3)	N.A.	N.A.	N.A.	*
	d. Effluent System Flow Rate Monitor	D	N.A.	R	Q	*
	e. Sampler Flow Rate Monitor	D	N.A.	R	Q	*
3.	HOT MAINTENANCE SHOP VENTILATION EXHAUST RADIATION MONITOR					
	a. Iodine Sampler	W(3)	N.A.	N.A.	N.A.	**
	b. Particulate Sampler	W(3)	N.A.	N.A.	N.A.	**
	c. Effluent System Flow Rate Monitor	D	N.A.	R	Q	**
	d. Sampler Flow Rate Monitor	D	N.A.	R	Q	**

TABLE NOTATIONS

\+ The (A or B) Wide Range Accident Monitor (WRAM) surveillance is specified in Technical Specification 3.3.7.5.
* At all times.
** During operation of the hot maintenance shop ventilation exhaust system.

TABLE 4.1-2 (Continued)

TABLE NOTATIONS

(1) The CHANNEL FUNCTIONAL TEST shall also demonstrate that control room alarm annunciation occurs if any of the following conditions exists:

1. Instruments indicate measured levels above the alarm/trip setpoint.
2. Circuit failure.
3. Instrument indicates a downscale failure.
4. Instrument controls not set in operate mode.

(2) The initial CHANNEL CALIBRATION shall be performed using one or more of the reference standards certified by the National Institute of Standards and Testing (NIST) or using standards that have been obtained from suppliers that participate in measurement assurance activities with NIST. These standards shall permit calibrating the system over its intended range of energy and measurement range. For subsequent CHANNEL CALIBRATION, sources that are traceable to the initial calibration shall be used.

(3) The iodine cartridges and particulate filters will be changed and analyzed at least once per 7 days.

3/4.2 RADIOACTIVE EFFLUENTS

3/4.2.1 LIQUID EFFLUENTS

3/4.2.1.1 CONCENTRATION

CONTROLS

3.2.1.1 The concentration of radioactive material released in liquid effluents to UNRESTRICTED AREAS (see Figures 1-1 and 1-2) shall be limited to the concentrations specified in 10 CFR Part 20, Appendix B, Table II, Column 2 (pre-1994) for radionuclides other than dissolved or entrained nobles gases. For dissolved or entrained noble gases, the concentration shall be limited to 2E-4 microcuries/ml total activity (NUREG 0133, Section 2).

APPLICABILITY: At all times.

ACTION:

a. With the concentration of radioactive material released in liquid effluents to UNRESTRICTED AREAS exceeding the above limits, immediately restore the concentration to within the above limits or terminate the release.

b. The provisions of Controls 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.2.1.1.1 Radioactive liquid wastes shall be sampled and analyzed according to the sampling and analysis program of Table 4.2-1.

4.2.1.1.2 The results of the radioactivity analyses shall be used in accordance with the methodology and parameters in ODCM Part II, Section 1.2 to assure that the concentrations at the point of release are maintained within the limits of Control 3.2.1.1.

TABLE 4.2-1

RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM

Liquid Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD)[a] (uCi/ml)
A. Batch Waste Release Tanks[b]	P Each Batch	P Each Batch	Principal Gamma Emitters[c]	5E-7
			I-131	1E-6
1. Floor or Equip. Drain Sample Tanks	P One Batch/M	M	Dissolved and Entrained Gases (Gamma Emitters)[c]	1E-5
2. Laundry Drain Sample Tank	P Each Batch	M Composite[d]	H-3	1E-5
			Gross Alpha	1E-7
	P Each Batch	Q Composite[d]	Sr-89, Sr-90	5E-8
			Fe-55	1E-6
B. Continuous Release[e]	W Grab Sample	W	Principal Gamma Emitters[c]	5E-7
			I-131	1E-6
1. RHR Service Water System Effluent Line[f]	W Grab Sample	W	Dissolved and Entrained Gases (Gamma Emitters)[c]	1E-5
2. Service Water System Effluent Line[f]	W Grab Sample	M Composite[d]	H-3	1E-5
			Gross Alpha	1E-7
	W Grab Sample	Q Composite[d]	Sr-89, Sr-90	5E-8
			Fe-55	1E-6

TABLE 4.2-1 (Continued)

TABLE NOTATIONS

a. The LLD is defined as the smallest concentration of radioactive material in a sample that will yield a net count, above system background, that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a measurement system, which may include radiochemical separation:

$$\text{LLD (Composite)} = \frac{(2.71 + 4.66\sigma_B)\ (\lambda\Delta t_2)}{E \cdot V \cdot 2.22E6 \cdot Y \cdot [\exp(-\lambda\Delta t_1)]\ (1-\exp(-\lambda\Delta t_2))}$$

$$\text{LLD (Grab Samples)} = \frac{(2.71 + 4.66\ \sigma_B)}{E \cdot V \cdot 2.22E6 \cdot Y\ (\exp - \lambda\Delta t_1)}$$

Where:

2.71	is a statistical term to properly calculate the LLD as the background approaches zero (see reference 17).
LLD	is the a priori lower limit of detection as defined above (as microcuries per unit mass or volume). The LLD for composite samples contains a correction to account for the decay of radionuclides during the collection time $\{(\lambda\Delta t_2) / [\exp(-\lambda\Delta t_1)](1-\exp(-\lambda\Delta t_2))\}$.
σ_B	is the standard deviation of the background counting rate or of the counting rate of blank sample as appropriate (as counts per minute),
E	is the counting efficiency, as counts per disintegration,
V	is the sample size, in units of mass or volume,
2.22E6	is the number of disintegrations per minute per microcurie,
Y	is the fractional radiochemical yield, when applicable,
λ	is the radioactive decay constant for the particular radionuclide,
Δt_1	for the plant effluents is the elapsed time between the end of the sample collection and the start of sample count.
Δt_2	for the plant effluents is the elapsed time between the start and the end of sample collection.

TABLE 4.2-1 (Continued)

TABLE NOTATIONS

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

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

c. The principal gamma emitters for which the LLD specification applies include the following radionuclides: Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, Ce-141 and Ce-144. The dissolved and entrained noble gases (gamma emitters) for which the LLD specification applies include the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, Xe-135m, Xe-138. This list does not mean that only these nuclides are to be considered. Other gamma peaks that are identifiable, together with those of the above nuclides, shall also be analyzed and reported in the Annual Radioactive Effluent Release Report pursuant to Control 6.2.

d. The term "Composite Sample" means a combination of individual samples obtained at regular intervals over a time period. Either the volume of each individual sample is proportional to discharge flow rates, or the sampling interval (for constant volume samples) is proportional to flow rates over the time period used to produce the composite.

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

f. Whenever effluent releases are in excess of the monitor's setpoint.

3/4.2 RADIOACTIVE EFFLUENTS

3/4.2.1 LIQUID EFFLUENTS

3/4.2.1.2 DOSE

CONTROLS

3.2.1.2 The dose or dose commitment to a MEMBER OF THE PUBLIC from radioactive materials in liquid effluents released from the site to UNRESTRICTED AREAS (See Figure 1-1) shall be limited:

a. During any calendar quarter to less than or equal to 3 mrem to the total body and to less than or equal to 10 mrem to any organ, and

b. During any calendar year to less than or equal to 6 mrem to the total body and to less than or equal to 20 mrem to any organ.

APPLICABILITY: At all times.

ACTION:

a. With the calculated dose from the release of radioactive materials in liquid effluents exceeding any of the above limits, Initiate an Issue Report that identifies the cause(s) for exceeding the limit(s) and defines the corrective actions that have been taken to reduce the releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits. This Issue Report shall also include: (1) the results of the radiological analyses of the drinking water source, and (2) the radiological impact on finished drinking water supplies with regard to the requirements of 40 CFR Part 141, Safe Drinking Water Act.*

b. The provisions of Controls 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.2.1.2 Cumulative dose contributions from liquid effluents for the current calendar quarter and the current calendar year shall be determined at least once per 31 days.

* The requirements of Action A. (1) and (2) are applicable only if drinking water supply is taken from the receiving water body within 3 miles of the plant discharge. In the case of river-sited plants this is 3 miles downstream only.

3/4.2 RADIOACTIVE EFFLUENTS

3/4.2.1 LIQUID EFFLUENTS

3/4.2.1.3 LIQUID RADWASTE TREATMENT SYSTEM CONTROLS

3.2.1.3 The liquid radwaste treatment system shall be IN SERVICE and appropriate portions of the system shall be used to reduce the radioactive materials in liquid waste prior to their discharge when the projected doses due to the liquid effluent, from the site, to UNRESTRICTED AREAS (See Figure 1-1) would exceed 0.12 mrem to the total body or 0.4 mrem to any organ in a 31-day period.

APPLICABILITY: At all times.

ACTION:

a. With radioactive liquid waste being discharged without treatment and in excess of the above limits and any portion of the Liquid Radwaste Treatment System not in operation initiate an Issue Report that includes the following information:

   1. Explanation of what liquid radwaste was being discharged without treatment, identification of any inoperable equipment or subsystems, and the reason for the inoperability.

   2. Action(s) taken to restore the inoperable equipment to OPERABLE status, and

   3. Summary description of action(s) taken to prevent a recurrence.

b. The provisions of Controls 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.2.1.3.1 Dose due to liquid releases from the site to UNRESTRICTED AREAS shall be projected at least once per 31 days.

4.2.1.3.2 The installed Liquid Radwaste Treatment System shall be considered OPERABLE by meeting Controls 3.2.1.1 and 3.2.1.2

3/4.2 RADIOACTIVE EFFLUENTS

3/4.2.2 GASEOUS EFFLUENTS

3/4.2.2.1 DOSE RATE

CONTROLS

3.2.2.1 The dose rate due to radioactive materials released in gaseous effluents from the site to areas at or beyond the SITE BOUNDARY (See Figure 1-1) shall be limited to:

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

b. For iodine-131, iodine-133, tritium, and for all radionuclides in particulate form with half-lives greater than 8 days: less than or equal to 1500 mrem/yr to any organ. (Inhalation pathways only).

APPLICABILITY: At all times.

ACTION:

a. With the dose rate(s) exceeding the above limits, immediately restore the release rate to within the above limits.

b. The provisions of Controls 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.2.2.1.1 The dose rate due to noble gases in gaseous effluents shall be determined to be within the above limits.

4.2.2.1.2 The dose rate due to iodine-131, iodine-133, tritium, and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents shall be determined to be within the above limits by obtaining representative samples and performing analyses in accordance with the sampling and analysis program specified in Table 4.2-2.

TABLE 4.2-2

RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS PROGRAM

Gaseous Release Point		Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD)[a]
A.	North Stack/ South Stack	Continuous[d]	Q Comp. Part. Sample	Gross Alpha	1E-11 µCi/cc
				Sr-89, Sr-90	1E-11 µCi/cc
		M[b] Grab Smpl.	M[b]	Noble Gas	1E-4 µCi/cc
				H-3	1E-6 µCi/cc
		Continuous[d]	W[c] Char. Smpl.	I-131	1E-12 µCi/cc
				I-133	1E-10 µCi/cc
			Part. Smpl.	Principal Gamma Emitters[e]	1E-11 µCi/cc
		Continuous[d]	Continuous Noble Gas Monitor	Noble Gas Beta or Gamma	1E-6 µCi/cc (Based on Xe-133)
B.	Hot Mainten. Shop Vent Exhaust[f]	Continuous[d]	Q Comp. Part. Sample	Gross Alpha	1E-11 µCi/cc
				Sr-89, Sr-90	1E-11 µCi/cc
		Continuous[d]	W Char. Smpl.	I-131	1E-12 µCi/cc
				I-133	1E-10 µCi/cc
			Part. Smpl.	Principal Gamma Emitters[e]	1E-11 µCi/cc
C.	Auxiliary Boiler	Prior to batch release for burn.	P Each batch	I-131	1E-6 µCi/ml
				Principal Gamma Emitters[e]	5E-7 µCi/ml
			Q Composite Sample	Gross Alpha	1E-7 µCi/ml
				Sr-89, Sr-90	5E-8 µCi/ml
				H-3	1E-5 µCi/ml
				Fe-55	1E-6 µCi/ml

TABLE 4.2-2 (Continued)

TABLE NOTATIONS

a. The LLD is defined, as the smallest concentration of radioactive material in a sample that will yield a net count, above system background, that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal. It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an after the fact limit for a particular measurement.

For a particular measurement system, (which may include radiochemical separation):

$$\text{LLD (Composite)} = \frac{(2.71 + 4.66\sigma_B)(\lambda\Delta t_2)}{E \cdot V \cdot 2.22E6 \cdot Y \cdot [\exp(-\lambda\Delta t_1)](1-\exp(-\lambda\Delta t_2))}$$

$$\text{LLD (Grab Samples)} = \frac{(2.71 + 4.66\,\sigma_B)}{E \cdot V \cdot 2.22E6 \cdot Y\,(\exp -\lambda\Delta t_1)}$$

Where:

2.71	is a statistical term to properly calculate the LLD as the background approaches zero (see reference 17),
LLD	is the a priori lower limit of detection as defined above (uCi/cc or uCi/ml). The LLD for composite samples contains a correction to account for the decay of radionuclides during the collection time $\{(\lambda\Delta t_2)/[\exp(-\lambda\Delta t_1)](1-\exp(-\lambda\Delta t_2))\}$,
σ_B	is the standard deviation of the background counting rate or of the counting rate of blank sample as appropriate (as cpm), shall be based on the actual observed variance of the background counting rate or of the counting rate of the blank samples (as appropriate) rather than on an unverified theoretically predicted variance.
E	is the counting efficiency, as counts per disintegration,
V	is the sample size, in units of cc or ml,
2.22E6	is the number of dpm/uCi
Y	is the fractional radiochemical yield, when applicable,
λ	is the radioactive decay constant for the particular radionuclide, and
Δt_1	for the plant effluents is the elapsed time between the end of the sample collection and the start of sample count.
Δt_2	for the plant effluents is the elapsed time between the start and the end of sample collection.

TABLE 4.2-2 (Continued)

TABLE NOTATIONS

b. Sampling and analyses shall also be performed following shutdown, startup, or a THERMAL POWER change exceeding 15% of the RATED THERMAL POWER within a 1-hour period. This requirement does not apply if (1) analysis show that the DOSE EQUIVALENT I-131 concentration in the primary coolant has not increased more than a factor of 3; and (2) the main condenser offgas pre-treatment radioactivity monitor shows that effluent activity has not increased more than a factor of 3.

c. Samples shall be changed at least once per 7 days and analyses shall be completed within 48 hours after changing, or after removal from sampler. Sampling shall also be performed at least once per 24 hours for at least 7 days following each shutdown, startup or THERMAL POWER change exceeding 15% of RATED THERMAL POWER in 1 hour and analyses completed within 48 hours of changing. When samples collected for 24 hours are analyzed, the corresponding LLDs may be increased by a factor of 10. This requirement does not apply if (1) analysis shows that the DOSE EQUIVALENT I-131 concentration in the primary coolant 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. The ratio of the sample flow rate to the sampled stream flow rate shall be known for the time period covered by each dose or dose rate calculation made in accordance with Controls 3.2.2.1, 3.2.2.2, and 3.2.2.3.

e. The principal gamma emitters for which the LLD specification applies include the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, Xe-135m and Xe-138 for gaseous emissions and Mn-54, Fe-59, Co-58, Co-60, Zn-65, I-131, Cs-134, Cs-137, Ce-141 and Ce-144 for particulate emissions. This list does not mean that only these nuclides are to be considered. Other gamma peaks which are identifiable, together with the above nuclides, shall also be analyzed and reported in the Annual Radioactive Effluent Release Report, pursuant to Control 6.2.

f. Required for the hot maintenance shop ventilation exhaust only during operation of the hot maintenance shop ventilation exhaust system.

3/4.2 RADIOACTIVE EFFLUENTS

3/4.2.2 GASEOUS EFFLUENTS

3/4.2.2.2 DOSE - NOBLE GASES

CONTROLS

3.2.2.2 The air dose due to noble gases released in gaseous effluents, from the site to areas at and beyond the SITE BOUNDARY (See Figure 1-1) shall be limited to the following:

a. During any calendar quarter: less than or equal to 10 mrad for gamma radiation and less than or equal to 20 mrad for beta radiation, and

b. During any calendar year: less than or equal to 20 mrad for gamma radiation and less than or equal to 40 mrad for beta radiation.

APPLICABILITY: At all times.

ACTION:

a. With the calculated air dose from radioactive noble gases in gaseous effluents exceeding any of the above limits, initiate an Issue Report that identifies the cause(s) for exceeding the limit(s) and defines the corrective actions that have been taken to reduce the releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits.

b. The provisions of Controls 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.2.2.2 Cumulative dose contributions for the current quarter and current calendar year for noble gases shall be determined in accordance with the methodology and parameters in the ODCM at least once per 31 days.

3/4.2 RADIOACTIVE EFFLUENTS

3/4.2.2 GASEOUS EFFLUENTS

3/4.2.2.3 DOSE – IODINE-131, IODINE-133, TRITIUM, AND RADIOACTIVE MATERIAL IN PARTICULATE FORM

CONTROLS

3.2.2.3 The dose to a MEMBER OF THE PUBLIC from iodine-131, iodine-133, tritium and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released from the site to areas at or beyond the SITE BOUNDARY (See Figure 1-1) shall be limited to the following:

a. During any calendar quarter: less than or equal to 15 mrem to any organ and,

b. During any calendar year: less than or equal to 30 mrem to any organ.

APPLICABILITY: At all times.

ACTION:

a. With the calculated dose from the release of iodine-131, iodine-133, tritium and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents exceeding any of the above limits, initiate an Issue Report that identifies the cause(s) for exceeding the limit and defines the corrective actions that have been taken to reduce the releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits.

b. The provisions of Controls 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.2.2.3 Cumulative dose contributions for the current calendar quarter and current calendar year for iodine-131, iodine-133, tritium and radionuclides in particulate form with half-lives greater than 8 days shall be determined in accordance with the methodology and parameters in the ODCM at least once per 31 days.

3/4.2 RADIOACTIVE EFFLUENTS

3/4.2.2 GASEOUS EFFLUENTS

3/4.2.2.4 GASEOUS RADWASTE (OFFGAS) TREATMENT SYSTEM CONTROLS

3.2.2.4 Section is not applicable. See UFSAR Chapter 11.3.

3/4.2 RADIOACTIVE EFFLUENTS

3/4.2.2 GASEOUS EFFLUENTS

3/4.2.2.5 VENTILATION EXHAUST TREATMENT SYSTEM

CONTROLS

3.2.2.5 The VENTILATION EXHAUST TREATMENT SYSTEM shall be OPERABLE and appropriate portions of the system shall be used to reduce releases of radioactivity when the projected doses in 31 days due to gaseous effluent releases, from the site to areas at and beyond the SITE BOUNDARY (See Figure 1-1) would exceed

a. 0.4 mrad to air from gamma radiation, or

b. 0.8 mrad to air from beta radiation, or

c. 0.6 mrem to any organ of a MEMBER OF THE PUBLIC.

APPLICABILITY: At all times.

ACTION:

a. With gaseous waste being discharged without treatment, and in excess of the above limits, initiate an Issue Report that includes the following information:

1. Identification of any inoperable equipment or subsystems, and the reason for the inoperability.

2. Action(s) taken to restore the inoperable equipment to OPERABLE status, and

3. Summary description of action(s) taken to prevent a recurrence.

b. The provisions of Controls 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.2.2.5.1 Doses due to gaseous releases from the site to areas at and beyond the SITE BOUNDARY shall be projected at least once per 31 days in accordance with the methodology and parameters in the ODCM, when the Ventilation Exhaust Treatment System is not being fully utilized.

4.2.2.5.2 The installed VENTILATION EXHAUST TREATMENT SYSTEM shall be considered OPERABLE by meeting Controls 3.2.2.1, and either 3.2.2.2 or 3.2.2.3

3/4.2 RADIOACTIVE EFFLUENTS

3/4.2.2 GASEOUS EFFLUENTS

3/4.2.2.6 INCINERATION OF RADIOACTIVE WASTE OIL CONTROLS

3.2.2.6 Incineration of radioactive waste oil shall be allowed in accordance with the requirements of 10CFR20.2004. The exhaust stack of the affected auxiliary boiler will be a release point for the radioactive effluents. Doses calculated will be based on the radioactive content of the oil prior to incineration. Dose calculated shall meet the limits specified in Controls 3.2.2.3 and 3.2.2.5. Radioactive effluents from this pathway shall be summed with other effluents from the site and reported to the Commission in the Annual Radioactive Effluent Release Report.

APPLICABILITY: At all times

ACTION:

a. With the radioactive content of waste oil not determined as specified in Table 4.2-2, do not incinerate waste oil.

b. With the calculated dose from the incineration of radioactive waste oil exceeding limits specified in Controls 3.2.2.3 and 3.2.2.5, do not incinerate waste oil.

c. The provisions of Controls 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS:

4.2.2.6.1 Doses due to gaseous effluent releases at or beyond the SITE BOUNDARY shall be projected for Each Batch.

4.2.2.6.2 The dose rate due to iodine-131, iodine-133, tritium, and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents shall be determined to be within the above limits by obtaining representative samples and performing analyses in accordance with the sampling and analysis program specified in Table 4.2-2

3/4.2 RADIOACTIVE EFFLUENTS

3/4.2.2 GASEOUS EFFLUENTS

3/4.2.2.7 MARK II CONTAINMENT

CONTROLS

3.2.2.7 The VENTING or PURGING of the Mark II containment drywell shall be through the Standby Gas Treatment System.

APPLICABILITY: Whenever the drywell is vented or purged.*

ACTION:

a. With the requirements of the above control not satisfied, suspend all VENTING and PURGING of the drywell.

b. The provisions of Controls 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.2.2.7.1 The containment drywell shall be determined to be aligned for VENTING or PURGING through the Standby Gas Treatment System within 4 hours prior to start of and at least once per 12 hours during VENTING or PURGING of the containment.

4.2.2.7.2 Prior to use of the purge system through the standby gas treatment system assure that:

a. Both standby gas treatment system trains are OPERABLE whenever the purge system is in use, and

b. Whenever the purge system is in use during OPERATIONAL CONDITION 1 or 2 or 3, only one of the standby gas treatment system trains shall be used to prevent damage to both trains should a LOCA occur (LCO 3.6.5.3 ACTION a applies during this configuration).

* Except after Containment is deinerted and purged while the reactor is in OPCON 4 or 5 OR for the one inch/two inch vent valves to the Reactor Enclosure Equipment Compartment Exhaust Filters when used for containment pressure control and nitrogen make-up operations.

3/4.2 RADIOACTIVE EFFLUENTS

3/4.2.3 TOTAL DOSE

CONTROLS

3.2.3 The annual (calendar year) dose or dose commitment to any MEMBER OF THE PUBLIC, due to releases of radioactivity and radiation, from uranium fuel cycle sources shall be limited to less than or equal to 25 mrem to the total body or any organ, except the thyroid, which shall be limited to less than or equal to 75 mrem.

APPLICABILITY: At all times.

ACTION:

a. With the calculated doses from the release of radioactive materials in liquid or gaseous effluents exceeding the limits of Controls 3.2.1.2.a., 3.2.1.2.b., 3.2.2.2.a., 3.2.2.2.b., 3.2.2.3.a., or 3.2.2.3.b calculations shall be made including direct radiation contributions from the reactor units (including outside storage tanks, etc.) to determine whether the above limits of Control 3.2.3 have been exceeded. If such is the case, initiate an Issue Report that defines the corrective action to be taken to reduce subsequent releases to prevent recurrence of exceeding the above limits and includes the schedule for achieving conformance with the above limits. This Special Report, as defined in 10 CFR 20.2203, shall include an analysis that estimates the radiation exposure (dose) to a MEMBER OF THE PUBLIC from the uranium fuel cycle sources, including all effluent pathways and direct radiation, for the calendar year that includes the release(s) covered by this report. It shall also describe levels of radiation and concentration of radioactive material involved, and the cause of the exposure levels or concentrations. If the estimated dose(s) exceeds the above limits, and if the release condition resulting in violation of 40 CFR Part 190 has not already been corrected, the Issue Report shall include a request for a variance in accordance with the provisions of 40 CFR Part 190. Submittal of the report is considered a timely request, and a variance is granted until staff action on the request is complete.

b. The provisions of Controls 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.2.3.1 Cumulative dose contributions from liquid and gaseous effluents shall be determined in accordance with Surveillance Requirements 4.2.1.2, 4.2.2.2, and 4.2.2.3, and in accordance with the methodology and parameters in the ODCM.

4.2.3.2 Cumulative dose contributions from direct radiation from the units (including outside storage tanks, etc.) shall be determined in accordance with the methodology and parameters in the ODCM. This requirement is applicable only under conditions set forth in Action a. of Control 3.2.3.

3/4.3 RADIOLOGICAL ENVIRONMENTAL MONITORING

3/4.3.1 MONITORING PROGRAM

CONTROLS

3.3.1 The Radiological Environmental Monitoring Program shall be conducted as specified in Table 3.3-1.

APPLICABILITY: At all times.

ACTION:

a. With the Radiological Environmental Monitoring Program not being conducted as specified in Table 3.3-1, prepare and submit to the Commission, in the Annual Radiological Environmental Operating Report required by Control 6.1, a description of the reasons for not conducting the program as required and the plans for preventing a recurrence.

b. With the level of radioactivity as the result of plant effluents in an environmental sampling medium at a specified location exceeding the reporting levels of Table 3.3-2 when averaged over any calendar quarter, initiate an Issue Report that identifies the cause(s) for exceeding the limit(s) and defines the corrective actions to be taken to reduce radioactive effluents so that the potential annual dose to a MEMBER OF THE PUBLIC is less than the calendar year limits of Controls 3.2.1.2, 3.2.2.2, or 3.2.2.3. When more than one of the radionuclides in Table 3.3-2 are detected in the sampling medium, this report shall be submitted if:

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

When radionuclides other than those in Table 3.3-2 are detected and are the result of plant effluents, an Issue Report shall be initiated if the potential annual dose* to a MEMBER OF THE PUBLIC is equal to or greater than the calendar year limits of Controls 3.2.1.2, 3.2.2.2, or 3.2.2.3. An Issue Report is not required if the measured level of radioactivity was not the result of plant effluents; however; in such an event, the condition shall be reported and described in the Annual Radiological Environmental Operating Report required by Control 6.1.

* The methodology and parameters used to estimate the potential annual dose to a MEMBER OF THE PUBLIC shall be indicated in this report.

3/4.3 RADIOLOGICAL ENVIRONMENTAL MONITORING

3/4.3.1 MONITORING PROGRAM

CONTROLS

ACTION (Continued)

c. With milk or fresh leafy vegetable samples unavailable from one or more of the sample locations required by Table 3.3-1, identify locations for obtaining replacement samples and add them to the radiological environmental monitoring program within 30 days. The specific locations from which samples were unavailable may then be deleted from the monitoring program. Pursuant to Technical Specification 6.14, submit as a part of or concurrent with the Annual Radioactive Effluent Release Report, a complete, legible copy of the entire ODCM, including a revised figure(s) and table for the ODCM reflecting the new location(s).

d. The provisions of Controls 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.3.1 The radiological environmental monitoring samples shall be collected pursuant to Table 3.3-1 from the specific locations given in the table and figure(s) in the ODCM and shall be analyzed pursuant to the requirements of Table 3.3-1, with the detection capabilities required by the Table 4.3-1.

TABLE 3.3-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM*

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATION[a]	SAMPLING AND COLLECTION FREQ.	TYPE AND FREQUENCY OF ANALYSIS
1. DIRECT RADIATION[b]	40 routine monitoring stations either with two or more dosimeters or with one instrument for measuring and recording dose rate continuously placed as follows: (1) An inner ring of stations, one in each meteorological sector, in the general area of the SITE BOUNDARY: (2) An outer ring of stations, one in each meteorological sector, in the 3-9 mile range from the site; (3) The balance of the stations placed in special interest areas such as population centers, nearby residences, schools and in 1 or 2 areas to serve as control stations.	Quarterly	Gamma dose quarterly.

* The number, media, frequency, and location of samples may vary from site to site. This table presents an acceptable minimum program for a site at which each entry is applicable. Local site characteristics must be examined to determine if pathways not covered by this table may significantly contribute to an individual's dose and should be included in the sample program.

TABLE 3.3-1 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATION[(a)]	SAMPLING AND COLLECTION FREQ.	TYPE AND FREQUENCY OF ANALYSIS
2. AIRBORNE Radioiodine and Particulates	Samples from 5 locations: 3 samples from close to the 3 SITE BOUNDRY locations (in different sectors) of the highest calculated annual average ground-level D/Q 1 sample from the vicinity community having one of the highest calculated annual ground level 1 sample from a control location, as for example 15-30 km distant and in the least prevalent wind direction.	Continuous sampler operation with sample collection weekly, or more frequently if required by dust loading.	Radioiodine canisters: I-131 analysis weekly Particulate Sampler: Gross beta radio activity analysis following filter change:[c] Gamma isotopic analysis[d] of composite (by location) at least quarterly

TABLE 3.3-1 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATION[(a)]	SAMPLING AND COLLECTION FREQ.	TYPE AND FREQUENCY OF ANALYSIS
3. WATERBORNE			
a. Surface[e]	1 sample upstream 1 sample downstream	Composite sample over 1-month period[f].	Gamma isotopic analysis[d] monthly. Composite for tritium analysis quarterly.
b. Ground	Samples from 1 or 2 sources only if likely to be affected[g]	Quarterly.	Gamma isotopic[d] and tritium analysis
c. Drinking	1 sample of each on 1 to 3 of the nearest water supplies that could be affected by its discharge. 1 sample from a control location	Composite sample over 2-week period[f] when I-131 analysis is performed; monthly composite otherwise.	I-131 analysis on each composite when the dose calculated for the consumption of the water is greater than 1 mrem per year.[h] Composite for gross beta and gamma isotopic[d] analysis monthly. Composite for tritium analysis quarterly.
d. Sediment from shoreline	1 sample from downstream area with existing or potential recreational value.	Semiannually.	Gamma isotopic analysis[d] semiannually.

TABLE 3.3-1 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATION[(a)]	SAMPLING AND COLLECTION FREQ.	TYPE AND FREQUENCY OF ANALYSIS
4. INGESTION a. Milk	Samples from milking animals in 3 locations within 5 km distance having the highest dose potential. If there are none, then 1 sample from milking animals in each of 3 areas between 5 to 8 km distance where dose are calculated to be greater than 1 mrem per year.[h] 1 sample from milking animals at a control location (15-30 km distance) and in the least prevalent wind direction.	Semimonthly when animals are on pasture, monthly at other times.	Gamma isotopic[d] and I-131 analysis semimonthly when animals are on pasture (April 1 - Oct. 1): monthly at other times.
b. Fish and Invertebrates	1 sample of each commercially and recreationally important species in vicinity of plant discharge area. 1 sample of same species in area not influenced by plant discharge.	Sample in season, or semiannually if they are not seasonal.	Gamma isotopic[d] analysis on edible portions.

TABLE 3.3-1 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATION[(a)]	SAMPLING AND COLLECTION FREQ.	TYPE AND FREQUENCY OF ANALYSIS
4. INGESTION (Continued)			
c. Food Products	1 sample of each principal class of food products from any area that is irrigated by water in which liquid plant wastes have been discharged	At time of harvest[l]	Gamma isotopic[d] and I-131 analysis.
	Samples of 3 different kinds of broad leaf vegetation grown nearest each of 2 different offsite locations of highest predicted annual average ground level D/Q if milk sampling is not performed.	Monthly during the growing season	Gamma isotopic[d] and I-131 analysis.
	1 sample of each of the similar broad leaf vegetation grown 15-30 km distance in the least prevalent wind direction if milk sampling is not performed.	Monthly during the growing season	Gamma isotopic[d] and I-131 analysis.

TABLE 3.3-1 (Continued)

TABLE NOTATIONS

a. Specific parameters of distance and direction sector from the centerline of the two reactors and additional description where pertinent, shall be provided for each and every sample location in Table 3.3-1 in a table and figure(s) in the ODCM. Deviations are permitted from the required sampling schedule if specimens are unobtainable due to hazardous conditions, seasonal unavailability, malfunction of automatic sampling equipment and other legitimate reasons. If specimens are unobtainable due to sampling equipment malfunction, every effort shall be made to complete corrective action prior to the end of the next sampling period. All deviations from the sampling schedule shall be documented in the Annual Radiological Environmental Operating Report pursuant to Control 6.1. It is recognized that, at times, it may not be possible or practicable to continue to obtain samples of the media of choice at the most desired location or time. In these instances suitable alternative media and locations may be chosen for the particular pathway in question and appropriate substitutions made within 30 days in the radiological environmental monitoring program. Pursuant to Technical Specification 6.14, submit as a part of or concurrent with the next Annual Radioactive Effluent Release Report a complete legible copy of the ODCM including a revised figure(s) and table for the ODCM reflecting the new location(s).

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

c. Airborne particulate sample filters shall be analyzed for gross beta radioactivity 24 hours or more after sampling to allow for radon and thoron daughter decay. If gross beta activity in air particulate samples is greater that 10 times the yearly mean of control samples, gamma isotopic analysis shall be performed on the individual samples.

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

e. The "upstream sample" shall be taken at a distance beyond significant influence of the discharge. The "downstream sample" shall be taken in an area beyond but near the mixing zone.

TABLE 3.3-1 (Continued)

TABLE NOTATIONS (Continued)

f. A composite sample is one in which the quantity (aliquot) of liquid sampled is proportional to the quantity of flowing liquid and in which the method of sampling employed results in a specimen that is representative of the liquid flow. In this program composite sample aliquots shall be collected at time intervals that are very short (e.g., hourly) relative to the compositing period (e.g., monthly) in order to assure obtaining a representative sample.

g. Groundwater samples shall be taken when this source is tapped for drinking or irrigation purposes in areas where the hydraulic gradient or recharge properties are suitable for contamination.

h. The dose shall be calculated for the maximum organ and age group using the methodology and parameters in the ODCM.

i. If harvest occurs more than once a year, sampling shall be performed during each discrete harvest. If harvest occurs continuously, sampling shall be monthly. Attention shall be paid to including samples of tuberous and root food products.

TABLE 3.3-2

REPORTING LEVELS FOR RADIOACTIVITY CONCENTRATIONS IN ENVIRONMENTAL SAMPLES

Reporting Levels

ANALYSIS	WATER (pCi/l)	AIRBORNE PARTICULATE or GASES(pCi/m^3)	FISH (pCi/kg, wet)	MILK (pCi/l)	FOOD PRODUCTS (pCi/kg, wet)
H-3	20,000*				
Mn-54	1,000		30,000		
Fe-59	400		10,000		
Co-58	1,000		30,000		
Co-60	300		10,000		
Zn-65	300		20,000		
Zr-Nb-95	400***				
I-131	2**	0.9		3	100
Cs-134	30	10	1,000	60	1,000
Cs-137	50	20	2,000	70	2,000
Ba-La-140	200***			300	

* For drinking water samples. This is a 40 CFR Part 141 value. If no drinking pathway exists, a value of 30,000 pCi/l may be used.
** If no drinking water pathway exists, a value of 20 pCi/l may be used
*** Total for parent and daughter.

TABLE 4.3-1

DETECTION CAPABILITIES FOR ENVIRONMENTAL SAMPLE ANALYSIS[a] [b]

Lower limit of Detection (LLD)[c]

ANALYSIS	WATER (pCi/l)	AIRBORNE PARTICULATE or GASES (pCi/m^3)	FISH (pCi/kg, wet)	MILK (pCi/l)	FOOD PRODUCTS (pCi/kg, wet)	SEDIMENT (pCi/kg, dry)
Gross Beta	4	0.01				
H-3	2,000*					
Mn-54	15		130			
Fe-59	30		260			
Co-58	15		130			
Co-60	15		130			
Zn-65	30		260			
Zr-95	30					
Nb-95	15					
I-131	1**	0.07		1	60	
Cs-134	15	0.05	130	15	60	150
Cs-137	18	0.06	150	18	80	180
Ba-140	60			60		
La-140	15			15		

* If no drinking water pathway exists, a value of 3000 pCi/l may be used.
** If no drinking water pathway exists, a value of 15 pCi/l may be used.

TABLE 4.3-1 (Continued)

TABLE NOTATIONS

(a) This list dose not mean that only these nuclides are to considered. Other peaks that are identifiable at 95% confidence level, together with those of the above nuclides, shall also be analyzed and reported in the Annual Radiological Environmental Operating report pursuant to Control 6.1.

(b) Required detection capabilities for thermoluminescent dosimeters used for environmental measurements are given in Regulatory Guide 4.13.

(c) The LLD is defined, for purposes of these controls, as the smallest concentration of radioactive material in a sample that will yield a net count (above system background) that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{4.66 s_b}{E \bullet V \bullet 2.22 \bullet Y \bullet \exp^{(-\lambda \Delta t)}}$$

Where:

LLD is the a priori lower limit of detection as defined above (as picocuries per unit mass or volume),

s_b is the standard deviation of the background counting rate or of the counting rate of blank sample as appropriate (as counts per minute),

E is the counting efficiency (as counts per disintegration),

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

2.22 is the number of disintegrations per minute per picocurie,

Y is the fractional radiochemical yield (when applicable),

λ is the radioactive decay constant for the particular radionuclide, and

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

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

TABLE 4.3-1 (Continued)

TABLE NOTATIONS (Continued)

It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an 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 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 shall be identified and described in the Annual Radiological Environmental Operating Report pursuant to Control 6.1.

3/4.3 RADIOLOGICAL ENVIRONMENTAL MONITORING

3/4.3.2 LAND USE CENSUS

CONTROLS

3.3.2 A land use census shall be conducted and shall identify within a distance of 8 km (5 miles) the location (in each of the 16 meteorological sectors) of the nearest milk animal, the nearest residence and the nearest garden* of greater than 50 m^2 (500 ft^2) producing broad leaf vegetation.

APPLICABILITY: At all times.

ACTION:

a. With a land use census identifying a location(s) that yields a calculation dose or dose commitment greater than the values currently being calculated in Control 3.2.2.3, identify the new location(s) in the next Annual Radioactive Effluent Release Report, pursuant to Control 6.2.

b. With a land use census identifying a location(s) that yields a calculated dose or dose commitment (via the same exposure pathway) 20% greater than at a location from which samples are currently being obtained in accordance with Control 3.2.2.3, add the new location(s) to the radiological environmental monitoring program within 30 days. The sampling location(s), excluding the control station location, having the lowest calculated dose or dose commitment(s) (via the same exposure pathway) may be deleted from this monitoring program after October 31 of the year in which this land use census was conducted. Pursuant to Technical Specification 6.14, submit as a part of or concurrent with in the next Annual Radioactive Effluent Release Report a complete, legible copy of the entire ODCM including a revised figure(s) and table(s) for the ODCM reflecting the new location(s).

c. The provisions of Controls 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.3.2 The land use census shall be conducted during the growing season at least once per 12 months using that information that will provide the best results, such as by a door-to-door survey, aerial survey, or by consulting local agriculture authorities. The results of the land use census are included in the Annual Radiological Environmental Operating Report pursuant to Control 6.1.

* Broad leaf vegetation sampling of at least 3 different kinds of vegetation may be performed at the SITE BOUNDARY in each of 2 different direction sectors with the highest predicted D/Qs in lieu of the garden census. Controls for broad leaf vegetation sampling in Table 3.3-1 item 4.c. shall be followed, including analysis of control samples.

3/4.3 RADIOLOGICAL ENVIRONMENTAL MONITORING

3/4.3.3 INTERLABORATORY COMPARISON PROGRAM CONTROLS

3.3.3 In accordance with LGS Technical Specification 6.8.4.f, analyses shall be performed on radioactive materials supplied as part of an Interlaboratory Comparison Program traceable to NIST, that correspond to samples required by Table 3.3-1.

APPLICABILITY: At all times.

ACTION:

a. With analyses not being performed as required above, report the corrective actions taken to prevent a recurrence to the Commission in the Annual Radiological Environmental Operating Report pursuant to Control 6.1.

b. The provisions of Controls 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.3.3 The Interlaboratory Comparison Program shall be described in the ODCM. A summary of the results shall be included in the Annual Radiological Environmental Operating Report pursuant to Control 6.1

3/4.3 RADIOLOGICAL ENVIRONMENTAL MONITORING

3/4.3.4 METEOROLOGICAL MONITORING INSTRUMENTATION

CONTROLS

3.3.4 The meteorological monitoring instrumentation channels shown in Table 3.3-3 shall be OPERABLE .

APPLICABILITY: At all times.

ACTION:

a. With less than the minimum required instrumentation channels OPERABLE for more than 7 days, initiate an Issue Report outlining the cause of the malfunction and the plans for restoring the instrumentation to OPERABLE status.

b. The provisions of Controls 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.3.4 Each of the above required meteorological monitoring instrumentation channels shall be demonstrated OPERABLE by the performance of the CHANNEL CHECK and CHANNEL CALIBRATION operations at the frequencies shown in Table 4.3-2.

TABLE 3.3-3

METEOROLOGICAL MONITORING INSTRUMENTATION

INSTRUMENT		TOWER 1 (PRIMARY)	TOWER 2 (BACKUP)	MINIMUM INSTRUMENT OPERABLE
1. Wind Speed				
a.	Elevation 1	30 feet	159 feet	1
b.	Elevation 2	175 feet	304 feet	1
2. Wind Direction				
a.	Elevation 1	30 feet	159 feet	1
b.	Elevation 2	175 feet	304 feet	1
3. Air Temperature Difference (ΔT)				
a.	Elevations	266 feet 26 feet	300 feet 26 feet	1

TABLE 4.3-2

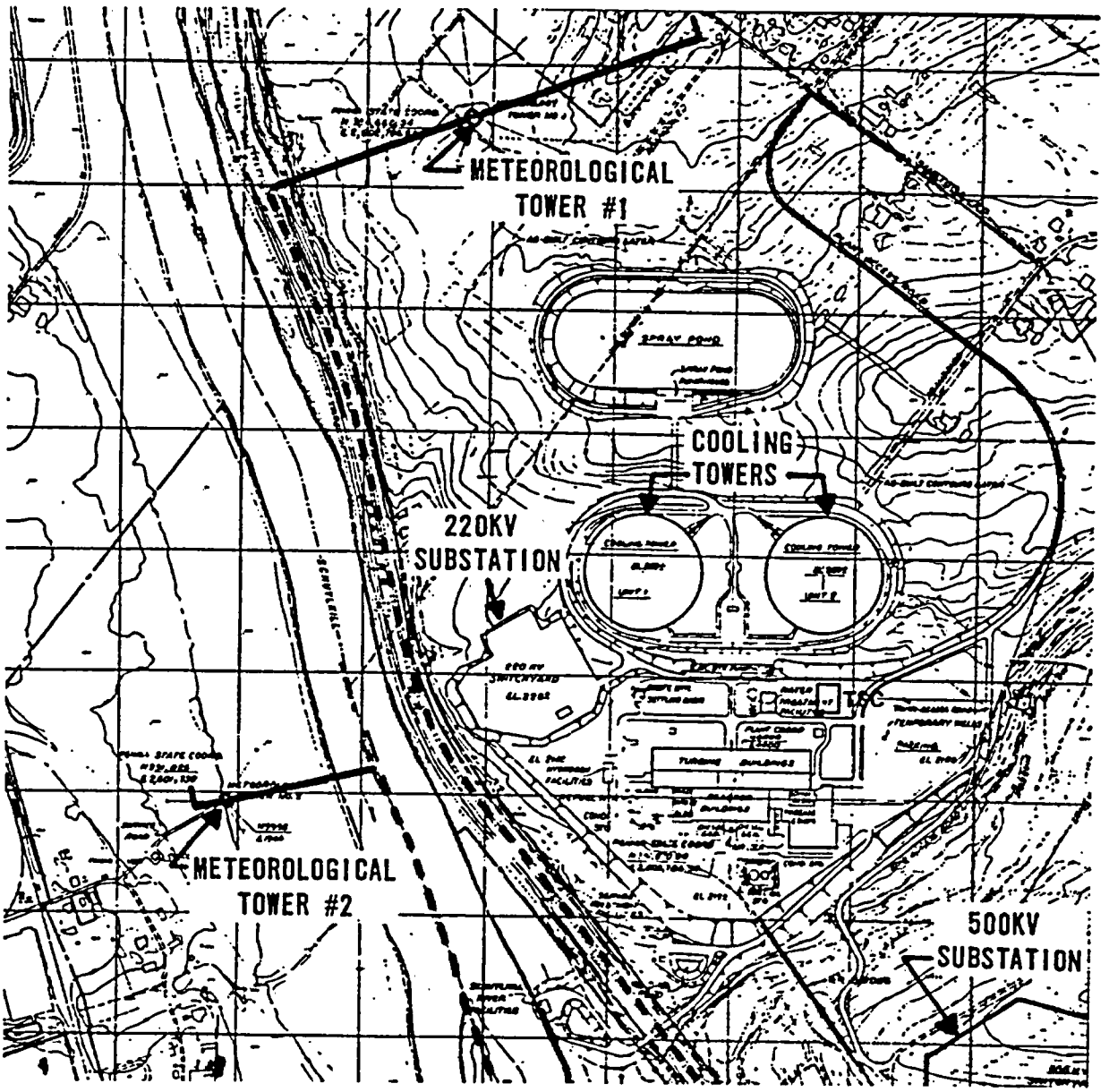
METEOROLOGICAL MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT	CHANNEL CHECK	CHANNEL CALIBRATION
1. Wind Speed		
a. Elevation 1 (Tower 1 and Tower 2)	D	SA
b. Elevation 2 (Tower 1 and Tower 2)	D	SA
2. Wind Direction		
a. Elevation 1 (Tower 1 and Tower 2)	D	SA
b. Elevation 2 (Tower 1 and Tower 2)	D	SA
3. Air Temperature Difference (ΔT)		
a. Elevations 266 - 26 ft (Tower 1)	D	SA
b. Elevations 300 - 26 ft (Tower 2)	D	SA

NOTE:
The meteorological towers shall be located as shown on Figure 3.3-1.

Figure 3.3-1

Meteorological Tower Locations



3/4.0 CONTROLS

BASES

GENERAL

It is expected that releases of radioactive material in effluents will be kept at small fractions of the limits specified in Section 20.1302 of 10 CFR, Part 20. At the same time, the licensee is permitted the flexibility of operation, compatible with consideration of health and safety, to assure that the public is provided a dependable source of power even under unusual operating conditions which may temporarily result in releases higher than such small fractions, but still within the limits specified in Section 20.1302 of 10 CFR, Part 20. It is expected that in using this operational flexibility under unusual operating conditions the licensee will exert his best efforts to keep levels of radioactive material in effluents as low as practicable.

MAPS DEFINING UNRESTRICTED AREAS AND SITE BOUNDARY FOR RADIOACTIVE GASEOUS AND LIQUID EFFLUENTS

Information regarding radioactive gaseous and liquid effluents, which will allow identification of structures and release points as well as definition of UNRESTRICTED AREAS within the SITE BOUNDARY that are accessible to MEMBER(S) OF THE PUBLIC, shall be as shown in Technical Specifications Figures 5.1.3-1a and 5.1.3-1b.

The exclusion area and low population zone shall be as shown in Figures 1-1 and 1-2.

10 CFR 20

Per Technical Specification Section 6.8.4.d, the Radioactive Effluent Controls Program must conform with limitations specified in 10 CFR 50.36a, 10 CFR Part 50, Appendix I, 10 CFR Part 20, Appendix B, Table II, Column 2 (pre-1994 issue) and 40 CFR 190. (See Reference 14)

3/4.0 CONTROLS

BASES

3/4.0 APPLICABILITY

Compliance with the controls is required during the OPERATIONAL CONDITIONS or other conditions specified therein; except that upon failure to meet the controls, the associated ACTION requirements shall be met.

Non compliance with a Control shall exist when the requirements of the control and associated ACTION requirements are not performed within the specified time intervals. If the control is restored prior to expiration of the specified time intervals, completion of the ACTION requirements is not required.

There are no actions in the ODCM which would require an operational condition change.

There are no restrictions on changing operating conditions in any of the controls on the ODCM.

Surveillance Requirements shall be met during the OPERATIONAL CONDITIONS or other conditions specified for individual controls unless otherwise stated in an individual Surveillance Requirement.

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

Failure to perform a Surveillance Requirement within the allowed surveillance interval defined by Surveillance Requirement 4.0.2.a, shall constitute noncompliance with the OPERABILITY requirements for a control. The time limits of the ACTION requirements are applicable at the time it is identified that a Surveillance Requirement has not been performed. The ACTION requirements may be delayed for up to 24 hours to permit the completion of the surveillance when the allowable outage time limits of the ACTION requirements are less than 24 hours. Surveillance requirements do not have to be performed on inoperable equipment.

The associated bases from the LGS Technical Specifications apply to this section.

3/4.1 INSTRUMENTATION

BASES

3/4.1.1 RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

The radioactive liquid effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in liquid effluents during actual or potential releases of liquid effluents. The alarm/trip setpoints for these instruments shall be calculated in accordance with the procedures in the ODCM Part II to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20 (pre-1994). The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR Part 50.

3/4.1.2 RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

The radioactive gaseous effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in gaseous effluents during actual or potential releases of gaseous effluents. The alarm/trip setpoints for these instruments shall be calculated in accordance with the procedures in the ODCM Part II to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20 (pre-1994). The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR Part 50.

3/4.2 RADIOACTIVE EFFLUENTS

BASES

3/4.2.1 LIQUID EFFLUENTS

3/4.2.1.1 CONCENTRATION

This control is provided to ensure that the concentration of radioactive materials released in liquid waste effluents to areas at and beyond the UNRESTRICTED AREAS will be less the concentration levels specified in 10 CFR Part 20, Appendix B, Table II, Column 2 (pre-1994). This instantaneous limitation provides additional assurance that the levels of radioactive materials in bodies of water in areas at and beyond the SITE BOUNDARY will result in exposures within (1) the Section II.A design objectives of Appendix I, 10 CFR Part 50, to a MEMBER OF THE PUBLIC, and (2) the limits of 10 CFR 20.1302 to the population. The concentration limits for dissolved or entrained noble gases are based upon the assumption that Xe-135 is the controlling radioisotope and its MPC 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.

The required detection capabilities for radioactive materials in liquid waste samples are tabulated in terms of the lower limits of detection (LLDs). Detailed discussion of the LLD, and other detection limits can be found in HASL Procedures Manual, HASL-300 (revised annually); Currie, L.A., "Limits for Qualitative Detection and Quantitative Determination - Application to Radiochemistry"; Anal. Chem. 40, 586-93 (1968); and Hartwell, J.K., "Detection Limits for Radioanalytical Counting Techniques", Atlantic Richfield Hanford Company Report ARH-SA-215 (June, 1975).

3/4.2.1.2 DOSE

This Control is provided to implement the requirements of Sections II.A, III.A, and IV.A of Appendix I, 10 CFR Part 50. Control 3.2.1.2 implements the guidance set forth in Section II.A of Appendix I and provides the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive material in liquid effluents will be kept "as low as 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 Part 141. The Surveillance Requirement 4.2.1.2 implement the requirements in Section III.A of Appendix I that conformance with the guidance of Appendix I be shown by calculational procedures based on models and data, such that the actual exposure of a MEMBER OF THE PUBLIC through appropriate pathways is unlikely to be substantially underestimated. The equations specified in the ODCM for calculating the doses due to the actual release rates of radioactive materials in liquid effluents are consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I,"

3/4.2 RADIOACTIVE EFFLUENTS

BASES

3/4.2.1.2 DOSE (continued)

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.

This control applies to the release of radioactive materials in liquid effluents from the site.

3/4.2.1.3 LIQUID RADWASTE TREATMENT SYSTEM

The requirement that the appropriate portions of this system be used when specified provides assurance that the releases of radioactive materials in liquid effluents will be kept "as low as reasonably achievable". Control 3.2.1.3 implements the requirements of 10 CFR 50.35a, General Design Criterion 60 of Appendix A to 10 CFR Part 50 and the design objective given in 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.

3/4.2 RADIOACTIVE EFFLUENTS

BASES

3/4.2.2 GASEOUS EFFLUENTS

3/4.2.2.1 DOSE RATE

This control is provided to ensure that the dose from radioactive materials in gaseous effluents at and beyond the SITE BOUNDARY will be within the annual dose limits of 10 CFR Part 20 (pre-1994) to UNRESTRICTED AREAS. The annual dose limits are the doses associated with the concentrations of 10 CFR Part 20, Appendix B, Table II, Column 1 (pre-1994). These limits provide reasonable assurance that radioactive material discharged in gaseous effluents will not result in the exposure of a MEMBER OF THE PUBLIC, either within or outside the SITE BOUNDARY, to annual average concentrations exceeding the limits specified in Appendix B, Table II of 10 CFR Part 20 (pre-1994). For MEMBERS OF THE PUBLIC who may at times be within the SITE BOUNDARY, the occupancy factor for that MEMBER OF THE PUBLIC will usually be sufficiently low to compensate for any increase in the atmospheric diffusion factor for above that for the SITE BOUNDARY. Examples of calculations for such MEMBERS OF THE PUBLIC, with the appropriate occupancy factors, are given in the ODCM. The specified release rate limits restrict, at all times, the corresponding gamma and beta dose rates above background to a MEMBER OF THE PUBLIC at or beyond the SITE BOUNDARY to less than or equal to 500 mrem/year to the total body or to less than or equal to 3000 mrem/year to the skin. These release rate limits also restrict, at all times, the corresponding thyroid dose rate above background to a child via the inhalation pathway to less than or equal to 1500 mrem/year.

This Control applies to the release of radioactive materials in gaseous effluents from all reactors at the site.

The required detection capability for radioactive materials in gaseous waste samples are tabulated in terms of the lower limits of detection (LLDs). Detailed discussion of the LLD, and other detection limits can be found in HASL Procedures Manual, HASL-300 (revised annually); Currie, L.A., "Limits for Qualitative Detection and Quantitative Determination - Application to Radiochemistry"; Anal. Chem. 40, 586-93 (1986); and Hartwell, J.K., "Detection Limits for Radioanalytical Counting Techniques." Atlantic Richfield Hanford Company Report ARH-SA-215 (June 1975).

3/4.2.2.2 DOSE - NOBLE GASES

This control is provided to implement the requirements of Sections II.B, III.A, and IV.A of Appendix I, 10 CFR Part 50. Control 3.2.2.2 implements the guidance set forth in Section II.B of Appendix I and provides the required operating flexibility to 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 reasonably achievable". The Surveillance Requirement 4.2.2.2 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 appropriate pathways is unlikely to be substantially underestimated. The dose calculation established in the ODCM for calculating the doses due to the actual release rates of radioactive noble gases in gaseous effluents are consistent with the methodology provided in

3/4.2 RADIOACTIVE EFFLUENTS

BASES

3/4.2.2.2 DOSE - NOBLE GASES (Continued)

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 I, October 1977 and Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routing Releases from Light-Water Cooled Reactors," Revision 1, July 1977 with site specific dispersion curves and deposition methodology.

The ODCM equations provided for determining the air doses at and beyond the SITE BOUNDARY are based upon the historical average atmospheric conditions.

3/4.2.2.3 DOSE - IODINE-131, IODINE-133, TRITIUM, AND RADIONUCLIDES IN PARTICULATE FORM

This control is provided to implement the requirements of Sections II.C, III.A, and IV.A of Appendix I, 10 CFR Part 50. Control 3.2.2.3 implements the guidance set forth in Section II.C of Appendix I and provides the required operating flexibility to implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive materials in gaseous effluents will be kept "as low as is reasonably achievable." The ODCM calculational methods specified in the Surveillance Requirements 4.2.2.3 implement the requirements in Section III.A of Appendix I, that conformance with the guides of Appendix I be shown by calculational procedures based on models and data, such that the actual exposure of a MEMBER OF THE PUBLIC through appropriate pathways is unlikely to be substantially underestimated. The ODCM calculational methods for calculating the doses due to the actual release rates of the subject materials are consistent with the methodology provided in Regulatory Guide 1.109, Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision I, 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 with site specific dispersion curves and deposition methodology. These equations also provide for determining the actual doses based upon the historical average atmospheric conditions. The release rate specifications for iodine-131, iodine-133, tritium, and radionuclides in particulate form with half-lives greater than 8 days are dependent on the existing radionuclides pathways to man in areas at and beyond the SITE BOUNDARY. The pathways which were examined in the development of these calculations were: (1) individual inhalation of airborne radionuclides, (2) deposition of radionuclides onto green leafy vegetation with subsequent consumption by man, (3) deposition onto grassy areas where milk animals and meat-producing animals graze with consumption of the milk and meat by man, and (4) deposition on the ground with subsequent exposure of man.

3/4.2 RADIOACTIVE EFFLUENTS

BASES

3/4.2.2.4 AND 3/4.2.2.5 GASEOUS RADWASTE TREATMENT SYSTEM AND VENTILATION EXHAUST TREATMENT SYSTEM

The requirement that the appropriate portions of this system 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." Controls 3.2.2.4 and 3.2.2.5 implements the requirements of 10 CFR 50.36a, General Design Criteria 60 of Appendix A to 10 CFR Part 50, and the design objectives given in Section II.D of Appendix I to 10 CFR Part 50. The specified limits governing the use of appropriate portions of the systems were specified as a suitable fraction of the dose design objectives set forth in Section II.B and II.C of Appendix I, 10 CFR Part 50, for gaseous effluents.

3/4.2.2.7 MARK II CONTAINMENT

This control provides reasonable assurance that releases from drywell venting or purging operations will not exceed the annual dose limits of 10 CFR Part 20 for areas at or beyond the UNRESTRICTED AREAS.

3/4.2 RADIOACTIVE EFFLUENTS

BASES

3/4.2.3 TOTAL DOSE

This control is provided to meet the dose limitations of 40 CFR Part 190 that have been incorporated into 10 CFR Part 20 (pre-1994) by 46 CFR 18525. Control 3.2.3 requires the preparation and submittal of a Special Report whenever the calculated doses due to releases of radioactivity and to radiation from uranium fuel cycle sources exceed 25 mrem to the whole body or any organ, except the thyroid, which shall be limited to less than or equal to 75 mrem. For sites containing up to four reactors, it is highly unlikely that the resultant dose to a MEMBER OF THE PUBLIC will exceed the dose limits of 40 CFR Part 190 if the individual reactors remain within twice the dose design objectives of Appendix I, and if direct radiation does from the units (including outside storage tanks, etc.) are kept small.

The Special Report will describe a course of action that should result in the limitation of the annual dose to a MEMBER OF THE PUBLIC to within the 40 CFR Part 190 limits. For the purposes of the Special Report, it may be assumed that the dose commitment to the MEMBER OF THE PUBLIC from other uranium fuel cycle sources is negligible, with the exception that dose contributions from other nuclear fuel cycle facilities at the same site or within a radius of 5 miles must be considered. If the dose to any MEMBER OF THE PUBLIC is estimated to exceed the requirements of 40 CFR Part 190, the Special Report with a request for a variance (provided the release condition resulting in violation of 40 CFR Part 190 have not already been corrected), in accordance with the provisions of 40 CFR 190.11 and 10 CFR 20.2203, is considered to be a timely request and fulfills the requirements of 40 CFR Part 190 until NRC staff action is completed. The variance only relates to the limits of 40 CFR Part 190, and does not apply in any way to the other requirements for dose limitation of 10 CFR Part 20, as addressed in Controls 3.2.1.1 and 3.2.2.1. An individual is not considered a MEMBER OF THE PUBLIC during any period in which he/she is engaged in carrying out any operation that is part of the nuclear fuel cycle.

3/4.3 RADIOLOGICAL ENVIRONMENTAL MONITORING

BASES

3/4.3.1 MONITORING PROGRAM

The Radiological Environmental Monitoring Program (REMP) required by this control provides representative measurements of radiation and of radioactive materials in those exposure pathways and for those radionuclides that lead to the highest potential radiation exposures of MEMBER OF THE PUBLIC resulting from the station operation. This monitoring program implements Section IV.B.2 of Appendix I to 10 CFR Part 50 and thereby supplements the radiological effluent monitoring program by verifying that the measurable concentrations of radioactive materials and levels of radiation are not higher than expected on the basis of the effluent measurements and modeling of the environmental exposure pathways.

The required detection capabilities for environmental sample analyses are tabulated in terms of the lower limits of detection (LLDs). The LLDs required by Table 4.3-1 are considered optimum for routine environmental measurements in industrial laboratories. It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not an after the fact limit for a particular measurement.

Detailed discussion of the LLD, and other detection limits, can be found in HASL Procedures Manual, HASL-300 (revised annually); Currie L.A., "Limits for Qualitative Detection and Quantitative Determination - Application to Radiochemistry," Anal. Chem. 40, 586-93 (1968), and Hartwell, J.K., "Detection Limits for Radioanalytical Counting Techniques", Atlantic Richfield Hanford Company Report ARH-SA-215 (June, 1975).

3/4.3.2 LAND USE CENSUS

This control is provided to ensure that changes in the use of areas at and beyond the SITE BOUNDARY are identified and that modifications to the monitoring program are made if required by the results of the census. The best information from the door-to-door survey, aerial survey or consulting with local agricultural authorities or any combination of these methods shall be used. 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 (26 Kg/year) of leafy vegetables assumed in Regulatory Guide 1.109 for consumption by a child. To determine this minimum garden size, the following assumptions were used: (1) that 20% of the garden was used for growing broad leafy vegetation (i.e. similar to lettuce and cabbage), and (2) a vegetation yield of 2 kg/Square meter.

3/4.3 RADIOLOGICAL ENVIRONMENTAL MONITORING

BASES

3/4.3.3 INTERLABORATORY COMPARISON PROGRAM

The requirement for participation in an Interlaboratory Comparison Program ensures that 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 that the results are reasonably valid for the purpose of Section IV.B.2 of Appendix I to 10 CFR Part 50.

3/4.3.4 METEOROLOGICAL MONITORING INSTRUMENTATION

The OPERABILITY of the meteorological monitoring instrumentation ensures that sufficient meteorological data is available for estimating potential radiation doses to the public as a result of routine or accidental release of radioactive materials to the atmosphere. This capability is required to evaluate the need for initiating measures to protect the health and safety of the public. This instrumentation is consistent with the recommendations of Regulatory Guide 1.23 "Onsite Meteorological Programs," February, 1972.

Site data compiled since January 1972 provide correlation between Elevation 1 (Tower 1) and Elevation 1 (Tower 2), and between Elevation 2 (Tower 1) and Elevation 2 (Tower 2). This correlation serves as justification for the use of the appropriate Tower 2 instrument as a back-up to the Tower 1 instrument as shown in Table 3.3-3.

6.0 ADMINISTRATIVE REQUIREMENTS

6.1 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

6.1 Routine Annual Radiological Environmental Operating Report covering the operation of Unit 1 and Unit 2 during the previous calendar year shall be submitted prior to May 1 for each year. The initial report was submitted prior to May 1 of the year following initial criticality (1984). A single report is submitted for a multiple unit station. The Annual Radiological Environmental Operating Report shall include summaries, interpretations, and an analysis of trends of the results report period, including a comparison (as appropriate), with preoperational studies, operational controls and previous environmental surveillance reports and an assessment of the observed impacts of the plant operation on the environment. The reports shall also include the results of land use census required by Control 3.3.2. The Annual Radiological Environmental Operating Report shall include the results of all radiological environmental samples and of all environmental radiation measurements taken during the report period pursuant to the locations specified in the tables and figures in the OFFSITE DOSE CALCULATION MANUAL, as well as summarized and tabulated results of these analyses and measurements in the format of the table in NUREG 1302. In the event that some individual results are not available for inclusion with the report, the report shall be submitted noting and explaining the reasons for the missing results. The missing data shall be submitted as soon as possible in a supplementary report. The report shall also include the following: a summary description of the radiological environmental monitoring program and at least two legible maps. One map shall cover stations near the SITE BOUNDARY; a second shall include the more detailed distant stations. Covering all sampling locations keyed to a table giving distances and directions from the centerline of the reactor plant; the results of licensee participation in the Interlaboratory Comparison Program, required by Control 3.3.3 discussion of all deviations from the Sampling Schedule of Table 3.3-1; and discussion of all analyses in which the LLD required by Table 4.3-1 was not achievable.

The Annual Radiological Environmental Monitoring Report shall include a summary of Issue Reports detailing level of radioactivity as the result of plant effluents in an environmental sampling medium exceed the reporting levels of Table 3.3-2.

6.0 ADMINISTRATIVE REQUIREMENTS

6.2 ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

6.2 A Routine Annual Radioactive Effluent Release Report covering the operation of Unit 1 and Unit 2 during the previous year shall be submitted in accordance with Tech Spec section 6.9.1.8. The period of the first report shall begin with the date of initial criticality. A single unit submittal is made for the 2-unit station. The submittal combines those sections that are common to all units at the station. The Annual Radioactive Effluent Release Report shall include a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the facility as outlined in Regulatory Guide 1.21, "Measuring, Evaluation, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants," Revision 1, June 1974, with data summarized on a quarterly basis following the format of Appendix B with the following exception: (1) Gaseous dose rates rather than effluent concentrations are used to calculate permissible release rates for gaseous releases. (2) ODCM Control 3.2.2.1 limits the dose equivalent rates due to the release of noble gases to less than or equal to 500 mrem per year to the total body and less than or equal to 3000 mrem per year to the skin. Therefore, the average beta and gamma energies ($\bar{E}$) of the radionuclide mixture in releases of fission and activation gases are not applicable. (3) Achieving doses of less than the limits of 10 CFR Part 50, Appendix I demonstrate that Limerick's gaseous effluents are ALARA. Therefore, calculations of total body doses to the population out to 50 miles from gaseous effluents are not performed.

The Annual Radioactive Effluent Release Report shall include an annual summary of hourly meteorological data collected over the previous year. This annual summary may be either in the form of an hour-by-hour listing on magnetic tape of wind speed, wind direction and atmospheric stability, and precipitation (if measured), or in the form of joint frequency distributions of wind speed, wind direction, atmospheric stability. The licensee has the option of retaining this summary of required meteorological data on site in a file that shall be provided to the NRC upon request. This same report shall include an assessment of the radiation doses due to the radioactive liquid and gaseous effluents released from both units during the previous calendar year. This same report shall also include an assessment of the radiation doses from radioactive liquid and gaseous effluents to MEMBER OF THE PUBLIC due to their activities inside the SITE BOUNDARY (Figures 1-1 and 1-2) during the report period. All assumptions used in making these assessments shall be included in these reports. The assessment of radiation doses shall be performed in accordance with the methodology and parameters of the OFFSITE DOSE CALCULATION MANUAL (ODCM).

The Annual Radioactive Effluent Release Report shall also include an assessment of radiation doses to the hypothetically highest 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 calendar year to show conformance with 40 CFR Part 190, Environmental Radiation Protection Standards for Nuclear Power Operation. Dose contribution from liquid and gaseous effluents is

calculated based on Regulatory Guide 1.109, Rev 1, October 1977.

The Annual Radioactive Effluent Release Reports includes the following information for each type of solid waste (as defined in 10 CFR Part 61) shipped offsite during the report period:

1. Total volume, activity and estimated total % error for each waste type:
   a. Spent resins filter sludges, evaporator bottoms, etc.
   b. Dry compressible waste, contaminated equipment, etc.
   c. Irradiated components, control rods, etc.
   d. Others (describe).
2. Activity and percentage of each principle radionuclide (>1%), for each individual waste type as defined in 1. (a-d) above.
3. The disposition of solid waste shipments (identify the number of shipments, the mode of transport, and the destination).
4. The disposition of irradiated fuel shipments (identify the number of shipments, the mode of transport, and the destination.

The Annual Radioactive Effluent Release Report includes a list and description of unplanned releases from the site to UNRESTRICTED AREAS of radioactive material in gaseous and liquid effluents made during the reporting period.

Changes made during the reporting period to procedure RW-AA-100 (formerly the PROCESS CONTROL PROGRAM) and to the ODCM, as well as a listing of new locations for dose calculations and/or environmental monitoring identified by the land use census pursuant to Control 3.3.2. shall be submitted in the form of a complete, legible copy of the entire ODCM as part of or concurrent with the Annual Radiological Effluent Release Report for the period of the report in which any change to the ODCM was made.

The Annual Radioactive Effluent Release Report shall include an explanation as to why the inoperability of liquid or gaseous effluent monitoring instrumentation was not corrected within the time specified in Controls 3.1.1 or 3.1.2, respectively;

The Annual Radioactive Effluent Release Report shall include a summary of Issue Reports detailing why discharge of liquid radwaste or gaseous radwaste without treatment exceeded the time specified in Controls 3.2.1.3 or 3.2.2.4, respectively.

The Annual Radioactive Effluent Release Report shall include a summary of Issue Reports for exceeding the calculated doses from the release of radioactive materials in liquid or gaseous effluents exceeding the limits of Controls 3.2.1.2.a., 3.2.1.2.b., 3.2.2.2.a., 3.2.2.2.b., 3.2.2.3.a., 3.2.2.3.b., 3.2.2.5.a., 3.2.2.5.b., 3.2.2.5.c., and 3.2.3.

6.0 ADMINISTRATIVE REQUIREMENTS

6.3 MAJOR CHANGES TO RADIOACTIVE WASTE TREATMENT SYSTEMS

6.3 Licensee-initiated major changes to the radioactive waste systems (liquid, gaseous, and solid):

a. Shall be reported to the Commission in the Annual Radioactive Effluent Release Report for the period in which the change was made effective. The discussion of each change shall contain:

1. A summary of the evaluation that led to the determination that the change could be made in accordance with 10 CFR 50.59;

2. Sufficient detailed information to totally support the reason for the change without benefit of additional or supplemental information;

3. A detailed description of the equipment, components, and processes involved and the interface with other plant systems;

4. An evaluation of the change which shows the predicted releases of radioactive materials in liquid and gaseous effluents and/or quantity of solid waste that differ from those previously predicted in the license application and amendments thereto;

5. An evaluation of the change which shows the expected maximum exposures to individual in the UNRESTRICTED AREA and to the general population that differ from those previously estimated in the license application and amendments thereto;

6. A comparison of the predicted releases of radioactive materials, in liquid and gaseous effluents and in solid waste, to the actual releases for the period prior to when the changes are to be made;

7. An estimate of the exposure to plant operating personnel as a result of the change; and

8. Documentation of the fact that the change was reviewed and found acceptable by the PORC.

b. Shall be reviewed and accepted by the PORC prior to implementation.

6.0 ADMINISTRATIVE REQUIREMENTS

6.4 CHANGES TO THE ODCM

6.4 Licensee-initiated changes to the Offsite Dose Calculational Manual

a. Shall contain the program elements described in Technical Specifications 6.8.4.d, e and f.

b. Shall be revised in accordance with the requirements described in Technical Specification 6.14.

c. Shall be revised per applicable procedures detailing other requirements for making changes to the ODCM.

d. Shall be reviewed and accepted by PORC and signed by the Plant Manager prior to implementation.

PART II

CALCULATION METHODOLOGIES

CALCULATION METHODOLOGIES

1.0 LIQUID EFFLUENTS

1.1 RADIATION MONITORING INSTRUMENTATION AND CONTROLS

The liquid effluent monitoring instrumentation and controls at Limerick for controlling and monitoring normal radioactive material releases in accordance with the Limerick ODCM Controls are summarized as follows:

1) Liquid Radwaste System: The liquid radwaste discharge monitor (RISH63-0K604) provides an alarm and automatic termination of radioactive material releases from the liquid radwaste system as required by ODCM Control 3.1.1. Additional design features of the liquid radwaste system which prevent inadvertent releases to the environment include 1) redundant discharge valves, 2) single discharge line with loop seal and siphon breaker to eliminate probability of inadvertent discharges, 3) Low Cooling Tower Blowdown flow interlock which isolates the radwaste discharge line.

2) Service Water System: The Service Water discharge monitor (RISH10-1K605 AND RISH10-2K605) provides an alarm upon indication of activity in the service water system as required by ODCM Control 3.1.1. While the service water system is not a normal release pathway, the monitor provides an indication of potential problems due to excessive leakage of the heat exchangers. In addition, the service water side of the fuel pool heat exchangers is kept at a higher pressure than the shell side to prevent potential radioactive contamination of the service water.

3) RHR Service Water System: The RHR Service Water Radiation (RHRSW) Monitors (RISH12-0K619A, RISH12-0K619B) provide alarm and automatic termination* of radioactive material release from the RHRSW system, as required by ODCM Control 3.1.1. While the RHRSW system is not a normal release pathway, the monitors provide indication of potential problems due to excessive leakage of the heat exchangers.

*Termination of the release is accomplished by auto trip of the RHRSW pumps and remote manual closure of isolation valves.

1.2 LIQUID EFFLUENT MONITOR SETPOINT DETERMINATION

Per the requirements of ODCM Control 3.1.1, alarm setpoints shall be established for the liquid effluent monitoring instrumentation to ensure that the release concentration limits of ODCM Control 3.2.1.1 are met. The concentration of radioactive material released in liquid effluents to UNRESTRICTED AREAS shall be limited to the concentrations specified in 10 CFR 20, Appendix B, Table II, Column 2 (pre-1994), for radionuclides other than noble gases and 2.0E-04 μCi/ml for dissolved or entrained noble gases (NUREG 0133).

1.2.1 Radwaste Discharge Monitor and Discharge Flow Rate - RISH63-0K604

The setpoint for the liquid radwaste discharge monitor and flow rate element are determined by the following equations. The radwaste discharge monitor high-high alarm/isolation setpoint is evaluated at least monthly based on isotopes detected in the liquid radwaste sample tanks released during the previous month or on any specific sample tank being released (ΣC_{igamma}), the required minimum cooling tower blowdown rate during discharge (CTBD), and average liquid radwaste discharge flow (RR). The flow rate determination is calculated for each release and the MPC fraction calculated includes, in the concentration mix, the most recent results from 1) the quarterly composite for SR-89, SR-90 and Fe-55, and 2) the monthly composite for H-3, and 3) the sample(s) for dissolved and entrained noble gases.

If the calculated setpoint is less than the existing setpoint, the setpoint will be reduced to the new value. If the calculated setpoint is greater than the existing setpoint, the setpoint may remain at the lower value or be increased to the calculated value.

The actual setpoint may be reduced to a value less than the calculated setpoint at the discretion of supervision.

If there were no sample tanks released or no activity detected during the previous month, then the calculation is performed using release data from the most recent month during which isotopes were detected. In addition, if there were no sample tanks released during the previous month, supervision may substitute more restrictive values (e.g., tritium) based on the plant sampling data.

1.2.1.1 Setpoint Determination - RISH63-0K604

The setpoints for the liquid radwaste discharge monitor is determined by the following equations:

CALCULATION METHODOLOGIES

$$\text{Hi-Hi Setpoint} = CPM_{(LRD)} \leq \left[1 - \frac{(S)(RR)[\Sigma(C_{ibeta}/MPC_{ibeta})]}{(RR+CTBD)}\right]\left[\frac{(\Sigma C_{igamma})(RR+CTBD)}{(S)(E)(RR)(\Sigma C_{igamma}/MPC_{igamma})}\right] - BKG_{(LRD)} \quad (1\text{-}1)$$

$$\text{Hi Setpoint} = (F)(\text{Hi-Hi Setpoint}) + BKG_{(LRD)} \quad (1\text{-}1a)$$

where:

$CPM_{(LRD)}$ = calculated liquid radwaste discharge monitor (RISH63-0K604) count rate attributable to the gamma emitting radionuclide, cpm

ΣC_{igamma} = the sum of the concentration of the identified gamma emitting nuclides (μCi/ml),

CTBD = the required minimum cooling tower blowdown rate during discharge (gpm),

RR = average liquid radwaste discharge flow (gpm),

BKG(LRD) = background count rate of liquid radwaste discharge monitor (CPM),

E = the gross detection efficiency of the liquid radwaste discharge monitor (μCi/ml/cpm), and

S = 2; margin of safety factor to assure that the release is terminated prior to 10 CFR 20 limits being exceeded. Included in this factor are errors associated with monitor uncertainty, sampling uncertainty, flow rate uncertainty, and the contribution of other release paths (Service Water and RHRSW) which are not normally contaminated.

F = a factor less than 1 that is used to calculate the Hi-Setpoint. The value of F is controlled by a procedure.

$\Sigma C_{igamma} / MPC_{igama}$ = the effective gamma MPC ratio for the mixture of radionuclides in the liquid radwaste discharge line (unitless).

where:

C_{igamma} = the concentration of each identified gamma emitting radionuclide 'i' in the liquid effluent (undiluted) (μCi/ml)

MPC_{igamma} = the MPC value corresponding to radionuclide 'i' from 10 CFR 20 Appendix B, Table II, Column 2 (dissolved and entrained noble gases MPC = 2.0E-4μCi/ml)

$\Sigma(C_{ibeta}/MPC_{ibeta})$ = the effective nongamma MPC ratio for the mixture of radionuclides in the liquid radwaste discharge line (unitless)

where:

C_{ibeta} = the concentration of each identified nongamma radionuclide 'i' in the liquid effluent (undiluted) (μCi/ml) * (See note below)

MPC_{ibeta} = the MPC value corresponding to radionuclide 'i' from 10 CFR 20, Appendix B, Table II, Column 2

*** NOTE:** The concentration mix must include the most recent sample data for H-3, Sr-89, Sr-90, Fe-55 and gross alpha.

1.2.1.2 Flow Rate Determination

The maximum liquid radwaste tank flow rate discharge to the river is determined by the following equation:

$$FLOW_{(LRD)} \leq \frac{CTBD}{S\left[\sum\left(C_i / MPC_i\right) - 1\right]} \qquad (1\text{-}2)$$

where:

$FLOW_{(LRD)}$ = flow limit for radwaste discharge line (gpm).

CTBD = required minimum cooling tower blowdown flow during discharge (gpm).

S = 2; margin of safety factor to assure that the release does not exceed 10 CFR 20 limits.

$\Sigma(C_i/MPC_i)$ = the effective MPC ratio for the mixture of radionuclides in the liquid radwaste discharge line (unitless) for $\Sigma(Ci/MPCi)>1$. If $\Sigma(C_i/MPC_i)<1$, then no flow rate determination is necessary.

where:

Ci = the concentration of each identified radionuclide 'i' in the liquid effluent (undiluted) (μCi/ml)* (See note below)

MPC_i = the MPC value corresponding to radionuclide 'i' from 10 CFR 20 Appendix B, Table II, Column 2, (dissolved and entrained noble gases MPC = 2E-4 μCi/ml)(μCi/ml).

* **NOTE:** The concentration mix must include the most recent sample data for H-3, Sr-89, Sr-90, Fe-55 and dissolved and entrained noble gases.

1.2.2 Service Water Radiation Monitor - RISH10-1K605, -2K605

The Service Water Radiation Monitor maximum (High-High) setpoint is determined by the following equation. The setpoint is evaluated every 24 months to assure that a high background count rate does not prevent adequate monitor sensitivity in order to meet the requirements of ODCM Control 3.2.1.1.

The High Setpoint shall be administratively controlled to a value that is less than the High-High setpoint.

1.2.2.1 Setpoint Determination

The setpoints for the Service Water Radiation Monitor is determined by the following equations:

$$\text{Hi-Hi Setpoint} = CPM_{sw} = (S)(MPC_{Cs-137})(CF) \quad (1\text{-}3)$$

$$\text{Hi Setpoint} = (F)(\text{Hi-Hi Setpoint}) \quad (1\text{-}3a)$$

where:

CPM_{sw} = Calculated Maximum Service Water Radiation Monitor (RISH12-1K605, -2K605) count rate, cpm.

MPC_{Cs-137} = MPC limit for Cs-137 (2.0E-05 μCi/ml)

CF = Monitor calibration factor - in cpm/μCi/ml

S = 0.5; Safety Factor,

F = a factor less than 1 that is used to calculate the Hi-Setpoint. The value of F is controlled by a procedure.

1.2.3 RHR Service Water Monitor -RISH12-0K619A, -0K619B

The RHR Service Water Radiation Monitor maximum High-High setpoint is determined by the following equation. The setpoint is evaluated every 24 months to assure that a high background count does not prevent adequate monitor sensitivity in order to meet the ODCM Control 3.2.1.1.

The High Setpoint shall be administratively controlled to a value that is less than the High-High setpoint.

1.2.3.1 Setpoint Determination

The setpoints for the RHR Service Water Radiation Monitor is determined by the following equations:

Hi-Hi Setpoint $=CPM_{RHRSW} = (S)(MPC_{Cs-137})(CF)$ (1-4)

Hi Setpoint = (F)(Hi-Hi Setpoint) (1-4a)

where:

CPM_{RHRSW} = Calculated maximum RHR Service Water Radiation Monitor (RISH12-0K619A, -0K619B) count rate, cpm.

MPC_{Cs-137} = MPC limit for Cs-137 (2.0E-05 μCi/ml)

CF = Monitor calibration factor - in cpm/μCi/ml.

S = 0.5; Safety Factor

F = a factor less than 1 that is used to calculate the Hi-Setpoint. The value of F is controlled by a procedure.

1.3 LIQUID EFFLUENT DOSE CALCULATION - 10 CFR 50

1.3.1 Dose to Members of the Public

Control 3.2.1.2 limits the dose or dose commitment to MEMBERS OF THE PUBLIC from radioactive materials in liquid effluents from Limerick Generating Station to:

During any Calendar Quarter	During any Calendar Year
≤ 3 mrem to total body	≤ 6 mrem to total body
≤10 mrem to any organ.	≤20 mrem to any organ

Per Surveillance Requirement 4.2.1.2 the cumulative dose contribution from liquid

effluents for the current calendar quarter and calendar year shall be determined at least once per 31 days in accordance with the following calculation methods. The monthly results are accumulated to give the quarterly doses and the quarterly results are accumulated to give the annual doses.

Receptor Location	Dist. (mi)	Pathways		
		Potable Water	Fish	Shoreline
LGS Outfall	0		X	X
PA. American Water	2.5	X	X	X
Phoenixville Water	9.0	X	X	X
Phil. Sub. Water	13.6	X		X
Crew Course	37.8			X

1.3.1.1 Potable Water Pathway

$$R_{apj} = 1100 \frac{U_{ap}}{M_p F} \sum_i Q_i D_{aipj} \exp(-\lambda_i t_p) \quad (1\text{-}5)$$

1.3.1.2 Fish (Aquatic Food) Pathway

$$R_{apj} = 1100 \frac{U_{ap}}{M_p F} \sum_i Q_i B_{ip} D_{aipj} \exp(-\lambda_i t_p) \quad (1\text{-}6)$$

1.3.1.3 Shoreline Deposition Pathway

$$R_{apj} = 110{,}000 \frac{U_{ap}}{M_p F} \sum_i Q_i T_i D_{aipj} [\exp(-\lambda_i t_p)] [1-\exp((-\lambda_i t_b)] \quad (1\text{-}7)$$

where:

B_{ip} = equilibrium bioaccumulation factor for nuclide I in pathway p, expressed as the ratio of the concentration in biota, in pCi/kg, to the radionuclide concentration in water, in pCi/liter (liters/kg). Values are in Table II1-1.

D_{aipj} = dose factor specific to a given age group a, radionuclide 'i'. pathway p, and organ j which can be used to calculate radiation dose (1) from an intake of a radionuclide, in mrem/pCi, or (2) from exposure to a given concentration of a radionuclide in sediment, in mrem/hr per pCi/m². Values are listed in Table II1-2 through Table II1-6.

F = flow rate of liquid effluent from site, cfs.

M_p	=	dilution factor at point of exposure or at point of withdrawal of drinking water (dimensionless). Values are graphically listed by receptor location in Figures II1.3.1-1 to II1.3.1-5. Value will be based on average monthly river flow. Mp appears in the equation denominator because river flow graphs display Mp as dilution flow and not the mixing ratio.
Q_i	=	total release of nuclide 'i' for time period (Ci).
R_{apj}	=	total dose for calculation time period to organ j of individuals of age group a from all nuclides 'i' in pathway b (mrem).
T_i	=	radioactive half-life of nuclide 'i' (days).
U_{ap}	=	usage factor specifying exposure time or intake rate for an individual of age group a associated with pathway p (hr/yr, liters/yr, or kg/yr) as indicated in Table II1-7.
W	=	shoreline width factor (dimensionless) = 0.2. Ref: Regulatory Guide 1.109, Rev. 1.
t_b	=	time period during which sediment is exposed to contaminated water (1.752E+5 hrs) (midpoint of plant life = 20 yrs)
λ_i	=	radioactive decay constant of nuclide 'i' (hr-1)
t_p	=	12 hours for delay time for water pathway in hours to allow for nuclide decay during transport through the water purification plant and the water distribution system, Ref: Regulatory Guide 1.109, Rev. 1, App. A.
tp	=	24 hours for delay time for fish pathway to allow for nuclide decay during transport through the food chain, as well as during food preparation. Ref: Regulatory Guide 1.109, Rev. 1, App. A.
tp	=	0 hours for delay time for shoreline pathway. Zero hours are assumed as shoreline activities can occur at the outfall.
1100	=	factor to convert from Ci/yr per ft^3/sec to pCi liter.
110,000	=	factor to convert from Ci/yr per ft^3/sec to pCi/liter and to account for proportionately constant (100) used in sediment radioactivity model.

1.3.2 Liquid Effluent Dose Projections

Control 3.2.1.3 requires that the liquid radwaste treatment system shall be operable and appropriate portions of the systems used to reduce the radioactive materials in liquid waste prior to their discharge when the projected doses due to the liquid effluent to UNRESTRICTED AREAS would exceed:

0.12 mrem/31 days to the total body
or
0.4 mrem/31 days to any organ.

Dose projections are made at least once per 31-days by the following equations:

$D_{tbp} = (D_{tb}/d) * 31 \text{ days}$ (1-8)

$D_{maxp} = (D_{max}/d) * 31 \text{ days}$ (1-9)

where:

D_{tbp} = the total body dose projection for the current 31-day period (mrem).

D_{tb} = the total body dose to date for the current calendar quarter as determined by equations 1-5, 1-6, and 1-7 (mrem).

Dmaxp = the maximum organ dose projection for the current 31-day period (mrem).

Dmax = the maximum organ dose to date for the current calendar quarter as determined by equations 1-5, 1-6, and 1-7 (mrem).

d = the actual number of days in the current calendar quarter at the end of the release (days).

31 days = the number of days of concern

2.0 GASEOUS EFFLUENTS

2.1 RADIATION MONITORING INSTRUMENTATION AND CONTROLS

The gaseous effluent monitoring instrumentation and controls at Limerick for controlling and monitoring radioactive material releases in accordance with the ODCM Part I are summarized as follows:

1) North Vent (Common): The plant gaseous discharges via this vent are monitored by two Particulate, Iodine and Gas (PIG) monitors (RY26-075A and RY26-075B) in parallel and by the Wide Range Accident Monitor (WRAM)

(RY26-076). The PIGS have separate Particulate, Iodine, and Gas sampling and monitoring channels but the Controls require only particulate and iodine sampling and noble gas monitoring. The WRAM has extended range (via three channels) noble gas monitoring and particulate and iodine sampling capability. In addition, the WRAM provides an isolation (Group 6A) of the large Drywell Purge and Vent valves.

2) South Vent (one per unit): The plant gaseous discharges via each South Vent are monitored by two redundant PIG monitors (RY26-285A,B). As is the case of the North Vent, each PIG has separate particulate, iodine, and gas sampling and monitoring channels but the Controls require only particulate and iodine sampling with gas monitoring.

3) Hot Maintenance Shop (Common): Due to the composition of the radioactive materials in the effluent steam (i.e., very low potential for noble gas), this release point is sampled by a particulate and iodine (P&I) monitor (RY26-025). The P&I monitor has a separate particulate and iodine sampling and monitoring channels but Controls require only particulate and iodine sampling.

4) Auxiliary Boilers (Common): Waste oil with some amount of radioactive particulate content may be burned in the site auxiliary boilers, as allowed by 10CFR20.2004. In this case, the exhaust stack of the affected auxiliary boiler will be a release point for radioactive effluents. Doses calculated will be based on the radioactive content of the oil sampled prior to incineration. The radioactive effluent will be summed with other effluents from the site and reported to the commission in the Annual Effluent Radiological Release Report.

2.2 GASEOUS EFFLUENT MONITOR SETPOINT DETERMINATION

Control 3.1.2 requires that an alarm setpoint be established for the noble gas effluent monitoring channels (RY26-075A(B), RY26-185A(B), RY26-285A(B), and RY26-076) to ensure that the release rate of radioactive materials does not exceed the limits of Control 3.2.2.1.a, which corresponds to a dose rate at the SITE BOUNDARY of 500 mrem/yr to the total body or 3000 mrem/yr to the skin.

Control limits are expressed in terms of dose rate, while the instruments that monitor effluents produce data in units of concentration or release rate. It is therefore necessary to identify the isotopes and calculate the corresponding release rate that will result in the dose rate limit being reached at the site boundary. This calculation is made more complex by the use of multiple release points at LGS.

Calculation Bases

The alarm setpoint calculation is performed monthly and is based on analytical results of grab samples from the appropriate release point. The concentration of each identified radionuclide in the grab samples is determined, and the data is used

to perform a setpoint calculation for that nuclide mix and release point.

The highest calculated annual average concentration (χ/Q) for an area at or beyond the site boundary (1.1E-05 sec/m^3, NE sector) is used in the setpoint calculation.

Maximum flow rates through the North and South vents are used in alarm setpoint calculations. This is necessary since flow can vary. By using maximum values, any flow less than the maximum will assure that the monitor will alarm before release rate limits are exceeded.

The fractional contribution of noble gas is calculated for each release point. The fractional contribution to the whole body and skin dose rates due to noble gases for the north stack and south stack vents are calculated by taking the product of this fraction and the limiting release rate. A comparison of the release rate for whole body and skin dose rates due to noble gas release is made to determine if the whole body or skin dose limit will be most restrictive. It is expected that the whole body limit will always be most restrictive, but the comparison is necessary to assure compliance with Control 3.2.2.1. The sum of the contributions from each release point, independently calculated for noble gases, will equal the maximum instantaneous release rate allowed from the site.

2.2.1 North Vent Noble Gas Effluent Monitors - RY26-075A-3, RY26-075B-3, and RY26-076-2

The North Vent Noble Gas Effluent monitor high-high setpoint is calculated monthly based on the grab sample results performed in accordance with Table 4.2-2. Release point grab samples may not identify any radionuclides. In this situation, use the results of the last grab sample that identified radionuclides or use the default setpoint which is based on expected concentration ratios as reported in the UFSAR. If any calculated alarm setpoint is less than the existing monitor setpoint, the setpoint will be reduced to the new value. If the calculated setpoint value is greater than the existing value, the setpoint may remain at the lower value or be increased to the new value.

2.2.1.1 Setpoint Determination

The High-High setpoint is calculated per equation 2-1 or 2-2. The High-High setpoint for the North Vent Noble Gas Effluent Monitor is set at or below the lesser of the $NVSP(Hi\text{-}Hi)_{NGWB}$ OR $NVSP(Hi\text{-}Hi)_{NGSK}$ value. (per equations 2-1 or 2-2)

$$NSVP(HI\text{-}HI)_{NGWB} \leq \frac{[VF_{NVNG}][500][\Sigma Ci_{NV}]}{[3.4475E9]\Sigma[(Ci_{NV})(K_i)]} \qquad (2\text{-}1)$$

$$NVSP(Hi\text{-}Hi)_{NGSK} \leq \frac{[VF_{NVNG}][3000][\Sigma C_{iNV}]}{[3.4475E9]\Sigma[(C_{iNV})(L_i + 1.11M_i)]} \quad (2\text{-}2)$$

The High Setpoint shall be administratively controlled to a value that is less than the High-High Setpoint.

Hi Setpoint = (F)(Hi-Hi Setpoint) (2-2a)

where:

$NVSP\ (Hi\text{-}Hi)_{NGSK}$ = North Vent High-High Setpoint - Noble Gas Skin (μCi/cc).

$NVSP\ (Hi\text{-}Hi)_{NGWB}$ = North Vent High-High Setpoint - Noble Gas Whole Body (μCi/cc).

VF_{NVNG} = fractional contribution to site boundary noble gas dose rate from the North Vent. (unitless).

500 = total body dose rate limit (mrem/yr)

3000 = skin dose rate limit (mrem/yr)

ΣCiNV = total noble gas activity from North Vent grab sample (μCi/cc)

F = a factor less than 1 that is used to calculate the Hi-Setpoint. The value of F is controlled by a procedure.

3.471E9 = Conversion factor, units are $\frac{(pCi)(cc)}{(\mu Ci)(m^3)}$

$$\left(\frac{1.1E-5\,\text{sec}}{m^3}\right)\left(\frac{1.0E+6\,pCi}{uCi}\right)\left(\frac{668450\,ft^3}{\text{min}}\right)\left(\frac{1\,\text{min}}{60\,\text{sec}}\right)\left(\frac{2.832E+4\,cc}{ft^3}\right) \quad (2\text{-}3)$$

where:

1.1E-5 sec/m^3	=	highest annual average χ/Q (NE Sector)
1E6 pCi/μCi	=	units conversion
668,450 cfm	=	maximum North Vent flow rate for two unit operation
1 min/60 sec	=	units conversion
2.832E4 cc/ft3	=	units conversion

C_{iNV} = concentration of noble gas nuclide 'i' as determined by radioanalysis of North Vent grab sample (μCi/cc)

K_i = Total body dose conversion factor for noble gas nuclide 'i' (mrem/yr per pCi/m^3, from ODCM Table II2-1).

L_i = Beta skin dose conversion factor noble gas nuclide 'i' (mrem/yr per pCim^3, from ODCM Table II2-1).

M_i = Gamma air dose conversion factor for noble gas nuclide 'i' (mrad/yr per pCi/m^3, From ODCM Table II2-1).

1.11 = The average ratio of tissue to air energy absorption coefficients (mrem/mrad) (Ref: Regulatory Guide 1.109, Section 2.0).

2.2.2 South Vent Noble Gas Effluent Monitors -RY26-185A-3, RY26185B-3, RY26-285A-3, AND RY26-285B-3

Each unit's South Vent Noble Gas Effluent monitor High-High setpoint is calculated monthly based on the grab sample results performed in accordance with ODCM Part I, Table 4.2-2. Release point grab samples may not identify any radionuclides. In this situation, use the results of the last grab sample that identified radionuclide or use the default setpoint which is based on expected concentration ratios as reported in the UFSAR. If any calculated alarm setpoint is less than the existing monitor setpoint, the setpoint will be reduced to the new value. If the calculated setpoint value is greater than the existing value, the setpoint may remain at the lower value, or be increased to the new value.

2.2.2.1 Setpoint determination

The High-High setpoint for the South Vent Noble Gas Effluent Monitor is set at the lesser of the $SVSP(Hi\text{-}Hi)_{NGWB}$ and $SVSP(Hi\text{-}Hi)_{NGSK}$ value. $SVSP(Hi\text{-}Hi)_{NGWB}$ and $SVSP(Hi\text{-}Hi)_{NGSK}$ are calculated for each unit's South Vent.

The High-High setpoint is calculated per equation 2-4 or 2-5.

$$SVSP(HI\text{-}HI)_{NGWB} \leq \frac{[VF_{SVNG}][500][\Sigma C_{isv}]}{[1.2149E9]\Sigma[(C_{isv})(K_i)]} \quad (2\text{-}4)$$

$$SVSP(HI\text{-}HI)_{NGSK} \leq \frac{[VF_{SVNG}][3000][\Sigma C_{isv}]}{[1.2149E9]\Sigma[(C_{isv})(L_i + 1.11M_i)]} \quad (2\text{-}5)$$

The High Setpoint shall be administratively controlled to a value that is less than the High-High Setpoint.

Hi Setpoint = (F)(Hi-Hi Setpoint) (2-5a)

where:

$SVSP(Hi\text{-}Hi)_{NGWB}$	=	South Vent High-High Setpoint - Noble Gas Whole Body (μCi/cc)
$SVSP(Hi\text{-}Hi)_{NGSK}$	=	South Vent High-High Setpoint - Noble Gas Skin (μCi/cc)
VF_{SVNG}	=	Fractional contribution to site boundary noble gas dose rate from the Unit's South Vent. (unitless)
500	=	Total body dose rate limit (mrem/yr)
3000	=	Skin dose rate limit (mrem/yr)
F	=	a factor less than 1 that is used to calculate the Hi-Setpoint. The value of F is controlled by a procedure.
$\sum C_{isv}$	=	Total noble gas activity from each unit South Vent grab sample (μCi/cc).
Cisv	=	concentration of noble gas nuclide 'i' determined by radioanalysis of South Vent grab sample (μCi/cc)
Ki	=	Total body dose conversion factor for noble gas nuclide 'i' (mrem/yr per pCi/m3, from ODCM Table II2-1).
Li	=	Beta skin dose conversion factor noble gas nuclide 'i' (mrem/yr per pCi/m3, From ODCM Table II2-1).
Mi	=	Gamma air dose conversion factor for noble gas nuclide 'i' (mrad/yr per pCi/m3, From ODCM Table II2-1).
1.11	=	The average ratio of tissue to air energy absorption coefficients (mrem/mrad) (Ref: Regulatory Guide 1.109, Section 2.0)
1.2149E9	=	Conversion factor units are in $\frac{(pCi)(cc)}{(\mu Ci)(m^3)}$

$$\left(\frac{1.1E-5\,\text{sec}}{m^3}\right)\left(\frac{1.0E+6\,pCi}{uCi}\right)\left(\frac{2.34E+5\,ft^3}{\text{min}}\right)\left(\frac{1\,\text{min}}{60\,\text{sec}}\right)\left(\frac{2.832E+4\,cc}{ft^3}\right) \qquad (2\text{-}6)$$

where:

1.1E-5 sec/m^3	=	highest annual average χ/Q (NE Sector)
1E6 pCi/μCi	=	units conversion
2.34E+5 ft^3/m	=	maximum South Vent flow rate
1/60 min/sec	=	units conversion
2.832E4 cc/ft^3	=	units conversion

2.2.3 Noble Gas Effluent Fractional Contribution

The three release points will be partitioned such that the sum does not exceed 100 percent of the limit (500 mrem/yr whole body noble gas, 3000 mrem/yr, skin noble gas.) The default fraction will be set at 80 percent for the North Vent, 10 percent for the Unit-1 South Vent and 10 percent for the Unit-2 South Vent.

These percentages can vary should operational concentrations warrant such change. However, the sum of the percentages shall be equal to or less than 100%. The following relationship shall be met:

$$VF_{NVNG} + VF_{1SVNG} + VF_{2SVNG} \leq 1 \qquad (2\text{-}7)$$

where:

VF_{NVNG} = fractional contribution to site boundary noble gas total body dose rate from the North Vent (unitless).

VF_{1SVNG} = fractional contribution to site boundary noble gas total body dose rate from the Unit 1 South Vent (unitless).

VF_{2SVNG} = fractional contribution to site boundary noble gas total body dose rate from the Unit 2 South Vent (unitless).

2.2.4 Noble Gas Effluent Default Setpoint

This methodology may be used when grab sample results from either the North Vent or the South Vent do not identify any radionuclides. This methodology is based on expected release concentration ratios as outlined in Section 11.3 of the Limerick UFSAR.

2.2.4.1 North Vent Noble Gas Monitors (RY26-075A-3 and RY26-075B-3). The default High-High setpoint for the North Vent Noble Gas Effluent Monitor is set at or below the $NVSP(Hi\text{-}Hi)_{NGD}$ value.

$$NVSP(Hi-Hi)_{NGD} \leq \frac{[8.00E-1][500][1.31E-6]}{[3.471E9][4.37E-9]} \qquad (2\text{-}8)$$

$NVSP(Hi\text{-}Hi)_{NGD} \leq$ 3.45E-5 μCi/cc

where:

$NVSP(Hi\text{-}Hi)_{NGD}$ = Default North Vent High-High Setpoint - Noble Gas Whole Body (μCi/cc)

8.00E-1 = Default fractional contribution to site boundary noble gas total body dose rate from the North Vent (unitless)

500 = Total body dose rate limit (mrem/yr)

1.31E-6 = Total noble gas concentration from North Vent (μCi/cc)

Ref: a) Based on UFSAR Table 11.3-1.
b) Based on maximum North Vent flow of 668,450 cfm

3.471E9 = Conversion Factor, units are in $\frac{(pCi)(cc)}{(\mu Ci)(m^3)}$. See Equation 2-3.

4.37E-9 = Summation of the North Vent concentration of noble gas nuclide 'i' multiplied by the corresponding whole body dose factor. Units are in $\frac{(\mu Ci)(mrem)(m^3)}{(cc)(yr)(pCi)}$

Ref: a) Based on UFSAR Table 11.3-1.
b) Based on maximum North Vent flow of 668,450 cfm.
c) ODCM Table II2-1.

2.2.4.2 South Vent Noble Gas Monitors (RY26-185A-3, RY26-285A-3, RY26-185B-3, and RY26-285B-3). The default High-High setpoint for each Unit's South Vent Noble Gas Effluent Monitor is set at or below the $SVSP(Hi-Hi)_{NGD}$ value.

$$SVSP(Hi-Hi)_{NGD} \leq \frac{[1.00E-1][500][1.02E-7]}{[1.2149E9][2.71E-10]} \quad (2\text{-}9)$$

$SVSP(Hi-Hi)_{NGD} \leq$ 1.54E-5 μCi/cc

where:

$SVSP(Hi-Hi)_{NGD}$ = Default South Vent Setpoint - Noble Gas (μCI/cc)

1.00E-1 = Default fractional contribution to site boundary noble gas total body dose rate from the South Vent (unitless)

500 = Total body dose rate limit (mrem/yr)

1.02E-7 = Total noble gas concentration from South Vent (μCi/cc)

Ref: a) Based on UFSAR Table 11.3-1.
b) Based on maximum South Vent flow of 234,000 cfm.

1.2149E9 = Conversion factor, units are in $\frac{(pCi)(cc)}{(\mu Ci)(m^3)}$. See Equation 2-6.

2.71E-10 = Summation of the South Vent concentration of noble gas nuclide 'i' multiplied by the corresponding whole

body dose factor. Units are in $\frac{(\mu Ci)(mrem)(m^3)}{(cc)(yr)(pCi)}$

Ref: a) Based on UFSAR Table 11.3-1.
b) Based on maximum South Vent flow of 234,000 cfm.
c) ODCM Table II2-1.

2.2.5 Wide Range Accident Monitor Noble Gas Effluent Monitor (RIX-26-076-4)

The Wide Range Accident Monitor (WRAM) noble gas total effluent channel displays the North Vent noble gas release rate. This monitor has Main Control Room Annunciation as well as a group 6A isolation function on the primary containment purge and vent valves. The isolation setpoint value of ≤2.1 μCi/cc specified in Technical Specification Table 3.3.2-2 is based on the accident dose limits for containment purge during an accident (Ref: UFSAR Section 1.13). For routine operations the total effluent high and high-high setpoints are based upon the methodology of Sections II 2.2.5.1 and II 2.2.5.2. The setpoint units are in microcuries per second using the two unit maximum North Vent flow rate of 668,450 scfm. The total effluent channel High-High setpoint is set at a value less than or equal to ten times the High setpoint (not to exceed the 2.1 Ci/cc equivalent using the two-unit maximum North Vent flow rate). These values are always more conservative than the Technical Specification Table 3.3.2-2 required value of ≤ 2.1μCi/cc.

If the calculated setpoint value is less than the existing monitor setpoint, the setpoint will be reduced to the new value. If the calculated setpoint is greater than the existing value, the setpoint may remain at the lower value, or be increased to the new value.

2.2.5.1 Routine Operations High Setpoint Determination

For routine operations, the High setpoint for the WRAM Noble Gas Total Effluent Channel is set at or below the lesser of the $NVSP(Hi\text{-}Hi)_{NGWB}$ or $NVSP(Hi\text{-}Hi)_{NGSK}$ value when activity is detected. When no activity is detected, the High setpoint is set at or below the $NVSP(Hi\text{-}Hi)_{NGD}$. This setpoint is calculated to ensure compliance with Control 3.2.2.1.a.

The setpoint values are converted from μCi/cc to μCi/sec using the maximum two-unit North Vent flow rate:

$$NVSP_{TEWB} = [NVSP(Hi\text{-}Hi)_{NGWB \text{ or } NGD}] [3.155E8] \quad (2\text{-}10)$$

$$NVSP_{TESK} = [NVSP(Hi\text{-}Hi)_{NGSK}] [3.155E8] \quad (2\text{-}11)$$

where:

$NVSP_{TEWB}$ = WRAM total effluent channel North Vent High Setpoint - Noble Gas Whole Body (μCi/sec).

$NVSP_{TESK}$ = WRAM total effluent channel North Vent High Setpoint - Noble Gas Skin (μCi/sec).

$NVSP(Hi\text{-}Hi)_{NGWB}$ or $_{NGD}$ = North Vent High-High Setpoint - Noble Gas Whole Body (μCi/cc) from equation 2-1 or 2-8.

$NVSP(Hi\text{-}Hi)_{NGSK}$ = North Vent High-High Setpoint - Noble Gas Skin (μCi/cc) from equation 2-2.

3.155E8 = Conversion factor (cc/sec).

$$= \left(\frac{668{,}450 sft^3}{\min}\right)\left(\frac{1\min}{60\sec}\right)\left(\frac{2.832E4cc}{ft^3}\right) \qquad (2\text{-}12)$$

2.2.5.2 Routine Operations High-High Setpoint Determination

For routine operations, the High-High setpoint for the WRAM Noble Gas total effluent channel is set at or below ten times the lesser of the routine operations $NVSP_{TEWB}$ or $NVSP_{TESK}$ value.

$$NVHP_{TEWB} = [NVSP_{TEWB}]\,[10] \qquad (2\text{-}13)$$

$$NVHP_{TESK} = [NVSPTESK]\,[10] \qquad (2\text{-}14)$$

where:

$NVHP_{TEWB}$ = WRAM total effluent channel North Vent High-High Setpoint Noble Gas Whole Body (μCi/sec).

$NVHP_{TESK}$ = WRAM total effluent channel North Vent High-High Setpoint Noble Gas Skin (μCi/sec).

$NVSP_{TEWB}$ = WRAM total effluent channel North Vent High Setpoint - Noble Gas Whole Body (μCi/sec) from equation 2-10.

$NVSP_{TESK}$ = WRAM total effluent channel North Vent Setpoint - Noble Gas Skin (μCi/sec) from equation 2-11.

10 = multiplication factor to calculate High-High value (unitless)

2.3 GASEOUS EFFLUENT DOSE EVALUATION

Monthly dose calculations are performed based on limiting sector average annual meteorological dispersion parameters. For the noble gas monthly dose calculation, effluent release data are based on the latest grab sample analysis for radionuclide composition. For the iodine and particulate monthly dose calculations, the effluent release radionuclide composition and release activity are based on weekly continuous samples.

The quarterly dose calculations are a summation of the applicable monthly dose results.

2.3.1 Dose Rate - Noble Gases

Control 3.2.2.1.a limits the dose rate in gaseous effluents from the site to areas at or beyond the SITE BOUNDARY due to noble gas releases to <500 mrem/yr total body and <3000 mrem/yr skin. Radiation monitor alarm setpoints are established to ensure that these release limits are not exceeded.

Simultaneous releases from the North and South Vents are considered in evaluating compliance with the release rate limits of Control 3.2.2.1.a. following any releases exceeding the alarm setpoints. Monitor indications (readings) are averaged over time periods not to exceed 60 minutes.

NOTE: For administrative purposes, more conservative alarm setpoints than those required to meet 10 CFR 20 Dose Rate limits are imposed. However, conditions exceeding these more limiting alarm setpoints do not necessarily indicate radioactive material release rates exceeding the dose limits of Control 3.2.2.1.a. Provided actual releases do not result in radiation monitor indications exceeding values based on the dose rate limits of Control 3.2.2.1.a., no further analyses are required for demonstrating compliance with the limits of Control 3.2.2.1.a.

In the event of a noble gas effluent release exceeding the setpoint value specified in ODCM Part II, Sections 2.2.1 or 2.2.2, the site boundary dose rate from the release is calculated using the methodology stated below. This methodology is based on worst sector (NE) annual average meteorological dispersion but, if further refinement is required to meet the requirements of Control 3.2.2.1.a, actual meteorological data from the time period of concern may be used to calculate actual meteorological dispersion.

$$D_{TB} = \chi/Q\ (1E+06)\left[\sum_{i=1}^{n}\left(\dot{Q}_i K_i\right)\right] \qquad (2\text{-}15)$$

$$D_{\gamma} = \chi/Q\ \ (1E+06)\left[\sum_{i=1}^{n}\ (L_i + 1.11M_i)\dot{Q}_i\right] \qquad (2\text{-}16)$$

where:

D_{TB}	= Total Body Plume Dose Rate (mrem/yr)
D_γ	= Skin Plume Dose Rate (mrem/yr)
χ/Q	= 1.1E-05 highest annual average relative concentration (NE Sector) (sec/m^3)
$\dot{Q}_i$	= The in units of mrem/yr/per pCi/m^3release rate of noble gas nuclide I from all vent releases averaged over one hour (uCi/sec)
K_i	= Total body dose factor for noble gas nuclide 'i' in units of mrem/yr per pCi/m^3. Values are listed in ODCM Table II2-1.
L_i	= Skin dose factor for the beta contribution for noble gas nuclide 'i' in units of mrem/yr per pCi/m^3. Values are listed in ODCM Table II2-1.
1.11	= the average ratio of tissue to air energy absorption coefficients (mrem/mrad) (Ref: Regulatory Guide 1.109, Section 2.)
M_i	= Gamma air dose factor for noble gas nuclide 'i' in units of mrad/yr per pCi/m^3. Values are listed in ODCM Table II2-1.
1E+06	= Units conversion ρCi/μCi

2.3.2 Dose Rate - Radioiodine and Particulates

Control 3.2.2.1.b limits the dose rate to ≤1500 mrem/yr to any organ (inhalation pathways only) for I-131, I-133, Tritium, and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents. Compliance with Control 3.2.2.1.b is determined monthly.

Simultaneous releases from the North and South Vents are considered in evaluating compliance with the release rate limits of Control 3.2.2.1.b. Release activity is based upon the results of the weekly continuous sample analysis performed in accordance with ODCM Part I, Table 4.2-2.

$$D_{IH} = \chi/Q_{depl} \sum_{i=1}^{n} R_i \dot{Q}_i \qquad (2\text{-}17)$$

where:

D_{IH} = Inhalation dose rate (mrem/yr)

χ/Qdepl = 1.0E-05 highest average annual depleted χ/Q (NE Sector) (sec/m3)

Ri = Dose factor for radionuclides other than noble gases for the inhalation pathway only (mrem/yr/μCi/m3). Values are listed in ODCM TABLE II2-2.

$\dot{Q}_i$ = The release rate of radionuclide 'i' other than noble gases from all vent releases (μCi/s).

2.3.3 Noble Gas Air Doses

Control 3.2.2.2 limits the air dose due to noble gases released in gaseous effluents (from both reactor units) to areas at or beyond the SITE BOUNDARY to:

≤ 10 mrad gamma for any quarter
≤ 20 mrad beta for any quarter
≤ 20 mrad gamma during any calendar year
≤ 40 mrad beta during any calendar year

As required by Surveillance Requirement 4.2.2.2, these doses are calculated at least once per 31 days using the results of the most recent grab samples for isotopic composition performed in accordance with Table 4.2-2. The monthly dose calculation is performed using the most limiting average annual meteorological dispersion values. The quarterly doses are based on the summation of the applicable monthly results. The monthly dose calculations are performed in accordance with the methodology below.

$$D_{\gamma AIR} = (3.17E-8)(1.00E+6)\chi \Big/ Q\sum_{i=1}^{n} MiQi \qquad (2\text{-}18)$$

$$D_{\beta AIR} = (3.17E-8)(1.00E+6)\chi \Big/ Q\sum_{i=1}^{n} NiQi \qquad (2\text{-}19)$$

where:

$D_{\gamma AIR}$ = Gamma air dose from noble gas releases in MRAD

$D\beta_{AIR}$	= Beta air dose from noble gas release in MRAD
3.17E-8	= Units conversion [year/sec]
1.00E+6	= Units conversion $\rho Ci/\mu Ci$
χ/Q	= 1.1E-05, Highest average annual relative concentration (NE Sector) in sec/m^3
Qi	= The release of noble gas radionuclides 'i' from all vents in μCi. Releases shall be cumulative over the period of interest.
M_i	= Gamma air dose factor for noble gas nuclide 'i' in units of mrad/yr per pCi/m^3. Values are listed in ODCM Table II2-1.
N_i	= Beta air dose factor for noble gas nuclide 'i' in units of mrad/yr per pCi/m^3. Values are listed in ODCM Table II2-1.

2.3.4 Radioiodine and Particulate Dose Calculations

Control 3.2.2.3 limits the dose (from both reactor units) to a MEMBER OF THE PUBLIC from I-131, I-133, Tritium, and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released to areas at or beyond the SITE BOUNDARY to:

≤ 15 mrem to any organ during any calendar quarter
≤ 30 mrem to any organ during any calendar year

As required by Surveillance Requirement 4.2.2.3, these doses are calculated at least once per 31 days using the results of the weekly continuous sample analysis performed in accordance with ODCM Part I, Table 4.2-2. The monthly dose calculation is performed using the most limiting average annual meteorological dispersion values. The quarterly doses are based on the summation of the applicable monthly results. The monthly dose calculations are performed in accordance with the methodology below. Total organ dose is obtained by the summation of the organ dose from each pathway.

2.3.4.1 Ground Pathway

$$D_{GPAR} = 3.17E-08\left[D/Q\sum_{i=1}^{n} RiQi\right] \qquad (2\text{-}20)$$

2.3.4.2 Vegetation, Meat, Cow Milk, and Goat Milk Pathway

$$D_{VPAR} = 3.17E-08\left[\chi/Q\sum_{i=1}^{2}RiQi + D/Q\sum_{i=3}^{n}RiQi\right] \quad (2\text{-}21)$$

2.3.4.3 Inhalation Pathway

$$D_{IPAR} = 3.17E-08\left[\chi/Q\sum_{i=1}^{2}RiQi + \chi/Q_{depl}\sum_{i=3}^{n}RiQi\right] \quad (2\text{-}22)$$

where:

D_{GPAR}	=	dose from ground pathway due to release of particulates and iodines (mrem).
D_{VPAR}	=	dose from vegetation, meat, cow milk, and goat milk, pathways due to releases of particulates, iodines, and tritium (mrem).
D_{IPAR}	=	dose from inhalation pathway due to release of particulates, iodines, and tritium (mrem).
3.17E-8	=	units conversion (year/sec).
i = 1	=	Tritium, H3
i = 2 thru n	=	all other isotopes (particulate and iodine)
Q_i	=	the release of nuclide 'i' from all vents in μCi. Releases shall be cumulative over the time period of interest.
R_i	=	dose factor for organ type, age group, and pathway (for radionuclides other than noble gas); dose factors are calculated based on the methodology given in NUREG-0133. - values of R_i are provided in ODCM Table II2-2.
χ/Q	=	1.1E-05 highest average annual χ/Q (NE sector) (sec/m^3)
$\chi/Qdepl$	=	1.0E-05 highest average depleted χ/Q (NE sector) (sec/m^3)
D/Q	=	1.82E-9 highest average annual deposition (ESE Sector) ($1/m^2$)

2.3.5 Incineration of Contaminated Oil

2.3.5.1 Site Boundary Dose Rate

The dose rate (mrem/yr) to any organ (inhalation pathway only) for I-131, I-133, Tritium, and all radionuclides in particulate form with half-lives greater than eight (8) days from the incineration of contaminated oil from the auxiliary boiler shall be calculated in accordance with the methodology below.

The dose rate from radioactive particulate release shall be determined by either of two methods. Method (a), total instantaneous release, assumes that the total activity contained in the contaminated oil is released in the first minute of incineration. Method (b) uses the activity release over the entire time of incineration.

For normal operations, it is assumed that Method (a) will be used, since the total activity from the waste oil is expected to contribute an insignificant dose compared to the annual limits. However, in the event that the dose rate calculated is higher than administrative or regulatory limits, then Method (b) may be used, because it uses the actual time of release, which results in a more accurate dose and dose rate calculated.

Since the auxiliary boiler stacks are at approximately the same height as the reactor vents and discharge from the auxiliary boiler will also be heated, the use of the reactor vent dispersion values for the calculations is considered conservative.

a. Instantaneous Release Rate Method

$$\dot{Q} = \sum_{i=1}^{n} \frac{(C_{iv})(3785)(Z)}{60} \qquad (2\text{-}23)$$

where:

$\dot{Q}_i$ = The release rate of radionuclide 'i' in gaseous effluents from the auxiliary stack releases, μCi/s.

C_{iv} = activity concentration measured in oil for nuclide 'i' in μCi/ml.

3785 = unit conversion (milliliters / gallon).

Z = gallons of oil consumed.

60 = number of seconds used for release.

b. Constant Release Rate Method

$$\dot{Q} = \sum_{i=1}^{n} \frac{(C_{iv})(3785)(Z)}{T} = \qquad (2\text{-}24)$$

where:

$\dot{Q}_i$ = The release rate of radionuclide 'i' in gaseous effluents from the auxiliary stack releases, μCi/s.

Civ = activity concentration measured in oil for nuclide 'i' in μCi/ml.

3785 = unit conversion (milliliters / gallon).

Z = gallons of oil consumed.

T = number of seconds used to burn oil for release.

The dose rate (mrem/yr) is calculated using equation 2-17. The dose rate calculated must comply with the limits stated in Control 3.2.2.1.

2.3.5.2 Radioiodine and Particulate Dose Calculations

The dose to an individual from radioactive materials in particulate form and radionuclides other than noble gases with half-lives greater than eight days in gaseous effluents released to areas at and beyond the SITE BOUNDARY from the incineration of contaminated waste oil from the auxiliary boiler stacks shall be calculated in accordance with the methodology below. Doses calculated are based on the radioactive content of oil sampled prior to incineration.

Total curies released:

$$Q_i = \sum_{i=1}^{n} (C_{iv})(3785)(Z) \qquad (2\text{-}25)$$

where:

Q_i = the release of radionuclide i, μCi

C_{iv} = activity concentration measured in oil for nuclide, 'i'. in μCi/ml.

3785 = milliliters per gallon.

Z = gallons of oil consumed.

The dose (mrem) is calculated using equations 2-20, 2-21, and 2-22. The dose calculated must comply with limits stated in Controls 3.2.2.3 and 3.2.2.5. The doses will be summed with cumulative dose contributions for current month, calendar quarter, and calendar year.

2.3.6 Gaseous Effluent Dose Projection

Control 3.2.2.5 requires the VENTILATION EXHAUST TREATMENT SYSTEM be used to reduce radioactive material levels prior to discharge when projected doses from both units to areas at and beyond the SITE BOUNDARY would exceed in a 31 day period:

a. 0.4 mrad to air from gamma radiation, or
b. 0.8 mrad to air from beta radiation, or
c. 0.6 mrem to any organ of a MEMBER OF THE PUBLIC

A dose projection is performed at least once per 31-days by the following equations:

$$Dmax_{gamma} = (Dmaxg / d) * 31 \quad (2\text{-}26)$$

$$Dmax_{beta} = (Dmaxb / d) * 31 \quad (2\text{-}26a)$$

$$Dmax_{organ} = (Dmaxo / d) * 31 \quad (2\text{-}26b)$$

where:

$Dmax_{gamma}$ = maximum gamma air dose projection for current 31-day period (mrad)

$Dmax_{beta}$ = maximum beta air dose projection for current 31-day period (mrad)

$Dmax_{organ}$ = maximum organ dose projection for current 31-day period (mrem)

Dmaxg = maximum gamma air dose to date for current calendar quarter as obtained by equation (2-18).

Dmaxb = maximum beta air dose to date for current calendar quarter as obtained by equation (2-19).

Dmaxo = maximum organ dose to date for current calendar quarter as determined by summing the organ dose obtained from equations (2-20), (2-21) and (2-22) (mrem).

d = number of days in current calendar quarter at the end of the release.

31 = the number of days of concern.

3.0 ANNUAL DOSE EVALUATION

The assessment of radiation doses for the radiation dose assessment report shall be performed utilizing 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 10CFR Part 50, Appendix I", Revision 1, October 1977. Any deviations from the methodology provided in Regulatory Guide 1.109 shall be documented in the radiation dose assessment report.

The meteorological conditions concurrent with the time of release of radioactive materials (as determined by sampling frequency of measurement) or approximate methods shall be used as input to the dose model.

4.0 SPECIAL DOSE ANALYSIS

4.1 TOTAL DOSE TO MEMBERS OF THE PUBLIC

Control 3.2.3 requires that the annual dose or dose commitment to any MEMBER OF THE PUBLIC, due to releases of radioactivity and radiation, from the uranium fuel cycle shall be limited to:

≤ 25 mrem whole body or any organ except thyroid
≤ 75 mrem thyroid

Surveillance Requirement 4.2.3.2 requires that cumulative dose contributions from direct radiation from operations be evaluated when the calculated dose from the release of radioactive materials in liquid or gaseous effluents exceed the limits of Controls 3.2.1.2.a, 3.2.1.2.b, 3.2.2.2.a, 3.2.2.2.b, 3.2.2.3.a, or 3.2.2.3.b. The direct radiation contribution shall be determined by the methodology described below. This methodology calculates the direct radiation contribution, which then must be added to the dose or dose commitment determined in accordance with ODCM Part II, Sections 1.3.1, 2.3.3, and 2.3.4 to determine total dose from all pathways. This evaluation of direct radiation contribution is in accordance with ANSI/ANS 6.6.1-1979 Section 7. The error using this method is estimated to be approximately 8%. The following evaluation is performed for each receptor of concern.

$$D_{DR1} = D_{TTLD1} - D_{X\,BKG} - D_{1EFFL} \qquad (4\text{-}1)$$

where:

D_{DR1} = cumulative dose contribution from direct radiation at the appropriate receptors (mrem).

NOTE: Due to the statistics of radiation measurements and to the conservative nature of effluent calculations it is

plausible the D_{DR1} may yield a negative value. In this situation the value for D_{DR1} shall be reported as zero (0).

D_{TTLD} = total dose at receptor of interest (as evaluated by TLD measurement)(mrem).

NOTE: If there is not a TLD location at the actual receptor location, a more conservative location will be used to evaluate Total Dose.

D_{XBKG} = mean of the background dose as evaluated by TLDs at background sites (mrem).

D_{1EFFL} = effluent contribution to dose (as evaluated in ODCM Part II, Sections 2.3.3 and 2.3.4.1).

4.2 DOSES DUE TO ACTIVITIES INSIDE THE SITE BOUNDARY

In accordance with Control 6.2, the Annual Radioactive Effluent Release Report shall include an assessment of radiation dose from radioactive liquid and gaseous effluents to MEMBERS OF THE PUBLIC due to their activities inside the SITE BOUNDARY.

There are three locations within the SITE BOUNDARY that are accessible to MEMBERS OF THE PUBLIC for activities unrelated to the operation of Limerick Station. These locations are: 1) the railroad tracks which run along the river within the SITE BOUNDARY; 2) the Limerick Information Center, on Longview Road next to the 500kv substation; and 3) Fricks Lock. Of these three locations, the railroad tracks are the closest to the plant confines. Sectors and distances of these locations are provided below:

Sector	Distance to Location (m)
Railroad Tracks:	
S	300
SSW	225
SW	225
WSW	225
W	225
WNW	345
NW	450

Information Center:
ESE 884

Fricks Lock:
WSW 450

Annual doses will be calculated in accordance with Reg. Guide 1.109 and assume an occupancy factor of 0.25. The maximum dose calculated will be reported in the Annual Radioactive Effluent Release Report.

5.0 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

5.1 SAMPLING PROGRAM

The operational phase of the Radiological Environmental Monitoring Program (REMP) is conducted in accordance with the requirements of Control 3.3.1. The objectives of the program are:

- To provide data on measurable levels of radiation and radioactive materials in the site environs.

- To evaluate the relationship between quantities of radioactive materials released from LGS and resultant radiation doses to individuals from principal pathways of exposure.

The sampling requirements (type of samples, collection frequency, and analysis) and sample locations are presented in Appendix A.

5.2 INTERLABORATORY COMPARISON PROGRAM

Control 3.3.3 requires analyses be performed on radioactive material supplied as part of an Interlaboratory Comparison.

Participation in an NIST traceable Interlaboratory Comparison Program provides a check on the preciseness of measurements of radioactive material in environmental samples. A summary of the Interlaboratory Comparison Program results is provided in the Annual Radiological Environmental Operating Report pursuant to Control 6.1.

TABLES

TABLE II1-1

BIOACCUMULATION FACTORS FOR FRESHWATER FISH (pCi/kg per pCi/liter)

ELEMENT	B_{ip}	ELEMENT	B_{ip}
H	9.0E-1	Nb	3.0E+4
C	4.6E+3	Mo	1.0E+1
Na	1.0E+2	Tc	1.5E+1
P	3.0E+3*	Ru	1.0E+1
Cr	2.0E+2	Rh	1.0E+1
Mn	4.0E+2	Te	4.0E+2
Fe	1.0E+2	I	1.5E+1
Co	5.0E+1	Cs	2.0E+3
Ni	1.0E+2	Ba	4.0E+0
Cu	5.0E+1	La	2.5E+1
Zn	2.0E+3	Ce	1.0E+0
Br	4.2E+2	Pr	2.5E+1
Rb	2.0E+3	Nd	2.5E+1
Sr	3.0E+1	W	1.2E+3
Y	2.5E+1	Np	1.0E+1

Ref: 1) U.S.N.R.C. Reg. Guide 1.109, Rev. 1, Table A-1

2)* Letter LTR 881209L001, from R.J. Clark, U.S.N.R.C., to G.A. Hunger, Philadelphia Electric Co., December 9, 1988, transmitting evaluation of Limerick ODCM.

TABLE II1-2

INGESTION DOSE FACTORS FOR ADULT (D_{aipj})

mrem/pCi

From Table E-11 of Reg. Guide 1.109*

	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H3	0.000E+00	1.050E-07	1.050E-07	1.050E-07	1.050E-07	1.050E-07	1.050E-07
C14	2.840E-06	5.680E-07	5.680E-07	5.680E-07	5.680E-07	5.680E-07	5.680E-07
Na24	1.700E-06	1.700E-06	1.700E-06	1.700E-06	1.700E-06	1.700E-06	1.700E-06
P32	1.930E-04	1.200E-05	7.460E-06	0.000E+00	0.000E+00	0.000E+00	2.170E-05
Cr51	0.000E+00	0.000E+00	2.660E-09	1.590E-09	5.860E-10	3.530E-09	6.690E-07
Mn54	0.000E+00	4.570E-06	8.720E-07	0.000E+00	1.360E-06	0.000E+00	1.400E-05
Mn56	0.000E+00	1.150E-07	2.040E-08	0.000E+00	1.460E-07	0.000E+00	3.670E-06
Fe55	2.750E-06	1.900E-06	4.430E-07	0.000E+00	0.000E+00	1.060E-06	1.090E-06
Fe59	4.340E-06	1.020E-05	3.910E-06	0.000E+00	0.000E+00	2.850E-06	3.400E-05
Co58	0.000E+00	7.450E-07	1.670E-06	0.000E+00	0.000E+00	0.000E+00	1.510E-05
Co60	0.000E+00	2.140E-06	4.720E-06	0.000E+00	0.000E+00	0.000E+00	4.020E-05
Ni63	1.300E-04	9.010E-06	4.360E-06	0.000E+00	0.000E+00	0.000E+00	1.880E-06
Ni65	5.280E-07	6.860E-08	3.130E-08	0.000E+00	0.000E+00	0.000E+00	1.740E-06
Cu64	0.000E+00	8.330E-08	3.910E-08	0.000E+00	2.100E-07	0.000E+00	7.100E-06
Zn65	4.840E-06	1.540E-05	6.960E-06	0.000E+00	1.030E-05	0.000E+00	9.700E-06
Zn69	1.030E-08	1.970E-08	1.370E-09	0.000E+00	1.280E-08	0.000E+00	2.960E-09
Br83	0.000E+00	0.000E+00	4.020E-08	0.000E+00	0.000E+00	0.000E+00	5.790E-08
Br84	0.000E+00	0.000E+00	5.210E-08	0.000E+00	0.000E+00	0.000E+00	4.090E-13
Br85	0.000E+00	0.000E+00	2.140E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Rb86	0.000E+00	2.110E-05	9.830E-06	0.000E+00	0.000E+00	0.000E+00	4.160E-06
Rb88	0.000E+00	6.050E-08	3.210E-08	0.000E+00	0.000E+00	0.000E+00	8.360E-19
Rb89	0.000E+00	4.010E-08	2.820E-08	0.000E+00	0.000E+00	0.000E+00	2.330E-21
Sr89	3.080E-04	0.000E+00	8.840E-06	0.000E+00	0.000E+00	0.000E+00	4.940E-05
Sr90	7.580E-03	0.000E+00	1.860E-03	0.000E+00	0.000E+00	0.000E+00	2.190E-04
Sr91	5.670E-06	0.000E+00	2.290E-07	0.000E+00	0.000E+00	0.000E+00	2.700E-05
Sr92	2.150E-06	0.000E+00	9.300E-08	0.000E+00	0.000E+00	0.000E+00	4.260E-05
Y90	9.620E-09	0.000E+00	2.580E-10	0.000E+00	0.000E+00	0.000E+00	1.020E-04
Y91m	9.090E-11	0.000E+00	3.520E-12	0.000E+00	0.000E+00	0.000E+00	2.670E-10
Y91	1.410E-07	0.000E+00	3.770E-09	0.000E+00	0.000E+00	0.000E+00	7.760E-05
Y92	8.450E-10	0.000E+00	2.470E-11	0.000E+00	0.000E+00	0.000E+00	1.480E-05
Y93	2.680E-09	0.000E+00	7.400E-11	0.000E+00	0.000E+00	0.000E+00	8.500E-05
Zr95	3.040E-08	9.750E-09	6.600E-09	0.000E+00	1.530E-08	0.000E+00	3.090E-05
Zr97	1.680E-09	3.390E-10	1.550E-10	0.000E+00	5.120E-10	0.000E+00	1.050E-04
Nb95	6.220E-09	3.460E-09	1.860E-09	0.000E+00	3.420E-09	0.000E+00	2.100E-05
Mo99	0.000E-00	4.310E-06	8.200E-07	0.000E+00	9.760E-06	0.000E+00	9.990E-06
Tc99m	2.470E-10	6.980E-10	8.890E-09	0.000E+00	1.060E-08	3.420E-10	4.130E-07
Tc101	2.540E-10	3.660E-10	3.590E-09	0.000E+00	6.590E-09	1.870E-10	1.100E-21
Ru103	1.850E-07	0.000E+00	7.970E-08	0.000E+00	7.060E-07	0.000E+00	2.160E-05
Ru105	1.540E-08	0.000E+00	6.080E-09	0.000E+00	1.990E-07	0.000E+00	9.420E-06
Ru106	2.750E-06	0.000E+00	3.480E-07	0.000E+00	5.310E-06	0.000E+00	1.780E-04
Ag110m	1.600E-07	1.480E-07	8.790E-08	0.000E+00	2.910E-07	0.000E+00	6.040E-05
Sb-124*	2.800E-06	5.290E-08	1.110E-06	6.790E-09	0.000E+00	2.180E-06	7.950E-05
Sb-125*	1.790E-06	2.000E-08	4.260E-07	1.820E-09	0.000E+00	1.380E-06	1.970E-05
Te125m	2.680E-06	9.710E-07	3.590E-07	8.060E-07	1.090E-05	0.000E+00	1.070E-05

TABLE II1-2 (Continued)

INGESTION DOSE FACTORS FOR ADULT (D_{aipj})

mrem/pCi

From Table E-11 of Reg. Guide 1.109*

	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Te127m	6.770E-06	2.420E-06	8.250E-07	1.730E-06	2.750E-05	0.000E+00	2.270E-05
Te127	1.100E-07	3.950E-08	2.380E-08	8.150E-08	4.480E-07	0.000E+00	8.680E-06
Te129m	1.150E-05	4.290E-06	1.820E-06	3.950E-06	4.800E-05	0.000E+00	5.790E-05
Te129	3.140E-08	1.180E-08	7.650E-09	2.410E-08	1.320E-07	0.000E+00	2.370E-08
Te131m	1.730E-06	8.460E-07	7.050E-07	1.340E-06	8.570E-06	0.000E+00	8.400E-05
Te131	1.970E-08	8.230E-09	6.220E-09	1.620E-08	8.630E-08	0.000E+00	2.790E-09
Te132	2.520E-06	1.630E-06	1.530E-06	1.800E-06	1.570E-05	0.000E+00	7.710E-05
I130	7.560E-07	2.230E-06	8.800E-07	1.890E-04	3.480E-06	0.000E+00	1.920E-06
I131	4.160E-06	5.950E-06	3.410E-06	1.950E-03	1.020E-05	0.000E+00	1.570E-06
I132	2.030E-07	5.430E-07	1.900E-07	1.900E-05	8.650E-07	0.000E+00	1.020E-07
I133	1.420E-06	2.470E-06	7.530E-07	3.630E-04	4.310E-06	0.000E+00	2.220E-06
I134	1.060E-07	2.880E-07	1.030E-07	4.990E-06	4.580E-07	0.000E+00	2.510E-10
I135	4.430E-07	1.160E-06	4.280E-07	7.650E-05	1.860E-06	0.000E+00	1.310E-06
Cs134	6.220E-05	1.480E-04	1.210E-04	0.000E+00	4.790E-05	1.590E-05	2.590E-06
Cs136	6.510E-06	2.570E-05	1.850E-05	0.000E+00	1.430E-05	1.960E-06	2.920E-06
Cs137	7.970E-05	1.090E-04	7.140E-05	0.000E+00	3.700E-05	1.230E-05	2.110E-06
Cs138	5.520E-08	1.090E-07	5.400E-08	0.000E+00	8.010E-08	7.910E-09	4.650E-13
Ba139	9.700E-08	6.910E-11	2.840E-09	0.000E+00	6.460E-11	3.920E-11	1.720E-07
Ba140	2.030E-05	2.550E-08	1.330E-06	0.000E+00	8.670E-09	1.460E-08	4.180E-05
Ba141	4.710E-08	3.560E-11	1.590E-09	0.000E+00	3.310E-11	2.020E-11	2.220E-17
Ba142	2.130E-08	2.190E-11	1.340E-09	0.000E+00	1.850E-11	1.240E-11	3.000E-26
La140	2.500E-09	1.260E-09	3.330E-10	0.000E+00	0.000E+00	0.000E+00	9.250E-05
La142	1.280E-10	5.820E-11	1.450E-11	0.000E+00	0.000E+00	0.000E+00	4.250E-07
Ce141	9.360E-09	6.330E-09	7.180E-10	0.000E+00	2.940E-09	0.000E+00	2.420E-05
Ce143	1.650E-09	1.220E-06	1.350E-10	0.000E+00	5.370E-10	0.000E+00	4.560E-05
Ce144	4.880E-07	2.040E-07	2.620E-08	0.000E+00	1.210E-07	0.000E+00	1.650E-04
Pr143	9.200E-09	3.690E-09	4.560E-10	0.000E+00	2.130E-09	0.000E+00	4.030E-05
Pr144	3.010E-11	1.250E-11	1.530E-12	0.000E+00	7.050E-12	0.000E+00	4.330E-18
Nd147	6.290E-09	7.270E-09	4.350E-10	0.000E+00	4.250E-09	0.000E+00	3.490E-05
W187	1.030E-07	8.610E-08	3.010E-08	0.000E+00	0.000E+00	0.000E+00	2.820E-05
Np239	1.190E-09	1.170E-10	6.450E-11	0.000E+00	3.650E-10	0.000E+00	2.400E-05

* Dose Factors for Sb-124 and Sb-125 from ICRP 2, NUREG 1276 – LADTAP II Users Manual.

TABLE II1-3

INGESTION DOSE FACTORS FOR TEEN (D_{aipj})

mrem/pCi

From Table E-12 of Reg. Guide 1.109*

	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H3	0.000E+00	1.060E-07	1.060E-07	1.060E-07	1.060E-07	1.060E-07	1.060E-07
C14	4.060E-06	8.120E-07	8.120E-07	8.120E-07	8.120E-07	8.120E-07	8.120E-07
Na24	2.300E-06	2.300E-06	2.300E-06	2.300E-06	2.300E-06	2.300E-06	2.300E-06
P32	2.760E-04	1.710E-05	1.070E-05	0.000E+00	0.000E+00	0.000E+00	2.320E-05
Cr51	0.000E+00	0.000E+00	3.600E-09	2.000E-09	7.890E-10	5.140E-09	6.050E-07
Mn54	0.000E+00	5.900E-06	1.170E-06	0.000E+00	1.760E-06	0.000E+00	1.210E-05
Mn56	0.000E+00	1.580E-07	2.810E-08	0.000E+00	2.000E-07	0.000E+00	1.040E-05
Fe55	3.780E-06	2.680E-06	6.250E-07	0.000E+00	0.000E+00	1.700E-06	1.160E-06
Fe59	5.870E-06	1.370E-05	5.290E-06	0.000E+00	0.000E+00	4.320E-06	3.240E-05
Co58	0.000E+00	9.720E-07	2.240E-06	0.000E+00	0.000E+00	0.000E+00	1.340E-05
Co60	0.000E+00	2.810E-06	6.330E-06	0.000E+00	0.000E+00	0.000E+00	3.660E-05
Ni63	1.770E-04	1.250E-05	6.000E-06	0.000E+00	0.000E+00	0.000E+00	1.990E-06
Ni65	7.490E-07	9.570E-08	4.360E-08	0.000E+00	0.000E+00	0.000E+00	5.190E-06
Cu64	0.000E+00	1.150E-07	5.410E-08	0.000E+00	2.910E-07	0.000E+00	8.920E-06
Zn65	5.760E-06	2.000E-05	9.330E-06	0.000E+00	1.280E-05	0.000E+00	8.470E-06
Zn69	1.470E-08	2.800E-08	1.960E-09	0.000E+00	1.830E-08	0.000E+00	5.160E-08
Br83	0.000E+00	0.000E+00	5.740E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Br84	0.000E+00	0.000E+00	7.220E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Br85	0.000E+00	0.000E+00	3.050E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Rb86	0.000E+00	2.980E-05	1.400E-05	0.000E+00	0.000E+00	0.000E+00	4.410E-06
Rb88	0.000E+00	8.520E-08	4.540E-08	0.000E+00	0.000E+00	0.000E+00	7.300E-15
Rb89	0.000E+00	5.500E-08	3.890E-08	0.000E+00	0.000E+00	0.000E+00	8.430E-17
Sr89	4.400E-04	0.000E+00	1.260E-05	0.000E+00	0.000E+00	0.000E+00	5.240E-05
Sr90	8.300E-03	0.000E+00	2.050E-03	0.000E+00	0.000E+00	0.000E+00	2.330E-04
Sr91	8.070E-06	0.000E+00	3.210E-07	0.000E+00	0.000E+00	0.000E+00	3.660E-05
Sr92	3.050E-06	0.000E+00	1.300E-07	0.000E+00	0.000E+00	0.000E+00	7.770E-05
Y90	1.370E-08	0.000E+00	3.690E-10	0.000E+00	0.000E+00	0.000E+00	1.130E-04
Y91m	1.290E-10	0.000E+00	4.930E-12	0.000E+00	0.000E+00	0.000E+00	6.090E-09
Y91	2.010E-07	0.000E+00	5.390E-09	0.000E+00	0.000E+00	0.000E+00	8.240E-05
Y92	1.210E-09	0.000E+00	3.500E-11	0.000E+00	0.000E+00	0.000E+00	3.320E-05
Y93	3.830E-09	0.000E+00	1.050E-10	0.000E+00	0.000E+00	0.000E+00	1.170E-04
Zr95	4.120E-08	1.300E-08	8.940E-09	0.000E+00	1.910E-08	0.000E+00	3.000E-05
Zr97	2.370E-09	4.690E-10	2.160E-10	0.000E+00	7.110E-10	0.000E+00	1.270E-04
Nb95	8.220E-09	4.560E-09	2.510E-09	0.000E+00	4.420E-09	0.000E+00	1.950E-05
Mo99	0.000E+00	6.030E-06	1.150E-06	0.000E+00	1.380E-05	0.000E+00	1.080E-05
Tc99m	3.320E-10	9.260E-10	1.200E-08	0.000E+00	1.380E-08	5.140E-10	6.080E-07
Tc101	3.600E-10	5.120E-10	5.030E-09	0.000E+00	9.260E-09	3.120E-10	8.750E-17
Ru103	2.550E-07	0.000E+00	1.090E-07	0.000E+00	8.990E-07	0.000E+00	2.130E-05
Ru105	2.180E-08	0.000E+00	8.460E-09	0.000E+00	2.750E-07	0.000E+00	1.760E-05
Ru106	3.920E-06	0.000E+00	4.940E-07	0.000E+00	7.560E-06	0.000E+00	1.880E-04
Ag110m	2.050E-07	1.940E-07	1.180E-07	0.000E+00	3.700E-07	0.000E+00	5.450E-05
Sb-124*	3.870E-06	7.130E-08	1.510E-06	8.780E-09	0.000E+00	3.380E-06	7.800E-05
Sb-125*	2.480E-06	2.710E-08	5.800E-07	2.370E-09	0.000E+00	2.180E-06	1.930E-05
Te125m	3.830E-06	1.380E-06	5.120E-07	1.070E-06	0.000E+00	0.000E+00	1.130E-05

TABLE II1-3 (Continued)

INGESTION DOSE FACTORS FOR TEEN (D_{aipj})

mrem/pCi

From Table E-12 of Reg. Guide 1.109*

	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Te127m	9.670E-06	3.430E-06	1.150E-06	2.300E-06	3.920E-05	0.000E+00	2.410E-05
Te127	1.580E-07	5.600E-08	3.400E-08	1.090E-07	6.400E-07	0.000E+00	1.220E-05
Te129m	1.630E-05	6.050E-06	2.580E-06	5.260E-06	6.820E-05	0.000E+00	6.120E-05
Te129	4.480E-08	1.670E-08	1.090E-08	3.200E-08	1.880E-07	0.000E+00	2.450E-07
Te131m	2.440E-06	1.170E-06	9.760E-07	1.760E-06	1.220E-05	0.000E+00	9.390E-05
Te131	2.790E-08	1.150E-08	8.720E-09	2.150E-08	1.220E-07	0.000E+00	2.290E-09
Te132	3.490E-06	2.210E-06	2.080E-06	2.330E-06	2.120E-05	0.000E+00	7.000E-05
I130	1.030E-06	2.980E-06	1.190E-06	2.430E-04	4.590E-06	0.000E+00	2.290E-06
I131	5.850E-06	8.190E-06	4.400E-06	2.390E-03	1.410E-05	0.000E+00	1.620E-06
I132	2.790E-07	7.300E-07	2.620E-07	2.460E-05	1.150E-06	0.000E+00	3.180E-07
I133	2.010E-06	3.410E-06	1.040E-06	4.760E-04	5.980E-06	0.000E+00	2.580E-06
I134	1.460E-07	3.870E-07	1.390E-07	6.450E-06	6.100E-07	0.000E+00	5.100E-09
I135	6.100E-07	1.570E-06	5.820E-07	1.010E-04	2.480E-06	0.000E+00	1.740E-06
Cs134	8.370E-05	1.970E-04	9.140E-05	0.000E+00	6.260E-05	2.390E-05	2.450E-06
Cs136	8.590E-06	3.380E-05	2.270E-05	0.000E+00	1.840E-05	2.900E-06	2.720E-06
Cs137	1.120E-04	1.490E-04	5.190E-05	0.000E+00	5.070E-05	1.970E-05	2.120E-06
Cs138	7.760E-08	1.490E-07	7.450E-08	0.000E+00	1.100E-07	1.280E-08	6.760E-11
Ba139	1.390E-07	9.780E-11	4.050E-09	0.000E+00	9.220E-11	6.740E-11	1.240E-06
Ba140	2.840E-05	3.480E-08	1.830E-06	0.000E+00	1.180E-08	2.340E-08	4.380E-05
Ba141	6.710E-08	5.010E-11	2.240E-09	0.000E+00	4.650E-11	3.430E-11	1.430E-13
Ba142	2.990E-08	2.990E-11	1.840E-09	0.000E+00	2.530E-11	1.990E-11	9.180E-20
La140	3.480E-09	1.710E-09	4.550E-10	0.000E+00	0.000E+00	0.000E+00	9.820E-05
La142	1.790E-10	7.950E-11	1.980E-11	0.000E+00	0.000E+00	0.000E+00	2.420E-06
Ce141	1.330E-08	8.880E-09	1.020E-09	0.000E+00	4.180E-09	0.000E+00	2.540E-05
Ce143	2.350E-09	1.710E-06	1.910E-10	0.000E+00	7.670E-10	0.000E+00	5.140E-05
Ce144	6.960E-07	2.880E-07	3.740E-08	0.000E+00	1.720E-07	0.000E+00	1.750E-04
Pr143	1.310E-08	5.230E-09	6.520E-10	0.000E+00	3.040E-09	0.000E+00	4.310E-05
Pr144	4.300E-11	1.760E-11	2.180E-12	0.000E+00	1.010E-11	0.000E+00	4.740E-14
Nd147	9.380E-09	1.020E-08	6.110E-10	0.000E+00	5.990E-09	0.000E+00	3.680E-05
W187	1.460E-07	1.190E-07	4.170E-08	0.000E+00	0.000E+00	0.000E+00	3.220E-05
Np239	1.760E-09	1.660E-10	9.220E-11	0.000E+00	5.210E-10	0.000E+00	2.670E-05

* Dose Factors for Sb-124 and Sb-125 from ICRP 2, NUREG 1276 – LADTAP II Users Manual.

TABLE II1-4

INGESTION DOSE FACTORS FOR CHILD (D_{aipj})

mrem/pCi

From Table E-13 of Reg. Guide 1.109*

	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H3	0.000E+00	2.030E-07	2.030E-07	2.030E-07	2.030E-07	2.030E-07	2.030E-07
C14	1.210E-05	2.420E-06	2.420E-06	2.420E-06	2.420E-06	2.420E-06	2.420E-06
Na24	5.800E-06	5.800E-06	5.800E-06	5.800E-06	5.800E-06	5.800E-06	5.800E-06
P32	8.250E-04	3.860E-05	3.180E-05	0.000E+00	0.000E+00	0.000E+00	2.280E-05
Cr51	0.000E+00	0.000E+00	8.900E-09	4.940E-09	1.350E-09	9.020E-09	4.720E-07
Mn54	0.000E+00	1.070E-05	2.850E-06	0.000E+00	3.000E-06	0.000E+00	8.980E-06
Mn56	0.000E+00	3.340E-07	7.540E-08	0.000E+00	4.040E-07	0.000E+00	4.840E-05
Fe55	1.150E-05	6.100E-06	1.890E-06	0.000E+00	0.000E+00	3.450E-06	1.130E-06
Fe59	1.650E-05	2.670E-05	1.330E-05	0.000E+00	0.000E+00	7.740E-06	2.780E-05
Co58	0.000E+00	1.800E-06	5.510E-06	0.000E+00	0.000E+00	0.000E+00	1.050E-05
Co60	0.000E+00	5.290E-06	1.560E-05	0.000E+00	0.000E+00	0.000E+00	2.930E-05
Ni63	5.380E-04	2.880E-05	1.830E-05	0.000E+00	0.000E+00	0.000E+00	1.940E-06
Ni65	2.220E-06	2.090E-07	1.220E-07	0.000E+00	0.000E+00	0.000E+00	2.560E-05
Cu64	0.000E+00	2.450E-07	1.480E-07	0.000E+00	5.920E-07	0.000E+00	1.150E-05
Zn65	1.370E-05	3.650E-05	2.270E-05	0.000E+00	2.300E-05	0.000E+00	6.410E-06
Zn69	4.380E-08	6.330E-08	5.850E-09	0.000E+00	3.840E-08	0.000E+00	3.990E-06
Br83	0.000E+00	0.000E+00	1.710E-07	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Br84	0.000E+00	0.000E+00	1.980E-07	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Br85	0.000E+00	0.000E+00	9.120E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Rb86	0.000E+00	6.700E-05	4.120E-05	0.000E+00	0.000E+00	0.000E+00	4.310E-06
Rb88	0.000E+00	1.900E-07	1.320E-07	0.000E+00	0.000E+00	0.000E+00	9.320E-09
Rb89	0.000E+00	1.170E-07	1.040E-07	0.000E+00	0.000E+00	0.000E+00	1.020E-09
Sr89	1.320E-03	0.000E+00	3.770E-05	0.000E+00	0.000E+00	0.000E+00	5.110E-05
Sr90	1.700E-02	0.000E+00	4.310E-03	0.000E+00	0.000E+00	0.000E+00	2.290E-04
Sr91	2.400E-05	0.000E+00	9.060E-07	0.000E+00	0.000E+00	0.000E+00	5.300E-05
Sr92	9.030E-06	0.000E+00	3.620E-07	0.000E+00	0.000E+00	0.000E+00	1.710E-04
Y90	4.110E-08	0.000E+00	1.100E-09	0.000E+00	0.000E+00	0.000E+00	1.170E-04
Y91m	3.820E-10	0.000E+00	1.390E-11	0.000E+00	0.000E+00	0.000E+00	7.480E-07
Y91	6.020E-07	0.000E+00	1.610E-08	0.000E+00	0.000E+00	0.000E+00	8.020E-05
Y92	3.600E-09	0.000E+00	1.030E-10	0.000E+00	0.000E+00	0.000E+00	1.040E-04
Y93	1.140E-08	0.000E+00	3.130E-10	0.000E+00	0.000E+00	0.000E+00	1.700E-04
Zr95	1.160E-07	2.550E-08	2.270E-08	0.000E+00	3.650E-08	0.000E+00	2.660E-05
Zr97	6.990E-09	1.010E-09	5.960E-10	0.000E+00	1.450E-09	0.000E+00	1.530E-04
Nb95	2.250E-08	8.760E-09	6.260E-09	0.000E+00	8.230E-09	0.000E+00	1.620E-05
Mo99	0.000E+00	1.330E-05	3.290E-06	0.000E+00	2.840E-05	0.000E+00	1.100E-05
Tc99m	9.230E-10	1.810E-09	3.000E-08	0.000E+00	2.630E-08	9.190E-10	1.030E-06
Tc101	1.070E-09	1.120E-09	1.420E-08	0.000E+00	1.910E-08	5.920E-10	3.560E-09
Ru103	7.310E-07	0.000E+00	2.810E-07	0.000E+00	1.840E-06	0.000E+00	1.890E-05
Ru105	6.450E-08	0.000E+00	2.340E-08	0.000E+00	5.670E-07	0.000E+00	4.210E-05
Ru106	1.170E-05	0.000E+00	1.460E-06	0.000E+00	1.580E-05	0.000E+00	1.820E-04
Ag110m	5.390E-07	3.640E-07	2.910E-07	0.000E+00	6.780E-07	0.000E+00	4.330E-05
Sb-124*	1.110E-05	1.440E-07	3.890E-06	2.450E-08	0.000E+00	6.160E-06	6.940E-05
Sb-125*	7.160E-06	5.520E-08	1.500E-06	6.630E-09	0.000E+00	3.990E-06	1.710E-05
Te125m	1.140E-05	3.090E-06	1.520E-06	3.200E-06	0.000E+00	0.000E+00	1.100E-05

TABLE II1-4 (Continued)

INGESTION DOSE FACTORS FOR CHILD (D_{aipj})

mrem/pCi

From Table E-13 of Reg. Guide 1.109*

	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Te127m	2.890E-05	7.780E-06	3.430E-06	6.910E-06	8.240E-05	0.000E+00	2.340E-05
Te127	4.710E-07	1.270E-07	1.010E-07	3.260E-07	1.340E-06	0.000E+00	1.840E-05
Te129m	4.870E-05	1.360E-05	7.560E-06	1.570E-05	1.430E-04	0.000E+00	5.940E-05
Te129	1.340E-07	3.740E-08	3.180E-08	9.560E-08	3.920E-07	0.000E+00	8.340E-06
Te131m	7.200E-06	2.490E-06	2.650E-06	5.120E-06	2.410E-05	0.000E+00	1.010E-04
Te131	8.300E-08	2.530E-08	2.470E-08	6.350E-08	2.510E-07	0.000E+00	4.360E-07
Te132	1.010E-05	4.470E-06	5.400E-06	6.510E-06	4.150E-05	0.000E+00	4.500E-05
I130	2.920E-06	5.900E-06	3.040E-06	6.500E-04	8.820E-06	0.000E+00	2.760E-06
I131	1.720E-05	1.730E-05	9.830E-06	5.720E-03	2.840E-05	0.000E+00	1.540E-06
I132	8.000E-07	1.470E-06	6.760E-07	6.820E-05	2.250E-06	0.000E+00	1.730E-06
I133	5.920E-06	7.320E-06	2.770E-06	1.360E-03	1.220E-05	0.000E+00	2.950E-06
I134	4.190E-07	7.780E-07	3.580E-07	1.790E-05	1.190E-06	0.000E+00	5.160E-07
I135	1.750E-06	3.150E-06	1.490E-06	2.790E-04	4.830E-06	0.000E+00	2.400E-06
Cs134	2.340E-04	3.840E-04	8.100E-05	0.000E+00	1.190E-04	4.270E-05	2.070E-06
Cs136	2.350E-05	6.460E-05	4.180E-05	0.000E+00	3.440E-05	5.130E-06	2.270E-06
Cs137	3.270E-04	3.130E-04	4.620E-05	0.000E+00	1.020E-04	3.670E-05	1.960E-06
Cs138	2.280E-07	3.170E-07	2.010E-07	0.000E+00	2.230E-07	2.400E-08	1.460E-07
Ba139	4.140E-07	2.210E-10	1.200E-08	0.000E+00	1.930E-10	1.300E-10	2.390E-05
Ba140	8.310E-05	7.280E-08	4.850E-06	0.000E+00	2.370E-08	4.340E-08	4.210E-05
Ba141	2.000E-07	1.120E-10	6.510E-09	0.000E+00	9.690E-11	6.580E-10	1.140E-07
Ba142	8.740E-08	6.290E-11	4.880E-09	0.000E+00	5.090E-11	3.700E-11	1.140E-09
La140	1.010E-08	3.530E-09	1.190E-09	0.000E+00	0.000E+00	0.000E+00	9.840E-05
La142	5.240E-10	1.670E-10	5.230E-11	0.000E+00	0.000E+00	0.000E+00	3.310E-05
Ce141	3.970E-08	1.980E-08	2.940E-09	0.000E+00	8.680E-09	0.000E+00	2.470E-05
Ce143	6.990E-09	3.790E-06	5.490E-10	0.000E+00	1.590E-09	0.000E+00	5.550E-05
Ce144	2.080E-06	6.520E-07	1.110E-07	0.000E+00	3.610E-07	0.000E+00	1.700E-04
Pr143	3.930E-08	1.180E-08	1.950E-09	0.000E+00	6.390E-09	0.000E+00	4.240E-05
Pr144	1.290E-10	3.990E-11	6.490E-12	0.000E+00	2.110E-11	0.000E+00	8.590E-08
Nd147	2.790E-08	2.260E-08	1.750E-09	0.000E+00	1.240E-08	0.000E+00	3.580E-05
W187	4.290E-07	2.540E-07	1.140E-07	0.000E+00	0.000E+00	0.000E+00	3.570E-05
Np239	5.250E-09	3.770E-10	2.650E-10	0.000E+00	1.090E-09	0.000E+00	2.790E-05

* Dose Factors for Sb-124 and Sb-125 from ICRP 2, NUREG 1276 – LADTAP II Users Manual.

TABLE II1-5

INGESTION DOSE FACTORS FOR INFANT (D_{aipj})

mrem/pCi

From Table E-14 of Reg. Guide 1.109*

	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H3	0.000E+00	3.080E-07	3.080E-07	3.080E-07	3.080E-07	3.080E-07	3.080E-07
C14	2.370E-05	5.060E-06	5.060E-06	5.060E-06	5.060E-06	5.060E-06	5.060E-06
Na24	1.010E-05	1.010E-05	1.010E-05	1.010E-05	1.010E-05	1.010E-05	1.010E-05
P32	1.700E-03	1.000E-04	6.590E-05	0.000E+00	0.000E+00	0.000E+00	2.300E-05
Cr51	0.000E+00	0.000E+00	1.410E-08	9.200E-09	2.010E-09	1.790E-08	4.110E-07
Mn54	0.000E+00	1.990E-05	4.510E-06	0.000E+00	4.410E-06	0.000E+00	7.310E-06
Mn56	0.000E+00	8.180E-07	1.410E-07	0.000E+00	7.030E-07	0.000E+00	7.430E-05
Fe55	1.390E-05	8.980E-06	2.400E-06	0.000E+00	0.000E+00	4.390E-06	1.140E-06
Fe59	3.080E-05	5.380E-05	2.120E-05	0.000E+00	0.000E+00	1.590E-05	2.570E-05
Co58	0.000E+00	3.600E-06	8.980E-06	0.000E+00	0.000E+00	0.000E+00	8.970E-06
Co60	0.000E+00	1.080E-05	2.550E-05	0.000E+00	0.000E+00	0.000E+00	2.570E-05
Ni63	6.340E-04	3.920E-05	2.200E-05	0.000E+00	0.000E+00	0.000E+00	1.950E-06
Ni65	4.700E-06	5.320E-07	2.420E-07	0.000E+00	0.000E+00	0.000E+00	4.050E-05
Cu64	0.000E+00	6.090E-07	2.820E-07	0.000E+00	1.030E-06	0.000E+00	1.250E-05
Zn65	1.840E-05	6.310E-05	2.910E-05	0.000E+00	3.060E-05	0.000E+00	5.330E-05
Zn69	9.330E-08	1.680E-07	1.250E-08	0.000E+00	6.980E-08	0.000E+00	1.370E-05
Br83	0.000E+00	0.000E+00	3.630E-07	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Br84	0.000E+00	0.000E+00	3.820E-07	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Br85	0.000E+00	0.000E+00	1.940E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Rb86	0.000E+00	1.700E-04	8.400E-05	0.000E+00	0.000E+00	0.000E+00	4.350E-06
Rb88	0.000E+00	4.980E-07	2.730E-07	0.000E+00	0.000E+00	0.000E+00	4.850E-07
Rb89	0.000E+00	2.860E-07	1.970E-07	0.000E+00	0.000E+00	0.000E+00	9.740E-08
Sr89	2.510E-03	0.000E+00	7.200E-05	0.000E+00	0.000E+00	0.000E+00	5.160E-05
Sr90	1.850E-02	0.000E+00	4.710E-03	0.000E+00	0.000E+00	0.000E+00	2.310E-04
Sr91	5.000E-05	0.000E+00	1.810E-06	0.000E+00	0.000E+00	0.000E+00	5.920E-05
Sr92	1.920E-05	0.000E+00	7.130E-07	0.000E+00	0.000E+00	0.000E+00	2.070E-04
Y90	8.690E-08	0.000E+00	2.330E-09	0.000E+00	0.000E+00	0.000E+00	1.200E-04
Y91m	8.100E-10	0.000E+00	2.760E-11	0.000E+00	0.000E+00	0.000E+00	2.700E-06
Y91	1.130E-06	0.000E+00	3.010E-08	0.000E+00	0.000E+00	0.000E+00	8.100E-05
Y92	7.650E-09	0.000E+00	2.150E-10	0.000E+00	0.000E+00	0.000E+00	1.460E-04
Y93	2.430E-08	0.000E+00	6.620E-10	0.000E+00	0.000E+00	0.000E+00	1.920E-04
Zr95	2.060E-07	5.020E-08	3.560E-08	0.000E+00	5.410E-08	0.000E+00	2.500E-05
Zr97	1.480E-08	2.540E-09	1.160E-09	0.000E+00	2.560E-09	0.000E+00	1.620E-04
Nb95	4.200E-08	1.730E-08	1.000E-08	0.000E+00	1.240E-08	0.000E+00	1.460E-05
Mo99	0.000E+00	3.400E-05	6.630E-06	0.000E+00	5.080E-05	0.000E+00	1.120E-05
Tc99m	1.920E-09	3.960E-09	5.100E-08	0.000E+00	4.260E-08	2.070E-09	1.150E-06
Tc101	2.270E-09	2.860E-09	2.830E-08	0.000E+00	3.400E-08	1.560E-09	4.860E-07
Ru103	1.480E-06	0.000E+00	4.950E-07	0.000E+00	3.080E-06	0.000E+00	1.800E-05
Ru105	1.360E-07	0.000E+00	4.580E-08	0.000E+00	1.000E-06	0.000E+00	5.410E-05
Ru106	2.410E-05	0.000E+00	3.010E-06	0.000E+00	2.850E-05	0.000E+00	1.830E-04
Ag110m	9.960E-07	7.270E-07	4.810E-07	0.000E+00	1.040E-06	0.000E+00	3.770E-05
Sb-124*	2.150E-05	3.150E-07	6.630E-06	5.680E-08	0.000E+00	1.340E-05	6.600E-05
Sb-125*	1.230E-05	1.190E-07	2.530E-06	1.540E-08	0.000E+00	7.120E-06	1.640E-05
Te125m	2.330E-05	7.790E-06	3.150E-06	7.840E-06	0.000E+00	0.000E+00	1.110E-05

TABLE II1-5 (Continued)

INGESTION DOSE FACTORS FOR INFANT (D_{aipj})

mrem/pCi

From Table E-14 of Reg. Guide 1.109*

	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Te127m	5.850E-05	1.940E-05	7.080E-06	1.690E-05	1.440E-04	0.000E+00	2.360E-05
Te127	1.000E-06	3.350E-07	2.150E-07	8.140E-07	2.440E-06	0.000E+00	2.100E-05
Te129m	1.000E-04	3.430E-05	1.540E-05	3.840E-05	2.500E-04	0.000E+00	5.970E-05
Te129	2.840E-07	9.790E-08	6.630E-08	2.380E-07	7.070E-07	0.000E+00	2.270E-05
Te131m	1.520E-05	6.120E-06	5.050E-06	1.240E-05	4.210E-05	0.000E+00	1.030E-04
Te131	1.760E-07	6.500E-08	4.940E-08	1.570E-07	4.500E-07	0.000E+00	7.110E-06
Te132	2.080E-05	1.030E-05	9.610E-06	1.520E-05	6.440E-05	0.000E+00	3.810E-05
I130	6.000E-06	1.320E-05	5.300E-06	1.480E-03	1.450E-05	0.000E+00	2.830E-06
I131	3.590E-05	4.230E-05	1.860E-05	1.390E-02	4.940E-05	0.000E+00	1.510E-06
I132	1.660E-06	3.370E-06	1.200E-06	1.580E-04	3.760E-06	0.000E+00	2.730E-06
I133	1.250E-05	1.820E-05	5.330E-06	3.310E-03	2.140E-05	0.000E+00	3.080E-06
I134	8.690E-07	1.780E-06	6.330E-07	4.150E-05	1.990E-06	0.000E+00	1.840E-06
I135	3.640E-06	7.240E-06	2.640E-06	6.490E-04	8.070E-06	0.000E+00	2.620E-06
Cs134	3.770E-04	7.030E-04	7.100E-05	0.000E+00	1.810E-04	7.420E-05	1.910E-06
Cs136	4.590E-05	1.350E-04	5.040E-05	0.000E+00	5.380E-05	1.100E-05	2.050E-06
Cs137	5.220E-04	6.110E-04	4.330E-05	0.000E+00	1.640E-04	6.640E-05	1.910E-06
Cs138	4.810E-07	7.820E-07	3.790E-07	0.000E+00	3.900E-07	6.090E-08	1.250E-06
Ba139	8.810E-07	5.840E-10	2.550E-08	0.000E+00	3.510E-10	3.540E-10	5.580E-05
Ba140	1.710E-04	1.710E-07	8.810E-06	0.000E+00	4.060E-08	1.050E-07	4.200E-05
Ba141	4.250E-07	2.910E-10	1.340E-08	0.000E+00	1.750E-10	1.770E-10	5.190E-06
Ba142	1.840E-07	1.530E-10	9.060E-09	0.000E+00	8.810E-11	9.260E-11	7.590E-07
La140	2.110E-08	8.320E-09	2.140E-09	0.000E+00	0.000E+00	0.000E+00	9.770E-05
La142	1.100E-09	4.040E-10	9.670E-11	0.000E+00	0.000E+00	0.000E+00	6.860E-05
Ce141	7.870E-08	4.800E-08	5.650E-09	0.000E+00	1.480E-08	0.000E+00	2.480E-05
Ce143	1.480E-08	9.820E-06	1.120E-09	0.000E+00	2.860E-09	0.000E+00	5.730E-05
Ce144	2.980E-06	1.220E-06	1.670E-07	0.000E+00	4.930E-07	0.000E+00	1.710E-04
Pr143	8.130E-08	3.040E-08	4.030E-09	0.000E+00	1.130E-08	0.000E+00	4.290E-05
Pr144	2.740E-10	1.060E-10	1.380E-11	0.000E+00	3.840E-11	0.000E+00	4.930E-06
Nd147	5.530E-08	5.680E-08	3.480E-09	0.000E+00	2.190E-08	0.000E+00	3.600E-05
W187	9.030E-07	6.280E-07	2.170E-07	0.000E+00	0.000E+00	0.000E+00	3.690E-05
Np239	1.110E-08	9.930E-10	5.610E-10	0.000E+00	1.980E-09	0.000E+00	2.870E-05

* Dose Factors for Sb-124 and Sb-125 from ICRP 2, NUREG 1276 – LADTAP II Users Manual.

TABLE II1-6

EXTERNAL DOSE FACTORS FOR STANDING ON CONTAMINATED GROUND*

(mrem/hr per pCi/m^2)

From Table E-6 of Reg. Guide 1.109

Element	Total Body(1)	Skin	Element	Total Body(1)	Skin
H-3	0.0	0.0	Ru-105	4.50E-09	5.10E-09
C-14	0.0	0.0	Ru-106	1.50E-09	1.80E-09
NA-24	2.50E-08	2.90E-08	Ag-110M	1.80E-08	2.10E-08
P-32	0.0	0.0	Sb-124*	1.30E-08	1.50E-08
Cr-51	2.20E-10	2.60E-10	Sb-125*	3.10E-09	3.50E-09
Mn-54	5.80E-09	6.80E-09	Te-125M	3.50E-11	4.80E-11
Mn-56	1.10E-08	1.30E-08	Te-127M	1.10E-12	1.30E-12
Fe-55	0.0	0.0	Te-127	1.00E-11	1.10E-11
Fe-59	8.00E-09	9.40E-09	Te-129M	7.70E-10	9.00E-10
Co-58	7.00E-09	8.20E-09	Te-129	7.10E-10	8.40E-10
Co-60	1.70E-08	2.00E-08	Te-131M	8.40E-09	9.90E-09
Ni-63	0.0	0.0	Te-131	2.20E-09	2.60E-06
Ni-65	3.70E-09	4.30E-09	Te-132	1.70E-09	2.00E-09
Cu-64	1.50E-09	1.70E-09	I-130	1.40E-08	1.70E-08
Zn-65	4.00E-09	4.60E-09	I-131	2.80E-09	3.40E-09
Zn-69	0.0	0.0	I-132	1.70E-08	2.00E-08
Br-83	6.40E-11	9.30E-11	I-133	3.70E-09	4.50E-09
Br-84	1.20E-08	1.40E-08	I-134	1.60E-08	1.90E-08
Br-85	0.0	0.0	I-135	1.20E-08	1.40E-08
Rb-86	6.30E-10	7.20E-10	Cs-134	1.20E-08	1.40E-08
Rb-88	3.50E-09	4.00E-09	Cs-136	1.50E-08	1.70E-08
Rb-89	1.50E-08	1.80E-08	Cs-137	4.20E-09	4.90E-09
Sr-89	5.60E-13	6.50E-13	Cs-138	2.10E-08	2.40E-08
Sr-91	7.10E-09	8.30E-09	Ba-139	2.40E-09	2.70E-09
Sr-92	9.00E-09	1.00E-08	Ba-140	2.10E-09	2.40E-09
Y-90	2.20E-12	2.60E-12	Ba-141	4.30E-09	4.90E-09
Y-91M	3.80E-09	4.40E-09	Ba-142	7.90E-09	9.00E-09
Y-91	2.40E-11	2.70E-11	La-140	1.50E-08	1.70E-08
Y-92	1.60E-09	1.90E-09	La-142	1.50E-08	1.80E-08
Y-93	5.70E-10	7.80E-10	Ce-141	5.50E-10	6.20E-10
Zr-95	5.00E-09	5.80E-09	Ce-143	2.20E-09	2.50E-09
Zr-97	5.50E-09	6.40E-09	Ce-144	3.20E-10	3.70E-10
Nb-95	5.10E-09	6.00E-09	Pr-143	0.0	0.0
Mo-99	1.90E-09	2.20E-09	Pr-144	2.00E-10	2.30E-10
Tc-99M	9.60E-10	1.10E-09	Nd-147	1.00E-09	1.20E-09
Tc-101	2.70E-09	3.00E-09	W-187	3.10E-09	3.60E-09
Ru-103	3.60E-09	4.20E-09	Np-239	9.50E-10	1.10E-09

* Dose Factors for Sb-124 and Sb-125 from ICRP 2, NUREG 1276 – LADTAP II Users Manual.

1) Dose Factors for the other organs (Bone, Liver, Thyroid, Kidney, Lung, GI-LLI) are assumed to be the same as the Total Body Dose Factor (Reference Reg. Guide 1.109, Appendix E, Dose Factor).

TABLE II1-7

Usage Factors (u_{ap})

Pathway	Infant	Child	Teen	Adult
Fish (kg/yr)	-	6.9[a]	16[a]	21[a]
Potable Water (l/yr)	330[a]	510[a]	510[a]	730[a]
Shoreline Recreation (hr/yr)	-	90[b]	600[b]	600[b]

Ref: [a] Regulatory Guide 1.109, Rev 1, Table E-5
[b] EROL Table 5.2.A-3

TABLE II1-8

Assumptions used in Limerick Liquid Effluent Dose Evaluation

Symbol	Description	Value	Reference(1)
t_b	Period of buildup of activity in sediment(hr)	1.752E+05	Site Specific
t_p	Envtl transit time for water ingestion (hr)	1.200E+01	A-2(2)
t_p	Envtl transit time for fish ingestion (hr)	2.400E+01	A-3(2)
t_p	Envtl transit time for shore exposure (hr)	0.000E+00	Site Specific
U_{ap}	Water ingestion (1/yr) adult	7.300E+02	E-5
U_{ap}	Water ingestion (1/yr) teen	5.100E+02	E-5
U_{ap}	Water ingestion (1/yr) child	5.100E+02	E-5
U_{ap}	Water ingestion (1/yr) infant	3.300E+02	E-5
U_{ap}	Shore exposure (hr/yr) adult	6.000E+02	Site Specific
U_{ap}	Shore exposure (hr/yr) teen	6.000E+02	Site Specific
U_{ap}	Shore exposure (hr/yr) child	9.000E+01	Site Specific
U_{ap}	Shore exposure (hr/yr) infant	0.000E+00	Site Specific
U_{ap}	Fresh water fish ingestion (kg/yr) adult	2.100E+01	E-5
U_{ap}	Fresh water fish ingestion (kg/yr) teen	1.600E+01	E-5
U_{ap}	Fresh water fish ingestion (kg/yr) child	6.900E+00	E-5
U_{ap}	Fresh water fish ingestion (kg/yr) infant	0.000E+00	E-5
W	Shoreline Width Factor (dimensionless)	2.000E-01	A-2(3)

1) The References refer to tables contained in Regulatory Guide 1.109 unless otherwise specified.

2) Equation A-2 and A-3 from Reg. Guide 1.109, Appendix A.

3) Table A-2 from Reg. Guide 1.109, Appendix A.

TABLE II2-1

Dose Factors for Noble Gas

From Table B-1 of Reg. Guide 1.109

Radionuclide	Total Body Dose Factor Ki (mrem/yr per pCi/m^3)	Beta Skin Dose Factor Li (mrem/yr per pCi/m^3)	Gamma Air Dose Factor Mi (mrad/yr per pCi/m^3)	Beta Air Dose Factor Ni (mrad/yr per pCi/m^3)
Ar-41	8.84E-03	2.69E-03	9.30E-03	3.28E-03
Kr-83m	7.56E-08	——	1.93E-05	2.88E-04
Kr-85m	1.17E-03	1.46E-03	1.23E-03	1.97E-03
Kr-85	1.61E-05	1.34E-03	1.72E-05	1.95E-03
Kr-87	5.92E-03	9.73E-03	6.17E-03	1.03E-02
Kr-88	1.47E-02	2.37E-03	1.52E-02	2.93E-03
Kr-89	1.66E-02	1.01E-02	1.73E-02	1.06E-02
Kr-90	1.56E-02	7.29E-03	1.63E-02	7.83E-03
Xe-131m	9.15E-05	4.76E-04	1.56E-04	1.11E-03
Xe-133m	2.51E-04	9.94E-04	3.27E-04	1.48E-03
Xe-133	2.94E-04	3.06E-04	3.53E-04	1.05E-03
Xe-135m	3.12E-03	7.11E-04	3.36E-03	7.39E-04
Xe-135	1.81E-03	1.86E-03	1.92E-03	2.46E-03
Xe-137	1.42E-03	1.22E-02	1.51E-03	1.27E-02
Xe-138	8.83E-03	4.13E-03	9.21E-03	4.75E-03

TABLE II2-2

INGESTION INDIVIDUAL DOSE FACTORS (R_i)
For Gaseous Effluents

UNITS FOR DEPOSITION PATHWAYS
(Pathway Numbers 1 to 5) are m^2-mrem/yr per μCi/sec

UNITS FOR AIRBORNE PATHWAY
(Pathway Numbers 6) is mrem/yr per $\mu Ci/m^3$

Pathway No.	Pathway
1	Ground
2	Vegetable
3	Meat
4	Cow Milk
5	Goat Milk
6	Inhalation

TABLE II2-2 R_i DOSE FACTORS Age: Adult Pathway: Ground

	BONE	LIVER	THYROID	KIDNEY	LUNG	GILLI	SKIN	TBODY	MAX VAL
H-3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
C-14	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CR-51	4.652E+06	4.652E+06	4.652E+06	4.652E+06	4.652E+06	4.652E+06	5.498E+06	4.652E+06	5.498E+06
MN-54	1.384E+09	1.384E+09	1.384E+09	1.384E+09	1.384E+09	1.384E+09	1.622E+09	1.384E+09	1.622E+09
FE-59	2.725E+08	2.725E+08	2.725E+08	2.725E+08	2.725E+08	2.725E+08	3.202E+08	2.725E+08	3.202E+08
CO-58	3.799E+08	3.799E+08	3.799E+08	3.799E+08	3.799E+08	3.799E+08	4.450E+08	3.799E+08	4.450E+08
CO-60	2.227E+10	2.227E+10	2.227E+10	2.227E+10	2.227E+10	2.227E+10	2.620E+10	2.227E+10	2.620E+10
ZN-65	7.455E+08	7.455E+08	7.455E+08	7.455E+08	7.455E+08	7.455E+08	8.574E+08	7.455E+08	8.574E+08
SR-89	2.160E+04	2.160E+04	2.160E+04	2.160E+04	2.160E+04	2.160E+04	2.507E+04	2.160E+04	2.507E+04
SR-90	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
ZR-95	2.453E+08	2.453E+08	2.453E+08	2.453E+08	2.453E+08	2.453E+08	2.845E+08	2.453E+08	2.845E+08
I-131	1.720E+07	1.720E+07	1.720E+07	1.720E+07	1.720E+07	1.720E+07	2.089E+07	1.720E+07	2.089E+07
I-133	2.450E+06	2.450E+06	2.450E+06	2.450E+06	2.450E+06	2.450E+06	2.980E+06	2.450E+06	2.980E+06
CS-134	6.917E+09	6.917E+09	6.917E+09	6.917E+09	6.917E+09	6.917E+09	8.070E+09	6.917E+09	8.070E+09
CS-136	1.508E+08	1.508E+08	1.508E+08	1.508E+08	1.508E+08	1.508E+08	1.709E+08	1.508E+08	1.709E+08
CS-137	1.134E+10	1.134E+10	1.134E+10	1.134E+10	1.134E+10	1.134E+10	1.323E+10	1.134E+10	1.323E+10
BA-140	2.054E+07	2.054E+07	2.054E+07	2.054E+07	2.054E+07	2.054E+07	2.347E+07	2.054E+07	2.347E+07
CE-141	1.365E+07	1.365E+07	1.365E+07	1.365E+07	1.365E+07	1.365E+07	1.539E+07	1.365E+07	1.539E+07
CE-144	6.958E+07	6.958E+07	6.958E+07	6.958E+07	6.958E+07	6.958E+07	8.046E+07	6.958E+07	8.046E+07

TABLE II2-2 R_i Dose Factors Age: Adult Pathway: Vegetable

	BONE	LIVER	THYROID	KIDNEY	LUNG	GILLI	SKIN	TBODY	MAX VAL
H-3	0.000E+00	2.077E+03	2.077E+03	2.077E+03	2.077E+03	2.077E+03	0.000E+00	2.077E+03	2.077E+03
C-14	2.092E+08	4.184E+07	4.184E+07	4.184E+07	4.184E+07	4.184E+07	0.000E+00	4.184E+07	2.092E+08
CR-51	0.000E+00	0.000E+00	2.104E+04	7.755E+03	4.671E+04	8.853E+06	0.000E+00	3.520E+04	8.853E+06
MN-54	0.000E+00	2.845E+08	0.000E+00	8.468E+07	0.000E+00	8.717E+08	0.000E+00	5.429E+07	8.717E+08
FE-59	1.049E+08	2.466E+08	0.000E+00	0.000E+00	6.889E+07	8.219E+08	0.000E+00	9.452E+07	8.219E+08
CO-58	0.000E+00	2.679E+07	0.000E+00	0.000E+00	0.000E+00	5.431E+08	0.000E+00	6.006E+07	5.431E+08
CO-60	0.000E+00	1.534E+08	0.000E+00	0.000E+00	0.000E+00	2.881E+09	0.000E+00	3.383E+08	2.881E+09
ZN-65	2.876E+08	9.152E+08	0.000E+00	6.121E+08	0.000E+00	5.765E+08	0.000E+00	4.136E+08	9.152E+08
SR-89	8.413E+09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.349E+09	0.000E+00	2.415E+08	8.413E+09
SR-90	5.555E+11	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.605E+10	0.000E+00	1.363E+11	5.555E+11
ZR-95	1.017E+06	3.261E+05	0.000E+00	5.117E+05	0.000E+00	1.033E+09	0.000E+00	2.207E+05	1.033E+09
I-131	3.564E+07	5.097E+07	1.671E+10	8.738E+07	0.000E+00	1.345E+07	0.000E+00	2.921E+07	1.671E+10
I-133	8.753E+05	1.522E+06	2.238E+08	2.657E+06	0.000E+00	1.368E+06	0.000E+00	4.641E+05	2.238E+08
CS-134	4.273E+09	1.017E+10	0.000E+00	3.291E+09	1.092E+09	1.779E+08	0.000E+00	8.313E+09	1.017E+10
CS-136	2.326E+07	9.184E+07	0.000E+00	5.110E+07	7.004E+06	1.044E+07	0.000E+00	6.611E+07	9.184E+07
CS-137	5.843E+09	7.991E+09	0.000E+00	2.712E+09	9.017E+08	1.547E+08	0.000E+00	5.234E+09	7.991E+09
BA-140	6.906E+07	8.675E+04	0.000E+00	2.950E+04	4.967E+04	1.422E+08	0.000E+00	4.525E+06	1.422E+08
CE-141	1.555E+05	1.052E+05	0.000E+00	4.885E+04	0.000E+00	4.021E+08	0.000E+00	1.193E+04	4.021E+08
CE-144	2.990E+07	1.250E+07	0.000E+00	7.413E+06	0.000E+00	1.011E+10	0.000E+00	1.605E+06	1.011E+10

TABLE II2-2 R_i Dose Factors Age: Adult Pathway: Meat

	BONE	LIVER	THYROID	KIDNEY	LUNG	GILLI	SKIN	TBODY	MAX VAL
H-3	0.000E+00	3.248E+02	3.248E+02	3.248E+02	3.248E+02	3.248E+02	0.000E+00	3.248E+02	3.248E+02
C-14	1.304E+08	2.608E+07	2.608E+07	2.608E+07	2.608E+07	2.608E+07	0.000E+00	2.608E+07	1.304E+08
CR-51	0.000E+00	0.000E+00	1.340E+03	4.938E+02	2.974E+03	5.637E+05	0.000E+00	2.241E+03	5.637E+05
MN-54	0.000E+00	4.546E+06	0.000E+00	1.353E+06	0.000E+00	1.393E+07	0.000E+00	8.674E+05	1.393E+07
FE-59	9.381E+07	2.205E+08	0.000E+00	0.000E+00	6.160E+07	7.349E+08	0.000E+00	8.452E+07	7.349E+08
CO-58	0.000E+00	7.213E+06	0.000E+00	0.000E+00	0.000E+00	1.462E+08	0.000E+00	1.617E+07	1.462E+08
CO-60	0.000E+00	4.002E+07	0.000E+00	0.000E+00	0.000E+00	7.518E+08	0.000E+00	8.827E+07	7.518E+08
ZN-65	1.723E+08	5.481E+08	0.000E+00	3.666E+08	0.000E+00	3.452E+08	0.000E+00	2.477E+08	5.481E+08
SR-89	1.098E+08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.761E+07	0.000E+00	3.151E+06	1.098E+08
SR-90	6.701E+09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.936E+08	0.000E+00	1.644E+09	6.701E+09
ZR-95	7.238E+05	2.321E+05	0.000E+00	3.643E+05	0.000E+00	7.357E+08	0.000E+00	1.571E+05	7.357E+08
I-131	3.141E+06	4.492E+06	1.472E+09	7.701E+06	0.000E+00	1.185E+06	0.000E+00	2.575E+06	1.472E+09
I-133	1.062E-01	1.847E-01	2.715E+01	3.223E-01	0.000E+00	1.660E-01	0.000E+00	5.631E-02	2.715E+01
CS-134	3.424E+08	8.147E+08	0.000E+00	2.637E+08	8.752E+07	1.426E+07	0.000E+00	6.660E+08	8.147E+08
CS-136	3.548E+06	1.401E+07	0.000E+00	7.793E+06	1.068E+06	1.591E+06	0.000E+00	1.008E+07	1.401E+07
CS-137	4.698E+08	6.425E+08	0.000E+00	2.181E+08	7.251E+07	1.244E+07	0.000E+00	4.209E+08	6.425E+08
BA-140	8.464E+06	1.063E+04	0.000E+00	3.615E+03	6.088E+03	1.743E+07	0.000E+00	5.546E+05	1.743E+07
CE-141	4.615E+03	3.121E+03	0.000E+00	1.450E+03	0.000E+00	1.193E+07	0.000E+00	3.541E+02	1.193E+07
CE-144	7.163E+05	2.994E+05	0.000E+00	1.776E+05	0.000E+00	2.422E+08	0.000E+00	3.846E+04	2.422E+08

TABLE II2-2 R_i Dose Factors Age: Adult Pathway: Cow Milk

	BONE	LIVER	THYROID	KIDNEY	LUNG	GILLI	SKIN	TBODY	MAX VAL
H-3	0.000E+00	7.629E+02	7.629E+02	7.629E+02	7.629E+02	7.629E+02	0.000E+00	7.629E+02	7.629E+02
C-14	1.423E+08	2.845E+07	2.845E+07	2.845E+07	2.845E+07	2.845E+07	0.000E+00	2.845E+07	1.423E+08
CR-51	0.000E+00	0.000E+00	5.436E+03	2.004E+03	1.207E+04	2.287E+06	0.000E+00	9.095E+03	2.287E+06
MN-54	0.000E+00	4.167E+06	0.000E+00	1.240E+06	0.000E+00	1.276E+07	0.000E+00	7.951E+05	1.276E+07
FE-59	1.050E+07	2.467E+07	0.000E+00	0.000E+00	6.893E+06	8.223E+07	0.000E+00	9.457E+06	8.223E+07
CO-58	0.000E+00	1.864E+06	0.000E+00	0.000E+00	0.000E+00	3.779E+07	0.000E+00	4.179E+06	3.779E+07
CO-60	0.000E+00	8.733E+06	0.000E+00	0.000E+00	0.000E+00	1.640E+08	0.000E+00	1.926E+07	1.640E+08
ZN-65	6.642E+08	2.114E+09	0.000E+00	1.414E+09	0.000E+00	1.331E+09	0.000E+00	9.552E+08	2.114E+09
SR-89	5.284E+08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	8.476E+07	0.000E+00	1.517E+07	5.284E+08
SR-90	2.521E+10	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.283E+08	0.000E+00	6.186E+09	2.521E+10
ZR-95	3.644E+02	1.169E+02	0.000E+00	1.834E+02	0.000E+00	3.704E+05	0.000E+00	7.912E+01	3.704E+05
I-131	8.662E+07	1.239E+08	4.060E+10	2.124E+08	0.000E+00	3.269E+07	0.000E+00	7.100E+07	4.060E+10
I-133	1.131E+06	1.967E+06	2.891E+08	3.432E+06	0.000E+00	1.768E+06	0.000E+00	5.996E+05	2.891E+08
CS-134	2.943E+09	7.002E+09	0.000E+00	2.266E+09	7.523E+08	1.225E+08	0.000E+00	5.725E+09	7.002E+09
CS-136	7.754E+07	3.061E+08	0.000E+00	1.703E+08	2.334E+07	3.478E+07	0.000E+00	2.203E+08	3.061E+08
CS-137	3.977E+09	5.438E+09	0.000E+00	1.846E+09	6.137E+08	1.053E+08	0.000E+00	3.562E+09	5.438E+09
BA-140	7.915E+06	9.942E+03	0.000E+00	3.380E+03	5.692E+03	1.630E+07	0.000E+00	5.186E+05	1.630E+07
CE-141	1.592E+03	1.077E+03	0.000E+00	5.001E+02	0.000E+00	4.117E+06	0.000E+00	1.221E+02	4.117E+06
CE-144	1.758E+05	7.348E+04	0.000E+00	4.358E+04	0.000E+00	5.943E+07	0.000E+00	9.437E+03	5.943E+07

TABLE II2-2 R_i Dose Factors Age: Adult Pathway: Goat Milk

	BONE	LIVER	THYROID	KIDNEY	LUNG	GILLI	SKIN	TBODY	MAX VAL
H-3	0.000E+00	1.155E+02	1.155E+02	1.155E+02	1.155E+02	1.155E+02	0.000E+00	1.155E+02	1.155E+02
C-14	1.056E+07	2.111E+06	2.111E+06	2.111E+06	2.111E+06	2.111E+06	0.000E+00	2.111E+06	1.056E+07
CR-51	0.000E+00	0.000E+00	4.840E+01	1.784E+01	1.075E+02	2.037E+04	0.000E+00	8.097E+01	2.037E+04
MN-54	0.000E+00	3.710E+04	0.000E+00	1.104E+04	0.000E+00	1.136E+05	0.000E+00	7.079E+03	1.136E+05
FE-59	1.012E+04	2.379E+04	0.000E+00	0.000E+00	6.648E+03	7.931E+04	0.000E+00	9.121E+03	7.931E+04
CO-58	0.000E+00	1.660E+04	0.000E+00	0.000E+00	0.000E+00	3.364E+05	0.000E+00	3.721E+04	3.364E+05
CO-60	0.000E+00	7.775E+04	0.000E+00	0.000E+00	0.000E+00	1.461E+06	0.000E+00	1.715E+05	1.461E+06
ZN-65	5.914E+06	1.882E+07	0.000E+00	1.259E+07	0.000E+00	1.185E+07	0.000E+00	8.504E+06	1.882E+07
SR-89	8.233E+07	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.321E+07	0.000E+00	2.363E+06	8.233E+07
SR-90	3.928E+09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.135E+08	0.000E+00	9.638E+08	3.928E+09
ZR-95	3.245E+00	1.041E+00	0.000E+00	1.633E+00	0.000E+00	3.298E+03	0.000E+00	7.044E-01	3.298E+03
I-131	7.712E+06	1.103E+07	3.615E+09	1.891E+07	0.000E+00	2.910E+06	0.000E+00	6.321E+06	3.615E+09
I-133	1.007E+05	1.751E+05	2.574E+07	3.056E+05	0.000E+00	1.574E+05	0.000E+00	5.339E+04	2.574E+07
CS-134	6.550E+08	1.559E+09	0.000E+00	5.044E+08	1.674E+08	2.727E+07	0.000E+00	1.274E+09	1.559E+09
CS-136	1.726E+07	6.813E+07	0.000E+00	3.791E+07	5.196E+06	7.741E+06	0.000E+00	4.905E+07	6.813E+07
CS-137	8.851E+08	1.211E+09	0.000E+00	4.109E+08	1.366E+08	2.343E+07	0.000E+00	7.929E+08	1.211E+09
BA-140	7.047E+04	8.852E+01	0.000E+00	3.010E+01	5.068E+01	1.451E+05	0.000E+00	4.617E+03	1.451E+05
CE-141	1.418E+01	9.587E+00	0.000E+00	4.453E+00	0.000E+00	3.665E+04	0.000E+00	1.087E+00	3.665E+04
CE-144	1.565E+03	6.542E+02	0.000E+00	3.880E+02	0.000E+00	5.291E+05	0.000E+00	8.402E+01	5.291E+05

TABLE II2-2 R_i Dose Factors Age: Adult Pathway: Inhalation

	BONE	LIVER	THYROID	KIDNEY	LUNG	GILLI	SKIN	TBODY	MAX VAL
H-3	0.000E+00	1.264E+03	1.264E+03	1.264E+03	1.264E+03	1.264E+03	0.000E+00	1.264E+03	1.264E+03
C-14	1.816E+04	3.408E+03	3.408E+03	3.408E+03	3.408E+03	3.408E+03	0.000E+00	3.408E+03	1.816E+04
CR-51	0.000E+00	0.000E+00	5.952E+01	2.280E+01	1.440E+04	3.320E+03	0.000E+00	1.000E+02	1.440E+04
MN-54	0.000E+00	3.960E+04	0.000E+00	9.840E+03	1.400E+06	7.736E+04	0.000E+00	6.296E+03	1.400E+06
FE-59	1.176E+04	2.776E+04	0.000E+00	0.000E+00	1.016E+06	1.880E+05	0.000E+00	1.056E+04	1.016E+06
CO-58	0.000E+00	1.584E+03	0.000E+00	0.000E+00	9.280E+05	1.064E+05	0.000E+00	2.072E+03	9.280E+05
CO-60	0.000E+00	1.152E+04	0.000E+00	0.000E+00	5.968E+06	2.848E+05	0.000E+00	1.480E+04	5.968E+06
ZN-65	3.240E+04	1.032E+05	0.000E+00	6.896E+04	8.640E+05	5.344E+04	0.000E+00	4.656E+04	8.640E+05
SR-89	3.040E+05	0.000E+00	0.000E+00	0.000E+00	1.400E+06	3.496E+05	0.000E+00	8.720E+03	1.400E+06
SR-90	9.920E+07	0.000E+00	0.000E+00	0.000E+00	9.600E+06	7.216E+05	0.000E+00	6.096E+06	9.920E+07
ZR-95	1.072E+05	3.440E+04	0.000E+00	5.416E+04	1.768E+06	1.504E+05	0.000E+00	2.328E+04	1.768E+06
I-131	2.520E+04	3.576E+04	1.192E+07	6.128E+04	0.000E+00	6.280E+03	0.000E+00	2.048E+04	1.192E+07
I-133	8.640E+03	1.480E+04	2.152E+06	2.584E+04	0.000E+00	8.880E+03	0.000E+00	4.520E+03	2.152E+06
CS-134	3.728E+05	8.480E+05	0.000E+00	2.872E+05	9.760E+04	1.040E+04	0.000E+00	7.280E+05	8.480E+05
CS-136	3.904E+04	1.464E+05	0.000E+00	8.560E+04	1.200E+04	1.168E+04	0.000E+00	1.104E+05	1.464E+05
CS-137	4.784E+05	6.208E+05	0.000E+00	2.224E+05	7.520E+04	8.400E+03	0.000E+00	4.280E+05	6.208E+05
BA-140	3.904E+04	4.904E+01	0.000E+00	1.672E+01	1.272E+06	2.184E+05	0.000E+00	2.568E+03	1.272E+06
CE-141	1.992E+04	1.352E+04	0.000E+00	6.264E+03	3.616E+05	1.200E+05	0.000E+00	1.528E+03	3.616E+05
CE-144	3.432E+06	1.432E+06	0.000E+00	8.480E+05	7.776E+06	8.160E+05	0.000E+00	1.840E+05	7.776E+06

TABLE II2-2 R_i Dose Factors Age: Teen Pathway: Ground

	BONE	LIVER	THYROID	KIDNEY	LUNG	GILLI	SKIN	TBODY	MAX VAL
H-3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
C-14	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CR-51	4.652E+06	4.652E+06	4.652E+06	4.652E+06	4.652E+06	4.652E+06	5.498E+06	4.652E+06	5.498E+06
MN-54	1.384E+09	1.384E+09	1.384E+09	1.384E+09	1.384E+09	1.384E+09	1.622E+09	1.384E+09	1.622E+09
FE-59	2.725E+08	2.725E+08	2.725E+08	2.725E+08	2.725E+08	2.725E+08	3.202E+08	2.725E+08	3.202E+08
CO-58	3.799E+08	3.799E+08	3.799E+08	3.799E+08	3.799E+08	3.799E+08	4.450E+08	3.799E+08	4.450E+08
CO-60	2.227E+10	2.227E+10	2.227E+10	2.227E+10	2.227E+10	2.227E+10	2.620E+10	2.227E+10	2.620E+10
ZN-65	7.455E+08	7.455E+08	7.455E+08	7.455E+08	7.455E+08	7.455E+08	8.574E+08	7.455E+08	8.574E+08
SR-89	2.160E+04	2.160E+04	2.160E+04	2.160E+04	2.160E+04	2.160E+04	2.507E+04	2.160E+04	2.507E+04
SR-90	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
ZR-95	2.453E+08	2.453E+08	2.453E+08	2.453E+08	2.453E+08	2.453E+08	2.845E+08	2.453E+08	2.845E+08
I-131	1.720E+07	1.720E+07	1.720E+07	1.720E+07	1.720E+07	1.720E+07	2.089E+07	1.720E+07	2.089E+07
I-133	2.450E+06	2.450E+06	2.450E+06	2.450E+06	2.450E+06	2.450E+06	2.980E+06	2.450E+06	2.980E+06
CS-134	6.917E+09	6.917E+09	6.917E+09	6.917E+09	6.917E+09	6.917E+09	8.070E+09	6.917E+09	8.070E+09
CS-136	1.508E+08	1.508E+08	1.508E+08	1.508E+08	1.508E+08	1.508E+08	1.709E+08	1.508E+08	1.709E+08
CS-137	1.134E+10	1.134E+10	1.134E+10	1.134E+10	1.134E+10	1.134E+10	1.323E+10	1.134E+10	1.323E+10
BA-140	2.054E+07	2.054E+07	2.054E+07	2.054E+07	2.054E+07	2.054E+07	2.347E+07	2.054E+07	2.347E+07
CE-141	1.365E+07	1.365E+07	1.365E+07	1.365E+07	1.365E+07	1.365E+07	1.539E+07	1.365E+07	1.539E+07
CE-144	6.958E+07	6.958E+07	6.958E+07	6.958E+07	6.958E+07	6.958E+07	8.046E+07	6.958E+07	8.046E+07

TABLE II2-2 R_i Dose Factors Age: Teen Pathway: Vegetable

	BONE	LIVER	THYROID	KIDNEY	LUNG	GILLI	SKIN	TBODY	MAX VAL
H-3	0.000E+00	2.467E+03	2.467E+03	2.467E+03	2.467E+03	2.467E+03	0.000E+00	2.467E+03	2.467E+03
C-14	3.517E+08	7.035E+07	7.035E+07	7.035E+07	7.035E+07	7.035E+07	0.000E+00	7.035E+07	3.517E+08
CR-51	0.000E+00	0.000E+00	2.869E+04	1.132E+04	7.374E+04	8.679E+06	0.000E+00	5.165E+04	8.679E+06
MN-54	0.000E+00	4.304E+08	0.000E+00	1.284E+08	0.000E+00	8.826E+08	0.000E+00	8.535E+07	8.826E+08
FE-59	1.605E+08	3.745E+08	0.000E+00	0.000E+00	1.181E+08	8.856E+08	0.000E+00	1.446E+08	8.856E+08
CO-58	0.000E+00	4.026E+07	0.000E+00	0.000E+00	0.000E+00	5.550E+08	0.000E+00	9.277E+07	5.550E+08
CO-60	0.000E+00	2.367E+08	0.000E+00	0.000E+00	0.000E+00	3.083E+09	0.000E+00	5.332E+08	3.083E+09
ZN-65	4.006E+08	1.391E+09	0.000E+00	8.902E+08	0.000E+00	5.890E+08	0.000E+00	6.488E+08	1.391E+09
SR-89	1.368E+10	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.629E+09	0.000E+00	3.916E+08	1.368E+10
SR-90	7.154E+11	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.008E+10	0.000E+00	1.767E+11	7.154E+11
ZR-95	1.582E+06	4.992E+05	0.000E+00	7.334E+05	0.000E+00	1.152E+09	0.000E+00	3.433E+05	1.152E+09
I-131	3.521E+07	4.930E+07	1.439E+10	8.487E+07	0.000E+00	9.751E+06	0.000E+00	2.648E+07	1.439E+10
I-133	8.131E+05	1.379E+06	1.925E+08	2.419E+06	0.000E+00	1.044E+06	0.000E+00	4.207E+05	1.925E+08
CS-134	6.753E+09	1.589E+10	0.000E+00	5.051E+09	1.928E+09	1.977E+08	0.000E+00	7.374E+09	1.589E+10
CS-136	2.691E+07	1.059E+08	0.000E+00	5.764E+07	9.084E+06	8.520E+06	0.000E+00	7.110E+07	1.059E+08
CS-137	9.656E+09	1.285E+10	0.000E+00	4.371E+09	1.698E+09	1.828E+08	0.000E+00	4.475E+09	1.285E+10
BA-140	8.359E+07	1.024E+05	0.000E+00	3.473E+04	6.887E+04	1.289E+08	0.000E+00	5.386E+06	1.289E+08
CE-141	2.440E+05	1.629E+05	0.000E+00	7.670E+04	0.000E+00	4.661E+08	0.000E+00	1.872E+04	4.661E+08
CE-144	4.993E+07	2.066E+07	0.000E+00	1.234E+07	0.000E+00	1.256E+10	0.000E+00	2.683E+06	1.256E+10

TABLE II2-2 R_i Dose Factors Age: Teen Pathway: Meat

	BONE	LIVER	THYROID	KIDNEY	LUNG	GILLI	SKIN	TBODY	MAX VAL
H-3	0.000E+00	1.938E+02	1.938E+02	1.938E+02	1.938E+02	1.938E+02	0.000E+00	1.938E+02	1.938E+02
C-14	1.102E+08	2.203E+07	2.203E+07	2.203E+07	2.203E+07	2.203E+07	0.000E+00	2.203E+07	1.102E+08
CR-51	0.000E+00	0.000E+00	9.958E+02	3.929E+02	2.559E+03	3.012E+05	0.000E+00	1.792E+03	3.012E+05
MN-54	0.000E+00	3.468E+06	0.000E+00	1.034E+06	0.000E+00	7.112E+06	0.000E+00	6.877E+05	7.112E+06
FE-59	7.498E+07	1.750E+08	0.000E+00	0.000E+00	5.518E+07	4.138E+08	0.000E+00	6.757E+07	4.138E+08
CO-58	0.000E+00	5.561E+06	0.000E+00	0.000E+00	0.000E+00	7.666E+07	0.000E+00	1.281E+07	7.666E+07
CO-60	0.000E+00	3.105E+07	0.000E+00	0.000E+00	0.000E+00	4.045E+08	0.000E+00	6.995E+07	4.045E+08
ZN-65	1.211E+08	4.206E+08	0.000E+00	2.692E+08	0.000E+00	1.781E+08	0.000E+00	1.962E+08	4.206E+08
SR-89	9.268E+07	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.104E+07	0.000E+00	2.654E+06	9.268E+07
SR-90	4.335E+09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.217E+08	0.000E+00	1.071E+09	4.335E+09
ZR-95	5.796E+05	1.829E+05	0.000E+00	2.687E+05	0.000E+00	4.221E+08	0.000E+00	1.258E+05	4.221E+08
I-131	2.610E+06	3.654E+06	1.066E+09	6.290E+06	0.000E+00	7.227E+05	0.000E+00	1.963E+06	1.066E+09
I-133	8.882E-02	1.507E-01	2.103E+01	2.642E-01	0.000E+00	1.140E-01	0.000E+00	4.596E-02	2.103E+01
CS-134	2.722E+08	6.408E+08	0.000E+00	2.036E+08	7.774E+07	7.969E+06	0.000E+00	2.973E+08	6.408E+08
CS-136	2.766E+06	1.088E+07	0.000E+00	5.925E+06	9.339E+05	8.759E+05	0.000E+00	7.310E+06	1.088E+07
CS-137	3.901E+08	5.190E+08	0.000E+00	1.766E+08	6.862E+07	7.385E+06	0.000E+00	1.808E+08	5.190E+08
BA-140	6.997E+06	8.574E+03	0.000E+00	2.907E+03	5.765E+03	1.079E+07	0.000E+00	4.509E+05	1.079E+07
CE-141	3.875E+03	2.587E+03	0.000E+00	1.218E+03	0.000E+00	7.401E+06	0.000E+00	2.972E+02	7.401E+06
CE-144	6.036E+05	2.498E+05	0.000E+00	1.492E+05	0.000E+00	1.518E+08	0.000E+00	3.244E+04	1.518E+08

TABLE II2-2 R_i Dose Factors Age: Teen Pathway: Cow Milk

	BONE	LIVER	THYROID	KIDNEY	LUNG	GILLI	SKIN	TBODY	MAX VAL
H-3	0.000E+00	9.938E+02	9.938E+02	9.938E+02	9.938E+02	9.938E+02	0.000E+00	9.938E+02	9.938E+02
C-14	2.624E+08	5.248E+07	5.248E+07	5.248E+07	5.248E+07	5.248E+07	0.000E+00	5.248E+07	2.624E+08
CR-51	0.000E+00	0.000E+00	8.823E+03	3.481E+03	2.268E+04	2.669E+06	0.000E+00	1.588E+04	2.669E+06
MN-54	0.000E+00	6.941E+06	0.000E+00	2.071E+06	0.000E+00	1.424E+07	0.000E+00	1.376E+06	1.424E+07
FE-59	1.832E+07	4.275E+07	0.000E+00	0.000E+00	1.348E+07	1.011E+08	0.000E+00	1.651E+07	1.011E+08
CO-58	0.000E+00	3.139E+06	0.000E+00	0.000E+00	0.000E+00	4.327E+07	0.000E+00	7.233E+06	4.327E+07
CO-60	0.000E+00	1.480E+07	0.000E+00	0.000E+00	0.000E+00	1.927E+08	0.000E+00	3.333E+07	1.927E+08
ZN-65	1.020E+09	3.542E+09	0.000E+00	2.267E+09	0.000E+00	1.500E+09	0.000E+00	1.652E+09	3.542E+09
SR-89	9.741E+08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.160E+08	0.000E+00	2.789E+07	9.741E+08
SR-90	3.562E+10	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.998E+08	0.000E+00	8.797E+09	3.562E+10
ZR-95	6.373E+02	2.011E+02	0.000E+00	2.954E+02	0.000E+00	4.640E+05	0.000E+00	1.383E+02	4.640E+05
I-131	1.572E+08	2.200E+08	6.421E+10	3.788E+08	0.000E+00	4.352E+07	0.000E+00	1.182E+08	6.421E+10
I-133	2.065E+06	3.504E+06	4.891E+08	6.145E+06	0.000E+00	2.651E+06	0.000E+00	1.069E+06	4.891E+08
CS-134	5.110E+09	1.203E+10	0.000E+00	3.822E+09	1.459E+09	1.496E+08	0.000E+00	5.580E+09	1.203E+10
CS-136	1.320E+08	5.195E+08	0.000E+00	2.828E+08	4.457E+07	4.180E+07	0.000E+00	3.489E+08	5.195E+08
CS-137	7.211E+09	9.593E+09	0.000E+00	3.264E+09	1.268E+09	1.365E+08	0.000E+00	3.341E+09	9.593E+09
BA-140	1.429E+07	1.751E+04	0.000E+00	5.936E+03	1.177E+04	2.204E+07	0.000E+00	9.207E+05	2.204E+07
CE-141	2.919E+03	1.949E+03	0.000E+00	9.175E+02	0.000E+00	5.575E+06	0.000E+00	2.239E+02	5.575E+06
CE-144	3.235E+05	1.338E+05	0.000E+00	7.994E+04	0.000E+00	8.133E+07	0.000E+00	1.738E+04	8.133E+07

TABLE II2-2 R_i Dose Factors Age: Teen Pathway: Goat Milk

	BONE	LIVER	THYROID	KIDNEY	LUNG	GILLI	SKIN	TBODY	MAX VAL
H-3	0.000E+00	1.470E+02	1.470E+02	1.470E+02	1.470E+02	1.470E+02	0.000E+00	1.470E+02	1.470E+02
C-14	1.903E+07	3.805E+06	3.805E+06	3.805E+06	3.805E+06	3.805E+06	0.000E+00	3.805E+06	1.903E+07
CR-51	0.000E+00	0.000E+00	7.676E+01	3.028E+01	1.973E+02	2.322E+04	0.000E+00	1.382E+02	2.322E+04
MN-54	0.000E+00	6.039E+04	0.000E+00	1.801E+04	0.000E+00	1.238E+05	0.000E+00	1.198E+04	1.238E+05
FE-59	1.727E+04	4.030E+04	0.000E+00	0.000E+00	1.271E+04	9.530E+04	0.000E+00	1.556E+04	9.530E+04
CO-58	0.000E+00	2.731E+04	0.000E+00	0.000E+00	0.000E+00	3.764E+05	0.000E+00	6.293E+04	3.764E+05
CO-60	0.000E+00	1.287E+05	0.000E+00	0.000E+00	0.000E+00	1.677E+06	0.000E+00	2.900E+05	1.677E+06
ZN-65	8.874E+06	3.081E+07	0.000E+00	1.972E+07	0.000E+00	1.305E+07	0.000E+00	1.437E+07	3.081E+07
SR-89	1.483E+08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.766E+07	0.000E+00	4.247E+06	1.483E+08
SR-90	5.423E+09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.522E+08	0.000E+00	1.339E+09	5.423E+09
ZR-95	5.544E+00	1.749E+00	0.000E+00	2.570E+00	0.000E+00	4.037E+03	0.000E+00	1.203E+00	4.037E+03
I-131	1.367E+07	1.914E+07	5.586E+09	3.296E+07	0.000E+00	3.787E+06	0.000E+00	1.028E+07	5.586E+09
I-133	1.797E+05	3.048E+05	4.255E+07	5.346E+05	0.000E+00	2.306E+05	0.000E+00	9.297E+04	4.255E+07
CS-134	1.111E+09	2.616E+09	0.000E+00	8.312E+08	3.173E+08	3.253E+07	0.000E+00	1.214E+09	2.616E+09
CS-136	2.871E+07	1.130E+08	0.000E+00	6.151E+07	9.694E+06	9.092E+06	0.000E+00	7.588E+07	1.130E+08
CS-137	1.568E+09	2.086E+09	0.000E+00	7.099E+08	2.759E+08	2.969E+07	0.000E+00	7.267E+08	2.086E+09
BA-140	1.243E+05	1.523E+02	0.000E+00	5.165E+01	1.024E+02	1.917E+05	0.000E+00	8.010E+03	1.917E+05
CE-141	2.540E+01	1.696E+01	0.000E+00	7.983E+00	0.000E+00	4.851E+04	0.000E+00	1.948E+00	4.851E+04
CE-144	2.814E+03	1.164E+03	0.000E+00	6.954E+02	0.000E+00	7.076E+05	0.000E+00	1.512E+02	7.076E+05

TABLE II2-2 R_i Dose Factors Age: Teen Pathway: Inhalation

	BONE	LIVER	THYROID	KIDNEY	LUNG	GILLI	SKIN	TBODY	MAX VAL
H-3	0.000E+00	1.272E+03	1.272E+03	1.272E+03	1.272E+03	1.272E+03	0.000E+00	1.272E+03	1.272E+03
C-14	2.600E+04	4.872E+03	4.872E+03	4.872E+03	4.872E+03	4.872E+03	0.000E+00	4.872E+03	2.600E+04
CR-51	0.000E+00	0.000E+00	7.496E+01	3.072E+01	2.096E+04	3.000E+03	0.000E+00	1.352E+02	2.096E+04
MN-54	0.000E+00	5.112E+04	0.000E+00	1.272E+04	1.984E+06	6.680E+04	0.000E+00	8.400E+03	1.984E+06
FE-59	1.592E+04	3.696E+04	0.000E+00	0.000E+00	1.528E+06	1.784E+05	0.000E+00	1.432E+04	1.528E+06
CO-58	0.000E+00	2.072E+03	0.000E+00	0.000E+00	1.344E+06	9.520E+04	0.000E+00	2.776E+03	1.344E+06
CO-60	0.000E+00	1.512E+04	0.000E+00	0.000E+00	8.720E+06	2.592E+05	0.000E+00	1.984E+04	8.720E+06
ZN-65	3.856E+04	1.336E+05	0.000E+00	8.640E+04	1.240E+06	4.664E+04	0.000E+00	6.240E+04	1.240E+06
SR-89	4.344E+05	0.000E+00	0.000E+00	0.000E+00	2.416E+06	3.712E+05	0.000E+00	1.248E+04	2.416E+06
SR-90	1.080E+08	0.000E+00	0.000E+00	0.000E+00	1.648E+07	7.648E+05	0.000E+00	6.680E+06	1.080E+08
ZR-95	1.456E+05	4.584E+04	0.000E+00	6.736E+04	2.688E+06	1.488E+05	0.000E+00	3.152E+04	2.688E+06
I-131	3.544E+04	4.912E+04	1.464E+07	8.400E+04	0.000E+00	6.488E+03	0.000E+00	2.640E+04	1.464E+07
I-133	1.216E+04	2.048E+04	2.920E+06	3.592E+04	0.000E+00	1.032E+04	0.000E+00	6.224E+03	2.920E+06
CS-134	5.024E+05	1.128E+06	0.000E+00	3.752E+05	1.464E+05	9.760E+03	0.000E+00	5.488E+05	1.128E+06
CS-136	5.152E+04	1.936E+05	0.000E+00	1.104E+05	1.776E+04	1.088E+04	0.000E+00	1.368E+05	1.936E+05
CS-137	6.704E+05	8.480E+05	0.000E+00	3.040E+05	1.208E+05	8.480E+03	0.000E+00	3.112E+05	8.480E+05
BA-140	5.472E+04	6.704E+01	0.000E+00	2.280E+01	2.032E+06	2.288E+05	0.000E+00	3.520E+03	2.032E+06
CE-141	2.840E+04	1.896E+04	0.000E+00	8.880E+03	6.136E+05	1.264E+05	0.000E+00	2.168E+03	6.136E+05
CE-144	4.888E+06	2.024E+06	0.000E+00	1.208E+06	1.336E+07	8.640E+05	0.000E+00	2.624E+05	1.336E+07

TABLE II2-2 R_i Dose Factors Age: Child Pathway: Ground

	BONE	LIVER	THYROID	KIDNEY	LUNG	GILLI	SKIN	TBODY	MAX VAL
H-3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
C-14	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CR-51	4.652E+06	4.652E+06	4.652E+06	4.652E+06	4.652E+06	4.652E+06	5.498E+06	4.652E+06	5.498E+06
MN-54	1.384E+09	1.384E+09	1.384E+09	1.384E+09	1.384E+09	1.384E+09	1.622E+09	1.384E+09	1.622E+09
FE-59	2.725E+08	2.725E+08	2.725E+08	2.725E+08	2.725E+08	2.725E+08	3.202E+08	2.725E+08	3.202E+08
CO-58	3.799E+08	3.799E+08	3.799E+08	3.799E+08	3.799E+08	3.799E+08	4.450E+08	3.799E+08	4.450E+08
CO-60	2.227E+10	2.227E+10	2.227E+10	2.227E+10	2.227E+10	2.227E+10	2.620E+10	2.227E+10	2.620E+10
ZN-65	7.455E+08	7.455E+08	7.455E+08	7.455E+08	7.455E+08	7.455E+08	8.574E+08	7.455E+08	8.574E+08
SR-89	2.160E+04	2.160E+04	2.160E+04	2.160E+04	2.160E+04	2.160E+04	2.507E+04	2.160E+04	2.507E+04
SR-90	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
ZR-95	2.453E+08	2.453E+08	2.453E+08	2.453E+08	2.453E+08	2.453E+08	2.845E+08	2.453E+08	2.845E+08
I-131	1.720E+07	1.720E+07	1.720E+07	1.720E+07	1.720E+07	1.720E+07	2.089E+07	1.720E+07	2.089E+07
I-133	2.450E+06	2.450E+06	2.450E+06	2.450E+06	2.450E+06	2.450E+06	2.980E+06	2.450E+06	2.980E+06
CS-134	6.917E+09	6.917E+09	6.917E+09	6.917E+09	6.917E+09	6.917E+09	8.070E+09	6.917E+09	8.070E+09
CS-136	1.508E+08	1.508E+08	1.508E+08	1.508E+08	1.508E+08	1.508E+08	1.709E+08	1.508E+08	1.709E+08
CS-137	1.134E+10	1.134E+10	1.134E+10	1.134E+10	1.134E+10	1.134E+10	1.323E+10	1.134E+10	1.323E+10
BA-140	2.054E+07	2.054E+07	2.054E+07	2.054E+07	2.054E+07	2.054E+07	2.347E+07	2.054E+07	2.347E+07
CE-141	1.365E+07	1.365E+07	1.365E+07	1.365E+07	1.365E+07	1.365E+07	1.539E+07	1.365E+07	1.539E+07
CE-144	6.958E+07	6.958E+07	6.958E+07	6.958E+07	6.958E+07	6.958E+07	8.046E+07	6.958E+07	8.046E+07

TABLE II2-2 R_I Dose Factors Age: Child Pathway: Vegetable

	BONE	LIVER	THYROID	KIDNEY	LUNG	GILLI	SKIN	TBODY	MAX VAL
H-3	0.000E+00	3.864E+03	3.864E+03	3.864E+03	3.864E+03	3.864E+03	0.000E+00	3.864E+03	3.864E+03
C-14	8.576E+08	1.715E+08	1.715E+08	1.715E+08	1.715E+08	1.715E+08	0.000E+00	1.715E+08	8.576E+08
CR-51	0.000E+00	0.000E+00	5.646E+04	1.543E+04	1.031E+05	5.395E+06	0.000E+00	1.017E+05	5.395E+06
MN-54	0.000E+00	6.377E+08	0.000E+00	1.788E+08	0.000E+00	5.352E+08	0.000E+00	1.699E+08	6.377E+08
FE-59	3.644E+08	5.897E+08	0.000E+00	0.000E+00	1.709E+08	6.140E+08	0.000E+00	2.937E+08	6.140E+08
CO-58	0.000E+00	6.059E+07	0.000E+00	0.000E+00	0.000E+00	3.534E+08	0.000E+00	1.855E+08	3.534E+08
CO-60	0.000E+00	3.645E+08	0.000E+00	0.000E+00	0.000E+00	2.019E+09	0.000E+00	1.075E+09	2.019E+09
ZN-65	7.782E+08	2.073E+09	0.000E+00	1.306E+09	0.000E+00	3.641E+08	0.000E+00	1.289E+09	2.073E+09
SR-89	3.322E+10	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.286E+09	0.000E+00	9.487E+08	3.322E+10
SR-90	1.199E+12	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.615E+10	0.000E+00	3.039E+11	1.199E+12
ZR-95	3.617E+06	7.951E+05	0.000E+00	1.138E+06	0.000E+00	8.294E+08	0.000E+00	7.078E+05	8.294E+08
I-131	6.716E+07	6.755E+07	2.234E+10	1.109E+08	0.000E+00	6.014E+06	0.000E+00	3.839E+07	2.234E+10
I-133	1.482E+06	1.833E+06	3.406E+08	3.055E+06	0.000E+00	7.387E+05	0.000E+00	6.936E+05	3.406E+08
CS-134	1.544E+10	2.533E+10	0.000E+00	7.850E+09	2.817E+09	1.366E+08	0.000E+00	5.343E+09	2.533E+10
CS-136	5.390E+07	1.482E+08	0.000E+00	7.890E+07	1.177E+07	5.206E+06	0.000E+00	9.587E+07	1.482E+08
CS-137	2.306E+10	2.207E+10	0.000E+00	7.194E+09	2.588E+09	1.382E+08	0.000E+00	3.258E+09	2.306E+10
BA-140	1.780E+08	1.559E+05	0.000E+00	5.076E+04	9.296E+04	9.018E+07	0.000E+00	1.039E+07	1.780E+08
CE-141	5.840E+05	2.913E+05	0.000E+00	1.277E+05	0.000E+00	3.634E+08	0.000E+00	4.325E+04	3.634E+08
CE-144	1.219E+08	3.822E+07	0.000E+00	2.116E+07	0.000E+00	9.964E+09	0.000E+00	6.506E+06	9.964E+09

TABLE II2-2 R_I Dose Factors Age: Child Pathway: Meat

	BONE	LIVER	THYROID	KIDNEY	LUNG	GILLI	SKIN	TBODY	MAX VAL
H-3	0.000E+00	2.341E+02	2.341E+02	2.341E+02	2.341E+02	2.341E+02	0.000E+00	2.341E+02	2.341E+02
C-14	2.071E+08	4.142E+07	4.142E+07	4.142E+07	4.142E+07	4.142E+07	0.000E+00	4.142E+07	2.071E+08
CR-51	0.000E+00	0.000E+00	1.552E+03	4.240E+02	2.833E+03	1.482E+05	0.000E+00	2.795E+03	1.482E+05
MN-54	0.000E+00	3.967E+06	0.000E+00	1.112E+06	0.000E+00	3.329E+06	0.000E+00	1.057E+06	3.967E+06
FE-59	1.329E+08	2.151E+08	0.000E+00	0.000E+00	6.236E+07	2.240E+08	0.000E+00	1.072E+08	2.240E+08
CO-58	0.000E+00	6.495E+06	0.000E+00	0.000E+00	0.000E+00	3.789E+07	0.000E+00	1.988E+07	3.789E+07
CO-60	0.000E+00	3.688E+07	0.000E+00	0.000E+00	0.000E+00	2.042E+08	0.000E+00	1.087E+08	2.042E+08
ZN-65	1.817E+08	4.842E+08	0.000E+00	3.051E+08	0.000E+00	8.503E+07	0.000E+00	3.011E+08	4.842E+08
SR-89	1.754E+08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.789E+06	0.000E+00	5.009E+06	1.754E+08
SR-90	5.601E+09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.545E+07	0.000E+00	1.420E+09	5.601E+09
ZR-95	1.029E+06	2.263E+05	0.000E+00	3.239E+05	0.000E+00	2.361E+08	0.000E+00	2.014E+05	2.361E+08
I-131	4.840E+06	4.868E+06	1.610E+09	7.992E+06	0.000E+00	4.334E+05	0.000E+00	2.766E+06	1.610E+09
I-133	1.650E-01	2.040E-01	3.791E+01	3.400E-01	0.000E+00	8.223E-02	0.000E+00	7.721E-02	3.791E+01
CS-134	4.801E+08	7.878E+08	0.000E+00	2.441E+08	8.761E+07	4.247E+06	0.000E+00	1.662E+08	7.878E+08
CS-136	4.773E+06	1.312E+07	0.000E+00	6.987E+06	1.042E+06	4.611E+05	0.000E+00	8.491E+06	1.312E+07
CS-137	7.185E+08	6.877E+08	0.000E+00	2.241E+08	8.064E+07	4.306E+06	0.000E+00	1.015E+08	7.185E+08
BA-140	1.291E+07	1.131E+04	0.000E+00	3.683E+03	6.745E+03	6.543E+06	0.000E+00	7.538E+05	1.291E+07
CE-141	7.297E+03	3.639E+03	0.000E+00	1.595E+03	0.000E+00	4.540E+06	0.000E+00	5.404E+02	4.540E+06
CE-144	1.138E+06	3.567E+05	0.000E+00	1.975E+05	0.000E+00	9.300E+07	0.000E+00	6.073E+04	9.300E+07

TABLE II2-2 R_i Dose Factors Age: Child Pathway: Cow Milk

	BONE	LIVER	THYROID	KIDNEY	LUNG	GILLI	SKIN	TBODY	MAX VAL
H-3	0.000E+00	1.570E+03	1.570E+03	1.570E+03	1.570E+03	1.570E+03	0.000E+00	1.570E+03	1.570E+03
C-14	6.452E+08	1.290E+08	1.290E+08	1.290E+08	1.290E+08	1.290E+08	0.000E+00	1.290E+08	6.452E+08
CR-51	0.000E+00	0.000E+00	1.798E+04	4.914E+03	3.283E+04	1.718E+06	0.000E+00	3.239E+04	1.718E+06
MN-54	0.000E+00	1.039E+07	0.000E+00	2.912E+06	0.000E+00	8.716E+06	0.000E+00	2.766E+06	1.039E+07
FE-59	4.248E+07	6.874E+07	0.000E+00	0.000E+00	1.993E+07	7.157E+07	0.000E+00	3.424E+07	7.157E+07
CO-58	0.000E+00	4.795E+06	0.000E+00	0.000E+00	0.000E+00	2.797E+07	0.000E+00	1.468E+07	2.797E+07
CO-60	0.000E+00	2.298E+07	0.000E+00	0.000E+00	0.000E+00	1.273E+08	0.000E+00	6.777E+07	1.273E+08
ZN-65	2.002E+09	5.332E+09	0.000E+00	3.360E+09	0.000E+00	9.365E+08	0.000E+00	3.316E+09	5.332E+09
SR-89	2.411E+09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.333E+07	0.000E+00	6.886E+07	2.411E+09
SR-90	6.018E+10	0.000E+00	0.000E+00	0.000E+00	0.000E+00	8.107E+08	0.000E+00	1.526E+10	6.018E+10
ZR-95	1.480E+03	3.254E+02	0.000E+00	4.658E+02	0.000E+00	3.394E+05	0.000E+00	2.897E+02	3.394E+05
I-131	3.812E+08	3.834E+08	1.268E+11	6.295E+08	0.000E+00	3.413E+07	0.000E+00	2.179E+08	1.268E+11
I-133	5.018E+06	6.205E+06	1.153E+09	1.034E+07	0.000E+00	2.501E+06	0.000E+00	2.348E+06	1.153E+09
CS-134	1.179E+10	1.934E+10	0.000E+00	5.993E+09	2.151E+09	1.043E+08	0.000E+00	4.080E+09	1.934E+10
CS-136	2.980E+08	8.191E+08	0.000E+00	4.362E+08	6.504E+07	2.878E+07	0.000E+00	5.300E+08	8.191E+08
CS-137	1.737E+10	1.662E+10	0.000E+00	5.418E+09	1.949E+09	1.041E+08	0.000E+00	2.454E+09	1.737E+10
BA-140	3.449E+07	3.022E+04	0.000E+00	9.837E+03	1.801E+04	1.747E+07	0.000E+00	2.013E+06	3.449E+07
CE-141	7.189E+03	3.586E+03	0.000E+00	1.572E+03	0.000E+00	4.473E+06	0.000E+00	5.324E+02	4.473E+06
CE-144	7.975E+05	2.500E+05	0.000E+00	1.384E+05	0.000E+00	6.518E+07	0.000E+00	4.256E+04	6.518E+07

TABLE II2-2 R_i Dose Factors Age: Child Pathway: Goat Milk

	BONE	LIVER	THYROID	KIDNEY	LUNG	GILLI	SKIN	TBODY	MAX VAL
H-3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
C-14	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CR-51	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
MN-54	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
FE-59	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CO-58	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CO-60	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
ZN-65	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
SR-89	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
SR-90	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
ZR-95	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
I-131	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
I-133	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CS-134	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CS-136	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CS-137	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
BA-140	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CE-141	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CE-144	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

TABLE II2-2 R_i Dose Factors Age: Child Pathway: Inhalation

	BONE	LIVER	THYROID	KIDNEY	LUNG	GILLI	SKIN	TBODY	MAX VAL
H-3	0.000E+00	1.125E+03	1.125E+03	1.125E+03	1.125E+03	1.125E+03	0.000E+00	1.125E+03	1.125E+03
C-14	3.589E+04	6.734E+03	6.734E+03	6.734E+03	6.734E+03	6.734E+03	0.000E+00	6.734E+03	3.589E+04
CR-51	0.000E+00	0.000E+00	8.547E+01	2.431E+01	1.698E+04	1.084E+03	0.000E+00	1.543E+02	1.698E+04
MN-54	0.000E+00	4.292E+04	0.000E+00	1.003E+04	1.576E+06	2.290E+04	0.000E+00	9.509E+03	1.576E+06
FE-59	2.068E+04	3.345E+04	0.000E+00	0.000E+00	1.269E+06	7.067E+04	0.000E+00	1.669E+04	1.269E+06
CO-58	0.000E+00	1.772E+03	0.000E+00	0.000E+00	1.106E+06	3.437E+04	0.000E+00	3.164E+03	1.106E+06
CO-60	0.000E+00	1.314E+04	0.000E+00	0.000E+00	7.067E+06	9.620E+04	0.000E+00	2.264E+04	7.067E+06
ZN-65	4.255E+04	1.132E+05	0.000E+00	7.141E+04	9.953E+05	1.632E+04	0.000E+00	7.030E+04	9.953E+05
SR-89	5.994E+05	0.000E+00	0.000E+00	0.000E+00	2.157E+06	1.672E+05	0.000E+00	1.724E+04	2.157E+06
SR-90	1.010E+08	0.000E+00	0.000E+00	0.000E+00	1.476E+07	3.434E+05	0.000E+00	6.438E+06	1.010E+08
ZR-95	1.898E+05	4.181E+04	0.000E+00	5.957E+04	2.231E+06	6.105E+04	0.000E+00	3.700E+04	2.231E+06
I-131	4.810E+04	4.810E+04	1.624E+07	7.881E+04	0.000E+00	2.842E+03	0.000E+00	2.727E+04	1.624E+07
I-133	1.658E+04	2.031E+04	3.848E+06	3.378E+04	0.000E+00	5.476E+03	0.000E+00	7.696E+03	3.848E+06
CS-134	6.512E+05	1.014E+06	0.000E+00	3.304E+05	1.210E+05	3.848E+03	0.000E+00	2.246E+05	1.014E+06
CS-136	6.512E+04	1.709E+05	0.000E+00	9.546E+04	1.454E+04	4.181E+03	0.000E+00	1.162E+05	1.709E+05
CS-137	9.065E+05	8.251E+05	0.000E+00	2.823E+05	1.040E+05	3.619E+03	0.000E+00	1.284E+05	9.065E+05
BA-140	7.400E+04	6.475E+01	0.000E+00	2.113E+01	1.743E+06	1.018E+05	0.000E+00	4.329E+03	1.743E+06
CE-141	3.922E+04	1.954E+04	0.000E+00	8.547E+03	5.439E+05	5.661E+04	0.000E+00	2.897E+03	5.439E+05
CE-144	6.771E+06	2.116E+06	0.000E+00	1.173E+06	1.195E+07	3.885E+05	0.000E+00	3.615E+05	1.195E+07

TABLE II2-2 R_I Dose Factors Age: Infant Pathway: Ground

	BONE	LIVER	THYROID	KIDNEY	LUNG	GILLI	SKIN	TBODY	MAX VAL
H-3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
C-14	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CR-51	4.652E+06	4.652E+06	4.652E+06	4.652E+06	4.652E+06	4.652E+06	5.498E+06	4.652E+06	5.498E+06
MN-54	1.384E+09	1.384E+09	1.384E+09	1.384E+09	1.384E+09	1.384E+09	1.622E+09	1.384E+09	1.622E+09
FE-59	2.725E+08	2.725E+08	2.725E+08	2.725E+08	2.725E+08	2.725E+08	3.202E+08	2.725E+08	3.202E+08
CO-58	3.799E+08	3.799E+08	3.799E+08	3.799E+08	3.799E+08	3.799E+08	4.450E+08	3.799E+08	4.450E+08
CO-60	2.227E+10	2.227E+10	2.227E+10	2.227E+10	2.227E+10	2.227E+10	2.620E+10	2.227E+10	2.620E+10
ZN-65	7.455E+08	7.455E+08	7.455E+08	7.455E+08	7.455E+08	7.455E+08	8.574E+08	7.455E+08	8.574E+08
SR-89	2.160E+04	2.160E+04	2.160E+04	2.160E+04	2.160E+04	2.160E+04	2.507E+04	2.160E+04	2.507E+04
SR-90	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
ZR-95	2.453E+08	2.453E+08	2.453E+08	2.453E+08	2.453E+08	2.453E+08	2.845E+08	2.453E+08	2.845E+08
I-131	1.720E+07	1.720E+07	1.720E+07	1.720E+07	1.720E+07	1.720E+07	2.089E+07	1.720E+07	2.089E+07
I-133	2.450E+06	2.450E+06	2.450E+06	2.450E+06	2.450E+06	2.450E+06	2.980E+06	2.450E+06	2.980E+06
CS-134	6.917E+09	6.917E+09	6.917E+09	6.917E+09	6.917E+09	6.917E+09	8.070E+09	6.917E+09	8.070E+09
CS-136	1.508E+08	1.508E+08	1.508E+08	1.508E+08	1.508E+08	1.508E+08	1.709E+08	1.508E+08	1.709E+08
CS-137	1.134E+10	1.134E+10	1.134E+10	1.134E+10	1.134E+10	1.134E+10	1.323E+10	1.134E+10	1.323E+10
BA-140	2.054E+07	2.054E+07	2.054E+07	2.054E+07	2.054E+07	2.054E+07	2.347E+07	2.054E+07	2.347E+07
CE-141	1.365E+07	1.365E+07	1.365E+07	1.365E+07	1.365E+07	1.365E+07	1.539E+07	1.365E+07	1.539E+07
CE-144	6.958E+07	6.958E+07	6.958E+07	6.958E+07	6.958E+07	6.958E+07	8.046E+07	6.958E+07	8.046E+07

TABLE II2-2 R_i Dose Factors Age: Infant Pathway: Vegetable

	BONE	LIVER	THYROID	KIDNEY	LUNG	GILLI	SKIN	TBODY	MAX VAL
H-3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
C-14	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CR-51	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
MN-54	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
FE-59	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CO-58	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CO-60	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
ZN-65	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
SR-89	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
SR-90	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
ZR-95	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
I-131	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
I-133	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CS-134	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CS-136	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CS-137	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
BA-140	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CE-141	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CE-144	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

TABLE II2-2 R_i Dose Factors Age: Infant Pathway: Meat

	BONE	LIVER	THYROID	KIDNEY	LUNG	GILLI	SKIN	TBODY	MAX VAL
H-3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
C-14	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CR-51	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
MN-54	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
FE-59	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CO-58	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CO-60	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
ZN-65	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
SR-89	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
SR-90	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
ZR-95	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
I-131	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
I-133	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CS-134	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CS-136	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CS-137	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
BA-140	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CE-141	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CE-144	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

TABLE II2-2 R_I Dose Factors Age: Infant Pathway: Cow Milk

	BONE	LIVER	THYROID	KIDNEY	LUNG	GILLI	SKIN	TBODY	MAX VAL
H-3	0.000E+00	2.382E+03	2.382E+03	2.382E+03	2.382E+03	2.382E+03	0.000E+00	2.382E+03	2.382E+03
C-14	1.264E+09	2.698E+08	2.698E+08	2.698E+08	2.698E+08	2.698E+08	0.000E+00	2.698E+08	1.264E+09
CR-51	0.000E+00	0.000E+00	3.349E+04	7.316E+03	6.515E+04	1.496E+06	0.000E+00	5.132E+04	1.496E+06
MN-54	0.000E+00	1.931E+07	0.000E+00	4.280E+06	0.000E+00	7.095E+06	0.000E+00	4.377E+06	1.931E+07
FE-59	7.930E+07	1.385E+08	0.000E+00	0.000E+00	4.094E+07	6.617E+07	0.000E+00	5.458E+07	1.385E+08
CO-58	0.000E+00	9.590E+06	0.000E+00	0.000E+00	0.000E+00	2.390E+07	0.000E+00	2.392E+07	2.392E+07
CO-60	0.000E+00	4.692E+07	0.000E+00	0.000E+00	0.000E+00	1.116E+08	0.000E+00	1.108E+08	1.116E+08
ZN-65	2.688E+09	9.219E+09	0.000E+00	4.471E+09	0.000E+00	7.787E+09	0.000E+00	4.251E+09	9.219E+09
SR-89	4.584E+09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.424E+07	0.000E+00	1.315E+08	4.584E+09
SR-90	6.549E+10	0.000E+00	0.000E+00	0.000E+00	0.000E+00	8.178E+08	0.000E+00	1.667E+10	6.549E+10
ZR-95	2.629E+03	6.406E+02	0.000E+00	6.904E+02	0.000E+00	3.190E+05	0.000E+00	4.543E+02	3.190E+05
I-131	7.957E+08	9.376E+08	3.081E+11	1.095E+09	0.000E+00	3.347E+07	0.000E+00	4.123E+08	3.081E+11
I-133	1.060E+07	1.543E+07	2.806E+09	1.814E+07	0.000E+00	2.611E+06	0.000E+00	4.518E+06	2.806E+09
CS-134	1.899E+10	3.541E+10	0.000E+00	9.116E+09	3.737E+09	9.620E+07	0.000E+00	3.576E+09	3.541E+10
CS-136	5.820E+08	1.712E+09	0.000E+00	6.821E+08	1.395E+08	2.599E+07	0.000E+00	6.390E+08	1.712E+09
CS-137	2.773E+10	3.245E+10	0.000E+00	8.711E+09	3.527E+09	1.014E+08	0.000E+00	2.300E+09	3.245E+10
BA-140	7.097E+07	7.097E+04	0.000E+00	1.685E+04	4.358E+04	1.743E+07	0.000E+00	3.657E+06	7.097E+07
CE-141	1.425E+04	8.692E+03	0.000E+00	2.680E+03	0.000E+00	4.491E+06	0.000E+00	1.023E+03	4.491E+06
CE-144	1.143E+06	4.678E+05	0.000E+00	1.890E+05	0.000E+00	6.556E+07	0.000E+00	6.403E+04	6.556E+07

TABLE II2-2 R_I Dose Factors Age: Infant Pathway: Goat Milk

	BONE	LIVER	THYROID	KIDNEY	LUNG	GILLI	SKIN	TBODY	MAX VAL
H-3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
C-14	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CR-51	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
MN-54	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
FE-59	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CO-58	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CO-60	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
ZN-65	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
SR-89	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
SR-90	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
ZR-95	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
I-131	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
I-133	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CS-134	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CS-136	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CS-137	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
BA-140	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CE-141	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
CE-144	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

TABLE II2-2 R_i Dose Factors Age: Infant Pathway: Inhalation

	BONE	LIVER	THYROID	KIDNEY	LUNG	GILLI	SKIN	TBODY	MAX VAL
H-3	0.000E+00	6.468E+02	6.468E+02	6.468E+02	6.468E+02	6.468E+02	0.000E+00	6.468E+02	6.468E+02
C-14	2.646E+04	5.306E+03	5.306E+03	5.306E+03	5.306E+03	5.306E+03	0.000E+00	5.306E+03	2.646E+04
CR-51	0.000E+00	0.000E+00	5.754E+01	1.323E+01	1.284E+04	3.570E+02	0.000E+00	8.946E+01	1.284E+04
MN-54	0.000E+00	2.534E+04	0.000E+00	4.984E+03	9.996E+05	7.056E+03	0.000E+00	4.984E+03	9.996E+05
FE-59	1.357E+04	2.352E+04	0.000E+00	0.000E+00	1.015E+06	2.478E+04	0.000E+00	9.478E+03	1.015E+06
CO-58	0.000E+00	1.219E+03	0.000E+00	0.000E+00	7.770E+05	1.113E+04	0.000E+00	1.820E+03	7.770E+05
CO-60	0.000E+00	8.022E+03	0.000E+00	0.000E+00	4.508E+06	3.192E+04	0.000E+00	1.177E+04	4.508E+06
ZN-65	1.932E+04	6.258E+04	0.000E+00	3.248E+04	6.468E+05	5.138E+04	0.000E+00	3.108E+04	6.468E+05
SR-89	3.976E+05	0.000E+00	0.000E+00	0.000E+00	2.030E+06	6.398E+04	0.000E+00	1.141E+04	2.030E+06
SR-90	4.088E+07	0.000E+00	0.000E+00	0.000E+00	1.124E+07	1.310E+05	0.000E+00	2.590E+06	4.088E+07
ZR-95	1.154E+05	2.786E+04	0.000E+00	3.108E+04	1.750E+06	2.170E+04	0.000E+00	2.030E+04	1.750E+06
I-131	3.794E+04	4.438E+04	1.484E+07	5.180E+04	0.000E+00	1.058E+03	0.000E+00	1.960E+04	1.484E+07
I-133	1.324E+04	1.918E+04	3.556E+06	2.240E+04	0.000E+00	2.156E+03	0.000E+00	5.600E+03	3.556E+06
CS-134	3.962E+05	7.028E+05	0.000E+00	1.904E+05	7.966E+04	1.334E+03	0.000E+00	7.448E+04	7.028E+05
CS-136	4.830E+04	1.345E+05	0.000E+00	5.642E+04	1.176E+04	1.428E+03	0.000E+00	5.292E+04	1.345E+05
CS-137	5.488E+05	6.118E+05	0.000E+00	1.722E+05	7.126E+04	1.334E+03	0.000E+00	4.550E+04	6.118E+05
BA-140	5.600E+04	5.600E+01	0.000E+00	1.343E+01	1.596E+06	3.836E+04	0.000E+00	2.898E+03	1.596E+06
CE-141	2.772E+04	1.666E+04	0.000E+00	5.250E+03	5.166E+05	2.156E+04	0.000E+00	1.988E+03	5.166E+05
CE-144	3.192E+06	1.211E+06	0.000E+00	5.376E+05	9.842E+06	1.484E+05	0.000E+00	1.764E+05	9.842E+06

TABLE II2-3

Assumptions Used in Limerick Gaseous Effluent R_i Calculations[1]

Symbol	Description	Value	Reference[2]
f_i	Fraction of annual intake of fresh, leafy vegetation grown locally	0.42	Site Spec.
f_g	Fraction of annual intake of stored vegetation grown locally	0.76	E-15
Y_v	Vegetation area density (kg/m^2)	2.0	E-15
r	Fraction of deposited particulates retained on vegetation	0.20	E-15
r	Fraction of deposited iodines retained on vegetation	1.0	E-15
SF	Shielding factor of residential structures	0.7	E-15
t	Period of buildup of activity in soil (sec)	6.31E08	Site Spec.
t_f	Transport time milkman (sec)	1.73E05	E-15
t_h	Delay time for ingestion of stored feed by animals (sec)	7.78E06	E-15
t_h	Delay time for ingestion of leafy vegetable by man (sec)	8.6E04	E-15
t_h	Delay time for ingestion of other vegetable by man (sec)	5.18E06	E-15
t_s	Time between slaughter and consumption of meat animal (sec)	1.73E06	E-15
Y_p	Grass yield (kg/m**2)	0.7	E-15
Y_s	Stored feed yield (kg/m**2)	2.0	E-15
λ_w	Weathering rate constant for activity on veg (sec^{-1})	5.73E-07	E-15
Q_F	Milk cow feed consumption rate (kg/day wet)	50.0	E-3
Q_F	Beef cattle consumption rate (kg/day wet)	50.0	E-3
Q_F	Goat feed consumption rate (kg/day wet)	6.0	E-3
K^*	Ground exposure (all age groups) (hr/yr)	8760.0	C-2[3]
BR	Breathing Rate adult (m**3/yr)	8000.0	E-5
BR	Breathing Rate teen (m**3/yr)	8000.0	E-5
BR	Breathing Rate child (m**3/yr)	3700.0	E-5
BR	Breathing Rate infant (m**3/yr)	1400.0	E-5
U_A^L	Leafy veg consumption rate adult (kg/yr)	64.0	E-5
U_A^L	Leafy veg consumption rate teen (kg/yr	42.0	E-5
U_A^L	Leafy veg consumption rate child (kg/yr)	26.0	E-5
U_A^L	Leafy veg consumption rate infant (kg/yr)	0.0	E-5
U_A^S	Stored veg consumption rate adult (kg/yr)	520.0	E-5
U_A^S	Stored veg consumption rate adult (kg/yr)	630.0	E-5
U_A^S	Stored veg consumption rate adult (kg/yr)	520.0	E-5
U_A^S	Stored veg consumption rate adult (kg/yr)	0.0	E-5
U_{ap}	Cow milk consumption rate adult (l/yr)	310.0	E-5
U_{ap}	Cow milk consumption rate teen (l/yr)	400.0	E-5
U_{ap}	Cow milk consumption rate child (l/yr)	330.0	E-5
U_{ap}	Cow milk consumption rate infant (l/yr)	330.0	E-5
U_{ap}	Goat milk consumption rate adult (l/yr)	23.0	Site Spec.
U_{ap}	Goat milk consumption rate teen (l/yr)	29.0	Site Spec.
U_{ap}	Goat milk consumption rate child (l/yr)	0.0	Site Spec.
U_{ap}	Goat milk consumption rate infant (l/yr)	0.0	Site Spec.
U_{ap}	Meat consumption rate adult (kg/yr)	110.0	E-5
U_{ap}	Meat consumption rate teen (kg/yr)	65.0	E-5
U_{ap}	Meat consumption rate child (kg/yr)	41.0	E-5
U_{ap}	Meat consumption rate infant (kg/yr)	0.0	E-5
f_p	Fraction of year animals on pasture	0.75	Site Spec.
f_s	Fraction of feed from pasture when on pasture	0.39	Site Spec.
H	Atmosphere absolute humidity (gm/m**3)	8.0	(4)

NOTES:

1) R_i values are calculated in accordance with the methodologies given in NUREG-0133.
2) The References refer to tables contained in Regulatory Guide 1.109 unless otherwise specified.
3) From Reg. Guide 1.109, Appendix C, Equation C-2
4) From NUREG-0133, Section 5.3.1.3.

TABLE II2-4

Nearest Gaseous Effluent Dose Receptor Distances (Meters)

Direction	Plume Ground Inhalation Pathways	Vegetation Pathway	Meat Pathway	Cow Pathway	Goat Pathway
N	965	2574	3414	7562	0
NNE	805	805	1585	0	0
NE	1287	2414	1097	0	0
ENE	965	2896	3871	0	0
E	965	1770	1890	0	0
ESE	805	1931	4511	1770	1770
SE	1609	1770	7241	0	0
SSE	1609	1931	7224	7562	0
S	1287	1931	3018	3701	0
SSW	1609	2253	1433	2896	0
SW	965	965	2835	4827	0
WSW	1287	1287	2134	4505	0
W	965	3540	4084	0	0
WNW	1126	1126	0	0	0
NW	2092	2574	6660	0	0
NNW	1448	1931	6325	0	0

FIGURES

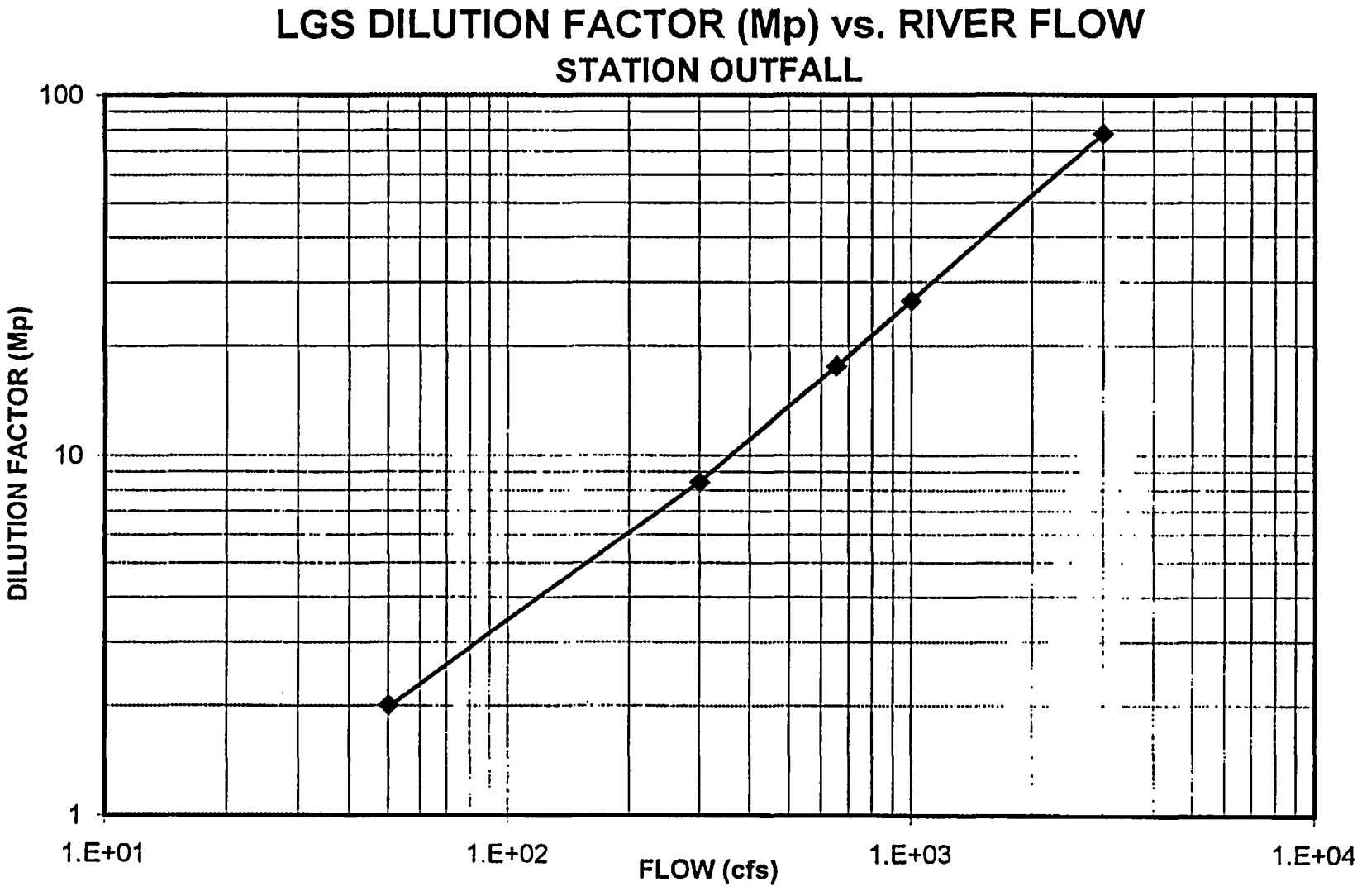


Figure II1.3.1-1

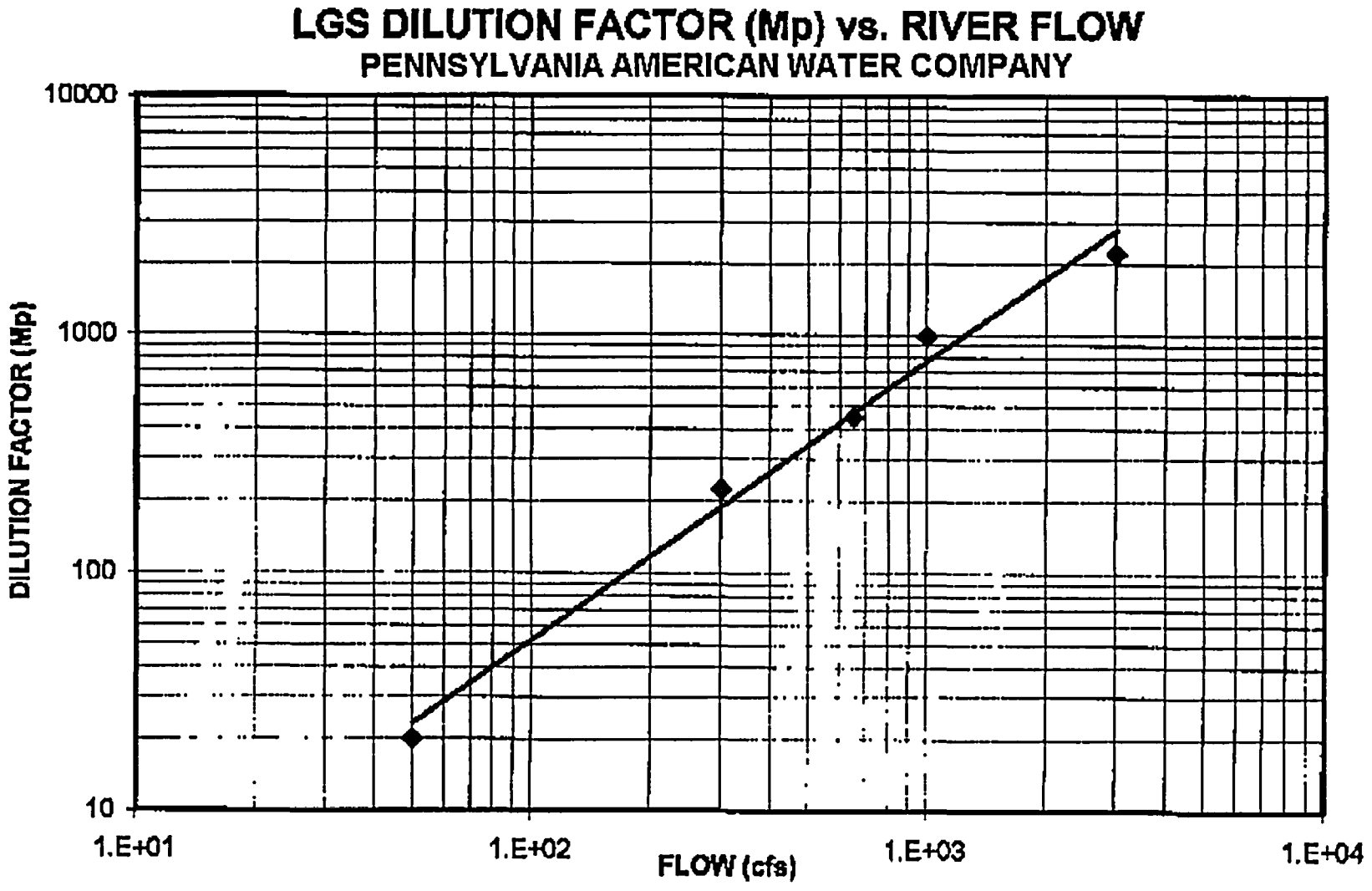


Figure II1.3.1-2

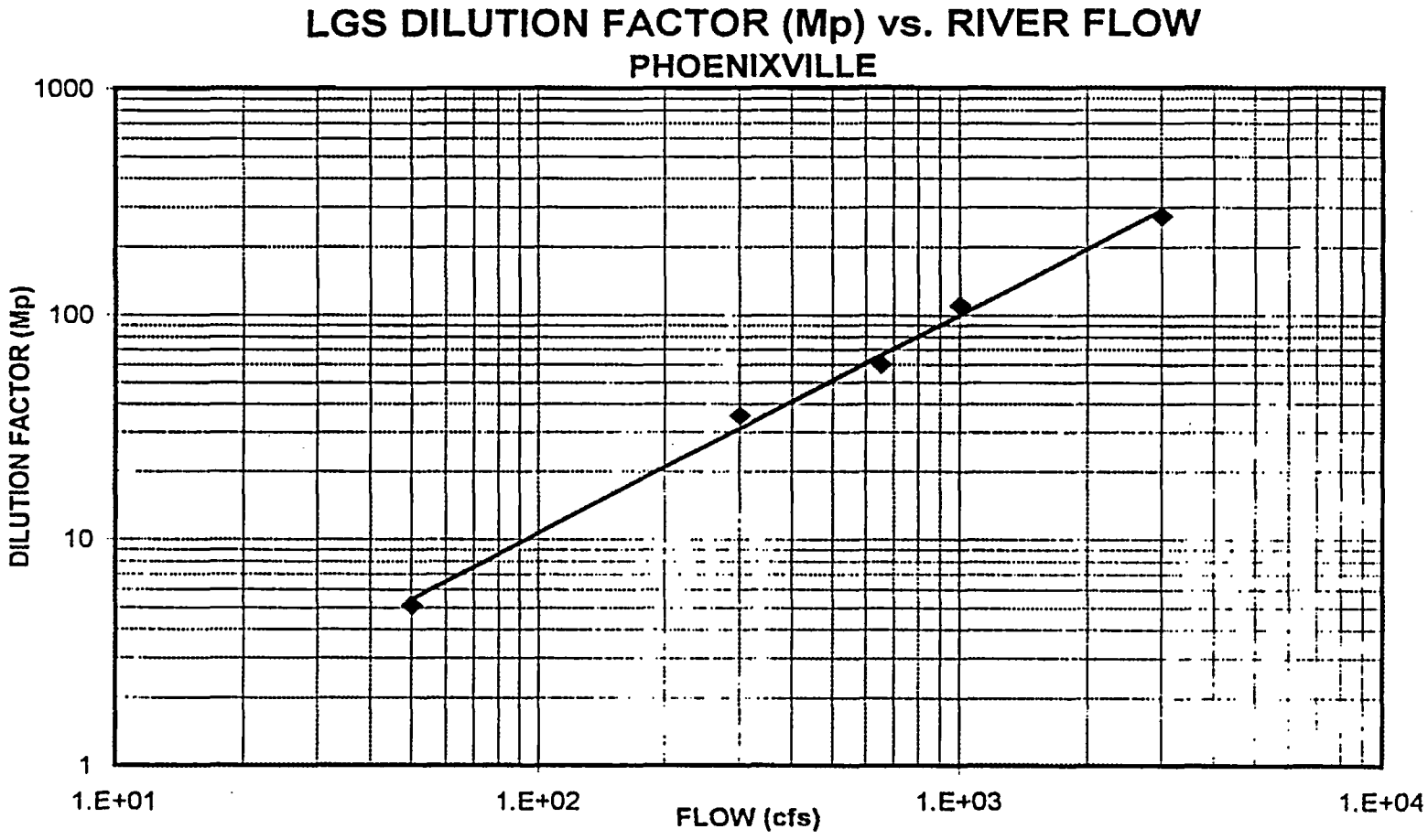


Figure II1.3.1-3

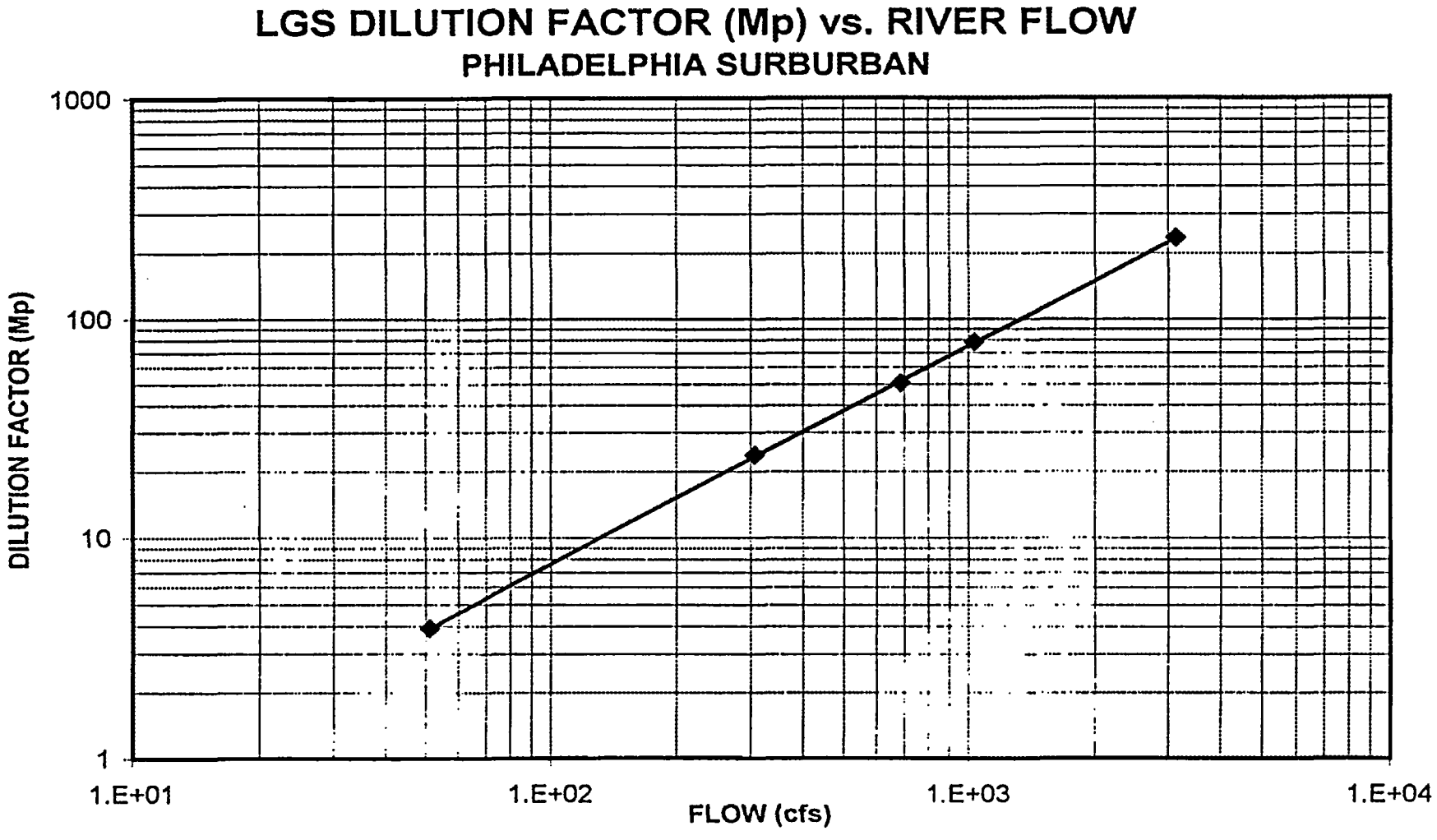


Figure II1.3.1-4

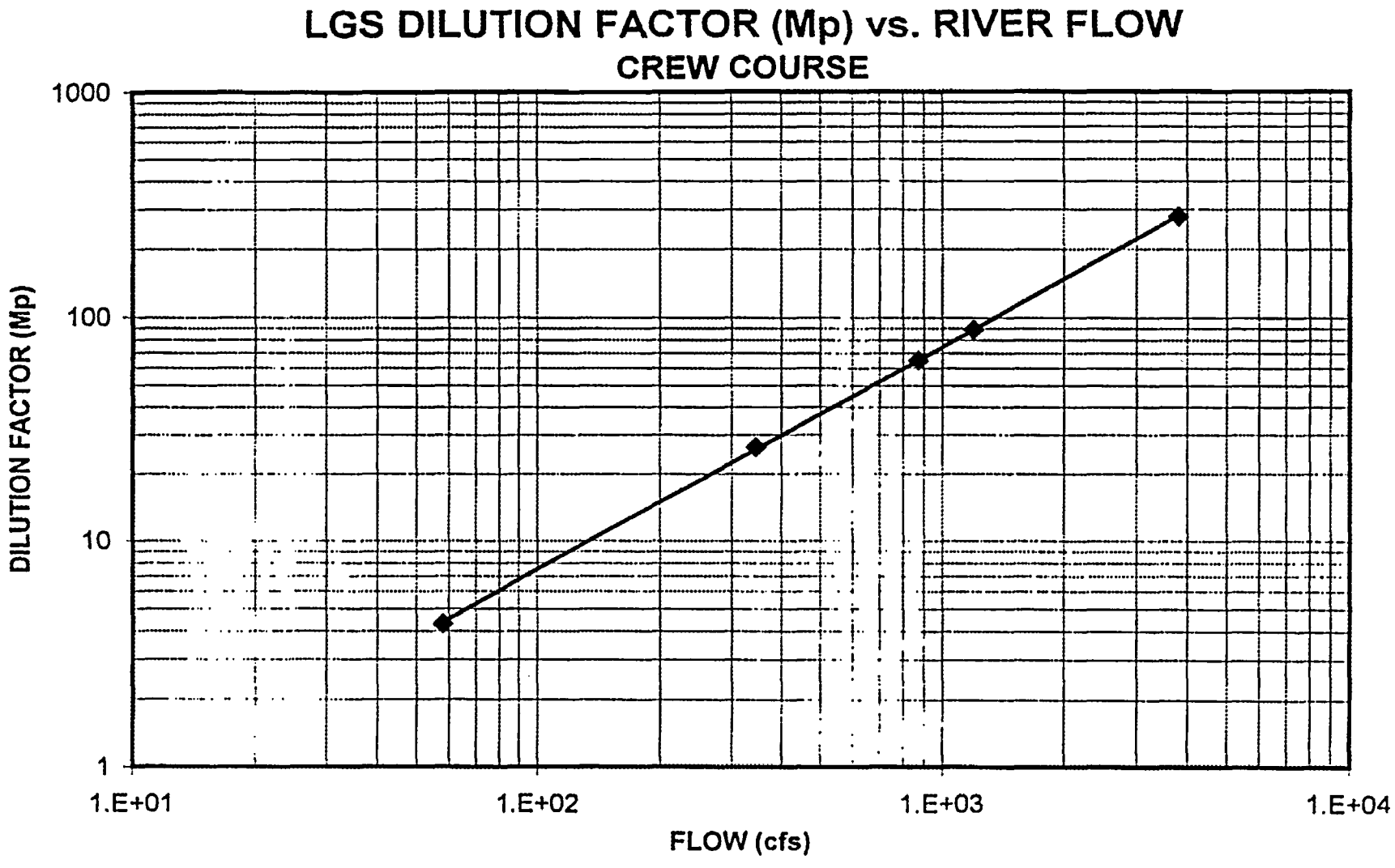


Figure II1.3.1-5

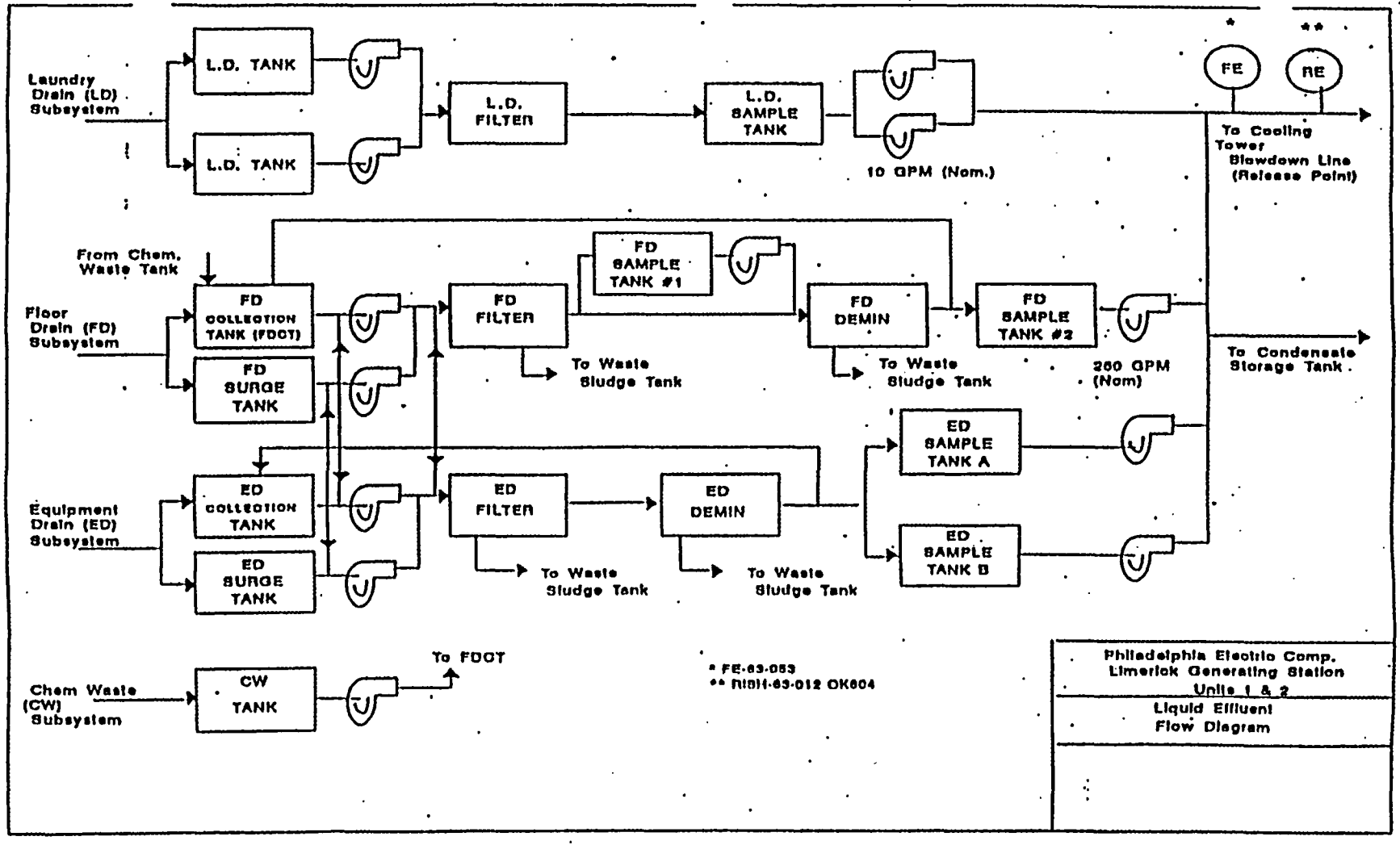

Laundry Drain (LD) Subsystem
L.D. TANK
L.D. TANK
L.D. FILTER
L.D. SAMPLE TANK
10 GPM (Nom.)
FE
RE
To Cooling Tower Blowdown Line (Release Point)
From Chem. Waste Tank
Floor Drain (FD) Subsystem
FD COLLECTION TANK (FDCT)
FD SURGE TANK
FD FILTER
FD SAMPLE TANK #1
FD DEMIN
FD SAMPLE TANK #2
To Waste Sludge Tank
To Waste Sludge Tank
250 GPM (Nom)
To Condensate Storage Tank
Equipment Drain (ED) Subsystem
ED COLLECTION TANK
ED SURGE TANK
ED FILTER
ED DEMIN
ED SAMPLE TANK A
ED SAMPLE TANK B
To Waste Sludge Tank
To Waste Sludge Tank
Chem Waste (CW) Subsystem
CW TANK
To FDCT
* FE-63-053
** RHR-63-012 OK604
Philadelphia Electric Comp.
Limerick Generating Station
Units 1 & 2
Liquid Effluent
Flow Diagram

Figure II1-1

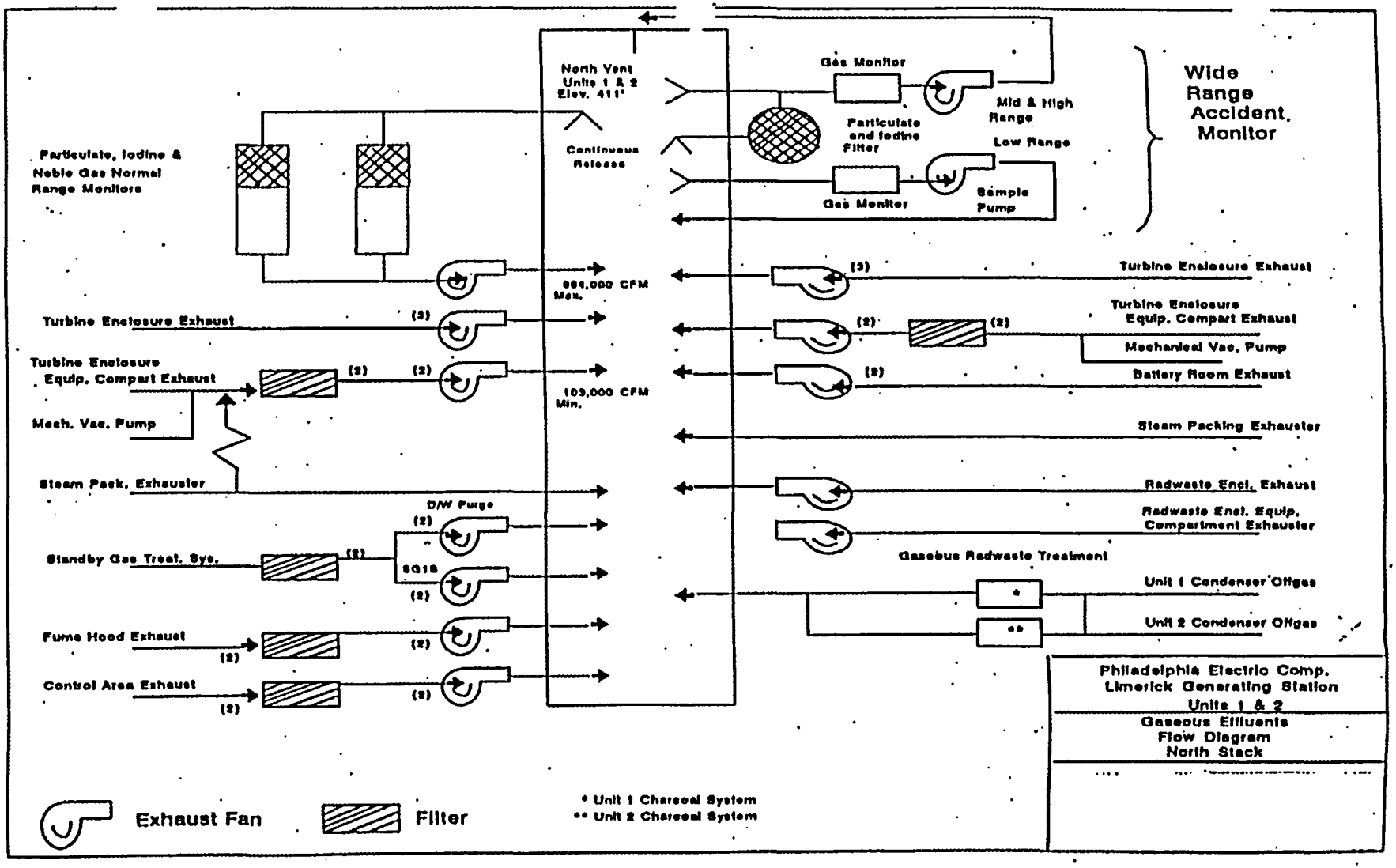

North Vent
Units 1 & 2
Elev. 411'
Continuous
Release
Gas Monitor
Mid & High
Range
Particulate
and Iodine
Filter
Low Range
Gas Monitor
Sample
Pump
Wide
Range
Accident
Monitor
Particulate, Iodine &
Noble Gas Normal
Range Monitors
884,000 CFM
Max.
Turbine Enclosure Exhaust
(3)
Turbine Enclosure
Equip. Compart Exhaust
(2)
(2)
103,000 CFM
Min.
Mech. Vac. Pump
Steam Pack. Exhauster
D/W Purge
(2)
Standby Gas Treat. Sys.
(2)
SGTS
(2)
Fume Hood Exhaust
(2)
Control Area Exhaust
(2)
(3)
Turbine Enclosure Exhaust
(2)
(2)
Turbine Enclosure
Equip. Compart Exhaust
Mechanical Vac. Pump
(2)
Battery Room Exhaust
Steam Packing Exhauster
Radwaste Encl. Exhaust
Radwaste Encl. Equip.
Compartment Exhauster
Gaseous Radwaste Treatment
*
Unit 1 Condenser Offgas
**
Unit 2 Condenser Offgas
Philadelphia Electric Comp.
Limerick Generating Station
Units 1 & 2
Gaseous Effluents
Flow Diagram
North Stack
Exhaust Fan
Filter
* Unit 1 Charcoal System
** Unit 2 Charcoal System

Figure II2-1

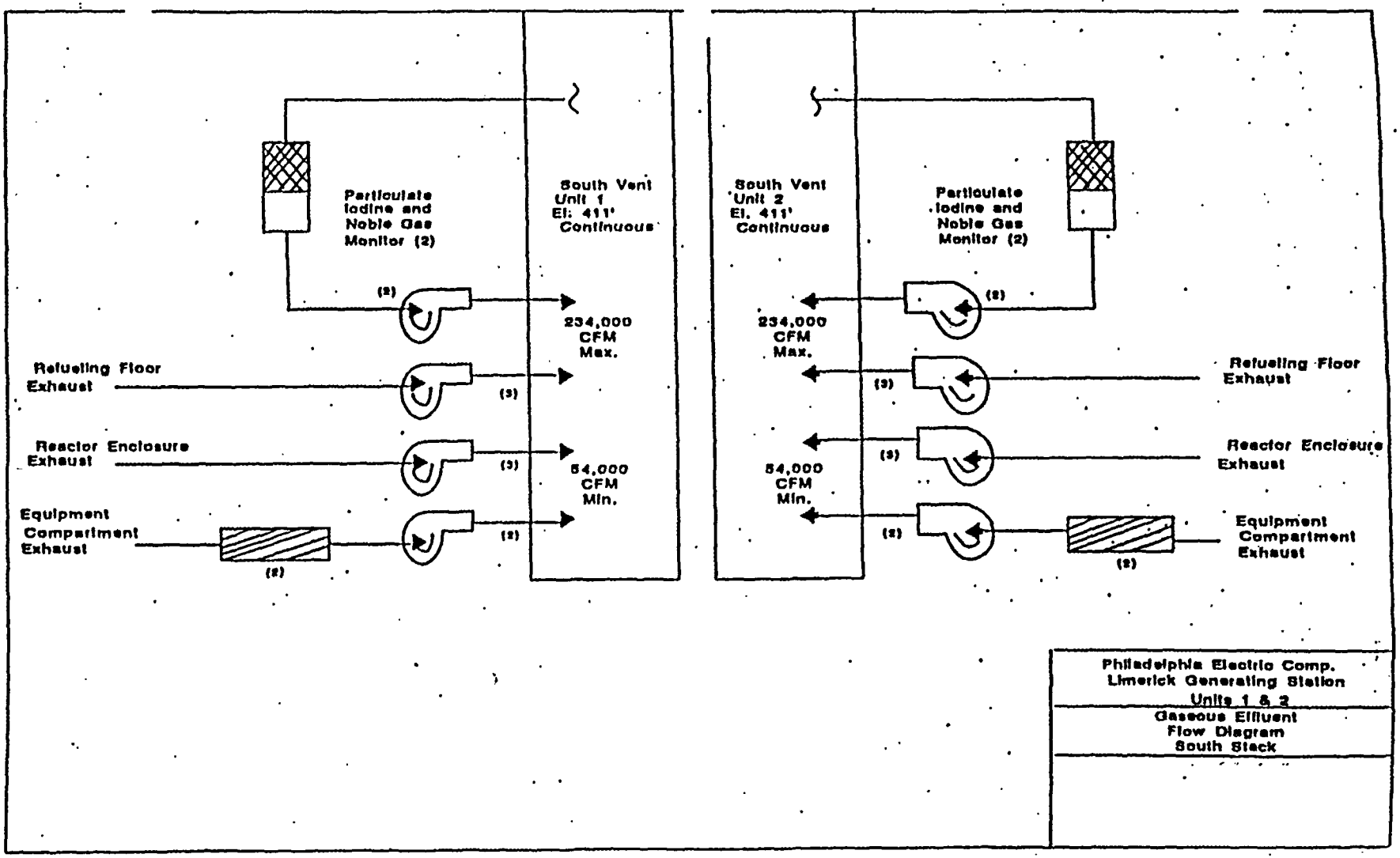

Particulate Iodine and Noble Gas Monitor (2)
South Vent Unit 1 El. 411' Continuous
(2)
234,000 CFM Max.
Refueling Floor Exhaust
(3)
Reactor Enclosure Exhaust
(3)
54,000 CFM Min.
Equipment Compartment Exhaust
(2)
(2)
South Vent Unit 2 El. 411' Continuous
Particulate Iodine and Noble Gas Monitor (2)
(2)
234,000 CFM Max.
Refueling Floor Exhaust
(3)
Reactor Enclosure Exhaust
(3)
54,000 CFM Min.
Equipment Compartment Exhaust
(2)
(2)
Philadelphia Electric Comp.
Limerick Generating Station
Units 1 & 2
Gaseous Effluent
Flow Diagram
South Stack

Figure II2-2

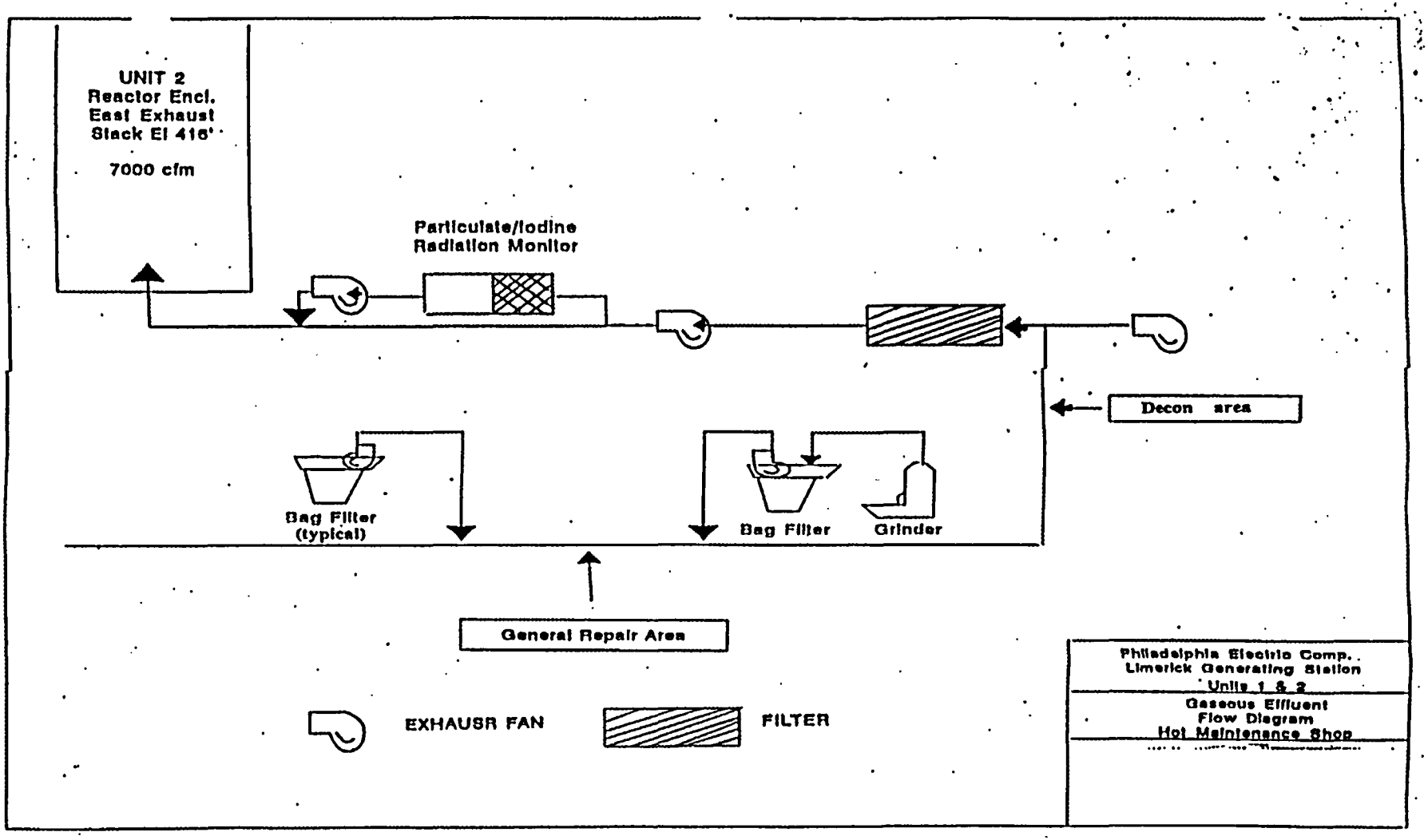

UNIT 2
Reactor Encl.
East Exhaust
Stack El 416'
7000 cfm
Particulate/Iodine
Radiation Monitor
Decon area
Bag Filter
(typical)
Bag Filter
Grinder
General Repair Area
EXHAUSR FAN
FILTER
Philadelphia Electric Comp.
Limerick Generating Station
Units 1 & 2
Gaseous Effluent
Flow Diagram
Hot Maintenance Shop

Figure II2-3

APPENDIX A

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM - SAMPLE TYPE, LOCATION, AND ANALYSIS

TABLE A-1

ODCM - Limerick Generating Station
Radiological Environmental Monitoring Program

Pathway	Station Code	Location	Collection Method	Analyses
Direct	36S2	3,183 feet N of site	1 set of four (4) TLDs from each location at least quarterly	Gamma dose quarterly
(1) Inner Ring	3S1	2,301 feet NNE of site		
	5S1	2,350 feet NE of site		
	7S1	3,099 feet ENE of site		
	10S3	2,648 feet E of site		
	11S1	2,017 feet ESE of site		
	13S2	2,149 feet SE of site		
	14S1	3,319 feet SSE of site		
	18S2	1,390 feet S of site		
	21S2	977 feet SSW of site		
	23S2	2,793 feet SW of site		
	25S2	2,445 feet WSW of site		
	26S3	2,088 feet W of site		
	29S1	2,886 feet WNW of site		
	31S1	1,395 feet NW of site		
	34S2	3,071 feet NNW of site		
(2) Outer Ring	36D1	18,527 feet N of site		
	2E1	25,112 feet NNE of site		
	4E1	25,221 feet NE of site		
	7E1	22,489 feet ENE of site		
	10E1	20,826 feet E of site		
	10F3	29,442 feet ESE of site		
	13E1	22,772 feet SE of site		
	16F1	26,608 feet SSE of site		
	19D1	18,439 feet S of site		
	20F1	27,648 feet SSW of site		
	24D1	20,972 feet SW of site		
	25D1	21,044 feet WSW of site		
	28D2	20,231 feet W of site		
	29E1	26,110 feet WNW of site		
	31D2	20,446 feet NW of site		
	34E1	24,243 feet NNW of site		

TABLE A-1 (Continued)

	Pathway	Station Code	Location	Collection Method	Analyses
	(3) Controls and Special Interest	5H1 C	130,742 feet NE of site		
		6C1	11,305 feet NE of site		
		9C1	11,377 feet E of site		
		13C1	14,980 feet SE of site		
		15D1	16,877 feet SE of site		
		17B1	8,462 feet S of site		
		20D1	16,157 feet SSW of site		
		31D1	15,853 feet WNW of site		
II.	Airborne Particulates	10S3	2,648 feet E of site	Approximately 1 cfm continuous flow through glass fiber filter which is collected weekly.	Gross beta analysis on each weekly sample. Gamma spectrometry shall be done when gross beta exceeds ten times the yearly mean of control station value. Gross beta analysis done 24 hr after sampling to allow for Radon and Thoron daughter decay. Gamma Spec on quarterly composite.
		11S1	2,017 feet ESE of site		
		14S1	3,319 feet SSE of site		
		13C1	14,980 feet SE of site		
		22G1 C	93,619 feet SW of site		
	Iodine	10S3	2,648 feet E of site	A TEDA impregnated flow-through cartridge is connected to air sampler and is collected weekly at site filter change.	Iodine 131 analysis on each weekly sample.
		11S1	2,017 feet ESE of site		
		14S1	3,319 feet SSE of site		
		13C1	14,980 feet SE of site		
		22G1 C	93,619 feet SW of site		
III.	Water a. Surface	24SI C	1,058 feet SW of site	Sample collected from a continuous water sampler, monthly. In event sampler is inoperable, weekly grab samples will be collected until sampler returned to service.	Gamma isotopic analysis monthly. H-3 on quarterly composite
		13BI	9,225 feet SE of site		
	b. Ground	No Ground water is sampled and analyzed, because ground water flow is to the river per UFSAR Section 2.4.13			
	c. Drinking	15F7	33,400 feet SSE of site	Sample collected from a continuous water sampler monthly. In event sampler is inoperable, weekly grab samples will be collected until sampler returned to service.	Gross beta and gamma isotopic monthly, H-3 on quarterly composite
		15F4	45,514 feet SE of site		
		16C2	14,034 feet SSE of site		
		28F3 C	30,811 feet WNW of site		

	Pathway	Station Code	Location	Collection Method	Analyses
III.	Water (Continued) d. Sediment from shoreline	16C4	11,510 feet SSE of site	A sediment sample is taken down stream of discharge semi-annually	Gamma isotopic analysis each sample
IV.	Ingestion a. Milk	18E1 19B1 25C1 23F1 C	22,704 feet S of site 10,317 feet SSW of site 14,224 feet WSW of site 26,505 feet SW of site	Sample of fresh milk is collected from each farm biweekly when cows are on pasture (April) through October), monthly at other times.	Gamma isotopic and I-131 analyses on each sample
	b. Fish and Invertebrates	16C5 29C1 C	9,251 feet SE of site 13,725 feet WNW of site	Two species of recreationally important fish (Predator and bottom feeder) sampled in season or semiannuall if not seasonal. Seasons are Spring and Fall There are no commercially or recreationally important species of invertebrates. Therefore no invertebrates are sampld.	Gamma isotopic analyses on edible portions.
	c. Food Products	There are no downstream food products that are irrigated by water in which liquid plant wastes have been discharged. No broad leaf vegetation sampling is performed, because milk sampling is performed.			

C = Control Location

Figure A-1
Environmental Sampling Locations On Site or
Near the Limerick Generating Station

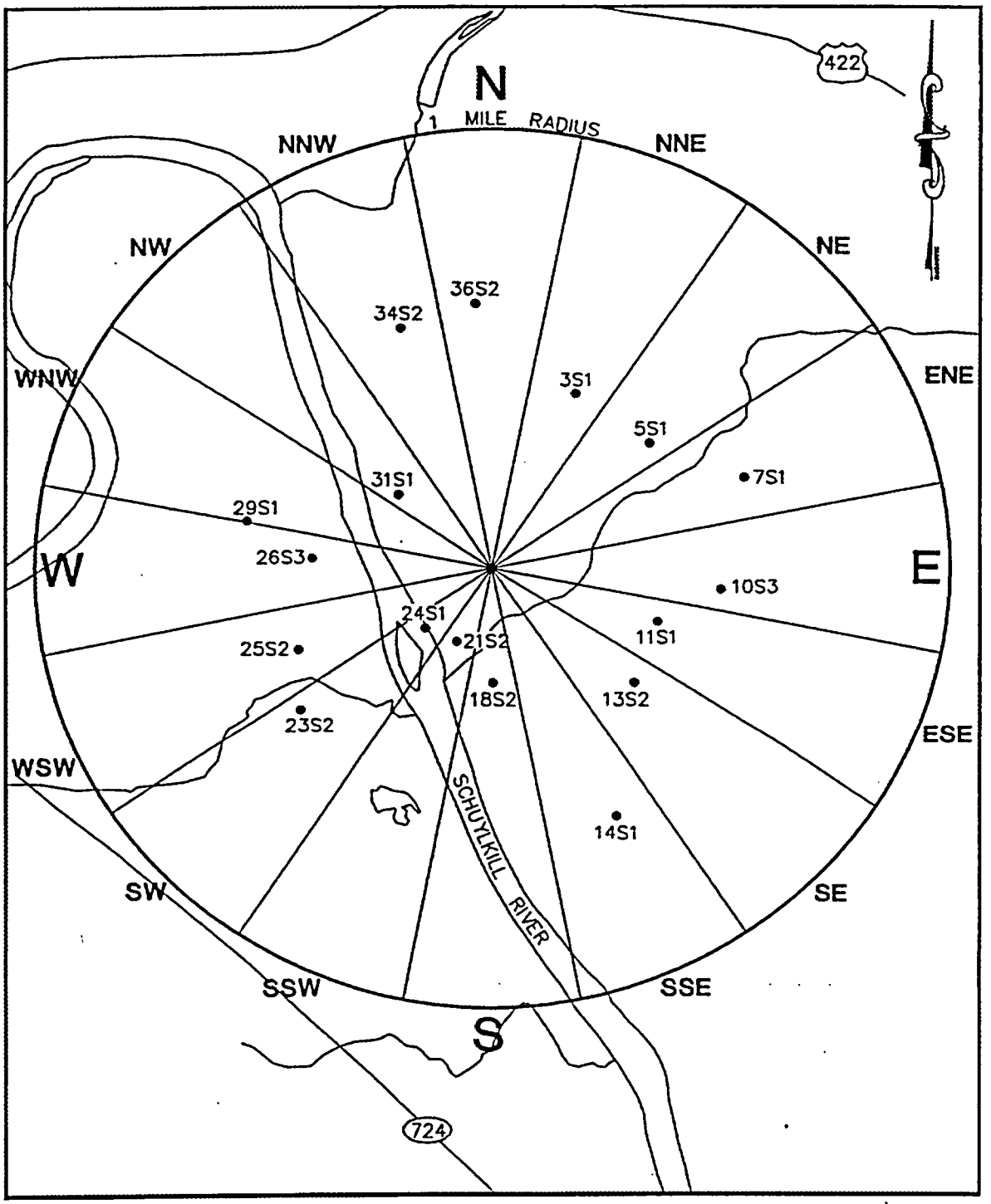


Figure A-2
Environmental Sampling Locations at Distances Less Than Five Miles from the Limerick Generating Station.

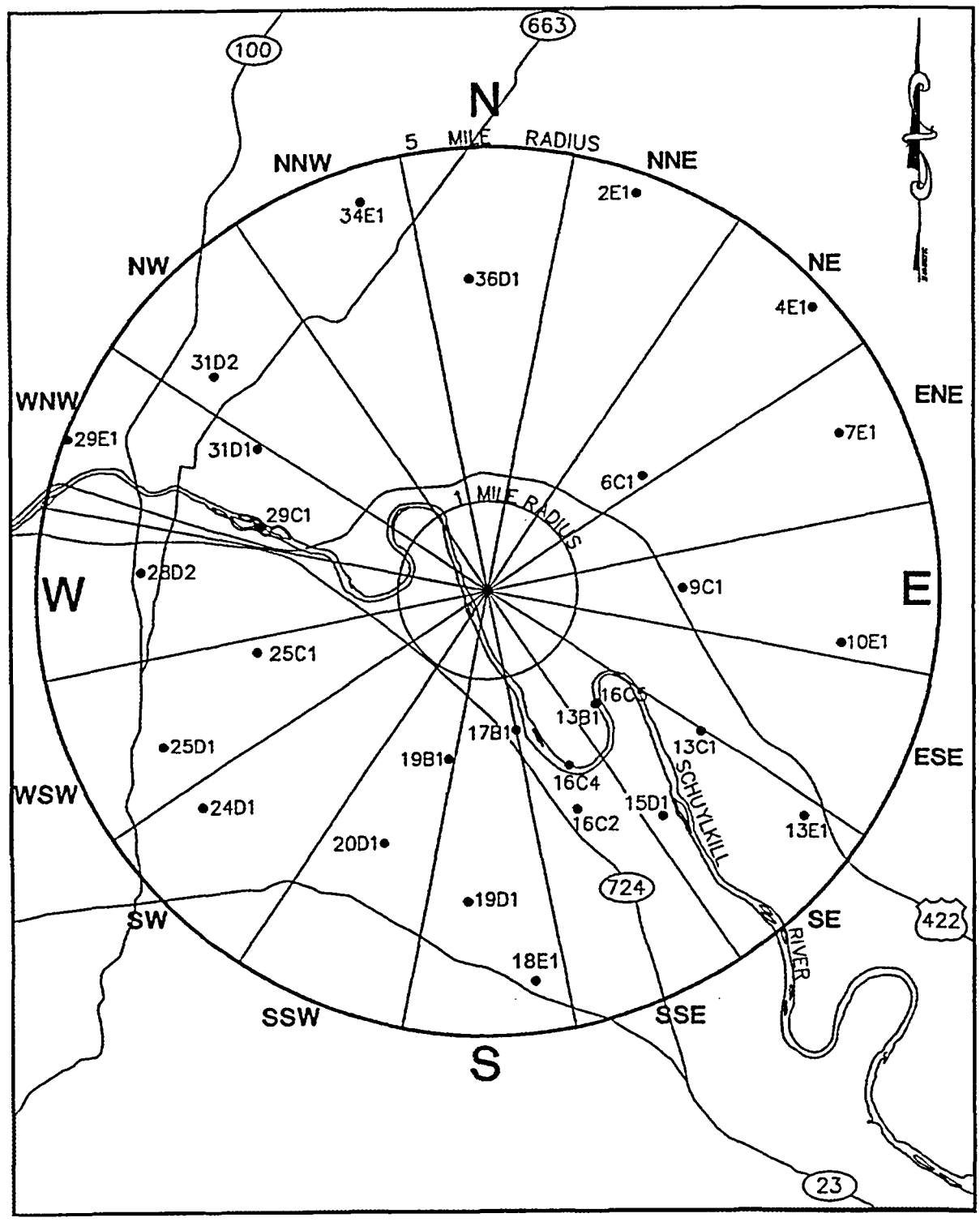
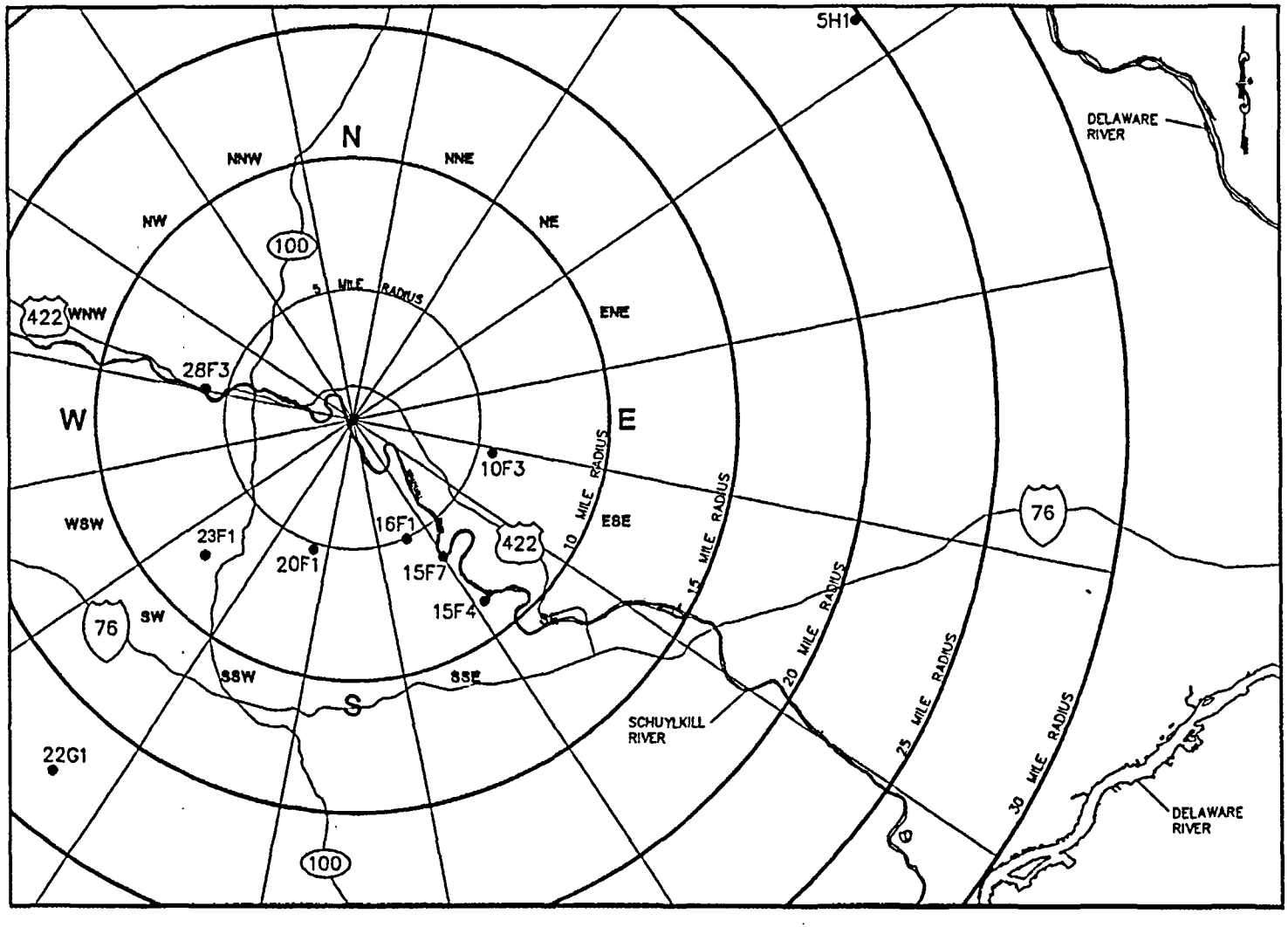


Figure A-3
Environmental Sampling Locations at Distances Greater Than Five Miles from the Limerick Generating Station.



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